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Conference on the Presentation of the Final Results of Coastal Area Management Programme for the Island of Rhodes

Rhodes, 14-15 May 1996

REPORT ON THE FINAL RESULTS OF THE COASTAL AREA MANAGEMENT PROGRAMME (CAMP) FOR THE ISLAND OF RHODES (CAMP/RHODES)

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1. INTRODUCTION

1.1 BACKGROUND AND PREPARATORY ACTIVITIES

Ever since the beginning of its activities in 1975, MAP has been aware of the need to apply the process of integrated planning of the development and management of the resources of Mediterranean marine and coastal areas in order to address immediate and future marine and coastal environmental and development issues in the Mediterranean region. Since 1987, MAP has geared its activities towards the development of an environmentally sound integrated Coastal Areas Management Programme (CAMP) for the Mediterranean region. Moreover, satisfying the needs of the present, without compromising the ability of future generations to meet their own needs, i.e. sustainable development, was an essential factor when undertaking the process of integrated planning of the development and management of the resources of the Mediterranean Basin.

CAMP is a new form of MAP cooperation with national and local institutions and experts aiming primarily to create conditions for the process of Integrated Coastal Areas Management, to be introduced and developed in Mediterranean coastal areas as a major tool for achieving sustainable development. Comparatively small areas of the region were selected to carry out activities on the basis of the integration of knowledge and experience obtained by all MAP components.

The focus of CAMP implementation is on the work of local institutions and experts. This approach was selected since analysis showed that a large number of international programmes implemented in Mediterranean developing countries by highly competent international expert teams were not sufficiently adaptable to the local conditions and follow-up due to the fact that the local institutions and experts had not been sufficiently involved in those programmes and capacity building had not reached a level which could guarantee a successful use of the programme results. A political commitment at the national and local level, and broad social support and involvement are the basic prerequisites for the development of a successful sustainable development programme in a given area.

This new approach of integrating resources management, including coastal resources with environmental protection, received full affirmation through the conclusions of the United Nations Conference on the Environment and Development held in Rio in 1992, as set out in the document "Agenda 21", chapter 17: Programme of Action for Sustainable Development. UNCED gave high prominence to integrated coastal zone management because it is seen as playing a key role in meeting three kinds of coastal needs which are of increasing importance: the sustainable development and rational use of coastal resources; the protection and development of marine and coastal ecosystems and biodiversity; and a rational response to the expected climate change. Consequently, the Conference recommended that all coastal nations develop capabilities for integrated planning programmes as soon as possible and develop their own national plans.

The CAMP approach was officially approved by the Sixth Ordinary Meeting of the Contracting Parties to the Convention for the Protection of the Mediterranean Sea

against Pollution and its related Protocols (Barcelona Convention) held in Athens, 3-6 October 1989 (UNEP(OCA)/MED IG.1/5). Four CAMP projects were approved during this meeting, (Kastela Bay, Izmir Bay, Syrian Coast and the Island of Rhodes).

The Greek Government expressed its commitment to the philosophy of the integrated planning and management of coastal areas and nominated the Island of Rhodes as one of the first group of Coastal Areas Management Programme.

On the basis of this decision, an "Agreement Relative to the Coastal Area Management Programme for the Island of Rhodes - Greece", was signed between UNEP/MAP and the Government of Greece in November 1990.

The European Investment Bank (EIB) decided to assist financially the implementation of some of the activities in the Rhodes CAMP Programme (Phase III). An agreement was signed in January 1993 by UNEP/MAP, the European Investment Bank and the Greek Government, by which EIB allocated to the project, under the European Community Financial Instrument for the Environment (LIFE), and the Mediterranean Environmental Technical Assistance Programme (METAP), an amount of EU 360,000 (which corresponds to US Dollars 435,000 at an exchange rate of 0.8275862 ECU per US Dollar).

Implementation of the Rhodes CAMP project comprises three phases:

Phase I:

The first phase of the project (1988-1990) was implemented under MAP Regional Activity Centre for Priority Actions Programme (PAP/RAC) pilot projects as a new form of advanced collaboration of PAP/RAC and other MAP programmes with national and local institutions and experts aimed at creating conditions for introducing or developing the process of integrated planning and management of coastal resources. During this phase, preparatory activities were completed and a considerable knowledge was gathered on the state and problems of ecosystems in the pilot area of Rhodes.

This phase was financed by the Mediterranean Trust Fund (MTF) within the framework of MAP.

Phase II:

The second phase of the project (1991-1992) was implemented under the Coastal Areas Management Programme (CAMP) through which all MAP components were included equally. A detailed workplan was prepared and incorporated in the Agreement relative to the Coastal Area Management Programme for the Island of Rhodes signed by UNEP/MAP and the Greek Government in November 1990. This phase was financed by the Mediterranean Trust Fund with a counterpart contribution from the Greek Government.

The Second Phase of the project lasted until the end of 1992, when a Presentation Conference was held in Rhodes, on 14-15 December 1992. During this

Conference, the final results of the project were presented officially to the Greek authorities at national and local levels (doc: UNEP(OCA)/MED WG.60/3). One of the main outcomes of the Conference was the proposal for a follow-up to the project on a few important activities which was presented to the European Investment Bank (EIB) for possible financing.

Phase III:

The third phase of the project (1993-1996) has been financed by a grant from the European Investment Bank (EIB), of US Dollars 435,000. A contract to that effect was signed between UNEP/MAP, EIB and the Greek government in January 1993 (see Annex I to this report).

Legislative Authority

The legislative texts relating to this project are:

- Mediterranean Action Plan (Barcelona, 1975);
- Convention for the Protection of the Mediterranean Sea against Pollution and its Protocols (Barcelona, 1976);
- Sixth Ordinary Meeting of the Contracting Parties to the Barcelona Convention (Athens, 1989) - document: UNEP(OCA)/MED IG.1/5;
- Seventh Ordinary Meeting of the Contracting Parties to the Barcelona Convention (Cairo, October 1991) - document: UNEP(OCA)/MED IG.2/4;
- Agreement relative to the Coastal Area Management Programme for the Island of Rhodes - Greece, signed in November 1990;
- Contract on "METAP/LIFE - Coastal Area Management Plan - Rhodes", signed in January 1993 between UNEP/MAP, EIB and the Greek Government.

Ten Activities were selected for follow-up with the objective of preparing an Integrated Planning Study for the Island of Rhodes. The ten activities are:

1. Land-Based Sources and Dumping Protocols
2. Liquid Waste Management
4. Monitoring of Pollution in Rhodes Coastal Region
5. General Water Resources Master Plan
7. Programme of Environmentally Sound Energy Planning
8. Programme of Protection of Historic Settlements
9. Training Programme on GIS
10. Environmental Impact Assessment (EIA)
13. Integrated Planning Study for the Island of Rhodes
14. Specially Protected Areas

For the successful implementation of the programme, the active involvement of national and local authorities was a very important factor. The knowledge of the local conditions and the precise identification of the environmental/development problems in Rhodes were provided by the relevant national and local institutions.

1.2 OBJECTIVES OF THE PROGRAMME

The objectives of the programme were the following:

- overall to protect and utilise rationally the coastal resources over a relatively long period of time. The task of such a programme was to determine and recommend appropriate management measures with a view to resolving the existing environmental development conflicts and establishing the optimum paths for dynamic development;

- in the long-term, to prepare the base for the development of the Island of Rhodes in harmony with the receptive capacity of the environment and to create conditions for the establishment of a system of integrated planning and management of resources on the Island.

- immediately to offer, within the individual activities, solutions to urgent environmental/development problems which could be implemented immediately.

1.3 INSTITUTIONAL FRAMEWORK

The Mediterranean Action Plan, the European Investment Bank and national and local authorities and institutions participated in the development and implementation of the CAMP project for the Island of Rhodes.

MAP participated through:

- the MAP Coordinating Unit (Athens);
- the Pollution Monitoring and Research Programme (MEDPOL - Athens);
- the Priority Actions Programme Regional Activity Centre (PAP/RAC - Split);
- the Specially Protected Areas Regional Activity Centre (SPA/RAC - Tunis);
- the Secretariat for 100 Historic Sites in the Mediterranean Region (Marseille).

The Ministry of the Environment, Physical Planning and Public Works of Greece was designated by the Greek government to act as General National Coordinator for the project. Local authorities - the Prefecture of Dodecanese and the Municipality of Rhodes were actively involved.

Individual national and local institutions and experts participated in the formulation, preparation and implementation of the programme as envisaged by the contract and its budget and workplan, signed between MAP, Greece and the European Investment Bank.

In conformity with the provisions of the contract signed with EIB, certain progress reports and qualified reports have been prepared and submitted to EIB for clearance and releasing funds (see Annexes II to VII).

1.4 EUROPEAN INVESTMENT BANK (EIB)

The European Investment Bank (EIB) is the long-term lending agency of the European Union (EU), set up in 1958 by the Treaty of Rome. Protecting and enhancing the environment is one of its primary objectives and loans for this purpose at present account for over one third of all operations within the EU. The Bank also supports environmental investment activities outside the Community, often within the framework of an international agreement.

In the Mediterranean region, such an agreement is provided by the **Mediterranean Environmental Technical Assistance Programme (METAP)**. This was launched in 1990 by EIB and the World Bank in partnership with the European Community (EC) and the United Nations Development Programme (UNDP) as well as local public and private institutions. Its aim was to provide technical assistance (TA) financed on grant terms to identify environmental projects, strengthen environmental management capacity and establish environmentally sound policies in the context of four priority themes, including that of coastal zone management.

During the first two cycles of METAP, in the period 1990 - 1995, over US$ 30 million was mobilised to fund over 100 TA activities; some, including the CAMP in collaboration with the Mediterranean Action Plan (MAP), in 21 Mediterranean countries. It is expected that a third phase of METAP, with refined priority themes, will be officially launched in the second half of 1996.

The CAMP project for the Island of Rhodes attracted support from EIB and EC within the METAP framework. It was identified in 1991 as one of four areas of cooperation between EIB and DG XI of the Commission with a focus on helping to prepare and promote a sound integrated environmental plan for Rhodes emphasising replicability and sustainability.

It is important to note a number of its features. Institutionally, the United Nations Environment Programme (UNEP) was assigned responsibility for coordinating and accounting for the project. In this respect, help would be provided by the Greek Ministry of the Environment, Physical Planning and Public Works. Local authorities, the Prefecture of Dodecanese and a number of municipalities, have also been actively involved.

A series of individual activities have been carried out to improve the state of a number of eco-systems in Rhodes and to promote the incorporation of environmental considerations into planning and decision-making; broadly, these activities covered mainly sewage and water resource management, energy planning and protection of specially protected areas and historic settlements. The project was budgeted at a cost of up to ECU 1.3 million, with contributions as follows: EIB/LIFE ECU 360 000 plus a 9% management fee, UNEP/MAP ECU 220 000 and the Greek authorities' ECU 720 000 in kind.

The EIB has been responsible on behalf of the Commission for the management of LIFE funds which, together with the management fee financed from its own resources, was set to cover the offshore costs of international consultants and associated imported equipment for the various activities. Apart from helping to set

up the project at the conceptual and planning stage, EIB has monitored project progress through reports and field visits. In accordance with the METAP philosophy, it is prepared to follow-up the study in partnership with local institutions by financing viable investment activities to the extent that these can be identified.

The project was the subject of considerable start-up delays and the pace of implementation has also been much slower than planned. The project is nevertheless expected to remain within the budget. A complete catalogue of achievements against objectives must await the presentation of the study and the time needed to carry out a complete assessment of the full set of final reports.

The achievements of the CAMP project will only be maximised by using its output as a master plan for the definition of a future investment programme for the Island of Rhodes. Therefore, proposals for follow-up activities and pre-investment plans will need to be submitted which aim at a clear definition of investment needs and priorities. Urgent action is expected in the sectors of liquid waste and water resources in order to guide decisions regarding the implementation of projects which will benefit from EC funding.

2. PRESENTATION OF THE FINAL RESULTS BY ACTIVITY

Activity No. 1: LAND-BASED SOURCES (LBS) AND DUMPING PROTOCOLS

1. Background Information

The programme of activities of the CAMP for Rhodes included, as a specific activity, the establishment of an inventory of land-based sources of pollution, which would be carried out through an appropriate survey.

The assessment of the total pollution input to the Mediterranean Sea from land-based sources was the major objective of a pilot project (MED X) implemented in 1976/77 within the framework of the Joint Coordinated Mediterranean Pollution Monitoring and Research Programme (MED POL Phase I). At their Fifth Ordinary Meeting (Athens 7-11 September 1987), the Contracting Parties to the Barcelona Convention and Protocols approved a calendar of activities towards the implementation of the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-based Sources, to be carried out within the framework of the Long-term Programme of Pollution Monitoring and Research in the Mediterranean Sea (MED POL Phase II). This calendar of activities included a new, improved survey of pollutants from land-based sources in the Mediterranean.

The survey was implemented through a new set of questionnaires which related to the following:

(a) Liquid domestic discharges;

(b) Industrial discharges containing selected substances listed in Annexes I and II to the Land-based Sources Protocol, adopted by the Contracting Parties in 1980;

(c) Industrial discharges of petroleum hydrocarbons, including sub-questionnaires on discharges from oil refineries and reception facilities respectively.

The above questionnaires were also used for the land-based sources of pollution survey for the Rhodes CAMP.

2. Activities Performed

An expert was recruited by the WHO Project Office in Athens to conduct a survey on land-based sources of pollution (LBS) in the Island of Rhodes. The specially prepared questionnaires for such surveys were given to him for completion and submission together with his report on the LBS.

Although the report, which was submitted in January 1995, contained quite a substantial amount of data, only one questionnaire was completed due to several problems which were encountered and, after consultation with the WHO Senior

Scientist, it was agreed not to include the questionnaires in the report in the given format.

3. Problems Encountered

The situation regarding domestic wastewater is rather vague and can only be estimated due to the following constraints:

(i) the actual population in the villages differs from the census recorded population due to local reasons;

(ii) there are no flow meters for water consumption in most of the villages;

(iii) people in the villages were not very helpful as either no data were available, or because for unknown reasons they were reluctant to cooperate;

(iv) even when data were submitted in the villages, it was not clear if they were correct as there was a tendency to produce data which would produce favorable results for the people;

(v) there are a lot of illegal connections.

Another problem encountered, with no obvious solution because of the seasonal functioning, is that of olive mills wastewater.

4. Results of the Survey

Domestic Wastewater Production, Collection and Discharge

The data reported are distinguished in three parts. The first part contains data on the City of Rhodes, the second on the area of Ialysos and the third on the 37 communities of the island under review. In the City of Rhodes, there is an increase of 95% in the coastal population during the summer months and in the area of Ialysos the population is tripled during that period. For the rest of the communities only the total number of 55,000 available beds for tourists was reported on, without any indication on the actual tourist increase. The population of the 37 communities was reported on according to the 1991 census, but it appears that the actual number of inhabitants differs. In 13 of the above communities, the actual population is on average 5% less as compared with that of the census. The data reported fluctuates between 500% to -22%, the minus indicating that the actual population is more than that provided by the census. In the context of the survey, it was impossible to gather any kind of data referring to municipal wastewater production due to constraints regarding measurements of water consumed. Therefore, following estimations, the water consumption is approximately 120 litres per capita per day for the local population, and 300 litres per capita per day for the tourists.

For collection of domestic wastewater, a separate sewerage system has recently been constructed in the City of Rhodes which collects sewage from 99% of the households, the rest being served by individual cesspools. The wastewater collected in this manner is being treated in the city's wastewater treatment plant and then discharged

into the sea by submarine outfalls. The inhabitants of the area of Ialysos are served by cesspools from which effluents are discharged into the subsoil. Tourist establishments, primarily hotels, are equipped with individual wastewater treatment plants from which treated effluents are discharged into the sea by submarine outfalls. For tourist establishments wastewater treatment is mandatory by law when it is not possible for them to be connected to a municipal sewerage system.

For the remaining communities, 14,6% of the inhabitants are served by a separate sewerage system. There are also a number of households, representing 5,4% of the total population of the villages, which are illegally connected to the existing storm drainage system. Most of the households, representing 40,5% of the population, are served by individual cesspools, a common method for domestic wastewater discharge in the villages. By using this method of domestic wastewater collection, effluents are discharged directly into the subsoil. It is interesting to note that, out of the total population served by cesspools, 6,2% collect wastewater from the WC only, while wastewater from kitchens is collected by other means. Finally, the remaining 39,5% of the population is served by watertight tanks, and the septage collected in this manner is transported by tank-lorries to the biological treatment plant constructed for the purpose of treating the septage. Even in this case, 9,2% of households served by watertight tanks are only connected as far as the WC is concerned. while the wastewater from kitchens is collected by other means.

Industrial Wastewater

The main industrial activities, representing a low pollution factor on the island, include an abattoir, an alcohol producing industry and two soft-drink factories. Of these, no data are available regarding the abattoir, while the alcohol producing industry is related to wine production. This specific one (CAIR) produces 190,000 m^3 of wastewater per year. Pollution indicators such as Biological Oxygen Demand (BOD_5) and Suspended Solids (SS) are between 210 and 3,00 mg/l and 175-1,400 mg/l respectively. The estimated pollution load for BOD_5 is 263,700 kg/year and for SS 190,800 kg/year. Wastewater is treated in the factory's treatment plant and the effluent has very reduced pollution indicators being 50 mg/l for BOD_5 and 180 mg/l for SS. The amount of wastewater treated in this manner is then discharged into the sea by a submarine outfall, contributing to the discharge of 8,000 kg/year BOD_5 and 29,000 kg/year SS.

Of the two soft-drink producing factories the first one, BAP, annually produces 16,000 m^3 of wastewater with an average BOD_5 of 2,500 mg/l. The wastewater produced in this way, after treatment in an appropriate wastewater treatment plant, presents a BOD_5 of less than 20 mg/l which yields about 318 kg BOD_5 annually. The treated effluent is then disposed into the subsoil. The second soft-drink producing factory, 3E, has an annual wastewater production of 40,000 m^3 with BOD_5 and SS being 1,500 mg/l and 210 mg/l respectively. After treatment, the above indicators are reduced to less than 40 mg/l for both, which yields an annual production of 1,600 kg BOD_5 and 1,600 kg SS to be discharged. The final disposal is made into the subsoil.

Another activity which exists on the island is that of olive mills which, although not on the same scale as other industries, also represents a source of pollution. In total there are 33 registered units on the island but it is a known fact that this figure is

much higher due to the fact that some of them are operating illegally. The production period of the olive mills is rather short, representing only 3 to 4 months per year. The amount of wastewater actually produced is not known for certain, as it depends on the quantity of olives treated. The manner of disposal which is followed mostly is the absorption by the subsoil of liquid wastes after neutralization of the pH by the use of lime. However, it has been observed that the olive mills were discharging their wastewater into the nearby river in the community of Archangellos, thereby causing pollution problems to the receiving waters of the beach. Following the advice of the competent authorities, some of the units collect their liquid wastes into watertight tanks, which are then transported by tank-lorries to the solid wastes disposal site.

Oil Discharges from Reception Facilities

On the Island of Rhodes, five reception facilities exist from which oil can be discharged. Three of these facilities are fuel distribution centres while the other two are used for oil storage for energy production. The fuel distribution centres are owned by private companies and have a total storage capacity of 10,050 m^3. Data on transported fuel are reported for only two of them, amounting to 101,000 m^3 annually. The wastewater produced from tank cleaning is estimated to be in the vicinity of 4,000 m^3 per year and, after being treated by oil separators, is discharged underground.

POPULATION AND WASTEWATER QUANTITY

	POPULATION			
			Local Population	Tourists
City of Rhodes	45,000	40,000	1,95	1,8
Ialysos	10,000	20,000	0.43	0,9
Communities	44,500	55.000w	1.90	N/A

Number of beds available, including part of Ialysos

WASTEWATER PRODUCED FROM INDUSTRY

Type of Industry	Total amount of wastewater m^3/year	BOD_5 kg/year	SS kg/year
CAIR (Wine production)	190,000	265,000	190,000
BAP (Soft drinks)	16,000	40,000	N/A
3E (Soft drinks)	40,000	60,000	8,500
Abattoir	N/A	N/A	N/A

POPULATIONS SERVED BY SEWAGE SYSTEMS

	POPULATION		ESTIMATED POPULATION SERVED							
Area	Normal	Seasonal increase	By municipal sewerage system	%	By individual wastewater treatment	%	By cesspools	%	By watertight tanks	%
City of Rhodes	45,000	40,000	84,100	99%	-	-	900	1%	-	-
Ialysos	10,000	20,000	0		20,000	66%	10,000	33%	-	-
Communities	44,500	-	6,500	14,6 %			18,000	40,5%	17,500	39,5 %

WASTEWATER POLLUTION LOAD FROM INDUSTRY

Type of Industry	Total pollution load after treatment			
	Total amount of treated wastewater m^3/year	BOD_5 kg/year	SS kg/year	Discharge
CAIR (Wine production)	190,000	8,000	29,000	Sea by Submarine outfall
BAP (Soft drinks)	16,000	318	N/A	Subsoil
3E (Soft drinks)	40,000	1,600	1,600	Subsoil

Solid wastes

The solid wastes disposal site for the City of Rhodes and for the Ialysos area, which is near Koskinou, is almost saturated. The manner of disposal of solid wastes is sanitary landfilling. Some of the communities have formed associations for the management of their common landfills, and the three associations formed include five, six and ten communities respectively. The rest of the communities use nearby sites for dumping of solid wastes. No data was available regarding the composition, quality and quantity of the solid wastes produced.

4. Conclusions and Recommendations

The results mentioned above and the information supplied in this report provide sufficient indication of the situation in the coastal area. It is evident that the area is of high importance to tourism as the seasonal increase may double the population, thereby giving rise to more than double the amount of wastewater to be collected, adequately treated and discharged. The installations for the local population show that an extension of the actual wastewater treatment plants is needed, while tourist establishments supplied by their own individual treatment plants, which are mandatory by law, can handle the seasonal increase provided they function under the planned efficiency.

A more effective method of enforcement is needed in order to discontinue, and preferably to localize, the illegal connections to the stormwater system, thus avoiding pollution of the discharged sites. The local authorities must be persuaded to only take proper action for facing specific problems when exact data are provided. Reliable data forms the foundation for any adequate future activities to be undertaken, and local authorities must be made aware of this.

The situation regarding industrial effluents is quite clear because of the limited number of installations, and it appears that sufficient treatment and adequate

discharge is taking place. In addition, the expert has clearly stated that there are no point sources of pollution related to mercury, cadmium, organohalogen and organophosphorus compounds or any other compounds listed in the 13 common measures adopted by the Contracting Parties to the Barcelona Convention and its related protocols. It was also added that a programme is to be commenced on the incineration of used lubricating oils in the island's lime kiln.

Finally, according to the information provided, no marinas exist on the island. A problem which is in need of special attention is that of the olive mills' wastewater. The seasonal functioning, the small size of the units and the absence of appropriate and economically suitable technology constitute the factors which one can deal with.

Taking into account the LBS report of the Island of Rhodes and the points clarified above, the following proposals can be made:

(a) All reported data must be taken into consideration when suggestions for liquid waste management have to be made;

(b) In order to have more reliable data for the LBS, and to follow up the results of the proposed measures, a well-designed monitoring network has to be created on the Island of Rhodes following a study based on all available data on this matter. Priorities for monitoring must be given to "hot-spot" areas regarding the presence in seawater, sediments and seafood of substances which can produce human health hazards or hazards to the marine environment;

(c) An appropriate study of the quality and quantity as well as the composition of solid wastes produced, is essential for the safe management of the dumping sites. In addition, geological surveys for deciding on the most suitable areas for disposal of solid wastes must follow the first study;

(d) An issue which needs further investigation is the pollution by persistent synthetic materials and its related measures of control, comprised in the common measures adopted by the Contracting Parties to the Barcelona Convention. Since no or limited data exist on the level and nature of the litter, and the litter sources, it is proposed to engage an expert. The expert should visit the Island and, together with local authorities, should prepare a programme of actions for implementing the common measures required to control litter contamination in collaboration with the local authorities, following the guidelines of the developed methodology described in the report IOC/FAO/UNEP(1989). In addition, he should design wherever possible educational programmes and/or campaigns for youngsters and schools.

	COMMON MEASURES	SITUATION IN RHODES ISLAND
1.	Interim Environmental Quality Criteria for Bathing Waters (1985) (Article 7.1(c))	Programme for monitoring bathing water exists
2.	Interim Environmental Quality Criteria for Mercury (1985) (Article 7.1(c))	No mercury producing activities exist on the island
3.	Measures to Prevent Mercury Pollution (1987) (item 4 of Annex I)	No mercury producing activities exist on the island
4.	Environmental Quality Criteria for Shellfish Waters (1987) (Article 7.1(c))	Included in the monitoring of bathing waters
5.	Measures for Control of Pollution by Used Lubricating Oils (1989) (item 6 of Annex I)	It is planned for incineration
6.	Measures for Control of Pollution by Cadium and Cadmium Compounds (1989) (item 5 of Annex I)	No cadmium producing activities exist on the island
7.	Measures for Control of Pollution by Organotin Compounds (1989) (item 3 of Annex I)	No major sources of organotin compounds
8.	Measures for Control of Pollution by Organohalogen Compounds (1989) (item 1 of Annex I)	No major sources of organohalogen compounds
9.	Measures for Control of Pollution by Organophosphorus Compounds (1991)	No major sources of organophosphorus compounds
10.	Measures for Control of Pollution by Persistent Synthetic Materials in the Mediterranean Sea (1991)	No or limited data exist
11.	Measures for Control of Radioactive Pollution (1991)	No sources of radioactivity
12.	Measures for Control of Pollution by Pathogenic Microorganisms (1991)	See 1 above
13.	Measures for Control of Pollution by Carcinogenic, Teratogenic and Mutagenic Substances (1993)	Related to monitoring

Activity No. 2: LIQUID WASTE MANAGEMENT

1. Background Information

Wastewaters from residential and tourist communities as well as industrial wastewaters may be hazardous for human health and may cause such undesirable changes in the ecosystem of continental waters and the coastal sea that their very use becomes impossible. On the Mediterranean islands this particularly refers to using the sea for food production (shellfish, crustacea, fish) and for the use of the coastal sea for tourism, water sports and general recreation.

Runoff waters from communal surfaces and industrial zones may, in certain circumstances, affect human health and the environment similarly as wastewaters.

On many Mediterranean islands wastewater management is far from satisfactory. Very frequently wastewaters are being discharged uncontrollably into the environment. There is insufficient experience in planning and managing wastewater control facilities. In many cases, institutional, technical and financial issues in the maintenance and operation of wastewater control plants are not given proper attention when planning, designing and constructing these facilities. This results in low efficiency of the already existing facilities, which, besides unwanted health-related and economic effects, also causes sociological problems.

1.1 Objectives of the General Plan for the Management of Wastewater

The purpose of the preparation of the General Plan is to prepare information on the state of the environment, to consider possible alternative solutions to wastewater discharge in accordance with established criteria, as well as to assess the technical, administrative, financial and other measures necessary to fulfil the set goals.

The fundamental objective of the General Plan is to prepare a document by means of which the impact of the sources of environmental pollution, as well as the necessary measures for reducing the pollution in order to protect human health and the environment, can be assessed from the technical, administrative, and financial aspects.

Other objectives in the preparation of the General Plan include determining which further research activities are to be carried out, and defining which new documents are needed in making decisions about the construction of particular parts of the wastewater collection, treatment and disposal system. Also, one further objective of the General Plan is to propose measures for upgrading local institutions for the management of wastewater control facilities.

Efficient operation of the institutions for water pollution control depends on the qualified personnel (scientists and other trained staff), financial support of their activities, and their public relations.

2. PERFORMED ACTIVITIES

2.1 Synthesis of The General Plan For The Management of Wastewater

The preparation of the General Plan began in 1993. The first part of the General Plan was prepared using MAP/UNEP-PAP/RAC funding and comprised the Sections "Assessment of Local Conditions" and "Setting of Standards". After signing the contract with the European Investment Bank (EIB), the entire General Plan was completed and was published as the Technical Report. In the meantime, Report of Phase 1 has been amended, and as such is the basis for the preparation of the Technical Report.

Methodological Approach

Taking into account the objectives of the General Plan, a method for the collection of information, comparison of variant solutions, and definition of final conclusions has been applied. Firstly, all existing available information on the state of the environment is to be collected, implementing legal measures (i.e. criteria, standards) on the existing sources of pollution and the current method of wastewater management, so as to determine possible limiting factors that could affect the selection of the optimum variant. This part of the Plan should also cover the available information on the planned urban and rural development so the future impact on the environment could be assessed.

The second part of the Plan deals with possible alternative solutions to the management of wastewaters. Different options of wastewater control systems are compared on the basis of their expected impact on the environment and human health, socio-cultural aspects of their use, the costs and benefits is expected, as well as in terms of management and financing.

By applying the method of comparative analysis, the best technical option, the one meeting all the required criteria, is selected.

The study of the technological measures of protection should be accompanied by an analysis of the institutional measures, resulting in a proposal of an appropriate organisation in charge of the wastewater control system.

The concluding part of the General Plan should include a proposal of the wastewater control system and the organisation that would manage the proposed system. The proposed solution should be in accordance with the legal measures, the economic and financial potentials available, and should also be in agreement with the planned development of the region in question, given an appropriate environmental and human health protection.

Collection of Information

Data collected is a particularly important part of the General Plan, since later reached solutions heavily depend on the "input" data and their reliability. As mentioned above, the collection of information began in 1993 (Report of Phase 1) and went on throughout 1994 (technical report).

The standards (ambient and effluent standards) which will be applied within the framework of the Plan are discussed in the Section "Definition of Criteria" (Technical Report). These standards are based on EU Directives and on WHO/UNEP Quality Criteria prepared on the Barcelona Convention.

Socio-economic criteria is defined and discussed in the Section "Planning of Systems". In this section, certain limitations on the efficiency of the proposed optimum option are evaluated. The limitations established on the island of Rhodes are:

- Past decision in selecting wastewater management facilities;

- inadequate existing capacity of the equipment and personnel in charge of waste control on Rhodes island;

- lack of a "central data bank system" based on which all precise data on the environment, sources of pollution, planned development etc. would be collected.;

- prolonged decision making process, during which changes in the area could occur before a proposed option is adopted.

The section "Assessment of Local Conditions" comprises the following: sources of pollution, oceanographic data on the coastal sea, topographical and morphological data on the island of Rhodes, climatic circumstances, geological and hydrological conditions, and the present condition of facilities and wastewater management.

The sources of pollution include data on the population, tourism, and the industry (as "point" sources) and on agriculture (as "dispersed" source of pollution).

Data on point sources are shown in the Report of Phase 1:

- the population of the island of Rhodes	98 181
- number of tourist beds	62 678
- estimated quantity of wastewater per capita	1201/cap/day
- daily quantity of wastewater per tourist	3001/cap/day

Existing data on industrial wastewaters is not sufficient as to enable the assessment, in terms of quantity, of the industrial wastewaters. Industrial facilities on the island include vineyards, juice production plants and slaughterhouses. Data on the quantity and composition of wastewater can be collected during future investigation works.

Out of the total of 8902 ha of agricultural land some 836.1 ha, or 9.4%, is irrigated. An analysis of agricultural land has been carried out in order to establish whether an option with wastewater re-use in agriculture is feasible. There is no data available on the possible pollution of water (ground or surface) from agriculture.

Data available from oceanographic investigations has been collected as well. The oceanographic data is shown in the Report of Phase 1 and then amended in the Technical Report. The existing data comes from sporadic investigations. However, there has been continuous monitoring along the coast of the city of Rhodes over the past years, carried out by the Hydrobiology Station of Rhodes within MED POL Monitoring Programme.

Based on investigations to date, it can be concluded that there is a strong surface current coming from the area of NW Levantine over the Aegean Sea. At a depth of 300 metres, much slower west-east currents have been observed. Local currents have been investigated only for the needs of laying a marine outfall at Cape Vodi.

The sea water temperature at the surface around the island of Rhodes is not less than 17.5°C (in February) and not more than 26.4 °C (in August). Thermal stratification has been recorded throughout the year, except in February.

The concentration of dissolved oxygen in the coastal sea is relatively high at all depths throughout the year. The average value of dissolved oxygen in the surface stratum ranges from 4.3 to 5.2 ml/l.

The sea around the island of Rhodes is generally oligotrophic, i.e. with low concentrations of nutrient salts. Somewhat higher concentrations of nutrient salts have been recorded at the station near the city of Rhodes, probably as a result of municipal wastewater discharge. However, not even this area can be marked as eutrophic. Studies of phytoplanktons show that there is an increase in phytoplanktonic population along the eastern coast of Rhodes in summer, which also points to the closeness of a wastewater outfall. Significant increase in phytoplanktons is recorded near the ports of the city of Rhodes (the Commercial Port and Mandraki).

There is no general recording of the height and length of waves. Only estimated values, based on the direction, strength and duration of winds, and the length of development can be used for particular cases.

Due to relatively scarce oceanographic investigations, a programme of future investigations has been prepared.

Bathimetric data is shown on the map (Hydrography Service of the Greek Navy - Maps).

The technical Report also includes other input data, such as general topographical and morphological parameters, climatic circumstances, geological and hydrogeological conditions.

The island of Rhodes has 1400 square kilometres, its coastal line is 220 kilometres long, and the highest mountain peak (Attavyros) of 1200 metres high. It is a hilly island with small valleys suitable for agriculture.

The island has long sunny periods with moderate temperatures. The lowest air temperature is 11.4 °C (in January) and the highest is 27.5 °C (in August). The

average air moisture in November and December is 74%, and 55% in July. The highest precipitation, 158.3 mm, has been recorded in January, whereas the lowest, in July, was 0.0 mm. The prevailing winds are westerly winds.

Geological and hydrogeological data is shown on the maps.

As for the waste control facilities on the island, there is a plant for the treatment of septic waters at Cape Vodi and a wastewater treatment plant for the municipality of Kremasti-Paradisi. The construction of the wastewater treatment plant of the city of Rhodes, which is to cover the area of the northern "triangle" as well, is underway.

The only company on the island in charge of the water supply and sewage system is DEYAR, which is part of the administration of the Municipality of Rhodes. DEYAR experts also maintain the Cape Vodi plant.

The plant at Kremasti-Paradisi is controlled by the Technical Services of the Department of the Interior (TYDK).

Planning of Systems

This Section mainly discusses the technical and technological measures for wastewater collection, treatment, and discharge.

Six geographical units at the island of Rhodes, established in accordance with the Greek Law 1416/84, have been observed. The sizes of the units are shown in the following table:

Geographical Units		Population	Tourist Beds	Effluent m^3/d (%)
1.	City of Rhodes, Ialyssos, Koskinou, Kalythies	55960	49928	21694 (70.9)
2.	Kremasti, Paradisi Maritsa, Pastida, Damatria, Theologos	10637	2686	2082 (6.8)
3.	Soroni, Fanes, Demylia, Kalvarda, Salakos, Platonia Appolona	5122	200	675 (2.2)
4.	Embona, Kritinia, Siana, Ayios Isidoros, Monolithos	3584	12	434 (1.4)
5.	Archangelos, Afandon, Psirithos, Archipalis, Maloua, Massari, Kalathos, Lindos, Pylano, Lardos, Laerma	18423	7697	4520 (14.8)
6.	Geunadi, Aschipio, Vati, Lachania, Kataria, Messangros, Apolokkia, Arnitha, Istrios, Profilia	4455	2155	1181 (3.9)
TOTAL		**98181**	**62787**	**30586 (100)**

For each of the geographical units, the possibility to collect and treat wastewater at a common plant for two or more communities has been considered.

When considering the possibilities for the final discharge of treated wastewater, the following options were analysed:

- discharge into the coastal sea;
- discharge into a watercourse;
- re-use for irrigation purposes;
- groundwater renewal;
- discharge into the soil.

The possible application of each of the three degrees of wastewater treatment, including the resulting consequences, has been considered. The "first level" of wastewater treatment, however, has not been adopted in any option. Namely, prior to the preparation of this Plan, the Greek authorities for Rhodes had not established the "less sensitive areas" as proposed by EU-Directive 271/91, therefore a possible application of the "first level" treatment will be considered within the Master Plan.

Within the "second level" wastewater treatment, the application of the biological procedure using active sludge, and particularly "extended aeration", is planned. The application of physico-chemical procedures (coagulation-flocculation) and of stabilisation ponds is unacceptable due to the specific conditions on the island of Rhodes.

The General Plan does not consider sewage networks of individual communities, and only raises the possibility of developing the sewage network as opposed to collection and disposal of wastewater from septic tanks.

When considering the transport of wastewater from septics, two options were analysed:

- vehicular transport to the existing wastewater treatment plant at Cape Vodi (Rhodes),

- vehicular transport and construction of a new treatment plant for wastewater from the septics.

The sludge from wastewater is planned to be drained at the plant, mostly applying "sludge beds". Final disposal of drained sludge is to be at sanitary landfills.

During the preparation of the General Plan, the method and location for the disposal of solid waste other than the existing dumps were not known. It is expected that the problem of solid waste disposal will have been solved by the time of preparation of the Master Plan. It is then to be decided on the possible compostation of sludge and part of the solid waste, either for use as agriculture and forestry or just to reduce the space for landfills.

Based on the assumptions discussed above, some alternative solutions to wastewater collection, treatment and discharge have been considered for individual communities on the island of Rhodes. It should be noted here that the problem of wastewater management has been solved for the Geographical Unit 1 (the City of Rhodes, Ialyssos, Koskinou, Kalythies). Namely, the construction of a main sewer, which will transport to Cape Vodi wastewaters of the whole region, is underway. Furthermore, a wastewater treatment plant is being constructed on the sewer as well. Treated wastewater will be discharged into the sea by means of a marine outfall, which has already been laid. Because of this, wastewater management in GU1 will no longer be considered in this Plan in terms of the selection of options.

Guidelines for solving wastewater collection, treatment and discharge have been proposed for communities with under 1000 inhabitants and tourists (in total). There are 17 such communities on the island, and they are not included in the wastewater collection options proposed for two or more communities. Small communities are located in mountainous areas and several kilometres apart, so that their wastewaters are planned to be solved separately.

The alternative solutions considered for particular communities differ with respect to the following parameters.

- wastewater collection is a) by sewage systems to a common plant, b) to a separate plant, or c) by collection in septic tanks and vehicular transport.

- wastewater treatment is a) primary, b) secondary (biological), or c) tertiary (removal of N and P);

- wastewater discharge is a) via marine outfall into the sea. b) into watercourse (stream), c) re-use for irrigation (storage in deep reservoir), d) groundwater renewal (soil aquifer treatment), e) groundwater renewal by discharge into wells (subsurface injection), and f) discharge into the underground.

By applying the solutions listed above, it was possible to propose 80 alternative options for five geographical units.

In item 13 of the Technical Report, the costs of construction, operation, and maintenance for the proposed alternatives was estimated.

The following values were estimated within the investment budget needed:

Main collectors	80 000 - 145 000 US$/km (depending on topographical conditions)
Treatment plants	105 US$/p.e (4 000 - 10 000 p.e) 125 US$/p.e (under 4 000 p.e)
Marine outfalls	400 000 - 177 000 US$/km (depending on sea bottom morphology)
Main irrigation canal	80 000 - 145 000 US$/km (depending on topographical conditions)
Irrigation network	1500 US$/ha
Costs of deep reservoir	15 US$/$m^3$
Costs of soil aquifer treatment	90 000 US$ (lump sum)
Costs of subsurface injection	30 000 US$ (lump sum)

Operation and maintenance costs were estimated based on the existing Kremasti-Paradisi plant (10 000 p.e) value of 10.3 US$/p.e per year, and a correction value for smaller plants up to 29.1 US$/p.e for 400 p.e.

Human health hazards were analysed with regard to using the sea for swimming, and especially with regard to re-using water for irrigation and soil aquifer treatment.

Due to the sensitivity of the environment of the island of Rhodes, and because of great significance of the environment, especially the coastal sea, for the development of tourism, the acceptability of individual technological solutions was evaluated in terms of the socio-cultural aspects. The following aspects were especially analysed:

- role of environment protection for local economy;
- acceptance of irrigation methods;
- reforestation requirements;

- land use planning;

- infrastructure - manpower for systems management.

Although the construction of the systems for wastewater collection, treatment, and discharge cannot be directly evaluated applying the cost-benefit analysis, the damage resulting from pollution of the environment can be defined and, consequently, so can the benefits if pollution is prevented. The damage resulting from polluted environment is analysed in terms of:

- loss of tourist revenue;

- loss of fisheries output;

- degradation of the beach (cost of rehabilitation);

- human health hazard, and

- resident amenity (reduced property values).

Some of the damages can be expressed as monetised effects whereas some others cannot be expressed as monetised but only as qualitative effects. The non-monetised effects include the attractiveness of landscape, promenade along the beach and the like.

The construction of sewage systems requires certain financial support as well as management organisation (maintenance and operation) for waste control facilities. This issue is analysed in a separated section of the Technical Report.

"Weighted ranking" method was used to compare different technological solutions and evaluate their acceptability.

The following criteria and pertaining ranking values were selected:

Criteria		Ranking value
a)	Environmental	
1.	Impacts on quality of sea water	8
2.	Impacts on quality of ground water	7
3.	Impacts on quality of surface water	5
4.	Impacts on quality of soil	4
5.	Impacts on quality of air	3
6.	Impacts on quality of landscape	3
7.	Conservation of resources	5
TOTAL		35
b)	Hygienic	
8.	Impact on sea uses	15
9.	Contamination of ground water	10
10.	Injection risks for population	20
TOTAL		45
c)	Economic	
11.	Construction costs	4
12.	O/M costs	6
13.	Land occupation	5
14.	Infrastructure - manpower requirements	3
15.	Acceptance by the public	2
TOTAL		20

The acceptability of each particular option according to different criteria was assessed as:

4. very good
3. good
2. moderate
1. poor

The comparison was carried out in a way that each collection and treatment option was combined with a discharge option. Thus, a matrix consisting of 28 options and 15 factors/criteria was formed. The option with the highest weight value was ranked first and the option with the lowest weight value was ranked last.

Based on the results of the evaluation, it could be concluded that the most appropriate solutions would be wastewater collection, high level treatment, and re-use for agriculture and/or for soil aquifer treatment.

3. Conclusions and Recommendations including follow-up Activities

The General Plan is essential but not sufficient for the implementation of the measures for the control of wastewaters. It is recommended that the decision makers decide on follow-up activities, particularly: investigation works for acquiring more accurate information, preparation of the Wastewaters Master Plan, preparation of Feasibility Studies, establishment of one or several organisations in charge of wastewater control:

(a) Additional investigations to cover field, laboratory, and office activities are needed so as to determine more accurate "input" data for the preparation of the Master Plan.

(b) The Wastewater Master Plan should include the technical data on future sewage systems to such detail as to enable the preparation of Feasibility Studies for particular systems.

(c) The Feasibility Studies would be prepared based on an adopted Master Plan, and in accordance with a time schedule for each investment entity.

(d) A Wastewater Management Organisation is to be established for the implementation of all follow-up activities.

(e) It is also recommended that, as an immediate action, investigation works for the Wastewaters Master Plan be started. Along with the establishment of the Wastewater Management Organisation, it is necessary to ensure the cooperation of the sector departments of the Prefecture as well as the financial sources for the follow-up activities.

Activity No. 4: MONITORING OF MARINE POLLUTION IN RHODES COASTAL REGION

1. Background Information

The Coastal Area Management Programme (CAMP) for the island of Rhodes, implemented through UNEP's Mediterranean Action Plan, aiming at the integrated planning and management of coastal resources was signed in November 1990. Monitoring of Marine Pollution is the activity No. 4 within CAMP, composed of microbiological and physic-chemical monitoring of Rhodes coastal waters.

The island of Rhodes with its 220 km of coastline is situated at the south-eastern corner of the Aegean archipelago and covers an area of 1400 ^{sq}. As a highly tourist island receiving approximately 20% of the total number of international tourists in Greece, it has properly developed the usage of its coastal areas for recreational purposes. This activity is, however, threatened from pollution sources. In order to maintain a high standard of tourism, the quality of bathing waters is already monitored systematically following the EEC Directive.

Monitoring of Marine Pollution within CAMP was designated to include this on-going programme on bathing waters quality, expanding it at the same time to include the winter period and various other parameters, such as nutrients, heavy metals and petroleum hydrocarbons, taking into consideration the land-based activities on the island. Its pilot character, could act as a prototype for the elaboration of similar programmes in tourist islands. In the long-term, a pollution monitoring programme of the coastal waters could be developed and implemented on a permanent basis.

2. Objectives of the Activity

The main objective of this activity is to establish a well organised administrative and scientific structural system for the successful monitoring of the coastal waters. It will be combined, as a controlling factor, with the effective waste water management plan.

The following immediate benefits are expected:

a) constant surveillance of the water quality on beaches;

b) constant surveillance of the pollution in the coastal zone;

c) quick response to accidental pollution;

d) implementation of (i) the EEC Directive on the quality of bathing waters, and (ii) the interim quality criteria for bathing waters adopted by the Contracting Parties to the 1976 Barcelona Convention, with additional provisions under national law for taking account of the special conditions of the Mediterranean marine environment (short coast lines, small bays);

e) the collection of data relevant to the implementation of the common measures for the protection of the sea against pollution, adopted by the Contracting Parties to the Barcelona Convention.

A long-term benefit will be the identification of pollution sources affecting the water quality of beaches, and implementation of the necessary measures to eliminate such pollution, thus ensuring good water quality, as well as the actual implementation of the common measures for the protection of the sea against pollution which have already been adopted by the Contracting Parties to the Barcelona Convention.

The output of this monitoring activity is mainly the establishment of a well organised monitoring programme of recreational sea water quality and pollution of the coastal zone, which will provide information for the formulation and implementation of appropriate control measures.

3. Performed Activities

The Monitoring of Marine Pollution within CAMP was carried out for a period of 2 years (1994-1996) under the coordination of the Ministry of Environment, Physical Planning and Public Works (Project leader/Coordinator Ms. A. Katsara, Civil Engineer), in collaboration with local authorities. Mr. A. Skiadopoulos, Environmentalist at the Environment Section of the Prefecture of Dodekanese with the support of the local Port Authority, was responsible for the collection of samples and the *in situ* measurements. All laboratory analyses were undertaken by the Chemical Service of Rhodes, Principal Investigator, Mr. E. Nikolaou, Chemist.

During this period, two activities were performed: monitoring of microbiological pollution and monitoring of physico-chemical pollution. All collected data was stored in PC files according to the MAP/UNEP formats and codes. Purchase of laboratory equipment training and meetings of the participating authorities were also performed.

Monitoring of Microbiological Pollution

Monitoring of Microbiological quality of sea water was carried out for the period April 1994 to April 1995 which consists of the bathing season of 1994 and the winter period 1994-1995.

From April to October 1994, monitoring was executed in fifty (50) bathing areas of the island within the framework of the National Programme of Bathing Waters Quality Monitoring following the 76/160 EEC Directive. The programme comprised fortnightly samples per bathing area and definition of the microbiological load in terms of total coliforms, faecal coliforms and faecal streptococci, as well as observations concerning the colour, floated matters, phenols and tar in sea water. The CAMP Monitoring Activity incorporated the EEC programme and additionally introduced two new areas of monitoring: R2 at Cape Vodi, where a recently constructed sewage treatment plant is discharging effluent into the sea and R9 at the western coast of Rhodes, located near Soroni-Kalavarda. Therefore fifty two (52) areas were monitored during the bathing season.

The monitoring activity carried on during the winter period on a monthly basis, in order to ensure integrated and constant surveillance of the sea water quality. The sampling points have been selectively reduced to nine (R1 to R9), covering the most representative areas subject to urban, industrial, agricultural and tourist activities. areas R1 and R3 to R8 correspond to bathing areas included in the Yearly National

Programme of Bathing Waters Quality Monitoring, while the remaining two, areas R2 and R9, constitute the aforementioned points introduced by the CAMP Monitoring Activity.

The positions of the sampling areas are shown in Figure 1.

Monitoring of Physico-chemical Pollution

Monitoring of physico-chemical quality of sea water was carried out form December 1994 to January 1996.

Nine coastal areas R1 to R9 (see Figure 1) were monitored: the city of Rhodes (R1) tourist areas (R3 - Falyraki Kalythion, R4-Afantou, R5-Lindos, R7-Ixia) and areas in the vicinity of sewage treatment plant outfalls (R2-Vodi, R8-Kremasti). Stations R6-Kiotari and R9-Soroni are near agricultural areas. In addition the Power Station of the island is located at Soroni.

The monitoring activity comprised for each area monthly samples and determination of temperature, dissolved oxygen, suspended solids, salinity, chlorophyll-a and nutrients (nitrates, ammonia, phosphates) in sea water. In addition, measurements of heavy metals (lead, cadmium, mercury and chromium) in sediment and biota and of petroleum hydrocarbons in sea water were carried out on a seasonal basis. The biota used was the fish *Mullus barbatus* obtained from fishermen in two localities (Rhodes East and Rhodes West in Figure 1).

4. Problems Encountered

One of the main problems faced during implementation of the monitoring activity was the sampling procedure. The boat of the Rhodes Port Authority was available only a few times and sampling was difficult during winter. Furthermore, delays in financing created problems in the proper implementation of the activity following the agreed timetable.

5. Main Achievements (Results)

Monitoring of Microbiological Pollution

During the bathing season of 1994 the sea water quality in the 52 areas under monitoring was excellent. All microbiological results were in accordance with the guide values, even lesser, of the 76/160 EEC Directive, as well as with the Greek's legislation stricter mandatory value for faecal coliforms. Moreover, the quality of waters was very good with regard to colour, floated matters, phenols and tar following visual inspections. The water's quality was also in compliance with MAP interim quality criteria.

The very good quality of sea water as regards microbiological parameters was also proved during winter in all nine areas (R1 to R9) under monitoring. However, a pollution incident was revealed at area R8-Kremasti, where in January exceptionally high values of microbiological parameters were reported: total coliforms concentration equal to 2400/100 ml, faecal coliforms 930/100 ml and faecal streptococci 480/100 ml. It is estimated that pollution originated from waste waters discharged from a river

flow. During summer the river bed was completely dry and used for septic sewage discharges. A heavy rain generated the river flow and consequently all polluted sediments have been carried off into the sea. During following months, however, the quality was ameliorated and microbiological concentration levels were very low.

The final report on microbiological monitoring within CAMP was submitted in September 1995.

Overall results of the microbiological load in the nine selected areas of CAMP Activity during the whole period of monitoring are presented in Table 1.

Monitoring of Physico-chemical Pollution

In general, the physico-chemical quality of coastal waters under monitoring (areas R1 to R9) was very good. Salinity concentrations were typical around 38 to 39 gr kg^{-1} . Temperature values ranged from 14.00 to 23.80 °C depending on weather conditions. Dissolved oxygen concentrations ranged from 5.88 to 6.16 ml L^{-1} . Oxygen saturation levels were found above 105% and coastal waters could be characterised as over saturated, which is justified by the low sampling depth and the near shore sampling area. Total suspended solids concentrations were higher during winter and in particular in the western region of Rhodes, areas R7, R8, R9. In general recorded values ranged from 0 to 68 mg L^{-1}.

In certain cases nutrient levels in sea water reached concentrations which are considered high with regard to Greek average figures. This is due to the fact that samples were collected from near shore stations next to effluent sources. Concentrations of NO_3-N and PO_4-P as high as 22.14 and 1.04 μg at L^{-1} respectively, were recorded during winter at stations in the vicinity of sewage treatment plants and rural areas (see Figures 2,3,4). Regarding chlorophyll-a, values were less than 0.45 μg kg^{-1} in all nine areas under monitoring. It should be pointed out that there are no rivers on the island but only streams which run during winter carrying agricultural run-off.

Mercury concentrations in sediments ranged from 10 to 42 μg kg^{-1} DW while those of cadmium never exceeded 140 μg kg^{-1} DW. Lead concentrations ranged from 350 to 2167 μg kg^{-1} DW and those of chromium from 1383 to 5050 μg kg^{-1} DW. The lowest values were recorded at stations near rural areas (Kiotari R6) while the highest at stations near the most economically developed and therefore urbanised areas of the island (city of Rhodes R1, Vodi R2, Lindos R5) (see Table 2).

The concentrations of mercury, lead, cadmium and chromium in the fish *Mullus barbatus* were very low indeed indicating the lack of this type of pollution. Mercury and lead concentrations were less than 50 and 395 $\mu g\ kg^{-1}$ FW respectively. The concentration of cadmium was found to be around 1.0 $\mu g\ kg^{-1}$ FW, while that of chromium was less than 355 $\mu g\ kg^{-1}$ FW. These values can be compared with the lowest recorded in the Mediterranean region.

The concentrations of petroleum hydrocarbons in chrysene equivalents were less than 2.70 $\mu g\ L^{-1}$ and in most areas less than 1.0 $\mu g\ L^{-1}$. It is remarkable, that the highest concentrations were reported from the western coastal region of Rhodes (Ixia R7 and Kremasti R8).

The final report on physic-chemical monitoring within CAMP was submitted in March 1996.

6. Conclusions and Recommendations Including Follow-up Activities

In general, the quality of Rhodes coastal waters as far as microbiological and physico-chemical parameters are concerned is very good.

No major industrial activities take place on the island which could cause chemical pollution from heavy metals or petroleum hydrocarbons. It is evident that the main pollution sources affecting the coastal environment are urban effluents together with urban and agricultural run-offs.

It is, therefore, suggested that the sea water quality in the vicinity of sewage treatment plants is monitored systematically. As regards pollution control measures, it is suggested that unrestricted sewage discharges in streams should be avoided and that a rational use of fertilisers and pesticides should be applied. A long-term measure could be related to the upgrade of the operating efficiency of sewage treatment plants to include nutrient removal.

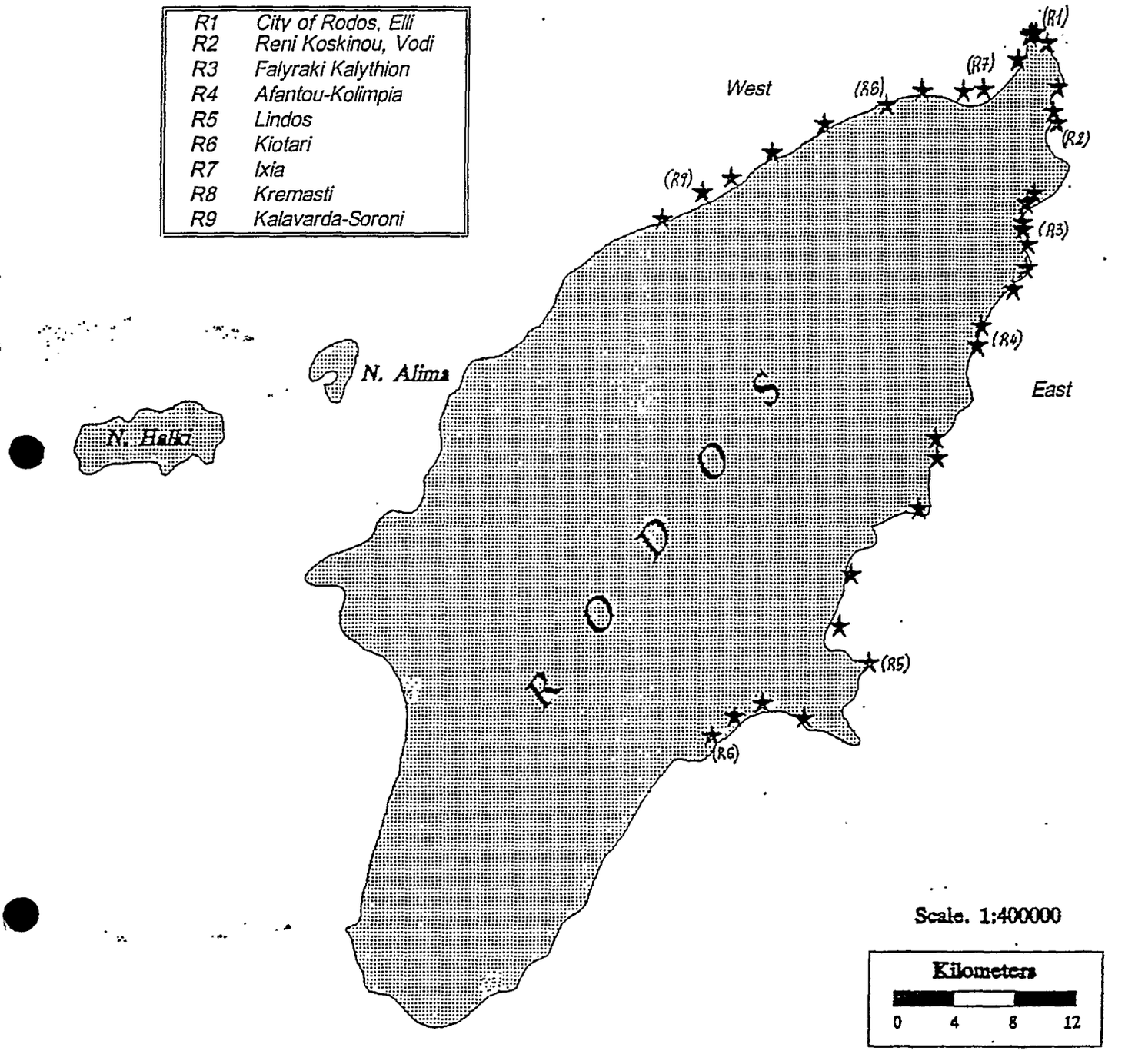


Figure 1. Areas under monitoring within CAMP for Rodos (activity n°4)

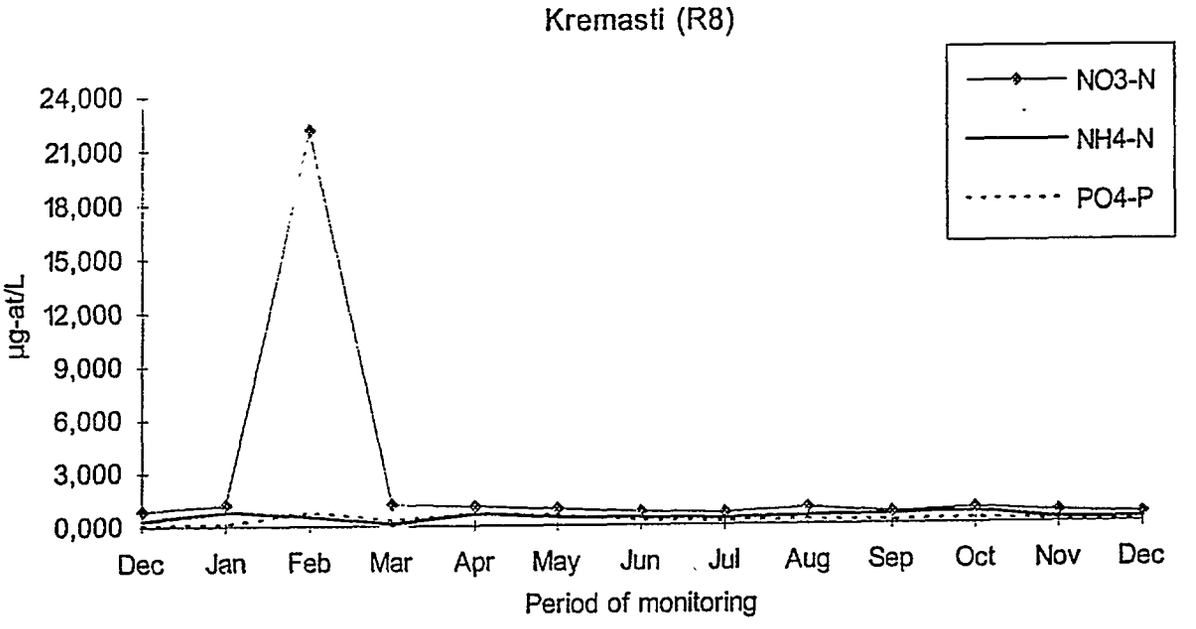


Figure 2. Seasonal variation of nutrients levels at Kremasti (area R8)

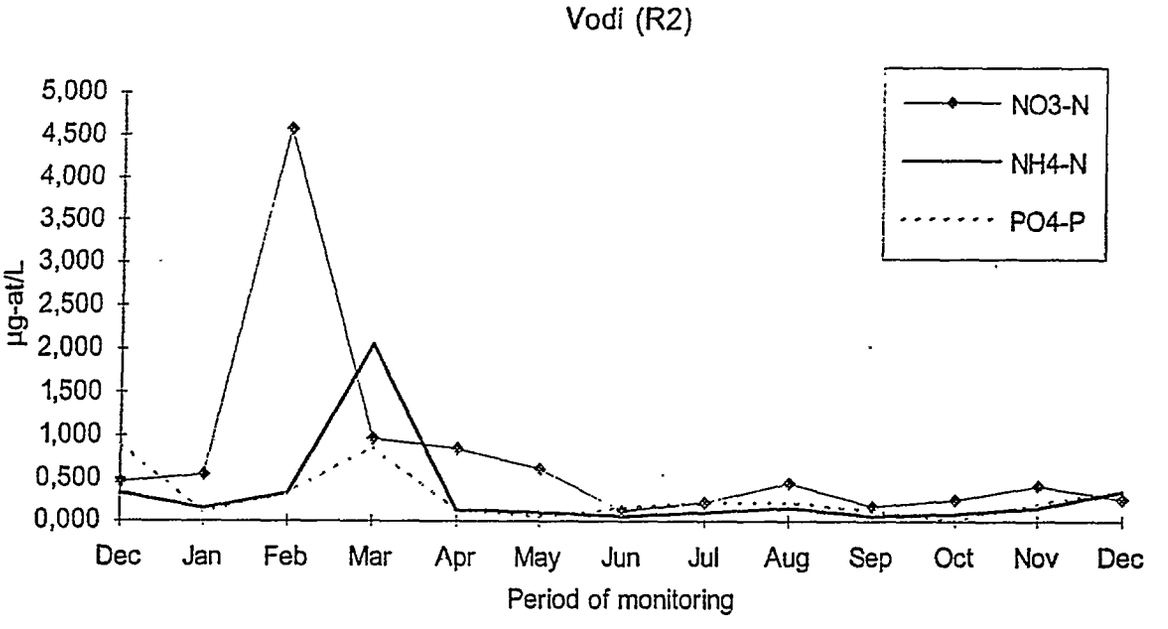


Figure 3. Seasonal variation of nutrients levels at Vodi (area R2)

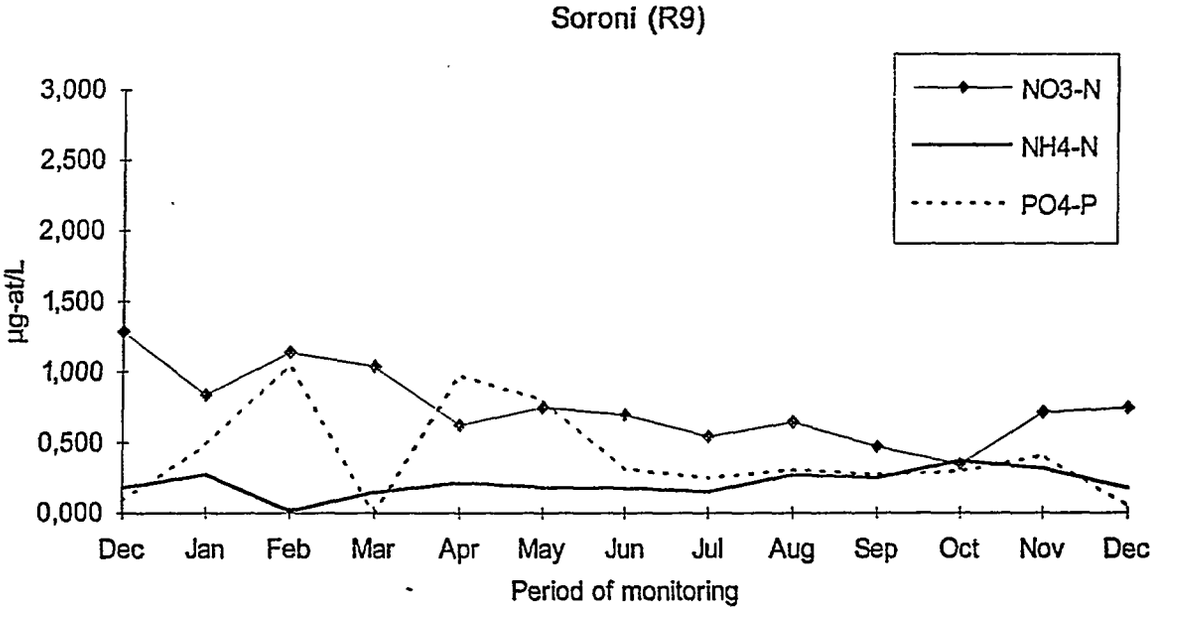


Figure 4. Seasonal variation of nutrients levels at Soroni (area R9)

Table 1. Microbiological load in the nine (9) selected areas of CAMP Monitoring Activity (Period of monitoring : April 1994-April 1995)

No	DATE	R1			R2			R3			R4			R5			R6			R7			R8			R9		
		TC	FC	FS	TC	FC	FS	TC	FC	FS	TC	FC	FS	TC	FC	FS	TC	FC	FS	TC	FC	FS	TC	FC	FS	TC	FC	FS
1	16.04.1994							25	25	25							25	25	25	25	25	25						
2	09.05.1994	30	30	0	30	30	0	30	30	0	30	30	0				25	25	25	40	25	25	30	30	0	30	30	0
3	21.05.1994																25	25	25	25	25	25						
4	23.05.1994	30	30	0	30	30	0	30	30	0	30	30	0										30	30	0	30	30	0
5	04.06.1994																25	25	25	40	25	25						
6	06.06.1994	30	30	10	30	30	0	91	36	30	430	30	20										73	30	10	30	30	0
7	18.06.1994																25	25	25	40	40	25						
8	21.06.1994	36	30	0	30	30	0	36	30	0	36	36	10										30	30	0	36	30	0
9	02.07.1994																			90	25	25						
10	04.07.1994	36	30	100	30	30	0	30	30	0	30	30	25	36	36	15	30	30	0				30	30	0	30	30	0
11	11.07.1994	30	30	80	30	30	0	30	30	50	30	30	0	36	36	15	30	30	0				36	30	0	30	30	0
12	16.07.1994																			250	40	30						
13	25.07.1994	36	30	20	36	30	0	30	30	10	30	30	25	91	91	60	91	30	0				230	30	15	36	30	0
14	30.07.1994																			40	25	25						
15	08.08.1994	30	30	0	30	30	10	30	30	0	36	30	0	36	36	10	30	30	0				30	30	0	30	30	0
16	16.08.1994																25	25	25	25	25	25						
17	22.08.1994	30	30	0	36	30	0	30	30	0	36	30	0	430	230	65							36	30	15	30	30	0
18	27.08.1994																25	25	25	40	25	25						
19	05.09.1994	91	36	150	91	30	20	36	36	0	30	30	0	91	91	30	30	30	0				30	30	0	30	30	25
20	10.09.1994																			25	25	25						
21	19.09.1994	30	30	60	91	36	20	30	30	40	30	30	0	36	36	0	30	30	0				430	150	40	30	30	0
22	24.09.1994																			40	40	25						
23	03.10.1994	30	30	20	36	30	0	91	30	60	30	30	0	30	30	0	30	30	0				36	36	10	30	30	0
24	08.10.1994																25	25	25	200	90	25						
25	18.10.1994	30	30	10				30	30	10				30	30	0							91	91	10	30	30	0
26	19.12.1994	30	30	0	91	36	40	30	30	0	30	30	0	30	30	0	30	30	0	30	30	0	30	30	10	30	30	0
27	16.01.1995	30	30	0	30	30	0	30	30	0	150	91	180	30	30	0	30	30	0	30	30	0	2400	930	480	230	91	30
28	14.02.1995	30	30	0	30	30	50	30	30	0	36	30	0	30	30	0	30	30	0	30	30	0	230	91	30	30	30	0
29	27.03.1995	30	30	0	30	30	0	30	30	0	30	30	0	30	30	0	30	30	0	30	30	0	30	30	0	30	30	0
30	28.04.1995	30	30	0	30	30	0	30	30	0	30	30	0	30	30	0	30	30	0	36	36	20	91	36	15	36	30	0

TC = Total Coliforms per 100 ml
FC = Faecal Coliforms per 100 ml
FS = Faecal Streptococci per 100 ml

Table 2. Heavy Metals in Coastal Sediment
(Grain size fraction < 500 µm)

AREA CODE	HGT µg/kg DW	CD µg/kg DW	PB µg/kg DW	CR µg/kg DW
R1	42	68	1033	2083
R2	37	135	1133	3417
R3	27	78	1150	5050
R4	15	75	850	3400
R5	42	67	2167	3767
R6	10	27	350	1383
R7	42	108	950	3217
R8	42	63	1050	2767
R9	32	95	967	2333

Activity No. 5: GENERAL WATER RESOURCES MASTER PLAN

1. Background Information

The state of the Water Resources is a limiting factor of a successful development of Rhodes. Therefore, priority should be given to the development of the **General Water Resources Master Plan.**

The Water Resources Master Plan of the island of Rhodes should provide an integrated presentation of all features of the water resources and will be used to define the optimum system of exploitation and protection of the resources in accordance with the present and future demands of the island. It will, thus, contribute to a sound and efficient management of water and other natural resources of the island.

OBJECTIVES

The objectives of the Water Resources Master Plan for the island of Rhodes are as follows :

Long - term objective : To contribute to the achievement of a sustainable development of the island through the establishment of an effective management system to enable protection and rational utilization of the water resources.

Immediate objective : To contribute to the solution of the current problems relative to the protection and exploitation of the fresh water resources of the island, and to provide for a rational water supply of the island.

To back up these objectives, the Assessment of the Water Resources and the Evaluation of their Availability, the Assessment of the Water Demand and Utilization and the Long - term Plan of Development, Exploitation and Protection of Water Resources, was carried out.

To the study is also reserved the usefulness to be pilot for similar cases elsewhere in the Mediterranean region.

The specific and detailed subjects the study went through, were :

I. Hydroclimatological Factors
II. Regime and Quality of Surface Water
III. Hydrogeology, Regime and Quality of Ground Water
IV. Development of Data Bank
V. Natural Water Balance
VI. Natural Factors related to Water Resources Master Plan
VII. Socio - economic Factors and Development Water Demand
VIII. Water Storage
IX. Protection from Water induced Natural Phenomena
X. Sewerage System in the Settlements and Industry
XI. Protection of Water Resources
XII. Water Exploitation

XIII. Analysis and Selection of Water Supply Solutions
XIV. Synthesis report on Measures and Activities for using the Island Water Resources

For each of the above Subjects has been prepared a Technical Document containing the following :

I. Hydroclimatological Factors

Hydroclimatological are the most indispensable data, concerning the assessment of the Water Resources of the island.

Data of precipitation, air temperature, sunshine, air humidity, wind, and evaporation were elaborated and presented, through Tables and Graphs, showing monthly and annual values, with all basic statistical indicators, probabilities and return periods. Also, daily values, when available were elaborated particularly for statistics of the extremes, of which probabilities and recurrence times were obtained.

II. Regime and Quality of Surface Water

The application of HYRROM mathematical watershed model was used for producing daily runoff figures from rainfall data.

The available data on rainfall and the computed depth - area precipitation for each of the catchments, the available runoff data and the calibration achieved together with the resulting model parameters as well as the simulated runoff figures for all the catchments and at selected sites with a potential for water works are presented.

Use, also, has been made of the rational method, that is the relationship of annual runoff v s catchment area, for a number of catchments for which runoff data were available, in order to produce for all catchments the mean annual amount of surface water.

III. Hydrogeology, Regime and Quality of Ground Water

The main lithological and structural characteristics of the island, that are of direct significance to ground water occurrence and regime have been studied.

The hydrogeological characteristics of the main formations of the island are evaluated, and produced among others is, information on their capabilities in terms, particularly, of borehole capacity, specific yield, transmissibility, saturated thickness and drawdowns. The ground water quality was studied and evaluated in extent and the situation, as well as, the relation to the lithological environment has revealed through the many quality factors and parameters. Numerous Diagrams are presented and the variation in space and time of various quantities, demonstrate the situation.

A Hydrogeological Map of scale 1 : 50000 demonstrates the whole situation efficiently through a great amount of hydrogeologic quantities and parameters. The land use (urban, agricultural, bare, forest and shrubby e t c) with its impacts on watersheds and on the ground water is also given and demonstrated by the relevant Map.

The assessment goes further with the pollution sources, the springs regime and the water abstraction.

V. Natural Water Balance

The evaluation of Water Balance concerning the whole island, has been produced by computing the balance for each catchment separately, on a yearly base. Applying all commonly used methods for the determination of evaporation (Penman's, Thornthwaite's, Turc's and Blaney - Criddle's), using the available rainfall data and the evaluated runoff figures, the unknown infiltration to subsurface, has been estimated.

In addition, the Natural Water Balance over broader regions, delineated with aquifer criteria is given. Also, a ground water balance of three main aquifer systems has been attempted

VI. Natural Factors related to Water Resources Master Plan

The evaluation of the available information on the most important natural factors of the island, including the main soil characteristics, the erodibility and mineral deposits, is presented.

Data and results on natural conditions, soil - type characteristics and hypsometry are presented in tabular and graphical form. Through the study of lithology, the geomorphological features and the process of erosion are interpreted. An erosion Map. a Map showing the distribution of land surface slope and a Map for mineral deposits sites, have been prepared, too.

VII. Socio - economic Factors and Development Water Demand

The compilation of existing data on population, settlements, manufacture, agriculture, energy, tourism, roads traffic, forestry and mining and the analysis of existing and future development of socio - economic factors in relation to Water Resources development, is presented.

Available data and information are tabulated and their characteristics are specified.

Detailed explanation of past pattern and future trends are examined and relative information necessary for estimating the future water demand, is presented.

Regarding agriculture, a presentation is being made of the present situation, structure, areal extent and distribution, producting, irrigation practice e t c .

It is given, also, a brief presentation of forestry and the imperative role it plays in the hydrological cycle and to a balanced environment.

VIII. Water Storage

Basic information is given on existing and planned surface reservoirs (location, natural, hydraulic and design characteristics, sedimentation and cost for each scheme).

An evaluation on the possibilities for artificial ground water recharge activities and of the influences of the proposed or existing surface reservoirs, is made.

IX. Protection from Water induced Natural Phenomena

A general presentation is made on floods and the factors favouring them. Vulnerable areas are examined in connection with human activity and detailed presentation of vulnerable to flooding zones is given and shown in Maps. Expected flood flows are estimated and presented.

Also, a presentation of the erosion process is made, as well as, outlined is the drainage problem, where it exists.

X. Sewerage System in the Settlements and Industry

This deals with the sewerage systems, both of waste and storm water, existing in the island, planned or under construction. Proposals are made on the preferred collection system, the treatment process and the disposal alternatives.

Priorities and the associated costs for each scheme component, are given.

XI. Protection of Water Resources

Presentation of the quality of all Water Resources of the island, is firstly, given. The whole situation is compared with the E U - Standards for potable water and is demonstrated by a variety of diagrams, while Maps are used to show the areal distribution of several parameters. It is, also, shown, the suitability of almost all water resources for agricultural use.

An evaluation, is made, of the pollution of the water resources from existing and potential sources, as well as, the measures that are or have to be taken to protect them. All pollution sources, the disposal practice and the recipients likely to become polluted are shown on Map.

Specific measures for the protection of Water Resources for each settlement or group of them, are proposed.

XII. Water Exploitation

A general presentation on the water exploitation of the whole island, regarding both sides, the water supply and the water demand, present and for the future, is given. It goes in more detail, concerning hydrogeologically differentiated areas and also development regions, as well as the individual settlements of the regions.

The water supply potential and sources, the water quality, the abstraction works, the storage and distribution facilities, the quantities of water abstracted and consumed, the calculated water demand, the water pricing, the trends of the residential and touristic population and of the water demand, are all among the parameters and the information given, and also demonstrated, by means Maps and diagrams.

XIII. Analysis and Selection of Water Supply Solutions

Three alternatives (groups of solutions) for the water supply have been analyzed. The proposed and strongly recommended alternative (Gadouras dam, mainly) envisages the predominant utilization of surface waters for supplying domestic needs, tourism and industry, while ground water is left to be used to irrigation, mostly.

The need for supporting the less developed southern island, as an alternative zone for a future expansion of tourism and relevant development, is recognized and to this aim emphasized.

XIV. Synthesis report on Measures and Activities for using the Island Water Resources

In order to enable easier overview of the work and the achieved results, the following synthesis reports have been prepared :

1/ Synthesis report on Water Characteristics
2/ Synthesis report on Water Utilization and Demand
3/ Executive Summary

PROBLEMS ENCOUNTERED

These were arisen mostly from the lack of adequate data or from the quality of certain data, that had to be managed and brought at a reliable and uniform level with the rest.

RESULTS

On the basis of the achieved results it can be concluded that the **Water Resources potential of the Island of Rhodes can meet all long - term water demands.** The Water Resources Crop of the island is estimated at 246 Mm^3 / year, of which Surface waters account for 131 Mm^3 / year and groundwaters for 115 Mm^3 / year. At present, only 27 Mm^3 / year are utilized, while the rest flows into the sea. The total planned long - term demand amounts to about 88 Mm^3 / year, in 2015 (18 Mm^3 domestic + touristic, 70 Mm^3 irrigation) or 95 Mm^3 / year, in 2040 (25 Mm^3 domestic + touristic, 70 Mm^3 irrigation). Irrigation needs are meant at full agricultural development.

More specifically :

The study and its results on the Water Resources of the Island of Rhodes have directed and focused us to the following principal thoughts and crucial conclusions :

Because water wealth of the whole island is understood to be comparatively impressive, since 246 Mm^3 are calculated as the annual volume, of which some 131 Mm^3 flow on surface and 115 Mm^3 in the subsurface, the stored water included, no matter where.

Because safe yield of the **aquifer of Sgouros - Afandou** (Region II on the Map) **has been exceeded,** since almost all the water needed to supply the NEastern part of the island is **being pumped from it and now its permanent resource is affected,** while **imminent is the sea intrusion or locally has already seriously occurred.**

Because the other large aquifer, extending **over the NWestern island** (Region I on the Map : Ialyssos - Maritsa - Damatria - Kalavarda) is estimated to be able to offer some 3 to 6 Mm^3 / year more, before having been reached its safe yield and because locally overpumping caused unacceptable quality deterioration.

Because from the third important aquifer of the island (Region III on the Map) can be abstracted an additional amount of 5 Mm^3 / year before safe yield having been exceeded (: todays abstractions amount to 3 Mm^3 / year).

Because all other aquifers of the island are of lower capacity and productivity, while their significance is limited to the local water needs and any consideration to abstract water to distant and intensive water demand without the risk of overcoming safe yield is rejected.

Because in socio - economic terms the principal and strategic target should be the touristic increase and expansion in the island of Rhodes, as well as in the rest of Dodecanese, probably within a touristic environment becoming continuously competitive.

Because quality of touristic industry in the island is high and as such is aspired to remain or improved further

Because touristic income is higher than other formed in other sectors of the island's economy and particularly of that from agriculture.

Very briefly to notice here, that the main aquifers are geologically and predominantly structured of the formations of " **Sgouros** " and " **Levantinians** ", secondly of alluvial deposits. Other aquifers either show deep saturation zone and / or are qualitatively and economically inappropriate to undergo serious exploitation or are threatened by sea intrusion, particularly, if put under pumping conditions. Few others take part in the hydraulic performance of the principal aquiferous systems.

For all the previous facts, limitations and goals, we came to the conclusion, which **we warmly introduce to the decision makers to make use of surface water resources,** that **very little** up to now have **been developed,** whilst are, comparatively, **quantitatively large** and offer in the long - run, **sufficient** and **safe solutions** to the water supply problems of the Island of Rhodes and of these facing water shortage in the rest of Dodecanese.

Additionally, any attempt for investment and development in the area will have objectively and psychologically the soundest of support from the island' s infrastructure, which should be water.

For the constraints imposed by the aquifers we more specifically underline the following facts :

An **annual loss** of stored water of about **2.7 Mm^3** , accumulated in the future, becomes threatening. This is anticipated to **13.5 Mm^3** and **33 Mm^3** after **5** and **15 years** (2015), respectively. **Nowadays, 9 Mm^3 / year** are **abstracted** for domestic use.

To cover this kind of loss only, not to refill depleted storage, a surface reservoir of 5.4 Mm^3 and of a investment cost of 14.8 M USD is needed, allowance for safety been made.

Over an area of 30 Km^2 the decline of water table reaches locally 10 m / year. **A mean value of 3 m / year** and in case **not less than 1.5 m / year** is being, acceptable to account for the decreased hydraulic performance of the aquifer with depth.

In boreholes, during the last 10 years, **a fall in yield by about 3 to 5 m^3 / h per year** is recognized, while applied discharges are commonly in between 45 and 70 m^3 / h at an average drawdown of 23 m and from borehole depths of 130 to 220 m, with 75 % going below sea level.

Under these conditions, after **5 years,** when a big surface storage (e g Gadouras) could be in operation the water level decline will attain **15 m** and after **15 years 45 meters. Threatened is therefore an entire depletion** of a large part of the main aquifer of the island, **followed by a slow but inevitable** and **irreversible occupation of evacuated porosity by**

brackish or sea water. From the induced compaction of the low coherence structure, will be irreversibly also lost valuable storage.

Furthermore, no induced natural recharge is offered to soften the situation.

Although up to now necessary, the violation of the aquifer's capability is costly and the consequences will be reflected upon other uses and **particularly upon the vital and sensitive touristic sector, if not found and decided soon an alternative and sound solution.**

The sector of declined reserves constitutes the 25 % of the aquifer.

The reestablishment to the previous state to avoid further consequences through the reduction of abstractions from the decline sector and by means of equal coverage of needs from sectors of the aquifer occurring further to the south will not avoid the undesired outcome because :

i/ for the increased grain finessess the " productive " parameters of the aquifer get lower towards south (: permeability, effective porosity)

ii/ boundaries of the aquifer, where productivity diminishes, will gradually approached. No inflows from adjacent hydrogeologic units are evident

Artificial recharge through spreading of the aquifer for geologic and geomorphologic reasons is not offered.

Injection through boreholes would be of preference and eventually feasible but only after a thorough experimentation, which presupposes detailed analysis and evaluation of the hydraulic performance and deep structure.

Nearby existing surface water resources for this purpose are hardly available.

Reuse of reclained domestic waste water to this purpose although a technologically attractive alternative **seems** not finally **admissible by the public**, as this is not get psychologically ready in this Country to such a kind of solutions.

PROPOSALS

To the preferred and proposed solutions are understood :

1 / Gadouras Storage Reservoir

with a design life of 50 years and a capacity of 63.5 Mm^3, the reservoir is capable and is warmly proposed to satisfy the island 's domestic water demand up to 2040 of

* all the NEastern from Massari to Kalavarda
* all the SEastern island
* all the nearby arid or water short islands

Total maximum water demand that it is called upon to cover is estimated to 24.6 Mm^3 / year. If added the distribution networks losses, the amount of water to be conveyed to demand places in 2040 will be 32.6 Mm^3 / year. With allowance made for evaporation losses the final amount of water is 35.622 Mm^3 / year.

Thus, the already designed capacity of the reservoir suffices to serve the whole solution, with one year safety storage. The resulting small deficit will be covered, when arised, by groundwater .

A water treatment plant at the foothills and three main aquedusts, in priority sequence:

* Gadouras - Sgouros, of peak flow of 1.28 m^3 / sec, 38 Km long, to the NE Water Supply Region
* Sgouros - Kalavarda of a peak flow of 0.34 m^3 / sec, 25 Km long to serve the NW island
* Gadouras - Kattavia, of a peak flow of 0.14 m^3 / sec, 47 Km long to serve the SE island

among with the necessary pumping stations, of a total power of 960 KW, will complete the main elements of the scheme.

Total investment cost of the scheme amounts to 95 M USD the benefit / cost ratio being 2.4.

Major justification of implementation of the solution remains the natural - geologic and socio - economic facts presented.

2 / Apolakkia Storage Reservoir

Additionaly to the irrigation purposes it has been designed, the reservoir can serve the domestic water needs of the Communities of Apolakkia, Sianna, Monolithos, Profilia, Istrios, Vati and eventually Ag. Isidoros.

The generalized elements of the scheme are :

Total length of pipeline 24 Km, water treatment plant of 1490 m^3 / d, peak flow of 13.7 lit /sec, total pumping power 88 KW, total investment cost 4 M USD.

3 / Kritinia Storage Reservoir

If increased the capacity of the proposed reservoir to 2.5 M m^3 , all water needs of the outmost NW island will be satisfied in the long - term. Communities to be served are Kritinia, Embonas, (Mandrico). More specific elements of the solution are :

Total pipeline length 9 Km, treatment plant of a capacity of 690 m^3 / d, peak flow 0.01 lit / sec, total pumping power 40 KW, total investment cost 10.5 M USD.

4 / Salakos and Profitis Elias Springs

All springw of this mountainous area and the nearby groundwater resource are rendered to the Communities of the area (Salakos, Dimylia, Apollonas, Platania). To the solution the water of about 100 m^3 / h, that todays flows from springs of the area of Rhodes, is included.

5 / Groundwater Resources

All irrigation needs, except those already served by the Apolakkia reservoir and what is anticipated for this purpose from the Kritinia reservoir, will be covered to the maximum possible extent from the groundwater resources underlain the agricultural land and from those that will be left free from domestic and touristic use after having been put into operation the whole group of solutions.

This group of solutions is additionally preferred and proposed because

- it is associated with
  - * an efficient management of few only catchments
  - * minimum or inexistence of risks
  - * less unit capacity cost (USD 0.8 / m^3)
  - * less investment cost 40.7 M USD (accompanying and auxiliary structures being about the same in other surface solution for same target)
- our intervention to the groundwaters resources is areally scattered at small pumping rates, so that deep drawdowns and subsequent sea intrusion are avoided or minimized
- almost the entire groundwater resource of the island is made available to exclusively agricultural use, where and when it is needed by the user and to the extent of development, evidently, the general and specific socio - economic conditions and the relevant benefits allow.
- offers
  - * better and greater water conservation
  - * less surface reservoirs
  - * less loss surfaces

* less distribution system
* existing well fields
* stage development possibilities
* less overall consequences to the broader ecolcgic environment
* less damage from dam failure
* better timing of water distribution by irrigators

Worthwhile environmental problems do not arise from the implementation of the solutions, except of that yet remained minor and related to the sediment deprived from the downstream of the dam terrestrial and marine environment.

Management

The establishment of a unified **Water Resources Service** having as a focal constituent the already mature, expert and efficient Municipal Corporation for Water Supply and Sewerage **(D E Y A R)** will be the indispensable background for a good performance, monitoring and protection of the solutions, of the water resources and of the related environment all over the island. The representation in the Service, through a flexible Body to perform **strategic management and control**, of all parts from both the **water supply** and **water demand side** , as well as of the Prefecture and the local Chambers relevant to water, is an idea that is laid down.

FOLLOW UP

The project identified the following activities to be implemented as urgent priorities :

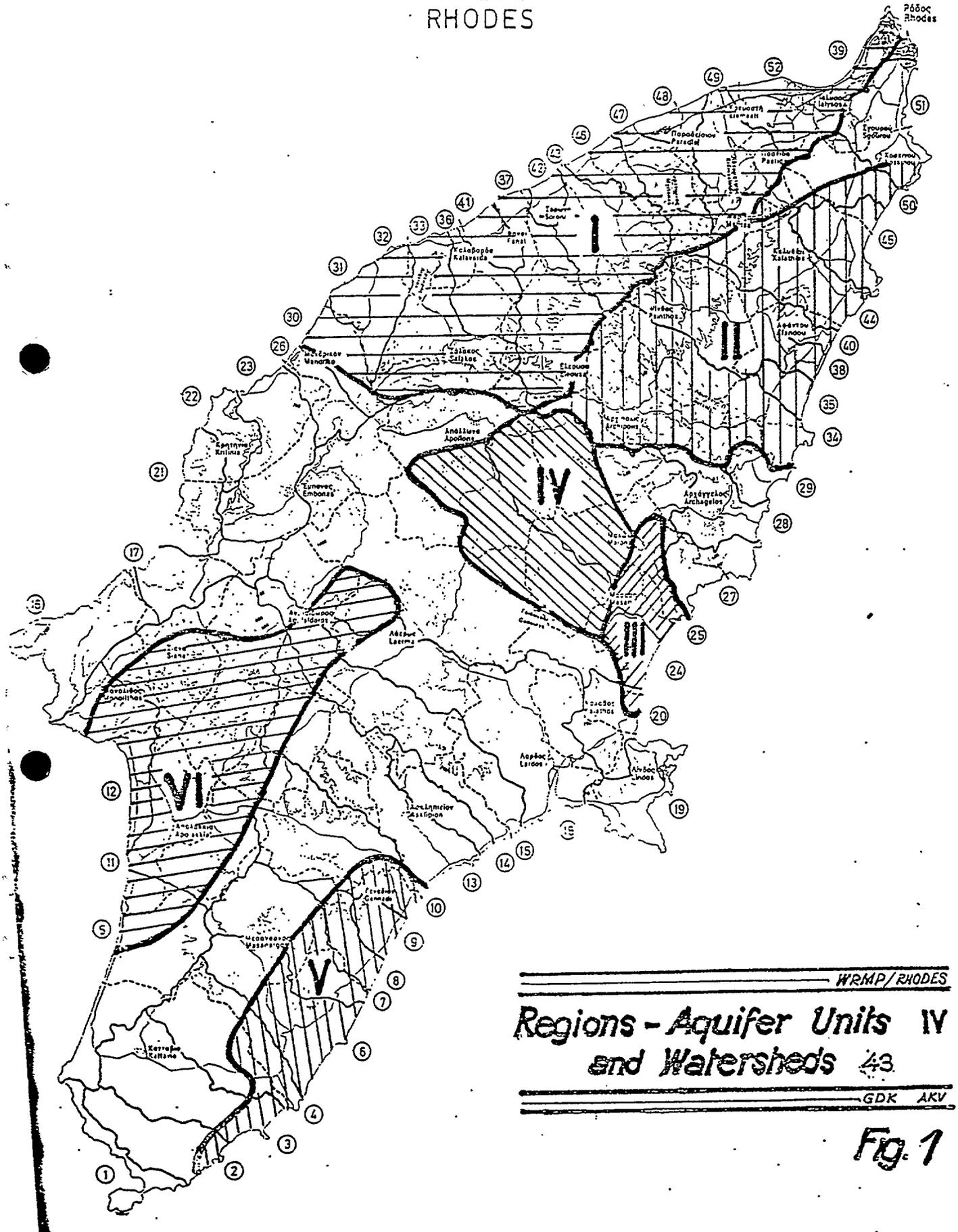
1/ Rational and sustainable management of Water Resources of the island if Rhodes requires, above all, **a considerable improvement of collection and procession of hydrometeorological, hydrological and hydrogeological data, and the establishment of a hydrological data bank. The continuous recording** of flows in few but representative catchments, the continuous recording of groundwater level and quality in a certain number of **new observatory boreholes** tapping crucial aquifer layers as well as the accurate determination of the hydraulic parameters of aquifers are understood among the imperative actions.

2/ A **detailed hydrogeological study of the island**, where it lacks with all modern investigation tools and techniques available, to reveal areal and especially precise depth conditions among with an **artificial recharge experimental study**, are all of particular significance

3/ On the basis of the project, **a feasibility study of the water supply system** of the island has to be prepared, and all other accompanying activities have to be performed.

4/ To secure a continuous and safe water supply in the island of Rhodes it will be necessary to perform **a detailed analysis of the environment and socio - economic effects of the construction of the water supply system** and particularly of the Gadouras Dam. All the environmental characteristics of both up - and down - stream areas of the dam, have to be thoroughly analyzed, and all protection measures must be taken.

ΡΟΔΟΣ
RHODES



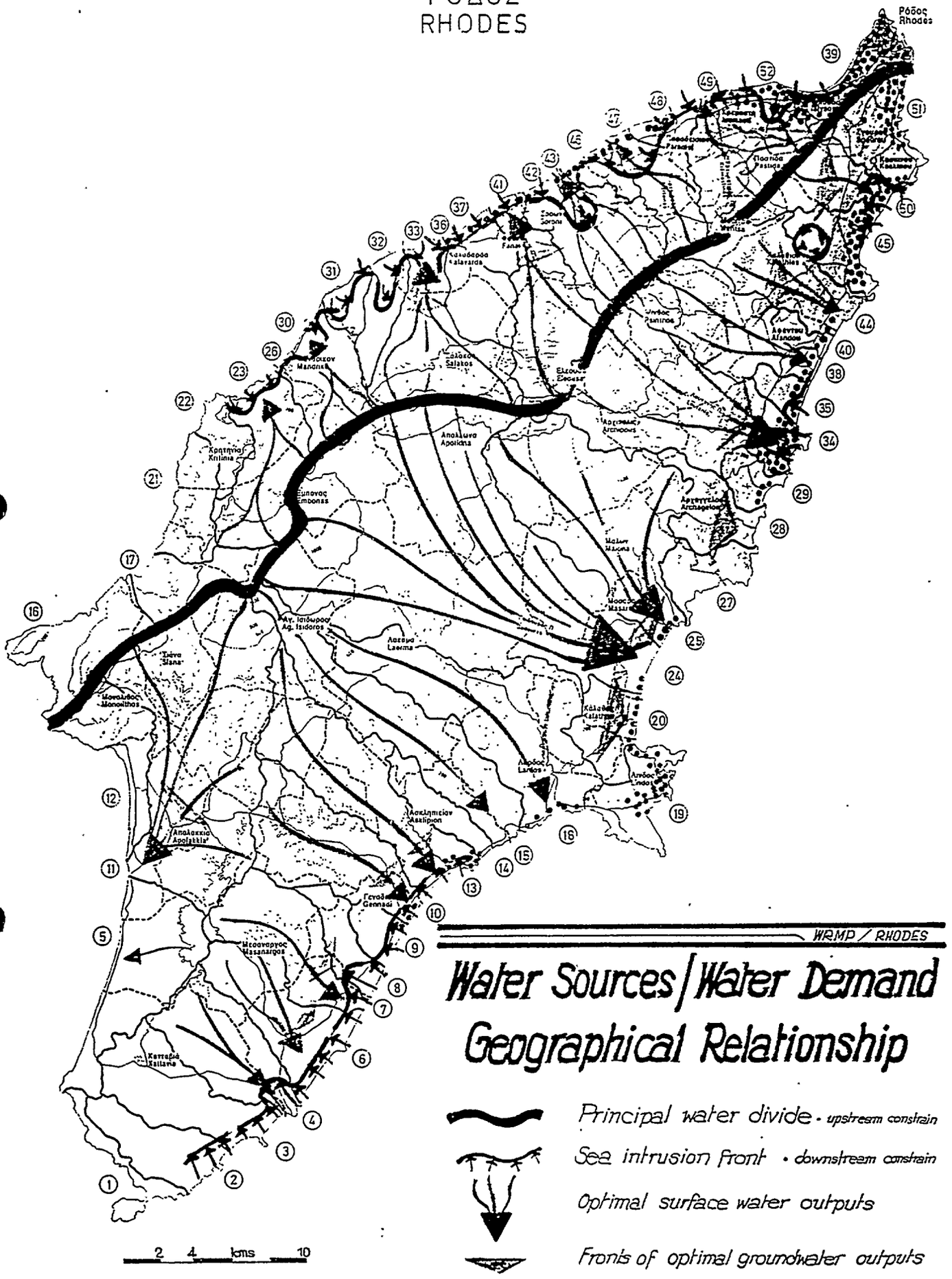
WRMP/RHODES

Regions - Aquifer Units IV
and Watersheds 43

GDK AKV

Fig. 1

ΡΟΔΟΣ
RHODES



WRMP / RHODES

Water Sources / Water Demand Geographical Relationship

Principal water divide - *upstream constrain*

Sea intrusion front - *downstream constrain*

Optimal surface water outputs

Fronts of optimal groundwater outputs

6% 12% 36% 45% Domestic / touristic demand zone, Along same zone most of the agricultural land,

Highly touristic sectors

Fig.2

G.D. Kounis A.K. Yiliariou

Activity No. 7: PROGRAMME OF ENVIRONMENTALLY SOUND ENERGY PLANNING

1. Background Information

The Greek Government and the Coordinating Unit of the Mediterranean Action Plan (MAP/UNEP), signed the Agreement on the Implementation of the MAP Coastal Area Management Programme (CAMP) "The Island of Rhodes".

The main characteristic of this material support was the isolation of Rhodes from the Greek infrastructure which stresses the need for securing a continuous supply of energy and for exploitation of the local resources to the maximum possible extent. Substitution of conventional energy sources by renewable energy sources, wind and solar energy applications, and applications of more efficient technologies at both production and end use levels were the main objectives of this activity.

Previous report, by ENERSYS Ltd. etc. have shown that the wind energy potential of the island of Rhodes was quite high and may be considered as one of the most important among the renewable energy sources. As the price of electricity produced by wind generators has decreased to that of conventional energy sources and the price for the installed KW has fallen close to $1,000, electricity production from wind generators could be a profitable and competitive application for the island of Rhodes.

In addition, a computerised expert system was developed at the University of Split, Croatia, in 1991 and it was available for the optimal selection of a wind generator system on a given location based on extensive database and on input data characterising this location.

2. Objectives of the Activity

The main objectives of the Programme of Environmentally Sound Energy Planning were:

- development and analysis of the strategies for the substitution of conventional energy sources by renewable sources of energy (RSE); and

- optimisation of the RSE system design for typical applications.

The specific objectives of the Programme were:

- to make an assessment of the wind energy potential of the island of Rhodes to satisfy the present and future energy requirements for various social and economic activities, as a part of the plan of action for the future environmentally and economically sound energy development for the island of Rhodes;

- to identify the potential consumers of electric energy and their present and future requirements, and to find an optimal rate of substitution of fossi fuels by wind energy, as well as to determine the upper limit of penetration of grid-connected wind generators in the total installed electricity generating capacity;

- to determine to optimal size and type of wind generators for each specific application;

- to determine microlocations for the proposed plan and schedule of installation of various wind generators;

- to analyse solar energy consumption in the hotel and industrial sector of the island of Rhodes; and

- to analyse deficiencies in the present installations of solar systems for wate heating and to propose better organisation of maintenance of such systems.

3. Performed Activities - Main Achievements

In 1990, the import of oil products contributed with 98,54% to the total energy requirements. In spite of the large technical potential, the contribution of solar and wind energy were quite marginal, being equal to 1.41% and 0.03%, respectively. As the island is not connected to the electric power system of the mainland, electricity has been produced by diesel engines, steam generators, and gas turbines in two power plants, with the total installed power capacity of about 120 MW.

As the total energy consumption amounted to about 4000 TJ in comparison with about 7000 TJ of the total energy provision, it may be concluded that a large amount of energy has been lost, mainly in the low efficiency energy transformation processes.

The technical potential of solar energy in the island is estimated to be around 26 Twh, a large amount almost 13 times bigger than the total primary energy used in 1990.

As the island of Rhodes has a high wind load factor of around 0.3, the total annual availability of wind machines is equivalent to operation for over 2500 hours at the rated power capacity, providing potentially about 300 Gwh/year.

An optimal energy scenario has been proposed based upon the so-called "sustainable tourism development", with a slower growth of tourst beds until the year 2010, sustainable employment growth, and preserving the environment.

The total energy demand in the year 2010, as calculated by the computer package LEAP, would reach about 5900 TJ, and for electricity an increase to the level of 434 Gwh. This would require an installation of additional 60 MW of diesel generators supported by about 20 MW of wind turbine generators.

By use of a multicriterial analysis incorporated in the CRO-EOL Expert System, it was possible to determine nine optimal microlocations for the future installation of wind turbine generators grouped in wind farms. The electricity production of the first five wind farms may satisfy the requirements for wind energy contribution in the optimal development scenario. Fifty one 400 KW units should be installed providing 68.8 Gwh/year at the total investment cost of about 23.5 million US$, and electricity production cost of 0.035 US$/KWh or 7.6 Drs/KWh. The pay back period would occur in 5 years. The investments in wind generators will be even more profitable if we take into account environmental effects of this partial substitution of fossil fuels power plants as the emission level of the main pollutants will be decreased by 15.85%.

Savings for the avoided CO_2 tax would amount up to 1.4 million US$/year.

It has also been shown that by retrofitting and modifications of the already installed solar water heating systems, they may provide almost 500 TJ of heat energy, raising solar contribution to 8.5% in the total final energy consumption in the year 2010, and displacing almost 16,000 tones of liquid fossil fuels a year, decreasing pollution level by 11.3%.

4. Problems Encountered

There were some problems encountered during the implementation of the contracted activities such as not having easy access to PPC' s recent data, PPC does not offer, free of charge, wind data. For example, PPC/DEME charges recent wind data for one year and one station, which refer to mean wind speed per month, wind direction and duration curves (Weibull distribution) 800 US$ after the Board of Directors approval which will be a time consuming procedure.

There is also a general lack of knowledge and measurements of the wind speed on many sites. An electronic anemographic station was only placed by PPC in a place called Chiotes (height 370 m, 10 m above the ground). The data elaboration for the whole island was feasible with the usage of mathematical computer models like NOABL. The tru fact is that on a large island, placing many anemographical station is costly and difficult to maintain. It must be also kept in mind that meteorological stations are not sited for energy purposes. Besides it is hard to find local people to collect the data due to their mishandling of the equipment. The whole situation can be explained because of the long distances between the specific installations and the towns or the villages and the lack of communication and transportation facilities. The training of local technical engineering firms and contractors on technology selection, system design, installation, operation and maintenance procedures is of great significance.

Finally, there were some other problems concerning the identification of favourable microlocations and the installation of wind generators, due to the limited time period which prohibited the team from making additional observations in some other interesting areas, which belong to the sixth, seventh and eighth geographical region of the island of Rhodes, for example the place of Mesanagros.

5. Conclusions and Recommendations including Follow-up Activities

Based upon the results of different actions undertaken so far, the following recommendations may be proposed:

- Before the beginning of the projects of installation of WTGs at the chosen microlocation, it is necessary to initiate the programme of measurements of wind characteristics at these sites for a minimal period of one yar. It is obvious that measurements should be taken before and after realisation of the project. Measurements should start as soon as possible, based on the previously elaborated measurement programme. The number of autonomous anemometer stations should be from 3 to 5. This is in function of estimating the average values of the specific wind speed.

- In order to create awareness to the local people and to coordinate actions in energy planning and management on the island of Rhodes, it is necessary to establish officially the Energy Office (preferable at the Prefecture of Dodecanese in Rhodes) to be in charge of promotion events on renewable energy shources and energy savings, media campaign, promoting the results and conclusions of the UNEP activity on Environmentally Sound Energy Planning, and updating the required energy plans.

In order to achieve a further lowering of the total energy cost in the local energy system and preserve the environment, the following activities are proposed:

- On-site surveys and audits in the hotel and industry sectors followed by specific proposals of energy conservation measures;

- Training courses on energy conservation and rational use of energy for managers and technical staff in the hotel and industry sectors;

- Feasibility and Technical Studies on specific projects;

- Proposals of new incentives in order to stimulate and promote more extensive utilisation of renewable energy sources.

6. Installation of Equipment for Solarimetric Measurements

The Greek National Meteorological Service was collecting data on sunshine duration and the total solar radiation on a horizontal plane in the period from 1961 to 1978 providing the average monthly values. The lack of more recent data taken on an hourly basis, suitable for more precise analysis necessary for different solar energy applications was a serious obstacle to any reliable planning of exploiting the solar energy.

Therefore, one of the main goals of the programme of Activity No. 7 was to install a solarimetric station in the norther urban region.

In order to reach this goal, a careful planning began with the collection of offers for the appropriate modern equipment among the leading world manufacturers, then, selecting the best offer from the technical and financial viewpoint, then finally preparing the detailed manual for correct utilisation and maintenance of the solarimetric station.

The next phase was the attempt to choose the most appropriate Greek agency, company, or institution, interested in solar radiation data, functioning as a permanent user of the donated equipment after the end of the project. After extensive discussions with representatives of various Greek organisations, institutions and services, and upon several field visits, the final conclusion was that there is one suitable location for the erection of the solarimetric station on the island of Rhodes, namely at the International airport Paradisi under the auspices of the National Meteorological Service. Finally, in 1995, the delivery of the equipment was completed and the first measurements (data), have already been collected.

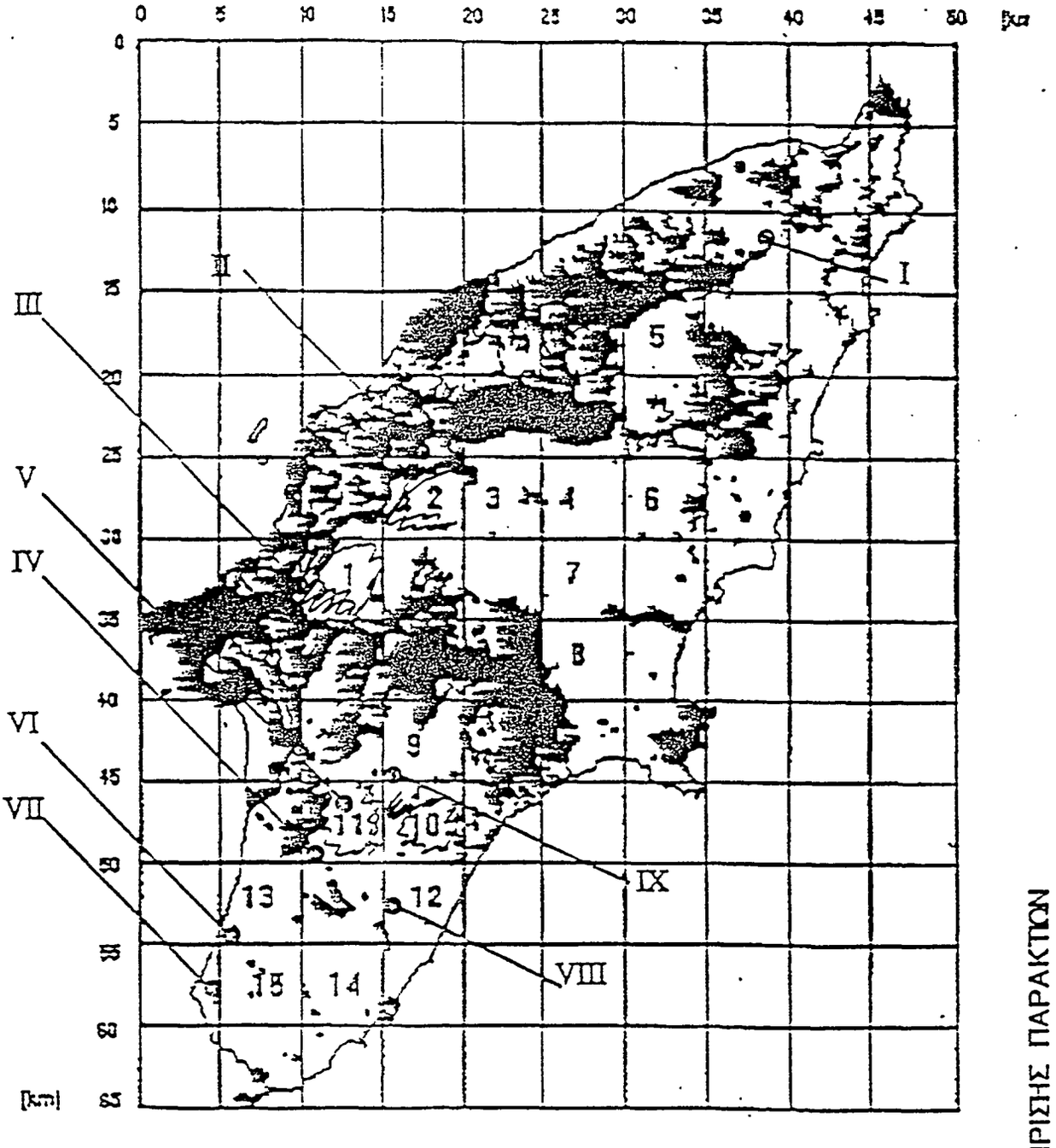
SPECIFICATION OF EQUIPMENT

Equipment for Radiation Stations

Item - description and type/model	Quantity
Printer - Recorder PIR 128	1 pc.
Pyranometer CM3 (with calibration)	3 pc.
Shadow ring CM121	1 pc.
Levelling Stand for CM3	1 pc.
Stand for Albedometer CM3	1 pc.
Memory Card Unit MRW133	1 pc.
1 Mbyte FLASH EEPROM Memory Card	2 pcs.
Spare Outer Glass Dome for CM3	3 pcs.
Housing Container for PIR 128	1 pc.

exergia

FIFTEEN MACROLOCATIONS AND NINE MICROLOCATIONS



MICROLOCATIONS:

I	*Louka*	VI	*Katavia-A*
II	*Embonas*	VII	*Katavia-B*
III	*Siana*	VIII	*Lachania*
IV	*Messangeros-A*	IX	*Messangeros-C*
V	*Messangeros-B*		

ΠΡΟΓΡΑΜΜΑ ΔΙΑΧΕΙΡΙΣΗΣ ΠΑΡΑΚΤΩΝ ΠΕΡΙΟΧΩΝ "ΤΟ ΝΗΣΙ ΤΗΣ ΡΟΔΟΥ"

Activity No. 8: PROGRAMME OF PROTECTION OF HISTORIC SETTLEMENTS

The contract, signed by the Greek government, MAP/UNEP and the European Investment Bank. for the Coastal management of the Island of Rhodes (CAMP-Rhodes) and within the framework of activity 8, Historic Settlements of the Island of Rhodes - Medieval town of Rhodes, assisted the local authorities and more specifically the Bureau of the Medieval town of Rhodes to carry out an in-depth study (master plan) of the integrated restoration of the medieval town. The decision of the scientific commission taken on 2 June 1994 concerning the master plan for the medieval town of Rhodes and of the commission entrusted with the follow-up of the urban development study (27 June 1996), really gave the impetus for the launching of the study.

1. Background Information

When the programme was launched in summer 1994, the following series of inventories and documents were available:

- data provided by the surveys of the Medieval town of Rhodes (1925 - '28 and 1984 - '86), the sociological study of 1988 and the inventory of commercial shop fronts (1993 - '94) which was in progress when the programme started;

- graphic and photographic documents: the register of 1925 - '28, the photographic archives of the Archaeological Service, the Carson miniatures (1480), old gravure and the relevant bibliography;

- maps, charts, diagrams: plan of the English Admiralty (mid 19th century), maps of 1917 and 1928, road plan of 1936, 1943 map of the English Administration, 1960 road plan, 1948 photogrammetric map, 1991 computerised map of public spaces.

2. Programme Objectives

The main objective of the programme was the special study of an urban area focused on integrated restoration as well as the formulation of specific directives on the planning project of the Medieval Town of Rhodes. The programme aimed at concrete results, so that it could be used as a pilot project for similar historic cities at local, regional and international level.

3. Activities Performed

After the above-mentioned decisions were taken, the Bureau of the Medieval Town of Rhodes set up a group of specialists (4 architects, 1 architect urban surveyor or planner and 1 architect specialised in GIS); inventory, which is the most essential part of any urban project, within the framework of the MAP/CAMP/EIB METAP Programme "The Island of Rhodes Activity 8: Historic Settlements - The Medieval Town of Rhodes". During the 1994 - '96 biennium the following activities were carried out:

1. Methodology for a specialised urban inventory. Special fiches were studies in depth, in order to carry out a survey of buildings, homes, businesses and services, which, once the data was collected, could be processed by computer

using a special programme (which is based on "Access"). The text with the explanations needed to apply this inventory makes clear the fact that we can process on the spot a large number of data for the inventory in little time and with no difficulty, after the work of the data collectors which lasted one month had been completed.

2. Application of the architectural surveys of the buildings of part of the Saint Panteleimon area of town which contained three large "islands" (areas surveyed), with buildings, monuments, free space and archaeological excavations. The methodology used was that proposed by Jerco Marasovic, which we improved upon: Most of the time the sketches for each building were drawn on the spot (scale 1/100) on special "fiches" (A4 dimensions). They form a special archive which will be useful to all future researchers. The combination of architectural and topographic surveys of the buildings gives rise to the architectural surveys of the "islands", the neighbourhoods and whole historic towns (floor plans, facades of buildings, sections etc). These sketches help in carrying out specific studies and urban projects of planning, development, integration of new buildings and restoration of monuments and sites. This work lasted between the fall of 1994 and the spring of 1995 i.e. 6 months). This survey has already helped in carrying out several projects in the specific neighbourhood, which had been selected as a pilot area for restoration and possible interventions, to serve as a model for the town of Rhodes and other historic towns.

3. The meeting of the Expert Group (Mr. D. Zivas, Mrs. Donatella Morozzo della Rocca and Mr. Carlo Cesari), (5-8 January 1996), issued the directives after adopting the methodology proposed in the urban inventory while limiting the information on morphological and decorative elements and on the typology of buildings which would require additional time.

4. The clarification of the status quo of ownership in the Medieval Town was completed in the spring of 1995 by the topographers who carried out research in the land registry office of Rhodes and the archives of topography maps of which we have copies in our office. This work led to the drafting of a study which was put on computer to clarify public ownership and better explore the possibility to establish social and public functions. It is a unique tool for the resolution of problems regarding ownership which is very complicated, especially in the Medieval Town.

5. A map of the actual situation of the properties and buildings (scale 1/1000) which was based on the registry plan of 1928, the photogrammetric map of 1984 and the computerised topographic map of 1991 were put together. The map was put on computer so that urban projects could be presented on that scale and was finalised in the summer of 1995.

6. Drawing up of maps of each area surveyed ("island") on a 1/200 scale separately for the ground floor, the first floor and the second floor, while distinguishing the properties, the buildings (built and unbuilt areas) and the various functions (family homes - apartments, businesses and public and private services). These maps were put together by surveying architects on the basis

of the registry plans of 1928 for each property and on the spot corrections indicating all interventions between 1928 and the present. Collation of the property plans of the area surveyed with the necessary corrections produced the map of the area surveyed. This phase was necessary in order to produce the master plan of the buildings and uses of the medieval town. The maps of all the areas surveyed can give a thematic computerised maps of the whole Medieval Town at different scales.

7. Urban Inventory

During the first semester of the programme (July - December 1994), the group carried out the urban inventory of the Saint Panteleimon district (the first three surveyed areas), where architectural surveys were also made, in collaboration with another group of four architects and one topographer.

After the January 1995 Expert Meeting the urban inventory was pursued without architectural surveys and less information on the morphology and typology of the buildings. In July 1995 one architect withdrew from the group. In November 1995 the contract of the architect-surveyors expired without the inventory being completed. Field inventorying had covered up to that point 85 out of 127 areas to be surveyed and the completion of the fiches in the office was still pending.

In March 1996, the group of three architect/surveyors resumed work but at a slower pace due to the members other professional commitments. At the moment they are finishing work on the first 85 areas. Moreover, they have started the computerisation of the mapping, for the areas that have been surveyed, as well as the computerisation of fiches. It is expected that the urban inventory, the digitalisation of maps and the computerisation of fiches will be completed by October 1996 (in 5 months).

Then data can be processed on a data base system in order to carry out multiple statistical analyses and a GIS for the clearer presentation of urban analysis and the alternative scenario of urban planning.

These proposals will be discussed at successive meetings of the competent services and representatives of the public and interested socio-economic groups, in order to come to the decision that would be accepted by all.

Finally, special legislation to cover the Medieval Town of Rhodes should be enacted, on the basis of which relevant problems might find their solution. This special urban legislation must provide for solutions that are not only legal but also appropriate from an economic and social viewpoint (i.e. development of social establishments, conditions for issuing permits for construction, restoration, business operation, renting of public spaces, improvement of business (shop) fronts, assistance to individual owners of historic houses who are unable to restore them and handicrafts.

8. The drawing up (in March 1996) of a report on the historic sites and monuments of the Island of Rhodes within the framework of Integrated Planning of the Island of Rhodes, which contains:

- a short description of historic sites and monuments;

- problems;

- probable risks;

- legislation in force and level of protection;

- protection, conservation and development needs for the historic monuments and sites of Rhodes;

- enhancement of protection and completion of existing legislation;

- conservation, planning and development, in general management of the cultural heritage of the island of Rhodes;

- cultural tourism and group visits to the island of Rhodes;

and the Annexes:

- list of the most important sites and monuments by period;

- list of the most important sites and monuments of the Island of Rhodes plus 8 maps.

9. Report on the Medieval town of Rhodes (in preparation).

10. Electronic equipment

A plotter inkjet in colour, HP650 C AO and an ArcView II programme were purchased in the framework of the technical assistance provided by MAP/EIB METAP "The Island of Rhodes".

The plotter has already been used extensively, as is obvious from the copies of tables, whereas the ArcView II programme will be used when processing the urban inventory data for GIS and the presentation of digitalised plans.

During the same period (1994 - 1996), the bureau of the Medieval town of Rhodes pursued the following activities:

a. Improvement of traffic measures (vehicle circulation and parking):

The 1992 measures taken by the Town of Rhodes, the Municipal Police and the Bureau of the Medieval Town, were only partially implemented, which in conjunction with the increase in the number of vehicles, aggravated the situation. At the same time it was felt that on the basis of the experience gained small adjustments could be made to improve the situation.

Thus the proposal was advanced to divide the medieval town into two zones. The first comprising the historic and commercial centre where the measures are

very strict and the second comprising the remaining are of the medieval town, where those that live in it may circulate and park the whole day without disturbing the centre of town. Vehicles belonging to non-residents may circulate in the whole medieval town in the morning only (between 6.00 and 10.00 hrs) to carry out business, but are excluded from it the rest of the day. This makes life easier for the residents of the medieval town who can also circulate in the historic and commercial centre in the afternoon (between 13.00 and 17.00 hrs) and at night (between 22.00 and 10.00 hrs the following day, without harming either the monuments or disturbing the large groups of pedestrians in the historic and commercial centre.

The effort of the Rhodes local authorities to organise better the controlled parking in the commercial centre of the city of Rhodes and around the medieval town, as well as the control of the circulation and parking of vehicles inside the medieval town by a private company may give positive results for the improvement of the quality of life of people living in Rhodes. When this private company takes over these responsibilities in the next few months, the situation will no doubt improve. However, it should be accompanied by an effort to organise better public transport and build car parks on the outskirts of town.

b. Infrastructure work and road paving

After a long period of negotiations, preparation of special projects and seeking funding for all infrastructure projects, DEPOS (the public body responsible for this programme) started work in the summer of 1994, in the same pilot district of Saint Panteleimon, mentioned above. It has completed almost all work in the district, including restoration of the traditional streets (paved with slates and small stones/pebbles.

c. Special inventory and control of commercial shop fronts and public spaces in the Medieval Town to be let to businesses

In the first semester of 1994 the analysis of the special inventory of commercial shop fronts was concluded and alternative proposals were formulated on the control and management of building facades.

In 1995 a survey was carried out of the public spaces rented by private persons/firms for commercial purposes (exhibit of products, installation of tables, chairs and refrigerators). It was proposed to limit the four rent spaces, the relevant regulations were strengthened. Then the local authorities of the city of Rhodes and the Bureau of the Medieval town started applying the relevant regulations controlling the spaces for rent (and this is repeated every year). At the same time they control the aesthetic problems which may arise in the shop fronts of the businesses involved. It is a lengthy process which may bring positive results in the future. The fact remains that controls started in 1995, whereas the regulations had existed since 1987. It may be possible in the future to strengthen controls and take more stringent measures.

d. New legislation in the form of a presidential decree of the Ministry for the Environment, Physical Planning and Public Works, concerning the listing of the Medieval Town of Rhodes as an urban listed site, the definition of specific urban planning regulations, the restructuring of construction and the definition of land uses (this is in the process of being publicised in the Official Journal

On the base of this decree, the legislative status and the road plan of 1960 have changed to conform with the legislation of the Ministry of Culture, covering archaeological sites and monuments. Moreover, no new enterprise can start operations without a special permit. Concerning land uses, the Medieval Town is divided into two zones. The first covers the commercial centre where multiple commercial businesses may be set up, in the second, mainly a residential area, only commercial establishments which cater for the needs of residents may set up for business. Special protection is provided for handicrafts.

The special permit for new businesses serves the purpose of controlling more adequately the arbitrary extension of the commercial centre and the consequent shrinking of the residential area with all the ensuing negative impact that such a phenomenon usually brings with it; it also makes it easier to control the shop fronts. The decree is already in force and can greatly further the implementation of the special urban legislation covering the Medieval Town; however the controls should be better organised.

Handing over this control to a special service, within the framework of the local authorities of the city, in close collaboration with the Bureau of the Medieval Town of Rhodes and the Archaeological Service, rather than having it carried out by the Bureau of Urban Planning of Rhodes, may help in the better implementation of this decree, as well as all future urban legislation which would concern the Medieval Town of Rhodes.

e. Conservation and restoration of public buildings, monuments and fortifications

The Bureau of the Medieval Town of Rhodes is pursuing its main task of conservation of urban buildings, squares and streets and restoration of monuments and fortifications.

At the same time, the Archaeological Service has launched new programmes for the restoration of churches and fortifications and the management of moats so that they can be used by the public (residents and visitors alike.

4. Problems Encountered

Various difficulties arose mostly due to the following:

1. The combined tasks of urban inventorying and architectural surveying, which, as is obvious, required a lot of time and staff and caused delays during the first semester. The problem was solved at the Expert Meeting in January 1995, where it was decided to continue with the urban inventory, which is necessary

for the completion of the Master Plan, while postponing work on the architectural surveying.

2. The fact that an architect/surveyor left the programme in July 1995 and the work was interrupted between November 1995 and March 1996. which hampered the effectiveness of the group.

3. The complex nature of the urban problems of the Medieval Town which are:

   - misgivings on the part of some residents to provide relevant information;

   - difficulties of several businessmen to provide information during working hours;

   - temporary or permanent absence of several residents;

   - closing down of almost all businesses for a long period of time (between November and March); and

   - difficulty in interpreting certain topographic plans, due to interventions since 1928 (when the register was put together), either through new construction or because of catastrophic events (such as bombings during World War II).

   The above mentioned difficulties brought about delays in carrying out the inventory.

Concerning the collection of documents from the archives of several European cities (Rome, Venice, Florence, Valetta, Istanbul etc.), it has not been completed as yet, due to the heavy workload of the staff of the competent services. However, it has been requested that it be completed in June- July 1996.

There has also been a great delay in the enhancement of the presidential degree in respect of the listing of the Medieval Town of Rhodes as a listed urban site, that same is true for the definition of specific urban planning rules, the restructuring of construction and the definition of land uses. Red tape and other reasons are to blame. However we have been given assurances that the decree will be published in the Official Journal in the next few days/weeks.

The fear of the previous local authorities that the control of the commercial centre and the shop fronts would incur political cost is no longer a big problem The new local authorities and the Mayor have taken it upon themselves to meet the problems of the commercial centre of the Medieval Town head on; the control of the free spaces to be rented out to private enterprises has started being effectively applied after a long period of negotiations between the Town Hall and the interested circles. This effort should be enhanced in the future through close collaboration with all competent services which should strengthen their actions towards the same objective.

The implementation of vehicle circulation and parking measures is the Medieval Town by the municipal services is a problem, because many of those who work in the Medieval Town demand that certain areas within the town be exempted from the measures so that they can drive and park their cars freely; there are also other problems, which led to the decision to strengthen the measures and entrust private

companies with organising enforcement.

The lengthy period which preceded the launching of infrastructure work and pavement restoration in streets and squares was followed by rapid implementation. Work was started in the Saint Panteleimon district in summer 1994 and is now being completed. However funding must be secured, because the work is very costly.

5. Major Results of the Programme (1994 - 1996)

The most important result of the programme of the Bureau of the Medieval Town of Rhodes and MAP/EIB METAP "The Island of Rhodes" Activity 8: Historic Settlements - the Medieval Town of Rhodes is without doubt the applied methodology of urban inventorying, which put rather descriptive data into a more organised form, so that they could be used for analyses and the drawing up of master plans, through the use of electronic equipment.

The inventory itself is an archive with a lot of urban, historic, architectural, technical, sociological and economic data, a database not only for the current projects and studies, but also for historical studies and projects to be undertaken in the future, the results of this analysis will become apparent after.

The completion of the inventory, the plans, the computerisation of all the data, the digitalisation of plans and their use through GIS.

It is an original methodology which can be used as a model approach for drawing up master plans and development plans for other historic cities.

Furthermore, the archive of architectural surveys, which was started with the surveyed areas of the Saint Panteleimon district, can also be taken as a model for the rest of the town, as well as for other historic towns. The surveys can also be used as basic documents for future architectural studies and projects, as well as for projects of restoration, development and the history of buildings or groups of buildings.

The collaboration between the Bureau of the Medieval Town of Rhodes and this programme and the support of the Expert Group promoted all relevant and significant interventions like urban projects, legislation on urban planning, development of the commercial centre, enforcement of measures on vehicle circulation and parking, infrastructure projects, development of the pilot neighbourhood and restoration of monuments and fortifications.

6. Conclusions including follow-up Activities

The conclusion that can be drawn from the implementation of this programme is that it has given impetus to all urban projects and major interventions in the Medieval Town of Rhodes; its impact is doubtless both positive and quite considerable.

Of course, one cannot consider that the work on the Medieval Town of Rhodes is completed since in the two-year programme. The studies and basic projects in the Medieval Town were not concluded. More specifically, it is felt that the work must continue in order to finalise the inventory and the Master Plan as a step towards

integrated planning and the relevant changes in the legislation affecting the Medieval Town of Rhodes. The contribution of the programme MAP/EIB METAP "The Island Of Rhodes" is therefore considered necessary and will make possible to conclude the effort already extended; the result will be a unique example on the management of historic towns.

The integrated management and restoration of the pilot/neighbourhood of Saint Panteleimon must also be analysed, the same goes for the bombed-out areas, the coast and moats.

It is also imperative to organise better the Bureau of the Medieval Town of Rhodes and the competent services for a more effective implementation of plans, a better management of controls and a sounder restoration and development in the area.

Activity No. 9: TRAINING PROGRAMME ON GEOGRAPHICAL INFORMATION SYSTEM (GIS)

1. Background Information

A Geographical Information System (GIS) is a specialised form of database systems, powerful in handling geographically referenced data, which can be displayed as map images, capable of integrating environmental, social and economic data into one system. Storage and retrieval of geographic information represents a simple form of use of GIS, but it has the capacity of contributing useful and transparent analytical data, including spatial models, within the decision making process. GIS is therefore an important and powerful tool for the process of integrated coastal management. Its application requires computer equipment, specialised software and a rather sopphisticated training of users.

Its benefits and advantages of the application of GIS for future integrated management of the island were the reasons for including GIS into the MAP CAMP METAP "The Island of Rhodes".

In the preceding phase (1991-1992) of the MAP CAMP "Rhodes", PAP/RAC organised first the initial, and later the advanced training on GIS for local experts, using the pcARC/INFO software. The practical application of GIS was focussed on the development of referenced data andmaps for the Integrated Planning Study of the Island, using PAP-provided software and locally available hardware. Examples of such application are attached as an annex to this summary.

The GIS activity within the actual MAP CAMP METAP project envisaged a follow up to the previous activities i.e. acquisition of a complete set of GIS equipment, its installation and final training of users on the installed equipment, as well as the presentation of a proposal for the relevant institutional arrangement.

The implementation of this activity was assigned to the Priority Actions Programme Regional Activity Centre (PAP/RAC), located in Split, Croatia, according to the Project Document CP/ME/5101-94-01 (3104) signed by UNEP and PAP/RAC on February 23, 1994.

The implementation of the activity started in February 1994 and was completed in October 1994.

The implementation of this activity was organised under the guidance of the MAP Coordinating Unit and the responsible officers of the EIB. The coordination and supervision from the Greek counterpart was secured through the Greek National Coordinator of the project. The local and PAP consultants were engaged after clearance obtained by the EIB.

2. Objectives of the Activity

The general objective of the GIS related activity was to contribute to the upgrading of the local institutional and human capabilities for environmentally sound coastal

management throught the application of GIS.

The immediate objective of the activity was to contribute to a cost-effective and efficient establishment of a permanent GIS programme within a suitable local institutional arrangement.

The practical objectives of the activity were:

- to select, order and deliver the relevant GIS equipment;
- to install the equipment and train the local users;
- to prepare a proposal for the institutional arrangement for the application of GIS.

3. Performed Activities

3.1 GIS Equipment:

The specification of the h/s equipment was agreed upon with the Greek National Coordinator and the local authorities; the end user (the Prefecture of the Dodecanese) was identified upon the report on institutional aspects; MOU was signed with the end user; offers for supplying the equipment were collected, and after clearance by the EIB, the supplier was selected and equipment ordered. Finally the equipment was delivered and installed by the end user.

According to the above, the following equipment was supplied and installed:

- HP Vectra VL2 4/66 486 DX2/66 computer, ser#3421F20886, 16 Mb RAM, 128 K cache, Hdd 340 and 213 Mb, Fdd 3.5 and 5.25", mouse, keyboard;
- ADI Microscan 17" colour monitor (ser# 522L0055838D);
- Kurta A2 digitizer XLC 18 x 24 (ser# 94051250);
- HP PaintJet X1300 A3 inkjet colour plotter (ser# 3402A83534);
- HP LaserJet 4P laser printer 600 dpi (ser# NLCB084404);
- PC ARC/INFO Starter Kit, ARCEDIT, ARCPLOT (ver. 3.4 D+);
- Microsoft Office software;
- HP Vectra VL2 486 DX2/66 computer, 340 Mb HDD, 8 Mb RAM, 128 cache, 3.5 and 5.25" FDD, HP 14" SVGA colour monitor;
- HP Vectra VL2 486 SX/33 computer, 340 Mb HDD, 8 Mb RAM, 3.5 and 5.25" FDD, HP 14" SVGA colour monitor;
- HP DeskJet 550 printer (two pieces).

3.2 Report on Institutional Aspects of the Installation of GIS as a Permanent Activity

The report was prepared by a local consultant, and after agreement with the Greek National Coordinator of the project, it was accepted. The report was prepared on the basis on consultations with representatives of various local and regional authorities, namely: Ministry of Agriculture; Prefecture of Dodecanese; Department for Amelioration of Infrastructure; Department of Forestry; Ministry of National Economy, Department for Investments and Coordination, Ministry of Environment, Department of Urban Planning; Department of Urban Planning; Ministry of Public Works; Technical Services; Municipalities and Communities; Municipal Water and Sewage Company (DEYAR); Ministry of the Environment, Region of the S. Aegean Island, department of Settlements; Ministry of Culture, Archaeological Services of the Dodecanese. The result of these contacts was the proposal for the installation of the GIS equipment under the direct supervision of the coordination department for the Prefecture of Dodecanese. This proposal was accepted by the Prefecture of Dodecanese. This proposal was accepted by the Prefecture and by the Greek National Coordinator for the MAP CAMP METAP project, and the equipment was installed on the premises of the Prefecture.

3.3 Final Training of Experts

A one-expert mission was organised, the equipment was installed and tested, the relevant software was installed, and the local experts were trained how to use it. The final training consisted of a number of meetings and interviews in order to determine available data relevant to the GIS, the data flow, the current organisational and other conditions. The members of the local GIS team showed excellent skill in the use of GIS and pcARC/INFO.

At the end of the training, Mr. J. Paraskevas, Prefect of the Dodecanese, expressed his satisfaction with the on-going GIS activity and informed on the establishment of the Department for GIS within the Prefecture.

4. Problems Encountered

The only problem encountered was related to the premises where the GIS equipment was installed. The room in which the equipment was situated was shared with some other employees of the Prefecture, not involved in GIS. Therefore it has been recommended to transfer the equipment to other premises, or to use the current ones for GIS activity only.

5. Conclusions and Recommendations including follow-up Activities

The main achievements of the GIS activity are as follows:

- GIS equipment delivered and installed in the Prefecture of Dodecanese;
- The institutional arrangement for the location of the GIS equipment and programme was studies, the most suitable solution proposed and accepted;

- The end users were trained for the GIS application with excellent results.

the main follow-up Activities are:

- the installed GIS equipment and the established GIS group to be permanently involved in a GIS programme for the Prefecture of Dodecanese, supporting planning and management activities;

- the ARCview 2.1 software to be acquired.

Activity No. 10. ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

1. Background Information

Environmental Impact Assessment (EIA) is one of the major tools for environmentally sound decision making within the process of sustainable development. The application of the EIA in the process of approving and monitoring the performance of development projects is now compulsory in almost all European countries. The EU, UNEP, UNDP and other UN agencies, as well as the World Bank and all international financial agencies consider the application of EIA prerequisite for approving development projects.

That is the reason why the activity related to EIA was included in the Rhodes project. The EIA activity within the project envisages:

- preparation of the EIA for the wastewater treatment plant for the city of Rhodes;
- organization of a training course on EIA for local experts;
- preparation of a decision support system (DST) for the management and control of the wastewater treatment plant; and
- training of end-users on the application of the DST.

The contribution and correct operation of the wastewater treatment plant for the city of Rhodes will contribute to the improvement of local infrastructure, and to the reduction of the pollution of the adjacent sea. The EIA activity of the Project should support the efforts aimed at preventing or reducing environmental damage due to discharge of non-treated effluent, at both short and long terms.

The implementation of this activity was assigned to the Priority Actions Programme Regional Activity Centre (PAP/RAC), located in Split, Croatia, according to the Project Document CP/ME/5101-94-01(3104) signed by UNEP and PAP/RAC on February 23, 1994.

The implementation of the activity started in February 1994 and was completed in October 1994.

The implementation of this activity was organized under the guidance of the MAP Coordinating Unit and the responsible officers of the EIB. The coordination and supervision from the Greek counterpart was secured through the Greek National Coordinator of the project. The local and PAP consultants were engaged after clearance obtained by EIB.

The EIA for the treatment plant has been prepared during the preceding MAP CAMP phase. The EIA document was prepared by national experts with the assistance and under the guidance of international experts engaged by PAP/RAC.

This EIA report and the experience gained during its preparation were used for the

training course on EIA, addressed to local experts.

Based on relevant data and analyses to be used as a decision support tool (DST), a software programme of a prototype nature also had to be prepared, which will later on allow a practicable computerized elaboration of similar studies.

2. Objectives of the activity

The objectives of the activity are:

- to prepare on EIA of the local water treatment plant, and use it for training and management purposes;
- to train local experts on the application and preparation of EIA's;
- to prepare software programmes for a practicable computerized elaboration of the environmental impacts of wastewater treatment plant, and control of the plant performance;
- to train the users of the software programmes; and
- to upgrade the local institutional and individual capacities for the application of the EIA process and of the DST for the wastewater treatment plant.

3. Performed activities

3.1 Preparation of EIA for the existing wastewater treatment plant

This document was prepared and distributed during the earlier phase of the MAP CAMP, and was used as a pilot document for the training on EIA. The EIA for the treatment plant has been prepared according to the procedure of EIA published in the UNEP Regional Seas Reports and Studies No.122. A group of national and local experts worked on its preparation under the guidance of PAP/RAC.

3.2 Training on EIA

A training course was prepared and held in September 1994 in Rhodes for 20 local and national trainees. The course had the task to familiarize the trainees with the basics of EIA, its role and place in the process of planning and decision making, and with the EIA procedure and guidelines developed by PAP/RAC in cooperation with UNEP-OCA/PAC and the Coordinating Unit of MAP. The course also discussed the completed EIA of the wastewater treatment plant of the city of Rhodes.

The course took place on September 25-29, 1994 in the premises of the Municipality of Rhodes. The event was co-organized by the Municipality of Rhodes, Greek Ministry of Environment, and PAP/RAC.

The participants were professionals involved in the preparation of EIAs, as well as civil servants and other experts working in administration in charge of

environmental protection and physical planning.

The role and place of EIA were presented, as well as the relevant experience in both developed and developing countries, and in particular the Greek experience and the relevant EU directives. The prepared EIA for the wastewater treatment plant was presented and discussed in detail. Finally, a visit to the site was organized, and the trainees were informed on the performance of the existing plant and of its planned extension.

3.3 Software - DST

On the basis of data and information collected, and the field-visit performed, and after consultations with local and national experts, an appropriate software, to be used as a decision support tool, was designed, tested on site, reviewed, amended and finalized together with accompanying technical documentation.

Relevant staff members of the local authorities actively contributed to the successful design and development of the software providing the necessary data and comments, whereas its functions and capabilities were thoroughly explained by appropriate training (December 1994).

As its name suggests, the main objective of the Decision Support Tool for Wastewater Treatment Plants is to support the technical staff of the plant by providing easy access to information, and statistical and graphical evaluation of the data measured. Additionally, the DST will help the technical staff get an overview whether the plant complies with the operational requirements and environmental standards.

Measurements are passed to the application for the following:

a) Biological Treatment A' (influents from lorries)

b) Coastal Area Parameters

c) Biological Treatment B' (influents from sewerage system)

All measurements are introduced into the DST database on a daily basis. The plant design parameters, EEC and national standards were entered and compared with the daily measurements. As a result, using the DST the technical person in charge will obtain a complete picture of the function of the two biological treatments and of the relevant effluent discharge into the sea.

For the coastal area parameters the related input will the follow the sampling and analysis frequency planned by the respective authorities (Ministry of the Environment): bathing season: once in 15 days; other periods: once in 30 days. Any change in this frequency decided by the plant managers (i.e. after operational drawbacks) can also be considered.

Data can be statistically analyzed for given periods (week, month, year), and the deviations from the given standards (EEC, design parameters) are shown for each

separate parameter. The removal efficiency for each parameter is computed as a percentage.

The measurements can also be elaborated through diagrams for each one of the parameters, and with respect to the EEC standards. In this way the deviations, if any, will be shown in an-easy-to-check format.

Finally, the DST was presented to the end-users and, after a thorough discussion, appropriately amended. The final version was again presented to the end-users and adopted. The DST was accepted very favourably by the local authorities being seen as a very useful tool for the management of treatment plants according to the EU directive 271/91. Also, the ability of DST to offer a continuous flow of information to the local population and the tourists about the actual performance of the plant and possible incidents of marine pollution was pointed out.

3.4 The main ouputs

- Software and DST: software on a diskette, description of the DST, Technical Report, and Users' Manual;
- Database for DST;
- Training of users and the relative report;
- Presentation of the final DST version for users.

4. Problems encountered

The main problems encountered were related to the collection of necessary data and information.

5. Conclusions and Recommendations including follow-up Activities

The main achievements of the EIA activity were:

- upgrading of the local institutional and individual capacities for the application of the EIA process;
- preparation of the EIA for the wastewater treatment plant;
- development and introduction of the DST for the wastewater treatment plant.

The main follow-up Activities are:

- As a result of discussions with local authorities, an expansion of the DST on several items will eventually enlarge its usefulness (drinking water parameters, marine sediments, etc)
- It seems that the planned new wastewater treatment plants in the island (see activity: Liquid Waste Management) will not be able to install their own analytical laboratories for performance control due to lack of qualified staff for continuous

management of the plants. Therefore, the establishment of a center for supporting those plants was recommended as an important follow-up activity. This centre should be fully equipped with portable analytical instruments, as well as with related software and DST for "around the clock" supervision of the smaller plants. In this framework, the already prepared DST will play the key role.

- A detailed study for the technical prescription of this centre is one of the recommendations for the follow up of the Project.

Activity No. 13: INTEGRATED PLANNING STUDY FOR THE ISLAND OF RHODES

1. Background

The integrated Planning Study (IPS) for the Island of Rhodes is one of the main outputs of the Coastal Area Management Programme (CAMP) "The Island of Rhodes" established by an agreement between the Greek Government and the UNEP Mediterranean Action Plan, and executed by the Priority Actions Programme (PAP/RAC) with the support of the Commission of European Communities (CEC) and the European Investment Bank (EIB).

Objectives

IPS sets out to articulate a future development strategy based on the principles of sustainable development. The formulation of the development strategy put forward has drawn from, and provided inputs to, a series of sectoral activities mainly on Liquid Waste Management, Water Resource Management, Environmentally Sound Energy Planning, Environmental Impact Assessment and GIS Application Programme.

The IPS is intended to be the first important step towards the launching of the process of Integrated coastal and marine area planning (ICAM) for the Island of Rhodes to serve as a practical planning and management tool for:

- identification and analysis of development and environmental issues;
- definition of major constraints in the interaction of development and environment, elaboration of a planning perspective on the most feasible future development pattern of the island following assessment of the resource opportunities and limitations;
- formulation of an integrated planning strategy and action-oriented environmental management plan; and
- definition of priorities for the implementation of immediate, early and long-term actions.

2. Performed Activities

The IPS is the culmination of the efforts of a multidisciplinary team of specialised professionals comprising three interlocking groups:

- **local experts** of the Prefecture of the Dodecanese and the Municipality of Rhodes;
- **national experts** of the Ministry of Environment, Physical Plannign and Public Works (Directorate of Regional Planning); and
- **international experts** (from Israel, Cyprus and Croatia) engaged by MAP' s Priority Actions Programme (PAP).

The IPS activity started in 1991 under MAP support engaging in a series of missions and consultations in Rhodes with the active participation of local, national and international experts and resulting in the preparation of the basic elements of the IPS. A total of 19 sectoral reports have been prepared covering all the sectoral and cross-sectoral issues of development and environmental problems, including analysis of the prospects for the island' s sustainable development process. A first draft of the IPS was presented in 1992 and presented to the MAP Conference in Rhodes in December 1992. Following the results of the activities closing with the December 1992 MAP Conference, further activities were pursued within the framework of MAP' s CAMP for the island of Rhodes and support from the EIB/METAP.

3. Methodological Approach

The IPS is a planning document and follows the methodology for Integrated Coastal Area Management.

- it identifies major problems, constraints and opportunities;
- it establishes the need for effective change in planning policy;
- it sets goals and objectives for the future;
- it considers and evaluates alternative policy options for the future in relation to these goals;
- it formulates a sustainable strategy;
- it develops a spatial concept and a physical planning framework;
- it outlines a programme of actions;
- puts forward proposed follow-up actions.

4. Sequence and Main Stages of Work Activities

The setting:

Identification of the Environmental Profile of the island of Rhodes,
Environmental Resources
Spatial Structure
Environmental Administration
Development Trends

Problems:

Development/Environment Interactions
Problems and Environment Consequences
Goals and Objectives
Future Opportunities and Policy Options
Inputs from sectoral activities

Strategy:

Sustainable development Strategy
Elements of the Strategy
Spatial Plannign Implications
Policy Proposals

Actions:

Outline Management Plan
Institutional and Financial Strengthening
Conclusions and Follow-up Actions

5. Problems Encountered

Despite the absence so far, of irreversible impacts on the terrestrial and marine environment, there are conflicts between human and natural resources and development activities. The "coastalisation" of development has given a "second-rate" socio-economic role to agriculture and environmental conservation.

The current development pattern in Rhodes is characterised by imbalances and constraints creating problems and trends which need to be addressed. The economy is caught up in a saturated mass tourism market, environmental resources are stretched and the hinterland rural communities are marginalised. The main trends underlying the development pattern of the island include the following:

- Resource development is biased towards maximisation of economic growth;
- over-dependence of the economy on coastal tourism;
- geographical concentration of tourism development;
- polarisation of development along the north/south divide;
- limited economic linkages of tourism with agriculture and manufacturing;
- social and economic marginalisation of hinterland communities;
- employment growth faster thatn popultation growth;
- accumulated environmental pressures on the coastal environment;
- neglect of ecological and cultural resources;
- weak enforcement of planning and environmental controls.

6. Data on key problems

6.1 Growth maximisation, over dependence on toursm and spatial concentration

In the period 1980-1990 tourist arrivals increased from 610,000 to 844,000 and

overnights from 5.8 million to 8.0 million, representing an increase of 38% (or 3.3% per annum). Hotel beds, in the same period, increased from 27,000 to 45,000, an increase of 67% (or 5.2% per annum). It is clear that the supply of new bed capacity was twice the increase of arrival s and overnights.

From 1993 to 1995 arrivals and overnights increased marginally, 907,000 to 985,000 and 8.6 to 8.9 respectively, while hotel beds jumped from 55,160 to 63,316. In terms of growth arrivals and overnights increased by 2.5% but bed capacity by 15%. It is noted that in 1995 there was a reduction of both arrivals and overnights relative to 1994 from 1.0 million arrivals to 985,000 and 9.8 million overnights to 8.8 million.

6.2 Spatial Distribution of hotel beds

City of Rhodes - Ialyssos (Ixia), Kalitheis, Koskinou (Reni, Faliraki), Afandou (Kolymbia)	88%
Lindos, Gennadi, Kiotari, other	12%

6.3 Environmental Impacts

Occasional/Recurrent sea pollution: Main "Hot Spot" areas are Kolymbia (Afandou) on the eastern coast and in Kremmasti-Ixia on the western coast.

Over exploitation of ground water: Main "Hot Spot" areas indicated by drop of aquifer level is the northern coastal part of the island, mainly the Trianda region, Koskinou, Kallithies and Sgourou-Faliraki.

Sea Water Intrusion: Main "Hot Spot" areas include the City of Rhodes, Kallities, Koskinou, Trianda and Afandou, and more recently affecting the south east coast of Kalathos and Gennadi.

Gradual deterioration of the quality of beaches: Tourism development and urbanisation have created strong pressures on the coastal zone manifestered in changes to the coastal morphology and sea level changes. The primary cause is the high concentration of development on the coastal zone; as many as 54,000 inhabitants (55%) live within a 10 km radius area from the City of Rhodes, 82,000 inhabitants (83%) live on coastal settlements up to 5 km from the beach, 54,000 tourist beds (75%) are built on the northern coast triangle Paradisi City of Rhodes Faliraki. The coastal lowlands are the most vulverable to the rise of the sea level, causing erosion and deterioration of the beach area. The areas subject to beach erosion and coastal reshaping include the northern tip in the City of Rhodes (particularly the area of the ports), the bay of Ixia and parts of the coastal strips along the Kremmasti-Theologos-Soroni-Kamiros Skala area.

6.4 Existing Planning Framework

It is reasonable to consider the capacities and limitations of the existing planning and environmental management system relative to the requirements for

achieving sustainable development. Two existing laws are particularly important for environmental policy. The Framework Planning Law (Ekistics Law) 1337/83 for physical planning and the Environment Law 1650/86 for environmental planning and control. Both are elaborate legislations but several limitations result in poor enforcement.

- lack of integrated planning process (no framework for regional planning and consideration of socio-economic considerations);

- Planning law is not enforced as a whole but selectively, occasionally and reluctantly.

- land property plays an important role in society and family solidarity. Planning controls affecting development rights are generally resented and often actively resisted seen as state threat to individual rights. Land use planning as a centrally administered governmental responsibility is poorly enforced.

7. Need for Change : Future Options

7.1 Future Opportunities

One of the fundamental principles of integrated planning is to highlight the unexplored opportunities inherent in the physical, cultural and economic profile of Rhodes and seek development approaches which would involve them in a "wise-use" future planning effort. Key factors which point to important opportunities for the future include:

- the ecological and cultural landmarks of the island as potential resources for the much needed diversification and enrichment of future tourism development;

- the hinterland communities which offer scope for a viable combination of environmental conservation and rural regeneration as a key element in a balanced development policy;

- the presence of an active and articulate business sector, and

- the location of the island as the south eastern Aegean outreach of Europe.

7.2 Goals and objectives

In the light of the present environmental concerns and given the need to utilise the latent opportunities for Rhodes, the following three inter-related goals are proposed for the future development strategy:

Environmental Quality Goal: Future development should protect the integrity of the island' s scarce environmental resources;

Income Growth Goal: Fugure development should ensure further improvements in the economic and social welfare of the present and future population of the island, and offer opportunities for a balanced utilisation of the island' s

accumulated capital base;

Social Equipty Goal: Future development should promote appropriate development and participation opportunities for all areas and groups in the benefits of development.

7.3 Population Projection

The **past trend** estimate shows how the future population is likely to evolve if its growth will occur regardless of economic development changes. The **No-action** estimate shows how future population is likely to evolve if the rate of growth continues to decline in response to local economic conditions. The **Policy-response** estimate presents future population growth as a factor within the context of the expected social, economic and environmental changes up to 2015. The last **Policy response** projection shows a future population of 142,000 approximating the figure of 147,000 which emerged as the average of the 10 different scenarios prepared in conjunction with the other CAMP activities.

		1991	2000	2015
(a)	Past Trend	98,181	108,500	128,000
(b)	No Action	98,181	104,500	112,000
(c)	Policy-response	98,181	108,500	142,000

7.4 Strategic Development Options

To determine appropriate strategy goals for the future and the relative emphasis of these goals on econimic, social and environmental objectives, the basic parameters of the current development trends are reviewed forming the context for identifying alternatives for future development strategies. The growth policy underlying the present development pattern is contrasted with a strict conservation control pattern to asses their strenghts and limitations as guides in search for the future sustainable development of Rhodes.

PROJECTION OF PRESENT DEVELOPMENT TREND
A Hypothetical Case
A tool for building up options

Development Parameters	1995	2015
Population	103,000	130,000
No. of beds	70,000	185,000
Total Employment	48,000	130,000
Tourist Employment (External demand)	34,000	92,500
Service Employment (Local demand)	14,000	37,500
Arrivals	1,200,000	3,300,000
Overnights	11,000,000	30,000,000
Water consumption	16m m3/year	30 m m3/year
Tourist receipts	870.0 m US$	2,250 m US$

The extreme case emerging from the projection of the current development trends clearly identifies the main carrying capacity constraints of the island to pursue a development path towards unrestrained economic growth.

7.5 Main Concerns

- the island has a small population and a limited labour force;
- increase of tourist beds at the present pace will result in a stock of tourist beds 2.5 times the present supply;
- total labour needs higher than the local labour force by some 83,000, creating a dependency on migrant labour;
- the island will be overcrowded by tourists and its coastline will be overwhelmed by building development causing very serious degradation to the coastal and urban environment;
- water resource, liquid and solid waste management facilities will be inadequate to support the required service standards;
- necessity for capital-intensive investment under "crisis situations";
- the agricultural sector will be totally squeezed out and the rural

communities will decline further and prices will be reduced by the over-supply of beds and the ensuing environmental degradation;

- impacts on the island' s profile as a tourist destination;

- the ecological and cultural "carrying capacity" is subject to even sharper constraints. Continuation of growth-push construction activity will put at serious risk the integrity of sites of landscape, ecological and cultural interest.

Recognising the unsustainability of the Economic Growth Option, attention is turned to a policy shift towards Environment Conservation. The thrust of a conservation policy would be the enforcement of a moratorium on tourism development activity to arrest the growth of tourst beds. Environmental Conservation would restrain economic activity as a means of conserving environmental resources. Policy options relying on single-minded restriction, without pro-active initiatives, would most likely be resisted and soon rendered socially untenable. "Passive" conservation policy would do little to address the main inter-related issues underlying the present development concerns.

8. Sustainable Development Strategy

The combination of the proposed future strategy goals and their articulation into an integrated policy framework comprise the Sustainable Development Option (SDO) put forward by the IPS. The backbone of the SDO is the introduction of a coherent environmental management programme to make feasible the combined pursuit of development goals (for income growth), environment conservation (for effective protection of natural resources and enhancement of environment quality) and social goals (for participation and equity in development and the accrued benefits).

SUSTAINABLE DEVELOPMENT OPTION		
	2000	**2015**
Population Projection	108,000	142,000
Local Labour Force	39,000	51,000
Migrant labour	8,000 (20%)	10,000 (20%)
Total Labour Force	47,000	61,000
Sustainable Tourst Beds	75,000	90,000
Estimated Overnights (million)	12.5	14.0
Estimated Arrivals (million)	1.5	1.4
Water needs (m m3)	18.0	22.0
Estimated Tourist receipts (m US$)	940	1,260

The main objectives for future sustainable development in Rhodes focus on actions to:

(a) arrest the socio-economic decline and physical disintegration of the hinterland and communities and promote an integrated programme for the diversification, new income opportunities and a viable economic role for the hinterland based on environmental conservation;

(b) promote organised tourism growth in the newly developing coastal parts of the island on the basis of controlled development and pro-active resource management policies;

(c) rehabilitate the urban and tourist environment, infrastructure services, in particular water resource, liquid and solid waste management and cultural monuments in the presently saturated norther past of the island and promote projects which will strengthen tourist services and the quality of life.

8.1 Elements of the Sustainable Development strategy

The strategy revolves around five basic elements:

- zoning (definition of management zones);

- sectoral policies and land use planning;

- management plan and guidelines;

- institutional capacities and financial resource mobilisation; and

- follow up actions for continuous planning initiatives.

8.2 Contents of the Sustainable Development Strategy

(i) Population: Policy response scenario

1991	:	98,181
2000	:	108,500
2015	:	142,000

(ii) Tourist beds: 90,000 beds by 2015 (increase of 20,000)

(iii) Zones: Planning and environmental management actions should be set in motion within the framework of a spatial concept based on zones covering areas of the island with common underlying problems. Three main strategic management zones are proposed:

(a) The Saturated Zone (SZ): The area which now concentrates the highest population, employment and economic activity density (Paradissi, Kremmasti, Ialyssos, Ixia, City of Rhodes, Faliraki).

- Policy Objective: to prevent further increase of tourist accommodation, while upgrading the quality of the urban environment, restoring the cultural heritage monuments, improving the availability of services, public open spaces, recreational facilities and traffic conditions;

- Population: 62,095 (1991) to reach 65,000 in 2000 and 71,000 in 2015;

- Tourist beds: Not to increase beyond the present level of about 52,000.

(b) The Controlled Development Zone (CDZ): The eastern section of the coastal area from Faliraki to Gennadi, the western section from Fanes to Paradissi, including the Saroni-Afandou hinterland area.

- Policy Objective: to encourage planned development of new tourist accommodation, based on spatial allocations and environmental policies, while protecting the natural and cultural resources as a key element of planned growth;

- Population: 24,400 (1991) to reach 27,000 in 2000 and 43,000 in 2015;

- Tourist beds: To take up 18,000 of the total increase of 20,000 tourist beds, by the year 2015, raising the present stock of 16,000 to 34,000.

(c) Environmental Conservation Zone (ECZ): The remaining territory, that is south of Gennadi to Prassonisi, the western coastal area of Fanes and the hinterland area.

- Policy Objective: to protect the environmental diversity and traditional rural character of the area as a basis for stimulating compatible socio-economic revitalisation and environmentally sustainable special-interest village-based tourism;

- Population: 12,000 (1991) to reach 16,000 in 2000 and 28,000 in 2015;

- Tourist beds: 2,000 village-based beds.

8.3 Sectoral Policies and Land Use Planning

The strategic zoning concept proposed for sustainable development should act as a guiding framework for spatial planning policies and management practices concerning sectoral and cross-sectoral activities. Sectoral policies (such as water management, energy planning, tourism, urban planning, agriculture and rural development, housing, liquid and solid waste management, nature conservation, historic settlement conservation, etc.) derive from and add to the plans for Integrated resource management on the ground. In the context of the broad zoning concept proposed, the island will have a comprehensive strategy including socio-economic and spatial content so that future management practices a complete set of guidelines for actions relative to the overall purpose and role of each planning area and the special controls and regulations that will have to be put in place and enforced under national legislation.

For instance, water resource and liquid waste management scenarios should, in addition to the technical feasibility parameters, take account of demand-side implications of the future distribution of tourism activities, population and agriculture consistent with the overall sustainable development strategy and the role of each zone to the implementation of that strategy. Likewise, tourism policy, in addition to quantity-relented limits, should take account of space, quality and diversification factors envisaged by the strategy. Equally, the policy on protected areas and historic settlements. The proposed restriction on new tourism accommodation capacity in the SZ is coupled with priority on rehabilitation of existing units and measures for the encouragement of investments on tourist services and recreation facilities. The CDZ tourism policy emphasis the need for controlled growth of accommodation, identifies target development areas and defines requirements for more detailed local planning studies, while in the ECZ environmental conservation, the promotion of village-based tourism accommodation and the regeneration of agriculture are main priorities.

8.4 Management Programme

To initiate the proposed policy changes towards sustainable development, an outline programme is proposed to show the direction of planning and management actions by zone. The programme comes close to specifying the status of the zones, including indications of the type of development to be encouraged, discouraged or prohibited, the controls and incentives to be used and the priorities for future investment project. It is a summary of policies and an outline of how management will be carried out. It serves as a "catalogue" for the future management of resources and control of development in the light of the required transition towards Sustainable Development.

8.5 Institutional Framework and Capacities

It is important that the IPS is incorporated into an evolving regional planning framework for Rhodes, for which institutional arrangements are at present unfocussed and fragmented. As regards physical planning, the legislation (law 1337/83) provides for a system of loosely related urban master plans (GPS), development contol zones (ZOE), village planning studies and settlement expansion boundaries. The planning system lacks focus on an island-wide regional level integrated strategy which is the policy gap expected to be addressed by the IPS activity. As regards historic settlements and nature protection, despite the existence of environmental legislation (1650/85) and powers for designation of protected historic sites, enforcement is piecemeal outside the framework of a comprehensive strategy. The IPS provides strong cross-sectoral linkages between protection and sustainable development with prominence given to the role of natural and historic settlement protection as a key factor in the diversification of tourism, the revitalisation of the hinterland and the restoration of the Medieval City of Rhodes.

Improved institutional capacities are proposed along two main lines with a view to addressing the fragmentation of administrative responsibilties and strengthening the links between regional strategy and site-specific land use planning:

(i) in the first instance, better (horizontal) coordination of the existing institutional framework to be achieved through closer and more effective networking initiatives, including (vertical) networking between the island and centre\al level authority;

(ii) Expansion and upgrading of the Environment and Land Use Planning Departments at the island level leading, in the future, to the establishment of an Environmental Management Service with the Dodecanese Prefecture to act as the main focal agency responsible for joint actions envisaged by the IPS with the central level counterpart ministry.

9. Conclusions and Recommendations including follow-up Activities

Main Achievements:

In summary, the main general outputs of the IPS Activity include:

First, it provides a framework for Integrated Planning and a practicla demonstration of the application of the guidelines for Integrated Coastal Zone Management following a sequence of "problem-opportunities-opportunities-options-strategy-planning activities-follow-up".

Second, it provides a strategy relevant to the activities of the various "user groups" concerned and involved in the planning and management activities in Rhodes, including physical planning (area-specific) and environmental management guidelines for the national and local experts for continuous policy initiatives.

Third, it provides the focus for initiating a process of consultations with regard to "where we go from here" in terms of technical and financial assistance and project programme implementation actions emanating from the IPS.

Follow-up Actions:

Two main objectives require follow-up actions:

(i) Getting the strategy off the ground

(ii) Focussing on investments and providing roles for donors and resource mobilisers.

Follow up actions concern projects, detailed pre-investment studies and programme preparation. These recommendations should enable local, national and international agencies and "actors" to identify their role in subsequent activities and contributions to the follow-up programme.

Proposed Actions:

(a) Preparation of an overall **Integrated Planning Master Plan** containing Management Plans for each of the zones, developing in more detail the Management Plan for the Environmental Conservation Zone, and a **Priority Investment Portfolio**;

(b) Preparation of **Liquid Wastes Master Plan**;

(c) Preparation of **Water Resource Feasilibity Study**;

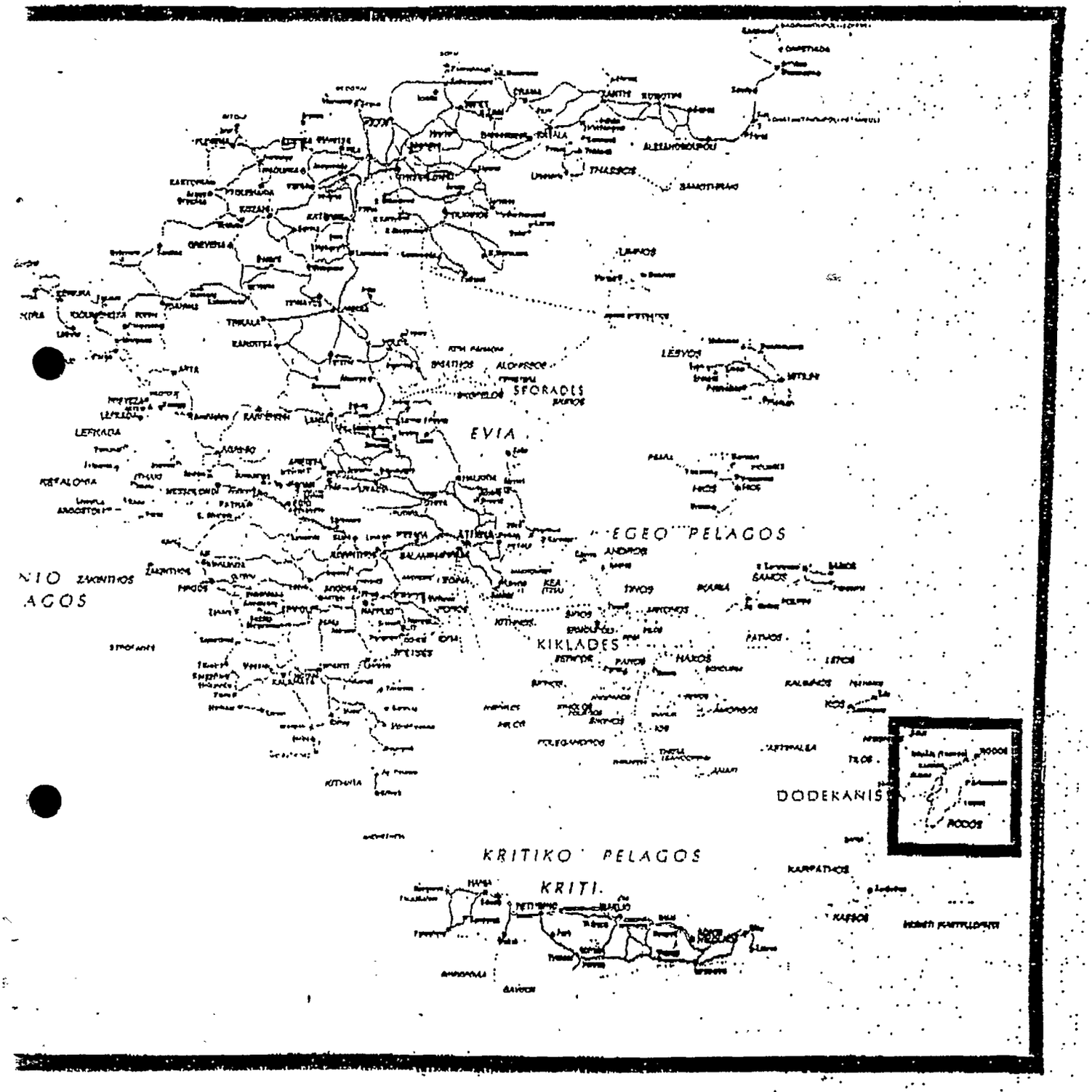
(d) Preparation of **Wind Generation Systems Feasiblity Study** for the micro-locations in the Biosphere Reserve, data collection through the installed solarimetric equipment and pre-feasilbiity study for the installation of a photovoltaic system;

(e) Preparation of detailed **Environmental Impact Assessment** guidelines;

(f) Preparation of an **inventory** of important cultural sites and historic settlements, including **restoration and management guidelines** and a time-bound priority action plan based on the **Mediaeval City Master Plan**;

(g) Preparation of a **public education** programme on sustainable development.

GEOGRAPHICAL POSITION OF THE ISLAND OF RHODES IN GREECE



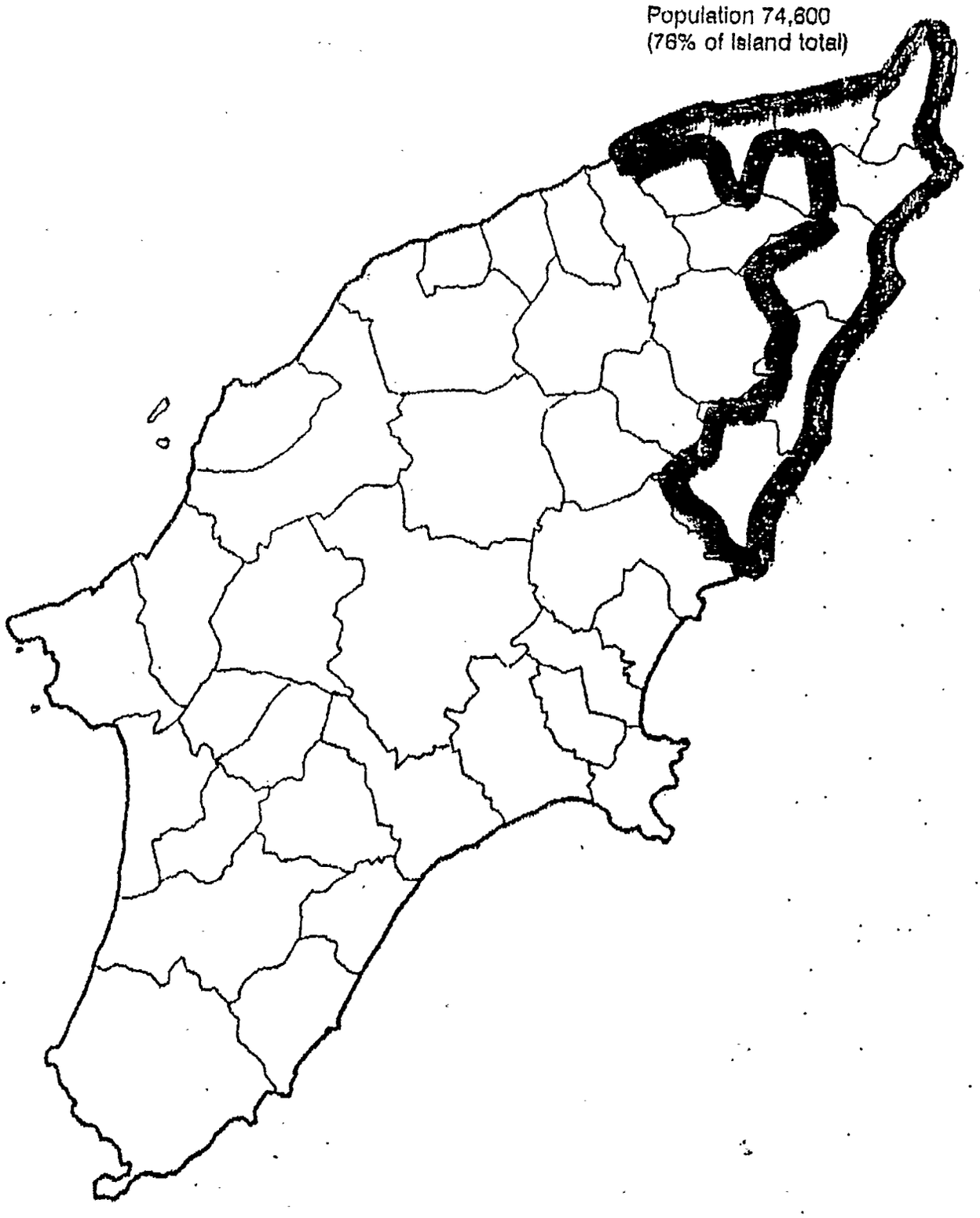


Fig 3.2 THE URBANISED TRIANGLE

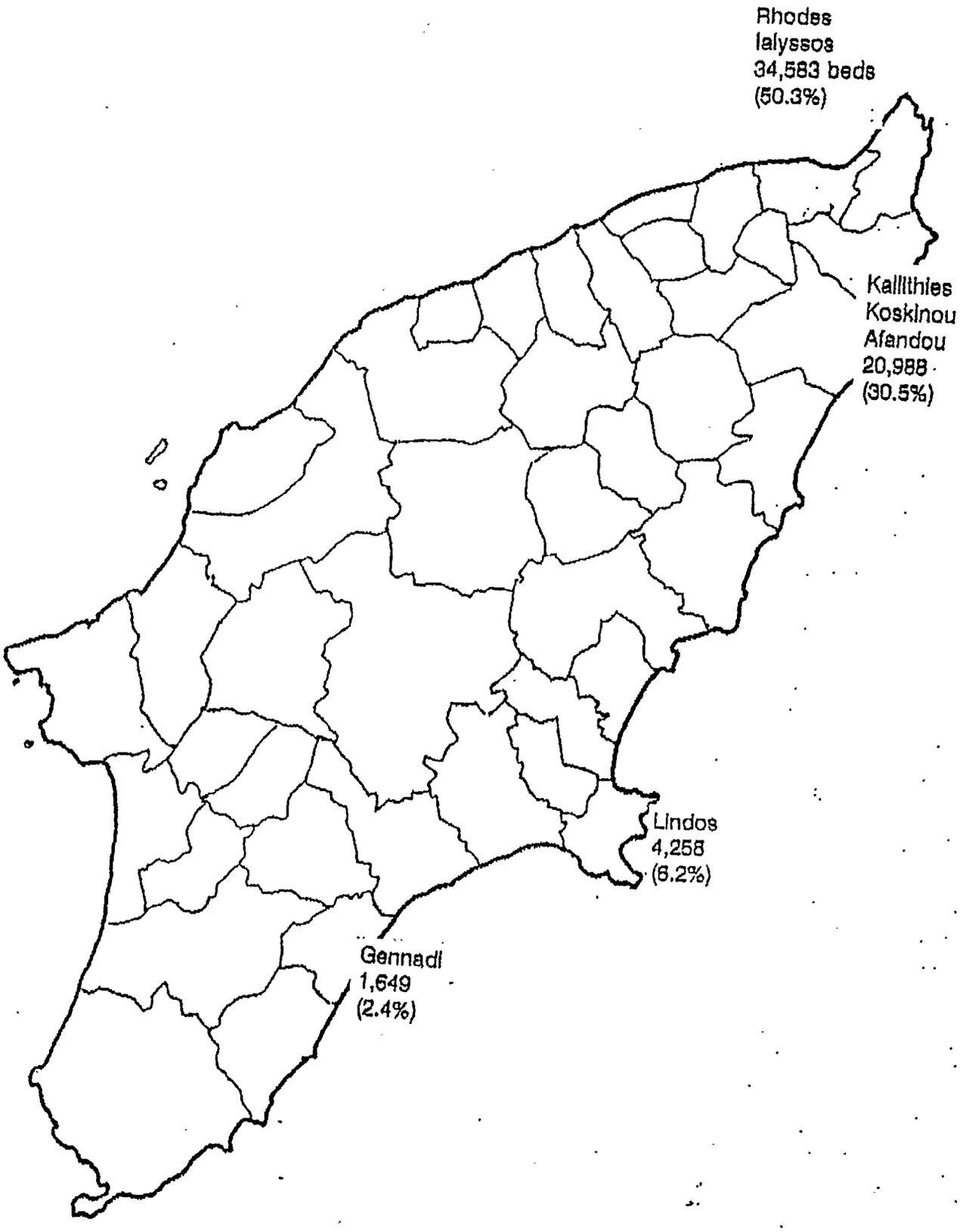


Fig 5.3 DISTRIBUTION OF TOURIST BEDS

ΡΟΔΟΣ
RHODES

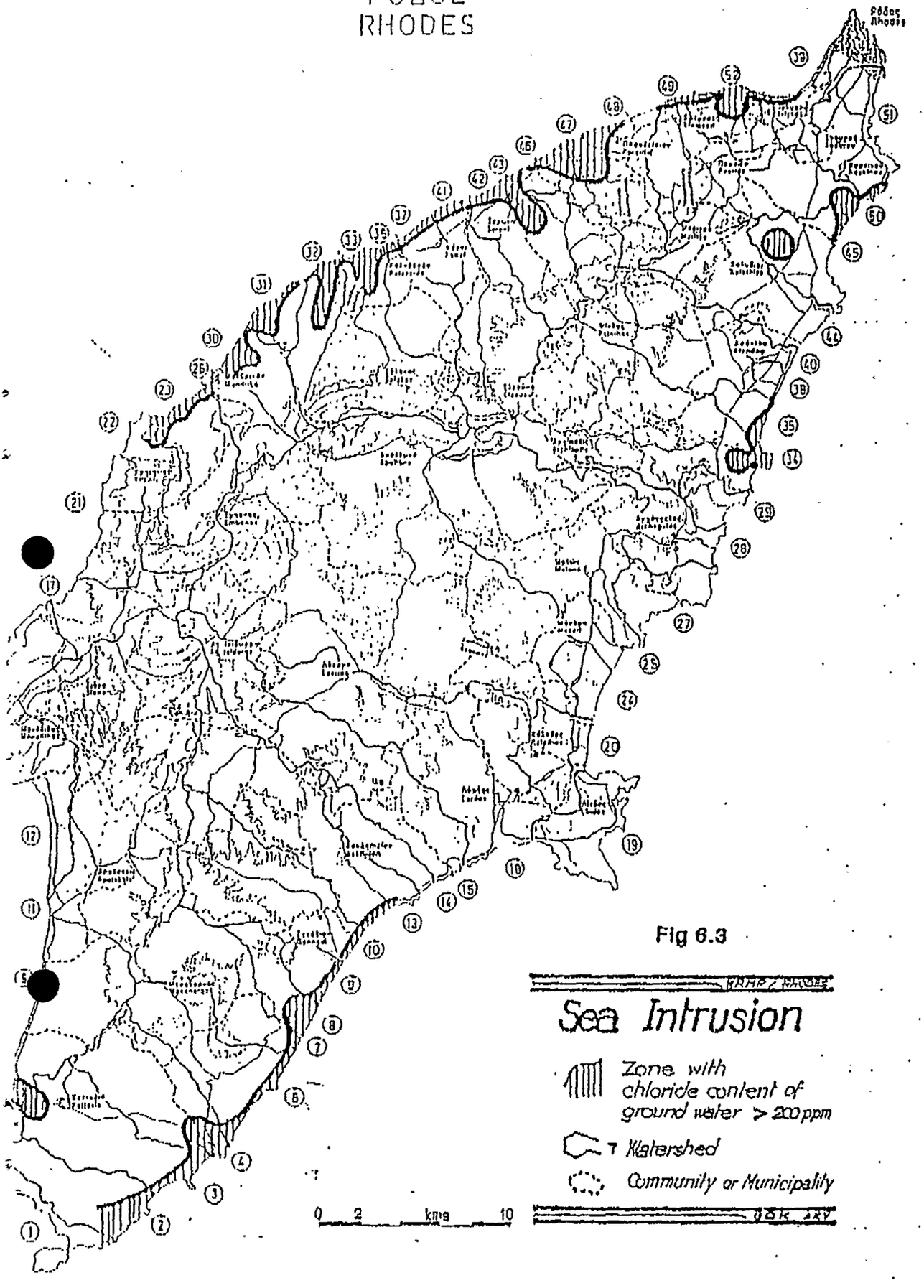


Fig 6.3

Activity No. 14: SPECIALLY PROTECTED AREAS

1. Background Information

The island of Rhodes is located in the south-eastern part of the Aegean sea and is part of the archipelago of Dodecanese. The island is 80 km long elongated NE-SW, around 1400 km2 large and has 220 km of coasts. Its geographical position makes it a particularly interesting site for the study of terrestrial insular populations and of marine species introduced through the Suez canal as well as for the relic species of the ancient Thetys.

The central mountains are relatively high (1215 m at Mount Attaviros). They are surrounded by plains northwards and southward which are borded by sandy beaches. The continental shelf is narrow and depth increases rapidly close to the coasts. Accordingly, the coastal zooplankton is essentially pelagic and several species of deep sea fishes can be found.

The coasts of Rhodes are exploited by mass tourism leading to an important urbanisation and locally degradation of areas such as in the northern part of the island and to a lesser extent on the east coast. On the other hand, the west coast from Kamiros onwards is more protected due to exposure to winds and swell from North-West and to rocky coasts hard to access by land.

2. Objectives of the Activity

The main objectives of the Activity 14 (Specially Protected Areas) are (i) to identify areas with special natural interest and (ii) to propose recommendations for the protection and management of these areas.

3. Performed Activity

For the implementation of the CAMP agreement (Activity 14), RAC/SPA organised the following field studies and missions:

1. August 1993: field mission aimed at diagnosing the situation and proposing management measures for Butterfly Valley and at making a first inventory of potential protected areas (Consultant: Mr. Andreas Demetropoulos).

2. Field study (31/05/94 to 11/06/1994) with the participation of a consultancy team composed of Greek consultants and experts from IUCN (Mr. Alain Jeudy de Grissac, Ms. Virginie Tilot, Mr. Jean Marc Sinnassamy, Mr. Panos Panayotidis).

3. Consultation mission organised from 14 to 18 January 1995 to receive comments and reactions from the authorities of Rhodes on the sites of bio-ecological interest proposed to be protected and on the management measures proposed in the preliminary report (Mr. Chedly Rais and Ms. Virginie Tilot).

Based on the data collected during the mentioned mission/field studies, the

consultancy team prepared a final report which includes a detailed description of the identified sites of interest as well as guidelines for the conservation of natural and cultural heritage of Rhodes.

The activities were carried out by RAC/SPA in collaboration with IUCN and with financial support from the European Investment Bank (EIB) and the Commission of the European Communities (CEC), under the Mediterranean Environmental Technical Assistance Programme (METAP).

Here are the main elements set out by the final report:

Ecological Characteristics

Three main types of natural terrestrial ecosystems can be observed: forest, shrublands and wetlands. Most of the forests are composed of cypress *Cypressus sempervirens* and of pine trees such as the native species *Pinus brutia* and the introduced *Pinus halepensis.* The forest covered 52% of the island before 1940 but is now reduced to 20% due mainly to forest fires. Shrublands (maquis and phrygana) cover 30% of the island. These terrestrial communities are marked by human impact due mainly to fires and overgrazing. The recurrence of these factors can increase the discontinuity of the agneous vegetation, leading to bushy formations between which appear large patches of barren soil.

There are four main marine ecosystems: near the coast sandy bottoms, forests of cystoseira generally on rocky bottoms, at a greater depth seagrass meadows of *Posidonie oceanica, Cymodocea nodosa and Halophila stipulacea,* then coralligene concretions in poor light conditions between 20 and 80 m depth.

Sites are presently protected and managed on the island, in particular the "Petaloudes" or butterfly valley is a major tourist attraction. The Attaviros forest is managed by the Forestry Section of the Agriculture Department.

Sites of interest (numbers are reported on Figure A).

Terrestrial environment

From north to south and mainly on the western part of the island, numerous terrestrial sites are of interest:

- the Petaloudes valley (15) which is one of the main attractions of the island due to the presence of a breeding area of a moth (nocturnal butterfly), the Jersey Tiger *(Euplagia quadripunctaria);*

- the Protitis Ilias forest (14) which remains undisturbed and presents a very interesting flora and associated fauna;

- the artificial lake of Nani (13), important for migrating and resident waterfowl;

- the artificial lake of Nani (13), important for migrating and resident waterfowl;

- the Attaviros forest (12). which is located around the highest point of the island, includes numerous interesting species and could be the place for the reintroduction of the wild of the fallow deer *dama dama;*

- the coastal ridges of Armenistis (10) and Akramytis (9), forming an impressive landscape with the sea and the islands in the background, including the historical sites of Lakki, Glyfada, Monolithos and Ayios Yeorgios;

- the artificial lake of Apolakkia (8), a small wetland of importance for numerous species;

- the coastal sand dune and hills from Fourni to Agiannis (7);

- the Loutani river bed near Epta Piges (2).

Other sites linked to the marine environment and including a terrestrial domain are described shortly hereafter.

Marine environment

As for the terrestrial environment, a zoning of the marine environment is needed, taking in areas for fisheries (including fisheries reserves), anchoring, tourist nautical activities (diving, snorkelling, windsurfing, etc.), landscape and nature conservation. Following further investigations, some or part of these areas could be declared strict nature reserves, due to the presence of endemic, rare or endangered species. The main areas identified so far are:

- on the northern part of the east coast, the area from Thermes Kallithea to Ladiko Bay (1) for its historical, landscape, biological and geological interests;

- on the central part of the east coast, from Cape Archangelos to Lardou Bay (3) including Lindos for the terrestrial and marine landscape value;

- the area of Plimiri (4) composed of wetland, dunes and beaches where marine turtles are nesting;

- the Prassonissi peninsula (5) and its tombolo as a unique marine formation for the island;

- the islands of Xtenia and of Karavolas (6) which could host some endemic or rare species, and where the Mediterranean monk seal is recorded;

- on the western coast, from Kamiros to Cape Fourni (11), for the general landscape, representative marine ecosystems and the presence of monk seal. A special status of nature reserve could be afforded to the island of Makry, Stroggyli and Tragoussa.

4. Conclusions and Recommendations including follow-up Activities

On the basis of the results and conclusions of the field studies and the consultation meetings, guidelines for the conservation and Management of the natural and cultural heritage of Rhodes were elaborated taking into account the following general principles:

- insure that development should not degrade the resource base upon which it depends;
- preserve ecological integrity through establishing ecologically sustainable limits for resource use;
- ensure that natural resource access is equitable between generations;
- use archaeological and environmental conservation as a tool to stimulate economic development;
- maximise uniqueness or authenticity of product;
- utilise a precautionary approach.

The main actions and follow-up activities proposed by the mentioned guidelines are:

As soon as the authorities of the Island have agreed on the necessity and the benefits linked to the adoption of a CAMP for the island of Rhodes, they will have to:

Prepare a zoning for activities and conservation

- At the Island level, a general zoning has been proposed by both the development and environment approach, reaching the same conclusion for the separation of the Island in three main areas:
- a conservation area which encompasses the main natural, and cultural (mainly landscape) features, mainly south of Gennadi, the western coastal area to Fanes and the hinterland area. The principal objective is the conservation of nature, of natural resources, landscape and cultural heritage. Development is mild;
- an intermediate area where the development could be controlled and covers the east coast from Faliraki to Gennadio Bay. The principal objective is a sustainable development with some areas of conservation.
- an urban, industrial and touristic area which is considered as saturated and encompasses Ialyssos, Ixia, Rhodes and Faliraki. The objective is to develop the area with the respect of the cultural features of the area.

The second and the third areas play a role of buffer zone for the previous one.

The main objectives and activities in relation with conservation does not preclude other sustainable activities. This zoning, if applied, could make the Rhodes Island a good example of Biosphere Reserve according to the Man and Biosphere programme criteria.

The conservation area could include different levels of management and part of this area could be classified as protected areas according to their features and sensitiveness (nature reserve, protected landscape etc.). Such protected areas should cover the Petaloudes valley, Profitis Ilias forest, the artificial lake of Nani, the Attaviros forest, the islands of Makry, Stroggyli and Tragoussa, Armenistis-Akramatis-Monolithos, the bay and coast of Apolakkia, the islands of Xtenia and Karavolas, the peninsula and tombolo of Prassonissi, and the coast of Plimiri. Each area will be afforded a specific management plan according to its resources (species, ecosystems) and their basic requirement in an island context.

Obtain a consensus at the Island's regional and local level

- Develop and maintain all along the process a participatory approach, including in particular all the governmental departments, local communities, the private sector, NGOs. To be effective on the medium and long term any regulation should have public acceptance and be supported by local people and users.

Offer alternative or compensation for displaced or reduced activities

- Even if such a programme brings short, medium and long term benefits for all the population, it is evident that in the first years of the process, some activities will have to be reduced or abolished due to their incompatibility with the objectives of the CAMP or of nature conservation. Users or community groups whose rights or activities are abolished, displaced or reduced should be given alternative rights or activities or otherwise be compensated.

Use the existing or adopt and implement the necessary legislation

- The creation and management of protected areas and the creation of adequate institutions for the successful implementation of the plan. Such a legislation or regulations will have to cover in particular the development outside village expansion boundaries, the designation of areas of outstanding natural, ecological and cultural value, the strict preservation of traditional architectural character, the encouragement of agricultural development, housing restoration, eco-tourism development in the villages, incentives for such actions, impact assessment of any existing and new project.

<u>Adoption of a CAMP and programme of implementation</u>

A process for the legal adoption and implementation of the plan has to be found, using the existing legislation or seeking new instruments.

<u>Implementation</u>

From the CAMP adoption to its implementation, a long way remains, which will be

realised through the improvement of the existing environmental policy for the island and a strengthening of the local administrations/institutions. Different level of actions are needed.

- for the short term priority has to be given to the creation under the responsibility of the Prefect of an **Environment Coordination Committee** including all the relevant departments for the implementation of the environmental law of the physical plan, of the proposed regulations, etc.;

- for the medium and long term actions dealing with conservation of nature and natural resources, create from the existing relevant departments a **planning and management team or protected area authority**;

- develop and implement with the relevant institutions collecting scientific, ecological and socio-economic data a **continuous survey of the marine and terrestrial environment** and in particular for the existing, potential and created protected areas;

- prepare and adopt for each protected area a **specific management plan** or at least a general management plan for the conservation area.

Identification of Projects, Feasibility Study and Funding Sources

As part of the plan, development and conservation projects will have to be identified and evaluated. The three main actions are the following:

Identify and prepare development and conservation pilot projects

- this could include the amelioration of the sewage system, a better knowledge and management of the water resources, a support to the hinterland development (agriculture and forestry), restoration of traditional villages and houses, new tourist development in particular inside the villages, rehabilitation of hotels, upgrading of historic monuments, specific valorisation of protected areas and landscapes, etc.

Costs, benefits and funding aspects of the conservation

- the cost and benefits of each of the scheduled activities or programmes will have to be analysed. For the implementation, national, regional and local resources could be identified for these actions, in particular the private sector could be an important partner. In addition, important funding could be afforded by international organisations, and in particular the European Union through different existing programmes.

Research international recognition

- with such a CAMP and an effective implementation, the Island of Rhodes could seek for international recognition. In particular, the Island as a whole could be classified as a world heritage site, both for natural and cultural value. Another opportunity is an application as a Biosphere Reserve of UNESCO for the conservation area of the Island.

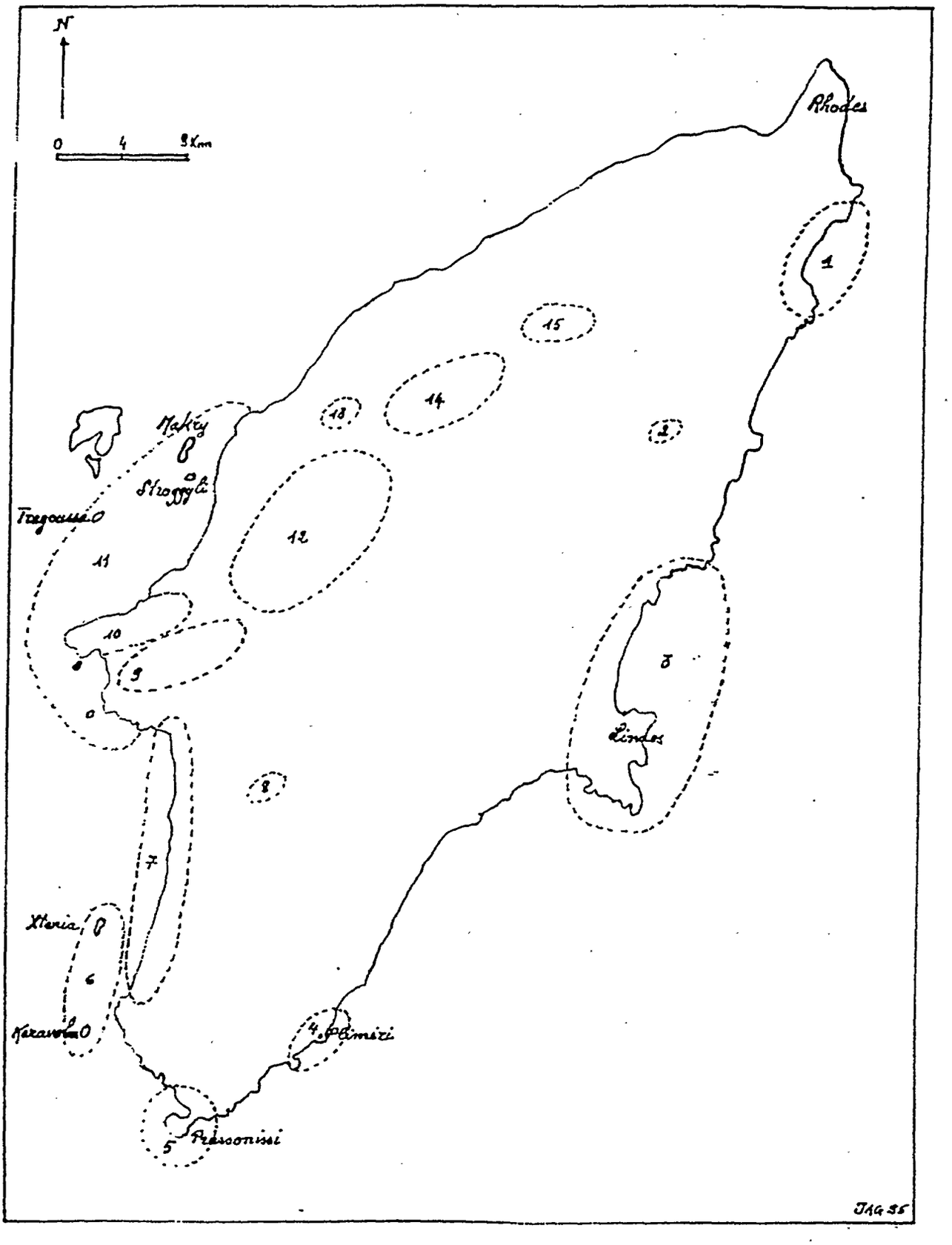


Figure A: Sites of interest of the Island of Rhodes (see page 2 for sites 1 to 15)

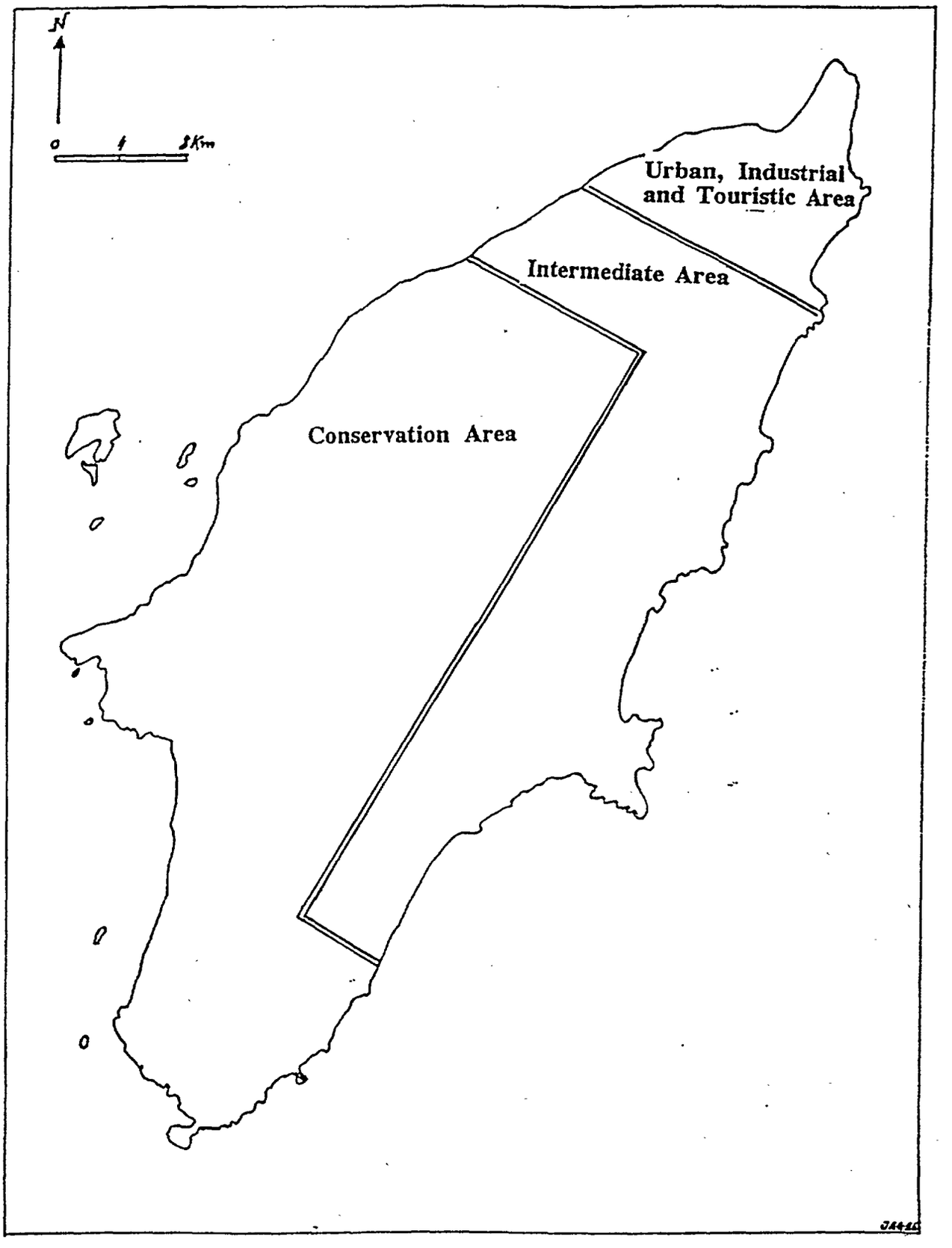


Figure B: Proposed zoning for the Island of Rhodes.

ANNEX I

BEI | EIB

DEN EUROPÆISKE INVESTERINGSBANK
EUROPÄISCHE INVESTITIONSBANK
ΕΥΡΩΠΑΪΚΗ ΤΡΑΠΕΖΑ ΕΠΕΝΔΥΣΕΩΝ
EUROPEAN INVESTMENT BANK
BANCO EUROPEO DE INVERSIONES
BANQUE EUROPEENNE D'INVESTISSEMENT
BANCA EUROPEA PER GLI INVESTIMENTI
EUROPESE INVESTERINGSBANK
BANCO EUROPEU DE INVESTIMENTO

United Nations Environment Programme
Co-ordinating Unit for the Mediterranean
Action Plan
Leoforos Vassileos Konstantinou 48
(second floor)
GR - 11635 Athens

c.c. Ministry for the Environment,
Physical Planning and Public Works
Directorate of Environment
Patision Street 147
GR - 11251 Athens
Attention Mr G. Kardassis

Commission of the European Communities
DG XI (M. Zampetti)
200, rue de la Loi
B - 1049 Bruxelles

Luxembourg, 22 January 1993 JU/PAM/amc n° 560

Subject : **METAP/LIFE "Coastal Area Management Plan Rhodes (CAMPR)"**

Dears Sirs,

With reference to our recent discussions, the European Investment Bank (the "Bank") in its own name and in the name and for the account of the Commission of the European Communities (the "CEC") confirms its intention to entrust the United Nations Environment Programme/Mediterranean Action Plan (the "UNEP/MAP") with the realisation and the coordination of the above mentioned CAMPR.

Funding for the CAMPR will be provided by the European Community financial instrument for the environment (LIFE) under the Mediterranean Environmental Technical Assistance Programme (METAP) for an amount up to ECU 360 000 (threehundredsixtythousand), which corresponds to US Dollars 435 000 (fourhundredthirtyfivethousand) at an exchange rate of 0.8275862 ECU per US Dollar.

The amount in ECU shall not be subject to any increase in any circumstances of for any reasons whatsoever.

1. Scope and content of UNEP/MAP's coordination role

UNEP/MAP shall be responsible for the realisation of the CAMPR in conformity with the "Agreement relative to the coastal area management programme for the island of Rhodes" signed by the Government of Greece (Ministry for the Environment, Physical Planning and Public Works) and the United Nations Environment Programme in November/December 1990 and with the Terms of Reference for individual Actions as agreed upon with the Bank. UNEP/MAP shall coordinate the various Action Units, which are listed in Annex A.

All the consultants and any other persons to be affected to the various Action Units will be selected by UNEP/MAP according to its own procedures, in consultation with the Greek government and with the approval of the Bank. The Bank shall also approve the choice of the equipment to be purchased.

2. Reports

UNEP/MAP shall keep the Bank informed on the progress of the CAMPR by means of three-monthly progress reports and qualified reports, as described in Annex B to this contract. The qualified reports shall be approved in writing by the Bank within 30 days from the reception of the full documentation forming part of the report and listed in Annex B.

3. Payments

The total cost of the Study shall be disbursed in US Dollars as follows :

- 30 % upon return of the countersigned copy of this contract
- 25 % upon approval by the Bank of the First Qualified Report
- 25 % upon approval by the Bank of the Second Qualified Report
- 20 % upon acceptance by the Bank of the Final Qualified Report.

The Bank shall pay the above mentioned amounts against the presentation of the necessary documentation, sixty days after the request from UNEP/MAP to the account it will indicate at least thirty days before the date proposed for the payment. However, any payment is conditional upon receipt of the relevant amounts in ECU from the CEC.

If on the day of payment the value of the ECU translated into US Dollars should be lower than the one fixed in the present contract, the Bank will pay in US Dollars, based on the exchange rate of the day of disbursement in question, funds equal to an amount in ECU equivalent to the total cost of the study (360 000 ECU) divided by the percentage of the total cost to be paid, determined in accordance with the first paragraph of this article. The exchange rate of the day is the exchange rate weekly established by the Bank for its administrative payments.

After the third disbursement the Bank shall verify if all the ECU received from the CEC and converted in US Dollars have been disbursed to UNEP/MAP. If a surplus should exist, the Bank, in the name and for the account of CEC, and UNEP/MAP shall agree upon an extension of the object of the Study.

4. Management fee

The Bank shall pay to UNEP/MAP on its own resources a management fee of 9 % (nine per cent) of the disbursed cost of the Study. This management fee shall be paid by the Bank in addition to the disbursements provided for above.

The amounts will be paid by the Bank in US Dollars.

5. Documentation

The Bank shall receive the documentation listed in Annex B and in accordance to the time table established therein.

6. General Conditions

The General Conditions listed in Annex C will apply.

7. Logo

All the Qualified Reports shall bear the logo of METAP (Annex D), the name of the Bank as well as the clear mention of CEC as donor.

Please indicate your agreement with the terms of this contract by returning to us one copy of it and its Annexes duly countersigned.

Yours faithfully,

EUROPEAN INVESTMENT BANK

28.1.93

Accepted for
(date)

M. DELEAU

K.J. ANDREOPOULOS

Annexes : 4

ANNEX A

to CONTRACT with UNEP/MAP for the realisation and the coordination of the Coastal Area Management for the Island of Rhodos (CAMPR)

ACTIONS within CAMPR to benefit from METAP support

	ACTION
1.	Land-Based Sources and Dumping Protocols
2.	Liquid Waste Management
4.	Monitoring of Pollution in Rhodes Coastal Region
5.	General Water Resources Master Plan
7.	Programme of Environmentally Sound Energy Planning
8.	Programme of Protection of Historic Settlements
9.	Training Programme on GIS
10.	Environmental Impact Assessment (EIA)
13.	Integrated Planning Study for the Island of Rhodes
14.	Specially Protected Areas

ANNEX B

to CONTRACT with UNEP/MAP for the realisation and the coordination of the Coastal Area Management for the Island of Rhodes (CAMPR)

A - TIMETABLE

A.1 - For Actions

ACTION	OUTPUT	DEADLINE
1 Land-based sources and dumping protocols	1.1 Completion of all questionnaires 1.2 Provision of expert 1.3 Final report	31 Jan. 93 30 June 93 30 Nov. 93
2 Liquid waste management	2.1 Commencement of Action 2.2 Interim report 2.3 Final report	1 Jan. 93 30 June 93 31 Dec. 93
4 Monitoring of pollution in the coastal region	4.1 Design of monitoring programme 4.2 Order of equipment 4.3 Commencement of sampling 4.4 Completion of training 4.5 First progress report 4.6 Second progress report 4.7 Final report	15 Jan. 93 13 March 93 15 May 93 31 Dec. 93 1 Dec. 93 1 June 94 1 Dec. 94
5 Water Resources Master Plan	5.1 Commencement of Action 5.2 Interim report 5.3 Final report	31 Jan. 93 31 Dec. 93 31 Dec. 94
7 Environmentally sound energy planning	7.1 First interim report 7.2 Second interim report 7.3 Final report	31 Jan. 93 31 July 93 31 Dec. 93
9 Training programme on GIS	9.1 Draft of final report 9.2 Order of equipment 9.3 Installation of equipment 9.4 Final report	31 Dec. 92 28 Feb. 93 30 April 93 31 May 93
10 Environmental Impact Assessment	10.1 Draft of final report 10.2 Training course 10.3 Final report	31 Dec. 92 31 March 93 31 Jan 94
13 Integrated planning study	13.1 Draft of final report 13.2 Revision of study by expert 13.3 Final report	31 March 93 31 May 93 30 June 93
8 Historic Settlements	8.1 Report on the information system 8.2 Urban and architectural studies 8.3 Final report	30 Sept. 93 30 Nov. 93 30 Sep. 94
14 Special Protected Areas	14.1 Report of expert 14.2 Final draft management plan	30 April 93 31 Dec. 93

A.2 For Reports

Progress Report	Qualified Report	Completion Date
First		30 April 93
	First	30 July 93
Second		30 October 93
	Second	31 January 94
Third		30 April 94
Fourth		30 July 94
Fifth		30 October 94
	Final	31 January 95

B - DOCUMENTATION

B.1 - Progress Reports

Information on progress of each Action indicating output, dates of completion of single key activities, expenditure effected, cost overrun (if any), delays, updated timetable, problems and ways to overcome it. Major changes in the scope, timing and team responsible for the Action to be explained. Experts involved, coordinating meetings and other relevant events.

B.2 - Qualified Reports

Each Qualified Report will include a progress report as indicated above plus the following output (for commencement and completion of activities, information should be provided to evidence it):

ACTION	QUALIFIED REPORTS		
	FIRST	SECOND	FINAL
1	Provision of expert	Final report	-
2	Interim report	Final report	-
4	Commencement of chemical and microbiological samples	1st progress report (3) & Completion of training	2nd progress report(4) & Final report
5	Commencement of Action	Interim report	Final report
7	2nd interim report	Final report	-
9	Installation of equipment & Final report	-	-
10	Completion of training course	Final report	-
13	Final report	-	-
3	-	Report on the info system Urban & architec. studies	Final report
14	Report of expert	Final draft management plan	-

(3) Including summer monitoring campaign for sea outfall of sewage treatment plant.
(4) Including winter monitoring campaign for sea outfall of city of Rhodes.

GENERAL CONDITIONS FOR THE EMPLOYMENT OF CONSULTANTS

1.1 Payment. Payment of fees and expenses will be made by the Bank upon submission of invoices accompanied by supporting documentation sufficient in the Bank's judgement to enable the Bank reasonably to verify the charges being claimed. Consultant is responsible for all his tax or social security liabilities.

1.2 Time records. During the course of this work, including field work, Consultant is required to maintain time records and to submit them to the Bank when requested.

2. Confidentiality

2.1 Bank information. Consultant agrees that all knowledge and information which Consultant may acquire from the Bank, its employees or any person to the extent that the Bank owes that person a duty of confidentially in the performance of this agreement shall for all time and for all purposes be regarded by Consultant as strictly confidential. The obligation under this section shall survive any termination of this agreement. This obligation does not apply to information which is in the public domain or which later enters the public domain (other than by wrongful disclosure by the Consultant).

2.2 Bank's use of Consultant information. Consultant agrees that any information which is provided by Consultant for the purpose of this Agreement and which he discloses to the Bank in the performance of services may be utilised by the Bank in accordance with its normal confidentiality rules.

2.3 Ownership of material. All materials produced or acquired by the Consultant and delivered to the Bank for the purposes of this Agreement and all copies thereof - whether in the form of writing, graphics, films, magnetic or optic storage or other - shall become the property of the Bank, and copyright in them belongs to the Bank.

2.4 Advertising. Consultant shall not use the Bank's name in any of Consultant's promotional literature or information without prior approval of the Bank.

3. Future work. During this assignment and for a period of three years after termination of this assignment, Consultant will not seek or accept work connected directly with projects appraised during this assignment without the prior consent of the Bank.

4. Insurance. Consultant shall maintain in effect during the term of this Agreement, at his sole cost, adequate insurance covering work activity and comprehensive general liability insurance including professional liability coverage to cover the indemnity obligation set out below provided that such coverage is available, in Consultant's opinion, at reasonable cost in all circumstances.

5. Indemnification. Consultant shall indemnify the Bank against any liability on the part of the Bank incurred by reason of any wrongful act by the Consultant.

6. Assignment. Consultant shall not assign this Agreement nor subcontract any portion of it without the Bank's prior written consent. Consultant shall not assign any monies due or to become due to it hereunder without the Bank's prior written consent.

7. Law and jurisdiction. This Letter of Contract shall be governed by Luxemburgish Law, and the parties to this Agreement submit to the jurisdiction of the Court of Luxembourg for all purposes of this Agreement.

MEDITERRANEAN ENVIRONMENTAL TECHNICAL ASSISTANCE PROGRAM

A revised Annex B to Contract between EIB and UNEP/MAP
(As at 20 January 1995)

A. Timetable

A.1 For actions

Action	Output	Deadline
1. LBS and Dumping protocols	1.1 Completion of all questionnaires 1.2 Provision of expert 1.3 Final report	31 Jan. 95 28 Feb. 95 30 Jun. 95
2. Liquid waste management	2.1 Commencement of Action 2.2 Interim report 2.3 Final report	1 Feb. 94 30 Sept. 94 30 Jun. 95
4. Monitoring of pollution in the coastal region	4.1 Design of monitoring programme 4.2 Order of equipment 4.3 Commencement of sampling: a. microbiological parameters b. chemical parameters 4.4 Completion of training 4.5 First progress report: a. microbiological parameters b. chemical parameters 4.6 Second progress report: a. microbiological parameters b. chemical parameters 4.7 Final report: a. microbiological parameters b. chemical parameters	31 May. 94 30 Dec. 94 on going 28 Feb. 95 28 Feb. 95 28 Feb. 95 31 May. 95 31 May. 95 30 Sept. 95 31 Jul. 95 31 Dec. 95
5. Water Resources Master Plan	5.1 Commencement of Action 5.2 Interim report 5.3 Final report	1 Feb. 94 30 Sept. 94 31 Dec. 95
7. Environmentally sound energy planning	7.1 First interim report 7.2 Second interim report 7.3 Final report	1 Feb. 94 30 Sept. 94 30 Jun. 95
9. Training programme on GIS	9.1 Order of equipment 9.2 Installation of equipment 9.3 Draft of final report 9.4 Final report	30 May. 94 30 Sept. 94 30 Nov. 94 30 Jun. 95
10. Environmental impact assessment	10.1 Training course 10.2 Draft of final report 10.3 Final report	30 Sept. 94 30 Nov. 94 30 Jun. 95
13. Integrated planning study	13.1 Draft of final report 13.2 Revision of study by expert 13.3 Final report	30 Sept. 94 31 Dec. 94 31 Dec. 95
8. Historic Settlements	8.1 Report on the information system 8.2 Urban and architectural studies 8.3 Final report	30 Sept. 94 30 Jun. 95 31 Dec. 95
14. Special protected areas	14.1 Report of expert 14.2 Final report	31 Jul. 94 30 Jun. 95

A.2 For Reports

Progress Report	Qualified Report	Completion date
First		31 July 93
Second		30 April 94
Third		31 July 94
	First	30 September 94
	Second	30 June 95
Fourth		31 March 95
	Final	31 December 95

B - DOCUMENTATION

B.1 - Progress Reports

Information on progress of each Action indicating output, dates of completion of single key activities, expenditure effected, cost overrun (if any), delays, updated timetable, problems and ways to overcome it. Major changes in the scope, timing and team responsible for the Action to be explained. Experts involved, coordinating meetings and other relevant events.

B.2 - Qualified Reports

Each Qualified Report will include a progress report as indicated above plus the following output (for commencement and completion of activities, information should be provided to evidence it):

ACTION	QUALIFIED REPORTS					
	FIRST		SECOND		FINAL	
1	30/9/94	Provision of expert	30/6/95	Final report	-	-
2	30/9/94	Interim report	30/6/95	Final report	-	-
4	31/7/94	Commencement of chemical and microbiological samples	31/12/94	1st progress report (3)	31/3/95	2nd progress report (4)
			28/1/95	Completion of training	31/12/95	Final report
5	1/2/94	Commencement of Action			31/12/95	Final report
	30/9/94	Interim report				
7	30/9/94	2nd interim report	30/6/95	Final report	-	-
9	30/9/94	Installation of equipment	30/6/95	Final report	-	-
10	30/9/94	Completion of training course	30/6/95	Final report	-	-
13	30/9/94	Draft final report	31/12/94	Revision of study by expert	31/12/95	Final report
8	30/9/94	Report on the info system	30/6/95	Urban & architec. studies	31/12/95	Final report
14	31/7/94	Report of expert	30/6/95	Final report	-	-

(3) Including summer monitoring campaign for sea outfall of sewage treatment plant
(4) Including winter monitoring campaign for sea outfall of city of Rhodes

UNEP

UNITED NATIONS ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

ANNEX II

MEDITERRANEAN ENVIRONMENTAL TECHNICAL ASSISTANCE PROGRAMME

EUROPEAN INVESTMENT BANK

MAP Coastal Area Management Programme
"The Island of Rhodes"

Activity No: *Progress Report*

FIRST PROGRESS REPORT

1 January - 31 July 1993

Prepared with the financial support of the CEC

Athens, 1993

ANNEX III

UNITED NATIONS ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

UNEP

MEDITERRANEAN ENVIRONMENTAL TECHNICAL ASSISTANCE PROGRAMME

EUROPEAN INVESTMENT BANK

MAP Coastal Area Management Programme
"The Island of Rhodes"

Activity No: *Progress Report*

SECOND PROGRESS REPORT

1 August 1993 - 30 April 1994

Prepared with the financial support of the CEC

Athens, April 1994

UNITED NATIONS ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

ANNEX IV

UNEP

MEDITERRANEAN ENVIRONMENTAL TECHNICAL ASSISTANCE PROGRAMME
EUROPEAN INVESTMENT BANK

MAP Coastal Area Management Programme
"The Island of Rhodes"

Activity No.: *Third Progress Report*

THIRD PROGRESS REPORT

1 May 1994 - 31 July 1994

Prepared with the financial support of the CEC

Athens, October 1994

ANNEX V

UNITED NATIONS ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

UNEP

MEDITERRANEAN ENVIRONMENTAL TECHNICAL ASSISTANCE PROGRAMME
EUROPEAN INVESTMENT BANK

MAP Coastal Area Management Programme
"The Island of Rhodes"

Activity No.: *Fourth Progress Report*

FOURTH PROGRESS REPORT

1 August 1994 - 31 March 1995

Prepared with the financial support of the CEC

Athens, March 1995

ANNEX VI

UNITED NATIONS ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

UNEP

MEDITERRANEAN ENVIRONMENTAL TECHNICAL ASSISTANCE PROGRAMME
EUROPEAN INVESTMENT BANK

MAP Coastal Area Management Programme
"The Island of Rhodes"

FIRST QUALIFIED REPORT ON THE IMPLEMENTATION OF ACTIONS AS PER SEPTEMBER 1994

Prepared with the financial support of the CEC

Athens, September 1994

ANNEX VII

UNITED NATIONS ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

UNEP

MEDITERRANEAN ENVIRONMENTAL TECHNICAL ASSISTANCE PROGRAMME

EUROPEAN INVESTMENT BANK

MAP Coastal Area Management Programme
"The Island of Rhodes"

SECOND QUALIFIED REPORT ON THE IMPLEMENTATION OF ACTIONS AS PER JUNE 1995

Prepared with the financial support of the CEC

Athens, September 1995