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MAP CAMP PROJECT "MALTA"

FINAL INTEGRATED PROJECT DOCUMENT AND SELECTED THEMATIC DOCUMENTS

MAP Technical Reports Series No. 138
Volume II

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The thematic structure of the MAP Technical Series is as follows:

- Curbing Pollution
- Safeguarding Natural and Cultural Resources
- Managing Coastal Areas
- Integrating the Environment and Development

This series contains selected reports resulting from the various activities performed within the framework of the components of the Mediterranean Action Plan: Pollution Monitoring and Research Programme (MED POL), Blue Plan (BP), Priority Actions Programme (PAP), Specially Protected Areas (SPA), Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC), Environment Remote Sensing Centre (ERS), and Cleaner Production Centre (CP).

MAP CAMP PROJECT "MALTA”

FINAL INTEGRATED PROJECT DOCUMENT AND SELECTED THEMATIC DOCUMENTS

Volume II

TABLE OF CONTENTS

VOLUME I

VOLUME II

Technical Note

The final activity documents of the individual CAMP activities, prepared by national experts and/or institutions with the assistance and guidance of the respective MAP centre, are normally published as a MAP technical report series. Since the final activity documents of the MAP CAMP Malta Project exceed the usual page numbers (80-200), it was not possible to present all project outputs in one MAP technical report issue. Documents are therefore being published in two volumes. Selection of documents to be published was carried out by PAP/RAC, with the consent of the CAMP National Project Administrator and the MAP Co-ordinating Unit.

The first volume contains the Final Integrated Project Document, the report of the Project Presentation Conference, the introduction to the Integrated Project Database and GIS, and the final report on the Systematic and Prospective Sustainability Analysis, presenting altogether an integrated synthesis and overview of project results. The documents Coastal Area Management in the Northwest Coast of Malta (as the second level project area), the Strategic Management Plan, the Strategic Environmental Assessment report and the Integrated Water Resource Management for the Northwest are included as Annexes. Furthermore, a CD-ROM presenting the complete Integrated Project Database and GIS is included.

The second volume contains the final thematic outputs of the activities: a) Marine Conservation Areas, b) Soil Erosion and Desertification Control Management, and c) Tourism and Health.

All documents are presented in their original form. In order to reduce printing costs, all figures and photos had to be printed in black/white. Finally, some maps or tables, originally presented on extended A4 format had to be reduced to the normal A4 format.

LIST OF PROJECT OUTPUTS

1. A Tool for Sustainable Use of Coastal Resources with Particular reference to the Northwest
2. Final Presentation Conference Report (Malta, November 28-29, 2002)
3. Final Integrated Project Database (CD)
4. Final Report on the Systemic and Prospective Sustainability Analysis Project within CAMP "Malta"
5. Strategic Management Plan - North West Coast of Malta
6. Strategic Environmental Impact Assessment Report of the Draft North West Local Plan Coastal Policies
7. A Pilot Study for the Evaluation, Designation and Management of a Marine Protected Area: Rdum Majjiesa to Raheb Cave (N.W. Coast of Malta) – Final Report
8. Integrated Water Management of the North-Western Region of Malta - Summary Report
9. Integrated Water Management of the North-Western Region of Malta – Part I: Hydroclimatological Factors; Surface Water; Groundwater; Soil Characteristics
10. Integrated Water Management of the North-Western Region of Malta Part II: Water Infrastructure Development; Hydrological Cycle and Water Balance of Catchment Areas; Socio-Economic System of the Catchment Area; Water Demand and Needs Assessment; General Water Resources Development Plan; Water Resources Development and Management of the NW Area
11. Protection of Soil and Rural Landscapes in Northwest Malta
12. A Study of Environmental Health Effects on Tourism
13. Thematic maps were produced by four thematic activities, i.e. sustainable coastal management, marine conservation areas, integrated water resources management and soil erosion/desertification control management. The tourism and health activity concentrated on descriptive rather than spatial analysis. Worth mentioning are the erosion risk map for Northwest Malta and the marine habitats map for the benthos stretching from Rdum Majjiesa and Ras il-Raheb (also along the Northwest coast of Malta).
14. A set of Sustainability Indicators with relevant baseline data for each thematic activity was drawn up.
15. A poster depicting the various interests occurring along the coast was also drawn. This was distributed amongst stakeholders, the public in general as well as in schools.
16. Articles on the CAMP Malta Project as well as individual thematic activities were published in the local papers and journals. Articles on specialised journals and magazines, especially those aimed for school children were also published. Moreover, the public participation exercise included the setting up of an exhibition, with exhibits on the thematic and horizontal activities.

PREFACE

The MAP Coastal Area Management Programme (referred to as CAMP or Programme) has been approved by the Sixth Ordinary Meeting of the Contracting Parties, held in Athens in 1989. Its adoption was preceded by four coastal management pilot projects, implemented by PAP/RAC in the 1987-1989 period.

CAMP is the MAP programme implementing sustainable coastal management integrating environmental concerns into development planning. CAMP is based on the principles of sustainable development and integrated coastal area management and implemented through individual problem solving projects in selected coastal areas.

During the 1989-2002 period CAMP projects were implemented in: Albania (the Albanian Coast), Croatia (the Kastela Bay), Egypt (the Fuka - Matrouh Coastal Area), Greece (the Island of Rhodes), Israel (the Israeli Coast), Malta (the island of Malta and its NW area), Syria (the Syrian Coastal Area), Tunisia (the Sfax Coastal Zone), and Turkey (the Izmir Bay). Presently, the CAMP "Lebanon" and "Algiers" projects are in implementation. Projects for Morocco, Cyprus and Slovenia are in preparation and are to start after 2003.

The MAP Co-ordinating Unit in Athens is responsible for the Programme as a whole and for the implementation of its individual projects. Since 1996, PAP/RAC has been the MAP Centre responsible for the co-ordination of the CAMP, under the supervision and guidance of the Co-ordinating Unit.

The conceptual framework of MAP CAMP is based on the principles of sustainable development and on Integrated Coastal Area Management (ICAM). The Programme involves practical coastal management projects in areas selected in accordance with the Programme objectives and defined criteria. The projects are implemented by MAP in co-operation with the responsible national and local authorities and institutions, by selected national teams or institutions, with the assistance of respective MAP Centres and MED POL.

The Programme is of a multilevel nature, being oriented at local/project area level by dealing with area-specific priority problems, and at national and Mediterranean levels by applying the project results and experience in other similar areas.

The objectives of the Programme are:

a) to develop strategies and procedures at local and national levels for sustainable development, environment protection, and rational utilisation of coastal and marine resources, to be also used as inputs for the formulation of Mediterranean strategies of sustainable development,

b) to identify, adapt, and test, in a realistic operational context, methodologies, tools and practices of sustainable coastal management in the region,

c) to contribute to the upgrading of relevant national/local institutional and human capacities, and

d) to secure a wider use, at national and regional levels, of experience achieved by the Programme and by its individual projects, and create conditions for follow-up activities.

Individual CAMP projects are structured into project units defined as individual project activities, each activity dedicated to a specific issue or to an interrelated multi-sectoral group of issues. Integration and co-ordination, data management, systemic and prospective sustainability analysis, and a public participation programme are considered as mandatory activities of each CAMP project.

INTRODUCTION

The CAMP "Malta" project has been approved by the Eighth Ordinary Meeting of the Contracting Parties to the Barcelona Convention, held in 1993 in Antalya. The preparatory activities for the project started in 1996, with a detailed preparation from 1998. Following signature of the Project Agreement in November 1999, the project was launched in February 2000. The individual project activities were completed by the end of 2001, followed by the integration of final results. The Final Presentation Conference, held in November 2002 in Sliema, Malta closed the Project.

The project area dealt with the island of Malta on a first level and its Northwest area as the operational level. Due to a high demand for further economic development and intensive expansion of all kind of activities, in particular tourism, the NW is subject to increasing pressures and users conflicts, requiring therefore urgent sustainable management measures.

The problems identified in this Project indicated the classical sectoral approach which is inadequate for solving or mitigating the problems of coastal management. This resulted with a growing recognition about the need for a better definition of sustainability of future development and for strengthening and improving the integration of the national decision making system. Amongst other initiatives, the MAP CAMP "Malta" project was proposed and formulated.

In addition to addressing development and management issues in the project area and on a national level, the broad objective of the project was to increase efforts towards sustainable development and environment protection in Malta. The project conceptual framework was built up on the MAP/UNEP methodology and practices of Integrated Coastal Area Management (ICAM), and on improved national capacities for land-use planning, environment protection and sectoral management of natural resources and economic activities.

The CAMP "Malta" project is the first national initiative to integrate national efforts in coastal area management. It addresses specific issues concerning coastal area management in a holistic manner, rather than by traditional land use zoning and development control.

On the MAP side, the project is the first one formulated and implemented following the conclusions of the Sixteenth Meeting of the MAP Co-ordinating Unit and Regional Activity Centres, held in Cairo in 1998, and according to the "Operational manual for the formulation and implementation of CAMP projects", prepared on the basis of the Meeting conclusions.

The following individual project activities were implemented according to the Project Agreement:

a) four transversal project activities: Co-ordination and Integration, Integrated Database and GIS, Participatory programme, and Systemic and Prospective Sustainability Analysis, and

b) five thematic project activities: Sustainable coastal management, Marine conservation areas, Integrated water resource management for the NW Area, Erosion and desertification control management and Environmental health effects on tourism.

The institutional arrangements from the MAP side included the MAP Co-ordinating Unit as the overall project co-ordinator and supervisor, PAP/RAC as the operational co-ordinator and PAP/RAC, BP/RAC, SPA/ RAC and the WHO Project office in MAP - Athens as Centres responsible for the implementation of individual activities within their mandates.

The then Environment Protection Department (now the Environment Protection Directorate within MEPA) was the national agency responsible for the co-ordination and implementation of the project. A number of other authorities and institutions were responsible for sectoral and thematic issues.

A full list of authorities and institutions involved in the Project was given in Annex 3 of the Final Integrated Project Document.

A number of innovative elements were introduced in the project:

a) The project preparatory phase was more intensive and longer than that of previous projects and was implemented with significant contributions from a number of relevant national ministries and institutions. Consequently, the project agenda was prepared and elaborated in detail, including areas and issues of priority national interest. The institutional arrangements defined during the preparatory phase proved to be efficient, securing the required co-ordination and integration of efforts and results. The consequence of this approach was that the implementation period of the project was the shortest one of the previous 9 CAMP projects.

b) The four “transversal” individual activities, namely: co-ordination and integration, project-level data management/GIS activity, the participatory programme and the systemic and prospective sustainability analysis, are innovative for CAMP Malta. Each of these activities contributed in a specific way to the project results and its efficiency and cost effectiveness.

c) Innovative procedures implemented include the organisation of an Inception Workshop and regular harmonisation/integration meetings and the compilation of an Inception Report and Aide Memoire. The innovative procedures provided for: (i) transparency of tasks to be implemented, (ii) transparency of allocation of funds, (iii) timely identification of practical and other implementation related problems, (iv) a better mutual information among teams and (v) harmonisation and integration of respective results.

d) A number of ICAM tools were also implemented for the first time in CAMP Malta, This included the drawing up of sustainability indicators and the application PAP/FAO methodologies for erosion mapping and control management and RAC/SPA methodology for marine benthic habitats mapping.

e) The inter-relations between tourism and health, a most important issue not only for Malta but also for the Mediterranean region as a whole, was dealt with for the first time within CAMP.

f) A careful preparation of the Final Integrated Project Document which includes a follow up programme might be considered as a good prerequisite for an efficient and beneficial post project phase.

g) Finally, innovative contributions made by the national teams in implementing the project, in particular when adapting tools and procedures to the national context and local scale, should be emphasised.

On a general level, new ideas and concepts indicating the needs for a change in policies and inducing impacts towards a sustainable and environmentally sound integrated coastal management were the major project benefits. In addition, practical results related to selected priority issues were produced. A well-structured and implemented co-operation of national institutions and teams with the various MAP Centres involved, established a good basis for successful further national initiatives towards ICAM and sustainable development of national resources and potentials.

Moreover, a Coastal Declaration for Malta was proposed together with the establishment of a high level Coastal Resource Advisory Board. An elaborated sustainable coastal management strategy, funding strategy, Project Investment Portfolio and a framework follow up programme were also proposed.

At sectoral levels, each thematic activity produced a number of outputs, the major ones being presented in this issue of MAP TRS.

Finally, the Project Presentation Conference was unanimous when stating that the results and experience of the CAMP "Malta" project should be considered as pilot ones not only at the national Maltese level, but at the Mediterranean regional level.

UNITED NATIONS ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

Coastal Area Management Programme
For Malta

A PILOT STUDY FOR THE EVALUATION, DESIGNATION AND MANAGEMENT OF A MARINE PROTECTED AREA: RDUM MAJJIESA TO RAHEB CAVE (N.W. COAST OF MALTA)

Final Report

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CONTENTS

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CHAPTER 1
INTRODUCTION

1.1 THE COASTAL ZONE

The Coastal Zone Topic Paper prepared by the Planning Authority defines the coastal zone as *a geographical space incorporating land and sea areas within which the natural processes interact to create a unique dynamic system. It also incorporates those activities on land and sea where human activities are directly influenced by or can influence the quality of the natural resources.*

Organisms living along the coast are therefore adapted to survive in a delicate balance under conditions characterized by both these environments. The coastal zone therefore incorporates those activities on land and on sea, which have a direct impact on these natural processes.

The richness and diversity of the resources found within the coastal zone are dictated by natural characteristics. Coastal areas and habitats are biologically productive but fragile and susceptible to degradation through human activities as well as natural events. Because of its economic and cultural importance, coastal areas are expected to absorb most of the future population increase. Already heavily stressed in places, this additional population load will increase development-related impacts leading to increased pollution, habitat loss with concurrent loss of fish and wildlife species, coastal erosion and a general increase in vulnerability to coastal hazards.

As a first step in Integrated Coastal Zone Management, the identification of a coastal boundary as the geographical extent where management is to be implemented is necessary. The delineation is mainly based on ecological, physical and socio-economic criteria present, which vary along different parts of the coast.

The Coastal Zone Topic Paper has established the inland boundary to correspond to that selected for coastal habitats scheduled through the Development Planning Act of 1992, particularly coastal cliffs. Otherwise, the boundary was determined as corresponding to the shortest distance between two mutually intervisible points.

In the same document, the seaward limit of 12 nautical miles was selected since national sovereignty extends to the territorial seas over which the Planning Authority has developmental jurisdiction with the advent of the Amendments to the Development Planning Act in 1997.

The total land area of the Maltese archipelago is approximately 315.4 km^2. The coastal zone as identified incorporates a land area of about 61.8 km^2, making up 19.6% of the total land area.

Table 1.1 Distribution of land and sea areas

	Land Area (km)	Coastal zone area (km)	Coastal zone (%)
Malta	246.8	39.8	16.1
Gozo	65.8	19.2	29.2
Comino	2.8	2.8	100.0
Total	315.4	61.8	19.6

Source: Coastal Zone Topic Paper - Planning Authority, Malta

1.2 COASTAL ZONE MANAGEMENT

The main objective of coastal zone management is to protect, preserve and restore natural resources where possible; and to encourage growth and development through planning and evaluating these consequences in accordance with adopted policies.

The strategic importance of the coastal zone, and the problems associated with rapid coastal growth and depletion of fragile resources, have forced coastal nations to seek solutions that would allow for the suitable utilization of natural resources for economic development without causing irreversible damage. Coastal zone management has become the most useful tool to resolve the conflicts that arise between the various uses and the conservation of natural resources along the interface between the terrestrial and marine environment. Conflicts arise primarily from the lack of understanding of natural processes occurring along the coast and the presence of incompatible activities making use of the same stretch of coast.

Coastal zone management in Malta has been considered an important environmental issue because its various aspects affect the environment. The need to address coastal issues has been raised by various resource issues such as marine pollution, aquatic resource exploitation, fisheries, protection of natural scenery and land-use plans for recreational facilities, residential development and industrial activities on the coast. Hence, effective countermeasures towards coastal zone management should be wider and deeper than any single environmental problem. Interdisciplinary studies and co-operation among the authorities concerned are strongly required for promoting coastal environment protection.

Managing a complex system requires an integrated approach capable of bringing together the multiple, interwoven and overlapping interests of the coastal area in a co-ordinated and rational manner, harnessing coastal resources for optimum social and economic benefit for present and future generations without prejudicing the resource base itself and maintaining the ecological processes.

1.3 COASTAL AREA MANAGEMENT PROGRAMMES (CAMP)

The Mediterranean Action Plan is gradually orienting its activities towards the environmentally sound integrated planning and management of the resources of the Mediterranean coastal area. Understanding that the protection and enhancement of

coastal areas and their ecosystems can only be achieved through traditional development which uses integrated planning as its main tool, the Regional Activity Center for Priority Action Programmes (PAP/RAC) emphasized "*integrated planning and management of the Mediterranean Coastal Areas*" as its priority action. During the 6th Ordinary Meeting of the Counteracting Parties, it was decided that these activities be updated to include all MAP components and the pilot projects were renamed "Coastal Area Management Programmes" (CAMP).

CAMP is the MAP programme for sustainable coastal management, integrating environmental issues into development planning. It is oriented at understanding and resolving practical environmental, development and management problems at local and national levels in the Mediterranean coastal areas.

The purpose of the Programme, whose geographical context is defined by the Barcelona Convention and encompasses the Mediterranean marine environment and its coastal zone, is to contribute to the achievement of the objectives of MAP Phase II. The Programme is harmonized within the framework programme of the Mediterranean Commission for Sustainable Development and the results must be integrated in the process of formulation and implementation of national and regional development policies.

During the 1993 meeting in Antalya, the Contracting Parties decided that a Coastal Area Management Programme should be implemented for the Maltese Islands. In May 1997, coordination started between PAP/RAC and the Environment Protection Department in Malta to intensify activities for the preparation of a CAMP project for Malta and an agreement was signed between the Government of Malta and UNEP (PAP/RAC) in December of 1999.

Several projects were proposed for CAMP. The CAMP Project area is defined as the island of Malta, with particular focus on the Northwest area. The project will deal with selected priority issues, and present relevant solutions and outputs at the island level, when related to general policies and strategies, and at the level of the NW part, when related to detailed plans, actions and solutions.

This report concerns one of the individual activity projects, specifically Activity 3.6 in the *Agreement relative to the Coastal Area Management Programme - The Project for Malta.* This project is entitled "*A pilot study for the evaluation, designation and drawing up of a management plan for a Marine Conservation Area on the northwestern coast of Malta, an area extending from Rdum Majjiesa to Raheb Cave*".

1.4 THE REGIONAL ACTIVITY CENTER FOR SPECIALLY PROTECTED AREAS

RAC SPA is the MAP thematic center dealing with nature conservation issues. It was established in Tunis in 1985 with the mandate to assist the Contracting parties in the implementation of the Protocol concerning Mediterranean Specially protected Areas (Geneva, 1982). In 1985, a new protocol concerning Specially Protected Areas and biological diversity in the Mediterranean was adopted in Barcelona.

Since its entry into force, the new Protocol reviewed in 1995 will replace the Geneva Protocol. Further tools de eloped with MAP dealing with nature conservation include four action plans addressing the conservation of specific taxa (monk sea, turtles, cetaceans and marine vegetation).

The RAC SPA carries out activities related to the drawing up of inventories of the elements of marine and coastal biodiversity, the establishment and management of coastal and marine protected areas, the elaboration of strategies for biodiversity conservation, the conservation of threatened species.

1.5 COASTAL AND MARINE HABITATS IN THE MALTESE ISLANDS

1.5.1 Coastal Habitats

The main terrestrial coastal habitats that play a key role in environmental issues are:

a) Saline Marshlands

These form an interface between the marine, freshwater and terrestrial environmental and are therefore characterized by seasonal changes in salinity. In Malta, the microtidal environment implies that coastal marshes are maintained by seasonal fluctuations in precipitation, runoff, evaporation and seepage. A harsh environment thus causes saline marshland to support a highly specialized flora and fauna. Saline marshlands make up only about 0.5% of the Maltese coastline (Anderson & Schembri, 1989)

b) Transitional coastal wetlands

These support communities consisting of species typical of both freshwater and saline habitats

c) Sand dunes

Only 2.4% of the Maltese coastline consists of sandy beaches (Schembri, 1991, Schembri & Lanfranco, 1993) but few support sand dune communities. The rest were degraded as a result of anthropogenic activities such as beach development for tourism and recreation and lack of knowledge by the public. Remnants of sand dune habitats at Ramla tat-Torri, Ramla tal-Mixquqa and Armier support tiny communities of rare dune biota. The only dune system preserving most of its original vegetation is that of ir-Ramla l-Hamra in Gozo which has been scheduled for protection according to Section 47 of the Development Planning Act of 1992.

d) Low-lying rocky coasts

Here halophytic vegetation grows in isolated patches in the shallow saline soil accumulating in pockets in the rock. Three endemic species characterize this habitat in the Maltese Islands (Schembri, 1993). However, this habitat is also being continually threaded from development e.g. lying down of concrete to create a smooth surface.

e) Rupestral Habitats

Cliffs and screes are still largely intact mainly due to their relative inaccessibility and as such they provide a refuge for many Maltese floral and faunal species. Some of the coastal cliffs in the Maltese Islands are scheduled according to the Development Planning Act of 1992. Smaller areas within the cliffs and screes qualify as Sites of Scientific Importance by virtue of the species inhabiting them, their geology and geomorphology.

1.5.2 Marine ecosystems

The Mediterranean is known as the tideless sea and this affects the geographical extent of the intertidal zone, leading to overlap with terrestrial coastal habitats. During the 1990's, intense research has been conducted in an attempt to identify a marine classification system that would help establish levels of protection and assist in the management of protected areas.

The marine environment is divided into a series of zones. These are zones based on the scheme introduced by Peres and Picard in 1964 for the Western Mediterranean. The basic unit is the ***biocoenosis***, a group of populations whose composition and abundance is determined by prevailing environmental conditions in the ***biotopes*** (sites) where they occur.

a) Supralittoral Zone

The supralittoral zone in Malta extends between 1 and 18m above mean sea level with increasing exposure to wave splash and sea spray. The communities in this zone are very common on Maltese shores especially the northeastern and eastern sides, where the coast is characterized by sloping coralline and globigerina limestone.

Hard substrata support halophytic communities which are more or less exclusive to this habitat type where extreme conditions have permitted the flora and fauna to adapt to this habitat. Soft substrata, as found on the northwestern shores of Malta, are associated with beaches. Two biocoenoses occur on soft substrata and one on hard substratum. The more accessible shores are highly disturbed as a result of recreational activities and tourist-related developments.

The biocoenosis occurring on the soft substrata are the following:

(i) rapidly-drying sediments - this biocoenosis is characteristic of all sandy beaches exposed to the sun and is inhabited by small crustaceans and insects which burrow in the sand

(ii) slow-drying sediment - this habitat occurs where sediment is covered by plant debris or cobbles and boulders, so that desiccation is slow. The biota is dominated by insects, myriapods, arachnids, crustaceans and marine and terrestrial gastropods

The supralittoral zone may also include the banquette system, a specialized community of Mediterranean coasts, developing on masses of drying and decaying

plant debris deposited on shores through wave action during autumn and winter. Such communities are of extreme interest, featuring terrestrial, semi-terrestrial, semi-aquatic and aquatic species. Banquettes are liable to act as a buffer zone against erosion induced by strong winds and wave action in stormy seasons.

b) Mediolittoral Zone

In Malta, this is usually between 0.5m and 2m wide depending on the wave action in the area. This is subject to alternate emergence and submergence. There are two biocoenoses in Malta, one on soft sediments, made up of sand and gravels, and the others on the upper mediolittoral zone and lower mediolittoral zone, characterized by *Chthamalus* spp. and lithophyllum cushions and vermetid platforms, respectively.

c) Infralittoral zone

This zone is never uncovered and extends to the depths with sufficient light for normal photosynthesis, at which sea grasses can live, about 40m to 50m in the Maltese Islands.

This zone is characterized by two soft sediment biocoenoses in Malta, inhabited by *Cymodocea nodosa* in shallow waters (5 to 10m) and by *Posidonia oceanica* in deeper and clearer waters. There are also two hard substratum biocoenoses, one characterized by different communities of photophilic algae in clean water, and the other by algae characteristic of polluted conditions.

Rocky substrates are dominated by attached macroalgae which may take the form of algal "forests" stratified with tall-growing species forming a canopy over the strata of lower growing species, including a basal layer of encrusting, shade-tolerant species. One such community is that dominated by *Cystoseira* spp. growing either on exposed rocky shores in very shallow waters or in deeper waters.

Seagrass meadows are the most important sublittoral biotic communities in the Mediterranean, forming highly productive ecosystems on which other ecosystems and individual species depend, while fish species and cephalopods use the meadows as breeding and nursery grounds. Such communities are mainly found on soft sediments or cobble substrata. They are very sensitive to pollution and habitat alteration, resulting in regression, leaving a system of thanatocoenosis. Substrate type, depth, degree of shelter and also light penetration govern the type of seagrass dominated by the community. Deeper waters are mainly dominated by the Mediterranean endemic species *Posidonia oceanica*, while shallower and sheltered areas are mainly inhabited by *Cymodocea nodosa*.

d) Circalittoral zone

In the circalittoral zone there are fewer organisms due to the very dim light conditions inhabit this zone. Sessile organisms, including encrusting algae, tubeworms, bryozoans, sponges and corals, also in submarine caves, populate rocky substrata. Soft substrata support a variety of bottom dwellers which either burrow into the sediment (heart urchins), are partially embedded (soft corals) or live on it (brittle stars, sea cucumbers).

This zone may contain macrobenthic assemblages of photophilic algae on hard substrata, seagrass meadows of *P. oceanica*, bare sand communities and maerl communities. Light intensity, hydrodynamic conditions, sediment granulometry, microtopography and other edaphic factors, and anthropogenic influences are parameters which give rise to the various subtypes and facies making up this zone.

1.6 LEGAL AND ADMINISTRATIVE ISSUES

The strategic importance of the coastal zone and the problems associated with rapid development, with a concurrent depletion of fragile resources, have forced coastal populations to seek solutions that would allow for the utilization of natural resources for economic development without causing irreversible damage to coastal resources. Coastal zone management is the best tool available to resolve the conflicts arising between the uses and the conservation of natural resources along the interface between he terrestrial and marine environment.

1.6.1 International and regional policy

The implementation of coastal zone management is covered by a number of international agreements targeting both general issues and more specific ones covering particular economic sectors. Malta is signatory to a number of international and regional agreements on coastal and marine environmental issues. The Convention on Biological Diversity, Agenda 21 and the United Nations Convention on the Law of the Sea focus on sustainable development of the coastal and marine environment while the Barcelona Convention and its Protocols, the MARPOL Convention and the London Dumping Convention amongst others target issues pertaining to the quality of the marine environment and the coastal zone, pollution issues and others.

In one way or another, all these conventions seek to protect the marine and coastal environment through the control and abatement of marine pollution and the protection of marine flora and fauna through the application of various tools.

The **Barcelona Convention** is the legal instrument of the regional agreement known as the Mediterranean Action Plan. From its inception, the priorities of the MAP have changed from the assessment and control of pollution, the identification of better options for development and gradually to integrate coastal zone planning and management. Following the Rio Summit, the approach for regional cooperation turned to a more comprehensive approach to ensure sustainable development. Consequently, the objectives for MAP Phase II to be implemented between 1996 and 2005 are the following:

- to ensure sustainable management of natural resource and integrate the environment in socioeconomic development
- to protect the marine environment and coastal zone through the prevention, control and elimination of pollution
- to protect nature and protect and enhance sites of ecological or cultural value
- to strengthen solidarity in the management of common heritage and resources for the benefit of present and future generations

- to contribute to improvement of the quality of life

One of the main aims of the MAP was a revision of the Protocols to the Barcelona Convention during 1995. Both the Convention, amended in 1995 to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, and the Protocols, outline several obligations directed towards coastal zone management and in particular the protection of species and their habitats. Although all these protocols have a role to play in the conservation of biodiversity, the protocol on specially protected areas is directed specifically towards the protection, preservation and management in a sustainable and environmentally sound manner, of areas of particular natural or cultural value, through the establishment of specially protected areas. The main obligations include a compilation of a comprehensive inventory of areas characterized by rare or fragile ecosystems, the listing of endangered or threatened floral and faunal species and the drawing up of a list of specially protected areas of Mediterranean importance.

Parties to the Protocol concerning Mediterranean Specially Protected Areas are obliged to establish specially protected areas and shall endeavour to undertake the action necessary in order to protect these areas and, as appropriate, to restore them as rapidly a possible. They shall also take measures with regards to their planning and management and develop scientific and technical research.

The **Bern Convention**, on the Conservation of European Wildlife and Natural Habitats (Bern Convention), is designed to protect threatened species of flora and fauna, the habitats of these species, the habitats of migratory species, endangered natural habitats, and to safeguard migratory species. The aims of the convention are to conserve those wild flora and fauna and their natural habitats whose conservation requires the co-operation of several states and to promote such conservation. Particular emphasis is given to endangered and vulnerable species, including endangered and vulnerable migratory species.

The **Bonn Convention** The Convention on the Conservation of Migratory Species of Wild Animals is an intergovernmental treaty that aims to conserve terrestrial and marine species over the whole of their migratory range. Migratory species are particularly vulnerable to a wide range of threats which can include destruction of habitat in breeding areas, excessive hunting along migration routes, and the degradation of feeding sites. The Bonn Convention provides for the adoption of strict protective measures for migratory species that have been listed as endangered.

Appendix I lists species that are in danger of extinction throughout all or a significant proportion of their range. Species included on the list and recorded in the Maltese Islands include amongst others, the Loggerhead Turtle (*Caretta caretta*) and Audouin's Gull (*Larus audouinii*). Appendix II lists migratory species, not necessarily threatened with extinction, whose conservation status require, or would benefit from, international co-operative agreements. Species listed in Appendix II that are recorded from the Maltese Islands include dolphins and the White Stork, amongst others.

The Habitats Directive - There is currently no EU legislation directed specifically to coastal zone management on a regional level. However, the EU recognizes that problems of the coastal environment had best be tackled and solved on a Union level. The EU has legislation specifically targeted towards the protection of species and/or their habitats, including council Directive 92/43/EC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive). The main aim of this Directive is the preservation of biodiversity in the Member States through the setting up of a common framework for the conservation of wild flora and fauna and habitats.

This legislation combines the obligations outlined in the Bonn and Bern Conventions through the strict protection, control of exploitation and hunting methods of listed species, and the control of alien species. The Annexes to this Directive are important as they list habitats which have been integrated in the European Ecological Network "Natura 2000". This network comprises "special areas of conservation" designated by Member States on the basis of this Directive.

The 'Habitats Directive' consists of four main parts and includes obligations pertaining to the selection and designation of Special Areas of Conservation (SACs), the establishment of priorities and conservation measures for the maintenance and restoration of those habitats and species of Union interest, among others.

A key part of the Directive is the annexes, of which there are six. Annex I lists natural habitats whose conservation requires the designation of SACs. A number of such habitats are also found in the Maltese Islands including meadows of the sea-grass *Posidonia* (a priority habitat), coastal cliffs with endemic species of sea-lavender (*Limonium*), Mediterranean salt meadows, Mediterranean sand dunes, caves and submerged and partly submerged sea-caves.

Annex II lists species of plants and animals whose habitats must be protected for their survival. Annex II species that are also found in the Maltese Islands include the Bottle-nosed Dolphin (*Tursiops truncatus*) and the Loggerhead Turtle (*Caretta caretta*).

The ultimate aim of the 'Habitats Directive' is the designation of Special Areas of Conservation and their integration into a larger entity – the European "Natura 2000" network. The main threat to European habitats and wildlife is seen as the fragmentation of natural habitats and the blocking of ecological corridors between different areas due to development. The "Natura 2000" network will be a system of linked conservation areas aimed at the maintenance of European biodiversity primarily through sustainable land management in and around habitats of Union or wider importance.

The **Convention on Biological Diversity** is a framework convention. Its provisions are expressed as overall goals and policies. It puts emphasis on decision making at the national level. The Convention's objectives include the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of utilisation of genetic resources. It requires parties to develop national strategies, plans or programmes for the conservation of biodiversity and for the sustainable use of biological resources. The convention sets

out policies to be followed. Major policies include effective *in situ* conservation of biological diversity, giving also goals on which to establish laws and policies.

The Convention creates obligations to develop national strategies and plans, and to integrate the conservation and sustainable use of biological diversity into relevant plans, programmes and policies as well as into national decision-making, as for example, road-building policies, land clearance polices, medicinal plant policies etc.

In situ conservation obligations are emphasized. These call for measures ranging from the establishment of a system of protected areas to the rehabilitation of degraded ecosystems, the recovery of threatened species, the protection of natural habitats, and the maintenance of a viable population of species in natural surroundings.

Agenda 21, adopted in Rio in 1992, gives guidance for the management of coastal and marine resources, with integrated coastal area management considered as the key tool to achieve these objectives. The **UN Convention on the Law of the Sea** regulates all marine activities by encouraging Member States to take all necessary action in enforcing regulations to prevent, reduce and control pollution from land-based sources, seabed activities, dumping and through atmospheric deposition.

1.6.2 National policy and legislation

1.6.2.1 The Environment Protection Act 1991 and The Development Planning Act 1992

There are currently two pieces of local legislation under which coastal and marine protected areas may be established in the Maltese Islands. Part 6 of the Environment Protection Act 1991 dealt with the protection of flora and fauna and article 32 empowered the Minister responsible for the environment to issue regulations declaring a particular species as protected and a specific area as Nature Reserve.

A number of sites have been declared nature reserves in terms of this Act, including Filfla, through the Filfla Nature Reserve Act, 1988, Fungus Rock in Dwejra Bay, (Legal Notice XXII of 1992), and Selmunett Islands (Legal Notice XXV of 1993).

The Environment Protection Department and the Planning Authority have now been amalgamated into the Malta Environment and Planning Authority (MEPA) and as such both the Environment Protection Act 2001 and the Development Planning Act of 1992 are under the responsibility of the two directorates under the MEPA.

The Development Planning Act established a Planning Authority to promote and control development in accordance with approved policies and plans. One key responsibility of the Planning Authority (now the Malta Environment and Planning Authority - MEPA) is the preparation and periodic revision of a Structure Plan for the Maltese Islands and supplementary planning documents. The Structure Plan formulates a national planning policy and puts forward general proposals in respect of the development and other use of land.

The presence of sand dunes, deep natural caves, and coastal cliffs, among others, qualify the study area as an **Area of Ecological Importance** (AEI). The Structure Plan requires the MEPA to give AEI and SSI or complexes of such a protection rating according to the following criteria:

> **LEVEL 1** zones will include important habitat types present only in small areas and/or sites with unique species or features.
>
> **LEVEL 2** zones will include habitat types present in relatively large areas and/or sites with rare species or features.
>
> **LEVEL 3** zones will include areas (buffer zones) where control is necessary to preserve habitats/species/features in adjacent sites.
>
> **LEVEL 4** zones will include habitats and/or features of general interest.

For AEIs and SSIs in general, the following general protection policies apply:

> 1. A general presumption against development, including roads and public utility services, and particularly on crests of ridges and the edges of coastal and inland cliffs.
> 2. A general presumption against activities likely to be a fire risk to a significant wooded area.
> 3. A general presumption against development where noxious emissions are likely to create problems in nearby AEIs and SSIs.
> 4. The removal of intrusive elements.
> 5. The inclusion of buffer zones to further their protection.

For LEVEL 1 AEIs and SSIs, the following are applicable:

1. Human intervention kept to the barest minimum.
2. No physical development.
3. All efforts made to protect the identified features of scientific interest.
4. Management by the competent Government agency in an appropriate manner.

For LEVEL 2 AEIs and SSIs, the following are applicable:

1. Human intervention strictly controlled.
2. Physical development limited to the maintenance of already existing structures, and construction of minor amenities designed to enhance the educational and recreational use of the area (e.g. narrow footpaths, nature trails, small scale visitor centres). Any such developments to be carried out with the least possible damage to the environment.
3. Traditional activities (e.g. agriculture) can continue, unless in conflict with other policies, but no new land diverted to these uses except for the suitable re-establishment of abandoned fields for agriculture.

For LEVEL 3 AEIs and SSIs, the following are applicable:

1. No residential, industrial, commercial, or tourism development.
2. No infrastructure or public utility works.
3. Small scale physical development can be considered providing the adjacent AEIs and SSIs are protected, and this is demonstrated by a suitable environmental impact assessment, and is consistent with other policies.

For LEVEL 4 AEIs and SSIs, the following are applicable:

1. Small to medium scale physical development can be considered, provided no suitable alternatives exist and features of ecological and scientific interest are protected.
2. A suitable environmental impact assessment is undertaken.

Additional policies on conservation include policies RCO 16, 17 and 18 concerning the protection of sandy beaches and sand dunes. Policies RCO 19 and 20 are concerned with the identification and rehabilitation of degraded habitats and landscapes, and policies RCO 21 to 27 are concerned with the control of erosion, including that of sandy beaches and sand dunes.

The Malta Structure Plan has for a long time contemplated the setting up of Marine Conservation Areas (MCAs) and policy MCO 1 designates 14 separate areas round the Maltese Islands as candidates for the status of Marine Conservation Areas. This requires collaboration between agencies responsible for environmental protection to conduct underwater surveys of the marine habitats in the shallow waters round the Maltese coast and to establish a national system of MCAs to include representative areas of all existing marine habitats as revealed by the said underwater survey.

13 policies (MCO1 to MCO13) concern marine conservation areas and three others (CZM1 to CZM3) concern management of the coastal zone. MCO1 designates fourteen separate areas in the Maltese Islands as candidates for the status of Marine Protected Areas " *following further analysis, these and other possible areas will be categorized and given protection according to defined criteria*" (Malta Structure Plan 1992).

Terrestrial coastal areas may be designated as Protected Areas on the basis of policies RCO1 to RCO38. Coastal habitats such as saline marshlands and other wetlands, coastal cliffs, sand dunes and gently sloping shores can be designated as Areas of Ecological Importance (Schembri, 1993). Some of these characterize the site under study and on whose basis long stretches of the coast have been declared as conservation areas.

1.6.2.2 Protection status

Over the last decade, provisions and improvements have been conducted in national legislation in an effort to be able to protect and conserve the natural environment which is a national heritage of vital importance. The absence of human and financial resources has proved to be the greatest obstacle in the progress in this field in order to carry out site management. The Planning Authority has scheduled several areas all over the island, and especially in the zone surveyed in this current study,

providing most of the terrestrial habitats with a level of protection which has to date prevented the complete destruction of natural habitats in the area.

Currently, most areas designated some degree of protection, such as Ghajn Tuffieha, is-Simar and l-Ghadira Nature Reserves are being managed by NGO's. It is not ideal to close off an area completely to the public, as in the case of the Nature Reserves mentioned. However, lack of awareness and other factors have created difficulties in the management and conservation of an unenclosed area such as Ghajn Tuffieha. Involvement of the public and stakeholders in a management programme from the very start is the basis for the establishment of a good and implementable management plan

Table 1.2 Scheduled areas of ecological importance in the coastal zone at the study site

Location	Description	Feature	Protection Type	Protection Level	Year of Scheduling
Ir-Ramla tal-Mixquqa	Remains of sand dune ecosystem. Dunes on north side heavily disturbed by rubble. Requires immediate attention	Sand dune	AEI, (BZ=AEI)	1 AEI, BZ = 3 AEI	1996
Ir-Ramla ta' Ghajn Tuffieha	No information on dunes	Sand dune, sandy beach	AEI, (BZ=AEI)	Sandy beach AEI 3	1996
Ir-Ramla ta' Ghajn Tuffieha	Slopes 60m high; of geological and geomorphological interest; promontory of rdum and boulder scree, bridged to mainland by narrow clay ridge and is rich in fossils	Clay slopes	AEI, (BZ=AEI)	Clay slopes AEI 2 Rdum AEI 2 Clay slope AEI 2, 4 BZ = 4	1995

Source: Coastal Profile I: Natural Resources (Planning Authority)

Government Notices GN 117/95, GN 400/96 and GN 401/96 are legislations published under the Development Planning Act of 1992 to protect Ghajn Tuffieha Bay, coastal cliffs and sand dunes respectively. A Conservation Order for Ghajn Tuffieha has only recently been issued, primarily due to lack of resources necessary for implementation of the policies emanating from such an order.

CHAPTER 2
THE PROJECT

2.1 ACTIVITY AREA

The Northwest coast of the island of Malta, specifically the coastal strip extending from Rdum Majjiesa to Raheb Cave.

2.2 RESPONSIBLE INSTITUTIONS

The Regional Activity Center for Specially Protected Areas (RAC/SPA) of UNEP and the Pollution Control Coordinating Unit within the Environment Protection Department.

2.3 DESCRIPTION OF TASKS

The present activity provides for the carrying out of a series of studies aiming to study and assess the status of the marine biological resources along the coast stretching from Rdum Majjiesa to Raheb Cave on the northwest coast of the island of Malta, and, on the basis of the results obtained, the elaboration of proposals and recommendations concerning the planning and management of the site, notably as a Marine Protected Area.

2.4 MAIN OBJECTIVES OF THE ACTIVITY

a) to implements a pilot study related to the identification, establishment and management of a Marine Conservation Area, following the criteria and guidelines elaborated within MAP, as a contribution to national efforts toward conservation of fragile and vulnerable marine resources and sustainable development of the island

b) to initiate and provide the basis and experience for a continuous activity on Marine Conservation areas in the country, by formulating protection and management resources for the project area, and proposals for the follow up of the activity

2.5 ACTIONS TO BE IMPLEMENTED

- selection of the study area
- zoning of the study area according to certain criteria
- collection and analysis of existing relevant information and data concerning the study area

- identification of survey zones within the study area
- surveying and registration by diving
- compilation of an inventory of marine biotopes in the study area, mapping of biotopes using GIS
- evaluation and interpretation of results
- drawing up of a proposal for a management plan for the area under study
- elaboration of proposals for follow-up action
- progress reporting

2.6 MAJOR TASKS TO BE PERFORMED

1) Detailed definition of boundaries of the site

This is a necessary initial step for the operational planning of the field studies expected under the project.

2) Collection and analysis of existing relevant information concerning the study area

The kind of documents and the type of information collected included:

Maps

- survey maps
- geological maps
- bathymetric maps
- any other relevant maps or charts

Scientific studies on topics related to:

- hydrology
- meteorology
- water quality
- geomorphology
- ecology and natural habitats, individual species or groups of species inhabiting the region

Information about the surrounding area

- direct disposal of sewage and other pollutants
- leaching of fertilizers and pesticides from cultivated land in the vicinity of the study area
- other particularly intense human activity on land which affects the adjacent marine environment

Information about human activities at sea which are likely to have an impact on the study area:

- shipping
- aquaculture
- fishing

Other important factors

- socio-economic factors determining the pressures on the site and its value of annual capital
- adjacent terrestrial and coastal protected areas

- the presence of wrecks and other archaeological remains

3) Identification of survey zones within the study area

4) Surveying of the survey zones

5) Compilation and processing of data

This includes:

- Using the Classification of Marine Habitat Types for the Mediterranean Region adopted within MAP (2000) as a reference for the identification of habitat units and their plotting on a GIS biotope map
- Additional confirmatory survey dives
- Compilation of data and information

6) Drawing up of a management plan for the study area

A draft comprehensive management plan is being drawn up. The process will include consultation with relevant institutions in order to ensure consistency and to promote integration of the various strategies and plans concerning the area. The draft plan will also be made available for public consultation prior to its finalization.

7) Reporting

- progress reports of the implementation of the activity
- final report including the outcomes of the activity and proposal for follow-up actions

2.7 WORK PLAN AND TIMETABLE

Table 2.1

Activity	Timeframe
Signature of agreement	October 1999
Detailed project formulation	November 1999 - January 2000
Implementation: - Initial activity - Implementation - Integration of results	February 2000 - June 2002
Post-project activity	June 2002 - June 2004

2.8 IMPLEMENTATION

The activity will be implemented in four main phases

Phase I Preparatory activities. Collection and analysis of existing informaiton and planning of fieldwork

Phase II Survey of the study area

Phase III Compilation and processing of field and bibliographic data and information

Phase IV Preparation of recommendations for a Management Plan and final report

Table 2.2

Phase	Period of implementation	Tasks	Outputs
I	February - May 2000	- Definition of boundaries of area - Collection and analysis of existing information - Identification of survey zones - Reporting	- Progress report - Fieldwork planning
II	June - September 2000	- Surveying of survey zones - Reporting	- Field records - Progress report
III	October - December 2000	- Compilation and processing of data - Reporting	- Inventory of marine habitat types - Benthic maps - Visual records - Database of species of marine flora and fauna - Filled SDFs - Progress report
IV	December 2000 - June 2001	- Drawing up of a management plan for the area - Reporting	- Management plan - Final report

2.9 OUTPUTS AND DELIVERABLES

- Analysis and evaluation of the sites surveyed
- Database, maps, visual records
- Benthic survey report including a compilation of data on the major/indicator species of marine flora and fauna inhabiting the area
- Management Protection Plan for the activity site and for its eventual designation as a Marine Protected Area
- Follow-up proposal
- Final activity report including proposals and recommendation for follow-up activities

2.10 SUMMARY BUDGET - PROJECTED

Table 2.3

(000 $)

Contribution by	1999	2000	2001	2002	Total
MAP (SPA/RAC), cash	15	17	8	-	40
Host country, cash	-	10	-	-	10
Host country, kind	15	90	45	-	150
Host country, total	15	100	45	-	160
Grand Total	**30**	**117**	**53**	**-**	**200**

2.11 PROJECT JUSTIFICATION

The Mediterranean is the cradle of western civilization and its littoral has always been a hubbub of activities of every type. A high resident population has always characterized it and today this is strongly exacerbated by the development of more socio-economic activities on the coast and by an annual influx of tourists.

Hence, the Mediterranean is also one of the most heavily polluted seas, the recipient of wastes for a multitude of human activities taking place along its coastal and one of the major shipping routes in the world.

However, in spite of being oligotrophic, the Mediterranean is rich in species variety, its floral and faunal compliment characterized by many endemic species and considerable richer than those of Atlantic shores.

It is therefore of utmost important that the threatened coastal and marine biota and habitats be protected and a balance be found between conflicting activities and the impact on the environment,.

Due to its small size, the 180km coastline of the Maltese Islands is within easy reach of the settlements and thus plays a vital role in the social and economic life of its inhabitants. Activities are flourishing at an appreciable rate along the coastal, putting the vital ecosystems at risk. It is therefore high time for action to be taken in order to assess the situation and initiate protection of the marine environment.

Recent legislation has introduced the concept of *environmental damage* and given power to the authorities concerned to take *preventive and remedial* measures for environmental protection. This presupposes a comprehensive knowledge of the environmental situation of the territory, including the seabed close to the shore.

Baseline scientific knowledge of habitats, populations, physicochemical characteristics and others are regrettably lacking especially in the case of the sublittoral zone. The present project is therefore intended to make good this need by compiling the existing information and data concerning the terrestrial part of the coastal zone and more importantly, by compiling information of the situation below the sea surface.

This would be beneficial to national purpose of integrated coastal zone management, satisfying national commitments through he establishment of Marine Protected Areas

and the drawing up and implementation of proper legislation regarding certain issues such as dumping of wastes at sea and aquaculture, and international policies such as the obligations of the Land-based Sources Protocol deriving from the Barcelona Convention.

To date, there are no Marine Protected Areas in Malta, although a number of potential sites have been identified. Over the last years, a set of biological criteria have bee designed to characterize major biotopes occurring around Malta and is waiting to be applied in a truly holistic marine conservation project, having so far been constrained though lack of the human and financial resources necessary for the establishment and management of protected areas.

The region was selected as a potential Marine Protected Area because it supports a representative selection of all major marine biotopes occurring around the Maltese Islands. It includes a number of sites originally proposed for protection in the 1992 Malta Structure Plan. The significance of the marine environment within this region is complementary with its terrestrial counterpart which has a high scientific, cultural and economic value.

Various localities within this region are currently heavily exploited and under intense pressure form human activities and thus require urgent conservation and management plans. Other zones within the proposed sit are relatively inaccessible to the public and hence it is easier to enact and enforce restrictions. Overall, this region is ideal for adopting the "zoning" management system which is currently being applied in many countries and the most advanced design form managing Marine Protected Areas.

2.12 METHODOLOGY OF THE STUDY – THE BENTHIC SURVEY

As can be seen from the previous sections, the main intent of this study is to undertake a detailed and comprehensive benthic survey in order to bring together the data and information collected and amalgamate it with existing data and information collected for the terrestrial part of the coastal zone in the area so as to be in a position to set out recommendations and action plans for a management plan of the area which would lead to the area being established as a Marine Protected Area under IUCN.

The principal objective was the assessment of the biological characteristics of the proposed site to produce an inventory and scientific description of the major biological complexes occurring within the site's boundaries. A second aim was to produce the base maps necessary for the drawing up of plans and programmes for the zoning, management sand protection of the site in a fully comprehensive management plan.

The benthic survey was conducted between March and October 2000 and a report was drawn up, entitled "*Report on surveys of the bathymetry, submarine geophysical features, seascapes and benthic biotic assemblages of the area from Rdum Majjiesa to Raheb Cave on the northwestern coast of the island of Malta, designated as a candidate Marine Conservation Area*" by K. Pirotta and P.J. Schembri (November

2000). This report gives a very comprehensive and detailed description of the benthic survey conducted as part of this study (Annex II).

The benthic survey was divided into a desktop study and three field surveys. In brief, the desktop study involved the compilation and perusal of existing bathymetric charts, terrestrial survey sheets, and reports on biological studies conducted in the area. A working boundary was set, the outer (seaward) boundary being the 45 – 50m depth contour. The whole area subdivided into six regions. The total area of seabed and length of shoreline were estimated using a digital version of the survey sheets, extended to the outward boundary using the appropriate software techniques.

This was followed by the field surveys consisting of:

1. A preliminary survey using SCUBA

Aims and objectives:

- To establish the boundary of the region under study
- To identify the major geophysical and topographic features of the coast and seabed within this boundary
- To identify the major biotic features present
- To subdivide the area into a number if zones with major geomorphologic and biotic differences to produce a workable classification of the area

2. A bathymetric survey using a hand-held GPS and echo-sounder

Aims and objectives:

- To produce detailed bathymetric profiles so as to construct a base map of the seabed for subsequent data plotting
- To establish accurately the outer boundary of the study area
- To locate major geomorphologic features of the seabed deducible from the depth profile
- To determine the area and extent to rock shoals
- To map the bottom types and corresponding biotic assemblages down to the 15m depth contour

3. A benthic survey using numerous snorkeling and SCUBA diving techniques

Aims and objectives:

- To identify and map the major seascapes present in the area
- To identify and map the major biocoenosis, associations and facies present within the study area
- To identify and map the major bottom types and other geomorphologic features present within the study area

A detailed description of the methodology applied and the procedures carried out can be found in the document mentioned above.

CHAPTER 3
MARINE CONSERVATION AREAS

3.1 BACKGROUND

The concept of Marine Protected Areas has been around for centuries and has come to mean different things to different people, based primarily on the level of protection provided by Marine Protected Areas.

Marine Protected Areas are used as a management tool to protect, maintain, or restore natural or cultural resources is coastal and marine waters. They have been used effectively both nationally and internationally to conserve biodiversity, manage natural resources, protect endangered species, reduce user conflicts, provide educational and research opportunities, and enhance commercial and recreational activities.

Globally, Marine Protected Areas may include national marine sanctuaries, fishery management zones, national seashores, natural parks, national monuments, endangered habitats, etc.

While the oceans comprise 70% of Earth's surface, less than 1% of the marine environment forms part of protected areas. Moreover, more than half of the global population resides within 60km of the coast, thus placing increasing stresses on coastal and marine resources and the areas upon which they depend. The need for additional marine conservation areas and for improving the management of existing ones has never been greater.

Recognizing this, the World Commission on Protected Areas (WCPA) of the IUCN has set a goal "*to provide for the protection, restoration, wise use, understanding and enjoyment of the marine heritage of the world in perpetuity through the creation of a global, representative system of Marine Protected Areas and by building the capacity to manage these areas in accordance with the principles pf the World Conservation Strategy*".

WCPA is therefore focused on three primary themes:

- demonstration of the effectiveness of Marine Protected Areas as a tool of sustainable fisheries management and for protecting and restoring marine biodiversity
- implementation of Marine Protected Areas as exemplary systems of participatory with adaptive management in the context of integrated coastal management
- encouragement of sustainable tourism by creating new partnerships with the tourism community and engaging it in marine protected areas management

One way of protecting the marine environment is through the establishment of Marine Protected Areas. Although the concept of protecting the marine environment has lingered behind its terrestrial counterpart for nearly a century, over the last two or three decades remarkable progress has been achieved and today it has become a major tool is marine conservation. There are well over 1000 marine protected areas in more than 100 countries all over the world.

The conservation and protection of natural capital has become a global priority. By their very nature, Marine Protected Areas not only conserve and protect natural capital but also offer a wide range of benefits within the scientific, cultural, aesthetic and socio-economic realms. Synoptically, Marine Protected Areas offer:

- a powerful tool in preserving natural heritage
- an effective mechanism to preserve ecosystems, habitats and species with the marine environment
- sites for research and investigation of ecosystems, habitats and specific species
- a baseline in the study of man's impact on the marine environment
- an assurance that future generations can experience the same natural magnificence we experience today
- an effective medium to help increase public awareness and support for marine conservation, thus improves the public attitude towards the environment
- an educational resource, helping the public to better understand the long-term benefits of the sustainable use of resources
- valuable economic resources important to local and national economies, since careful management can allow both protection of biodiversity and economic development
- economic benefits such as job creation through harvests of renewable resources such as fish and molluscs
- additional economic benefits through non-consumptive activities such as tourism and recreation
- a considerable number of benefits which cannot be expressed in monetary terms, e.g. the economic value of biological resources, the so called "environmental services" such as wave-buffering by healthy sea-grass meadows

IUCN defines a Marine Protected Area as "*an area of intertidal or subtidal terrain, together with its overlying waters and associated flora, fauna, historical and cultural features, which has been reserved by legislation or other effective means to protected part of all of the enclosed environment*" (IUCN 1988, Kelleher 1999)

The main purposes of management fall within the following categories:

- Scientific research
- Wilderness protection
- Preservation of species and genetic diversity
- Maintenance of environmental services
- Protection of specific natural and cultural features
- Tourism and recreation
- Education

- Sustainable use of natural resources
- Maintenance of cultural and traditional attributes

A Marine Protected Area can accommodate a broad spectrum of activities. Zoning is a concept that can be utilized to afford high levels of protection to particularly sensitive "core" areas and moderate levels of protection to less sensitive and surrounding buffer areas. As a minimum, however, activities such as non-renewable resource management, dredging, dumping, bottom trawling or dragging, should be prohibited in Marine Protected Area.

Marine Protected Areas serve as:

- protection of critical habitats (e.g. spawning and nursery grounds)
- establishment of a "seed bank" source for replenishment of commercial fishery stocks e.g. ground fish and shellfish
- protection of an ecological feature or process e.g. upwelling zones, conservation of a rare or endangered species or their habitats
- establishment of a "control" area for research, monitoring and assessment
- preservation of important cultural areas

3.2 BENEFITS OF MARINE PROTECTED AREAS

3.2.1 Natural resource protection

The loss of marine resources as a result of human-induced changes in the marine environment is a growing problem globally. More than one quarter of the world's coral reefs are effectively lost (Wilkinson, 2000). Between 69% and 74% of fish stocks globally or over fished or fully exploited (FAO, 1998)

Marine Protected Areas can address these problems by managing human activities in certain areas. Ideally, Marine Protected Areas should create a level of management that can be applied outside of Marine Protected Areas and provide a more focused ecosystem-based approach to resource management.

Thus, effective Marine Protected Area management can help protect and restore various components of the marine environment, including natural ecosystems, biodiversity, habitats and endangered and threatened species.

3.2.2 Historic and cultural resource protection

Marine Protected Areas are also a means of preserving and protecting important historical and cultural resources of our marine heritage, including archaeological sites containing significant cultural artifacts, sunken vessels, and others. Protecting cultural resources in Marine Protected Areas reduces the chance that artifact will be removed or damaged by commercial and recreational activities. Unlike many biological communities that have some level of resilience to recover from degradation, underwater historic and cultural resources usually cannot recover. Utilizing Marine Protected Areas to conserve historical resources can help stabilize

deteriorating structures and encourage actions to find, preserve and place on public display artifacts that may otherwise be inaccessible. By protecting marine sites that were important to different time periods and culture, a part of history is preserved for future generations.

3.2.3 Social and economic benefits

These derive from the resource protection and high quality environment that effective Marine Protected Areas can afford. Some of the socio-economic benefits include:

- enhancing non-consumptive uses
- maintaining fisheries
- providing research and education opportunities

As with overall ecosystem protection, safeguarding specific species and their habitats will help ensure that future generations are able to enjoy the benefits provided by these resources. Many economic coastal activities rely on people's enjoyment of marine resources. Non-extractive uses of the marine environment e.g. SCUBA diving, wildlife watching, boating, relay on healthy marine environments. Good water quality, abundant living resources and scenic ocean habitats attract visitors to coastal areas around thus help ensure that these resources survive and continue to draw the recreational users that are so critical to many coastal economics.

Through the protection of natural, historic and cultural resources, Marine Protected Areas also provide intangible benefits such as the pleasure of viewing particular species, habitats or artifacts. There is an intrinsic enjoyment in knowing that a particular species is unlikely to become extinct or that a cultural treasure has been preserved.

Marine Protected Areas help sustain commercial and recreational fisheries by controlling fishing rates, protecting critical stages in the life history of fishery species, conserving genetic diversity of exploited species, reducing secondary impacts of fishing on essential habitats and other species, and ensuring against the collapse of the industry (Murray *et al.*). Marine Protected Areas may allow site-specific regulations of selected species, gear type or fishing methods. Certain Marine Protected Areas or zones within Marine Protected Areas may be fishery reserves protecting all species from fishing. Studies by Dugan & Davis 1993, Crowder *et al.*, 2000 and others indicate that abundance and size of target species increase in Marine Protected Areas limiting extractive use. In Looe Key, Florida, the abundance of snappers nearly doubled and that of grunts more than quadrupled in only 2 years of fishing prohibitions (Clark *et al.,* 1989). Increase size and abundance within Marine Protected Areas may also lead to a "spillover effect", potentially increasing fishery yield in waters outside the Marine Protected Areas boundaries (Russ & Alcala, 1999, Crowder *et al.*, 2000)

Marine Protected Areas provide opportunities for research and monitoring of short-lived events and long-term trends. Marine Protected Areas can be stable long-term venues for ongoing studies of the same group of organisms or the same area of habitat. They can also provide baselines for the measurement of management

efforts. Students at all levels are drawn towards natural areas to learn about the fascinating marine wildlife. Marine Protected Areas provide hands on experience and outdoor laboratories for bringing mundane classroom studies to life. Moreover with so many people living in coastal regions, Marine Protected Areas' educational programme have a potential to help the public understand the importance of marine ecosystems and the impact of human activities on them. Marine Protected Areas also serve to educated and train users and interest groups e.g. divers, fishermen, boaters and wildlife watchers on ways to enjoy the marine environment without damaging the features that make them valuable and attractive.

As a result of the conflicting uses and activities taking place on the coastal zone, the following emerge as distinct categories of protected areas. Areas managed mainly for:

I. Strict protection (Strict Nature Reserve/Wilderness Area)
II. Ecosystem conservation and recreation (National Park)
III. Conservation of natural features (Natural Monument)
IV. Conservation through active management (Habitat/Species Management Area)
V. Landscape/seascape conservation and recreation (Protected Landscape/Seascape)
VI. Sustainable use of natural ecosystems (Managed Resource Protected Area)

3.3 CATEGORIES OF MARINE PROTECTED AREAS

Based on the formulation of a matrix of management objectives and IUCN Protected Areas management categories, IUCN developed an international system for categorizing protected areas.

Category Ia **Strict Nature Reserve: protected area managed mainly for science**

Definition

Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring

Management Objectives

- To preserve habitats, ecosystems and species in as undisturbed a state as possible
- To maintain genetic resources in a dynamic and evolutionary state
- To maintain establish ecological processes
- To safeguard structural landscape features or rock exposures
- To secure examples of the natural environment for scientific studies, environmental monitoring and education, including baseline areas from which all avoidable access is excluded

- To minimize disturbance by careful planning and execution of research and other approval activities
- To limit public access

Guidance for Selection

- The area should be large enough to ensure the integrity of its ecosystem and to accomplish the management objectives for which it is protected
- The area should be significantly free of direct human intervention and capable of remaining so
- The conservation of the area's biodiversity should be achieved through protection and not require substantial active management or habitat manipulation

Category Ib Wilderness Area: protected area managed mainly for wilderness protection

Definition

Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition

Management Objectives

- To ensure that future generations have the opportunity to experience understanding and enjoyment of areas that have been largely undisturbed by human action over a long period of time
- To maintain the essential natural attributes and qualifies of the environment over the long term
- To provide for public access at leaves and of a type which will serve best the physical and spiritual well-being of visitors and maintain the wilderness qualities of the area for present and future generations
- To enable indigenous human communities living at low density and in balance with the available to maintain their life style

Guidance for Selection

- The area should possess high natural quality, be governed primarily by the forces of nature, with human disturbance substantially absent and be likely to continue to display those attributes if managed as proposed
- The area should contain significant ecological, geological, physiogeographical, or other features of scientific, educational, scenic or historic value
- The area should offer outstanding opportunities for solitude, enjoyed once the area has been reached, by simple, quiet, non-polluting and non-intrusive means of travel
- The area should be of sufficient size to make practical such preservation and use

Category II **National Park: protected area managed mainly for ecosystem protection and recreation**

Definition

Natural area of land and/or sea, designated to:

- Protect ecological integrity of one or more ecosystem for present and future generations
- Exclude exploitation or occupation inimical to the purposes of designation of the area
- Provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible

Management Objectives

- To protect natural and scenic areas of national and international significance for spiritual, scientific, educational, recreational or tourist purposes
- To perpetuate, in as natural a state as possible, representative examples
- To manage visitor use for inspirational, educational cultural and recreational purposes at level which will maintain the area in a natural or near natural state
- To eliminate and thereafter prevent exploitation or occupation inimical to the purpose s of designation
- To maintain respect for the ecological, geomorphologic, sacred or aesthetic attribute which warranted designation
- To take into account the needs of indigenous people, including subsistence resource use, in so far as these will not adversely affect the other management objectives

Guidance for Selection

- The area should contain a representative sample of major natural regions, features or scenery, where plant and animal species, habitats and geomorphological sites are of special spiritual, scientific, educational, recreational and tourist significance
- The area should be large enough to contain one or more entire ecosystems not materially altered by current human occupation or exploitation

Category III **Natural monument: protected area managed mainly for conservation of specific natural features**

Definition

Area containing one, or more, specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance

Management Objectives

- To protect or preserve in perpetuity specific outstanding natural features because of their natural significance, unique or representational quality, and/or spiritual connotations
- To an extent consistent with the foregoing objective, to provide opportunities for research, education, interpretation and public appreciation
- To eliminate and thereafter prevent exploitation or occupation inimical to the purpose of designation
- To deliver to any resident population such benefits as are consistent with the other objectives of management

Guidance for Selection

- The area should contain one or more features of outstanding significance (appropriate natut6uraql features include spectacular waterfalls, caves, craters, fossil beds, sand dunes and marine features, along with unique or representative fauna and flora; associated cultural features might include cave dwellings, cliff-top forts, archaeological sites, or natural sites which have heritage significance to indigenous people
- The area should be large enough to protect the integrity of the feature ad its immediate related surroundings

Category IV Habitat/species Management Area: protected area managed mainly for conservation through management intervention

Definition

Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species

Management Objectives

- To secure and maintain the habitat conditions necessary to protect significant species, groups of species, biotic communities or physical features of the environment where these need specific human manipulation for optimum management
- To facilitate scientific research and environmental monitoring as primary activities associated with sustainable resource management
- To develop limited areas for public education and appreciation of the characteristics of the habitats concerned and of the work of wildlife management
- To eliminate ad thereafter prevent exploitation or occupation inimical to the purposes of designation
- To deliver such benefits to people living within the designated area as are consistent with the other management objectives

Guidance for Selection

- The area should play an important role in the protection of nature and the survival of species (including breeding areas, wetlands, coral reefs, estuaries, grasslands, forests or spawning areas, including marine feeding beds)
- Area should be one where protection of habitat is essential to the well-being of nationally or locally-important flora, or to resident or migratory fauna
- Conservation of these habitats and species should depend upon active intervention by the management authority
- Size of area should depend on habitat requirements of species to be protected and may range from relatively small to very extensive

Category V **Protected Landscape/Seascape: protected area managed mainly for land/seascape conservation and recreation**

Definition

Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biodiversity.
Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area

Management Objectives

- To maintain the harmonious interaction of nature and culture through the protection of landscape and/or seascape and the continuation of traditional land uses, building practices and social and cultural manifestations
- To support lifestyles and economic activities which are in harmony with nature and preservation of the social and cultural fabric of communities concerned
- To maintain diversity of landscape and habitat, and of associated species and ecosystems
- To eliminate where necessary, and thereafter prevent, land uses and activities which are inappropriate in type and scale to the essential qualities of the areas
- To encourage scientific and educational activities which will contribute to the long-term well being of resident populations and to the development of public support for the environmental protection of such areas
- To bring benefits to\, and to contribute to the welfare of, the local community through provision of natural products (forest, fisheries) and services (clean water or income derived for sustainable forms of tourism

Guidance for Selection

- The area should possess a landscape and/or coastal and island seascape of high scenic quality, with diverse associated habitat, flora and fauna along with manifestations of unique or traditional land-use patterns and social organizations as evidenced in human settlements and local customs, livelihoods, and beliefs
- The area should provide opportunities for public enjoyment through recreation and tourism within its normal lifestyle and economic activities

Category VI **Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems**

Definition

Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing a sustainable flow of natural producer and services to meet community needs

Management Objectives

- To protect and maintain biodiversity and other natural values of the area I the long term
- To promote sound management practices for sustainable production purposes
- To protect the natural resource base from being alienated for other land-use purposes that would
- To contribute to regional and national development

Guidance for Selection

- The area should be at least 2/3 in a natural condition, although it may also contain limited areas of modified ecosystems; large commercial plantations would not be appropriate for inclusion
- The area should be large enough to absorb sustainable resource uses without detriment to its overall long-term natural values

3.4 MARINE PROTECTED AREAS IN MALTA

The coastal and marine ecosystems in Malta comprise littoral habitats, where conditions are predominantly terrestrial, and sublittoral, where conditions are aquatic. While littoral ecosystems have been studied to come degree, very little work has been done on the sublittoral so that knowledge of sublittoral species and biotic communities is very poor.

To date, no Marine Protected Areas have been designated in Malta. Activities such as fishing and diving are restricted in certain areas but for reasons of safety and the preservation of wrecks and other archaeological remain rather that protection of marine ecosystems. A number of islets have been declared Nature Reserves but the sea around them is not protected, including Filfla, Cominotto, Fungus Rock and Selmunett.

In 1989, a coastal zone survey conducted jointly by the University of Durham and the University of Malta, was of extreme importance in producing a set of coastal land-use maps (1:25,000) and a series of synoptic maps at various scales depicting coastal features of ecological importance. Although this survey was restricted to the terrestrial part of the coastal zone, its relevance was made evident in making possible the relation of coastline characteristics to adjacent underwater seascapes.

The comprehensive identification of the coastline according to type was one of the major outputs of this study. Mainland Malta possessed a considerably higher percentage of low rocky coasts than Gozo and Comino. This point is of significance in the delimitation of underwater protected areas while the type of coastline is a crucial factor in the development of marine parks and reserves as it controls accessibility. Another important criterion for the siting of Marine Protected Areas is their contiguity with terrestrial protected areas (Schembri, 1993). Finally, the 1989 Coastal Zone Survey identified natural landscapes of national and international importance, including zones within the area under study:

- Stretch from Golden Bay to Gnejna Bay

The Malta Structure Plan of 1992 was preceded by two studies, one by Schembri (1991) on natural resources and the other by Role (1991) on marine parks and reserves potential. The reports included a listing of coastal and marine ecosystems, a review of existing legislation and of management practices related to protection, an analysis of trends, existing and future needs and problems in the field of nature conservation and recommendations. Underwater habitats were classified on the basis of:

Slope	- cliff faces and drop offs - gently sloping rocks/platforms
Substrate	- bare sand - muddy bottoms
Overlays	- boulders - sea grass meadows
Features	- marine caves - interesting rock formations

The following list of candidate sites for Marine Protected Areas was drawn up:

1. Dwejra, Gozo
2. Qbajjar, Gozo
3. Ramla l-Hamra, Gozo
4. Mgarr ix-Xini, Gozo
5. Comino Island
6. Filfla Island
7. Cirkewwa
8. Mistra – St. Paul's Island (Selmunett) – Selmun
9. Outer Marsamxett Harbour
10. Delimara to St. Thomas Bay
11. Wied iz-Zurrieq to Ghar Lapsi
12. Il-Blata to Ras il-Wahx

In 1993, the Environment Secretariat of the Ministry for Environment requested the assistance of RAC SPA to assess the possibility of having Marine Protected Areas in the Maltese Islands. To this end, Prof Patrick J. Schembri was commissioned and in his study recommended 26 marine areas as candidate Marine Protected Areas and 16

coastal sites as Nature Reserves. He based his recommendations on guidelines issued by RAC SPA for the 1982 Geneva Protocol on Mediterranean Specially Protected Areas. The management recommended was based on the standard categories applied by the IUCN - the World Conservation Union. However, knowledge of the sublittoral environment in Malta was so limited that it did not allow recommendations to be made of the specific areas to the IUCN categories.

It was therefore suggested that areas be declared as candidate Marine Protected Areas without specifying the type, and to later conduct detailed physical and biological surveys on the basis of which, each Marine Protected Area can be subdivided into different management zones and a management plan formulated (Schembri, 1993)

Recommendations for the preservation of these habitats included the formulation of legislation to control immediate threats to he environment, and regular monitoring in the case of Marine Protected Areas adjacent to some potential source of pollution. The setting up of a Management Board for each Nature reserve was also suggested, with the mandate of managing the Reserve and encouraging scientific study of the ecosystems within each Marine Protected Area. It was also recommended that the Environment Protection Department and Planning Authority integrate their respective policies and adopt a common approach for protection of habitats and wildlife in protected areas (Tabone & Vella, 1997).

In this study, the Marine Protected Areas proposed included sites already listed as "candidate Marine Protected Areas" in the Malta Structure Plan as well as additional sites. The selection of sites was based on the following criteria:

- Good accessibility
- Presence of a coastline unobscured by development
- Coastline and shallow sea area not dominated by tourism
- Presence of coastal zone agriculture or of natural vegetation
- Coastline not polluted with tar residues and dumps
- Clear, unpolluted water
- Presence of coastal nature reserves (already declared) and proposed AEI's or SSI's, especially sand dunes, saline marshlands and transitional coastal wetlands
- Presence of individual marine species which are either rare, threatened or of some particular scientific interest
- Presence of marine biotic communities which are either rare, threatened or of some particular scientific interest
- Presence of seascapes where the dominant components are living elements, especially sea-grass meadows
- Presence of interesting geomorphological features, particularly those associated with particular biotic communities including sheer cliff faces, rocky shoals, boulder fields and marine caves
- Presence of underwater features of scenic interest such as arches, eroded limestone beds, subsidence structure
- Presence of typical examples of the different types of marine habitats, particularly if these are pristine and if habitat diversity is high in the area

Areas proposed for coastal protection were in the terrestrial part of the coast, characterized by habitat types which are rare or unique in the Maltese Islands and/ or particular scientific interest, designated as Areas of Ecological Importance (AEIs) designed to protect particular types of habitat, and as Sites of Scientific Importance (SSIs), designed to protect species or individual features, as established by the Structure Plan.

The list included part of the area which was the subject of this study, namely:

- Ras il-Wahx (S.W. Malta)
- Ramla tal-Mixquqa (W. Malta)

CHAPTER 4
THE STUDY AREA

4.1 INTRODUCTION

The study area is considered a potential candidate for the establishment of a marine protected area on the northwestern coast of the island of Malta, from Rdum Majjiesa to Raheb Cave. Consequently, a set of recommendations will be included in this study for the designation and management of the site.

The region is being proposed as a potential marine conservation area since it supports a representative selection of all major biotopes occurring around the Maltese Islands. It also includes a number of sites that had originally been proposed as candidate Marine Conservation Areas in the Malta Structure Plan of 1992. Moreover, the significance and importance of the marine environment within thins region is complementary to its terrestrial counterpart since the adjacent coastal zones have a high scientific, cultural and economic value.

Numerous localities within this region are at risk from heavy exploitation by human activities and this calls for urgent conservation and management plans to be drawn up. There are also areas which are relatively inaccessible to the public, and hence it is easier to enforce restrictions here.

All in all, this region is ideal for adopting the "zoning" management system currently applied in many countries and is the most advances design for managing Marine Protected Areas. The study area extends along approximately 11km of coast trending form north to south on the northwestern shore of the island of Malta and its outer boundary follows the 50m-depth contour. The inland boundary extends to the coastal zone limit established for the area in the Coastal Zone Topic Paper of the Planning Authority (2001). The study covers an area of 4.75km^2 of seabed and for convenience was subdivided into six regions.

4.2 THE REGIONS

For the purpose of the survey, the study area was subdivided into six regions or zones as listed in table 4.1 below.

Table 4.1

Region	Name of terrestrial locality	Shoreline boundary – UTM Co-ordinates			
		From		To	
		East	North	East	*North*
1	ix-Xaghra tal-Majjiesa	33S 0439775	3978200	33S 0439700	3977480
2	Rdum Majjiesa, ir-Ramla tal-Mixquqa & ir-Ramla ta' Ghajn Tuffieha	33S 0439700	3977480	33S 0440650	3976430
3	Qarraba Promontory, il-Bajja tal-Qarraba, il-Bajja tal-Gnejna, il-Barumbara	33S 0440650	3976430	33S 0439960	3975750
4	Il-Pellegrin	33S 0439960	3975750	33S 0439950	3974800
5	Il-Bajja ta' Fomm ir-Rih	33S 0439950	3974800	33S 0439500	3974030
6	Ras ir-Raheb to Raheb Cave	33S 0439500	3974030	33S 0439750	3973500

4.3 RESOURCES

4.3.1 Geology and geomorphology

The coastline of the Maltese Islands is governed by the geological structure of limestone features which have attained an advanced stage of development. Bays or inlets in northern Malta correspond to potentially submerged downthrown blocks while high cliffs characterize the southwestern coast, associated with the geology created by the presence of major faults.

Numerous semicircular coves represent a conspicuous feature of the Maltese coastline. Upper Coralline Limestone formation and Blue Clay slopes dominate the northwestern coastline. The Upper Coralline Limestone overlies the Blue Clay layer of the geological formation of the Maltese Islands. In this area, the Blue Clay layer is most evident because the tilting of the strata laying between the northern side of the Great Fault and the fault which bounds the southern side of St Paul's Bay in an easterly direction, causes the thickest part of the clay layer to occur on the western side of Ghajn Tuffieha and il-Qarraba (Cooke, 1892).

A major characteristic feature of the study area is the *rdum* which corresponds to a special kind of marine cliff related to a specific geological structure prone to mass movement. These form when marls of blue clay formation crop out at sea level and are overlaid with the massive strata of the Upper Coralline Limestone. Unconsolidated marls are easily eroded by wave action. In addition, heavy rainfalls cause water to percolate through fissures in the limestone layer and from there seep into the underlying marls. Moistening followed by saturation of previously dry rock

layers causes the marls to become plastic and huge rockslides occur. *Rdum* type cliffs are thus characterized by blocks and irregular masses of rocks, marls and fragmented limestone, which slide down to the sea at the foot of the cliffs.

In such circumstances, cliff retreat is slow, a certain time period being necessary for the removal of the large accumulation of boulders protecting the foot of the scarp, by wave action (Paskoff 1985; Vella, 1994).

South of Gnejna Bay, the rock formation changes drastically. Vertical cliffs of Lower Coralline Limestone plunge straight into the sea between Ras il-Pellegrin and Raheb Cave. There are almost no shore platforms and the formation is probably of tectonic origin (Paskoff in Bird & Schwartz, 1985; Pedley *et al.*, 1976).

4.3.1.1 The beaches and sand dunes

Sand dunes are associated with sandy beaches which constitute only about 2.4% of the entire Maltese coastline, thus making then a rare and vulnerable habitat type. Sand dunes are a dynamic ecosystem, created by the transportation of sand through wave action and wind which deposit beach sand and eroded material of terrestrial origin to the back of the beach. Specially adapted plants augment their stabilization. Sand dunes are geomorphologically important since they provide a sediment bank which may replenish the beach following erosion caused by a catastrophic event such as a storm. (Coastal Profile I: Natural Resources)

The most characteristic aspect of sand dune systems is the presence of sand-binding vegetation acting as sand-stabilizers. As a result, other types of vegetation less tolerant to a shifting substratum are able to develop, and on mature dunes the area behind the sand-binding vegetation (foredune) becomes colonized by a variety of trees, shrubs and other vegetation. In Maltese dunes, the principal sand-binding grasses are the Sand Couch (*Elymus farctus*) and the Dropwort Grass (*Sporobolus arenarius*). The most important sand binder in the Mediterranean, the Marram Grass (*Ammophila australis*), once present in several dune systems in Malta, has now been completely eradicated due to disturbance by anthropogenic activities (Schembri & Lanfranco, 1994).

Many local sandy beaches were backed by dune systems, but with the exception of Ramla l-Hamra in Gozo, only remnants remain as most have been degraded due mainly to human activities pertaining to beach development for tourism ad recreational use. One of the remaining dune systems is found at Ramla tal-Mixquqa (Golden Bay) (Schembri & Lanfranco, 1994), which is extant, while that in Ramla ta' Ghajn Tuffieha is highly degraded.

This is a popular sandy beach which is subject to an active beach-cleaning programme. In particular, the sand is kept clear of vegetation by regular bulldozing. In spite of this, the beach still carries a fairly well developed sand dune ecosystem which includes several of the typical species of such communities, including *Elymus farctur, sporobolus arenarius, Scolymus hispanicus, Pancratium maritimus, Cakile maritime* and others. Reeds fill the gully at the mouth of the small valley while Tamarisks occur to the south of the beach and eventually give way to a typical coastal community dominated by *Inula crithmoides* (Schembri & Lanfranco, 1994).

Much of this dune community is found at the mouth of what was once a *wied* (valley) but is now segregated by various "temporary" developments. The dunes on the northern bank of the valley are heavily disturbed due to dumped soil, rubble and other waste. *Orobanche mutelli* and *Cakile marittima* are nevertheless found in various patches. To the south, a short stretch of banquettes lies at the foot of more dune remnants, dominated by grasses and large bushes of *Euphorbia melitensis* and *Inula crithmoides*.

It is though that up to some 50 years ago, the beach of Gnejna Bay supported a well developed dune ecosystem which today has been almost totally obliterated through destruction by beach cleaning and such other activities.

The sandy area in Ghajn Tuffieha Bay does not support any appreciable vegetation. However, the clay slopes abutting the bay support vegetation which stabilizes the clay substrata. Well-developed banquettes occur along the southern arm of the beach, skirting the Ras il-Qarraba isthmus (Schembri & Lanfranco, 1994).

4.3.1.2 Coastal cliffs and rupestral communities

The southwest and western coast of Malta is made up of 70 to 130m high cliffs arising from the sea, whose proximity to the marine environment instigated the development of a typical coastal habitat with its typical flora and fauna. Due to their relative inaccessibility and available shelter, the cliff and *rdum* coastlines with their accompanying boulder screes provide refuge for several species of Maltese flora and fauna. Several species are endemic to the Maltese Islands. Such an area within the study important for its endemic and rare species is Ras ir-Raheb. The relative inaccessibility also attributes to ornithological importance to the coastal cliff habitat especially since development has altered habitats formerly used for breeding, feeding and wintering purposes, so that these activities are now mainly restricted to coastal cliffs.

4.3.2 Geophysical features

The study area is outstanding for the heterogeneity of its seabed geomorphology. The unique lithology and chemical composition of the bedrock and the interaction between geology and marine and bioerosional processes, interplay to give rise to the varied seascapes and diverse bottom types characterizing the area.

Wave action on shore platforms has over time given rise to two rocky shoals, Ras il-Pellegrin and Ras il-Wahx, composed of |Globigerina Limestone exposed at sea level. The level surface of these shoals is due to a planning of the overlying rock layers down to the presently exposed Globigerna Limestone and Lower |Coralline Limestone formations, and to a lack of major subsidence and joints along the length of the shoals.

As described previously, the boulder aggregations along the coast and forming extensive boulder fields, result from the collapse, under gravity, of blocks from the edges of the overlying Upper Coralline Limestone plateaux, resulting from erosion of the Blue Clay layer though a combination of terrestrial and marine forces.

The bays and coves along this coast evolve at the seaward extremities of major East to West fault systems. Most of these coves are in fact low lying, partially inundated, grabens e.g. Fomm ir-Rih Bay formed by the Great Fault bisecting the island from Fomm ir-Rih to Madliena. This part of the study area is characterized by minor accurate faults radiating out from the Great Fault towards the coast.

The bathymetry of the study area reflects the seascape's varied relief. The three main large-scale features are:

- The extensive boulder screes lining the shoreline
- The submerged boulder fields extending form shore out to sea
- The two shoals projecting out to sea for about 1km from the shore

Other features include a series of extended gentle slopes, and steep drops, which are less extensive and followed by slightly inclined plateaux extending to sea for considerable distances beyond the seaward boundary of the study area. To the south of Ras il-Pellegrin, the *rdum* formations give way to sheer vertical cliffs and continuous drop-offs below mean sea level, along a 2km length of shore. As along the rest of the coast, stepped drop offs occur at the seaward edge of the shoals.

4.4.3 Marine biotic features

The heterogeneous nature of the seabed supports a rich and diverse flora and fauna. Five main biotic assemblages characterize the area:

- Those on hard substrata
- *Posidonia oceanica* meadows
- Fine sands with more or less mud
- Coarse sands with more or less mud
- Stones and pebbles

Moving southwards along the coast, the seabed is mainly characterized by different ecomorphoses of *P. oceanica*, forming thick extensive 2m high layers of matte on an organic substratum colonized by a wide variety of photophilic algae. In this area, many different ecomorphoses were identified supporting various species of economic and conservation interests e.g. the bivalve *Pinna nobilis* and the cephalopod *Octopus vulgaris* and a number of demersal fish species.

Another abundant seagrass in the lesser Neptune Grass (*Cymodocea nodosa*) which forma a major association within the biocoenosis of fine sands. However, its morphology gives rise to very thin matte layers which are susceptible to extensive damage by wave action. It usually precedes and succeeds *P. oceanica* but does not colonize hard substrata though patches may be found between cobbles on sand, and on Blue Clay and Globigerina Limestone bedrock covered with silt.

Hard substrata not colonized by seagrasses were almost completely dominated by photophilic algae, the Phaeophytes being the most abundant algal group. The most abundant species was found to be *Cystoseira spinosa* var. *tenuior* occurring over large areas in the form of an almost monospecific stand and accompanied by other co-dominant or sub-dominant species. This dominant species was replaced by other

photophilic and/or sciaphilic algae with depth, such tall-growing species including *Dictyopteris popypodioides, Cystoseira squarrosa, Sargassum vulgare* and *Sargassum acinarium.*

Drop-offs in deeper water were found to be characterized maily by sciaphilic algae, the most important being *Flabellia petiolata, Halimeda tuna* and *Pesssonelia* sp. Other red algae, a number of coralline algae and low-growing hydroids were also very abundant in some areas but overshadowed by larger and more conspicuous species, as was also the case for low-growing floral species forming an algal turf beneath the canopy of tall-growing species, including *Dasycladus vermicularis*.

Table 4.2

Species Group	Description	Dominant species
Tall-growing	> 10cm above substratum	*Cystoseira spinosa* var. *tenuior, Cystoseira ercegovici, Cystoseira squarrosa, Dictyopteris polypodioides, Sargassum vulgare*
Low-growing	3cm-10cm above substratum	*Padina pavonica, codium bursa, Flabellia petiolata, Halopteris* sp., *Halimeda tuna*
Encrusting	Hugging the substratum	*Peyssonelia* spp., *Corallina elongata, Lithophyllum encrustus, Pseudolithophyllum expansum, Mesophyllum lichenoiodes*
Algal turf	>3cm above substratum	*Chondria* spp., *Cladophora* spp., *laurencia* spp., *Vaucheria* spp., *Polysiphonia* spp.

Extensive areas of “bare sand” also characterized the area, areas within coves and on the periphery of seagrass meadows, devoid of epiflora but supporting a diverse epifauna of echinoderms and the number of burrow openings and feeding traces visible on the surface could deduce endobiotic species as.

The alien species *Caulerpa racemosa* was encountered throughout the study area, with dense patches characterizing the deeper waters off Ras il-Pellegrin.

CHAPTER 5
THE STUDY AREA: ISSUES AND IMPLICATIONS

A detailed and intensive study conducted by the Planning Authority during the year 2000 has produced a full coastal profile, addressing current uses and development in order top give as holistic picture of existing issues pertaining to the coastal and marine environment.

5.1 EXISTING USES

- Recreational
- Commercial
- Research & education
- Traditional

5.2 EXISTING AND POTENTIAL THREATS

The status of a habitat depends very much on the type and level of activities and uses occurring inside the "boundary" or in the vicinity. The inaccessibility of cliff and *rdum* habitats has given them the chance to develop richer communities. However, over the last decade, new development practiced and mineral exploitation have posed an ever-increasing pressure on them. Low-lying shores and beaches are also under continuous pressure from tourism-related and recreational activities leading to the obliteration of certain habitats.

5.2.1 The coastal environment

Table 5.1 Main threatening activities to coastal habitats

Habitat	Threat	Causes
Rupestral; cliffs & plateau; boulder screes & clay slopes	Damage to cliff face Erosion	Quarrying Off-road vehicles
Sand dunes	Trampling; loss of species and habitat	Clearing of vegetation, informal recreational spots, camping, off-roading vehicles, kiosks and other construction on beach
Supralittoral sand	Trampling, loss of sand	recreational activities, beach cleaning
Banquettes communities	Community not allowed to expand	Beach cleaning; material used as natural fertilizer
Sea grass meadows	Degradation and loss of habitat	Terrestrial runoff and pollution, dredging, trawling, coastal engineering
Posidonia barrier reefs	Same as for meadows	same as for meadows
Cystoseira communities	Degradation and loss of habitat	Pollution, altered hydrodynamics and sediment transport processes from coastal engineering activities
Corallegene communities	Degradation of habitat	Bottom trawling, coastal engineering
Submarine caves	degradation	Uncontrolled diving may cause mechanical damage and trapped air bubbles

Source: Coastal Profile I: Natural Resources (Planning Authority 2000)

A) Raheb Cave to Rdum il-Pellegrin

The main activity in this area is agriculture, especially the pressure of cultivated land on the lower tier of cliffs.

Existing uses and issues

The issues arising from this activity include:

- The formation of numerous tracks, some of which have been cemented or tarmac, to facilitate accessibility to the fields, even by vehicles. These give rise to trampling on natural habitats and create a negative visual impact

- Irrigation needs have caused farmers to redirect freshwater courses, thuds depriving natural vegetation and resulting in a general degradation of communities. Present irrigation techniques needed to be improved to make better use of these invaluable resources

- Abandoned agricultural land is threatened by soil erosion though neglect of rubble wall maintenance

- Land reclamation for agriculture has not taken into consideration the natural environment

- Natural ecosystems are threatened by the planting of alien species particularly in the boulder screes area

- Dumping creates a negative visual impact, smothers considerable areas inhabited by ecological communities and area a risk to human safety

- Limited access due to various reasons have caused people to tend to concentrate in localized areas, thereby accelerating localized impacts from trampling

- The presence of numerous pleasure craft in Fomm ir-Rih Bay ahs placed seagrass meadows under threat from anchors dragging on the seabed and destroying the rhizome matte

b) Ras il-Pellegrin to Ramla tal-Mixquqa

Its geomorphological features of sandy beaches, clay slopes and rdum boulder screes, the associated habitats populated by endemic biotic species, characterize the area of shore extending between these two points. A maritime garigue is predominant on the plateau at il-Pellegrin whilst remnants of sand dune ecosystems are extant at ir-Ramla tal-Mixquqa. The level of activity present in this area varies according to the characteristic features of beaches bay.

Existing uses and issues

(i) Gnejna Bay

- Freshwater courses are utilized for irrigation in the valley system and thus disrupting the hydrological balance sustaining the beach

- Encroachment of the beach and adjacent vegetation by parking facilities and the pressure of vehicular access to boat houses has caused extensive reduction in the size of the beach

- All this disrupts the natural process of sediment supply to the beach

- The kiosk present in the area is visually intrusive on an otherwise natural landscape

(ii) Ghajn Tuffieha Bay

- This bay, together with the adjacent promontory (Ras il-Qarraba) are scheduled as a level 1 SSI

- Access is mainly via a dilapidated concrete stairway. Vehicles gain access over the clay slopes, denuding them of vegetation of this making the slopes susceptible to gulleying by rain and erosion

- The practice of paragliding from the top of the clay slopes is severely threatening further destruction of clay slope vegetation

- Illegal extension of the restaurant and sanitary facilities on the right hand side of the bay. It is uncertain how the generated waste is disposed of

- A visual hindrance is created by the derelict structure present on top of the ridge overlooking the bay. It is also an ever-present threat to safety through collapse

iii) Ramla tal-Mixquqa

- Kiosk with ancillary facilities in the middle of the bay is smothering a reed bed system and a sand dune habitat

- Golden Sands Hotel has a beach concession. It is facing structural problems due to the receding cliff face

- The presence of numerous marine vessels in the area may create a problem through anchorage to the bottom and are also liable to pose a risk to human safety

c) Rdum il-Wahx to Anchor Bay

The plateau at Ras il-Wahx is dominated by steppe vegetation characterized by species which are either endemic or have a restricted distribution. The stretch of boulder screes and clay slopes associated with Rdum Majjiesa maintains naturally occurring shrub vegetation, clay steppe communities and planted trees. Accumulated sand at il-Minzel tal-Majjiesa has given rise to a small beach, as can also be found at il-Prajjiet.

Existing uses and issues

- Fields at Ras il-Wahx have been abandoned and are utilized for bird trapping. Garigue areas are threatened by land reclamation for agriculture
- Introduction of alien species through afforestation projects
- Horse-riding activities utilize tracks
- Off-roading on Ras il-Wahx plateau is placing this area under pressure from trampling of vegetation and displacing of soil, leading to soil erosion
- Sewage outfall at il-Prajjiet discharges untreated waste directly on the shoreline. This degrades the water quality and ecology associated visual impact and obnoxious smells reduce the attraction potential of the site

5.2.2 The marine environment

The report on the survey of the benthic environment in the study area (Annex II) describes in detail the biotic features, region by region. In brief, it was found that the area is characterized by a very diverse and rich biota which comes as no surprise given he heterogenous nature of the seabed.

Five main biotic assemblages could be identified, namely:

1. Hard rocks and beds
2. Posidonia oceanica meadows
3. Fine sands with more or less mud
4. Coarse sands with more or less mud
5. Stones and pebbles

The seabed was largely dominated by Posidonia oceanica, transmuting from one ecomorphoses to another from north to south, forming thicker mattes on soft sediment. In some places, the matte served as a substratum for the growth of photophilic algae and also produced "walls" round the edges of the meadow that functioned as "barrier reefs" and protected the sand bottom from the effects of strong currents and waves. In the shallows, seagrass meadows helped absorb the wave energy and reducing the impact on the shoreline of these important sandy beaches.

The nine different ecomorphoses encountered supported a large variety of organisms such of which are of particular scientific, conservation and economic interest, including the bivalve *Pinna nobilis*, the cephalopod *Octopus vulgaris* and demersal fish.

Another abundant sea grass in the study area is *Cymodocea nodosa* which was mainly encountered within the biocoenosis of fine sands. It forms thinner mattes and is more susceptible to damage by rough seas, so that it is mainly found in the more sheltered and shallower zones. It was not found to colonize areas with hard substrata although it was found among cobbles on sand and on Blue Clay and Globigerina limestone bedrock with a thin layer of silt.

Where *P. oceanica* was not the dominant species on hard substrata, its role was taken over by photophilic algae, especially phaeophytes such as *Cystoseira spinosa* var. *tenuior* in depths of less than 15m. Below this depth, sciaphilic algae were observed to be more dominant forming associations of *Dictyopteris polypodioides*, *Sargassum* spp. and *Cystoseira squarrosa.*

The most abundant and conspicuous algae in the study area fall into the following categories:

Tall-growing species (>10cm above substratum): *Cystoseira spinosa* var. *tenuior, C. ercegovici, C. squarrosa, Dictyopteris polypodioides*, *Sargassum vulgare.*

Low-growing species (>10cm but >3cm above substratum): Occur as sub-canopy beneath the tall-growing species. *Padina pavonica, Codium bursa, Flabellia petiolata, Halimeda tuna, Halopteris* spp. and *Zonaria tournefortii.*

Encrusting species are mostly calcified and usually possess s hard but smooth texture. These occur mainly in shaded areas. *Peyssonnelia* spp., *Corallina elongata, Lithophyllum encrustus, Pseudolithophyllum expansum, Mesophyllum lichenoides.*

Algal turf (>3cm above substratum) is made up of algae attached to substratum or other biota. These included *Chondria* spp., *Cladophora* spp., *Laurencia* spp, *Vaucheria* spp., and *Polysiphonia* spp.

Extensive areas of bare sand was encountered mainly in coves and the outer periphery of the area. Although almost completely devoid of epiflora, it was quite rich in epifauna, especially species of Echinodermata, and endobiotic species as could be evidenced by the large number of different burrows encountered. The alien algal species *Caulerpa racemosa* was found in most of the study area in areas deeper than 25m, but not in Gnejna Bay.

The benthic survey, although not a completely exhaustive study and not an inventory, ahs however showed that the site is characterized by a varied littoral and sublittoral geomorphology that includes all the main types of seascape elements encountered in the coastal waters of the Maltese Islands. It also includes representatives of most locally occurring marine biotopes and a high biodiversity. This confirms the preliminary work conducted in this area and justifies the proposal that the area is a suitable candidate for a Marine Protected Area.

5.3 RESOURCE PROTECTION

Data on terrestrial coastal ecosystems in the area under study has been collected extensively over the last years but information on marine ecosystems has been severely lacking. Hence, an intensive and complete benthic survey was deemed necessary in order to have a complete picture of all issues involved which need to be addressed in the setting up of the Marine Protected Area being proposed. Protection has been legally afforded to particular coastal areas and habitats, based primarily on the ecological value of particular species or habitats. To this end, other areas which also have an importance of their own, have been largely ignored and consequently suffered deleterious impacts caused through indiscriminate coastal development and

inadequate protection and management measures. It is to this end that the Malta Structure Plan has sought to identify sites as candidate increase protected areas and hence this site has been selected as the first to go through the process of study, protection and management to be given a legally protected status.

Current protection measures lack a systems approach which would take into consideration natural processes and their ecological value. Geological and hydrological factors need to be included in the process of protection, while anthropogenic activities need to be regulated to been harmony with the coastal and marine environment.

Protection is not simply a case of designating an area as a protected area, or placing it is a particular category. A holistic approach needs to be adopted. Until recently, sand dunes were protected and the beach designated as a buffer zone. This disregarded entirely the natural processes of beach formation whereby the sediment process incorporates beach, dunes and a significant area below mean sea level. Ignoring any of these systems would cause the sand dunes to degrade from development. No habitat can be protected or conserved as a resource in isolation from the surroundings, as has been the practice over the last years. This also means that a habitat must be studied in detail in all its aspects because the interaction of the various components cannot be ignored.

The main resources that need to be taken into consideration in attempting to assess the conservation and/or protection status that an area should be given, can be categorized as follows:

1. Natural coastal resources which include geological, geomorphological and hydrological features
2. Historical and cultural resources such as coastal heritage
3. Coastal uses which include in particular tourism and recreation, agriculture, aquaculture, fisheries, shipping and maritime activities, infrastructure and technology, mineral extraction and oil exploration
4. Coastal development

Of course, not all these features apply to the study site. However, an extensive amount of research has been conducted into these issues by governmental organizations, such as the Planning Authority, as part of studies fro the drawing up of the Structure Plan for Malta 1990, the Northwest Local Plan, the Coastal Zone topic Paper and other such literature. Hence, it was envisaged from the start that such useful documentation cannot be disregarded for the purpose of this study and in fact such literature was perused and studied in detail in order to assess the information relating to the terrestrial side of the coastal zone. On the other hand, very little information was known of the marine counterpart and hence the reason for carrying out the extensive benthic survey during summer 2000.

5.3.1 Natural features and resources

The interplay of geological features and natural process such as erosion, influence the characteristics of living natural resources, especially as regards topography and the natural undeveloped and pristine landscape. In their turn, these features influence the type of habitat they support mainly through the influence of the

geology on the hydrology of the area. Tectonics, drainage and drowned geological structures determine the geomorphological characteristics of the area.

Coastal erosion in the study area is an important issue insofar as the area is important for the occurrence of clay slopes which depend upon the presence of a particular vegetation with binding properties for their survival. Man-made activities such as trampling and off-roading are the main hazard in this regard as they destroy and uproot the vegetation and thus alter the stability of the sloes themselves, leading to increasing and precipitate erosion. Wind, rain and the influence of wave action also contribute to erosion and influence the geomorphology of the area. This is the main problem characterizing the bay of Ghajn Tuffieha.

In the case of Gnejna Bay and other areas within the study site, the abandonment of agricultural activities leads to the breaching of rubble walls and the consequent loss of soil through erosion. The impact of such run-off may affect the environment through further destabilization of the *rdum* areas, increase in turbidity of the coastal water and increasing levels of pollution from pesticides and fertilizers, which effects lay drastically alter the marine ecosystem of the area in the long term.

The characteristics of coastal and marine habitats as natural resources have already been discussed in previous sections of this document. Of the five main terrestrial coastal habitats, three are present in the study area, namely sand dunes, rupestral communities and some low-lying rock communities. The marine environment is characterized by the major littoral zones described by Peres and Picard (1968) for soft substrata. These zones were then further described through the existence of seascapes by Schembri and Pirotta as the preliminary part of this study. This document summarizes these features in the various sections but a completely comprehensive description is given in the document in Annex II.

As previously described, protection to these natural resources has been given to certain habitats and species on the basis of their scientific and ecological value, under the Environment Protection Act of 1991 (and 2001) and the Development Planning Act of 1992, through legal notices, government notices and conservation orders. However, no Marine Conservation Areas have been designated to date and it is hoped that this study will be a pioneer in this regard and open the way towards the establishment of more areas to different degrees of conservation.

5.3.2 Historical and cultural resources

Although evidence has been found of the existence of historical remains of archaeological value within the study area, yet this issue has not yet been given the attention it deserves and as such historical resources in the area have remained largely unexplored. Maltese legislation does however provide, to some extent, for the provision of protection to such resources and a number of areas have been

designated as Areas or Sites of Archaeological Importance under the DPA. However, no such designation has yet been given to any zone in the area under study. MCO 2 of the Malta Structure Plan of 1990 contains a provision for the inclusions of marine archaeological sites within the boundaries of Marine Conservation Areas.

5.3.3 Coastal uses

The major coastal uses occurring in Malta have been studied and discussed extensively by the various authorities and in fact, the Coastal Zone Topic Paper of the Planning Authority, published in 2001, tackles various aspects of such uses.

The main coastal uses in the study area and its environs include the following:

1) Tourism and recreation
2) Agriculture
3) Fisheries
4) Maritime and shipping
5) Infrastructure

Although the current uses fall more or less within these sectors, yet all possible coastal uses need to be taken into consideration in the drawing up and implementation of the management plan itself in order to assess whether such a use is sustainable or not, or to what extent it could be allowed.

The coastal uses can best be represented diagrammatically on the map as shown in figure 5.1.

1) Tourism and recreation

Tourism in the Maltese Islands has grown over the years to exceed 1.2 million visitors per annum (statistics 1998). Over the last years, there has been an ever increasing tendency to develop coastal areas for tourism related facilities and this has taken up extensive areas of the coast previous used for walking, bathing and other such recreational activities. The Strategic Plan 2000 – 2002 indicates that the policy of the Ministry of Tourism supports a strategy previously highlighted in the Tourism Development Plan for the Maltese islands (Horwarth & Horwarth, 1989) based on *diversification, seasonality and product development* and the aim to *"encourage the development of new or improved recreational and cultural facilities with less emphasis on accommodation and on increase in bed stock".*

The product development refers to the improvement, conservation and sustainable management of resources which are the essence that make this an attractive toursi destination and as such ensures that the development of tourism related facilities will take into account the capacities and fragility of environmental resources.

The area under study is characterized by only limited accommodation for tourists, consisting of one hotel and a tourist residential complex. There is also a dilapidate hotel on the promontory between Ramla tal-Mixquqa and Ghajn Tuffieha and lately there has also been the possibility of setting up another tourist complex on the northern cliffs close to Ramla tal-Mixquqa.

Hence, to date, the area offers little in terms of accommodation and tourist and locals crowd its beaches in the summer mainly during the daytime. However, recreational and tourist related infrastructure includes not only the hotel and the tourist complex which is situated away from the coast, but also kiosks in Ghajn

Tuffieha and Ramla tal-Mixquqa which over the years have established themselves as permanent structure on the beach.

Tourism related development has inevitable consequences which must be given great consideration prior to setting forth in the development. Such effects include the using up of coastal areas form construction purposes, the development of yacht marinas and a demand on national infrastructure such as water supply and sewage treatment. Over the last years there has been the tendency for hotels to install their own desalination system. Considering the impacts of the discharge of hypersaline effluent onto the shores on shore ecosystems, such an issue needs a careful and in depth study.

The sharp increase in population in summer in certain areas have also placed a heavier load on the sewerage systems so that overflows have become a problem in certain areas, making the water unfit for bathing. The Sewerage Master Plan is currently being implemented and one of the main provisions is the upgrading of the sewerage network to allow for the heave populations in certain coastal areas and thus prevent overflows of contaminated wastewater into the sea along the coast. The Master Plan 's other main target is the treatment of all sewage prior to being discharged into the sea. Currently, there are three main sewage outfalls, and one is situated directly to the north of the study area, at ic-Cumnija, and this may constitute a problem. The Department of Public Health and the Environment Planning Directorate jointly carry out a monitoring programme between May and October in order to keep surveillance over the quality of bathing area in this zone

Apart from accommodation, tourism and recreational related activities include the use of beaches and shores for the purpose of bathing. This has caused some of our precious beaches to be utilized for beach concessions or to be taken up by beach furniture which limit the availability of area for visitors and also disturb and epifauna which may be present. Sandy beaches constitute only about 2% of the coast of the Maltese Islands and most have been degraded through construction of roads, development of concrete platforms, the establishment of kiosks, also leading to the destruction of sand dune ecosystems where these existed, such as Mellieha Bay, Armier and Ramla tal-Mixquqa.

The area under study is characterized by sandy beaches and as previously stated, these beaches are very popular in the summer. In this regard, great concern for the stability of the beaches and the sustainability of the habitat has been an issue over the last years and one of the main priorities of a management plan for the area is to carry out a carrying capacity study for the area.

Diving has over the last decade become increasingly popular both with locals and tourists. In fact, it has been estimated that over 40,000 foreigners come to Malta per year for the purpose of SCUBA diving. Although most of the divers dive for site seeing, they can cause harm through the dislodgment of sessile organisms and the destruction of organisms by air bubbles trapped in caves. The taking of souvenirs needs to be greatly discouraged, and if necessary, penalized. On the other hand, harpoon fishing using SCUBA gear also constitutes a hazard to local fish stocks and a means needs to be found to enact a legislation which will control this practice before it is too late.

The area under study is not to date a popular diving site since SCUBA diving is currently concentrated round wrecks and physical features such as arches, caves, and such like. However, diving for the purpose of fishing does take place especially in areas where the seascapes offer strategic habitat for certain species.

A major problem related to the domestic search for recreation is the illegal conversion of boat houses for the purpose of accommodation and the construction of structures that have sprouted all over the island for the same purpose. Besides being illegal, such structures are almost always ill equipped for sanitary purposes with the consequence of increasing pollution in the sea in the vicinity. They are also destroying the landscape and degrading the habitat. Moreover, much beach and shore space is taken up by these structures to the detriment of those who wish to visit the area for the day for recreation al purposes. Over the last few years, the Planning Authority ahs taken up this issue and in some cases has pulled down the structure. Currently, many of these have been given the order to evacuate and / or pull down the structures within a given period of time.

2) Agriculture

The main issues on coastal agriculture relate to:

a) Landscape
b) Pollution
c) Accessibility
d) Forestation and reclamation of garigue

The area under study has been devoted to agriculture immediately beyond the coast in certain areas, especially Gnejna Bay which is formed out of a fertile valley system. The areas above the cliffs south of Gnejna Bay and towards Fomm ir-Rih are also characterized by agricultural land, however, this to a large extent is limited immediately off the coast due to the preserve of cliffs made out of Coralline Limestone. A garigue type of landscape characterizes the landscape north of Gnejna Bay immediately off the coast. However, further inland, the land is devoted to agriculture and is in fact one of the most fertile on the island.

Apart from the limitation to agricultural activities offered by the type of geology in an area, agricultural use of low-lying shores areas in the north has been replaced by urban development but mainly away from the study site. Hence, every effort must be made to manage the study area in a manner that will sustain agriculture where this is possible without jeopardizing other habitats which although may not be useful for agriculture, such as garigue, are still very important for the natural environment. Several abandoned fields in the area, particularly around Fomm ir-Rih, have been given over to hunting and trapping activities as the leasing leaves more income to the owner. Apart from the detriment to the surrounding habitat and the loss of good agricultural land, such practice is also preventing people from visiting the area for recreational purposes.

Where agricultural practices are carried out in the study area, one main problem is the pollution resulting from run off containing pesticides and fertilizers which finds its way to the sea, where it destroys the marine and coastal habitats through contamination and eutrophication. The pesticide list only controls the importation

and use of these chemicals on the basis of their potential human toxicity; no regard is being given to the impacts on the natural environment. Studies have shown over the years the enormous potential for these chemicals to bioaccumulate and it is foolish to ignore this when so much of our diet depends on fish and seafood which may be grossly contaminated and thus consumed by unsuspecting people.

The problem of fertilizers is also extensive since the presence of nitrates and phosphates in runoff to the sea may cause eutrophication effects in the area. This problem cannot be disregarded especially since very little information, if any, exists of the importation, use, application and control of fertilizers to agricultural land.

Farmyard waste is currently left to decompose in unsheltered areas or discharged untreated into the sewerage system. It is not known how much farmers are abiding by the Discharge Control Regulations or the need to place a sedimentation tank. Rainwater runoff from farms storing waste in unsheltered sites leads to pollution of the coastal zone, while if thrown untreated into the sewers, this will still end up into the sea through outfalls. In the case of the study area, the proximity of an outfall at ic-Cumnija and the presence of agricultural land place the marine environment at risk from pollution resulting from such activities. The control of discharge of such farmyard waste and the banning of use of untreated sewage for irrigation need to be addressed without further delay and form part of the management plan envisaged for this site.

3) Fisheries

There are no aquaculture activities within the boundaries of the study area. However, the fisheries industry is important and there is an important trawling area in the vicinity. Mgarr is mainly a fishing village, as well as agriculture, and some fishermen have boats anchored in Gnejna Bay. Infrastructurally, these are not posing a problem in the area. The main issue regards the availability of stocks and this is a problem which concerns the livelihood of every fisherman on the island. Hence, it is of utmost importance that the marine environment and all its habitats are safeguarded from direct and indirect deleterious effects which may cause deterioration in the quality and quantity of fish stocks. The management plan needs to actively delve into the most appropriate way to ensure that this does not happen, not only through the control of pollution but also through the control of overfishing by establishing a good and sustainable management system for the industry.

4) Shipping and maritime activities

This industry is very important for the economy of the island. Moreover, the Maltese Islands are surrounded by some of the major shipping routes in the Mediterranean and cargo ships and oil tankers frequently pass in close proximity to our territorial waters. These may pose a risk to the marine environment and our shores, in the event of an accident involving the spillage of hydrocarbons or some other chemicals and bunkering activities conducted within our territorial waters exacerbate such risk.

One such bunkering site is just offshore and to the north of the area which is being considered for designation as a MCA and in view of the important and unique habitats and features characterizing the area, the environmental damage which will result in the case of an accident is extremely high. Bunkering also takes up a

considerable amount of sea surface which prohibits any other activity from taking place, creating conflicting interests with other activities.

Water sports is very popular in the study area, with all forms of sea craft going to and fro from Ramla tal-Mixquqa to Ghajn Tuffieha and back. Sea craft vary from small powerful jet skis and speedboats to wind surfers to small craft and large powerboats and yachts. Hence, the natural environment is susceptible to various impacts such as noise, pollution and also risk of damage to the natural environment and danger to bathers. In Ramla tal-Mixquqa, an area has been delimited so that sea craft are prevented from approaching too close to the chore. Legislation exists on distance limits from shores and also speed limits close to a bathing area but such policies are rarely enforced. The Armed Forces of Malta frequently patrol the shores for such miscreants but there is the need to have a permanent system of beach wardens who will have enforcement of laws among their duties.

5) Infrastructure

As regards infrastructure, the main problems in the area emanate from road construction, building and coastal engineering and sewage outfalls. The latter has been mentioned previously and it is envisaged that by the year 2007 at the latest, no untreated water will be flowing out. Instead, a treatment plant is to be constructed at ic-Cumnija and an Environment Impact Assessment is underway to assess and eliminate as much as possible and undesirable effects on the surrounding environment.

5.3.4 Coastal development

During the last years and for the purpose of the coastal zone topic paper, the Planning Authority conducted an analysis of coastal development trends in order to assess the extent and type of development pressure affecting the coastal zone. Since 1994, demand for development in the coastal zone has increased marginally and the request now constitutes about 8.5% of all form of development.

Currently, the study site has very little urban development and much of it has been scheduled and established as an ODZ. Hence it is very important that the management plan takes this into consideration especially in the event that any development is proposed in the vicinity, which would probably be related with recreational activities. Designation of ODZ is a useful tool to deter pressure from development and together with Scheduling with can be more effective.

5.4 Emergent issues

The Coastal Zone Topic Paper published in 2001 by the Planning Authority is proposing a strategic direction which would be beneficial to follow in the setting up of the management plan for the site under study. In this was, the government strategy towards and integrated coastal zone management system will be initiated.

Not all the emergent issues and proposed strategies are applicable to the study site and some may need to be looked into in more detail than others, according to

necessity. Although the strategy only addresses the coastal zone, yet it will undoubtedly affect the marine environment and hence most of the issues can be extrapolated in this area. Moreover, it can be linked with strategies which are specific to the marine environment as a whole.

In the case of areas designated as AEI's or SSI's legal protection has to some extent effectively controlled the types and level of activities permissible in ecologically and scientifically important areas at a strategic level. Similar strategies need to be applied within the marine environment.

The management plan envisaged for the study area will include a coastal strategy that will address issues for the coastal uses discussed previously. Issues concerning tourism and recreation will focus on safeguarding popular tourist areas from incompatible uses, such as the implementation of measure to protect popular bathing areas from development. It is also vitally important that every effort is made to protect natural resources present in a site so as to enhance the habitats.

The abandonment of agriculture in coastal areas needs to be halted in order to prevent further erosion and alterations in the coastal landscape, mainly through assistance to farmers in the cultivation of land. It is also necessary to start details studies in the use and effects of pesticides and fertilizers being applied to agricultural land close to the coast in order to avoid deterioration of the marine environment through runoff of contaminated water.

Another important issue is the safeguarding of Gnejna Bay used for registered fishing boats and more importantly for the setting up o0f a strategy that will focus on finding a balance between the fishing industry and other activities in the study area in order to avoid conflicts. Moreover, a Marine Protected Area includes provisions for the safeguarding of fish stocks, an issue that needs to be taken up with the local fishermen from the very start.

It would be highly beneficial if the bunkering site could be removed. In the event that this is not possible, the management plan will include a specific contingency plan for the site so that immediate action can be taken to prevent damage in the event of an accident involving the spillage of a chemical such as hydrocarbons.

Other implications involve the drawing up, implementation and enforcement of legislation that will prohibit the deterioration of the environment such as off-roading on the clay slopes, trampling in sensitive areas, the haphazard use of water sport vehicles, the setting up of illegal camp sites, the development/establishment of structures for the purpose of residence or kiosks or restaurants, the discharge of untreated waste water or any other effluent from shore structures, etc.

5.5 Zoning scheme for the Coastal Zone

This scheme varies from the one proposed later on through this study for the proper management of a MPA. However, it is deemed appropriate to take into consideration when it comes to coordinating the management of the MPA with coastal zone management in the study area, coastal zone being defined by the Planning Authority in the recently published Coastal Zone Topic Paper.

The coastal zone strategy proposed by the Planning Authority is based on a refined zoning scheme which have the following objectives:

- the protection of coastal and marine habitats and their biodiversity
- the protection of cultural heritage
- the protection of coastal uses that must be located within this zone
- the protection of the right of public access and utilization
- the minimization of existing and potential user conflicts

The topic paper identifies the terrestrial coast into two main categories:

- predominantly urban
- predominantly rural

The marine environment is dominated by different characteristics than those on the terrestrial counterpart of the coastal zone. The available information on the marine environment indicate that the main benthic communities are located down to 50m depths, making this area the more susceptible to impacts and thus the one which requires greater protection.

The coastal zone in the study area is predominantly rural with very limited infrastructural development and dominated by ecological, scientific and geomorphologic features.

Based on the coastal strategy, the management plan aims to safeguard the natural and cultural resources, thus minimizing and limiting the type of development that may be undertaken. All conservation and protection policies will be implemented and enforced in order to improve degraded areas and enhance the natural environment.

The coastal zone topic paper of the Planning Authority states that the primary objective of the strategy for the marine environment is to safeguard the natural and cultural resources present, protect and enhance legitimate uses and minimize existing and prevent potential conflicts and deleterious effects.

The management plan will also take into consideration the implementation and enforcement of policies that will allow better management of the marine environment and protect the ecosystem. New development at sea needs to consider the impacts on the marine environment and other coastal and maritime uses.

CHAPTER 6
RECOMMENDATIONS FOR MANAGEMENT

Over the years, several studies were conducted in relation to the terrestrial part of the coastal area in the site under study, and all have come up with various recommendations as to the needs of the area to be protected and of how to best establish a management system of the area for conservation and protection.

The main aims for the designation of a Marine Protected Area include 'preservation of biodiversity', 'education and research' and 'public awareness', aspects which feature prominently in the management programmes emanating from the studies. However, one must constantly watch out against these aims becoming mere clichés rather than targets for which one must strive in order to attain, and so their successful fulfillment and progress must be monitored and gauged.

Unfortunately, open-ended goals and broad policies can hardly ever be transformed into tangible short-term measurable achievements. Moreover, management plans without a science-based foundation with little sound and factual data to support the aims of the programmes and implementation strategies are bound to fail. On the other hand, scientific studies and reports must be interpreted properly in order to be of value for the implementation of a management plan. Therefore, management plans for Marine Protected Areas require focused guideline based on properly interpreted scientific data which must be applied in the right environmental, socio-economic, cultural, spatial and temporal context in order to succeed.

In the present study, the main output consists of recommendations for the establishment of a Marine Protected Area and as such there was the need to conduct studies to yield reliable and fully comprehensive information about the marine environment. The scientific investigations carried out in this study yielded new knowledge, data and visual records of the geophysical and biotic features prevalent in the area. To this end, a series of recommendations were outlined, highlighting features worthy of or in need of protection. These recommendations also identified activities which may have adverse impacts on the natural capital of the study area. The recommendations included provisions for the protection of natural resources either on the basis of their scientific importance or uniqueness, or because they are good representatives of such resources in the Maltese Islands.

6.1 MANAGEMENT GOALS AND OBJECTIVES

Management of the study site will consist of a number of actions whose effects may or may not be visible in the short term. It is therefore very important that any action taken or activity implemented be carried out as part of the long-term plan for the area.

Studies conducted over the last years mainly focused their research on the terrestrial part of the study site, both for ecological characteristics and activities. The studies

included preliminary surveys for the needs of the Northwest Local Plan of the Planning Authority, ecological surveys for the Ghajn Tuffieha Area for the GAIA Foundation as part of the management plan for the area, and others.

Such studies have identified the situation existing in the area as regards ecology and the environment in general and have also come to realize the implications that development of certain activities has had or may have on the zone. On the other hand, there was a serious lack of knowledge and data concerning the marine environment. This lack was made good by the present, much needed survey, from which emanated the various recommendations for establishing a fully comprehensive and implementable management plan which in the long term will ensure the sustainability of the various resources in the area and of any development which may be sanctioned.

In the benthic survey, an ecological appraisal has yielded invaluable information about the status and characteristics of the marine environment and from this a set of recommendations has been proposed for protection. It is intended that this information, together with data compiled from studies of the terrestrial environment, both ecological and socio-economical, will be put together to set out a management plan for the establishment and sustainability of the area as a Marine Protected Area.

The main objectives should include:

- Conservation of indigenous flora and fauna, and their habitats
- Protection of the cultural and historical heritage
- Visitor education
- Promoting low-impact recreational use
- Control of activities and resource utilization in a sustainable manner

The management plan should address the different characteristics in question, namely:

- Protection/conservation of natural features
    - Coastal geomorphology
    - Submarine geomorphology
    - Marine biotic assemblages

- Protection/conservation of cultural resources
    - Archaeological
    - Historical (towers, etc)

- Regulation of activities
    - Recreational
    - Social
    - Economical

The Coastal Strategy Topic Paper formulated by the Planning Directorate as part of the review of the Structure Plan, has adopted a more focused approach with respect to coastal issues at a national level and the management plan in this study will seek to follow the system, in so far as the marine environment is concerned. The overall strategic objective for the coast is based on three levels:

- Protection of coastal and marine habitats and biodiversity
- Protection of uses necessitating a coastal location
- Protection of public use and access

As mentioned previously, the draft topic paper proposes a zoning scheme that recognizes the differences in the coastal zone, characterized by the level and type of activity or development present. In general terms, the coastal zone may be classified as follows:

- Predominantly rural coast
- Predominantly urban coast
- Marine environment

In the study sire, the coastal zone falls under the category of predominantly rural coast on the terrestrial side and the marine environment, however, for the purpose of this survey and management recommendations, we are currently only concerned with the marine environment although the management plan for the marine environment will be combined with the one for the terrestrial part of the coastal zone.

The draft topic paper identifies biological productivity as being predominant in shallow waters and that the main benthic communities are located down to depths of 50m, therefore falling within the area most susceptible to impacts arising from development or uses. However, offshore activities cannot be ignored as these also have direct and indirect effects on the benthic community. Although the topic paper proposes a strategy for the marine environment up to the 12 nautical mile limit, the MPA being proposed is strictly coastal up to the 50m depth contour; the management plan will however address offshore activities which may have an effect on the MPA and as such the zonation scheme proposed in Chapter 7 and in Annex III includes Buffer Zones.

The primary objectives of the coastal strategy for the marine environment are to safeguard the natural and cultural heritage, to safeguard legitimate marine uses, and to minimize existing and potential conflicts. In a detailed manner, this study has sought to gain all necessary information to be able to effect this objectives and beyond, through the drawing up of a management plan through whose implementation the area will be designated as a MPA.

The crucial part of any management plan is its implementation and this necessitates coordination between the various stakeholders following an identification of the roles played by the various institutions and agencies. The Management Plan inherently requires the participation of all relevant stakeholders for an effective and complete implementation.

6.2 RECOMMENDATIONS FOR THE PROTECTION OF NATURAL CAPITAL WITHIN THE PROPOSED MARINE PROTECTED AREA

A summarized version of the detailed recommendations outlined in Annex II is given below.

6.2.1 Coastal geomorphologic features

Protection should be given because in the study area, these features are:

- good examples of their type*
- rare or unique **

Table 6.1 Summary of the main geomorphologic features within the study area

Feature	Type	Location	Justification	Threats
Boulder shores & *rdum*	*	Ras il-Wahx, Rdum Majjiesa, Nahhalija, il-Barumbara, il-Qala ta' l-Imgarr	Rare; rich in pebbles & cobbles, inaccessibility offers refugia for biota	Illegal construction, dumping, removal of rocks & boulders, floating debris, tar balls, oil slicks
Sandy coves & beaches	*	Ir-Ramla tal-Mixquqa, ir-Ramla ta' Ghajn Tuffieha, il-Bajja tal-Gnejna	Not common; striking geomorphological features, low sand dunes; tourism	Large number of visitors; removal of sand disturbs equilibrium; eutrophication & pollution from sewage and agriculture
Wave cut terraces & shore platforms	*	Ic-Ceken at Gnejna Bay, il-Bajja tal-Qarraba	Very limited occurrence; extensive SLZ and MLZ	Illegal construction, tar balls & oil slicks; trampling damages encrusting biota
Shoreline cliffs	*	Fomm ir-Rih to Raheb Cave	Aesthetic value; unique geomorphologic features; refuge for biota; support a specific biota; nesting sites	Pollution from sea; dumping; quarrying & rock blasting; abseiling
Clay slopes at sea level	**	Ir-Ramla ta' Ghajn Tuffieha, il-Qarraba, Ras il-Pellegrin	Very rare or unique; support clay steppe communities of a high ecological value; slopes act as windbreaks and trap sand; tourism	Off-roading & trampling and fires lead to erosion and destruction of vegetation; dehydration causes loss of clay and accelerates erosion
Promontories	**	Il-Qarraba	Unique; several rock types can be seen; *rdum* supports important coastal communities	Trampling and fires; erosion of clay slopes; pollution
Cobble beaches	**	Il-Bajja ta' Fomm ir-Rih eastern cove	Rare; scientific & aesthetic value; best example of formation	Pollution
Semi-submerged caves	**	Ghar Marija at Ras il-Pellegrin, Raheb Cave	Geomorphologic aesthetic values; rare; incorporate littoral zones of a rocky shore; harbours sciaphilic assemblages; nesting sites for birds & bats	Pollution; SCUBA divers & visitors in small boats through collection of souvenirs; excavations and rock blasting

6.2.2 Submarine geomorphologic features (seascapes)

These features are of scientific, economic and aesthetic importance and should therefore be included in the management and protection programmes of the proposed Marine Protected Area.

- good examples of their type*
- rare or unique **

Table 6.2 Summary of the seascapes within the study area

Feature	Type	Location	Justification	Threats
Shoals	*	Sikka tal-Wahx, Sikka tal-Pellegrin	Best examples; support boulder fields, drop-offs & gentle slopes; good fishing grounds	Over-fishing & over-harvesting; anchoring by large vessels; illegal dumping
Continuous drop-offs	*	Shoutern shores of Fomm ir-Rih to Raheb Cave	Illustrate ILZ zonation on hard substrata down to 45-50m depths; overshadowing of cliffs above MSL and orientation creates sciaphilic assemblages; extensive hydroid assemblages	Pollution; SCUBA divers knock and scrape against facades & protruding ledges
Stepped drop-offs out to sea	**	SW edge of Wahx shoal & Pellegrin shoal	High aesthetic & scenic value; uncommon; support extensive sciaphilic assemblages; important feeding ground for small demersal fish	As for shoals
Boulder screes & boulder fields	*	Ras il-Wahx, Rdum Majjiesa, in-Nahhalija, il-Barumbara, il-Qala ta' l-Imgarr, Sikka tal-Wahx, Sikka tal-Pellegrin	High level of biodiversity; best examples; popular for fishing; support extensive photophilic assemblages	Illegal dumping; poor water quality; unrestricted fishing leading to destruction of many species of predatory fish

6.2.3 Biotic assemblages

These biotic assemblages encountered in the study area also merit protection and management because of their scientific, economic and conservation interest.

Table 6.3 Summary of the main biotic assemblages within the study area

Feature	Location	Justification	Threats
Posidonia oceanica meadows	ix-Xaghra tal-Majjiesa to il-Qarraba; il-Barumbara to il-Qala ta' l-Umgarr	Good examples; several different ecomorphoses; good state of health; primary producers; nursery grounds; protect against wave action; etc	Anchorage; turbidity & reduction in light intensity; pollution rich waters give rise to phytoplankton bloom and reduction in light penetration
Cymodocea nodosa meadows	Minzel tal-Majjiesa – Qarraba; between ir-Ramla tal-Mixquqa & ir-Ramla ta' Ghajn Tuffieha; il-Bajja ta' Fomm ir-Rih	Extensive & dense; important primary producer; sand stabilizer	Anchoring; dumping; competition by alien species
Photophilic assemblages	Throughout the site except for sand dominated substrata	Good examples; important primary producers; oxygenate water & produce detritus; nursery and grazing grounds	Turbidity; silting; pollution; anchorage; dumping
Sciaphilic assemblages	As undergrowth beneath tall-growing algae; in dark & shady regions	High species richness & density; adaptations of their component species to light poor conditions	Destruction of habitat; pollution; divers by collection

6.3 FURTHER RECOMMENDATIONS FOR MANAGEMENT

Ghajn Tuffieha area is protected in terms of the Development Planning Act 1992 at Lev el I and Level II AEI/SSI. It is recommended that the whole area under study be protected in terms of both this Act and the Environment Protection Act of 2001 in order to enable the issuing of regulations for the management of the site and integrate the activities of all authorities concerned for the conservation and protection of this ecologically sensitive area.

The types of habitat that are to be designated as AEI as specified in the Malta Structure Plan policy RCO10 include sand dunes. Deep natural caves, gently sloping rocky shores and coastal cliffs, all of which are found in the study site. These are all to be preserved as a valuable part of our natural heritage. Coastal cliffs is one of the most scientifically important due to the large number of unique species and others of biogeographical interest that it supports. This habitat is not only worthy of conservation as part of our natural heritage, but also as that of all mankind.

Other resources recommended for management are largely the result of studies carried out on the terrestrial side of the coastal zone and include the terrestrial biotic assemblages and habitats, the geomorphology, the historic resources such as the watch towers dating back from the time of the Knights of Malta, the scenic and aesthetic and recreational value of the zone and other such factors. These issues have been dealt with exhaustively by the Planning Authority for the purpose of the Northwest Local Plan, the Coastal Zone Topic Paper for the Structure Plan Review and the Draft Strategic Management Plan for the North West Coast of Malta, among others. Hence, for the purpose of this document, the marine environmental issue will be dealt with here and will later be conjoined to any management plan which will be established for the terrestrial side to form one whole implementative and management system.

6.4 REGULATION OF ACTIVITIES IN THE CANDIDATE AREA

The following activities need to be studied and discussed in detail and managed in such a way as to make possible the establishment of a Marine Protected Area. Measures may entail the control, reduction and where necessary the elimination and prohibition of the activity. Activities which have a deleterious effect on the environment but cannot be eliminated must be subjected to mitigation measures and a comprehensive monitoring programme. It should be noted that the intention of the management plan is to protect the area from negative impacts and enhance the value of the natural resources, thus enabling the establishment of sustainable development. It does not necessarily mean the prohibition of all human activities, and if this is necessary for certain issues, elimination may have to be implemented only in certain localities. This entails the establishment of different management zones with different regulatory regimes for the candidate site.

1. Harvesting of natural marine resources

- Use of explosives
- Commercial fishing methods (mainly trawling)
- Spear fishing (especially using SCUBA)

- Artesian and sport fishing methods (mainly nets & lines)
- Collection of date mussels (*Lithophaga lithophaga*)

2. Removal or destruction of abiotic natural features

- Collection of fossils
- Removal of clay, sand, pebbles, cobbles
- Excessive pumping of ground water from perched aquifer
- Removal of boulders and blocks

3. Operations involving hydrocarbons

- Oil exploration
- Bunkering operations
- Disposal of ballast/bilge waters from vessels out to sea

4. Discharge and deposition of substances

- Discharge of chlorinated waters
- Discharge of sewage and other nutrient rich effluents from the sewage outfall at ic-Cumnija and overflows
- Dumping of excavation, demolition and construction waste at sea
- Discharge of thermal effluent (from cooling systems)

5. Development of coastal area or seabed

- Sea reclamation and construction of breakwaters, jetties or quays
- Construction of fixed and floating pontoons
- Anchored platforms
- Quarrying

6. Navigation

- Uncontrolled and unrestricted traffic
- Anchoring by pleasure and commercial sea craft
- Use of sea craft in close proximity to shore

7. Miscellaneous

- Atmospheric pollution from anthropogenic activities
- Marine pollution from the various activities including bunkering, sea craft, sewage outfall, littering, etc.
- Light and noise from social activities on beaches and establishments especially in the summer months
- Unrestricted access to the site by large number of visitors, beyond the carrying capacity of the area
- Use of boat houses for anything other than boat and the construction of illegal buildings anywhere on the coastal side which would be to the detriment to the marine environment and to the whole natural environment in the area

CHAPTER 7
THE MANAGEMENT PLAN

7.1 MISSION STATEMENT FOR THE MANAGEMENT PLAN

From the results obtained in this study, the following primary objectives will be incorporated in the management plan for the proposed Marine Protected Area:

1. to preserve a unique and strategically located site where marine life, geological formations, sea currents and atmospheric conditions integrate to form an outstanding and healthy marine ecosystem

2. to ensure that anthropogenic activities do not further degrade existing habitats, or otherwise threaten the health, stability and diversity of marine and coastal life forms

3. to encourage scientific research on the natural resources of the area which will contribute to a better understanding of ecological relationships and to the resolution of management, regulatory and enforcement issues

4. to enhance public awareness of the resources of the Marine Protected Area by ensuring adequate and up-to-date educational services

5. to demonstrate the viability and usefulness of this pilot project in order to encourage future research and studies in the evaluation and designation other sites around the Maltese Islands as Marine Protected Ares.

7.2 CONCEPTUAL FRAMEWORK OF THE MANAGEMENT PLAN

The authors of the benthic survey studied the data and information resulting from the study in detail and came up with the recommendations outlined in Chapter 5 of this document and also with a proposed framework management plan for the area, an outline of which is given below.

As already stated and as clearly can be seen from the results emanating from this study and also from studies carried out over the last decade as part of the Northwest Local Plan and other such documentations, one undeniable fact comes out – the extreme heterogeneity of the area and its diversity of socioeconomic significance of the activities taking place. This fact makes the study site an excellent model for the application of the Multiple Use Marine Conservation Area, a designation which is the most realistic and appropriate approach to attain the recommended goals and objectives, allowing the preservation and maintenance of biodiversity and the conservation of seascapes and adjacent landscapes, with a concurrent fulfillment of socioeconomic requirements and obligations.

A management plan for a Multiple Use Marine Conservation Area requires a management plan to be based on a Multi-level Protection System in which the whole

area is subdivided into regions or zones with varying regulations and procedures according to requirements.

7.2.1 Zoning

Zoning is essential in that it inherently recognizes the diversity of natural resources, requirements and activities occurring within the same designated areas, thus facilitating the implementation of the multiple use approach. Such a scheme assigns different protection levels, monitoring programmes and surveillance procedures to different regions. It aims to be dynamic and versatile enough to provide for seasonal and other temporal variations.

One important factor to be considered for a zoning scheme to be effective is that such a system needs to be tailor-made for that specific area and cannot easily be applied from or to another area.

Zoning schemes consist of the following designations:

- Core area – strictest possible protection
- Secondary areas – less protection and less stringent regulations
- General purpose areas – little protection and limited regulations and enforcement
- High socioeconomic value areas – may occur and operate within the MPA
- Buffer zones – encircle the entire MPA to protect the more sensitive and important regions from activities occurring outside the MPA boundaries through the control of activities and resource exploitation to protect the inner areas

The successful implementation of a management plan based on a zoning scheme depends also on complete integration with a complementary terrestrial protected area which would also afford a buffer zone on the landward side of the coast.

7.2.2 Proposed zoning scheme

The zoning scheme being proposed emanates from a careful and in depth analysis of the data and information resulting from the benthic survey. This scheme was proposed as a guideline to be used in conjunction with a comprehensive assessment including the landward side of the coast, as established from the various studies conducted during the last decade.

This scheme is being proposed on the basis of it giving prominence to areas with a high ecological and/or conservation value and areas which are socially and economically viable. Such seemingly diverse attributes are in fact interlinked and cannot realistically be treated separately, or to the exclusion of each other. This gives a common purpose for protection - that of protecting natural resources for conservation and for sustainable use and long-term preservation of the resource.

A] LEVEL 1 BIOTOPE PROTECTION ZONE

Definition
Areas of exceptionally high scientific, ecological, conservation and aesthetic value

Management objectives
The highest level of protection is attribute here. Human activities are greatly curtailed and monitoring and surveillance are a must, including monitoring for human activities, water quality and biota.

B] LEVEL 2 BIOTOPE PROTECTION ZONE

Definition
Areas of high ecological and conservation importance

Management objectives
The aim is to protect living marine resources from deleterious effects of anthropogenic activities. Regulations and restrictions need not be as stringent as in Level 1 and monitoring may be limited to the more important benthic communities and water quality.

C] RESOURCE PROTECTION ZONE

Definition
Areas with special economic, social and scientific value

Management objectives
Such areas boast a high natural capital and a high socioeconomic value. Hence, most human activities must be allowed, but be constantly under strict monitoring and surveillance. Monitoring should include also economic and other sociological indicates to better gauge the variety, level and effects of human impacts in these areas.

D] GENERAL-PURPOSE AREAS

Definition
Areas with moderately high scientific, economic, social and aesthetic value

Management objectives
Such areas are important for their close proximity to more significant and sensitive regions mentioned above. Regulations need not be stringent or very restrictive and monitoring may be limited to water quality.

E] PRIMARY BUFFER ZONE

The proposed zone is an area of approximately 300 to 500m encircling the outer perimeter of the study area. Such a zone must be under surveillance and activities

within it should be regulated or prohibited in order to protect the MPA. Water quality monitoring should be undertaken on a periodic basis.

F] SECONDARY BUFFER ZONE

The proposed zone is shown in Anne III and extends for about 1km out to sea to the west and for about 500 to 600m to the north and south. Surveillance and restriction are aimed to control activities that pose a potential threat to the MPA through the generation of long-range pollution, and as such should include a comprehensive and well targeted contingency plan to be put into action in the event of a threat from oil slicks, plankton blooms and such like. No monitoring is required here but strict surveillance will help provide an early warning system should the need arise.

7.3 MANAGEMENT TACTICS

1) Coordinating Committee

In view of the legal and functional responsibilities of the Malta Environment and Planning Authority, the best practical scenario would be to set up a multidisciplinary committee composed of members of staff from both the Environment Protection Directorate and the planning Directorate within the Authority, in order to coordinate the implementation of the Management Plan. The committee will then have representatives from the following organizations:

- the Malta Maritime Authority
- the Malta Tourism Authority
- the Health Division
- the Department of Local Councils
- the Ministry for Economic Services
- the Museums Department
- the Malta Resources Authority
- experts in the various fields

and any other institution as the situation may require.

This Committee will oversee the coordination of implementation of the management plan through delegation of responsibilities to the relevant entities in order to ensure that there is full participation at all levels. The Committee would be answerable to government and thus the support of the relevant Ministries needs to be given in order to ensure commitment and provision of the required resources.

Once the Management Plan is being implemented, and the site has been designated as a Marine Protected Area in its own right, the Committee will have an added responsibility to ensure that all the legal and administrative obligations are carried out as required by the designation.

Moreover, the Committee must ensure that any obligations under international, regional and national legislation are followed and any issue that can be implemented through existing procedures, such as EIA's and development control should be

continued to be regulated as such, involving the necessary consultation and cooperation between the agencies and with the general public. In this way, proper integration of resources will be ensured.

2) Thematic Sub-committees

It must be noted that in the implementation of a management plan, the creation of Thematic Sub-committees is a necessity especially in the tackling of priority issues relating to specific actions for particular actions such as the setting up of the protected area, beach management, protection of a particular species or habitat, the control and better management of an activity such as fishing, and others.

In this case, a lead agency is designated to be responsible for overseeing the implementation of a specific action plan. The sub-committee will then include not only representatives from the relevant government agencies, but also representatives from he local councils, action committees, the private sector, non-governmental organizations and any other stakeholder as deemed appropriate. This would ensure that all interests are respected and that the discussion will be exhaustive so that in the end any action taken will have had the input off all stakeholders involved.

The sub-committee will also include experts in the field as necessary to give the required advise so that an action taken will be based on a sound scientific background.

3) Interagency agreements

Once an action plan is devised and agreed upon, the agencies or institutions involved may need to come to a definite agreement to work together for the betterment of the natural environment which is a resource of each and over one of the people inhabiting or visiting this zone.

4) Boundary and zoning

The boundary of the site has already been identified and described and zoning of e area into regions has also been carried out, on the marine side. This needs to be combined with the boundary and zoning of the terrestrial counterpart as in the management plans to be established and implemented as part of the North West Local Plan and the implementation of the Structure Plan policies. In this way, issues can be acted upon and implemented in a more comprehensive manner. Zoning will not only relate to a specific area but may also relate to a specific species, habitat or activity but in any case it must finally always be seen in the context as a whole.

5) Actions

The priority actions are listed below:

- Development of a comprehensive Management Plan for the Marine Protected Area
- Initiation of the implementation of the Management Plan
- Establishment of the Marine Protected Area and designation of the various zones within it

- Coordination with management plans established for the terrestrial side of the coastal zone of the study area
- Development of Action Plan for the various resources present in the area which are at risk e.g. coastal and submarine geomorphologic features, biotic assemblages, specific species and/or their habitats
- Regulation of the various activities taking place in the candidate site (recreational, developmental, social, economical, etc)

6) Policy and legislation

In order to ensure that provisions of the Management Plan and consequently of the various action plans are abided by, one of the first actions of the Coordinating Committee would be to draft and publish the necessary legislation, and policies, which will outline the obligations necessary for the proper protection and/or conservation of the area as an MPA. This would give the relevant institutions the necessary legislative and enforcement powers to enact the various policies and obligations for the safeguarding of the resources in the area and the betterment of the environment.

Once the area has been established as an MPA, it needs to be protected by law and the various activities controlled through the enforcement of the various pieces of legislation covering a particular issue. Activities will be subject to authorization by the relevant organizations.

7) Resources: studies and management plan

The various resources, which need to be managed and protected, are discussed in Section 5 of the document in Annex II and summarized in tables 6.1, 6.2 and 6.3 of this document. Action Plans may be required for this to be carried out in the proper manner in order to ensure the sustainability of these priceless resources. Proper consultation with the experts in the field is necessary for this to be carried out in order to have sound scientific advice.

8) Regulation of activities

The activities briefly outlined in section 6.4 of this document necessitate an in depth study and give rise to the setting up of the various sub-committees where necessary. Although information is available about the various activities taking place along the coast of the candidate site as well as offshore, an in depth investigation may be necessary in some cases in order to be in a position to assess how best to address the issue and manage or regulate in the best possible manner.

9) Surveillance and enforcement

In order to implement a management plan in the proper way and later on be able to manage and administer the MPA, a system of surveillance of the area and enforcement of the various obligations has to be devised in order to safeguard the best interests of the site. This may involved the recruitment and training of beach wardens who patrol the area on foot and by boat and/or enforcement officers to subdue reprehensible visitors.

7.4 ADMINISTRATION OF THE MANAGEMENT PLAN

1) Budget and financial resources

The most crucial factor in the implementation of a management plan is the availability and allocation of funds. At the highest strategic level, commitment from the various Ministries is necessary and the Coordinating Committee should include an administrative faction to deal with this issue. Apart from this, the Management Plan must therefore be presented in such a way as to prove practicability and emphasize that the outcome would be socioeconomically beneficial to the country so as to reassure the Ministries involved that funds are necessary and the plan is viable.

In the case of financial commitment relating to funding for the initiation of work on the Action Plans and Priority Actions identifies, the relevant agencies must be in a position to adopt the Priority Actions as part of their separate business plan and allocate the required resources in terms of funds, staff and equipment.

Various options are available for the funding of a Priority Action including voluntary agreements with the private sector and any other stakeholders, agreements and assistance with NGO's and Local Councils, and participation by the public.

2) Work plan and time frames

The implementation of the Management Plan and the designation of the site as some form of work plan can govern a MPA over a specific time frame, but this must be in line with any management plan to be established and implemented for the terrestrial part of the coastal zone. Following this, the management of the MPA after this has been so designated, is an ongoing process and as such does not fall within a specific timetable.

Table 7.1 Time frame

Phase	**Description**	**Period**
1	Drawing up of a Management Plan for the area Establishment of Coordinating Committee	6 months from adoption of strategic plan
2	Identification of Priority Actions Setting up of Thematic Sub-committees	6 months from setting up of Coordinating Committee
3	Implementation of Management Plan	Initiated with Phase 2
4	Drawing up of Action Plans for the various issues and Priority Actions for Protection	1 yr. Initiated after Phase 2
5	Implementation of Action Plans for Protection	2 – 3 yrs. Initiated after Phase 4
6	Drawing up of Action Plans for the various issues and Priority Actions for Activities	1 – 2 yrs. Initiated after Phase 2
7	Implementation of actions re activities	2 – 3 yrs. Initiated after Phase 6
8	Establishment of MPA	During this period as deemed appropriate
9	Training of staff	Initiated with Phases 4 and 6
10	Public participation programmes	Initiated with Phases 4 and 6
11	Public awareness programmes	Initiated with Phases 4 and 6

3) Facilities and equipment

Once the Management Plan has been drawn up, discussed thoroughly and accepted, one of the tasks of the Coordinating Committee would be to allocate appropriate premises as a base for the management team. Such a base should be within the candidate site and located in such a way so as the team involved in the management plan or in a specific activity will have first hand information of the situation. Moreover, any wardens or enforcement officers which may be employed may well use the premises as a base. The premises will also serve to store the necessary equipment and information about the area.

7.5 EVALUATION OF PLAN EFFECTIVENESS

Once the Management Plan is launched, through its various steps, the effectiveness of the plan has to be periodically evaluated. This is necessary in order to monitor the progress of the plan and also in order to be in a better position to apply the lessons learnt to other candidate sites in the establishment of management plans for their protection and management and their designation as MPA's.

There are various tools to ensure that this is so, including monitoring of the environmental resources, monitoring of the economy in the various sectors involved, the establishment of Sustainability Indicators, continual communication and feedback from the public and such like. The Coordinating Committee should establish such devices with the assistance of detailed studies. During the CAMP Malta project, one of the horizontal activities involved the identification of Sustainability Indicators which would help monitor the progress or otherwise of the area as a MPA. Such SI's can be used and improved upon in order to be more specific for the site and the requirements of protection and/or conservation of the marine environment in the area.

As regards monitoring of the environment, this is already done, to some extent, as part of the National Marine Monitoring Programme, which however needs to be enhanced in the area. In brief, this will include the weekly monitoring of seawater samples collected close to shore and analyzed for microbiological and physicochemical parameters during the bathing season. Seasonally, sea water and sediment samples will be collected from established stations using sea craft and analyzed for various physicochemical parameters as necessary, including nutrient levels, heavy metals and hydrocarbons. This will give a clear picture of the trend in the seawater quality in the area. Moreover, benthic surveys should be conducted at least once a year, preferably accompanied by some form of biomonitoring as necessary. Any effluent discharge into the marine environment from a land-based source will be subjected to permit, under LN 213/01, and such discharge will be periodically monitored by the operator and crosschecked form time to time by the authorities concerned.

Public awareness and education programmes need to be set up. In this way, the public will be made aware of the surroundings and advised to avoid littering and causing any form of harm to the environment. Education programmes are also a necessity and the MPA may serve as a useful tool in this regard in the teaching of children about the beauty of the marine environment and the priceless resources it contains. The public must be made aware and taught to appreciate this invaluable resource and thus enhance the quality of our environment.

CONCLUSIONS

Constant awareness of the priceless value of the natural environment of the coastal zone of the Maltese Islands, and in view of the risks and threats to which this environment is constantly subjected, has over the years indicated the pressing need to take action towards the protection and preservation of the coastal and marine environments.

Against all odds and every type of resistance, the Structure Plan policies outlined in 1991 are finally coming to fruition with studies being conducted on the first candidate site so as to have a complete picture of the situation and be in a position to formulate a management plan whose implementation will le4ad to the designation of the site as a Marine Protected Area.

The designation of the site under study as a Marine Protected Area, and the implementation of a Management Plan, would signify formal acknowledgement of the special value of these waters. Besides discouraging and deleterious impacts from uncontrolled development, focusing attention on the natural resources of the area, this study is aimed to act as a pilot project for assessing the benefits of MPA's and leads to similar projects for the other candidate sites. It would also assess current and innovative research techniques and can be used to refine environmental policies towards national needs.

In this project, the main aim was to conduct a benthic survey of the area to complement already existing data collected from the terrestrial part of the coastal zone as part of the Northwest Local Plan of the Planning Directorate within the Malta Environment and Planning Authority. Further, a proposed zoning and protection strategy was outlined, together with the needs that a suitable management plan should address.

Following this, a post-project activity is currently being initialed. This activity, funded by E.U. and conducted under the supervision of the Regional Activity Centre for Specially Protected Areas of UNEP, is looking at the data collected in order to formulate a Management Plan that will address the various issues and consequently set up a management strategy for the area, to include human and financial resources, among others. Once the management plan is in place and being implemented, the area will be formally designated under the appropriate category or categories, as a Marine Protected Area. Such designation would give tangible proof and a much-needed boost to pro-environmental policies being adopted on a national level.

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UNITED NATIONS ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN
PRIORITY ACTIONS PROGRAMME

MAP Coastal Area Management Programme
"The Island of Malta – North-West Region"

INTEGRATED WATER MANAGEMENT OF THE NORTH-WESTERN REGION OF MALTA

EXECUTIVE SUMMARY

Malta, December 2001

Executive Summary

Contents

EXECUTIVE SUMMARY

1 Background information

The Mediterranean Action Plan (MAP) is one of the regional plans of the Regional Seas Programme (UNEP). Its legal basis is the convention for the Protection of the Mediterranean Sea (The Barcelona Convention) to which Malta is a signatory).

The Priority Actions Programme Regional Activity Center- PAP/RAC is an integral agency within MAP. Its activities focus on the implementation of Integrated Coastal and Marine Areas Management (ICAM) and individual MAP Camp projects.

One of the most important MAP programmes for sustainable management is the Coastal Areas Management Programme (CAMP) established in 1989. The operational framework of CAMP is based on the principles of sustainable development and integrated coastal area management.

The MAP CAMP Malta Project was agreed to in November 1999. The general objective of the project was to contribute towards Malta's effort to the achievement of sustainable management and environmental protection.

This document is part of the final report on the activity 'Integrated Water Resources Management Plan' for the North-West Area of the MAP CAMP 'Malta' project implemented by the Institute of Water Technology. The expert team co-coordinated by Mr E. Azzopardi included Mr P. Micallef and Mr J. Mangion. This activity has been implemented as one of the PAP/RAC related project activities with Prof. J. Margeta as the responsible PAP consultant. This activity was implemented in close co-operation with other project activities and in particular with the integrated database and GIS activity, executed by the Planning Authority, and with the involvement of the Sustainability Analysis Team under the Blue Plan/RAC responsibility. PAP/RAC was responsible for the co-ordination of the activity at MAP level.

2 The Project area and water resource management related problems

The island of Malta is located at the centre of the Mediterranean Sea, South of Sicily and North of Libya. Malta is one of the most densely populated countries in the world with about 1198 inhabitants per square kilometers. The highest point is at 250 m above sea level. The total surface area of the two largest islands of the archipelago is 311 km^2. About 23 % of Malta has been urbanized in contrast to 5 % in the sixties. The average total rainfall is 605.7 mm concentrated over 6 months and with an average monthly value over 10 years of 50.5 mm. Runoff flows causing floods in low-lying areas occur occasionally especially as the rainfall intensity is relatively high and the low-lying areas are normally at the end of the valley systems.

Malta is one of the Mediterranean islands, which attract many tourists, approximately 1.1 million per annum. In fact, tourism is the largest industry in Malta and its development in the sixties and eventual expansion later on in the seventies, eighties and nineties marked the most important turning point in the socio-economic structure of the island.

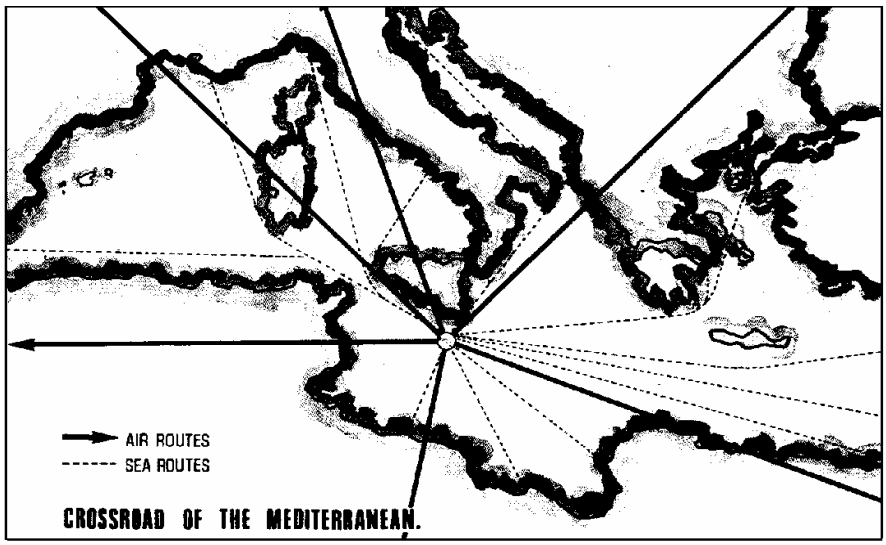

Figure 1: Malta in the Mediterranean Sea

The North-Western Region has a surface area of circa 73 km^2. An estimated 8.85 mm^3 of runoff originates from the major catchment area in the region. This cathcment is normally known as the Burmarrad catchment and encompasses the Wied il-Qleigha valley system. This region is predominantly situated on higher grounds but generally ends up at sea level on the eastern part of the region.

There are no rivers in Malta; rather perennial springs which originate from the excess storage on the perched aquifer. As regards to "lakes", the water bodies existing in Malta and especially in the North West Region of Malta are limited to runoff water captured behind dams especially constructed to retain stormwater In particular in the Burmarrad catchment, there are the well-known Chadwick Lakes which are not really lakes but rather captured water bodies.

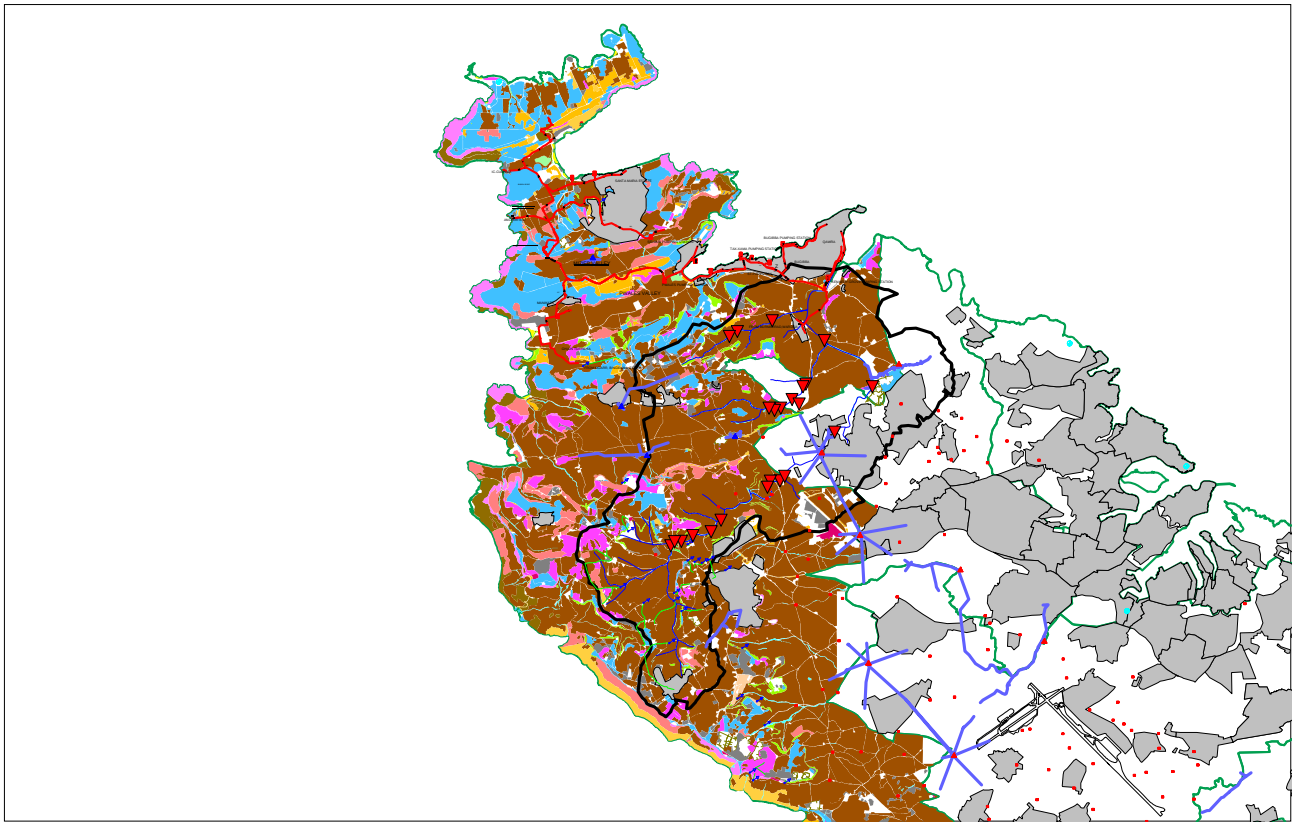

Figure 2: Northwestern Region

3 Objectives of Integrated Water Resources Management in the NW Region

The overall objectives for this activity were to:

- Contribute to the sustainable management of national water resources
- Reduce dependency on expensive desalinated water
- Provide basic study for future projects namely groundwater polishing, reuse of treated sewage effluent and stormwater

4 Implementation and major results

4.1 Implementation procedure

To achieve these objectives, a set of project stages have been stipulated.

1. An analytical phase which included the assessment of the actual hydro-climatological parameters predominant in the NW area.

2. An assessment of the hydrological and hydro-geological characteristics of the North West area. This included the presence of perched aquifer blocks in the NW as well as that of surface water and in particular in the largest water catchment of the region, namely that of Wied il-Qleigha also known as Burmarrad catchment. A water balance of each block was also included.

3. An inventory of the water resources available as well as sources of pollution and impacts on water resources. This included water infrastructure development (e.g. fresh water, stormwater, sewerage systems) as well as the socio-economic status in the region.

The report covered the following areas:

1. Hydroclimatological Factors
2. Surface water
3. Groundwater
4. Soil Characteristics
5. Water Infrastructure Development
6. Hydrological cycle and water balance of catchment areas
7. Socio-Economic system of the catchment area
8. Water Demand and Needs assessment
9. General Water Resources Development Plan
10. Water Resources Development and Management of the NW Area

During the compilation of the report the following aspects were taken into consideration:

- Qualitative and quantitative assessment of resources.
- MSLA gallery beneath Blue Clay.
- Potential use of surface run-off and TSE
- Identification of cost-effective treatment methods.
- Land use impact on groundwater quality.
- Assessment of water quality trends.
- Water Demand assessment.
- Design treatment plant for GW sources in the north-west.

This activity produced reports on the hydroclimatological factors, quantity and quality of the surface waters and groundwater, natural water balance, water

demand and utilization including the analysis of the natural and socio-economic factors. Moreover, a general overview of the present situation in the production and distribution of potable water supply, sewerage system, treatment plants, stormwater and wastewater infrastructure was given for the NW region. Short term and long-medium term solutions and projections have been included.

4.2 General characteristics of water resources of the North-West Region

There are no rivers in Malta, rather 19 perennial springs which originate from the excess storage on the perched aquifer. In the dry season, the flow from these springs decrease markedly.

The water resources of Malta are mainly groundwater originating from the mean sea level aquifer and desalinated seawater. The groundwater is pumped via about 90 boreholes, none of which in the NW and 13 pumping stations out of which 5 in the activity area. Desalinated water has, for years now, been used to blend the ever-increasing saline groundwater. However, increasing desalination costs as well as increasing degradation of groundwater due to uncontrolled private extraction, has compelled the water authority to contemplate the polishing of groundwater and eventually reduce desalinated seawater.

Apart from the chloride content, which is high, there is the problem of nitrate which has also increased over the years. No use of groundwater found on the perched aquifers is used for potable purposes because of the high nitrate content. Groundwater in perched aquifers is mainly used for irrigation and domestic washing purposes.

Alternative sources of water for secondary uses have been identified in order to alleviate stress on first class water. These are stormwater and treated sewage effluent. The use of the latter is already being practiced in the South East of the Island for these last 18 years and has proved to be successful even though improvement in sewage quality and eventual more efficient use would make this source of water more attractive to use. Use of stormwater has been made over the years for irrigation but no real study has ever been concluded to ascertain the quantities, the quality and the effect of stormwater.

In the NW region, there are 26 catchment areas. However, most of these have small surface areas. In order to carry out a concise hydro-geological and morphological study, Burmarrad was identified as the largest river basin suitable for such a study. The catchment area (marked X in Figure 3) of this basin is 42 km^2. The valley system is made up of 19 drainage sub-branches.

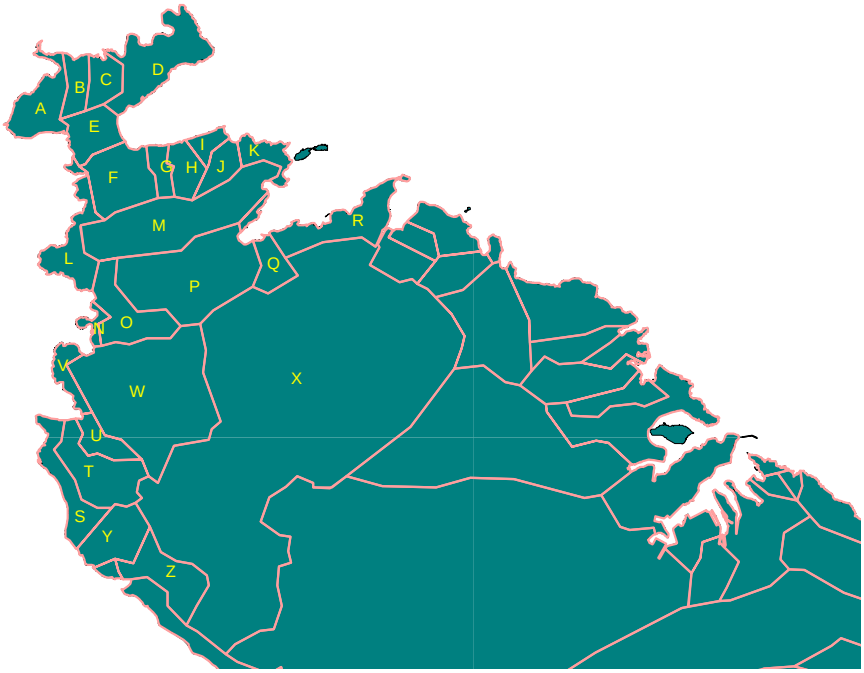

Figure 3: The 26 catchment areas in the North-West Region

Plate 1: General view of the downstream part of Burmarrad catchment

4.3 Impact of human activities on the status of surface and groundwater

Surface and groundwater present in the NW region of Malta exhibit significant pressures from human activities as well as on human activities. The impact of man on the natural water resources is manifested mainly in two ways, quantity and quality. The tourist industry entails larger amounts of water for consumption. Water from groundwater sources as well as from reverse osmosis plants must be provided either within the region or imported from other plants outside the region. Water for irrigation has also to be provided from the same sources together with surface waters. Floods occur because of extensive urbanization as well as artificial dams and field allocations. These, in turn, impact on human activities downstream by creating havoc in traffic organization as well as threat to human life and property damages.

With regards to quality, the extensive agricultural activities in the region have resulted into high nitrate levels in groundwater sources. Over-extraction of aquifers has in turn resulted in high chloride content thus rendering groundwater sources not suitable for potable purposes and thus requiring more RO water for blending purposes.

4.4 Protected areas

Malta should ensure the establishment of a register of all areas lying within each river basin district which have been designated as requiring special protection under specific Community legislation for the protection of their surface water and groundwater or for the conservation of habitats and species directly depending on water.

As Malta has only one such river basin district covering the whole of the island, it means that the register for NW region will be part of register of Island of Malta.

4.5 Water uses

In this report, an attempt was made to establish the sectoral users of water resources. The following is a summary:

- Domestic
- Tourism
- Agriculture (Irrigation)
- Agriculture (Animal Husbandry)
- Recreational (Irrigation)
- Recreational (Streams, dams, parks)
- Industry
- Forestry

4.6 Sustainable development and management of water resources

Several actions have not been conducive to sustainability either from the economic point of view or from the environmental perspective. Typical problems are issues of water supply and quality, sanitation and pollution, flooding and stormwater drainage and groundwater deterioration. Although these issues are strongly interrelated, actions to address these problems are frequently undertaken by separate agencies with limited co-operation among them.

Funds have often been inadequate to augment the quantity and quality of water resources. Efficient and timely maintenance is often neglected causing water systems to deteriorate rapidly. Non-conventional means of water production, especially expensive desalinization methods on their own do not succeed in changing the legacy of past and current practices that treat water as a cheap unlimited resource. General water ignorance overlooks the real costs of desalinated water in terms of increased energy consumption, environmental pollution and financial burden

4.7 General strategy for water resources development and management of the NW area

In the management of NW water resources it is necessary to take into consideration that:

- water is a resource without property rights
- water is a limited resource but at the same time a renewable public good
- water resources development requires large investments
- water is an easy medium to transfer external effects which easily endanger water value.

Water resources management in NW region has to be developed on the basis of a national strategy of water resources management and a national master plan. Regional plans as the NW plan have to follow these in hierarchical higher plans.

4.8 Implementation considerations

In the implementation stage of the project, one must take into consideration various issues. These include socio-economic as well as cultural and political considerations.. Funding to execute recommendations need to be sought and a thorough program of works and plan of execution must be formulated.

5 Major outputs and results

5.1 Data collection and problem identification

In the quest to formulate a reliable set of data, one must note that certain problems related to continuity, length and reliability of data have arisen. First, it should be noted that the Meteorological Office used to form part of the Civil Aviation Governmental Department under military administration. Recently, this office has been taken over by the Malta International Airport (MIA). Thus, the services offered by this office began to be considered on a commercial basis. Though data collection continued, no processing of such data was ever done. So, loads of information had to be processed in order to compile tables.
As regards to precipitation data, though rainfall data owned by WSC date back to 1841 and can be considered as homogenous, the source of such data cannot be traced and so it is not possible to get the raw daily values. Results from recently- acquired electronic data logging and sensory equipment has proved to be quite reliable but the equipment is too recent to offer any real data on which a time-series and probabilistic analyses could be formulated.

Moreover, sensors can develop faults and so appropriate planning is needed to limit downtime of equipment by purchasing substitute equipment for quick change over. The same can be said for the runoff data. In recent years, a gradual changeover from mechanical recorders to electronic equipment has highlighted the advantages which the latter can offer. Continuous readings with time-steps as low as 5 minutes or lower are possible in contrast to the mechanical chart system. Though the latter may be more reliable in operation, the electronic equipment can be more precise for data analysis purposes. Again, as for the precipitation equipment, a quick changeover of systems following a fault would benefit continuity of data. WSC is striving to reach equilibrium between electronic and mechanical equipment so that they could serve also as double check on each other.

As regards the other climate data, the three climate stations installed in 1995 have given good results following initial teething troubles and are being maintained so as to give better, more reliable and continuous data for future analysis Keeping in mind the assessment of the present state of affairs, it was decided to utilise the data from both the Meteorological Office and from WSC-owned stations.

At this stage, it should be noted that in Malta, there is no one unique Hydroclimatological Database Centre and so there is no monitoring system with all elements of the observation cycle from concept to information dissemination. Due to lack of one centralised unit, analysis of data is not an ongoing process and so any analytical work is carried out within particular projects and studies such as the current one which may require such investigations. Thus, so far, there is a lack of comprehensive hydroclimatological system and study of the Maltese Islands.

The study is on the largest and surely the most interesting watershed of the NW Region namely the Burmarrad catchment. It has offered quite a number of interesting results. The catchment has rural, agricultural, recreational and urban characteristics. Throughout geological ages, climatic conditions together with the geo-morphological development, has rendered the topography of the region as it is today. Man's interventions have had their effects. Some may be termed as having been adverse (e.g. roads, urbanisation farm developments and quarrying) but others can be defined as being profitable. These include dams (arrest soil erosion and loss and water retention) and gabions (stop erosion of the sides along valleys with eventual soil loss).

It should be said that from a hydrological perspective, maintenance on the retention structures such as dams and gabions is lacking. Rehabilitation of the valley started 3 years ago has stopped.

Plate 2: Adoption of a gabion system to avoid soil and rubble wall erosion

Urbanisation in the Region under study, though still accounting for a small percentage (10-15 %), should be checked to avoid runoff short response time to storm events in lower areas such as Burmarrad. Urban runoff from part of Rabat and Mtarfa, a large part of Mosta and Naxxar are actually diverted via pipes into the valley with little if any, provision to detain this runoff either in-pipe, in reservoirs or behind dams. This invariably causes flooding events downstream in the Burmarrad area. But flooding in the Burmarrad area is not only due to the above events. Introduction of field allocations over the years inside the valley downstream of the Burmarrad Runoff recorder is also a reason for such flooding.

During the final stage of the study, a brief but at the same thorough inventory of the water infrastructure development has been made. This includes water systems ranging from potable water to irrigation to sewerage. The impacts of such systems as well as other man-made activities on natural water resources such as groundwater are also provided. In essence, the presence of “polluting” establishments already existing within the protection zone boundary, leads to encourage developers to transgress this boundary. Existing old establishments, farms, industry etc., some in appalling sanitary conditions are often pointed out, to shoot down the relevance of the protection zones and substantiate the developer’s claims.

Another related issue bearing on aquifer protection, is the inefficient monitoring and control of operating conditions. Enforcement of sanitary conditions is minimal, at times non-existent. Inspectors from different departments work independently to achieve some form of sanitary improvement often abandoned a few days following the actual inspection. Furthermore, they are normally met with apprehension and arrogance, making their career a rather unpleasant one which very few would like to follow.

In the absence of a proper legal framework, developers know that once a development permit is granted, sanitary enforcement is weak and there is neither any definition of polluter responsibilities nor any penalties to deter abuse. One is therefore free to operate in the cheapest way and in complete disregard of environmental constraints.

5.2 Increased knowledge and upgraded capacity

An amount of new information was gathered and presented in the study. Knowledge about the sewerage, distribution, stormwater networks as well as demand requirements for potable and non-potable water has been acquired. Upgrades have been suggested and illustrated. Moreover, hydrological water balances were formulated. These are illustrated in Table 1.

Table 1

Hydrological Balnce of Surface Water Sheds in the North-Western Region.						
No.	**Name**	**Surface Area in Km^2**	**Precipitation input m^3**	**Evapotranspiration losses m^3.**	**Run-off m^3**	**Recharge m^3**
A	Wied Musa	1.79	1020300	642789	61218	316293
B	Tal-Bir.	0.83	473100	298053	28386	146661
C	Qortin	0.94	535800	337554	32148	166098
D	Armier	2.99	1704300	1073709	102258	528333
E	Ghadira	1.38	786600	495558	47196	243846
F	San Niklaw	2.36	1345200	847476	80712	417012
G	Gnien Ingraw	0.61	347700	219051	20862	107787
H	Is-Sellum	0.95	541500	341145	32490	167865
I	Ghajn Zejtuna	0.48	273600	172368	16416	84816
j	Mgiebah	0.83	473100	298053	28386	146661
k	Blata il-Bajda	0.81	461700	290871	27702	143127
L	Ghajn Znuber	1.81	1031700	649971	61902	319827
M	Mizieb	5.2	2964000	1867320	177840	918840
N	Il-Karraba	0.3	171000	107730	10260	53010
O	Ghajn Tuffieha	2.13	1214100	764883	72846	376371
P	Pwales	5.49	3129300	1971459	187758	970083
Q	Wied Bufula	0.92	524400	330372	31464	162564
R	Qawra	2.29	1305300	822339	78318	404643
S	Rdum tal-Vicarju	1.73	986100	621243	59166	305691
T	Wied Bahrija	2.44	1390800	876204	83448	431148
U	Wied Gerzuma	0.87	495900	312417	29754	153729
V	Ras il-Pellegrin	0.73	416100	262143	24966	128991
W	Wied Hmar& Wied	8.39	4782300	3012849	286938	1482513
X	Wied ilQleigha	42	23940000	15082200	1436400	7421400
Y	Wied Migra il-Ferh	1.78	1014600	639198	60876	314526
Z	Wied Ghar Ilma &	2.04	1162800	732564	69768	360468
	TOTAL	**92.09**	**52491300**	**33069519**	**3149478**	**16272303**

5.3 The General water resources development plan

A plan for the water supply system in the Northwest has been formulised. This sub-system cannot, however, be presented on its own and all the system must be considered for the plan to be effective.

In this Plan, the following issues wereconsidered:

- Municipal water supply production capacity
- Distributions systems
- Water quality improvement systems
- Resource protection measures
- Organizational and administrative infrastructure
- Protection from water resources such as wastewater, storm water, flood waters
- Sewerage systems
- Sewer system development concept
- Treatment and ways of disposal or reuse
- Possible quantity of reused wastewater
- General estimation of economic and other characteristics of the proposed projects.
- Long term solution

5.4 The water resource development and management of the NW Area

Some of the main outputs of this report are listed below:

- Organization addressing the establishment of a River basin district as a basic unit for the water resources management in accordance with Water Framework Directive (WFD). A Water Resources Authority has been established with an aim to co-ordinate the implementation of the WFD.

- Management in the context of sustainable development of the environment with the main objectives of enhancing individual and community well-being and welfare by following a path of economic development that safeguards the welfare generations as well as to provide for equity within and between generations whilst protecting biological diversity and maintaining essential ecological processes and life-support systems.

- Legislation and other administrative measures

Legislation and other administrative measures are not proposed in this Study because legislation and administrative measures are specified in EU Water Framework Directive which Malta has to implement.

- Water conservation program

At the NW region as well as at the National level, a water conservation program is being successfully implemented. This program, among other, includes: leakage detection and repair, water audit, pressure reduction, implementation water saving devices, tariffs, etc. Therefore, there is no need for this Study to propose a new program of action for the NW region.

New water conservation program will be developed during the elaboration of the river basin plan of the Malta Island in accordance with EU WFD.

- Monitoring proposal

The monitoring program includes ecological and chemical status of surface water (inland and sea) as well as quantitative and chemical status of ground water. To accomplish this, three levels of monitoring are required namely surveillance monitoring, operational monitoring and investigative monitoring.

6 Problems

6.1 Problems related to water resources management and development

- As mentioned in section 5.1 of this summary, various problems were encountered in the course of this study especially the lack of continuous hydrological data. It was quite recent that rainfall and runoff data were collected in digital form and continuously. Previously, such data was in chart form, which had to be translated in digital format. Moreover, the hydrological data available for this catchment is limited to three rainfall gauges and one runoff recorder situated at Fiddien, Speranza, Naxxar and Burmarrad respectively. Records from these stations do not permit any spatial distribution of outflows to be analyzed and to be presented.

- Another problem that is of concern to the water resources management and development is the lack of control in the private extraction. Today no control exists over the operation of private wells and misuse is rampant. Unauthorized wells are often equipped with high capacity pumps and indiscriminately pumped to the detriment of public sources. Government is

consequently forced to bear the cost of these mal-practices by producing more desalinated water to correct salinity shortfalls and in extreme cases to shut down those sources under its control that exhibit degradation in quality.

- Clear definitions of ownership of water resources have also resulted in a problematic holistic and integrated water resource management. Responsibilities to manage cost-effectively and in sustainable manner assets such as aquifers, water basins and the water environment in general are not clearly defined amongst Governmental and non-Governmental agencies.

- Related to the private extraction problem is the problem of lack of precise information on the quantity of private extraction and in some cases on where and how extraction is taking place. Thus, it is not possible to carry out a sound, dynamic diagnosis of how the aquifers are behaving under the various man-made pressures.

- In order to manage water resources effectively as well as meeting EU standards, extra funding needs to be found to carry out the necessary quality tests.

- Another technical problem which is evident, is the actual cost-effective allotment of the different types of water resources according to the diverse users requirements in terms of both quantity and quality

6.2 Problems related to implementation of the activity within the project

The main problems encountered in the implementation of the activity were primarily:

- Lack of adequate funding to resource sufficiently the full implementation of the activity
- Lack of fulltime staff on the project
- Lack of availability of team members in other activities for consultation
- Lack of timely exchange of information between different thematic groups
- Delays in availability of PAP consultant when needed

7 Major Recommendations

In conclusion, the final report included a number of recommendations regarding various aspects emanating from this project:

7.1 Water resources management at island and project area levels

- It is no secret that the hydro-climate monitoring network and its administration need revision and improvements. Its administration should be unified in such a way as to guarantee continuity, less double monitoring and hence less expense and increased availability to local and foreign entities. It is necessary to commence the periodic checking, processing and analysing of all data which should be organized in a meaningful manner to be of value to agriculture, tourism, ecological and environmental groups as well as for educational and research purposes. This could be done in a systematic way to serve as a work of reference. The availability of such data locally and to foreign entities via say Internet should be made on a commercial basis so as to ensure that the sustainability of such gathering and management of hydrological and climate data are made in a cost-effective manner.

- Dams still require cleaning from accumulated silt most of which is precious soil, which can be re-distributed onto adjacent fields. This would eventually enhance the storage capacity of the dams. These also need careful repair to retain effectively runoff for eventual reuse by farmers and in strategic places for recharge of the aquifer. The concept of gabions should be encouraged and eventually introduced in other tracks of the valley system. This would simplify eventual cleaning as well as retaining of soils. Their introduction in other countries has proved their effectiveness in protecting the local biological species.

- Further studies need to be carried out particularly in flood management. More specifically, the culvert construction for the recorder, which was installed in the 60's i.e. prior to the extensive urbanisation in the catchments is now outdated and needs review and modification.

- Due to floods caused by introduction of field allocations downstream of the Burmarrad run-off recorder station, a systematic re-allocation of fields and cleaning of this part of the valley network need to be started as soon as possible so as the hydrological soundness of the whole valley and catchments is guaranteed. To complement this, dredging operation should be conducted in Salina Bay.

- Finally, one must point out that the adverse hydrological and environmental effects of quarrying along the Victoria fault in the Wied il-Ghasel region have not been adequately assessed and can be considered as a study on its own which needs immediate attention. Re-instatement of the quarry/quarries in that region must be intelligently designed and executed so as the original geo-morphological features of that track of the valley can be re-established as much as possible.

- The hydrological data available for this catchment is limited to three rainfall gauges and one runoff recorder situated at Fiddien, Speranza, Naxxar and Burmarrad respectively. Records from these stations do not permit any spatial distribution of outflows to be analysed and presented. A general study of the hydrological data, review of the monitoring and data collection methodologies is required. This would allow planners to develop discharge curves, carry out water balances along the stream flow in individual streams and work out probabilities of occurrence of the average and maximum monthly and annual discharges in both gauged and ungauged streams.

- As regards aquifer protection in the circumstances, it is hard to implement effectively aquifer protection. The present state of groundwater quality is the inevitable result of a long history of disregard towards environmental conservation. Disturbances are generated by many different sectors of our society and they are often associated with land development. A new institutional and legal framework is today required that would set the measures and regulations needed to protect groundwater resources. The Malta Resources Authority may attain this.

- On the whole, the experience gained during the compilation of this report was positive since it threw light on certain aspects, which previously might have been underestimated if not outright ignored. The most important conclusion that came out of this project is not purely technical. The importance of having structured and regular monitoring of all parameters related to the aspects and issues mentioned in the report came out clear. Moreover, a National Data Management unit apart from or as a part of the Statistical Department would be appropriate. This would eventually divulge raw or manipulated information to the various entities to compile reports as required. Alternatively, more funds should be made available to the various departments so that the necessary data is kept and managed effectively.

7.2 Follow-up activities to be implemented in the post-project period (2003-2004):

- Follow-up consultation with other teams on the project
- Public relations exercise to raise project awareness and influence decision makers
- Review and evaluation of the activity

7.3 Professional scientific studies

This investigation has highlighted certain shortcomings that needs appropriate in depth studies. A lot of data and information are still missing so that at this stage, it is impossible to realize the necessary analysis and develop the necessary viable solutions to the problem.

Collection of data on quantitative, morphological, ecological and chemical status of water resources is one of the priorities. Appropriate data banks and information systems on water resources characteristics and hydroclimatological factors have to be established.

Several studies have been identified as requiring immediate attention particularly on:

- Water balance of surface water, perched and mean sea level aquifers.
- Balance of chemicals in the surface water, perched and mean sea level aquifers.
- Impact of diffused sources of pollution on water.
- Cycle “Driven forces-Pressure-State-Impact-Measures” for each important water body, giving priority to perched aquifers and coastal water of the important bays.
- Best possible technology for treatment perch aquifer water for drinking purposes and associate necessary level of protection of catchments’ pollution.
- Appropriate indicators for sustainable use of island water resources
- Wastewater reuse
- Groundwater polishing
- Storm water management

Protection of Soil and Rural Landscapes in Northwest Malta

Christine Tanti
Avertano Role
Anthony Borg
Ivan Calleja

MAP Coastal Area Management Programme (MAP CAMP)
The Malta Project

Activity 5: Soil Erosion/Desertification Control Management
Final Activity Document

Note: This final activity document was written by Christine M Tanti, National team leader for the activity (Environment Protection Department) and team members, Avertano Role' (University of Malta), Anthony Borg (Department of Agriculture) and Ivan Calleja and gives the outputs and results of the activity carried out within the CAMP Malta Project. Carol Agius (Mapping Unit, Planning Authority) provided the mapping outputs while the drawings of the sediment traps and field profiles were prepared by Antoine Gatt (Works Division).

Malta, January, 2002

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF PLATES

LIST OF TABLES

LIST OF ACRONYMS

CAMP	Coastal Area Management Programmes
CIHEAM	Centre International des Hautes Etudies Agronomics Mediterranee
CoS	Central Office of Statistics
EPD	Environment Protection Department
EU	European Union
FAO	The Food and Agriculture Organisation of the United Nations
GIS	Geographic Information Systems
ICAM	Integrated Coastal and Marine Area Management
IPCC	International Panel on Climate Change
MAP	Mediterranean Action Plan
MCSD	Mediterranean Commission for Sustainable Development
NGOs	Non-Governmental Organisations
NSO	National Statistics Office
NW	Northwest (of Malta)
PA	Planning Authority
PAP	Priority Actions Programme
OPM	Office of the Prime Minister (Government of Malta)
RAC	Regional Activity Centre
SI(s)	Sustainability Indicator(s)
SoE	State of the Environment
SPSA	Systemic and Prospective Sustainability Analysis
ToRs	Terms of Reference
UN	United Nations
UNEP	United Nations Environment Programme
UNCCD	United Nations Convention to Combat Desertification
UoM	University of Malta
WSC	Water Services Corporation

ACKNOWLEDGEMENTS

The National team leader wishes to acknowledge the support and collaboration of PAP/RAC, in particular Mr Ivica Trumbic (Director PAP/RAC) and Mr Arsen Pavasovic (CAMP Malta Project Co-ordinator) for providing the opportunity to carry out this activity within the CAMP Malta Project. A special note of appreciation is also conveyed to the MAP consultant Mr Jean Claude Griesbach for his invaluable technical advice and contribution to the team. Appreciation is also due to Gunter Englisch for his advice and comments regarding this report.

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The Team leader is indebted to the endless encouragement, dedication and support of the National team members, especially Mr Anthony Borg, Mr Ivan Calleja and Mr Avertano Role'. The completion and success of this activity and the drawing up of this report would not have been possible without their efforts, contributions and co-operation. The outputs of the activity have more value due to their technical and expert knowledge. Acknowledgements are due to Mr Role for taking and making available all the photographs for this report.

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Furthermore a note of thanks is to Ms Carol Aguis, from the Data management team (PA), not only for her assistance to the team but for actually carrying out the mapping exercises related to the overlaying of maps.

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Last but not least, thanks are due to the stakeholders who actively participated in this activity; worth mentioning are the Mgarr Farmers' Co-operatives, the farmers working at Dingli and Tas-Santi and the Mgarr Local Council.

Christine M Tanti
Environment Officer
National Team Leader

EXECUTIVE SUMMARY

In the framework of the Mediterranean Action Plan (MAP) and within its Coastal Area Management Programme (CAMP), a project for Malta was launched in November 1999, to be completed by June 2002. The Project was oriented towards sustainable management of the coast of Malta, in particular the Northwest area, whilst introducing and applying principles, methodologies and practices of sustainable coastal management and Integrated Coastal and Marine Area Management (ICAM).

The present report represents the final report for the project activity "Soil Erosion/Desertification Control Management", implemented between November 1999 and January 2002.

Soil erosion in the Maltese Islands has been recognised as a predominating desertification and land degradation process and a major threat to the sustainability of the agricultural sector. Malta's extensive terraces testify an age-old practice of soil conservation. However, this has traditionally necessitated heavy investment in the maintenance of terraces. Despite this, there have been very few, if any, attempts to appropriately address and mitigate for this widespread problem on a national level.

The general objective of the Project activity therefore consisted in contributing to the national efforts towards sustainable management and environmental protection in Malta. This was achieved through:

- undertaking and completing systematic erosion/desertification surveys and mapping activities at different levels;
- providing proposals for remedial measures and elaborating conservation/rehabilitation/protection recommendations for the implementation of global and site specific actions;
- contributing to the protection, rehabilitation and rational exploitation of the rather limited soil resources, scenic beauty and biodiversity, by applying updated and adapted erosion/desertification control management strategies and techniques.

The Project activity was implemented through the application of the new consolidated erosion mapping and assessing methodological procedure as defined in the "Guidelines for Erosion and Desertification Control Management with particular reference to Mediterranean Coastal Areas" (UNEP/MAP/PAP, 2000).

The mapping survey procedures mainly identified and assessed physical parameters and processes that were integrated during the synthesis phase with socio-economic factors such as land use, cropping practices and urbanisation.

During the implementation of the activity, there was a constant concern for participatory approaches, sustainability assessment and monitoring and integration of sectoral surveys. As the participatory approach was considered as a pre-requisite for proper determination of priority areas and elaboration of sustainable remedial options, special emphasis was placed on formal and informal contacts with the Project stakeholders. In fact, involving the main stakeholders, i.e. local authorities, the population involved in agricultural activities, the scientific community and NGOs, was an asset to the activity. A close link was therefore kept with the participatory programme within the CAMP project.

A set of sustainability indicators were also drawn up as a tool for the development of trends on erosion/desertification processes and control management strategies. The development of these indicators involved several discussions with the main land users/stakeholders who also endorsed the indicators.

Data was collected such that scenarios for the future could also be developed. Five main indicators were identified, namely the number of flood warnings, land tenure, the number and length of breaches in rubble walls and the number of claims for compensation of storm damages. The source of data for monitoring these sustainability indicators was also identified.

The erosion/desertification control management activity was implemented in three main phases:

- Phase I: Preliminary analysis/processing/interpretation
- Phase II: Erosion mapping/surveying at different levels
- Phase III: Final synthesis and remedial recommendations

The general sequence of actions consisted of eight sub-programs of specific activities: collection of basic technical data and information; development of an erosion GIS; site-descriptive erosion mapping; other surveying activities; integration of mapping outputs within a socio-economic background; diagnostic analysis; strategy development and monitoring/capacity building.

For integration of mapping outputs with socio-economic parameters, a report on the relevant socio-economic patterns and strategies was prepared. The main patterns identified to have an impact on soil erosion/desertification processes can be summarised as being:

- population (population changes and urbanisation, road development, farming practices)
- exploitation of freshwater resources (irrigation, salinisation, nitrate pollution in water table, irrigation with 2nd class water)
- costs of soil erosion (cost of soil replacement, cost of preventing soil erosion)
- soil as a non-agricultural resource (hunting and trapping, quarries, ecotourism)
- industrialisation of agriculture (greenhouses, hydroponics, animal husbandry, irrigation techniques, reservoirs and bore-holes, crop type, viticulture)
- land tenure (fragmentation of holdings, land abandonment).

As a result of the field surveys, predictive mapping and the integration of the socio-economic parameters, priority areas for immediate intervention were identified and categorised:

- Clay soils with a low degree of maintenance of rubble walls
- Steep slopes with a current agricultural use or abandoned fields and neglected rubble walls
- Valley beds/flood prone areas
- Areas under the influence of runoff water from non-absorbent sealed surfaces (roads and buildings), where storm water runoff is not taken into consideration in the planning or construction stage.

Furthermore, one of the main indicators for the identification and delineation of priority areas for preventive, curative and/or protective remedial measures was the state of repair of retaining rubble walls. For this purpose, the state of repair of rubble walls in Northwest Malta was surveyed during the period July 2001 and August 2001. The main aim of this mapping exercise was to observe and note the state of rubble walls and terracing in the area. A practical legend was adopted which took into consideration all the possible variants encountered during the field visits.

The diagnostic analysis clearly showed that in the Northwest, soil erosion (as a desertification process) is a common phenomenon which needs urgent attention, especially in the above identified priority areas. Therefore, detailed technical recommendations for addressing the problem were elaborated and complemented by general recommendations for capacity building.

Following the completion of the activity, the need for further research was felt in order to assess erosion/desertification phenomena in Malta. Therefore, a number of post-project activities were identified for future implementation. Especially, the following two recommendations should be considered:

- The study is extended to the whole island of Malta and Gozo so as to complete the determination of priority areas for the Maltese Islands.

- The development of site specific rehabilitation and remedial measures schemes should be addressed by a specific project in order to make full use of the results of the diagnostic analysis provided in this project activity.

Moreover, this activity has produced some important baseline data which should be followed up. Thus, arrangements for regular follow-up surveys for soil erosion processes should be made. Funding of these activities should be included in the regular budget of the relevant institutions. Also, the relevant Government Institutions should explore the possibility that key stakeholders, (e.g. Farmers' Co-operatives) ensure monitoring of erosion/desertification processes through the sustainability indicators. A central database needs to be identified and accessibility of the data has to be guaranteed to the stakeholders.

I. INTRODUCTION: THE MAP CAMP MALTA PROJECT

I.1 Basic information

The Mediterranean Action Plan (MAP) is one of the regional plans of the Regional Seas Programme of the United Nations Environment Programme (UNEP). MAP started in 1975 as the first regional plan of the Regional Seas Programme and its legal basis is the Convention for the Protection of the Mediterranean Sea against Pollution (the Barcelona Convention) and its related protocols. The Convention was signed in 1975, entered in force in 1977 and revised in 1995. All Mediterranean coastal states, except one, are contracting parties to the Convention, are actively involved in the implementation of MAP and contribute to its funding.

After the revision of the Convention in 1995, MAP started its Phase II, based on MAP Phase II Action Plan and on Priority Fields of Activities for the environment and development in the Mediterranean basin (1996 - 2005). These priority fields are related to: (i) integration of environment and development, (ii) integrated management of natural resources, (iii) integrated management of coastal areas, (iv) activities of particular importance for environment protection and sustainable development, (v) assessment, prevention and control of marine pollution, and (vi) conservation of nature, landscape and sites.

The institutional structure of MAP consists of the MAP Coordinating Unit - MEDU in Athens, the Priority Actions Programme Regional Activity Centre - PAP/RAC (Split, Croatia), the Blue Plan Regional Activity Centre - BP/RAC (Sophie Antipolis, France), the Centre for the Specially Protected Areas - SPA/RAC (Tunis), the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea - REMPEC (Malta), the Environment Remote Sensing Centre - ERS/RAC (Scanzano, Italy) and the Centre for Clean Production - CP/RAC (Barcelona). In addition, MEDU is implementing the Mediterranean Pollution Monitoring and Control Programme - MEDPOL, while the respective actions related to health aspects are implemented by the WHO Project Office in Athens, associated with MEDPOL.

The activities of PAP/RAC are focused on the implementation in the region of the Integrated Coastal and Marine Area Management (ICAM) as well at the implementation of individual MAP CAMP projects. Within such a context, PAP/RAC is also implementing activities related to integrated water resource management, integrated coastal and river basin management, protection of soil, erosion management control, solid and liquid waste management and the application of tools and techniques for ICAM (land-use and sea-use planning, data management and GIS, EIA, Strategic Environmental Assessment - SEA, resource valuation, carrying capacity assessment for tourism activities). The training component and on - the - job training within the implementation of all PAP related activities and within the implementation of CAMP projects, make part of the regular PAP activities. Finally, PAP/RAC is contributing to the work and programme of the MAP Mediterranean Commission for Sustainable Development (MCSD).

The Coastal Area Management Programme (CAMP) is the MAP Programme for sustainable coastal management, which integrates environmental concerns into development planning. It is oriented at understanding and resolving practical environmental, development and management problems at local and national levels in Mediterranean coastal areas. The conceptual framework of CAMP is based on the principles of sustainable development and integrated coastal area management.

CAMP is implemented through selected individual projects, applying ICAM and selected methodologies and tools developed by other MAP RACs and programmes. Integration of project activities and the participatory approach are essential elements of each CAMP project.

CAMP as a MAP component has been established in 1989. So far CAMP projects were implemented in Albania, Croatia, Egypt, Greece, Israel, Tunisia and Turkey, while the projects for Syria, Lebanon and Slovenia are in preparation. Details on the implementation of a CAMP Project are given in the "Operational Manual for the Formulation and Implementation of CAMP Projects" (PAP/RAC, 1999).

The MAP CAMP Malta project has been approved by the Contracting Parties of the Barcelona Convention in 1993. Preparatory activities for the project started in 1996 with detailed preparation in 1998. The Project Agreement was signed in November 1999 and officially launched in February 2000, during an Inception Workshop. The objectives, concept, structure and the relevant institutional arrangements of the project were defined by the Project ToRs, which are an integral part of the Project Agreement.

The project area is the island of Malta, with particular focus to the Northwest. It is co-ordinated by the Environment Protection Department with the participation of other institutions, i.e. Ministry for Economic Services, Department of Agriculture, Department of Health, Economic Planning Division, Institute for Water Technology (Water Services Corporation), Planning Authority, University of Malta (Institute for Mediterranean Studies, Department of Biology) and National Statistics Office. Since public participation is an important aspect in this programme, environmental NGOs, such as Nature Trust (Malta) and Local councils were invited to be involved in this project from the very start.

I.2 The CAMP Malta project: objectives, structure and phasing

The objectives of the Project were defined in accordance with:

- priority needs as presented within the Diagnostic Analysis report (Grech & Tabone, 1998) and in the proposals of the Maltese institutions for individual Project activities, and
- general objectives of MAP and of its Coastal Area Management Programme.

The general objective of the Project is therefore to contribute to national efforts towards sustainable management and environment protection in Malta, whilst the immediate objectives are:

a) to identify and elaborate strategies, solutions, tools and actions contributing to a sustainable development, environment protection and rational utilization of coastal and marine resources of the island of Malta, focusing on the Northwest area;
b) to apply methodologies, tools and practices of sustainable coastal management and of Integrated Coastal and Marine Area Management (ICAM);
c) to contribute to the upgrading of national and local capacities for sustainable coastal management and protection of the environment;
d) to provide for use of project results and experiences, creating conditions for and implementing the post project activities as envisaged by the Project Agreement, and
e) to use the experiences and results achieved by the project in other areas at national and regional levels.

The strategy of the Project has been based on principles of sustainable development, applying the methodology of ICAM. The Malta Project has been implemented by national teams which were assisted by MAP experts and professionals. The integration of Project results was made jointly by the MAP team and the selected national experts. The post project activities (follow up, monitoring of implementation of the results and reporting) will be implemented by responsible national authorities and reported to MAP.

All results of individual and final integrated activities are targeted at:
a) environment/development related issues,
b) spatial aspects,
c) management/institutional aspects, and
d) follow up activities.

The project was structured in four segments, each segment encompassing various individual activities:
I. Co-ordination and functional activities: Integration and coordination, Data Management, Participatory programme, Systemic Sustainability Analysis;
II. Individual Project activities: Sustainable coastal management, Marine conservation areas, Integrated water resource management plan for the NW, Erosion/desertification control management, Tourism and health;
III. Integration of Project results: preparation of final project documents and database, and
IV. Post Project activities: formulation and implementation of follow up activities; monitoring, evaluation and reporting; use of project results at MAP level.

The phasing of the project implementation followed the standard ICAM procedure (UNEP, 1995) and the detailed description presented in the Manual (UNEP/MAP, 1999). Details on the Project, the integration and achievement indicators were presented in excerpts from the Project ToRs.

I.3. The Project area

I.3.1 The Maltese Islands

The Maltese Islands are a group of small islands located in the central Mediterranean. The archipelago consists of three inhabited islands - Malta, Gozo and Comino, and a number of small uninhabited islets and rocks. Geologically, the islands are composed almost entirely of marine sedimentary rocks, mainly limestone of Oligo-Miocene age, capped by minor Quaternary deposits of terrestrial origin.

Due to its geographical location, the Maltese Islands have a typical Mediterranean climate: hot, dry summers and mild, humid winters. The rainy season extends between September and March with the last rainfalls in April. The average annual rainfall is around 524mm and the temperature varies between 7ºC and 15ºC in January to between 25ºC and 35ºC in August. Projected changes in precipitation and temperature patterns induced by climate change phenomena may aggravate the present regime[1].

[1] Climate change models endorsed by IPCC concur that precipitation in central Mediterranean areas may not necessarily decrease but precipitation is expected to fall within a shorter period of time. This would mean that the intensity of rainfall would increase whilst the longer summer drought would place greater stress on natural vegetation area.

The five main rock types of the Islands are: Lower Coralline Limestone, Globigerina Limestone, subdivided into three units – Lower, Middle and Upper Globigerina Limestones, Blue Clay, Greensand and Upper Coralline Limestone. *In situ*, the Globigerina limestone, the Coralline limestones and Blue Clay strata are important in terms of the Island's natural water resources. Rainwater percolates through the porous limestone rock and accumulates in natural underground water reservoirs, the aquifers, which are the only natural freshwater source of the country.

Erosion of the different rock types gives Malta its characteristic topography. The Lower and Upper Coralline limestones form the sheer cliffs at the southwest side of the island; the karstic landscape is also a result of erosion by rain of the Coralline limestones. Globigerina limestone forms exposed rock formations.

Characteristic topographic features of importance are the *rdum*, *widien* (singular *wied*) and subsidence structures. *Rdum* are near vertical faces of rock formed either by erosion or by tectonic movements. Their bases are surrounded by screes of boulders eroded from the *rdum* edges.

Widien are drainage channels formed either by stream erosion during a previous much wetter climatic regime or by tectonism of by a combination of both. Most *widien* are now dry valleys, where water flows through the watercourse only during the wet season. A few valleys drain perennial springs and have some water flowing through them throughout the year (Schembri, 1997).

A system of ridges and valleys run between the major fault, i.e. the Great Fault of Malta. Block faulting north of the Great Fault gives rise to a sequence of horsts (ridges) and grabens (valleys) - the Bingemma Basin, Wardija ridge, Pwales valley, Bajda ridge, Mistra valley and Marfa ridge.

I.3.2 Northwest Malta

Mainland Malta was identified as the Project area but particular focus was given to the Northwest which is delineated according to the Local plan boundaries of the Planning Authority. The total area of 116.9km^2 extends from Wied Fulija (l/o Zurrieq) to Salini Bay (Fig.I.1).

The Northwest is characterised by a distinctive rural character and includes some of the most popular beaches and sites within the countryside for recreation. The cliffed headlands and secluded bays of the North give way to the continuously high cliff coast of Dingli with its secondary upper cliff rim and to the more broken cliffs, steep bare limestone escarpments and rocky inlets of ix-Xaqqa, Blue Grotto in the south. In some places such as Mtahleb, the upper cliff rim curves inland. Dingli cliffs, rising 250m from the sea, are often described as the culmination of the West's coast scenery.

The cliffs have an important natural historic and archaeological value, since they harbour the most important flora and fauna of the Islands. A large number of endemics as well as other species of biogeographical interest are found residing on the cliffs. The endemic species include the National Plant, the Maltese Rock-centaury *Palaeocyanus crassifolius* (Maltese Widnet il-Bahar), the salt-tree *Darniella melitensis* (Maltese Xebb) as well as the very rare snail *Lampedusa melitensis* (Maltese Bebbuxu). The coastal cliffs, sand dunes and saline marshlands occurring in the locality are protected under Section 46 of the Development Planning Act of 1992.

Mellieha, St Paul's Bay and Rabat are the three main settlements of Northwest Malta, where the former two are important residential, recreational and tourism areas while Rabat is predominantly residential. Apart from the main settlements there are a number of smaller settlements, most of which are closely associated with the agricultural activities in the surrounding countryside. The slopes are terraced and well cultivated giving a generally green fertile land. Maquis and groves of taller trees enhance this impression.

Traditional agricultural structures, which are of a high landscape quality, dominate in the Northwest. These include walled terraces occupying all but the steepest slopes of the escarpments, "widien" and coastal cliffs; corbelled stone field huts (Maltese giren) and the green of irrigated orchards and vineyards and their associated water tanks, reservoirs and wind pumps. The expansion of towns and villages, often through tourism-oriented development is however, steadily reducing the total area being farmed. A decrease in agricultural use was identified in the draft Northwest Local Plan (1996) as a serious threat to the character and quality of the Maltese landscape.

The Ghajn Tuffieha area has a high aesthetic value. Due to the presence of four sandy beaches, the area is highly frequented and subject to intense anthropogenic pressures which need to be managed with both ecological and recreational considerations. This stretch of land incorporates substantial stretches of karstland, boulder screes, agricultural land and clay slopes, which are prone to erosion accelerated by recreational pressures e.g. offroading.

I.3.3 The Pilot areas

Three pilot areas within the Northwest were chosen for a more detailed study. These pilot areas represented typical features of the Northwest, namely fields along the coastal fringe, terraced and flat lands and a valley system exhibiting typical slope processes.

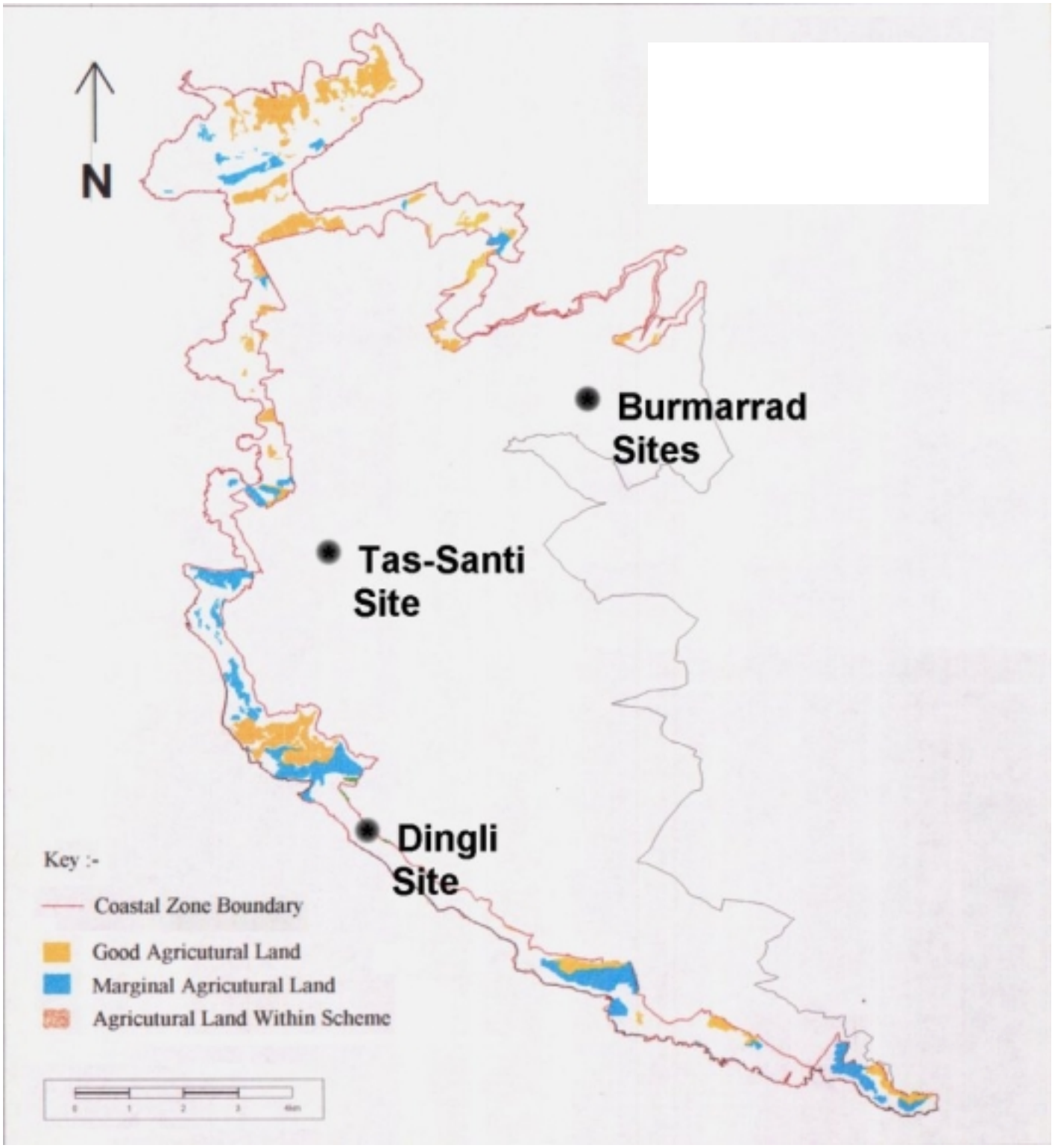


Fig. I.1. Northwest, Malta, showing the pilot areas

(i) Coastal Fringe

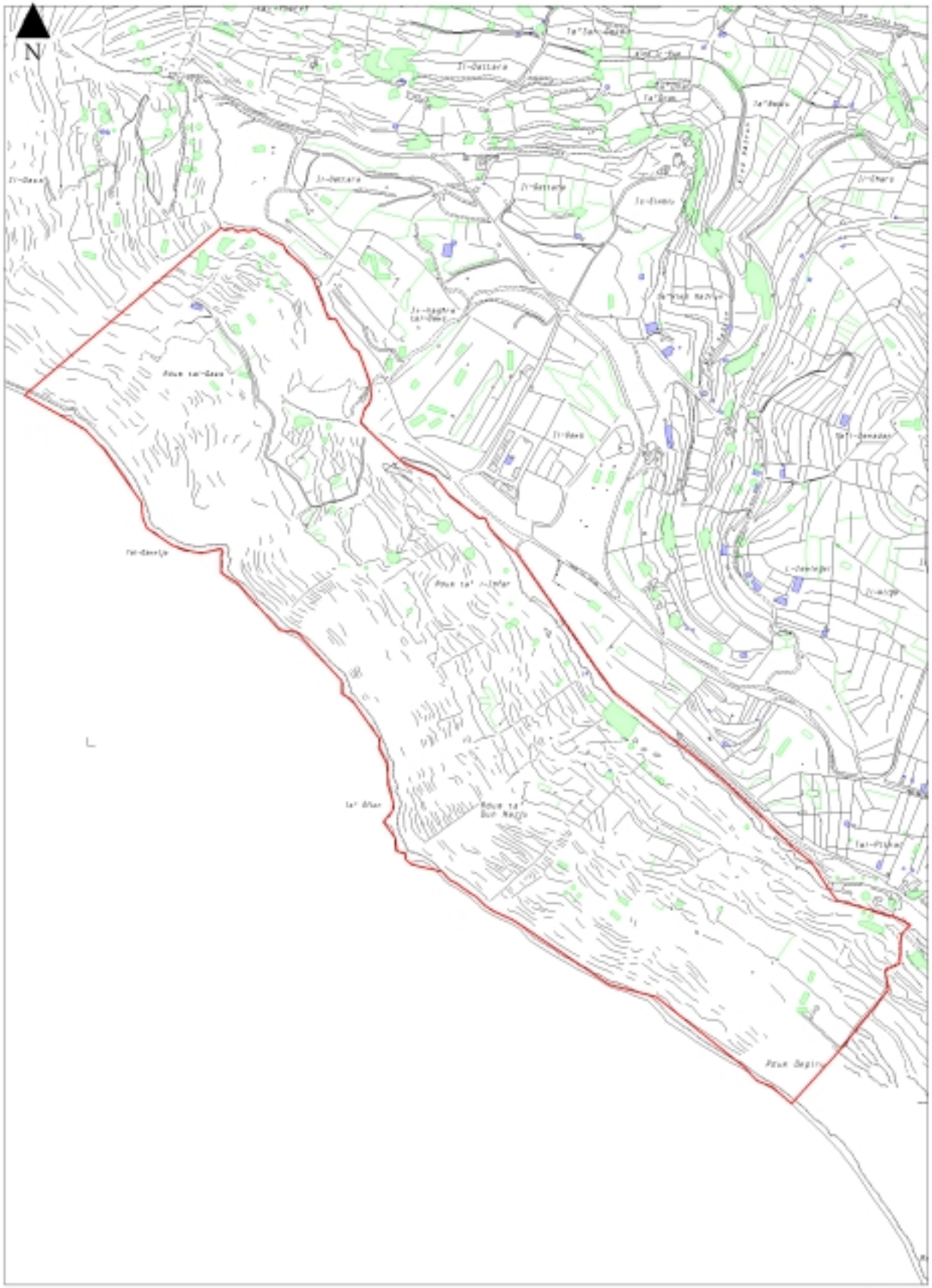
- Site A - Dingli Cliffs (Plate I.1 & Fig.I.2.)

The Rabat - Dingli plateau is situated at the Northwest coast of the Maltese Islands. The Western side of this plateau forms vertical cliffs which reach a depth of 120m in some places. The highest point of the Maltese Islands is in fact at Dingli cliffs, with a maximum height of 253m above sea level. The plateau surface is mainly composed of Upper Coralline Limestone, except for a portion in the centre and the fringes which have been eroded to the Blue Clay layer.

On the Blue Clay Layer of this plateau, there is very intensive agriculture, particularly since the clay rich soils tend to retain moisture and the area is supplied with water from springs above the Blue Clay Layer.

The pilot area consists of two steep parallel cliffs with a total area of 54 hectares. A belt of sloping land, approximately 200 – 300m wide, lies between these cliffs. Much of this land is cultivated for summer crops, due to the water retaining properties of the soil. To compensate for the slope and thus prevent soil erosion, most of these fields are terraced. The farmers store crops, such as onions, in the belt of caves at the top part of the cliffs.

Plate I.1. Dingli Cliffs pilot area



Title :
Site Plan for Dingli

Scale :
1:5,200

Date :
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

(ii) Terraced and flat lands

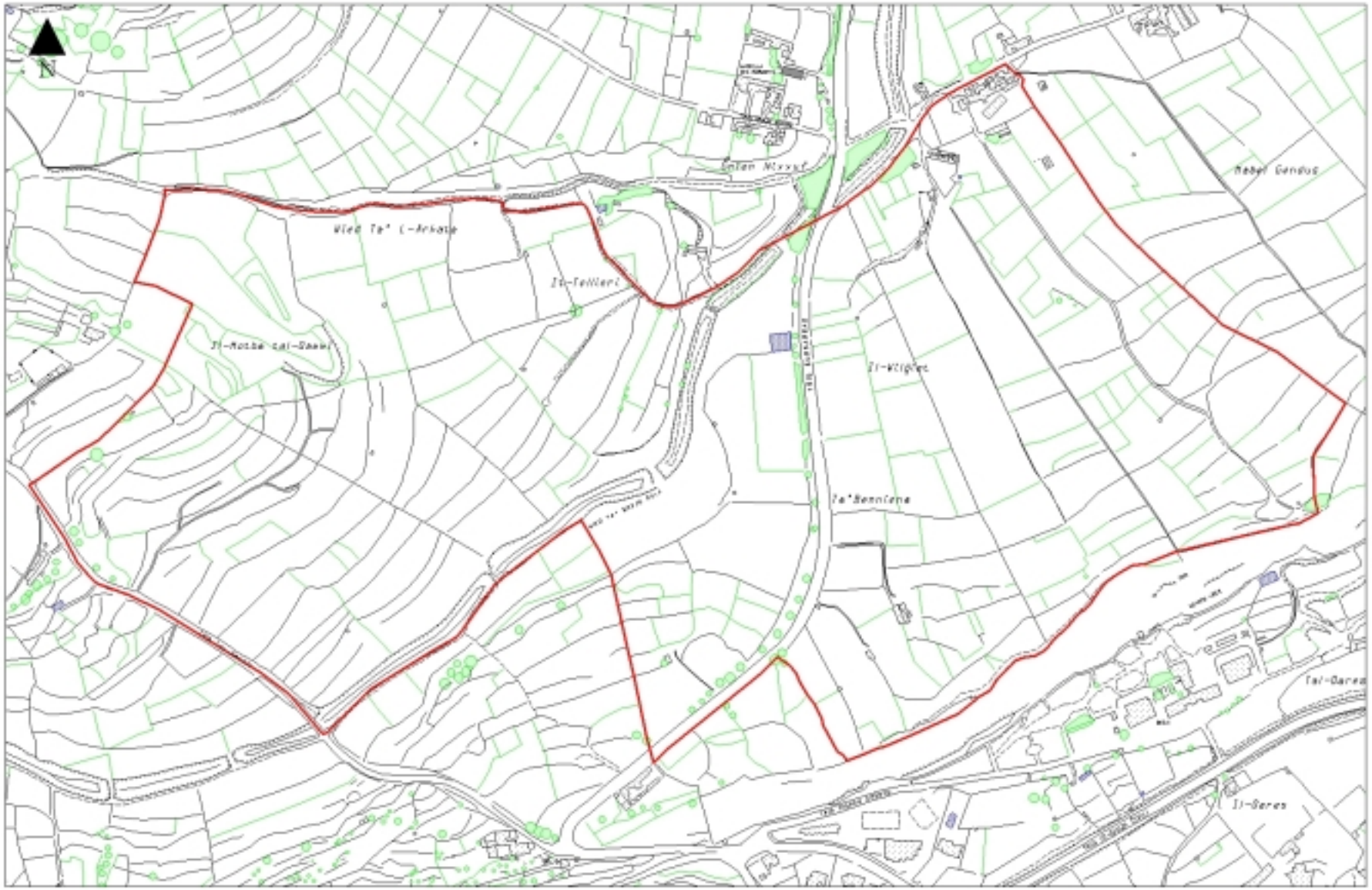
- Site B – Burmarrad, l/o Mosta (Plate I.2 & Fig.I.3.)

This is the region on the northern part of the Island and consists of flat-topped ridges and flat-bottomed valleys. The pilot area is situated along the Great Fault. This area consists of sloping terraced land on the western side and a comparatively plain area on the eastern side. This site is, in fact, for convenience, divided into two areas: Burmarrad west where there is located the sloping fields and Burmarrad east, the flat plain beneath. The Wied ta' Ghajn Mula separates these two areas.

The land here is very fertile due to silt and soil deposited from the valleys upstream. It is also well cultivated, with cereals, tomatoes, marrow and melons often being grown under plastic tunnels.

The Burmarrad area is also greatly affected by urbanisation (the neighbouring Mosta and Naxxar and the village of Bidnija which lies to the Northwest of the site). Soils in the area are threatened by the close proximity of the lower fields to salt water intrusions in the sea level aquifer. In fact, soil salinisation is a very real problem in the area.

Plate I.2. Burmarrad, l/o Mosta



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Site Plan for Burmarrad, l/o Mosta

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Date:
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

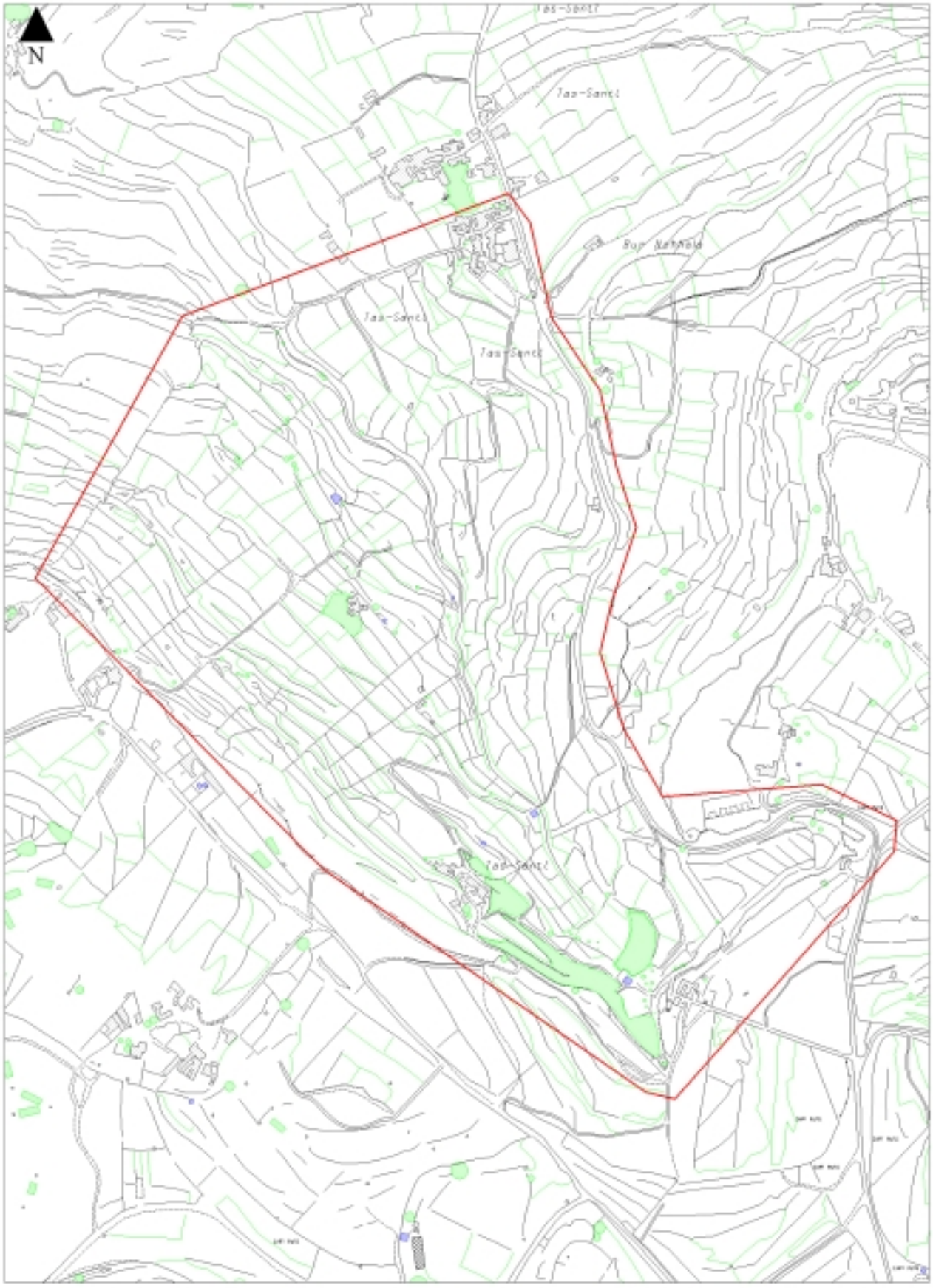
(iii) Valley systems

- Site C - Tas-Santi Valley, l/o Mgarr (Plate I.3 & Fig.I.4)

Tas-Santi valley is typical of a series of valleys which cut into the Southeast horst platform of the Great Fault. Tas-Santi Valley is situated Southwest of the small agricultural village of Mgarr. It is mainly composed of Blue Clay and this attains a considerable depth near to the valley bottom and on the eastern valley sides. In fact, in these areas carbonate raw soil is widespread. On the western sides of the valley terrarossa is dominant. The large embayment and the steep valley sides provide the valley bed with freshwater flowing down from numerous natural springs. Terracing is widespread within this valley, especially on the steeper western valley sides.

The pilot area consists of a wide V-shaped valley forming part of the system of valleys found along the Great Fault. It reaches a maximum height of 220m on the western side of the valley while the valley bottom reaches a height of about 150m. Agriculture is quite intensive in the area and land can be described as being highly productive.

Plate I.3. Tas-Santi valley, l/o Mgarr



Title :
Site Plan for Tas-Santi, l/o Mgarr

Scale :
1:3,700

Date :
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

II. THE PROBLEM: EROSION/DESERTIFICATION IN MALTA

II.1. The Desertification Issue

Desertification has been defined in the UN Convention to Combat Desertification (UNCCD) as '*the degradation of land in arid, semi-arid and dry sub-humid areas caused by climatic changes and human activities*' (UNCCD, 1997). In very simple words, while degradation represents the sickness of the land, desertification denotes its death and is often irreversible within human time frames.

Soil erosion has been accepted to be the direct mechanism of desertification (PAP/RAC, 1997). Soil is a precious resource that takes thousands of years to form but is lost forever through erosion, e.g. during heavy storms large amounts of soil are carried downstream into the sea where they are deposited. Gullies and rills (Plate II.1) are visual indicators of severe soil erosion. Sheet wash, on the other hand, is less obvious but more selective (Plate II.2). It tends to remove the uppermost organic matter horizon (O horizon) thus resulting in the reduction of soil fertility, while gradually decreasing the finer particles in the soil.

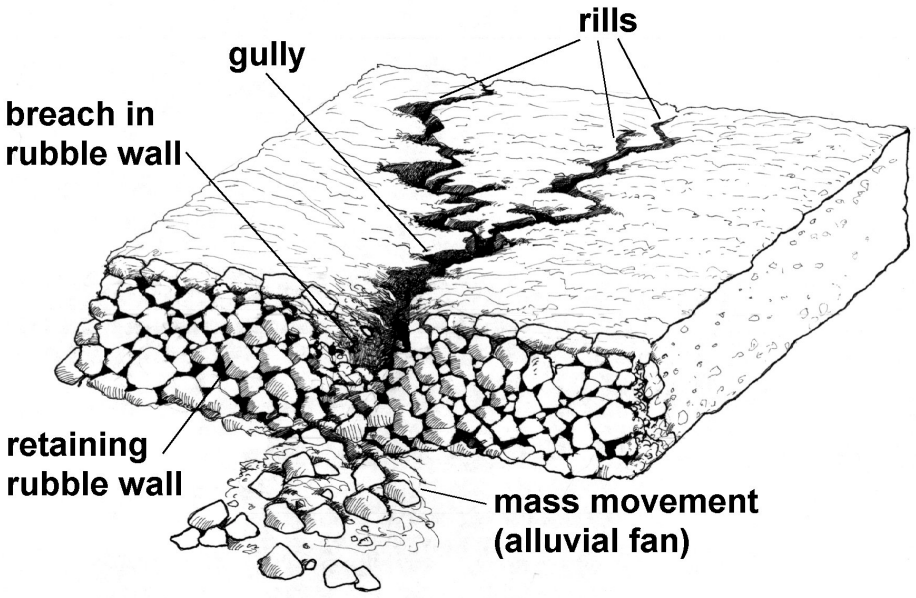


Plate II.1. Rill and gully erosion

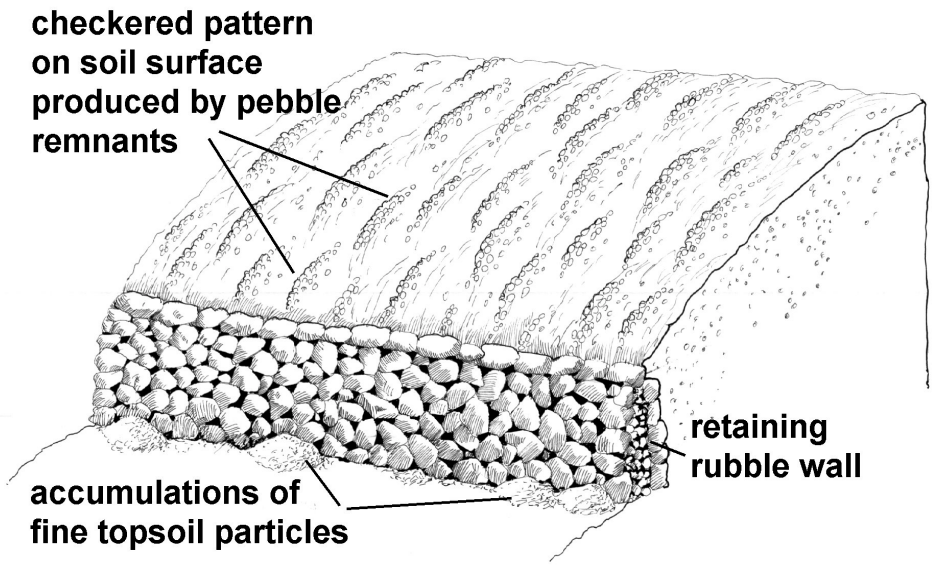


Plate II.2. Sheetwash

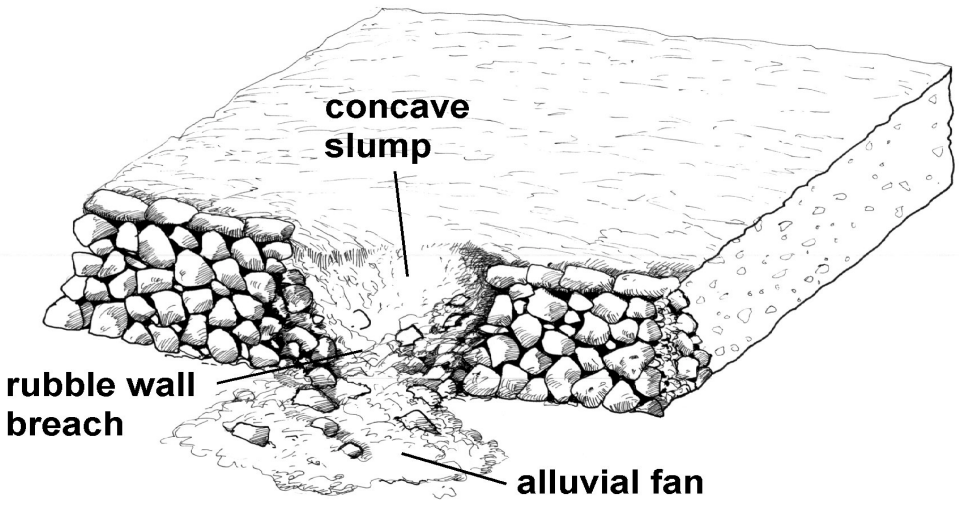


Plate II.3. Breaches in retaining rubble walls, leading to slumping

Human processes also contribute to soil erosion and are responsible for widespread desertification throughout the Mediterranean region. The Maltese Islands are no exception (Table II.1).

Urbanisation, tourism and industrialisation. In the past 50 years much land has been lost or become highly degraded as a direct or indirect result of urbanisation and infrastructural development. Whereas in 1910 less than 6% of the Maltese Islands were inhabited, in 1991 the figure rose to 21% (Report of Survey, 1991). Also, the immense human pressure on available resources is being created by the over one million tourists visiting the islands every year. Urbanisation, touristic and industrial development has been accompanied by the increase in the length of roads on the Islands, approximately 1500 km in 1987 (Report of Survey, 1991).

Quarrying. Many hardstone quarries are situated in ecologically sensitive areas (e.g. valleys and cliffs) with the result that both the activity itself and its by-products, such as dust and waste material, are increasing land degradation.

Landfilling and waste disposal. The Maghtab landfill (together with all unofficial dumping sites) are leading to severe pollution and degradation of soil and groundwater resources.

Overexploitation of freshwater resources. The excessive abstraction of groundwater for irrigation and domestic use from the Mean Sea Level Aquifer has led to saltwater intrusion in many parts of this aquifer. The result is irrigation with brackish water and progressive soil salinization which has adverse long term effects on soil productivity.

Deforestation and overgrazing. These two practices have had a long lasting impact on the landscape of the Maltese islands. Throughout their history deforestation has led to severe soil losses in many areas while overgrazing, especially on marginal land, has had a similar effect, resulting in large quantities of soil loss.

Land abandonment. More and more land is being abandoned, especially the more marginal, smaller-sized fields. This is resulting in rapid soil loss due to rubble wall collapse.

Increased use of pesticides and fertilisers. The decrease in land available for agriculture and the ever increasing price of land means that farmers must work the fields more intensely in order to be economically viable. This leads to the use of excessive amounts of pesticides and fertilisers with a consequent negative effect on soil productivity and harmful effects on freshwater resources. A high percentage of agriculture in Malta is oriented towards market gardening - supplying the local urban market with fresh vegetables. This is very intensive in character and often involves high capital expenditure such as irrigation networks.

Soil erosion in the Maltese Islands has been recognised as a problem and a major threat to the sustainability of the agricultural sector. Despite this, there have been very few, if any, attempts to appropriately address and mitigate for this widespread problem on a national level. However, individual farmers using their own limited resources, manpower and time have tried to tackle the problem, e.g. digging culverts in their fields to drain excess water.

Rural	Recreational	Industrial	Suburban	Urban
Land Speculation due to expanding urbanisation	Summer residences accelerate urban expansion	Municipal dumps / landfills	By-pass development	Inner city degraded green areas
Fragmentation of land holdings – inheritances	Tourist holiday apartments accelerate urban growth	Clearing of *Posidonia* and "beach cleaning" activity create unofficial dumps	Badly located government-owned housing estates	Public recreational sites turned into rubbish dumps
Insecurity of land tenure prohibiting investment	Seaside squatter "shanty" towns occupy agric. Land	Derelict factories and industrial estates	Development of golf courses	Vacant plots - vestiges of green
Over-protection of tenant farmers prohibiting share-cropping	*De facto* parking areas take up abandoned/fallow agric. Land	Derelict fortifications and barracks	Vacant plots awaiting re-zoning or in inheritance disputes	
Lack of land-based system of effective taxation (e.g. rates)	Boat houses accelerate coastal urban growth	Derelict airfields and airstrips	Dumping of building spoil and rubble	
New Job opportunities in industry instead of agriculture	Bird trappers (mansab) and shooters' clear field of fire	Derelict and active quarries	Laying down of sewage lines/infrastructural services through agricultural fields	
Church-owned lands lying idle or appropriated by third parties	Picnic areas and degraded barbecue sites	Batching plants		
Field Abandonment	Off-road activities	Fireworks factories		
Part-time farming discouraged by pilfering of produce		*De facto* (illegal) industrial estates		
Collapsed rubble walls, soil erosion and pollution		Scrap yards		

Table II.1. A classification of land degradation factors in the Maltese Islands (Role', IN *Land Degradation as a Product of Urbanisation in an Island State;* National Awareness Seminar on Desertification and Land Degradation, 1998)

II.2. Justification of the Erosion/desertification control management activity

The Project activity dealt with the environmental problem of desertification by addressing urgent land degradation processes which are resulting in significant negative impacts on the environment, biodiversity, socio-economic conditions and agricultural potential of the Maltese Islands.

The Government of Malta took measures towards soil conservation and control of desertification through the ratification of the United Nations Convention to Combat Desertification. Following this, a National awareness seminar on desertification and land degradation was organised in June 1998 by the Environment Protection Department in collaboration with the Multilateral Affairs Department (Ministry of Foreign Affairs) and the Interim UNCCD Secretariat (Baldacchino & Tanti, 1999).

In October 1996, an official from the Department of Agriculture attended a workshop to discuss draft "Guidelines on Mapping and Measurement of Erosion Processes in the Mediterranean Coastal Areas", organised by PAP/RAC in co-operation with FAO.

This was followed by another workshop on "Guidelines for Mapping and Measurement of Rainfall-induced erosion processes in the Mediterranean coastal areas", also organised by PAP/RAC in collaboration with FAO and Spanish Authorities. A representative from the Environment Protection Department and from the Department of Agriculture, attended. During this workshop, assistance for carrying out soil erosion mapping in Malta under the PAP/FAO project of mapping and measurement of erosion processes was asked. A technical report "Soil erosion assessment and mapping in Malta" (Tanti, 1998) was drawn up and presented to PAP/RAC for further justification of assistance.

In May 1998, a national training course on "Guidelines for Mapping and Measurement of Rainfall-induced erosion processes in the Mediterranean coastal areas" was organised by the Environment Protection Department where two senior consultants, from PAP/RAC and FAO provided their services. Representatives from the Environment Protection Department, Planning Authority, Department of Agriculture and University of Malta participated in this training course.

As the erosion/desertification problem was thus perceived as a main priority for Malta, the respective activity component was included in the CAMP Malta Project. The growing impact of erosion processes and the risk of desertification as well as the present experience in the depletion of natural resources make it mandatory to consider erosion and desertification control management in the efforts for sustainable coastal area management in Malta.

III. AIMS/OBJECTIVES OF THE INDIVIDUAL PROJECT ACTIVITY 'EROSION/DESERTIFICATION CONTROL MANAGEMENT'

The general objective of the project activity consisted in contributing to the national efforts towards sustainable management and environment protection in Malta, which was achieved by

- undertaking and completing systematic erosion/desertification surveys and mapping activities at different levels by means of the newly consolidated FAO/PAP methodology for the cartographic assessment of both actual and potential erosion balance;
- preparing erosion/desertification control management and planning schemes at different levels providing remedial measure proposals and conservation/rehabilitation/protection recommendations for the implementation of global and site specific actions;
- contributing to the protection, rehabilitation and rational exploitation of the limited soil resources, scenic beauty and bio-diversity, by applying updated and adapted erosion/desertification control management strategies and techniques.

The specific activity objectives were:

- to identify, assess and process basic reference available data, maps, technical reports and statistics;
- to prepare adequate thematic working documents to clearly identify and assess all factors and parameters participating in erosion/desertification processes;
- to assess and integrate all relevant factors and components (by the means of GIS and matrices overlay procedures) in view to define overall Erosion status of the pilot areas;
- to prepare and restructure the Erosion Status map to be used as a basic mapping canvas and support for site-descriptive erosion mapping procedure of the pilot areas;
- to make available a clear cartographic statement/balance of global erosion status and site-specific actual erosion damages/potential risks/stable areas;
- to integrate physical and socio-economic parameters for the diagnostic analysis procedure;
- to elaborate final cartographic and statistic documentation on the state of erosion/desertification (actual and potential) as a basic reference for the formulation of remedial measures;
- to prepare and finalise the synthesis map and the final set of remedial measures, priorities and technical implementation recommendations;
- to lay the foundations for strategy development and action frameworks;
- to contribute to capacity building for erosion and desertification control management.

IV. CONCEPTUAL FRAMEWORK

IV.1 Procedure for integrated erosion/desertification control management

The activity was implemented by applying the basic conceptual approach of the new consolidated erosion mapping and assessing methodological procedure which is defined in the "Guidelines for Erosion and Desertification Control Management with particular reference to Mediterranean Coastal Areas" (UNEP/MAP/PAP, 2000) (Fig.IV.1).

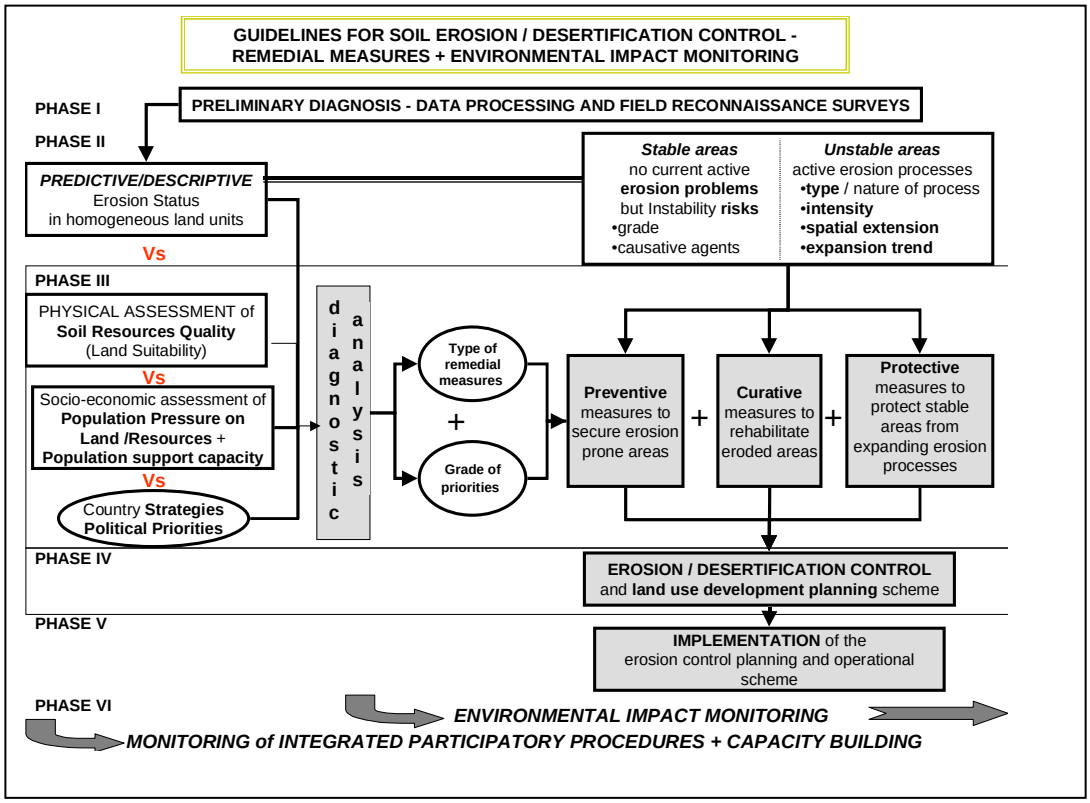


Fig. IV.1. Integrated erosion/desertification control management procedure (UNEP/MAP/PAP, 2000)

The overall framework consisted of a logistical sequence of phases of specific integrated activities:

i. Phases I and II: Diagnostic analysis, erosion mapping, data processing, preparation of sectoral working documents;
ii. Phase III: Integration of the mapping outputs with socio-economic/land use features, identification of priority areas, formulation of remedial measures;
iii. Phase IV: Formulation of the strategy and of the programme for management of erosion/desertification control;
iv. Phase V: Implementation of the management programme;
v. Phase VI: Post implementation activities, environmental impact monitoring, evaluation, reporting, and readjusting, if needed.

An interactive participatory approach was considered as a pre-requisite for the proper determination of priority areas and elaboration of sustainable remedial options. Therefore, emphasis was placed on formal and informal contacts with the key stakeholders. This was also in accordance with the public participatory programme within the CAMP Project.

IV.2. Methodology

The main techniques applied during the implementation of this activities included:

- the general methodological framework of MAP CAMP projects, as presented in the Operational Manual (PAP/UNEP, 2000) and in the Project Inception Report (PAP/EPD, 2000);
- the common consolidated UNEP/MAP/PAP mapping methodology;
- the UNEP/MAP/PAP erosion control management methodology and procedure
- photo-interpretation;
- digitisation into a GIS (MapInfo)

Special emphasis was given to place this activity in line with other on-going related projects. This was achieved through the participation in international training courses/workshops/conferences (Annex 3) as well as establishing a contact with relevant international/national institutions.

International policy links were kept with:

(i) general policies and principles of sustainable development, Agenda 21 and Agenda 21 for the Mediterranean,

(ii) the Global Programme of Action for the Protection of the Marine Environment against Land - based Sources of Pollution,

(iii) the revised Barcelona Convention, MAP Phase II document and the MAP Priority Fields of Action for the 1996 - 2005 period,

(iv) principles and policies of MAP CAMP,

(v) MAP policies implemented and experience achieved during the hitherto implementation of MAP RACs and MEDPOL activities.

During the implementation of this activity, Malta was undertaking the screening process for accession to the EU. In view of this, correspondence with EU-related projects, such as the European Commission DGXII Archaeomedes Research programme and the European Environment Agency (working on indicators for soil sealing and soil erosion) was kept.

Furthermore, contacts were enhanced by the active participation to workshops, such as the MedStat Environment Project (MedStat, 2001), Management Strategies to mitigate drought in the Mediterranean: monitoring, risk analysis and contingency planning (Morocco, 2001).

National policies and planning instruments (i.e. Structure Plan for the Maltese Islands, draft Northwest Local Plan) were also assessed vis-à-vis land degradation and soil erosion and main issues were considered in the activity.

The activity was also linked to the integration of results at the Project level (i.e. preparation of the Final integrated Project document and database, the Follow up proposals, and the Urgent Investment Portfolio), as well as the established procedures for the harmonisation and co-ordination of individual project activities.

IV.3. Integration of results

The results of this activity are directly linked:

- at national level with the adoption of Follow up Proposals by the responsible national and local authorities and the formulation of the Follow up Programme and its gradual implementation,
- at regional level by:
  - (i) reporting of the project results, applicable in the region to MAP and to the Mediterranean Commission for Sustainable Development,
  - (ii) applying the project results, as appropriate in ongoing and future MAP CAMP projects,
- at wider/higher levels, by disseminating, as appropriate, the project results:
  - (i) interested UN agencies and international organisations,
  - (ii) at the EU level,
  - (iii) through UNEP to other regional areas.

The Erosion/desertification control management activity was implemented in a harmonised way and in close co-operation with the Data management, the Participatory programme, Systemic sustainability analysis, Sustainable coastal management and Water resource management activities as envisaged in the Activity's Technical Specifications.

The activity used the basic data and information prepared by the Data management team and within each phase the produced outputs were presented to the Data management team and other activities where and as appropriate.

The project activity also took into account and used as appropriate the results and inputs provided by the Systemic sustainability analysis, and provided inputs to this activity, as possible and appropriate.

The National Team Leader was responsible for securing the above-described communication, links and integration. In doing so, the horizontal liaison was secured by coordination and communication with other National Team Leaders, and with the MAP Team leader for this activity, while the vertical liaison was implemented through communication with the National Project Co-ordinator and when required with the PAP/MAP Project Coordinator.

V. IMPLEMENTED ACTIVITIES

The project activity was implemented in three main phases:
- Phase I: Preliminary Analysis/processing/interpretation
- Phase II: Erosion mapping/surveying at different levels
- Phase III: Final synthesis and remedial recommendations.

The general sequence of actions consisted of eight sub-programs of specific activities as described below.

V.1. Basic technical data and information (Inventory of physical and socio-economic factors leading to natural resources degradation)

(i) Inventory of basic information and data

Following the compilation of the available data and information related to soil erosion/desertification, the adequate maps, aerial photographs and statistical data were identified and procured.

(ii) Preliminary data processing

Different base maps at varying scales were used for the mapping surveys. The baseline map and its scale depended on the mapping exercise, thereby ensuring appropriate working scales for the field surveys (*vide* Chapter X V2).

(iii) Elaboration of thematic working documents and data

An analysis of the trends for specific issues, such as land tenure and climate change was produced (based on the initial inventory of the statistical data).

In Malta, steep sloping ground is characteristically terraced in order to mitigate the effects of slope and prevent soil loss. Therefore, a thematic map for the state of condition of terraces in the Northwest was produced and included in the GIS matrix. The base map used for the mapping of the state of rubble walls consisted of a 10m contour map, with the boundary for the Northwest, pilot areas, water courses and built up areas delineated. The working scale of this map was 1:50,000.

V.2 Development of a soil erosion/desertification control management GIS

(i) Field surveys

1.Site descriptive erosion processes identification and mapping

Field surveys were conducted in the three pilot areas by the application of the legend given in the UNEP/MAP/PAP Guidelines for mapping and measurement of rainfall-induced erosion processes in the Mediterranean coastal areas [2].

[2] Reference to this document from this point onwards will be given as Guidelines for convenience sake.

This involved the identification of stable, non-erosion-affected areas and unstable areas (with predominating erosion processes and expansion trends) as well as the main geomorphic features. The field work was carried out between October 2000 and March 2001.

During the field surveys, informal discussions with farmers and other land-users were carried out. The information gained through these discussions was a major asset for the initial determination of trends for the integration of socio-economic parameters (*vide* Chapter VI.6).

The base map used in the erosion status mapping exercise was a land use/habitats map (containing topographical features such as cliff lines), with field boundaries, watercourses, settlements and roads. A base map for each of the three pilot areas was employed at a working scale of 1:2,500. As a first step broad geographical units were identified and delineated.

The legend given in the Guidelines was used to establish the erosion status for the pilot sites. The actual erosion features, namely rills, gullies, sheetwash and mass movements were also mapped.

2. Level of soil protection management

Moreover, an assessment of the relative state of repair of the rubble walls in the NW was carried out through a series of field sessions. This survey also took into consideration the identification of remnants of visually old rubble walls and the identification of the location of terraces which contained no obvious retaining rubble walls. The results were digitised to produce another thematic map (*vide* Chapter VI.3)

3. Final soil erosion risk map for Northwest Malta

The methodology followed was that of the Guidelines. However due to specific local topography and management, the Guidelines were adapted. Justification for this departure is also given (*vide* below).

The basic carthographic outputs used for the production of the erodibility map were the slope (derived from a high resolution Digital Elevation Model) and geology (digitised from hard copies published at a scale of 1: 25,000 maps for the Northwest. These overlays were prepared and modified according to Tables 1.2 and 1.3 in the Guidelines (*vide* Annex 4).

Different shades of red were chosen to depict different slope classes, starting from transparent where slopes are flat and increasing the intensity of the colour to red where slopes are extreme (*vide* Annex 4).

In order to elaborate the lithofacies map, the geology map for the Northwest (1:25,000) was converted into a vector map. The legend given in Table 1.3 was adapted as given in Table V.1 (*vide* Annex 4).

The polygons resulting from the overlaying of the slope and lithofacies map were classified according to the matrix as given in Table 1.4 of the PAP/FAO Guidelines (*vide* Annex 4).

The unavailability of a vegetation cover map for Malta (and the NW) effectively halted further development in the production of the level of soil protection map as indicated in the Guidelines. Vegetation cover in the Maltese Islands is minimal and is only significant in very small forested areas such as Buskett.

The general scheme for superposition of the various layers is given in Fig. V.1.

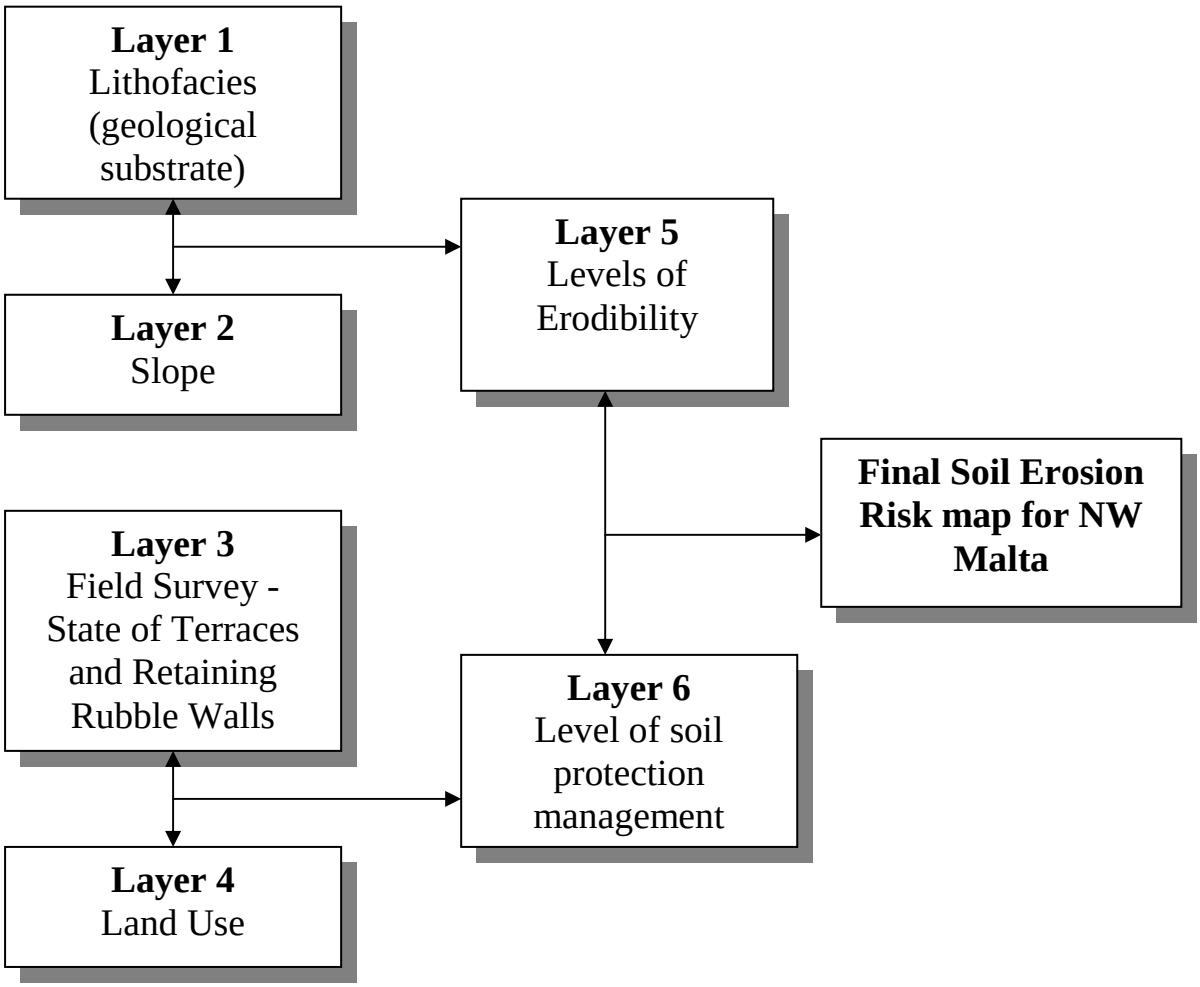


Fig. V.1. Scheme of overlays for the production of the final erosion risk map, NW, Malta (adapted from UNEP/FAO Guidelines, 1999)

Layer 1 (Fig.V.2) is the lithofacies layer. Maltese geological stratigraphy is relatively simple and lends itself readily to the classification. Both the Upper as well as the Lower Coralline Limestones were categorised as (a) since they are composed of dense crystalline limestones which are relatively resistant to erosion. The Globigerina stratum and its various subdivisions were categorised as (c) and (d) largely due to the fact that these strata are prone to chemical weathering by solution despite the fact that they are fine jointed; often presenting relatively homogeneous erosion surfaces. The Blue Clay stratum and associated thin outcrops of Greensand were classified as (e). Both of these strata are extremely friable and erode easily thus contributing extensively to the formation of Maltese soils.

Lithofacies classes	Corresponding rock type in Malta[3]	Description
(a) [4]	Upper Coralline Limestone formation & Lower Coralline Limestone formation	**Upper Coralline Limestone** consists of hard, pale-grey carbonates, pale grey and brownish grey coarse grained wackestones and packstones and massive to thickly bedded carbonate mudstones and wackestones, yellow in their lower levels and unconformable upon greensand in western outcrops. **Lower Coralline Limestone** consisting of tabular beds of pale-cream to pale-grey carbonate mudstones, wackstones and packstones, planar to cross-stratified, coarse grained limestones with abundant coralline algal fragments. The member is best developed in a North-South zone extending from Wied iz-Zurrieq to St Andrews. A marked erosion surface separates the member from overalying Globigerina limestone member in West Malta.
(c)	Globigerina Limestone Formation i. Middle Globigerina Limestone Member **Mmg** ii. Lower Globigerina Limestone Member **Mlg**	**Mmg**- A planktonic foraminifera-rich sequence of massive, white soft carbonate mudstones locally passing into pale-grey marl mudstones. The base of the formation is unconformable upon Lower Globigerina limestone member. Thickness 15-38m. **Mlg** – Pale cream to yellow planktonic foraminiferal packstones rapidly becoming wackestones above the base. Glauconite is common in western outcrops south of Fomm ir-Rih. The top of the member is marked by a ubiquitous hard ground, which is phosphatised in western areas. Thickness 0-50m.
(d)	Upper Globigerina Limestone member **Mug**	A tripartite, fine grained planktonic foraminiferal limestone sequence of a lower cream coloured wackestone, a central pale grey marl and an upper pale cream coloured wackestone. It is conformable in eastern outcrops but lies above a hard and erosion surface in eastern areas. Thickness 8-26m.
(e)	Blue Clay formation **Mbc**	Medium grey and soft, pelagic marls, typically with well developed pale bands rich in planktonic foraminifera but lower clay content. Thickest deposits are in coastal sections from Ghajn Tuffieha to Dingli in NW Malta. Thickness 15-75m.

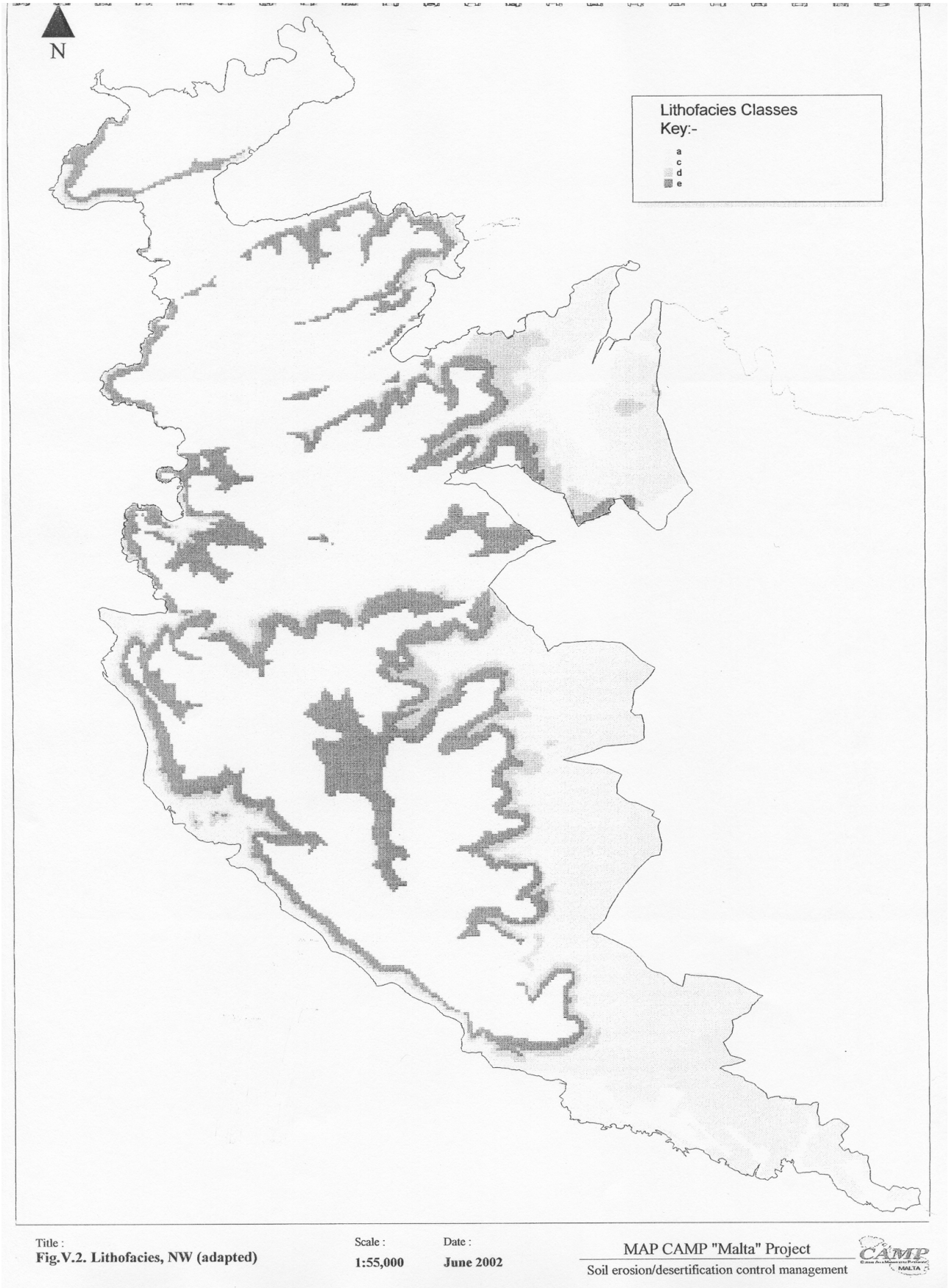
Table V.1. Modified lithofacies classes

It must be stressed, however, that the classification is not based on the suitability of geological strata as parent material for soil production but, rather, on their structural properties in terms of resistance to subsequent soil erosion.

Although a soil taxonomy map is available for Malta (Lang, 1960), this was not taken into consideration during the mapping procedure. It is rather dated and the azonal characteristics of many Maltese soils renders its utility somewhat limited. Furthermore, this map is not available in digitised format.

[3] Greensand horizontal outcrops in Malta are extremely rare. The main role of greensand in soil development is the production of eroded material to augment a soil body. In addition, the erosion of a greensand layer contributes significantly to the undercutting of upper coralline limestone.

[4] There is no distinction between fractured weathered rocks/soil and non-weathered compact rock.



Title :
Fig.V.2. Lithofacies, NW (adapted)

Scale :
1:55,000

Date :
June 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

Layer 2 (Fig.V.3) defines slope and was derived from the standard digital elevation model for the Maltese Islands. Some further elaboration was necessary before the slope layer could be utilised within the Soil Erosion GIS. A raster image was created with a particular value of slope for each pixel. These values were then categorised according to the Guidelines. Due to the difficulties encountered while working on particularly high resolutions, a 50m pixel size was eventually chosen.

Layer 3 (*vide* Fig. VI.5) is the field-derived map. The compilation of this map is discussed in detail in Chapter VI (*vide* Chapter XVIII. VI.2).

Layer 4 is a standard land-use map. Urban areas and other sealed surfaces were delineated. Delineation of wooded areas and field units also proved useful. However, garigue and abandoned terraced fields were not delineated, since the field data transcended the classification employed in the Land Use map. In many cases, terraces and remnants of rubble walls were present in fields which were obviously abandoned. The distinction between irrigated and non-irrigated fields is not given. This would have been impossible to interpret from a single set of aerial photos.

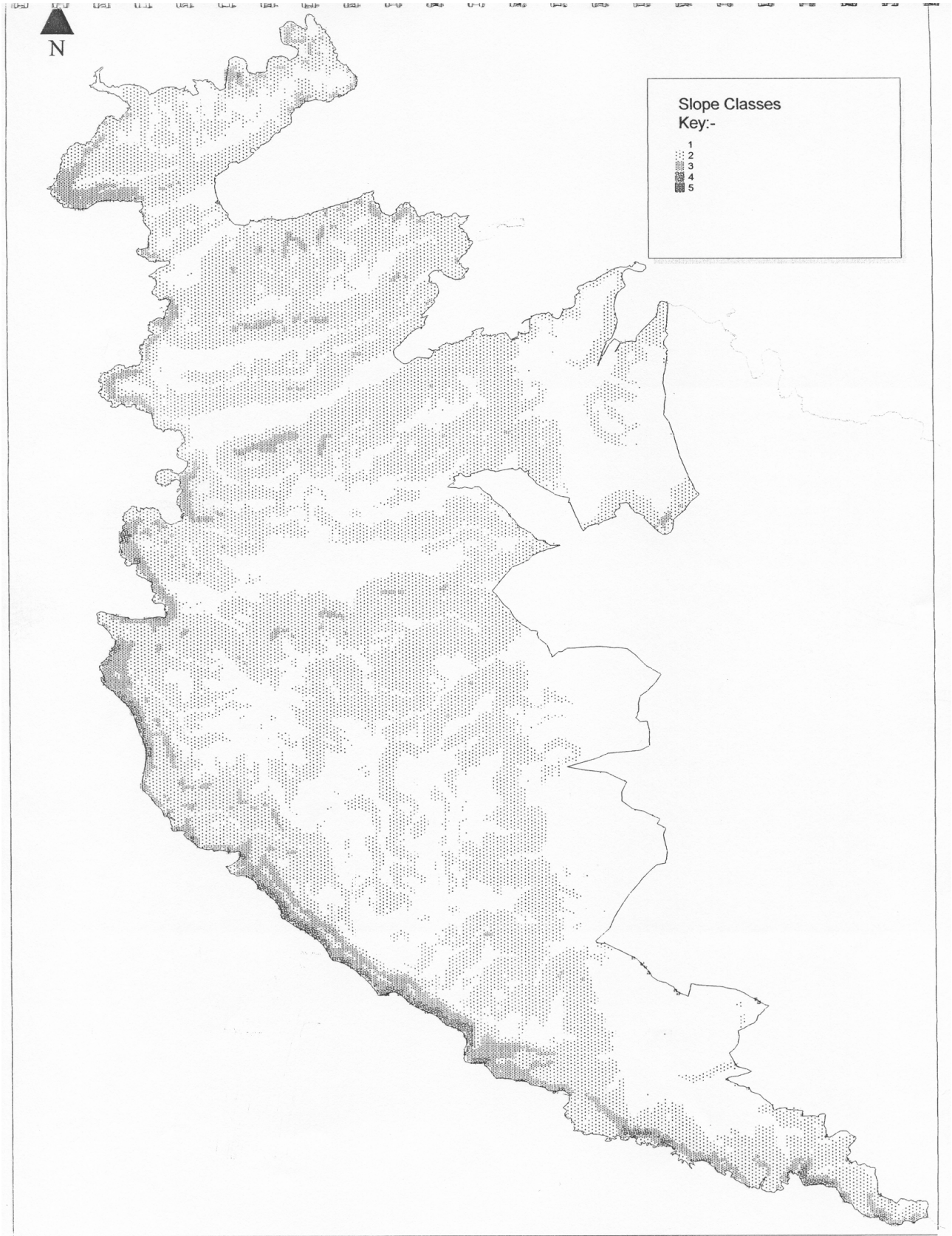
Most fields are rain fed all year round whilst some crops are semi-irrigated (e.g. early potato crops which are supplied with water shortly after sowing in anticipation of the Autumn rains). On the other hand, permanently irrigated areas are supplied with an almost year round supply of fresh water from springs, reservoir or boreholes.

True forests are inexistent in Malta, where wooded areas are limited to a few small scale re-afforestation schemes, such as Buskett, Mizieb and Marfa ridge. The otherwise dry schlerophyllous forest typical of the Islands has a canopy cover ranging from 35% to 60% at its best.

Furthermore, important and most common natural habitat types in Malta are the garigue, steppe and maquis. Garigue develops on large expanses of limestone bearing numerous depressions and fissures and is characterised by dense, low-growing herbaceous plants.

Steppe (includes also rocky steppe and clay slope steppe) is characterised by grasses, geophytes and herbaceous plants, while the maquis habitat is characterised by small trees and shrubs. Maquis is typically found in inaccessible areas and in areas considered to be too marginal for agricultural use. Such areas are often located on the sides and bottoms of valleys and at the base of cliff formations.

Layer 5 (Fig.V.4) is the Level of Erodibility map (*vide* above).



Title :
Fig.V.3. Slope map, NW (adapted)

Scale :
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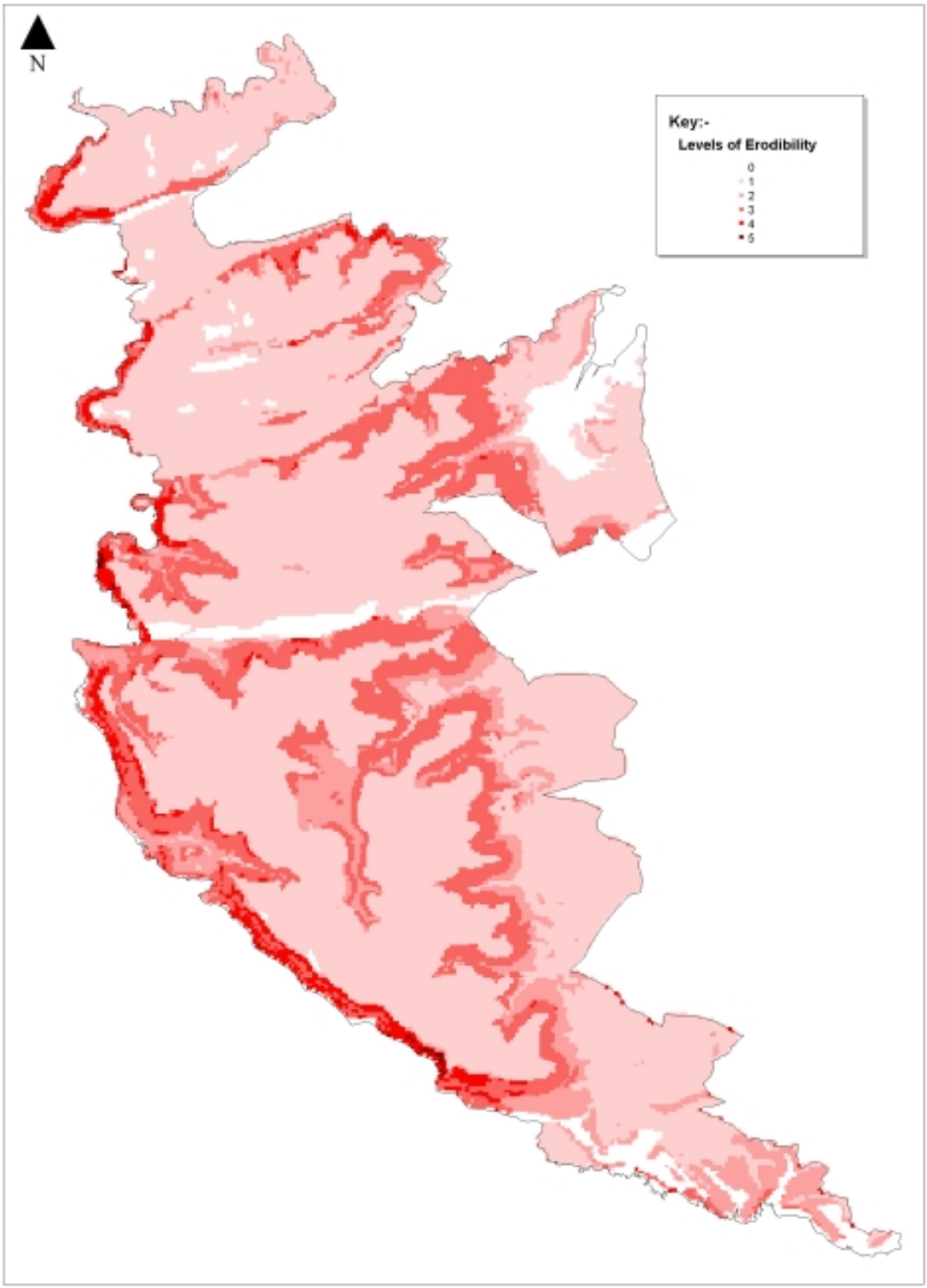
Date :
June 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management



Title :
Levels of Erodibility

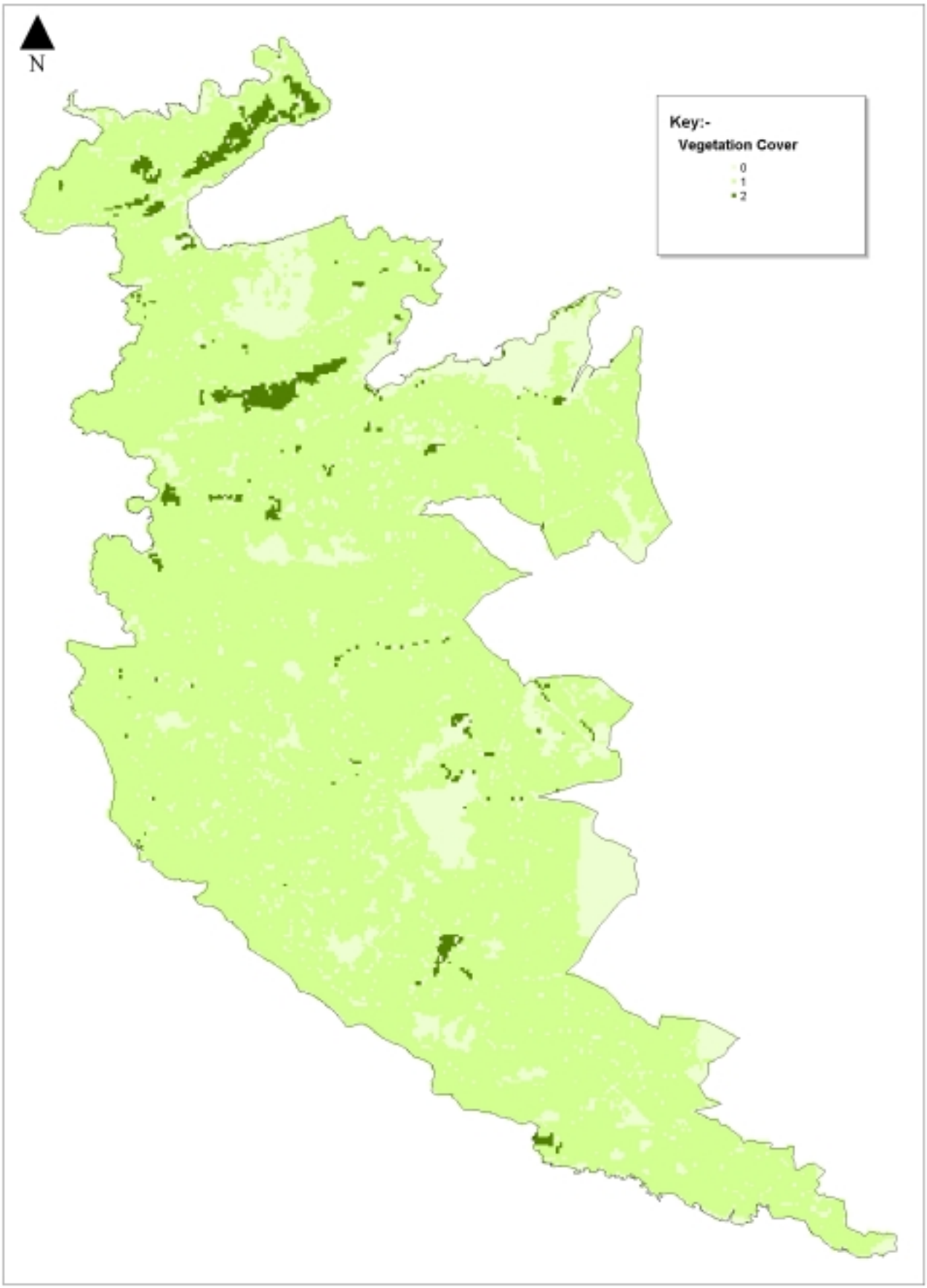
Scale :
1:55,000

Date :
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

Layer 6 (Fig.V.6) is the level of soil protection management map for NW Malta. This is a resultant of the superpositioning of layers 3 and 4. This is the major point of departure from the Guidelines. The specific layer for vegetation cover is not considered to be a very important differentiating spatial factor in the Maltese context (Fig.V.5). Vegetation cover was incorporated in the land use layer and spatial differentiation was achieved by the delineation of wooded areas. These are the only permanent areas of vegetation cover which afford more than a 25% coverage of the soil surface. The rest of Malta's northwest is practically all under less than 25% coverage during the crucial end of the summer drought.

Rather than vegetation cover, a far more important spatial factor for Malta is the condition of traditional soil conservation measures practised on the island for several hundred years. In this respect, the state of repair of the extensive areas of field terraces, constructed within valley slopes, and their retaining rubble walls are of major concern.

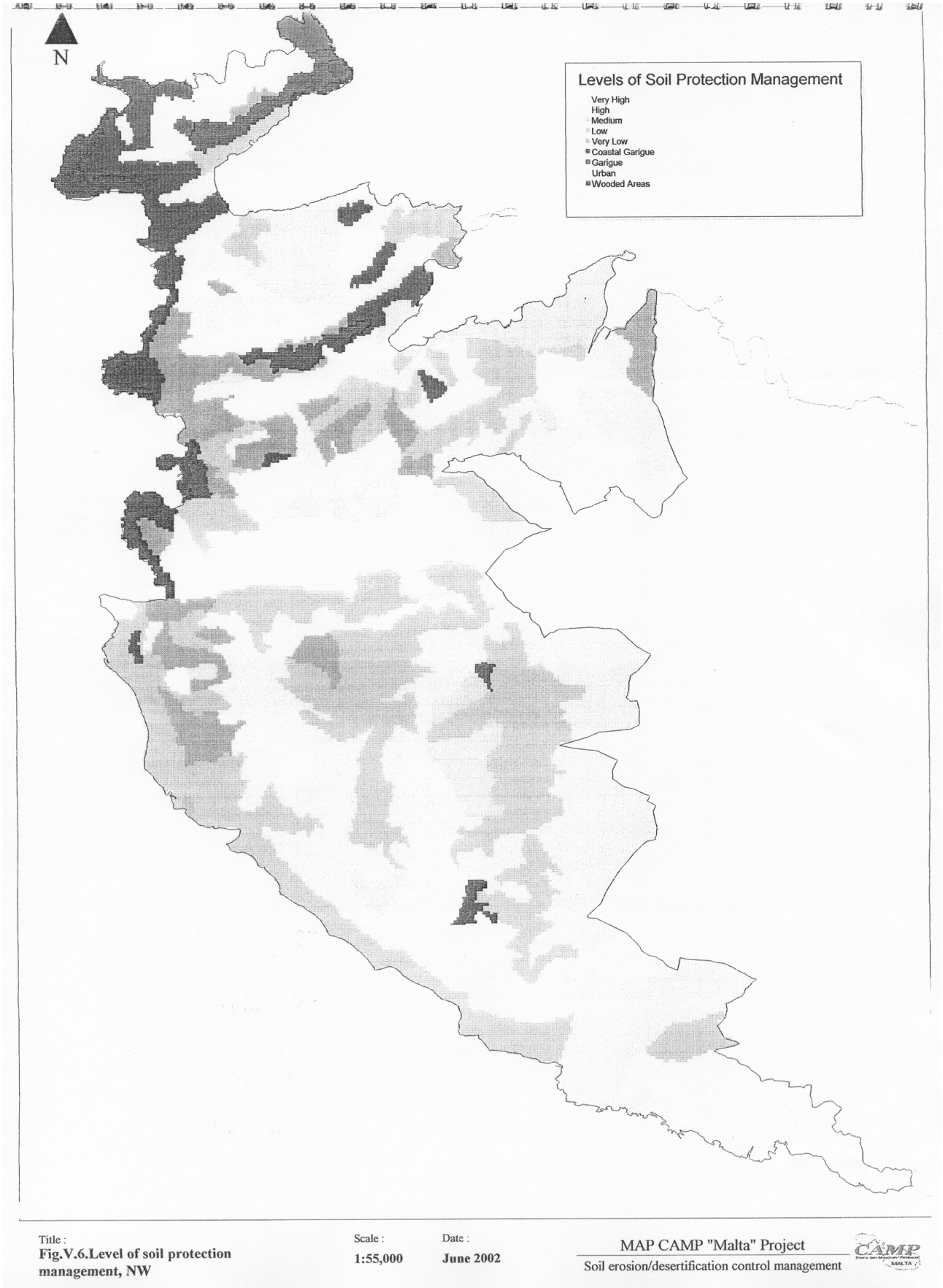


Title :
Vegetation Cover

Scale :
1:55,000

Date :
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management



Title :
Fig.V.6.Level of soil protection management, NW

Scale :
1:55,000

Date :
June 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

V.3. Systematic site-descriptive erosion mapping

(i) Preparatory office activities

The pilot areas were selected such that they represent the different geomorphological characteristics of the Northwest.

1. Criteria for pilot area selection

During the preparatory phase, criteria for selection of pilot areas were drawn up. These criteria were based on the different landscapes found in Malta and were classified according to soil types and environments (Griesbach, 1998):

- Peri-urban areas
- 100% terraced lands
- Relatively flat lands
- Coastal fringe
- Intermediate areas (between flat lands and terraced lands)

Representative areas of the above classification were identified such as to incorporate the various environment types.

- Dingli Cliffs, representing marginal fields in a typical boulder-scree environment (i.e. costal fringe).
- Burmarrad, l/o Mosta, divided into Burmarrad east representing plains and Burmarrad west representing sloping, terraced fields (i.e. peri-urban, 100% terraced lands and flat lands).

Tas-Santi Valley, l/o Mgarr, representing a valley system typical of Great Fault valleys was subsequently included. It was crucially important that a representative valley system was to be included in the survey in order to give a holistic picture of the land use processes occurring in Maltese valleys as described in Fig.V.7. The selection of this site was therefore beneficial in that it served as an example of a whole valley system, thereby contributing significantly to the analysis of human and environmental processes.

A detailed description of the selected pilot areas is given in Chapter I, Section I.3.3.

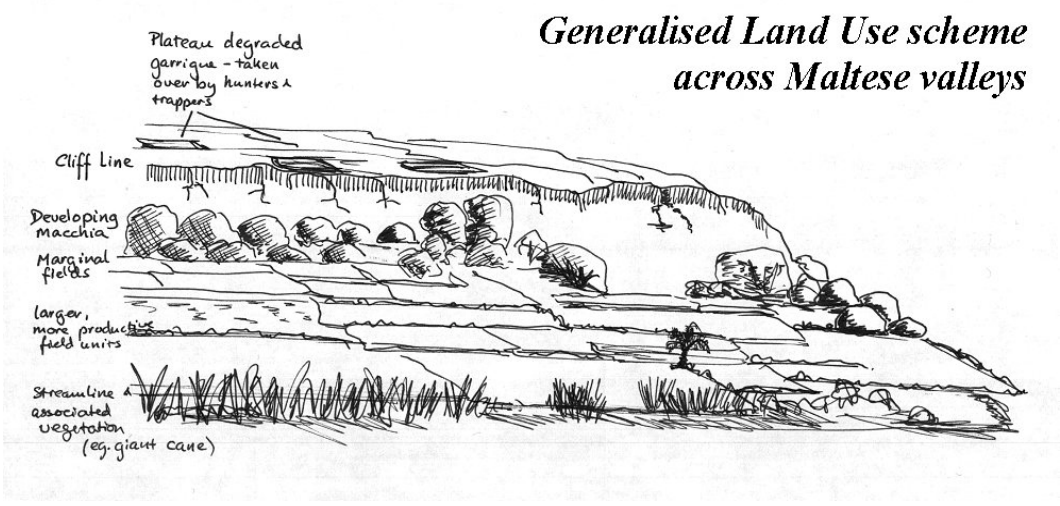


Fig.V.7. Land use processes in a typical Maltese valley system (Role', 1999)

(ii) Analysis of Aerial photographs

As a preliminary activity, the erosion processes at selected pilot areas were identified through photo-interpretation. The aerial photos were taken in 1994, at a scale of 1:10,000. This exercise included the identification/delineation of main landscape features such as access roads, drainage networks, high contrasted features (rock outcrops, cliffs, water bodies, etc.).

V.4 Other surveying activities

(i) Establishment of sediment traps

The identification of catchment-scale sediment traps was carried out to obtain an estimate of how much soil is being lost after a particular rain event and/or after the wet winter season. The three sites were chosen according to their location, accessibility, size and ease to take measurements. This was meant to establish a baseline and initiate a long term monitoring programme.

Two main catchment areas (both within the Northwest) were identified, namely at Burmarrad and Fomm ir-Rih (Plate V.1).

Plate V.1. Sediment trap at Fomm ir-Rih, 2000

At Burmarrad, two sites were further chosen – a check dam built across the watercourse of Ghajn Rihana (Plate V.2) where sediment collects. The second site was a WSC station where sediment also accumulates (Plate V.3).

Plate V.2. Sediment trap at Burmarrad, 2000

Plate V.3. Sediment trap, WSC Station, Burmarrad, 2000

During the Summer of 2000, measurements of sediment accumulated in the selected site was carried out. Therefore, baseline data was produced for these sites.

(ii) Field profiles

Cross sections of fields and slopes were taken in order to investigate soil erosion phenomena at Burmarrad and Tas-Santi valley (Plate V.4a). The sites chosen had proven particularly prone to soil erosion during storm events of the November 1999. In fact, most cross sections were sited in areas which had developed rills and gullies (Plate V.4b). Due to the irregular terrain at Dingli cliffs, no measurements were taken there. These measurements were taken during the Summer of 2000, after harvesting of the cereal crop.

Plate V.4a. Measuring field profiles at Tas-Santi, 2000

(iii) Number of breaches in rubble walls

Since the state of repair of rubble walls was identified as being one of the main structures contributing to the stability of the area, the number and length of breaches in rubble walls were measured in representative field units at Tas-Santi and Burmarrad pilot areas. Due to inaccessibility and irregular terrain at Dingli, the survey for this area was omitted.

It was decided that specific rubble walls needed to be selected according to established geographical stratified spatial sampling techniques (Hagget *et al*, 1977) (Figs. V.8 & V.9). Five and seven field units were respectively surveyed at Tas-Santi and Burmarrad. The length of each breach was measured at the upper soil level of the field affected by the gap in the rubble wall (Fig. V.10).

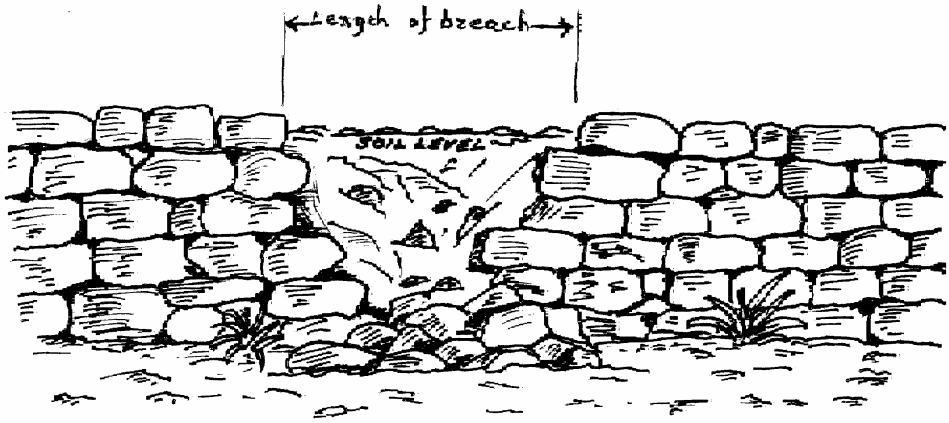
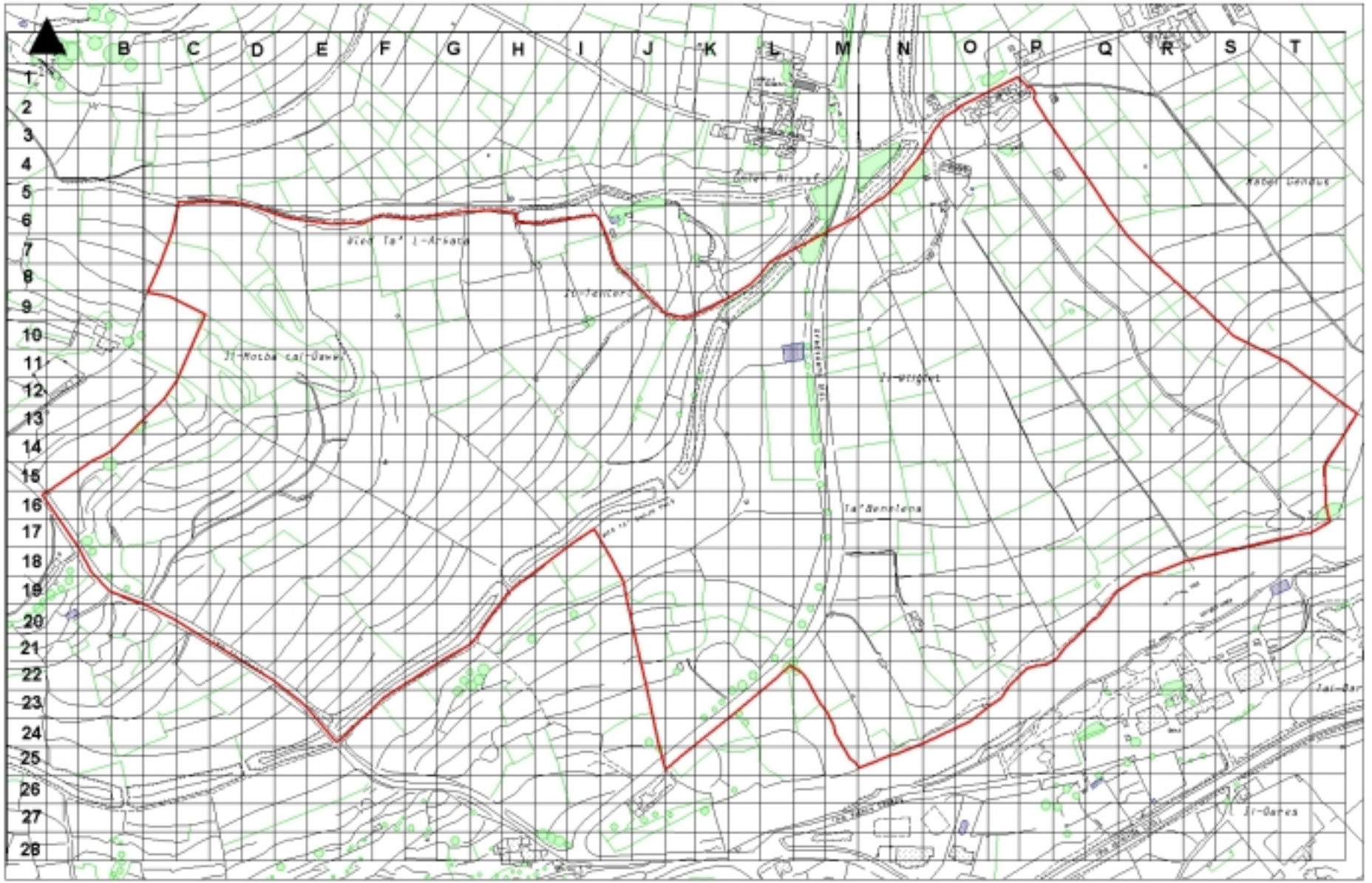


Fig.V.10. Measurement of the length of breach in a retaining rubble wall (**Borg, 2001**)

This survey gave an indication to the state of retaining rubble walls (hence the extent of the liability of soil loss) in the pilot areas. This data was also used as an indicator for sustainable land management.

Plate V.4b. Measuring rills and gullies at Burmarrad, 2000

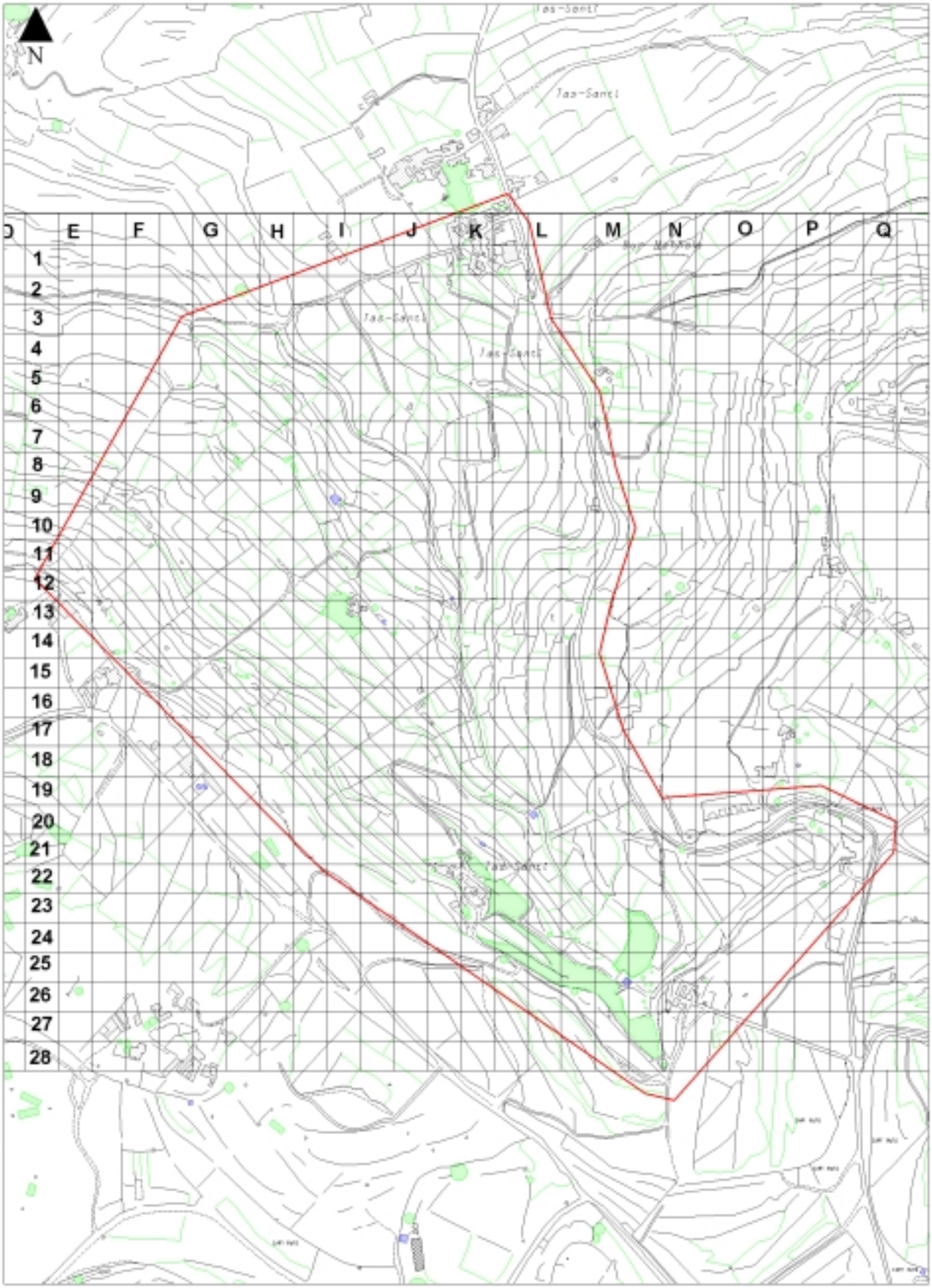


Title :
Stratified Spatial Sample - Grid Reference
Burmarrad, l/o Mosta

Scale :
1:4,000

Date :
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management



Title :

Stratified Spatial Sample - Grid Reference
Tas-Santi, l/o Mgarr

Scale :

1:3,700

Date :

February 2002

MAP CAMP "Malta" Project

Soil erosion/desertification control management

(iv) Chemical Soil analysis

Soil sampling at Tas-Santi was carried out on 19th June, 2000. This was carried out along three transects - transect A runs along the watercourse whilst transects B and C run across the valley sides (Fig. V.11). Another 6 sampling points were collected at random to include the different soil types.

Therefore, a total of 17 surface soil samples were collected. The physico-chemical parameters analysed were pH (measured potentiometrically by standard glass electrodes), electrical conductivity (applying EC25=Ect*ft), particle size distribution (% sand, clay and silt; determined according to standard techniques adopted from Day (1965) and ASTM (1985)), percentage organic matter and dissolved salts.

All analyses on soil samples were carried out at the Agricultural Chemistry Laboratory, Department of Agriculture (Malta). The soil types were classified according to the classification from Kubiena's "Soils of Europe" (1953).

Fig. V.11. Location of soil analysis, Tas-Santi, 2000

(v) Direction of water flow

The direction of water flow was mapped during field sessions carried out between August and September 2000. The mapping exercise was carried out for Tas-Santi valley, on a survey map at a scale of 1:2,500 and digitised into GIS MapInfo.

Evidence of passage of water, i.e. rills and gullies, lines of breaches in rubble walls and the concave shape of fields, was depicted by arrows.

V.5. Integration of mapping outputs into socio-economic background

The integration of socio-economic patterns with spatial aspects was given in a report which also gave a review of the potential trends and patterns relevant to erosion and desertification processes in Malta. The results of this report are summarised in Chapter VI whilst the full report was presented to PAP/RAC.

Furthermore, land tenure patterns were spatially represented for selected pilot areas (*vide* Chapter VI.5).

V.6. Diagnostic analysis

(i) Identification of erosion/desertification prone areas

The results of the field surveys, the predictive mapping and the assessment of the socio-economic parameters were used to determine priority areas for future intervention. The state of repair of rubble walls served as a main indicator for erosion risk. The respective thematic map (*vide* Chapter VI.3) represented therefore an important tool for the determination of priority areas requiring immediate remedial measures.

(ii) Preparation of draft designs and technologic sets of remedial measures

Through informal and formal discussions with land-users and other project stakeholders (including discussions with the other thematic teams on the CAMP Project), ideas for remedial measures for each of the identified priority areas were generated. Moreover, participation at an international workshop on “Technologies for and management of erosion and desertification control in the Mediterranean region”, organised by PAP/EPD in June 2000, was also beneficial in this regard.

(iii) Definition of preliminary priority schemes

The ideas for remedial measures were assessed and, where appropriate, considered for preliminary schemes of remedial action for each priority area identified (*vide* chapter VI).

V.7. Global strategy/Action framework

(i) Preparation and proposal of a draft erosion/desertification control planning scheme

The framework summarising the relevant information on thematic priority areas was prepared as a basis for the development of a strategy (*vide* Chapter VI.7). In the elaboration of this framework attention was paid to the possible integration of the draft scheme into the national planning schemes and priorities (*vide* Chapter VI.9).

V.8 Monitoring and capacity building

(i) Determination of post-implementation monitoring

Possibilities of post-project activities for continuous monitoring of erosion and desertification processes in Malta were discussed and respective recommendations were elaborated (*vide* Chapter VII.).

(ii) Elaboration of capacity building strategy

An analysis of the capacity building status for erosion/desertification control was conducted in accordance with the indicators given in the UNEP/MAP/PAP Guidelines. This served as a starting point for detailed analysis of factors which influence capacity building in Malta.

As proposed in the UNEP/MAP/PAP Guidelines actors, strategies, structural framework conditions, specific situations and the nature of problems were discussed and analysed (*vide* Chapter VI.8). The results were used for elaboration of specific recommendations (*vide* Chapter VII.).

VI. ACTIVITY RESULTS AND OUTPUTS PRODUCED

VI.1. Basic technical data and information

The first activity undertaken was the preparation of relevant maps and statistical data/information (at the required scale and detail) to produce a reference mapping canvas.

An inventory for the existing maps and data was drawn up according to standard format as requested by Data management team.

Title	Description	Owner	Creation date	Cover-age	Source	Format
Contour map	Map giving contours every 10m interval	PA		NW	PA	Digitised
Survey site plans	-Burmarrad -Dingli -Tas-Santi	PA		Pilot areas	PA	Digitised
Land use		PA			PA	Digitised
Slope		PA			PA	Digitised
Vegetation cover		PA			PA	Digitised
Aerial photos	1:10,000 and 1:4,000 -Burmarrad -Dingli -Tas-Santi	PA	1994 and 1998		PA	Raster image
Geology	1:25,000	OPM	1993	NW	OPM	Digitised
Hydrology		WSC		NW	WSC	Digitised
Malta and Gozo Soils map	Different soil classes as described by Lang (1:31,680)	Directorat e of overseas survey	1960	Malta and Gozo	Dept. of Agric.	Raster image
Land tenure (Tas-Santi)	Classification of land units according to land owner	Mr Ivan Calleja	1998/ 1999	Tas-Santi valley, l/o Mgarr	University of Malta	Digitised
Human intervention (Tas-Santi)	Land use map giving particular emphasis on agricultural activities	Mr Ivan Calleja	1998/ 1999	Tas-Santi valley, l/o Mgarr	University of Malta	Hard copy
Potentially good agricultural land	Graphical representation	Govt. of Malta	1990	Malta	Adapted from Report of Survey, Planning Services Division	Hard copy
Use of natural fertiliser	Graphical representation of the number of farmers using natural fertiliser	Ms Maria Pullicino	2000	Malta by locality	University of Malta	Hard copy
Distribution of dry and irrigated land	Graphical representation of dry and irrigated land	Ms Maria Pullicino	2000	Malta by locality	University of Malta	Hard copy
Distribution of farmers who use compost from Sant Antnin	Graphical representation of the number of farmers using compost produced from re-cycled waste	Ms Maria Pullicino	2000	Malta	University of Malta	Hard copy
Meteorological data	Annual rainfall, air temperatures, wind speed and direction	Meteorolo-gical Office	1996-2000		PA	Hard copy
State of the Environment report	Report giving statistical and other data about the environment as it was at the time of writing	EPD	1999	Malta and Gozo	EPD	Hard copy
Structure Plan for the Maltese Islands	Legal document giving the policies for development	PA	1992	Malta and Gozo	PA	Hard copy

Title	Description	Owner	Creation date	Cover-age	Source	Format
Reports of survey Vols I & II		PA	1990	Malta	PA	Hard copy
Northwest Local plan (Draft)	Draft report	PA	1996		PA	Hard copy
Dry land (in hectares)	Field units that are not irrigated	NSO	1983 1986 1991	By locality	Agric. census reports drawn up following census carried out by the NSO (former COS)	Tabulated hard copy
Irrigated land (in hectares)	Field units with all year round supply of water	NSO	1983 1986 1991	By locality	Agric. census reports drawn up following census carried out by the NSO	Tabulated hard copy
Waste land (in hectares)	Mostly garigue and maquis	NSO	1983 1986 1991	By locality	Agric. census reports drawn up following census carried out by the NSO	Tabulated hard copy
Total cultivated land	Land that is under agricultural cultivation	NSO	1983 1986 1991	Malta	Agric. census reports	Tabulated hard copy
Dry land (in hectares)	Field units that are not irrigated	NSO	2001	By locality and district type	Agric. census reports	Tabulated hard copy/ electronic format
Irrigated land (in hectares)	Field units with all year round supply of water	NSO	2001	By locality and district type	Agric. census reports	Tabulated hard copy/ electronic format
Waste land (in hectares)	Mostly garigue and maquis	NSO	2001	By locality and district type	Agric. census reports	Tabulated hard copy/ electronic format
Total cultivated land	Land that is under agricultural cultivation	NSO	2001		Agric. census reports	Tabulated hard copy/ electronic format
Number of full/part time farmers		Dept. of Agric.	1983 1986 1990	Malta	Agric. census reports	Tabulated hard copy/ electronic format
Number of full/part time farmers		NSO	2001	Malta	Agric. census reports	Tabulated hard copy. electronic format
Number of applications for monetary compensation for storm damages	Reports of storm damages to agricultural crops, land and livestock	Dept. of Agric.	1973 - 2001	Malta	Unpublished correspond-ence	Hard copy

Table VI.1. Inventory of existing data related to erosion/desertification/land degradation

VI.2. Development of soil erosion/desertification control management GIS

One of the more integrative outputs of the project was the contribution to the establishment of a Soil Erosion GIS which is meant to dovetail with other geo-referenced data providing information on the Northwest in order to serve as an essential platform for land use planning in the locality.

The pragmatic aim of this part of the project conditioned the scope, resolution and scale of most of the identified layers. Much of the available geo-referenced data was digitised from scales of 1:25,000 or 1:50,000. Such data was of limited use for the study of the pilot areas where data needed to be available or generated at higher resolutions. For example, the soils, slope, and geology layers are too generalised when applied to a scale of 1:2,500 which was the working scale at the pilot areas. This made it difficult to extrapolate more than generalised locational trends for the areas.

The identification of layers, including utility and availability comprised the following:

Soils - The soils layer has been digitised as a raster image from Lang (1960). The hard copy is presented at a scale of 1:31,680 which is somewhat unorthodox for most Maltese cartography. The map is also rather outdated and few copies are still in existence.

Geology (lithofacies) - Geology has been digitised from Pedley (1993-latest update). The hard copy is published at a scale of 1:25,000. This provided a reasonably useful layer for the Northwest but had far more limited value for the individual case studies.

Topography - A digital elevation model was available from the Mapping Unit of the Planning Authority and the resolution rendered it useful for scales of the Northwest as well as the individual case studies. Different contour intervals can be selected to suit particular needs.

Slope - A generalised slope map is available; generated from the digital elevation model but it has limited use for the individual case studies. It is far more useful for the whole of the Northwest and can be utilised as a layer for the risk assessment map as called for in the Guidelines.

Vegetation cover- This layer is particularly useful in locating areas which experience no ploughing and may have some sort of vegetation cover for most of the year. Some previously cultivated areas have reverted back to a maquis vegetation community and, despite its open canopy, offer some measure of protection to the soil. In the case of garigue areas, or steppe vegetation, the risk of soil erosion is much greater. In fact, garigue communities are commonly found where entire soil profiles had been removed at some time in the past.

Land Use - The identification of urban areas and other sealed surfaces, like roads, is crucial in understanding surface water flow and, coupled with slope layer, the direction of water flow. Urban areas possess much higher coefficients of runoff in this respect and usually generate substantial volumes of storm water runoff within predictable time lags. Other information contained in this layer includes field boundaries, surface water supply for irrigation, etc.; all of which is valuable in determining soil erosion risk assessment at practically all scales.

State of repair of Terraces & Rubble Walls (Northwest) - This is based on direct field observation but its utility is greatest at a Northwest scale. Of course, the poorer the state of the rubble walls, the greater is the risk of soil erosion, particularly wherever the underlying slopes are steepest.

VI.3. Systematic site-descriptive erosion mapping

The site-descriptive mapping provided graphic information at the level of homogeneous geographic units in terms of specific erosion processes, their nature, intensity, extension and evolutive trend. The three pilot sites were selected according to the criteria and scales previously described in Chapter V, Section XI.V.3.

VI.3.1. Analysis of aerial photographs

A comparative study was carried out in order to assess the significance of recent soil erosion features at Tas-Santi. This essentially consisted of an analysis of soil erosion features which were captured from an aerial photographic survey performed in 1994 (Plate VI.1 & Fig. VI.1).

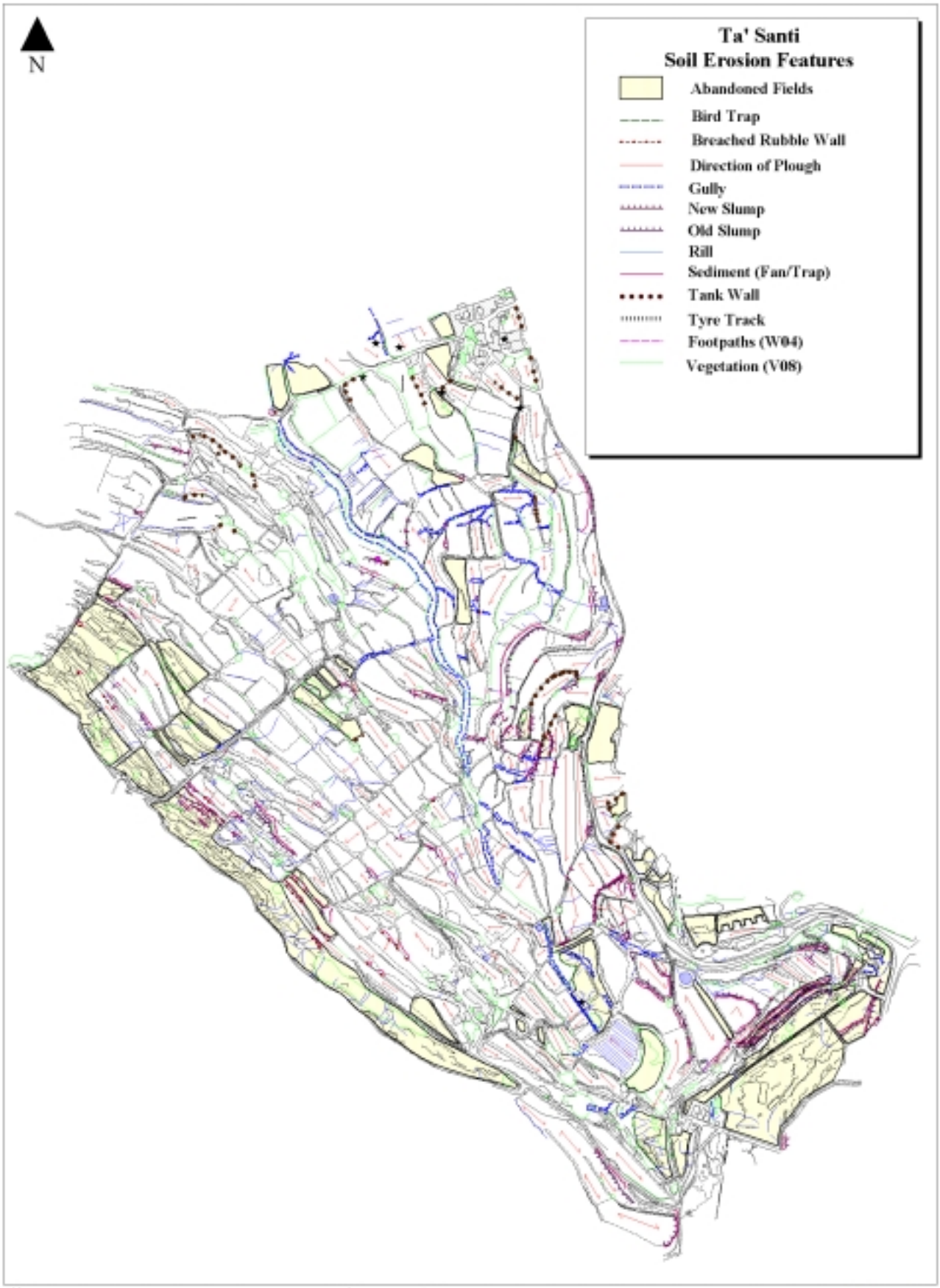
Even a cursory look at this map shows that the risk prone areas indicated in the erosion status on-site surveys correlate very closely with the pattern that emerged from the 1994 photography. The clay rich fields on the southeastern side of the study area (contiguous with the road) can be seen as a perennial problem area. Similarly, the northwestern fields located immediately below the cliff line have also been identified as risk-prone areas experiencing several recent and older slumps. Gully patterns also follow the same trend. Abandoned fields and areas contiguous with such fields show a higher proportion of rills and gullies. The eastern side of the valley is also far more prone to such processes; a pattern confirmed in the more recent descriptive mapping field exercise.

Title :
Tas-Santi, l/o Mgarr

Scale :
1:3,700

Date :
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management



Title :
Tas-Santi : Soil Erosion Features

Scale :
1:3,900

Date :
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

VI.3.2. Soil descriptive erosion maps

Erosion mapping of the pilot areas took place between October 2000 and March 2001. For this exercise the Guidelines were applied. Some modifications to the legend, namely adding another grade for instability risk (moderate to high) were needed in order to suit Malta's scale of agriculture and the nature of the agricultural landscape, especially the intense terracing of slopes. Also the 021 category was described as wasteland being reverted back to maquis.

The outputs of this mapping exercise were digitised into a MapInfo GIS and form an integral part of the Project database.

The results are summarised as follows.

- Burmarrad east and west (Fig. VI.2)
  Most of the parts in the eastern part of the pilot site were classified as being stable managed areas with no erosion risks (040) whilst the gently sloping areas immediately beneath the cliff were described as being stable, managed areas with a moderate to high erosion risk (042), due to factors of topography and human intervention.

  The western part of the site is characterised by stable managed areas with a moderate to high erosion risk due to human influence and topography (042 t & h) and in the upper parts there is a trend towards an increased generalised degradation, also due to topography and human intervention (043 t & h). Localised rills and gullies were in fact clearly visible.

  The site descriptive erosion pattern in the whole site clearly reflects the overriding influence of topography in the area. The most stable areas are those found between the water course of Ghajn Rihana and the main road and a large area to the northeast of the road (Plate VI.2).

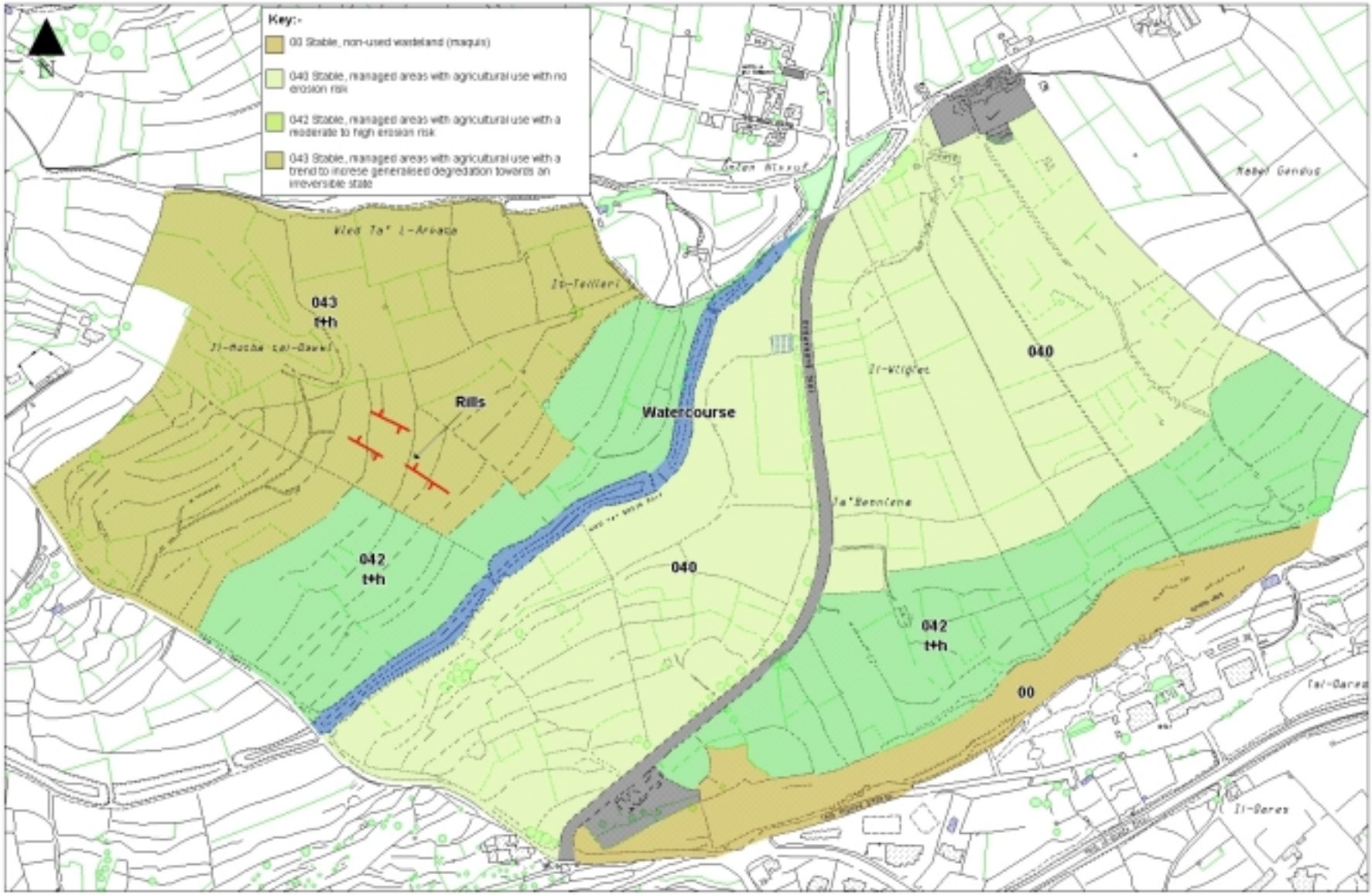
Plate VI.2. Fields located on flat terrain, Burmarrad, 2001

Erosion risk in this area is minimal. In fact, the area receives sediment from higher contiguous locations. Rubble walls within this area simply demarcate boundaries of field units and have a very minor role to play as retaining rubble walls. To the south and west of this stable area, the slopes are elevated and this causes correspondingly higher risk of erosion (Plate VI.3).

Plate VI.3. Fields located mid-slope at Burmarrad, 2001

The highest risk of erosion was seen in the western most part of the pilot area where slopes are steepest but field units are still relatively large. In fact, such fields are relatively too large to render terracing effective (Plate VI.4). Moreover, many rubble walls in the area were found in a bad state of repair. At times they were virtually absent. Additionally, much of the soil in the area has a high clay content, thereby increasing the risk dramatically. An elongated area of regenerated maquis is found bordering the pilot area on the southeast side. This is probably due to the decrease of grazing livestock in the locality.

Plate VI.4. Relatively large field units on steep slopes, Burmarrad, 2002



Title :
Site Descriptive Erosion Process
Burmarrad, l/o Mosta

Scale :
1:4,000

Date :
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

- Dingli (Fig. VI.3)
  This area was mostly characterised by unmanaged areas. Those areas closest to the sea fringe were described as being unstable showing generalised sheet and/or rill erosion with soil profile removal (D33 and L22) as well as having some localised rill and gully networks (C23).

  The area immediately below the boulder scree is described as stable with a moderate to high erosion risk due to topography and human intervention (021 and 022). The stable managed areas identified within the area have a low to moderate erosion risk (041) due to topography or have a moderate to high erosion risk (042 t & h) also due to topography and human influence.

  The Dingli pilot area is dominated by a large swathe of unstable terraced and non-terraced land which borders the coast and extends right down to the cliff edge. Evidence of several cultivated marginal terraced fields and remnants of their rubble walls can still be seen (Plate VI.5).

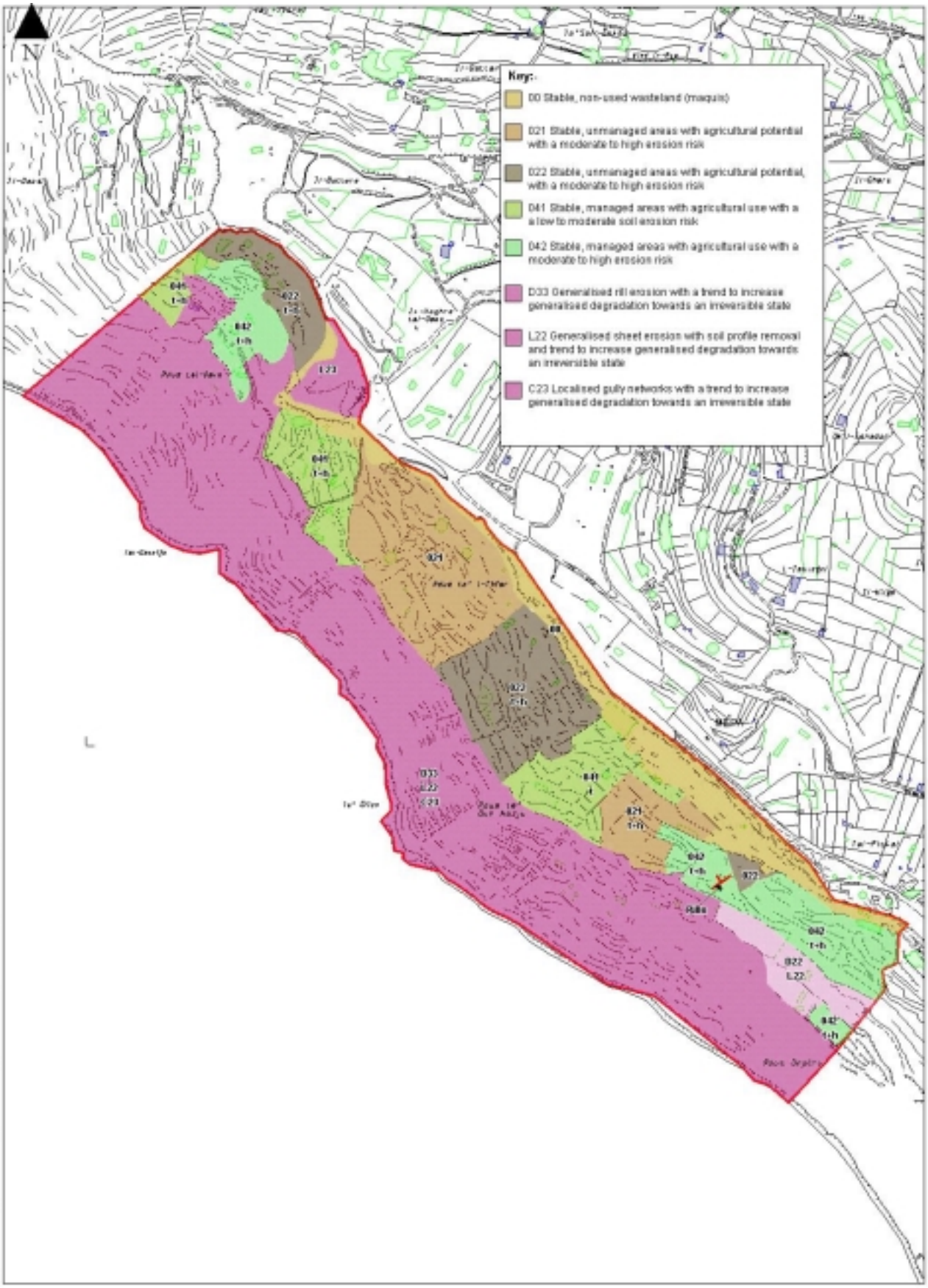
  In fact, one observation made during the state of rubble wall survey was a number of apparently ancient remnants of rubble walls found in some of the more inaccessible areas of similar sites. Their origins are unknown and it can only be guessed that such walls may have retained soil allowing cultivation in the area. The soil may have been subsequently lost. The more perplexing aspect of these walls is that arable cultivation in such exposed areas would be difficult to imagine, as would be the transport of raw materials and eventual produce. A purely speculative explanation is that the area may have supported a far greater population of trees which would have been fenced off by rubble walls.

Plate VI.5. Remnants of retaining rubble walls, Dingli 2001

The rest of the pilot area shows patchy distribution of stable managed agricultural areas with varying degree of soil erosion. Much of the erosion is a result of human activities (such as lack of maintenance of rubble walls) coupled with topography. The presence of numerous bird trapping and hunting sites is a cause for concern (Plate VI.6) (*vide* Table VI.10)

Plate VI.6. Regenerating maquis, with bird trapping sites in the background, Dingli (1999)

A narrow strip of stable regenerating maquis is located at the base of the Upper Coralline Limestone cliffs, where large boulders undercut from the cliff line are found (*vide* Plate VI.6). There is also evidence that the area was used for pastoral agriculture and the several caves found along the cliff baseline were in fact used to house such livestock.



Title :
Site Descriptive Erosion Process, Dingli

Scale :
1:5,200

Date :
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

- Tas-Santi Valley, l/o Mgarr (Fig. VI.4)
  Most parts of the pilot area were found to be stable managed areas with varying erosion risks (041, 042, 043, 044). Some localised unstable areas were identified. In these areas, localised landslides occur due to mismanagement of rubble walls and steep slopes in the areas (M2). In the valley bottom, periodic flooding occurs (W1), leading to generalised sheet erosion in some of the flooded areas (L22).

  The erosion status for the valley follows the general pattern of the slope, soil type and topography, i.e. cliff lines/sharp breaks in slope and valley beds.

  The pilot area contained a few hot spots where erosion processes dominated. These were designated with L22 and erosion is mainly due to the clay substrate which contributes to localized mass movement and the undermining of rubble wall foundation in the area (Plate VI.7).

Plate VI.7. Hot spots designated as L22 Tas-Santi, 1999

  In the upper parts of the valley, stable unmanaged areas occur with or without agricultural potential (00 and 021). These areas are largely confined to the plateaux overlooking the valley and are dominated by garigue and degraded intermittent steppe.

  To the southwest of the pilot area a swathe of land hugging the base cliff line is largely occupied by regenerating maquis, evidence that the area was used for cultivation at some time in the past. This cultivation however must have been

marginal. Most of these areas were in fact used for grazing. Decline of this type of pastoral agriculture is permitting the maquis vegetation to regenerate.
Also in this area several large boulders undercut from the cliff line can be found, therefore decreasing agricultural potential (Plate VI.8).

Plate VI.8. Southwestern part of the pilot area, Tas-Santi, 1999

Contiguous with the previous 02 site (i.e. the NW side) is an area consisting of relatively stable managed land (044). Although this land is used for arable cultivation, it demonstrates high risk of erosion, largely due to the condition of the rubble walls. In fact, several breaches in rubble walls were evident in this area. The steep slopes in this area have been broken up by a series of terraced fields which are narrow and rather marginal (Plate VI.9).

Plate VI.9. Northwestern side of Tas-Santi valley, 1999

The most stable arable land in the area is found on the western side of the valley (designated as 041). The soil type found here is the terra rossa soil, tending towards clay in the northern parts of the pilot area. Most of the fields seem to have fairly deep soils (by Maltese standards), especially towards the valley bed. This may be due to accumulation of sediment from contiguous higher areas and well as sediment carried by the watercourse during heavy rainfalls.

The area close to Tas-Santi hamlet (which has a similar designation of 041) is also stable but the soils are markedly different, i.e. carbonate raw soils. Erosion risk is low and is mostly due to the management practices employed.

The areas demonstrating medium to high risk of erosion are located east of the water course and are directly adjacent to the main road which runs also on the side of the valley (Plate VI.10).

Plate VI.10. Fields with a medium to high erosion risk, Tas-Santi, 2000

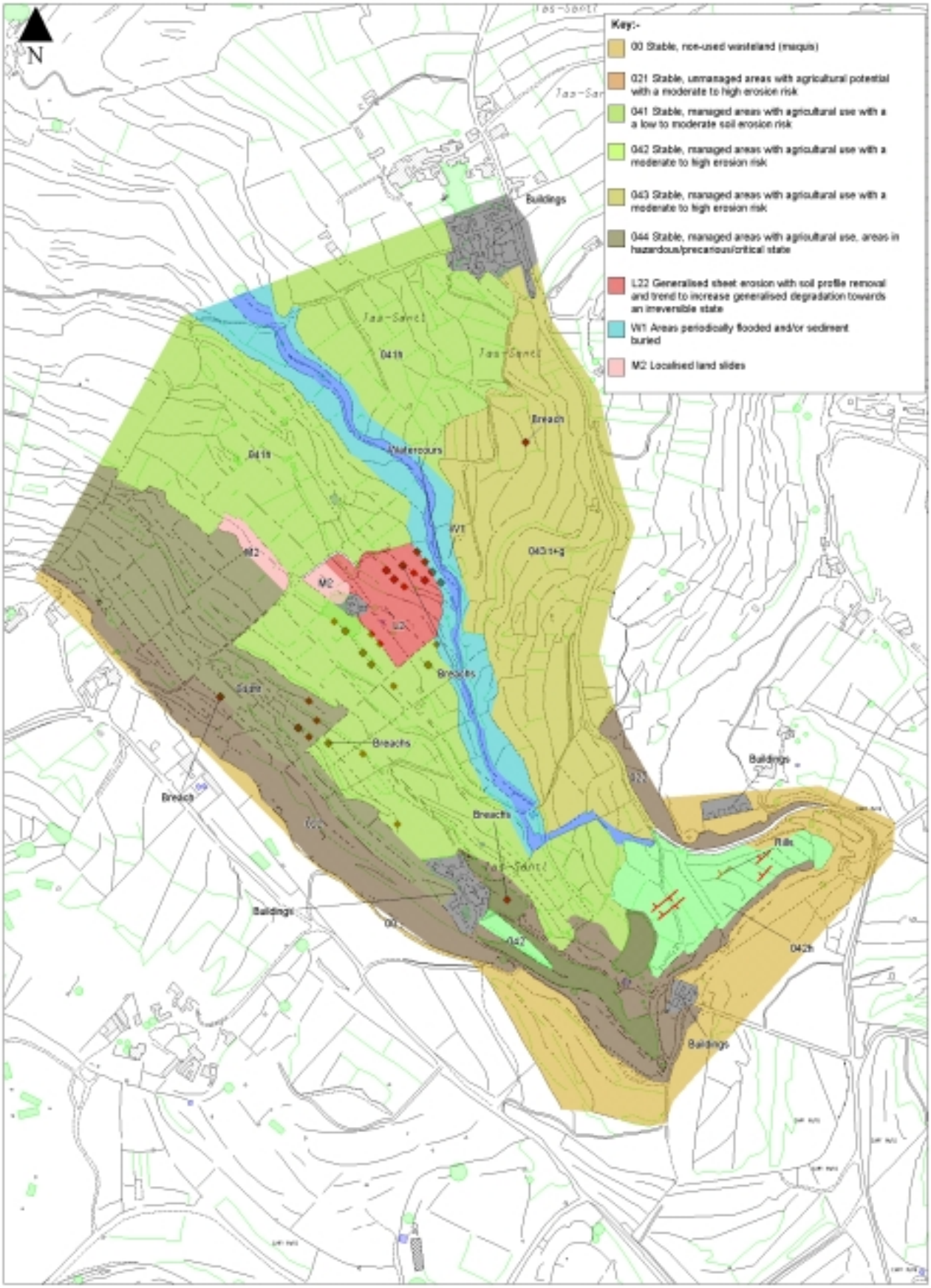
Most of the soil in this area contains a very high clay content and was perceived as a continuation of a clay talus which is bisected by the road. Several slopes here are convex and contain remnants of rubble walls which are often in a poor state of repair. This area is therefore prone to erosion. In fact several examples of rills, gullies and sheetwash were observed in the area following the November 1999 storm[5] (Plate VI.11).

[5] A total of 524.2mm of precipitation were recorded between November and December 1999, where rain fell in Malta for three consecutive days.

Plate VI.11. Rill and gully formation in clay soils, Tas-Santi, November 1999

Much of this area is also devoted to dry land cultivation, where the fields are ploughed into deep furrows at the beginning of autumn in an effort to trap the first rains. Unfortunately this has the effect of increasing the risk of erosion because of the torrential nature of the autumn rains.

At the southeastern tip of the pilot area, the risk of erosion is slightly less. This area is dominated by orchards and contains rubble walls which are in a better state of repair. Clay content of these soils is also less than that found in the adjoining fields.



Title :
Site Descriptive Erosion Process
Tas-Santi, l/o Mgarr

Scale :
1:3,700

Date :
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

VI.3.3. Terraces and rubble walls - State of repair

One of the main indicators chosen for the identification and delineation of priority areas for preventive, curative and/or protective remedial measures was the state of repair of rubble walls (Fig.VI.5). For this purpose, the Northwest was surveyed during the period July 2001 and August 2001. The main aim of this mapping exercise was to observe and note the state of rubble walls and terracing. A practical legend was adopted which took into consideration all the possible variants encountered during the field visits. The legend used for this mapping exercise is being reproduced below.

A three class graded scale index was devised which ranged from Good to Fair to Poor.

- The Good class (1) grouped rubble walls which were in an obviously good state of repair and possessed very few relatively recent breaches.
- The Fair category (2) comprised those rubble walls which contained a greater number of breaches which could also be older.
- The Poor category (3) represents those rubble walls which demonstrated patent long term neglect.

In some cases, the neglect seemed to be historical where there were only remnants of old rubble walls with soil profile removal. These were grouped within a fourth separate category (4). A fifth category identified the location of terraces which contained no obvious retaining rubble walls (5).

No fine distinction was made between retaining rubble walls (i.e. rubble walls which hold back soil to form a terrace along slopes) and demarcation rubble walls (i.e. rubble walls which merely act to define the boundaries between land holdings or individual field units). It is clear, however, that the condition of retaining rubble walls was considered to be far more important and this relative weighting was taken into consideration during the mapping exercise.

The mosaic boundaries of this map were delineated with the intention of integrating the map as a layer within the Soil Erosion GIS. Principal demarcation lines follow watersheds as outlined within the Guidelines. Sub-catchment basins were subsequently identified and plotted.[6] This eventually yielded specific geomorphological slope units which possessed relatively homogeneous slope angles which served as the basis for the mosaic.

In some specific cases, the slope unit had to be subdivided further if sufficiently localised variation of the condition of rubble walls within the slope unit was encountered. In other cases, the variation in the condition of the rubble wall was so disaggregated that it was only possible to make a note of this variation on the map.

Areas with rubble walls in a good state of repair (classed as 1) were observed to be located in plains and plateaux. However, even here some isolated cases where the breaches in the rubble walls were significant could be noted. These locations were identified on the map. Well maintained rubble walls also occur where there is absence of negative impact of sealed surfaces and thus prevent the occurrence of storm water runoff directly onto the fields.

[6] The main watersheds for the Wied il-Qlejjgha drainage basin follow those demarcated by WSC, thanks to Dr John Mangion for his sterling help in this regard.

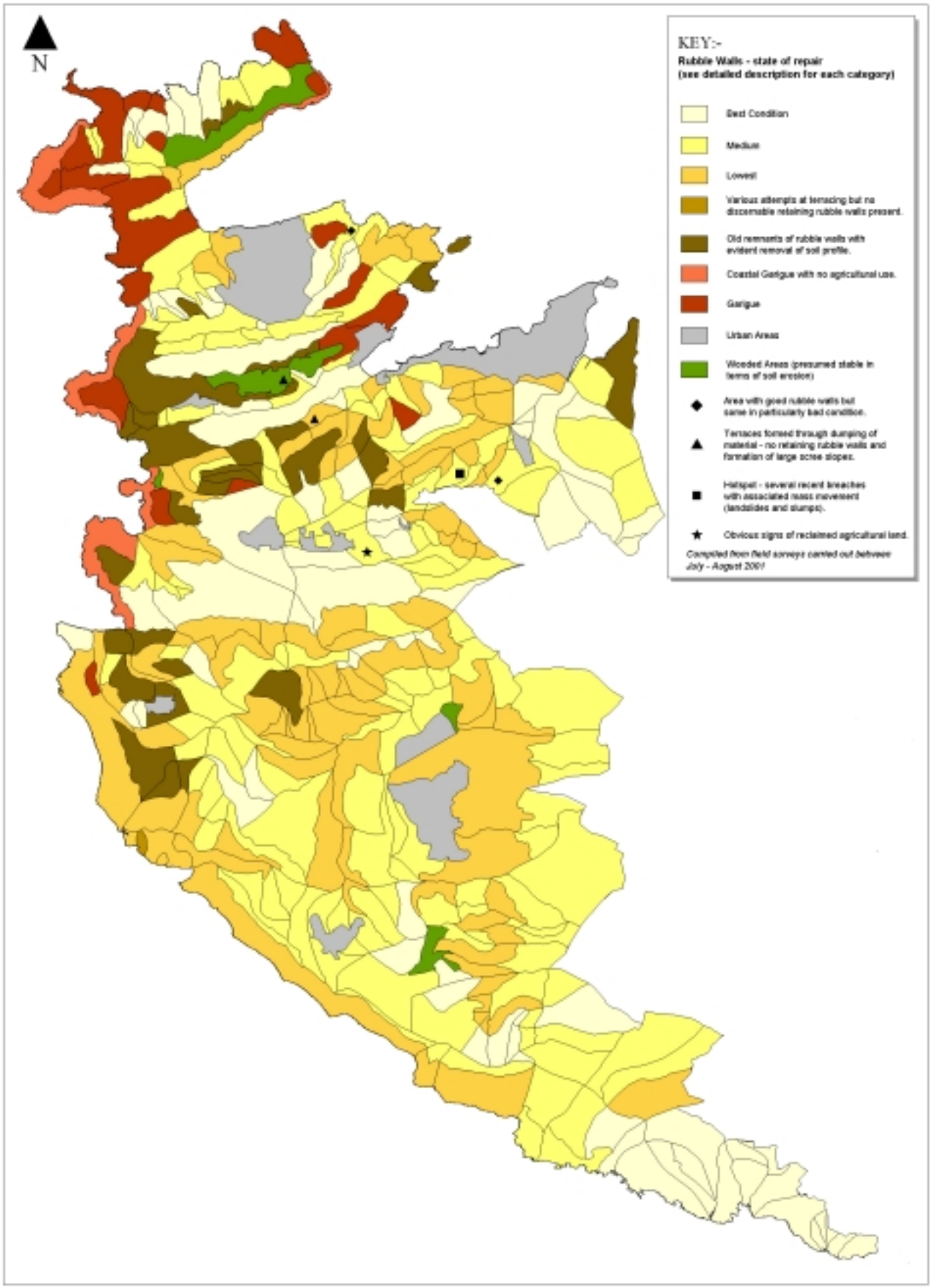
Areas with less maintained rubble walls (classed as 2) occur in many areas.
The most breached rubble walls were generally observed in areas where clay soils are present (classed as 3). On clay soils, often the foundation for rubble walls is less solid. This is due to the characteristics of the soil which is mobile when wet. As a consequence, farmers need to invest more in the maintenance of the rubble walls. Furthermore, areas with rubble walls in a bad state of repair were found on steeper slopes, where the need for maintenance is higher.

In some cases, the neglect seemed to be historical where there were only remnants of old rubble walls with soil profile removal. These areas (classed as 4) have been abandoned mainly due to low potential for agricultural production and difficult access to the fields.

The fifth category of state of rubble walls (classed as 5) was the location of terraces which contained no obvious retaining rubble walls. These mainly occurred at the coastal fringe and in garigue areas (Plates VI.12 & 13).

Plate VI.12. Terraces with no retaining rubble walls, Qammiegh, 2001

Plate VI.13. No rubble walls, even though terracing is present, Pwales valley, 2001



Title :
Terraces & Rubble Walls - State of Repair

Scale :
1:55,000

Date :
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

VI.3.4. Final soil erosion risk map for Northwest Malta

This is one of the most important outputs of the activity (Fig. VI.6). The resulting soil erosion risk map is a composite derived map based upon a set of physical factors (lithofacies and slope – *vide* Fig.V.2 & 3) coupled with a set of human factors (terraces/retaining rubble walls and land use – *vide* Fig.V.5).

A cursory examination of the final soil erosion map reveals that the greatest threat to soils occurs along the clay slopes which delineate the Upper Coralline Limestone platforms. This has been confirmed by extensive field observations. Perfect examples of these can be seen to the east of Rabat, Mdina, and Mtarfa. In fact, most of the clay slopes at Qlejgha Valley are particularly prone to soil erosion and this was in evidence following the December 1999 rainstorms. Another extensive area of high risk can be seen at the clay dominated slopes the Bahrija and Mtahleb areas. Part of the problem in these cases is the difficulty that farmers have to face in attempting to construct rubble walls upon clay foundations.

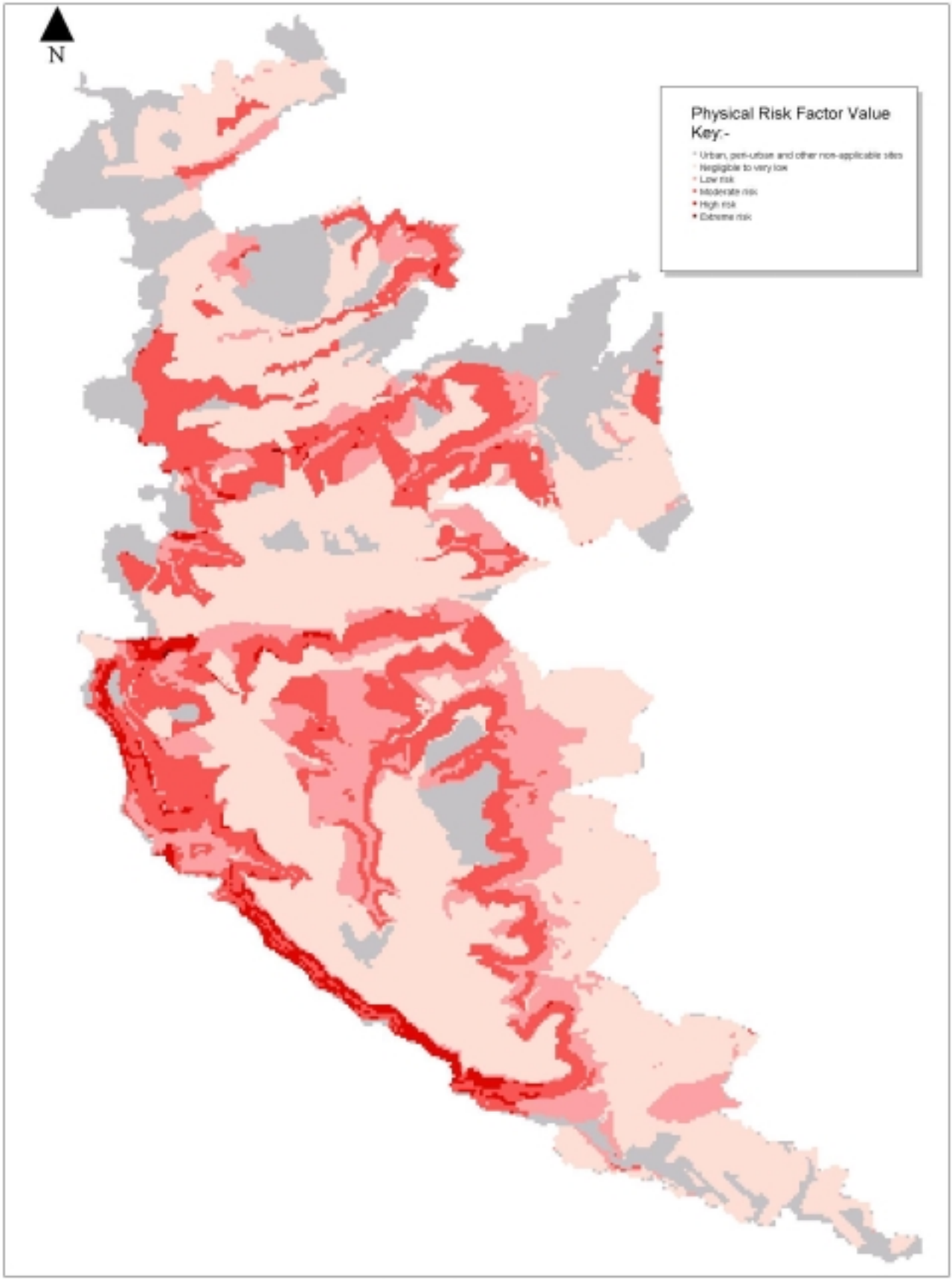
In a marked contrast to this are the Upper Coralline Limestone platforms and the series of graben valley structures which cut across Malta in a northeast to southwest direction. Both of these areas present flat or low gradient slopes. Terraces and retaining rubble walls are often well-constructed on sound, solid rock foundations. These areas are also characterised by a very high percentage of irrigated cultivation. Much of the irrigated farmland is still present in the valleys but abstraction of groundwater for domestic consumption on the Upper Coralline platforms has driven many farm wells dry. This has resulted in several previously irrigated arable farmland reverting back to dryland cultivation on the Upper Coralline platforms.

Areas which present moderate risk tend to be terraced farmland which may either have been recently abandoned, or converted to hunting and trapping, or whose farmers may have allowed their retaining rubble walls to fall into some state of disrepair. Many of these fields are found on the lower parts of the clay slopes. Some of these fields often experience problems of rilling and gullying due to surface water runoff originating from much further upslope.

Levels of erodibility	**Very low**	**Low to fair**	**Moderate**	**High**	**Extreme**
Condition Of rubble walls	**1**	**2**	**3**	**4**	**5**
Good 1	A	A	A	B	C
Fair 2	A	B	C	C	D
Bad 3	B	B	C	D	D
Terrace/no rubble wall 5	B	B	D	D	E
Remnants of rubble wall 4	C	C	D	E	E

Table VI.2. Matrix: level of soil protection against level of erodibility (adapted from Guidelines)

where A refers to negligible to very low risk of soil erosion
B refers to a low erosion risk
C refers to moderate risk
D refers to high erosion risk
E refers to extreme risk



Title :
Physical Erosion Risk Map

Scale :
1:55,000

Date :
June 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

VI.3.5. Photocatalogue

During the period of activity implementation, various photographs were taken. Emphasis was given to the three pilot sites and specific erosion/desertification processes. The main photos collected were scanned and saved in JPEG format in a CD which forms an integral part of this report. This will serve as a basis for the preparation of pictorial representation of soil erosion and desertification for teachers teaching subjects relating to soil erosion and desertification.

VI.3.6. Public participation

The first exercise taken in this regards was the identification of major stakeholders. Farmers and their co-operatives were identified as being the main stakeholders since they are the ones working the land. Other actors who may have a role in erosion control management include hunters/trappers, land owners and NGOs.

Plate VI.14. Members of the National team speaking to a farmer on the field (2000)

Regular formal meetings with the farmers and their co-operatives were very successful and were followed by informal meetings on the field (Plate VI.14). This exercise also assisted the National team to have a different perception of the problem the farmers are encountering.

Furthermore, NGOs were also involved in this activity. Nature Trust as the main CAMP NGO was mostly involved with the dissemination of information to the public by organising on site information field sessions. The Fondazjoni Wirt Artna (FWA) was involved through the organisation of a campaign for increasing consciousness of the importance of rubble walls as soil retaining structures. The FWA was also responsible for securing funds for the organisation of a regular course in the revival of the skill of traditional rubble wall building.

Regular meetings with the local authorities, especially those occurring in localities with a high percentage of agricultural land were held.

The involvement of the scientific community was secured through the Institute of Mediterranean studies (University of Malta) which was represented also on the National team. Several lectures at the University as well as to the Geography Teachers' Association were given on the issues and processes of land degradation and soil erosion in Malta. University dissertations were also geared towards desertification by the undertaking of specific issues on land degradation, e.g. the effect of salinisation and the state of terracing and rubble walls in specific valleys located on the two main Islands.

A public participation week was organised through the CAMP Malta Project by the drawing up of an exhibition (Plate VI.15). At least 200 Secondary school children visited this exhibition. During this week, information re soil erosion processes and issues in Malta as well as the UNCCD were given. Members from the National team were always present to answer any queries asked by the public.

Plate VI.15 CAMP Malta Project Exhibition – showing the erosion/desertification exhibits (2001)

In addition to the above, several articles on the subject were written and published. These included two separate articles (English) published on local papers; two separate articles (Maltese) published on a local farmers' journal (published by the local Department of Agriculture) and two separate articles published in a children's journal (Maltese).

Furthermore, two separate radio programmes (on a programme specifically for farmers) were recorded by the National team and transmitted. This also proved to be a success since the Team received a substantial amount of feedback following these programmes. Finally, a 10 minute TV slot on the local station was allocated where a journalist interviewed the National team leader on the subject of erosion and its control in Malta.

VI.4. Other surveying activities

(i) Establishment of sediment traps

Measurements at the established sediment traps were taken (Fig. VI.7, VI.8 & VI.9). Monitoring of these traps commenced during Winter 2000/2001. Such measurements yielded negligible results due to the fact that the rainy season of 2000/2001 was remarkably deficient in rainfall (total of 380.0mm) and particularly in heavy rainstorm events. This was recorded from the 1st of September 2000 to the 31st August 2001.

(ii) Field profiles

Cross sections of fields and slopes were taken in order to investigate soil erosion phenomena at the pilot areas (Figs.VI.10a, b & c & VI.11).

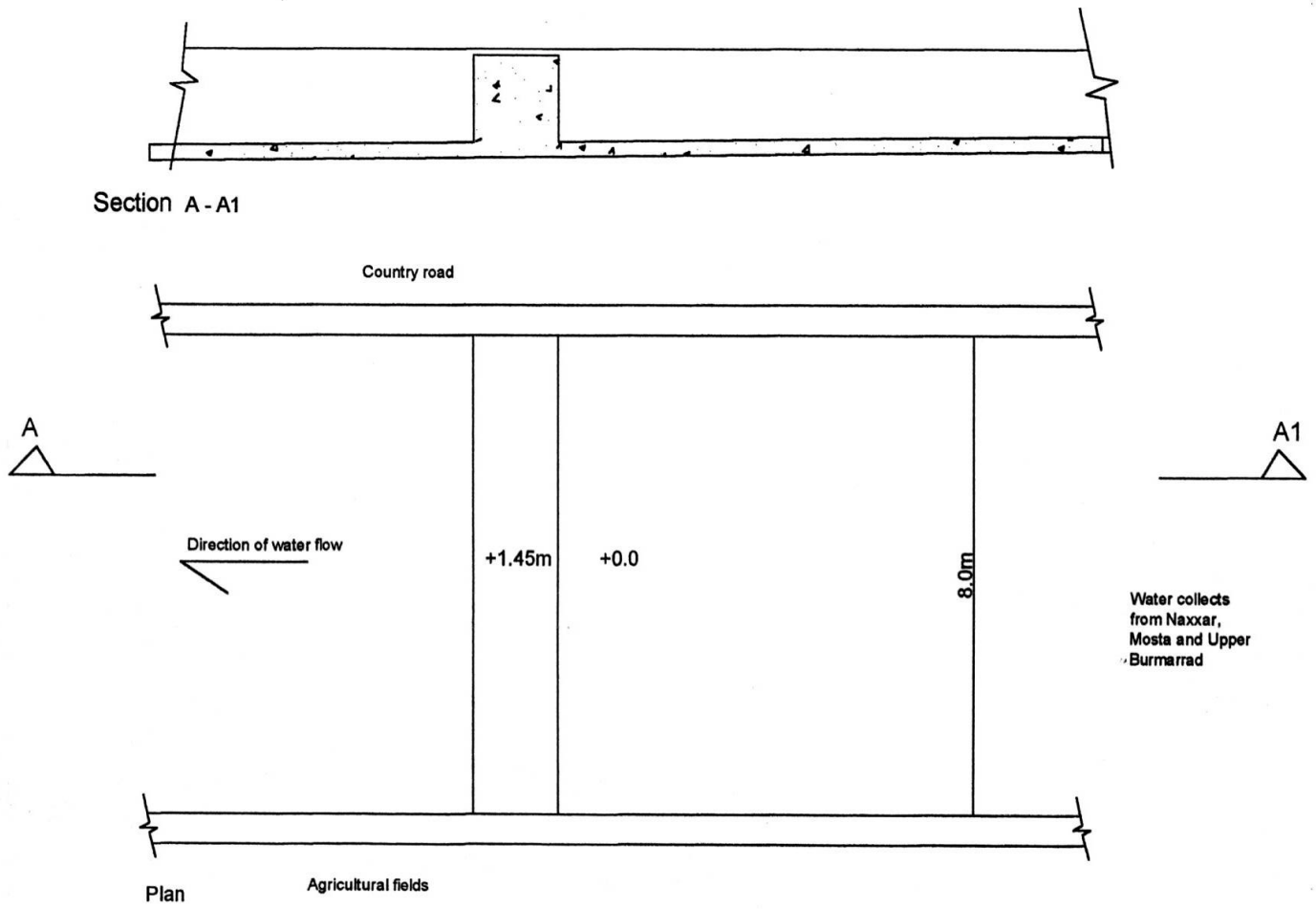
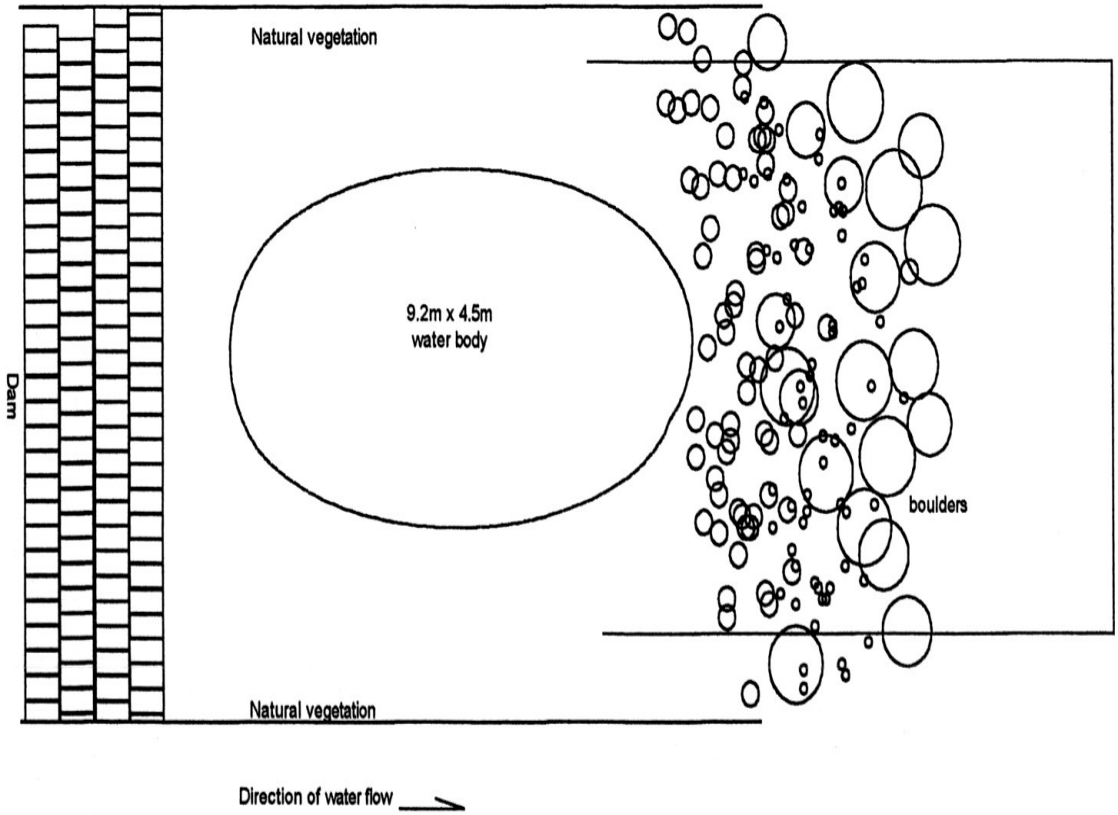


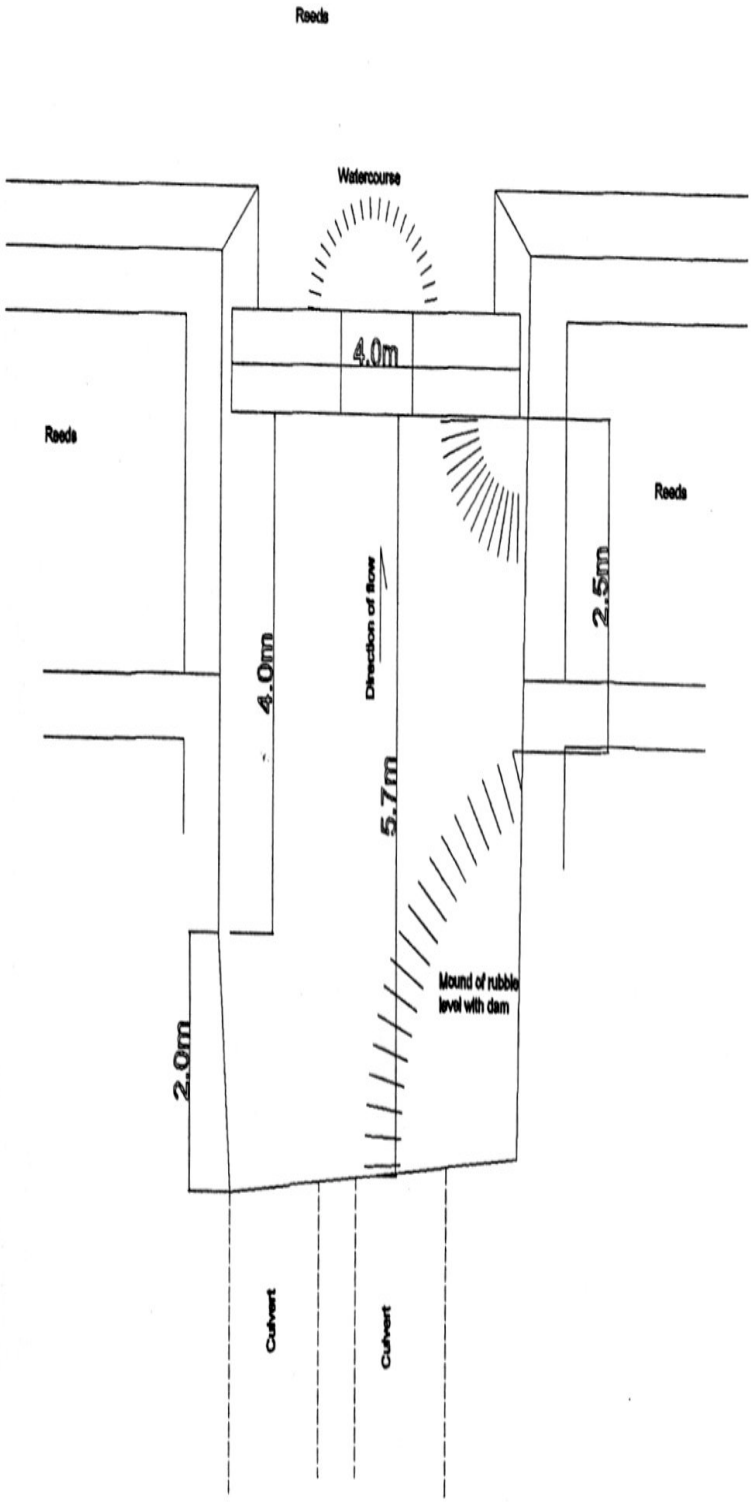
Fig.VI.7. Sediment trap at Burmarrad (WSC Station), 2000



Average depth of pool: 300-400mm
taken at centre of pool

Water course passes under main vehicular
thoroughfare further down stream.

Fig.VI.8. Sediment trap (behind check dam), Burmarrad, 2000



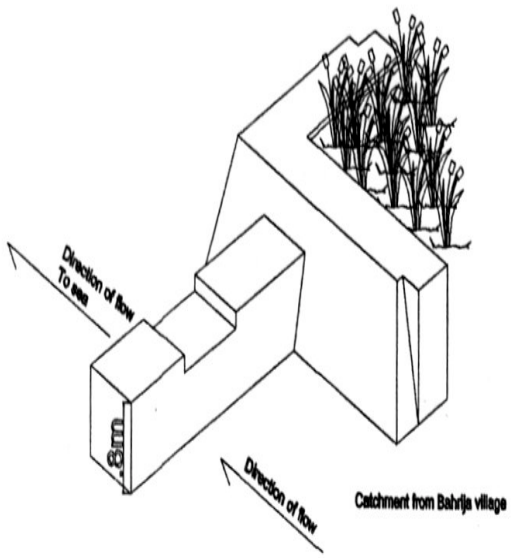


Fig.VI.9. Measurements of sediment trap at Fomm ir-Rih, 2000

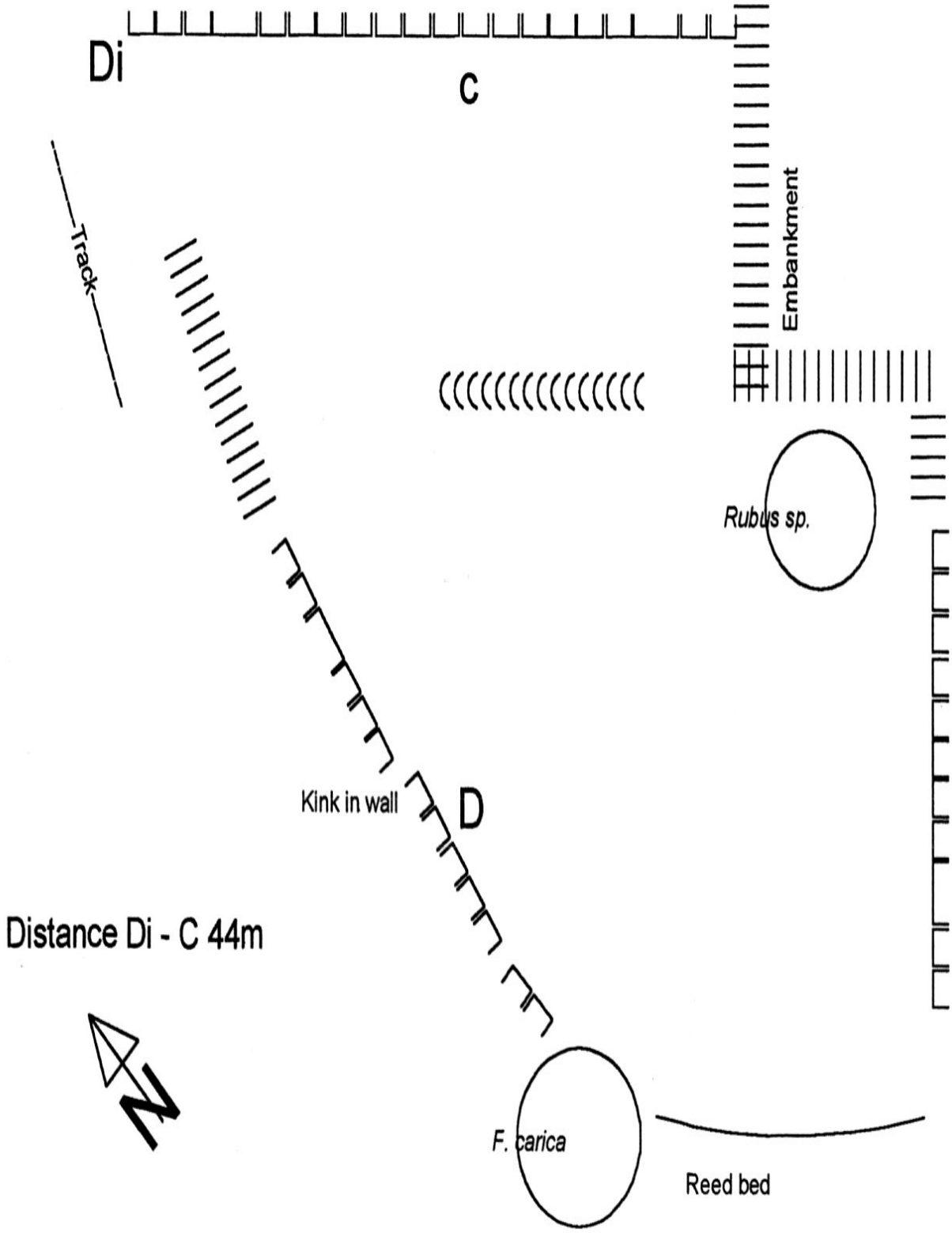


Fig.VI.10a. Plan of field unit, Tas-Santi, 2000

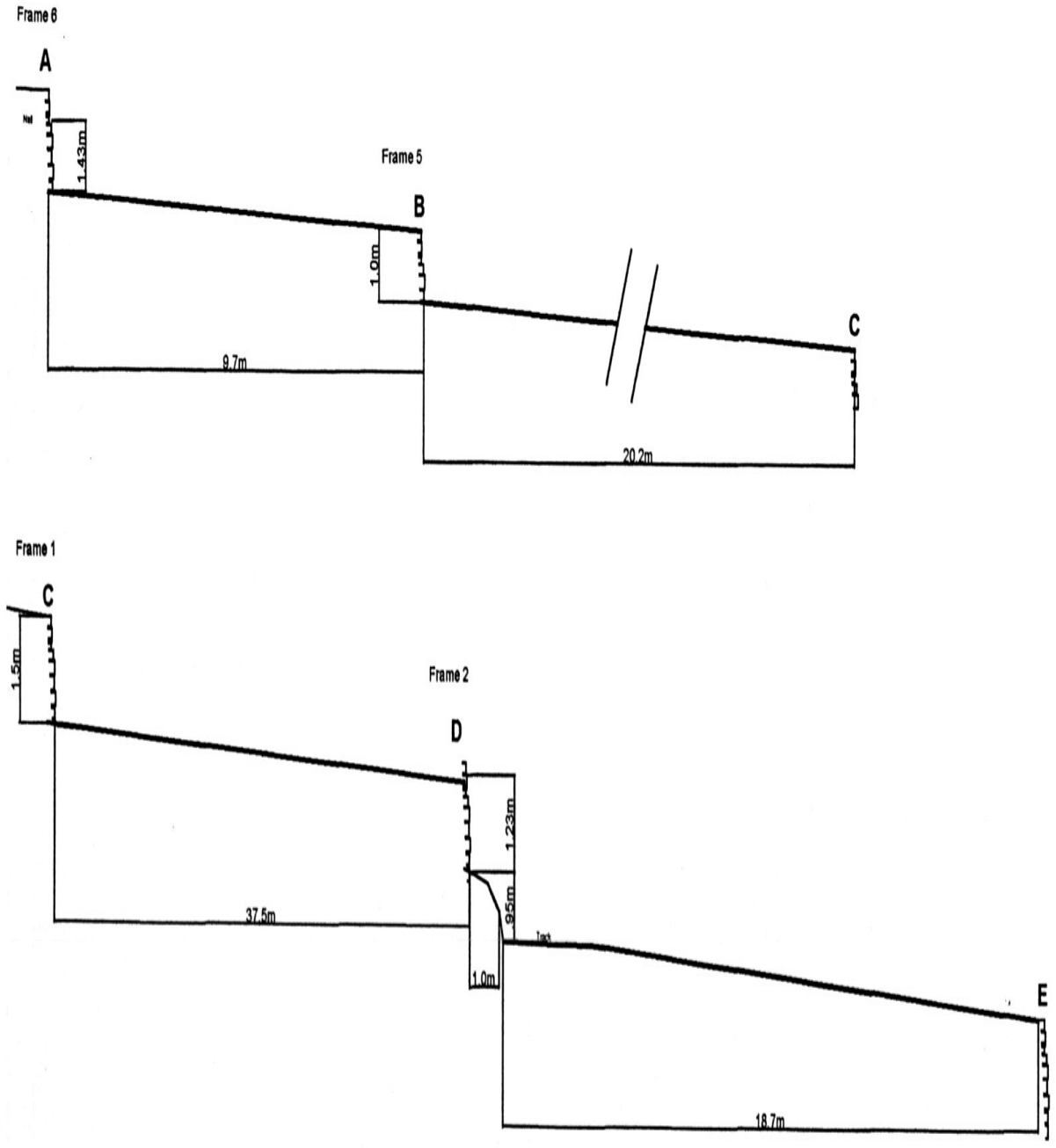


Fig. VI.10b. Cross-section of field terraces, Tas-Santi, 2000

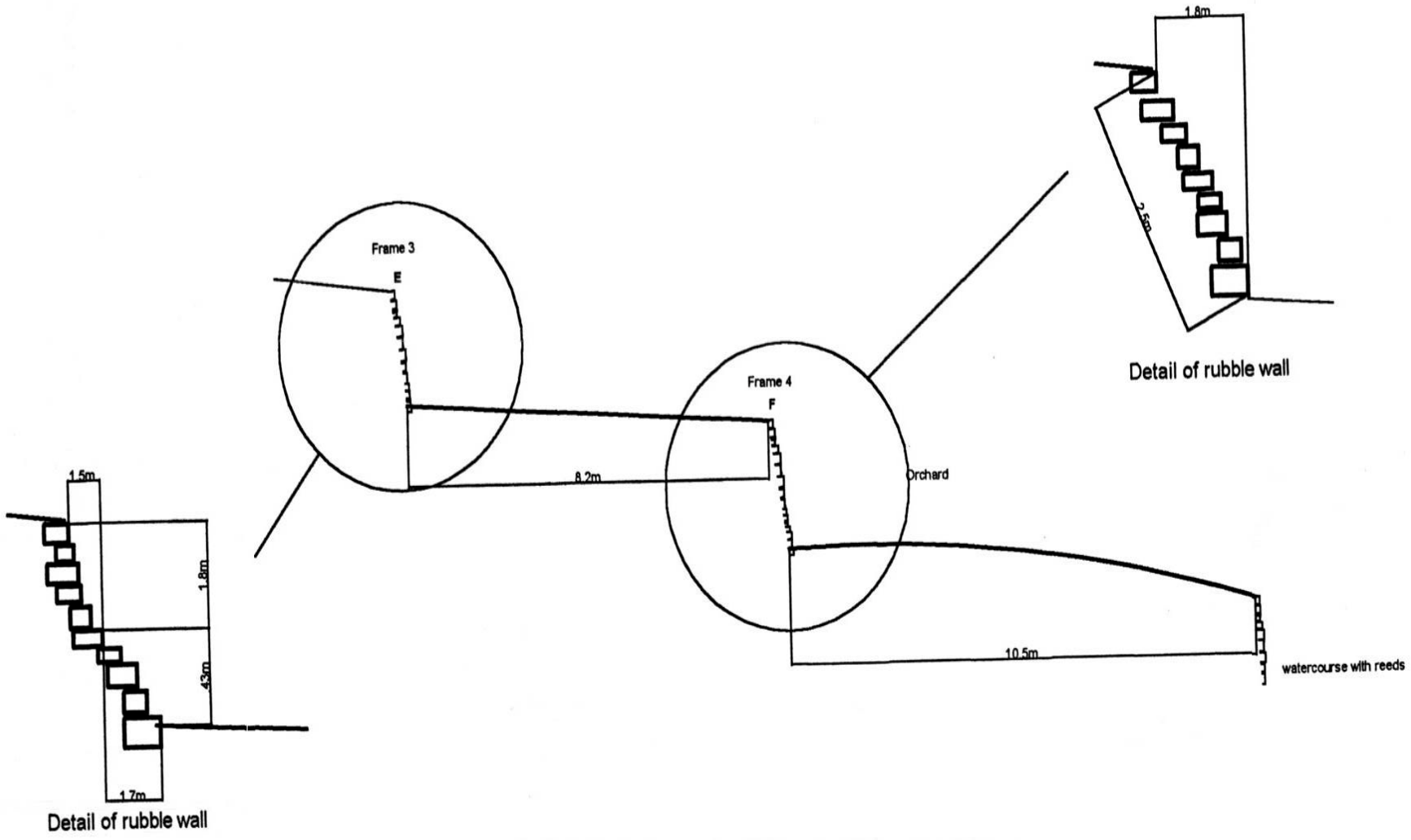


Fig. VI.10c. Details of profile of field terraces at Tas-Santi, 2000

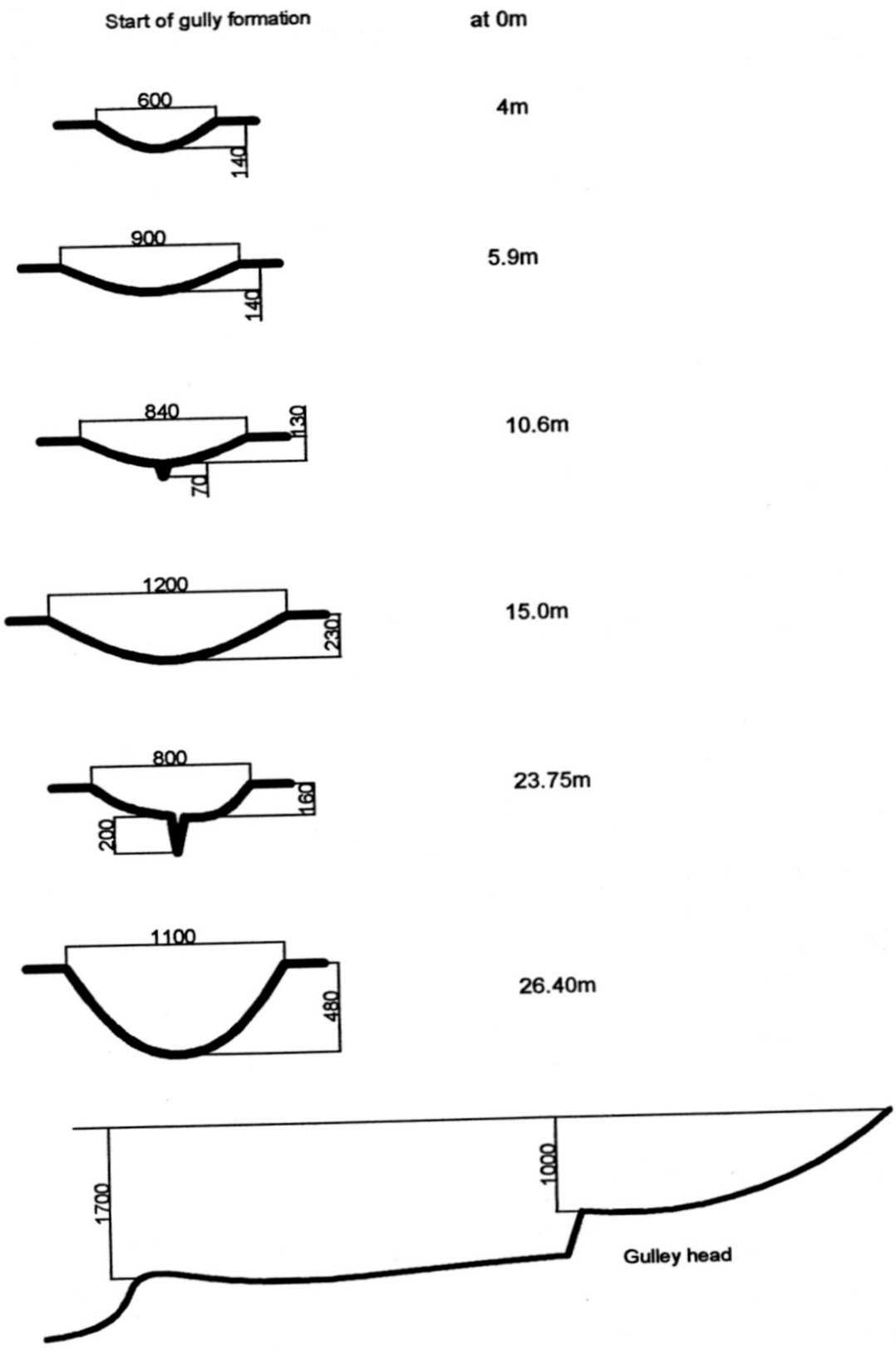


Fig.VI.11. Profile of a rill/gully in a field unit at Burmarrad, 2000

(iii) Number and length of breaches in rubble walls

The number and length of breaches in rubble walls were measured at Burmarrad and Tas-Santi in order to produce baseline data for monitoring of the respective sustainability indicator (*vide* Chapter V.).

Field unit	Perimeter of field unit m	Area of field unit m^2	No. of breaches/field unit	Length of breach m
A	1,046	46,980	Nil	n/a
B	437	10,390	Nil	n/a
C	329	6,724	Nil	n/a
D	559	8,842	2	132
E	308	3,221	1	94
F	496	10,400	2	321
G	469	7,302	No walls	n/a
Total length of breaches **547m**				
Total number of breaches **5**				

Table VI.3. Length & number of breaches at Burmarrad, 2000

The investigation of the Burmarrad area further enhanced the need to divide the area in two parts. The eastern part mainly consists of a level plain with large, open fields, where risk to damage by runoff storm water is minimal. In fact, no breaches in the rubble walls were observed in field units A, B and C (Plate VI.16).

On the other hand, Burmarrad west consists of a deep valley with high sloping grounds with relatively large terraced fields. The results clearly show the high risk of soil erosion. In fact, about 30% of the retaining walls of field units D, E, F and G, were collapsed. Here also, little or no effort has been made to repair and maintain the retaining walls.

Plate VI.16. Rubble walls in a good condition, Burmarrad

Plate VI.17. Fields on steep slopes, Burmarrad, 2000

In general, the Tas-Santi valley is a well maintained cultivated fertile area, with clear evidence that efforts are being made by the farmers/tenants to maintain the retaining rubble walls (Plate VI.18).

Plate VI.18. Well-maintained fields at Tas-Santi, 2000

Field unit	Perimeter of field unit m	Area of field unit m^2	No. of breaches/field unit	Length of breach m
A	266	1,636	2	12.4
B	132	718	No wall present	n/a
C	121	898	No wall present	n/a
D	187	1,058	6	52.4
E	357	2,437	2	5.0
Total length of breaches **69.8m**				
Total number of breaches **11**				

Table VI.4. Number & length of breaches at Tas-Santi valley, 2000

Nonetheless, the survey showed that certain specific areas within the valley require more attention. It has been observed that two particular field units at Tas-Santi, i.e. B and C had totally collapsed retaining walls, and which were left in this state for quite some time. These two small field units are situated on high ground where the fields, as a result of the steep slope, are prone to damage by storm water runoff. No efforts have been put in by the farmer to repair and maintain these retaining walls. This further supports the conclusion that steep unmanaged slopes require priority intervention measures (Plate VI.19).

Plate VI.19. Unmanaged fields on steep slopes, Tas-Santi, 2000

Apart from the statistical results yielded in this survey, the importance of integrating the physical parameters of the area with the socio-economic patterns has been especially highlighted. Only then can the conclusions drawn up be realistic.

(iv) Chemical Soil Analysis

The main soil groups identified at Tas-Santi were the Carbonate raw soil and the Xerorendzina group. According to the classification of soils as described by Lang (1960), the Fiddien and San Lawrenz series of the Carbonate Raw group of soils and the San Biagio series of the Xerorendzina group are present (Table VI.5).

According to Kubiena (1953), the Carbonate raw soil is a very young raw soil, extremely low in humus. In Malta, four series of carbonate raw soils have been distinguished on the basis of the variation in the parent material, from which the biological soil differs very little. These are the Nadur, Ramla, Fiddien and San Lawrenz series.

The Fiddien and San Lawrenz series are soils dominated by their content of Blue clay, they are calcareous with a field pH of about 8 and they are dominantly heavy soils.

The Xerorendzina soil is a rendzina, ash grey in colour, usually very loose, when dry in general powdery, with extremely high chalk content, often also of water soluble salts, particularly gypsum. The San Biagio, Alcol and Tal-Barrani series have been classified as xerorendzinas.

The San Biagio series are usually undifferentiated from just below the surface of the bedrock. Frequently the parent material is largely alluvial and colluvial on the lower slopes and the profiles are somewhat eroded on the upper slopes.

The data compiled so far does not permit the analysis of trends with respect to soil vulnerability to erosion. Such trends are usually based on actual measurements of soil loss and parameters such as aggregate stability of particles. Other parameters such as particle size distribution and percentage organic matter may be selected as indicators of susceptibility to erosion, but only if they have shown temporal trends verifiable by actual measurements.

Soil sample	Soil series	Description	Texture Class
A1	San Biagio	Most extensive series in intensive agricultural use. The soils are found at the foot of main scarps where they are strongly terraced and in the dissected low plateaux which lie below the scarps. Developed on the Globigerina soft limestones and marls. Structure is rather weak but tillage is very easy compared with the clays.	loam
A2	San Biagio	-ditto-	sandy loam
A3	San Biagio	-ditto-	loam
A4	San Biagio	-ditto-	clay loam
A5	San Biagio	-ditto-	clay loam
A6	San Biagio	-ditto-	clay loam
A7	San Lawrenz	Related to the Fiddien series since parent material is Blue clay and globigerina soft limestone colluvium and alluvium on globigerina rock. Texture is clay loam or light clay at the surface. Yellow-brown when damp. Developed below the Fiddien soils in a scarp slope, as a belt of variable width, often right at the foot of the scarp and on the upper edge of the Globigerina plateau.	Sandy clay loam
A8	Fiddien	Developed on Blue clay. Two texture types, a very heavy clay and a somewhat lighter clay, the differences between which are of considerable importance to agriculture. Heavy clay type soil is low in organic matter, raw soil humus, calcareous, saline, slightly alkaline. Light clay type is a grey brown gritty clay loam, low in organic content, calcareous.	clay
A9	Fiddien	-ditto-	Sandy clay loam
B1	San Lawrenz	Refer to above	Clay loam
B2	San Lawrenz	Refer to above	Clay loam
B3	San Biagio	Refer to above	Clay loam
B4	San Biagio	Refer to above	Clay loam
C1	Fiddien	Refer to above	sandy loam
C2	San Lawrenz	Refer to above	clay
C3	San Biagio	Refer to above	clay loam
C4	San Biagio	Refer to above	sandy loam
R1	San Biagio	Refer to above	clay loam
R2	San Lawrenz	Refer to above	clay
R3	Fiddien	Refer to above	clay
R4	Fiddien	Refer to above	clay
R5	San Lawrenz	Refer to above	clay
R6	San Biagio	Refer to above	sandy loam

Table VI.5. Soil series and texture class for soil samples, Tas-Santi

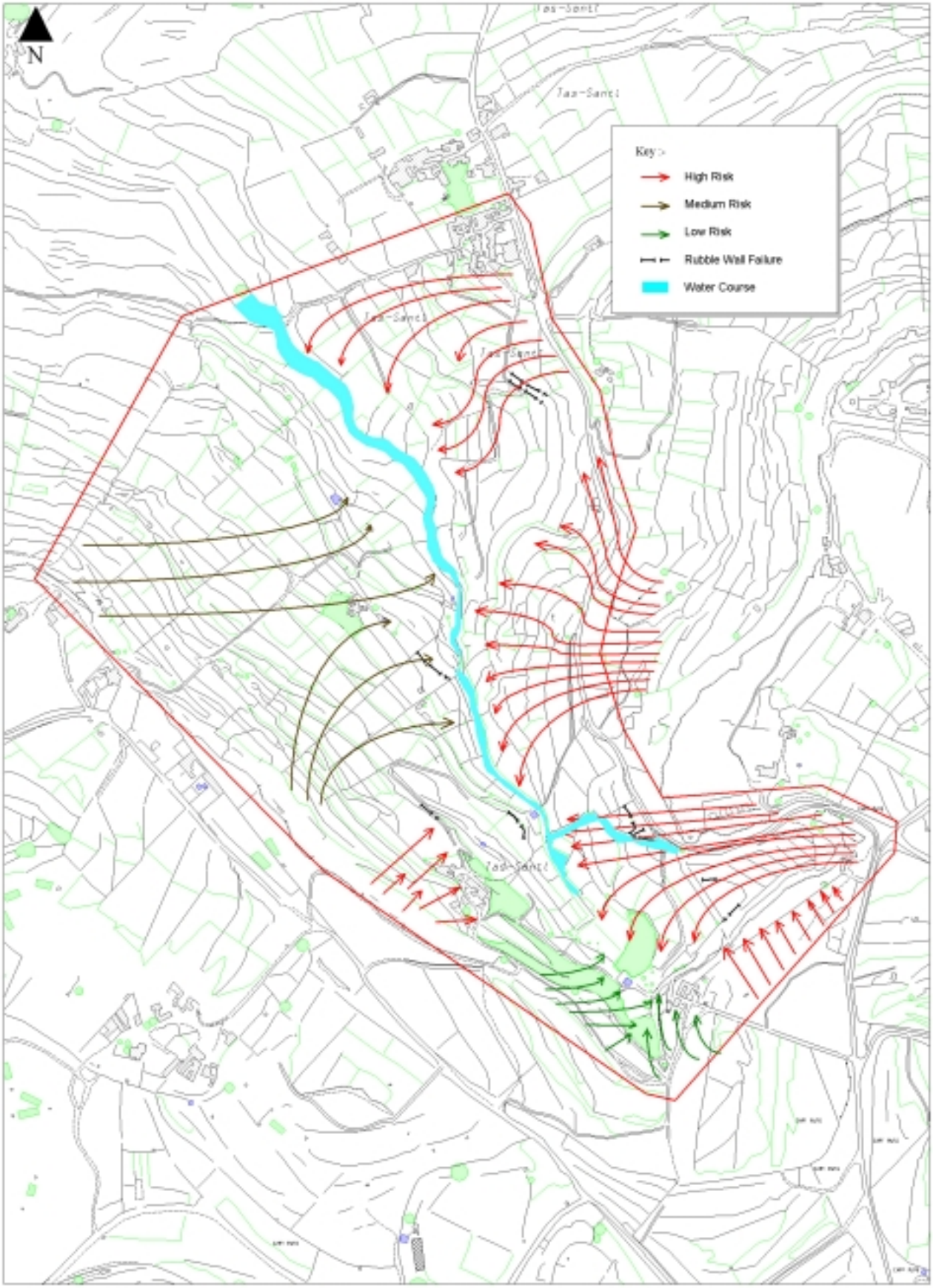
(v) Direction of water flow (Fig. VI.12)

Tas-Santi valley is part of the system of watercourses. The plateau is characteristically karst land where the rock has low water infiltration properties. During rainstorm events, water flows through the watercourse running along the valley bottom.

It was observed that the passage of water is greatest in the south-eastern side of the valley and therefore this particular area shows the highest erosion risk. The amount of localised rills and gullies in this area are evidence of the passage of a large volume of water. (This phenomenon was also confirmed by the farmers working the land). Furthermore, the tarmaced road along the side of the valley accentuates this risk since surface water runoff is bottlenecked onto the contiguous fields. The direction of water runoff could also be traced by following the line of breaches in the rubble walls from one terrace to another.

The situation is different on the other side of the valley, i.e. the soutwestern side. Few rills were observed in the area. In fact, this valley side is protected against surface water runoff by the overhanging cliff edge. The water is not funnelled into one particular spot, thus the risk pattern is low (area has a medium to low erosion risk).

The northern tip of the valley shows the lowest risk pattern, since the land here is less sloping and there is little (if any) water runoff from the road.



Title :
Erosion Risk Pattern, Tas-Santi, l/o Mgarr

Scale :
1:3,700

Date :
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

VI.5. Integration of mapping outputs into socio-economic background

It is clear that in most cases, anthropogenic factors place undue pressure upon vulnerable environments, thereby contributing towards irreversible damage (Role', 1999). The relationship between natural processes and socio-economic dynamics underlying human interactions with the environment has been analysed vis-à-vis the soil erosion/desertification phenomena, keeping in mind that the activity is built around a conceptual framework which combines physical and human factors acting within specific landscapes.

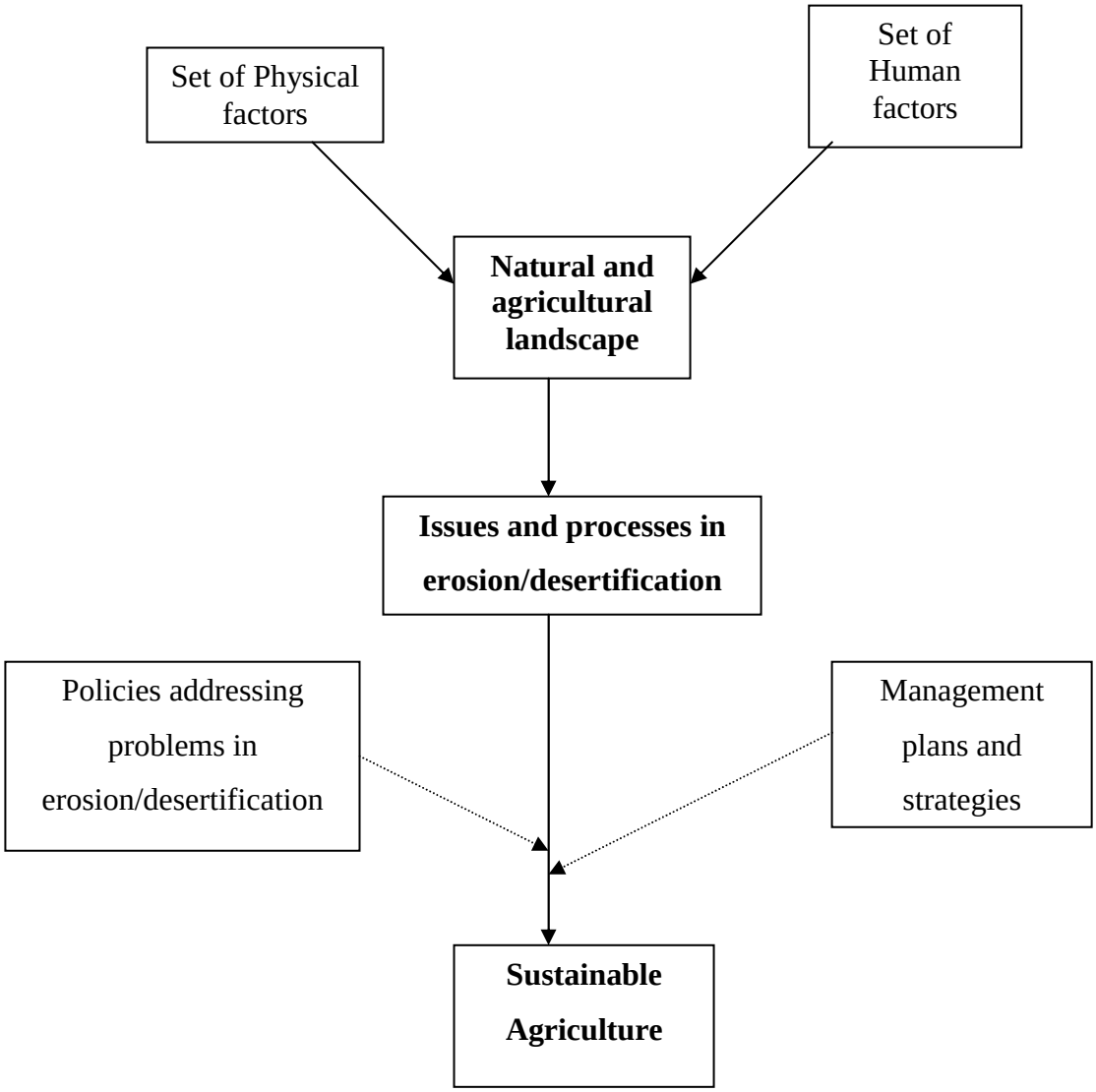


Fig. VI.13. Conceptual framework (Role', 1999)

The socio-economic assessment showed the following results:

(i) Population

- Population changes and urbanisation
  The process of urbanisation in the Maltese Islands has been very rapid. In 1995 the built up area on the Islands amounted to approximately 65 km^2 or 21% of the total surface area (SoE, 1999).

  The consequences of urbanisation on the agricultural sector can be summarised as follows:
  (a) loss of formerly productive agricultural land;
  (b) replacement of soil covered areas (permeable surface) with impermeable surfaces such as concrete and tarmac. This has increased the amount of runoff with the consequence that soil erosion on adjacent fields has also increased;
  (c) the number of full-time farmers has decreased drastically since the 1960's as a direct result of rapid urban growth. More farmers were, since then, lured to move to more financially secure and less demanding jobs, with the result that the farming population began to drop steadily. In 1978, there were 6,070 full time farmers and 10,498 part time farmers while in 1991, there were 1,510 full time farmers and 12,418 part time farmers (CoS, 1991). Some agricultural land was inevitably abandoned in the process.

- Road Development
  The road network in the Island is very dense with a huge number of links to cope with the increased number of cars on the roads and in order to facilitate access. On a positive note, access to the fields and therefore transportation of machinery and products has been improved. Accessibility has, in some cases, resulted in increased productivity.

- Farming Practices
  Mechanised ploughing and the size of Maltese land holdings often leads to ploughing patterns which tend to reflect the limitations imposed by field boundaries rather than slope. Downslope ploughing accelerates surface water runoff and therefore increases potential for soil loss. Contour ploughing, which highly decreases the erosion potential of surface runoff, cannot always be practised either because of the small size of the fields or because of the steep slope which can endanger the stability of machinery with a consequent danger for human security.

  Wherever irrigation water is unavailable or too costly to transport, fields are generally left uncultivated (fallow) during the summer months. During this time, the soil is highly susceptible to wind erosion. In August - September, the soil is ploughed, ready to receive the first rains. However, the first torrential rains in September - October find the soil vulnerable to soil loss, resulting in gullies and mass movement.

  Heavy machinery such as tractors and other motor vehicles that are driven on the soil can damage the structure of the soil by causing compaction, increasing risk of surface runoff and erosion. In fact, problems in erosion were observed wherever there were tyre tracks in the fields. Most farmers are aware of this problem and avoid driving their vehicles on wet soil.

(ii) Exploitation of freshwater resources

- Irrigation
  Although agricultural land has decreased, agricultural production has increased over the last years mainly as a result of more and better irrigation. This trend may be a result of the increasing accessibility and availability of irrigation water by pumping water from boreholes. In 2000, 1100 hectares of agricultural land was being irrigated (NSO, 2001). In 1998, 3000 boreholes were registered while a survey carried out in the same year showed that 800 new boreholes had been dug.

- Salinisation
  As in all other semi-arid countries, severe competition exists between agricultural and domestic water users. Malta is dominated by a karst geomorphology with a lack of permanent surface water flow, perennial rivers and lakes. In fact, the Maltese countryside used to be dominated by wind-driven water pumps but many of these are no longer visible since their water supply ran dry back in the 1970s when a massive borehole drilling programme was launched by the former Water Works Department. Despite all of this, agriculture still depends mostly on ground water for all year round irrigation.

  Overabstraction of groundwater, especially in coastal areas has contributed to salt water intrusion, with a consequent salinisation of the water used for irrigation. Tapping of springs and water seepages appears to have been carried out since antiquity. Most springs no longer flow into watercourses which has resulted in the elimination of nearly all former permanent stream habitats. The productive capacity of the aquifers is around 28 million metres^3 per annum compared to the total recorded extraction of 30.9 million metres^3 (J. Mangion, pers. comm., 2001).

- Nitrate pollution in water table
  As a result of excessive use of fertilisers, the water table is also being contaminated with nitrates. The Water Services Corporation has declared that in some areas the nitrate levels are so high that the water is not suitable for drinking. High nitrate levels do not have adverse impacts on agricultural irrigation practices. Ironically wherever high nitrate levels occur the extraction of ground water for domestic human consumption is halted by the Water Services Corporation and consequently more water is "theoretically" available for the farmers.

- Irrigation with 2nd class water
  The potential output of second class water for irrigation has increased from 7,000m^3 per day (1983) to 17,000m^3 per day (2000). Second class water is used by farmers in relatively close proximity to the treatment plant located at Sant Antnin (M'Scala). In fact, the Department of Agriculture claims that one third of irrigated agricultural produce in Malta now comes from this particular area (A. Mifsud, pers. comm., 2001).

- Crop type

  The increasing density of population of the Maltese Islands as well as the growth in the tourist industry provides a ready market for market gardening produce. Most of these crops consist of highly perishable produce grown under intensive cultivation systems. In fact, the size of most Maltese land holdings is perfectly suited to such intensive farming and facilitates the employment of irrigation systems. In this respect, such land holdings should have a semi-permanent vegetation cover all year round and this should contribute significantly to the reduction of soil erosion, especially during early Autumn when the first torrential rains are normally expected.

(iii) Costs of Soil Erosion

Soil loss, through erosion, entails very real and specific economic costs, although it is often extremely difficult to place monetary value on soil as a natural resource.

- The Cost of Soil Replacement

  The real cost of soil is hidden under transport tariffs. Soil suppliers are, mostly small to medium sized excavation contractors who are engaged for site preparation before building works can commence. Any soil found on the construction site must be removed according to a strict permit system governing its transport. The Fertile Soil (Preservation) Act 1973 (amended in 1983) and L.N. 104 of 1973 Preservations of fertile soil regulations prohibits the dumping of soil or its burial but the economic incentive ensures that no soil is lost during construction. The Department of Agriculture is another major supplier of soil but the distribution of such soil from the Department is largely confined to farmers. Much of this soil is also poor in quality and, therefore, not much in demand.

  An indication of relative costs is provided in Table 6 which is calculated on the prices negotiated for a residential buyer. Prices for manure and mushroom compost are also included to provide some information on the additional costs incurred in soil conditioning.

  Relative costs depend upon the quantity of soil which is required as well as the relative quality of the soil. Clayey, raw carbonate soils tend to fetch lower prices since they are more difficult to work while the darker brown fertile loams command the highest prices. The crumb structure of the latter allow optimal drainage and these are sometimes used as topsoil placed upon inferior quality soils. Terra Rossa soils often fetch very high prices amongst domestic buyers due to the widespread, and misplaced, belief that such soils are very fertile and are supposedly suited to the cultivation of citrus orchards.

Soil type	**Price per m^3 Lm**	**Price per truckload ($15m^3$) Lm**
Clayey, raw carbonate soil	n/a	n/a
Brown Loam	2 to 2.5	35 to 50
Terra Rossa	2 to 2.5	35 to 40
Mix of soil and gravel (Hamrija Marbula)	1.5 to 2	25 to 30
Mushroom compost	1	15
Cattle/horse manure	2.5	35
Sant Antnin compost	Lm3.00 per ton (subsidised rate for farmers)	n/a

Table VI.6. Estimates of cost of soil in Malta (Role', 2001)

Furthermore, the availability of soil for replenishment has decreased considerably over the last few years and this has triggered a corresponding increase in the market value of soil.

- The Cost of Preventing Soil Erosion
  Soil erosion has been traditionally contained by terracing and the building of retaining rubble walls. It is impossible to provide a monetary estimate of the capital which such ancient terraces constitute. The labour invested in such structures over so many years is impossible to quantify especially when one bears in mind that the availability of earth moving machinery is a relatively very recent commodity. It is equally difficult to calculate a global figure for the amount of capital lost through neglect of agricultural land since the relative productivity of some of these fields was rather marginal.

  Estimates for the construction of rubble walls average Lm40 per square qasba (approximately 2.2 metres squared). Such prices apply to decorative rubble walls for domestic and tourist-related development. Farmers, of course, cannot pay such prices for the maintenance or re-building of their retaining rubble walls. Full time farmers have to find time to re-build the rubble walls within their farming schedule. Part-time farmers, on the other hand, often discover that it is quite impossible to carry out such maintenance and allow walls to fall into a serious state of disrepair.

  Costs for the rebuilding of retaining (load bearing) rubble walls varies according to the steepness of the slope they are meant to stabilise. This, of course, determines the height and thickness of the required rubble wall. Another important consideration, however, is the depth of excavation necessary to reach sound bedrock for the construction of a solid foundation. Some soils formed over clay lithologies would require several metres of excavation before the underlying globigerina layers are exposed. In such cases, the construction of well-founded, retaining rubble walls is quite impossible to achieve.

(iv) Industrialisation of agriculture

- Greenhouses
  During the last 20 years, greenhouse cultivation increased considerably in the Maltese Islands. There are approximately 250 greenhouse units in the islands, with a total area of 37.5 hectares. Generally these occupy good agricultural land thereby changing the characteristics of the Maltese landscape as well as increasing the impermeable area. It is only fair to say that, most greenhouse unit owners harness the precious rainwater runoff into reservoirs specifically constructed for this reason. The water is then used to irrigate the crops in the greenhouses.

- Hydroponics
  In contrast to greenhouses, hydroponic structures are rather permanent, usually having a concrete platform base. Thus it is not so easy to restore the land to its former state, once the hydroponic unit is abandoned.

  Furthermore, the water which is discarded is rich in nutrients (fertilisers), and sometimes contains fungicides, increasing the risk of groundwater contamination.

- Animal Husbandry
  Malta is self sufficient in pork, milk and poultry products. Animals that are traditionally pastoral animals like goats, sheep and cattle are bred in enclosed farms. Grazing is supplemented by fodder – mostly wheat, which is stall fed to animals. Thus land degradation by overgrazing, so prominent in the Mediterranean basin, is non-existent in Malta. Clover, a popular fodder crop of great benefit to the soil, is seldom grown nowadays.

  Also, the inadequate disposal methods for slurry produced by the farms ends up being leached into the water table.

- Irrigation techniques
  With the introduction of drip irrigation, which is widely used today, the efficient use of water for irrigation has been highly enhanced. More land could be irrigated with less water. Soil is being less disturbed as there is no need to dig long, deep furrows in the fields for water distribution. Also the formation of large deep vegetable beds (to be flooded with water) is no longer carried out.

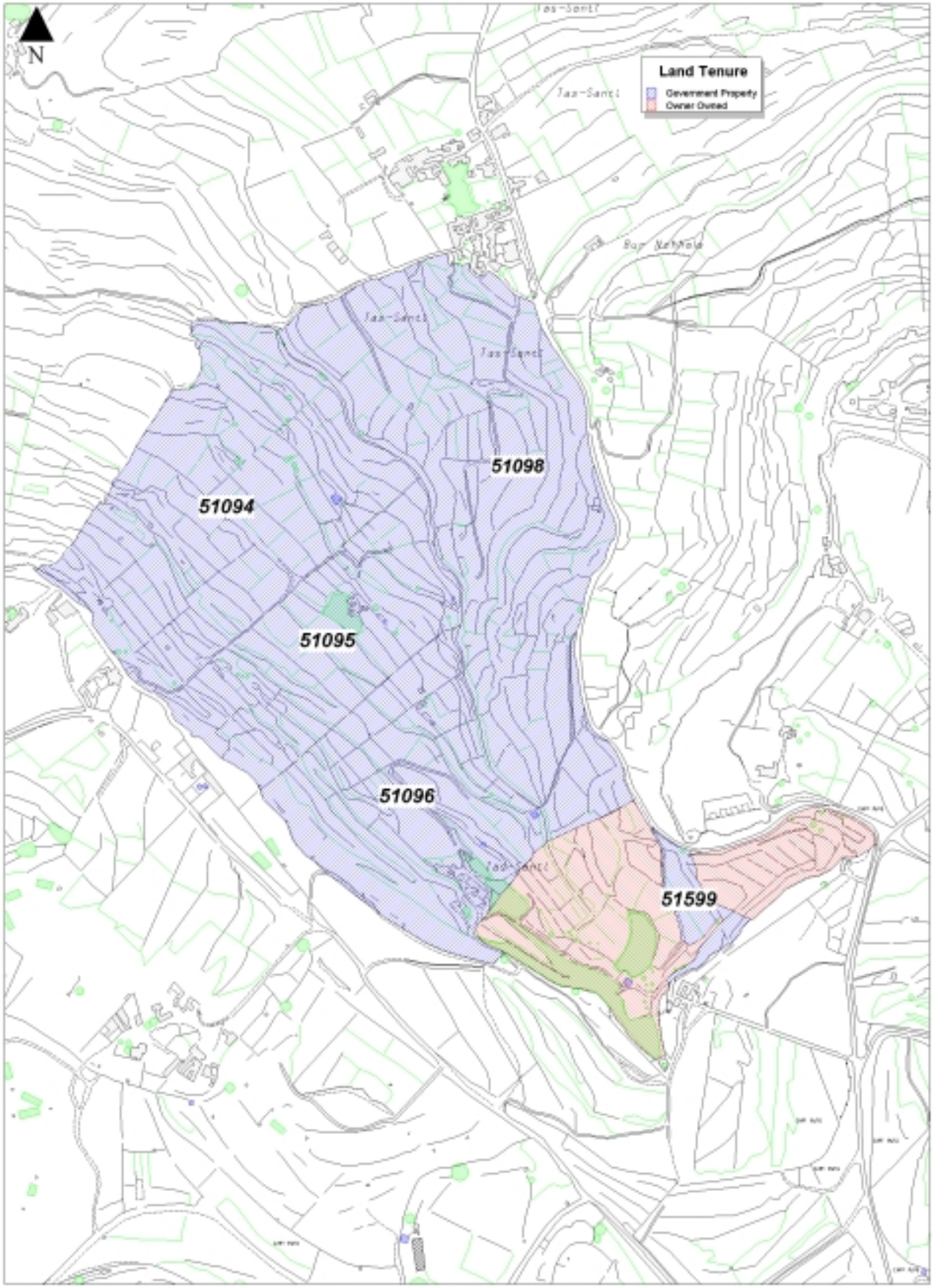
- Reservoirs and Bore-holes
  The traditional method of harnessing water is by building reservoirs. Today this is a costly venture, because to build a medium sized reservoir, one needs thousands of pounds. The local farmer is resorting to borehole digging and tapping the underground water, as the initial cost of such an exercise is minimal when compared to reservoir building. This is resulting in the risk of the degradation of soil by salinisation, as the underground water is being overexploited.

- Viticulture
  A section of agriculture that is on the rapid increase in the Maltese Islands is viticulture. The demand for grapes, especially wine grapes, is high, thus ensuring a ready market when harvesting. The modern techniques used make work in viticulture highly efficient, less laborious and a success in crop production ensured. This has a marked positive effect on land preservation. Fields that have long been abandoned or badly cultivated are being reinstated into vineyards. Retaining walls built and land is being reclaimed.

(v) Land tenure

Land tenure is 'the way in which rights in land are held' and varies from ownership since the latter deals mainly with legal title (ECE, 1996). Security of tenure plays a fundamental role in agricultural land management since it can positively or negatively affect farmers' decisions on the land.

In the Maltese Islands the majority of farmers are tenants. These lease their land either from private landowners or from the government. The latter has become the principal landowner in 1992 when a large proportion of church owned property was passed on to the government (Meli, 1992). Security of tenure varies considerably between these two major landowners. Farmers renting government owned land enjoy a relatively high security of tenure while those working on privately owned land (from private landowners) have a generally low security of tenure (Calleja, 1999 & Fig.VI.14).



Title :
Land Tenure, Tas-Santi, l/o Mgarr

Scale :
1:3,700

Date :
February 2002

MAP CAMP "Malta" Project
Soil erosion/desertification control management

Farmers' decisions on the land are highly affected by the perception of security (or lack of it) of tenure. Whereas farmers enjoying a good security of tenure are generally willing to invest, those who lack such a security are, many a times, discouraged and reluctant to invest in long term improvements on their land such as maintenance, investment and upgrading work. These factors can all lead to a deterioration of the land and in some cases can lead to degradation and erosion.

- Fragmentation of Holdings
  The fragmentation of holdings is a common problem in the Maltese Islands and is generally a direct result of the structure of inheritance laws. In some cases it can lead to land abandonment. This happens when an individual becomes the owner of a number of small patches of land as a result of inheritance laws. Unfortunately, because of the small size of the fields and of their being situated at a distance from each other, the individual decides to abandon the fields, as they would be uneconomical to work. Once the fields are no longer maintained and taken care of, there is a greater risk of degradation and erosion. The incidence of erosion and degradation increases if the fields are situated on marginal terraced fields.

  In several cases, small fragments of arable land are inherited by people who are not farmers and therefore have no inclination to cultivate the land. Such beneficiaries of inherited land, however, are often reluctant to sell their share in the hope that the land is re-zoned for building purposes.

  Inheritance of immovable goods, such as fields, is often the source of a number of family disputes. A number of cases, which remain unsolved, are taken to the civil court. Unfortunately, the time taken for such cases to be decided is very long with the consequence that many fields become degraded and derelict. Once abandoned, these fields would rarely be re-cultivated on a commercial basis.

- Land Abandonment
  Land abandonment in the Mediterranean region generally takes place on marginal terraced slopes where poor soils, difficult access and small size of fields make the farmers' work uneconomical. The steepest terraced slopes need a lot of maintenance in order to achieve slope and soil stability. Once the fields are abandoned, rubble walls collapse, leading to land degradation and eventually soil erosion. In some cases all soil horizons are stripped away from the abandoned field leaving an exposed bedrock. However, where vegetation in such fields takes over rapidly, a steppic community, which in time may evolve into maquis, develops. Fields lower down from abandoned fields are affected since the flow of water is directed in such fields causing further erosion.

(vi) Non-agricultural processes

- Hunting and trapping
  It is estimated that each individual trapping site occupies about 100 - 200m^2 (Camilleri, 1999). Apart from the total obliteration of the habitat, often small hides are built in close proximity of such sites, taking up good agricultural land. Also, access to these sites is improved by the creation of new access roads and asphalting of these new roads. Extensive use of herbicides is also used to prevent growth of vegetation, which would tear nets.

- Quarries
  The construction of new buildings and roads is a major consumer of raw rock material, namely Globigerina Limestone (used for building stone) and Coralline Limestone aggregate (hardstone - used for making concrete). Therefore, urbanisation is inevitably accompanied by the sprawl of quarries and their related development, e.g. processing plants.

  Apart from the obliteration of the habitat, quarries have an indirect affect on the surrounding agricultural land. Farmers are therefore discouraged to cultivate the land and often abandon the fields due to a layer of dust settling on the surface of fields and crops.

- Ecotourism
  The trend towards ecotourism is directly linked to agriculture and the general state of the natural environment. Access paths would be improved with the risk of further increase in asphalted roads. Rubble walls have been identified as important structures of the rural landscape. The need for their conservation and maintenance has in fact been recognised.

VI.6. Diagnostic analysis

According to the UNEP/MAP/PAP Guidelines, the Diagnostic analysis is the essential input document for the formulation and implementation of remedial programmes. Therefore, overlaying and integrating the physical assessment and the relevant socio-economic parameters, remedial measures and priority areas for immediate intervention were identified.

- **Clay soils** with a low degree of maintenance of rubble walls, e.g. Tas-Santi and Qammiegh (Plate VI.20).

- **Steep slopes** with a current agricultural use or abandoned fields and neglected rubble walls, e.g. Mistra (Plate VI.21).

Plate VI. 21. Steep slopes, Mistra, 2001

- **Valley beds**/flood prone areas, e.g. Wied Hazrun (Plate VI.22).

Plate VI. 22. Farmers recount how half the field contiguous with the watercourse was carried away by floodwaters during the November 1999 storm, Wied Hazrun, l/o Dingli

- Areas under the influence of runoff water from **non-absorbent sealed surfaces** (roads and buildings), where storm water runoff is not adequately managed, e.g. (Plates VI.23 - 26).

Plate VI. 23. Following the November 1999 storm, a new asphalt road was laid down with one course layer of stone blocks built along the perimeter of the road to divert storm water, Tas-Santi

Furthermore, a matrix of Key issues relating to soil erosion/desertification was drawn up (Annex 7).

Plate VI. 24. Mtarfa urban sprawl, 2001

Plate VI. 25. Following the construction of a peripheral road at Dingli, storm waters were channelled onto the fields located down slope and about 20cm topsoil was carried away (November, 1999).

Plate VI. 26. Loss of soil due to channelling of storm waters directly onto fields, Dingli, 1999

VI.6.1. Proposals for remedial measures

The proposals for remedial measures were based upon the various field surveys, statistical documentation and interpretation of the actual and potential state of erosion. Informal and formal discussions with land users and consultations with other stakeholders were an asset to the formulation of draft technologic sets of remedial measures.

Priority Areas	Options for remedial measures
Clay soils with a low degree of maintenance of rubble walls	- Maintenance of rubble walls - Use of specific vegetation {(e.g. Prickly pear *Opuntia* sp (Maltese Bajtar tax-Xewk), Pine tree *Pinus halepensis (*Maltese Znuber), Carob *Ceratonia siliqua* (Maltese Harruba), Olive *Olea europaea* (Maltese Zebbuga)} - Use of drainage systems to regulate the water regime of the soil
Steep slopes with a current agricultural use or abandoned fields and neglected rubble walls	- Maintenance of rubble walls - Use of specific vegetation {e.g. Prickly pear *Opuntia* sp (Maltese Bajtar tax-Xewk), Pine tree *Pinus halepensis (*Maltese Znuber), Carob *Ceratonia siliqua* (Maltese Harruba), Olive *Olea europaea* (Maltese Zebbuga)} - Mulching of agricultural soils - Reclamation of abandoned fields - Ensuring security of land tenure
Valley beds/watercourse/flood prone areas	- No land reclamation at valley bottoms - Maintenance and appropriate cleaning of check dams, watercourses and valley beds - Prevention of blocking of watercourses by waste material
Areas under the influence of runoff water from non-absorbent sealed surfaces (roads and buildings), where storm water runoff is not adequately managed.	- Regular and appropriate cleaning of culverts in rural areas - Sensitisation of civil engineers, architects and contractors to storm water runoff. - Promote system of cisterns to hold runoff at key locations

Table VI.7. Curative/preventive/protective remedial measures for intervention priority areas

VI.7. Global strategy/Action framework

The development of the strategy for future intervention and the establishment of a respective action framework were based on the final integrated erosion risk map (*vide* Fig. VI.6). It is emphasised that the integration of results of this activity with the other CAMP Malta Project activities as well as the various linkages to other erosion/desertification initiatives was mandatory (*vide* Chapter VI.9).

Additionally, the following thematic priority issues have been identified through the integration of socio-economic parameters:

- Retaining rubble walls and their maintenance
- Land tenure (security of tenure)
- Water availability/competition for scarce water resources
- Blockage of dams and water courses with silt and other debris, including waste from fields, e.g. plastic irrigation pipes
- Spread of urbanisation/roads/sealed surfaces and mismanagement of storm water off
- Salinisation
- Climate change, especially drought management and mitigation
- Procuring information for indicators e.g. storm damage claims

As basis for the development of a strategy and action framework, a table summarising relevant information on these five thematic issues, including dominating problem causes, impacts, significance and intervention measures was elaborated (Table VI.8).

These thematic priority issues were the assessed in terms of soil erosion and desertification control management and proposed mitigating measures drawn up (Table VI.9).

Plate VI. 27. Farmers warn off potential snail gatherers about the use of pesticides

Priority issues	Dominating causes	Impacts	Significance	Intervention measures
Climate change especially drought management	Several factors have been identified to cause global warming, e.g. increasing carbon dioxide & methane levels	Prolonged summer dry season and high frequency of drought episodes & increase in intensity and spatial extent of rainfall. Drought renders soils vulnerable to soil erosion and degradation (wind and rain induced erosion)	All seven models accepted by IPPC predict shorter rainy seasons within most intense parts of the Mediterranean and an increase in evapotranspiration rates	Develop drought mitigation plans, multi/bilateral agreements with other countries and including international organisations such as CIHEAM.
Spread of urbanisation/ roads/sealed surfaces	Building development, including roads are largely insensitive to the impact of accelerated runoff onto adjacent fields	Accelerated water runoff spills onto fields creating rills, gullies and massive sheet wash	Whole fields destroyed with loss of upper 10cm of soil after a single storm event	Sensitise civil engineer, architects and contractors to storm water runoff. Promote system of cisterns to hold runoff at key locations
Water availability	Typical Mediterranean climate – semi arid climate and summer drought. Unclear responsibility over borehole drilling practices	Increase in competition for water for agriculture (irrigation) vs. domestic and industrial use	Trend towards increase in reliance of farmers on boreholes for irrigation	Promote water conservation/saving irrigation practices, e.g. drip irrigation. Need at least some control over indiscriminate use of boreholes. Promote harnessing of surface water runoff, water saving processes check dams, etc.
Procuring information for indicators	Lack of perception of need of building trends in Registry in Government Departments	Data held in non-retrievable formats. Difficulty in monitoring and establishing trends	Important as a indicator to provide valid reasons to implement adequate mitigation measures	Propose a system jointly run by the Department of Agriculture and National Statistics Office where data can be adequately recorded
Maintenance of retaining walls	Security of land tenure, vandalism, lack of resources, especially time	Breached retaining walls result in accelerated soil erosion	Strong correlation between breaches in retaining walls and steep slopes/clay soils. Effect is transmitted from one terrace to other terraces downfield	Promote maintenance and rebuilding programmes Educational campaign amongst the public

Table VI.8 Thematic Issues

Causative Processes	Repercussions for Soil Erosion	Significance	Trend	Some Mitigation Measures
Land Abandonment	• Fragmentation of Land holdings through laws of inheritance; resultant pockets are too small and fragmented to allow agricultural activity	Highly significant and necessitates intervention	Large families are now rare and the 2.3 (?) average child family may result in future consolidation	Revision of legislation aimed at reversing fragmentation & facilitating consolidation
	• Speculation (Residential re-zoning and tourist development); arable land owned by speculators who have no intention of cultivating it.		Successive building booms occurred in the past. EU accession may accelerate speculation	Boost speculation control measures (introduce land rates) Boost alternative investment avenues.
	• Insecure Land Tenure inhibits sustainable and responsible land stewardship; prolonged court cases involving co-inheritors prevent proper stewardship		Recent efforts aimed at land registration by farmers working State-owned land may reduce uncertainty	Completion of land registration program and streamlining of land ownership queries (through application of IT)
	• Marginal agricultural returns inhibits farmer investment in maintaining terraces		Aging farming population and decrease in full-time farmers indicates diminishing returns in sector	Focus on high quality agricultural products. Support young farmers and cooperatives.
	• Unavailable Irrigation Water		Increasing competition for scarce water from domestic, tourist, and industrial users.	Boost conservation measures in irrigation (e.g. mulching, drip irrigation). Intercept & store surface water flow.

	• Soil erosion reduces soil productivity and leads to abandonment since the cost of soil replacement becomes prohibitive		Cost of soil replenishment increasing due to transport costs and low availability of soil	Continue soil protection measures. Organise depot for soil storage. Encourage use of clean fill to deepen soil profiles.
Urban Sprawl	• Road construction is often insensitive to the role of roads as channels and barriers to surface water flow. • Sealing of surfaces disrupts natural infiltration process and produces an increase in the coefficient of runoff. • Dumped construction debris and domestic/agricultural refuse interrupts surface flow and blocks road culverts and other natural or artificial drainage channels. • Construction debris dumped on potential agricultural land.	Highly significant and requires intervention	Some degree of awareness seems to have been achieved but remedial action is still required. The rate of sealing surfaces continues. 21% of surface area in Malta sealed by 1995. Covered construction transport reduced spill but recent "road cleaning" efforts still cause problems. Decrease in the rate of illegal dumping of construction waste.	Construction and maintenance of storm water culverts. More sensitive road planning, especially country roads. Construction of reservoirs for aquifer recharge was initiated in the 1970s but water quality is questionable Continued enforcement of transport vehicles and immediate removal of collected wastes from roadside verges. Continued enforcement of pertinent regulations.
Industrialisation of Agriculture	• Increased rate of sealing surfaces in agricultural areas (glasshouses). • Dumping of plastic residue from fields blocks surface flow	Highly significant on a local scale	Construction of glasshouses and tunnelling continues to increase. Increased use of plastics in agriculture provides more material for dumping.	Planning applications need to address this issue in Environmental Impact Statements Greater farmer educational programs effected through cooperatives.

Poor Maintenance of rubble walls	• Difficulty and expense in building rubble walls on clay slopes • Difficulty in finding rubble suitable for wall construction • Art of building rubble walls in decline • Difficulty and expense of re-building rubble walls by part-time farmers	Highly significant	More significant in Gozo where clay taluses are greater and rubble walls are falling into disrepair. Greater demand for decorative weathered rock from building industry. Recent training programs for rubble wall construction bearing fruit. Maintenance requires longer time for repair following storm events.	Invest in research to determine best solutions to problem. Enforce controls on pilfering of decorative quality stone from rubble walls. Continue training programs for rubble wall construction - create job opportunities for youth. Groups of rubble wall builders made available to farmers.
Farming Practices	• Vegetation cover, found in irrigated fields during the crucial autumn torrential rains, reduces the risk of erosion through rainsplash • • Costly Irrigation systems render farmers far more likely to carry out soil protection measures to protect their investment • Dryland cultivation requires deep ploughing after the summer drought in anticipation of the autumn rains but ploughing direction is often down slope.	Highly significant	Early season crops (e.g. potatoes) are increasingly boosted with temporary irrigation systems. Drip irrigation systems have extended irrigation where water resources were limited. Use of machinery allows deeper ploughing and wider turning circles.	Encourage perennial vegetation cover over the higher risk areas; even to intercept surface water flow. Encourage farmers to invest in drip irrigation systems. Discourage down slope ploughing through standard educational programmes.

Recreational Pressures	• Off-road vehicle activity: removes vegetation cover; compacts soil; disturbs soil structure; and creates channels accelerating rill erosion and sheetwash	Highly significant at a local scale	Increased purchases of off-road vehicles and competitions is a threat to soil conservation.	Use clubs to foster awareness of erosion and environmental damage of off-roading
	• Hunting activity often results in vehicle damage to soil and planting of exotic tree species		Increased lobbying power and official protection of hunting activity.	Use clubs and federations to sensitise hunters to the need of soil conservation and environmental integrity.
	• Bird trapping sites necessitate the removal of protective vegetation to prevent nets getting entangled. Herbicides are often used to keep trapping sites free of vegetation.		Increased lobbying power and official protection of bird trapping activity.	Use clubs and federations to sensitise hunters to the need of soil conservation and environmental integrity.
Miscellaneous	• Snail gatherers pull down walls while seeking edible snails	Significant at local scales	Diminishing countryside and increasing population place added pressure.	Some farmers place notices warning snail gatherers about use of pesticides (Plate VI.28). Greater public education is also needed.
	• Rubble walls are often pulled down to use as decorative wall facing on building facades		Practice of using decorative rubble wall for facades has been in fashion for the last few years.	Enforce stricter controls on firms that sell rubble wall facing and query their sources. Planning Authority needs to address issue.

Table VI.9 Summary of main human-induced processes contributing to land degradation (Role', 2002)

VI.8. Monitoring and capacity building

VI.8.1. Sustainability Indicators

The use of sustainability indicators (SIs) for appropriate future monitoring of erosion control management was identified as an efficient and valuable tool. Therefore, a list of SIs was drawn up and discussed in detail during the various training courses and workshops organised by the SPSA activity within the Project (Plate VI.28). These indicators were also discussed in detail and endorsed by the main stakeholders, especially the local Farmers' Co-operatives. A full report on the development of SIs for this activity was drawn up and presented to the SSA team.

Plate VI.28. SSA workshops

The discussion of the SIs vis-à-vis sustainable development has been developed on the following criteria:

- Description of the indicator
- Reason why the particular indicator was chosen
- Efficiency and effectiveness of the indictor vis-à-vis soil erosion

Indicator 1. Official flood warnings			
Description	Source of data	Time factor	Interpretation of indicator
The flood warning gives a warning for a certain amount of precipitation and intensity which will lead to a volume of water that is hazardous for safety of humans in urban and specific areas which are prone to flooding.	Civil Protection Department	Seasonal/ yearly	This indicator gives a good estimate of the intensity and volume of water following a rainstorm. The greater the number of flood warnings in a particular season, the greater the risk of soil erosion. Most serious flood warnings expected to occur around beginning of autumn when farmers deep plough fields and therefore no vegetation cover can mitigate rain splash effect.

Indicator 2. Land tenure			
Description	Source of data	Time factor	Interpretation of indicator
Land tenure refers to the way land is held, i.e. being the owner of the land, being the tenant, i.e. owns title of land (Government/private owner).	Lands Department and Joint Office	Decade	Farmers owning land they work tend to be more willing to invest in augmenting agricultural productivity of their holdings, i.e. irrigation; water retention structures; e.g. reservoirs; building and maintaining rubble walls. Also, any soil lost from the fields has to be replaced by the farmer himself at a considerable amount.

Indicator 3. Number of claims for compensation			
Description	Source of data	Time factor	Interpretation of indicator
Compensation (monetary and other depending on availability) was given to farmers suffering for storm damages (including wind storm/whirlwind, flashfloods). Soil loss is one of the claims (e.g. 19/11/98). Claims could be monetary or in kind, i.e. material including soil.	Department of Agriculture	Seasonal	A decrease in the number of claims shows that less damage is done to agricultural holding (maintenance of rubble walls and terraces), therefore indicating better maintenance regime within farming community.

Indicator 4. Number and length of beaches in rubble walls (2 indicators)			
Description	Source of data	Time factor	Interpretation of indicator
A breach can be described wherever the level of soil is higher than the retaining rubble wall and wherever there is a physical evidence of failure to the retaining wall, therefore exposing the soil layer at that particular point.	Erosion/desertification national team (CAMP Malta Project)	Seasonal	A high number of breaches in retaining rubble walls indicate that a considerable amount of soil is being lost following rainfall as well as an increase in annual rainfall intensity. The state of repair of rubble walls is linked to land tenure since farmers owning the land tend to maintain the rubble walls.

Table VI.10. Proposed SIs for erosion/desertification control management

VI.8.2. Capacity building

The process of capacity building is dependant on the organisational and institutional capacities, as well as the technical, scientific and human resources. Therefore, an analysis of the capacity building status for erosion/desertification control was conducted in accordance with the indicators given in the UNEP/MAP/PAP Guidelines. This served as a starting point for detailed analysis of factors which influence capacity building in Malta. Actors, strategies, structural framework conditions, specific situations and the nature of problems were discussed and analysed. The results were used for elaboration of specific recommendations (*vide* Chapter VII.).

The following actors were preliminary identified to play a role in capacity building for erosion and desertification control. This list is however not exhaustive and further discussion should take place with the relevant institutions and organisations.

- Department of Agriculture
- Environment Protection Department
- Planning Authority
- Water Services Corporation
- Farmers' Co-operatives
- Civil Protection Department
- Works Division, incorporating the Roads and Drainage departments
- National Statistics Office
- Local Councils
- Environmental NGOs
- Tourist industry
- Malta Tourism Authority
- Meteorological office
- University of Malta
- Media
- Teachers' Associations
- Individual farmers
- Hunters and trappers
- Construction industry

VI.8.3. Legal aspects

Clearly defined national policies on land use and soil conservation are a precondition for successful management of erosion/desertification control programmes (UNEP/PAP/MAP, 2000). The existing Maltese legislation was thus reviewed and analysed. As such, there are no regulations that explicitly tackle the problem of soil erosion. However, since soil has been recognised as an invaluable resource, there are particular regulations that protect soil.

- Agricultural Leases (Reletting) Act 1967
  Under this act, the landlord may wish to impose lease conditions on the tenant, thus resulting in a shift of responsibility of the maintenance of rubble walls from the landlord to the tenant. Failure to maintain the rubble walls may lead to a legal suit to evict the tenant.

- Fertile Soil (Preservation) Act 1973 - Amended in 1983
  No person may transport soil to any site for any purpose in larger quantities than one half cubic metre without permission from the Director of Agriculture. Fertile soil is not to be covered with stones or similar material. All soil effected by building development has to be removed from site and transported elsewhere.

- Rubble Walls & Rural Structures (Conservation & Maintenance) Regulations 1997 (Environment Protection Act 1991, revised 2001)
  Rubble walls and non-habitable rural structures are protected, in view of their exceptional beauty, their affording a habitat for flora and fauna and their vital importance in the conservation of soil and water.

  This act prevents any person from demolishing or endangering by any means whatsoever, the stability or integrity of any rubble wall or to prevent the free percolation of rainwater through the structure of a rubble wall.

- Motor Vehicle (Offroading) Regulations 1997 (Environment Protection Act 1991, revised 2001)
  No person is allowed to drive any motor vehicle other than in a locality which is marked as an offroading site (any place authorised in writing by the Environment Protection Department). This act thus prevents activities that have an impact on the soil structure, thereby increasing soil erosion risk.

- Development Planning Act 1992 – Northwest Local Plan (Soil Conservation 1996)
  Soil conservation and soil saving measures, under the North West Local Plan will continue to be mandatory in accordance with the Fertile Soil (Preservation) Act 1973. Development will only be granted if existing rubble walling is suitably constructed or if new walling is required, it must be constructed to the satisfaction of the Planning Authority using traditional methods which are compatible with the landscape.

  The signature to international conventions on the matter provides additional strength to existing local legislation. The United Nations Convention to Combat Desertification, which the Maltese Government ratified in 1998, is one such example.

VII. CONCLUSIONS

- Sets of physical and human processes, and their interaction leading to soil erosion have been identified for the Northwest Malta.
- Identification of related issues that need to be explored in the near future.
- Priority areas for immediate intervention have been identified for Northwest Malta.
- Retaining rubble walls are the most important water and soil conservation structures in the Maltese Islands.
- The need to protect and conserve the rural landscape of Northwest Malta is of utmost importance.
- The magnitude of the problem of soil erosion has not been adequately addressed, partly since during the two years of study, precipitation has been well below average.
- Soil erosion is most intense following the seasonal summer drought, thus erosion occurs in episodic intervals.
- Long term studies need to be implemented to produce patterns of erosion. The issue of climate change may exacerbate the situation.
- Due to longer drought periods, it is envisaged that wind erosion may become more significant.
- Farmers are aware of the problem at a local level but a need is felt to get them more aware of the problem on a national level.
- Co-operatives are very important since farmers can be approached and discussions can be carried out through the Co-operatives. This will become even more important with the possible entry of Malta into the EU.
- Beneficiaries of the activity have been identified: Environment Protection Department, Planning Authority, Department of Agriculture, Ministry for the Environment, Works Division, Malta Resource Authority, Farmers' Co-operatives, academic and research institution, interested private individuals and NGOs.
- Identification of the National Action Body as laid down by the provisions of the United Nations Convention to Combat Desertification.
- Provision of the baseline for the National Action Body in implementing measures to combat desertification.
- Identification of Sustainability Indicators and their usefulness as a tool for monitoring soil erosion.
- Baseline data for monitoring of SIs.

VIII. RECOMMENDATIONS FOR FOLLOW-UP ACTIVITIES

This present study has shown that some useful and important data and information regarding soil erosion and land degradation are lacking. As a consequence, possible post-project activities were identified and are listed below. These are not exhaustive and not prioritised in any way.

- ***This study would be far more useful when the complete erosion risk map is produced for the Maltese Islands. Therefore the continuation and extension of this work to the rest of Malta and Gozo is an urgent priority.***

- One of the consequences of overabstraction of ground water is chemical soil erosion exhibited in the form of soil salinisation. Very few studies have actually been carried out in Malta regarding this issue. This present project therefore serves as an impetus for future studies in this field. Thus a study on the assessment and monitoring of soil salinisation would be valuable.

- A detailed study on "the price of soil erosion" in Malta is also important in providing a better economic and financial understanding of the consequences of soil erosion for soil fertility and the impact on agriculture in the Maltese Islands.

- Site specific rehabilitation and remedial measure schemes should be developed. The outcomes and results of the diagnostic analysis of this project activity should be adequately addressed.

- Regular follow-up surveys for soil erosion processes as identified in this project.

- A sustained awareness campaign was identified as one crucial activity for securing the implementation of good soil conservation measures. During this campaign ways of improving communication with stakeholders should be identified. This campaign should serve as basis for development of a strategy for capacity building in accordance with the Guidelines.

- The promotion of the use of vegetation for stabilisation of terraces should be further explored, especially on clay slopes when foundations for dry retaining rubble walls may be difficult to construct.

This present study has been invaluable in identifying remedial actions that will facilitate the process of collection and compilation of necessary data for erosion/desertification control management. These include:

- Possibilities for monitoring the sustainability indicators by Farmers' Co-operatives. This can be explored by the relevant departments in order to ensure sustainable monitoring of soil erosion and desertification processes. Data for these indicators could also be stored in a central database and their accessibility guaranteed for the stakeholders.

- Funding for the regular collection of relevant data should be included in the regular budget of the relevant departments.

Furthermore, legal and administrative recommendations were also identified and listed.

- Stricter fines for people dismantling and vandalising rubble walls for sale and search for edible snails should be enforced. In this respect, existing organisations and frameworks for law enforcement (Environment Inspectors and local wardens) should be empowered to address problems of rubble wall vandalism and theft. Additionally, an educational campaign should be carried out (*vide* below).

- For maintenance of rubble walls, secure land tenure represents an important precondition. Thus, security of land tenure should be promoted, since this will favour investments in structures such as retaining rubble walls

- The Agricultural Leases (Reletting) Act, 1967, Section 4.2 (d, e & f) provides for ensuring that tenant farmers take good care of their leased land. These have been neglected over the last few decades, with the result that soil erosion has become more evident. Farmers and the general public need to be made more aware of these provisions, with the ultimate aim of reducing soil erosion and promoting good husbandry. This could be done by clearly stating these provisions in the respective leasing contracts.

- The possibility of providing some form of subsidies or grants to those farmers wishing to carry out soil conservation measures should be explored by the relevant departments.

- Interim depositories for soil should be identified, so that in case of temporary inaccessibility of fields, soil (for increase of soil depth) could be temporarily deposited until fields are accessible again. Current planning practices should address adequately and effectively this issue.

- Land reclamation at valley bottoms is not recommended. Formation of field parcels close to the watercourses (sometimes occupying the actual watercourse) must be prevented. Farmers have made repeated claims during public participation meetings that such fields have created negative impacts further downstream or to the adjacent farmland.

- The cleaning of water courses (from debris) and check dams should be regularly executed (especially accumulated silt, which should be re-used in the fields). In this respect, the proper disposal of agricultural waste (such as irrigation drip pipes and other plastics) should be promoted.

- The present policy of the Lands Department, where agricultural leases are prohibited from being turned into trapping sites and hunting grounds, need to be encouraged and enforced more strictly.

- Planning of roads and other construction projects should include structures for direction and collection of storm water runoff, as well as reconstruction of rubble walls which have been damaged during construction works. In this respect, civil engineers, architects and contractors should be sensitised to the problems of storm water runoff. Also the promotion of systems of cisterns to hold runoff at key locations could be envisaged.

- Cleaning of culverts in rural areas should be regularly executed in order to prevent runoff damages in fields due to blocked culverts. The cleaning of roadside verges must ensure that accumulations of debris are removed immediately to prevent their blocking of road culverts.

Through regular discussions with the farmers themselves, a number of recommendations for promotion of capacity building for soil erosion and desertification control were drawn up:

- The promotion of maintenance and repair of rubble walls represents a crucial task for successful soil erosion and desertification control management in Malta. Rubble walls should be perceived as a precious legacy produced through the work of countless generations and, as such, they shape the landscape of the Maltese Islands. Rubble walls are the main soil erosion control measure applied and an appropriate technique for sustainable soil erosion control. Maintenance and repair of these structures is therefore the major challenge of soil erosion control in Malta.

- A sustained awareness creation campaign on soil erosion/desertification issues should be organised. During this campaign ways of improving communication with stakeholders should be identified. This could include a number of workshops with the various stakeholders, therefore establishing different perceptions re soil erosion and the role of the various stakeholders in promoting or opposing soil erosion control management. This will serve as basis for development of a strategy for capacity building in accordance with the Guidelines. In this respect, the possibilities of including hunters and trappers in soil erosion/desertification control management programmes should be explored.

- An integral part of the awareness campaign should be the dissemination of soil erosion/desertification issues as part of environmental education present in the National Minimum Curriculum.

- Promotion of good access to fields may have positive effects on the maintenance of rubble walls. These effects should be further investigated.

- Irrigated cultivation needs to be encouraged, since risk of soil erosion under such cultivation is considerably reduced. Investment in irrigated cultivation is far higher than dry land cultivation and this acts as a powerful incentive for farmers to invest in soil protection measures. In this respect, the promotion of water conservation/saving irrigation practices, e.g. drip irrigation (N.B. this does not refer to the use of 2nd class water) needs to be encouraged.

- Soil conservation measures, e.g. contour ploughing, need to be disseminated more widely amongst the agricultural community. This may be performed through educational programmes organised by the College of Agriculture as well as at the Extension Services within the Department of Agriculture and Co-operatives.

- Farmers who carry out soil conservation measures need to be actively encouraged and have their work publicised through the Department of Agriculture, Co-operatives, etc.

- A study unit on soil erosion and desertification (with special reference to the Maltese Islands) should be introduced in the College of Agriculture.

IX. REFERENCE BIBLIOGRAPHY

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ANNEX 1

MAPPING OUTPUTS

1. Site descriptive erosion processes map for Burmarrad, L/o Mosta, 2000
2. Site descriptive erosion processes map for Dingli, 2000
3. Site descriptive erosion processes map for Tas-Santi, l/o Mgarr, 2000
4. Photo-interpretation map for Tas-Santi, l/o Mgarr, (1994)
5. Direction of water flow, Tas-Santi, 2000
6. Land tenure, Tas-Santi, 1999
7. Number and length of breaches in selected rubble walls, Burmarrad, l/o Mosta, 2001
8. Number and length of breaches in selected rubble walls, Tas-Santi, l/o Mgarr, 2001
9. Terraces and rubble walls – State of repair, Northwest Malta, 2001
10. Slope map for NW Malta, modified to incorporate slope classes as given in Table 1.2 of the MAP/PAP/FAO Guidelines
11. Lithofacies/geology map for NW Malta, modified to incorporate classes as given in Table 1.3 of the MAP/PAP/FAO Guidelines
12. Levels of Erodibility map, Northwest Malta
13. Level of soil protection management, Northwest, Malta
14. Final soil erosion risk map for Northwest Malta

ANNEX 2

LIST OF REPORTS PRODUCED DURING THE IMPLEMENTATION OF THE ACTIVITY

1. Tanti, C. (1999) Activity Proposal Soil erosion/desertification control management
2. Tanti, C. (2000) Report on the Workshop on Systemic Sustainability Analysis, 27th – 29th March 2000
3. Tanti, C. (2000) Interim Report June 2000
4. Borg, A (2000) Report on Conference "Participation of Mediterranean NGOs on National Programmes to combat desertification and drought" organised by MEDForum, Murcia, 16th – 18th June 2000
5. Tanti, C. (2000) Report on advanced seminar "Climate change – effects on agriculture in the Mediterranean region" organised by CIHEAM, Zaragoza, Spain, September 2000
6. Tanti, C. (2000) Notes of meeting with stakeholders, 23rd November 2000
7. Tanti, C. (2000) Progress Report December 2000
8. Borg, A. & A. Role' (2001) Report on advanced course "Management Strategies to mitigate drought in the Mediterranean: monitoring, risk analysis and contingency planning" organised by CIHEAM, Morocco, May 2001
9. Tanti C. (2001) Progress Report June 2001
10. Tanti, C. (2001) Final report on Systemic Prospective Sustainability Analysis as implemented by the soil erosion/desertification control management team (presented to the SSA Team)
11. Tanti, C., Borg, A., Calleja, I. & Role A. (2002) Socio-economic patterns and strategies

ANNEX 3

LIST OF WORKSHOPS/SEMINARS/CONFERENCES ATTENDED

1. Participation of Mediterranean NGOs on National Programmes to combat desertification and drought"

This Conference, organised by MEDForum, a Mediterranean NGO network for ecology and sustainable development, was held in Murcia, Spain, between the 16th and 18th June 2000. The main aim of this Conference was to assess the participation of society in combating desertification and drought in the Mediterranean, as well as to establish recommendations and proposals of NGOs with regards to the participation of the public and other concerned entities.

At the end of the Conference, draft Terms of Reference of the Regional Action Programme for Annex IV Countries of the UN Convention to Combat Desertification were drawn up.

These ToRs and recommendations were also taken into consideration whilst drafting the recommendations for remedial intervention measures for the erosion/desertification control management activity.

Mr Anthony Borg attended this Conference.

2. Climate change – effects on agriculture in the Mediterranean region

The Advanced seminar was organised by CIHEAM – IAMZ, RICAMARE Project (Research in global change in the Mediterranean and the European Commission, in Zaragoza, Spain, September 2000.

The objective of this seminar was to provide answers to questions related to the effects of climate change on Mediterranean agriculture and what are the possible consequences of climate change on agriculture. In fact, the topics covered in the seminar included the description and evaluation of the phenomenon of global climate change, the specific vulnerability to climate change of the Mediterranean agricultural systems, sectoral analysis of climate change impacts, management of water resources in view of climate change as well as the socio-economic aspects of global change in the Mediterranean. Also intensive discussion on the strategies to predict and adapt to the consequences of global climatic change were carried out.

Ms Christine Tanti attended this course.

3. Management Strategies to mitigate drought in the Mediterranean: monitoring, risk analysis and contingency planning

This advanced course was organised by CIHEAM, in Morocco, May 2001.

Mr Avertano Role and Mr Anthony Borg participated to this course.

4. MEDSTAT Environment Project, Defining, collecting, producing land use and land degradation statistical data

Blue Plan was contracted by the EU Commission through EUROSTAT for the implementation of the MEDSTAT Environment. The 5-day training course was organised by Blue Plan in collaboration with NSO, in Sliema, Malta 29th January – 2nd February 2001.

One of the main focuses of the MEDSTAT Environment Project is the harmonisation of statistics towards international standards in the filed of environment. The 4th Mediterranean Environment training focused on statistics related to land use and land degradation. The aim of this course was to allow the participants to have a better understanding of the scope of land use and land degradation issues, of the related terminology, the existing problems and difficulties in data production,. The course specially stressed the importance of data quality assessment and the reporting on data production.

Ms Christine Tanti participated as well as gave a presentation of the progress and methodology being implemented in the erosion/desertification control management activity within the CAMP Malta Project.

5. Workshop on technologies for management of erosion and desertification control in the Mediterranean region

This workshop was organised by PAP/RAC and EC DGXI with the co-operation of the Environment Protection Department.

The principle aim of this workshop was to present and discuss the draft Guidelines for erosion control management.

Ms Christine Tanti, Mr Ivan Calleja and Mr Avertano Role gave a presentation during this workshop. Mr Anthony Borg, Ms Sonya Vella and Mr Joe Gerada also attended.

ANNEX 4

Table 1.2. Slope classes (pg. 18 of the “Guidelines”)

Classes	Type of slope
1	Flat to gentle slopes (0-3%)
2	Moderate (3-12%)
3	Steep (12-20%)
4	Very steep (20-35%)
5	Extreme (>35%)

Table 1.3. Lithofacies classes (pg.18 of the “Guidelines”)

Lithofacies classes	Type of material
(a)	Non-weathered compact rock, strongly cemented conglomerates or soils, crusts, hard pans outcrops (massive limestone, highly stony soils, igneous or eruptive rocks, locally crusted soils)
(b)	Fractured and/or medium weathered cohesive rocks or soils
(c)	Slightly to medium compacted sedimentary rocks (slates, schists, compacted marls, etc.) and/or soils
(d)	Soft/low-resistant or strongly/deeply weathered rocks (marls, gypsum, clayey slates, etc.) and/or soils
(e)	Losses, no cohesive sediments/soils and detritic materials

Table 1.5. Levels of erodibility (pg.19 of the “Guidelines”)

Classes	Potential erosion
1	Low (EN)
2	Moderate (EB)
3	Medium (EM)
4	High (EA)
5	Extreme (EX)

ANNEX 5

LIST OF ACTIVITIES AND MEETINGS IMPLEMENTED IN CONNECTION WITH OTHER CAMP ACTIVITIES

1. Workshops and Training courses on Systematic Sustainability Analysis held in Malta.
2. Public Participation Workshop held in Malta in April 2000.
3. Public Participation Week and Seminar held in Malta in 26th - 28th April 2000, organised by the Environment Protection Department.
4. Inception workshop.
5. Harmonisation workshop.
6. Strategic Environment Assessment workshop.
7. Resource valuation workshop.
8. Meetings with other team leaders and members.
9. Meetings with data management team.
10. Meetings with the Mgarr Local Council.
11. Meetings with the Farmers' Co-operatives, Mgarr (11/12/00).
12. Meetings with the farmers (23/11/00, at the Mosta Extension Services).
13. Articles written - 1 in local papers (written by Ms Tanti, October' 01)
    2 in Biedja u Sajd (written by Mr Borg, Mr Calleja, Ms Tanti & Mr Role', Nov/Dec 2000)
    2 in Xummiemu (written by Ms Tanti, December 2000 & June 2001).
14. Radio programmes: 2 (by Ms Tanti, Mr Borg & Mr Role').
15. TV Spot (by Ms Tanti, 21st July 2000).
16. Site visit and talk at Tas-Santi, given by Mr I Calleja, 25th February 2001, organised by Nature Trust.
17. Site visit at Tas-Santi and talk given by Mr Role' on the 9th December 2001, for the Geography Teachers Association.
18. Talk given to foreign students (BirdLife) on 17th September 2001 by Mr I Calleja.

Annex 6

LIST OF POTENTIAL STAKEHOLDERS VIS-À-VIS LAND DEGRADATION AND SOIL EROSION

1. National Team (Rene Attard, Anthony Borg, Ivan Calleja, Joseph Gerada, Christine M Tanti, Avertano Role', Sonya Vella)
2. Ministry/Department of Agriculture
3. Institute for Water Technology/Water Services Corporation
4. Malta Environment and Planning Authority
5. Malta Resource Authority
6. Malta Tourism Authority
7. Farmers' Co-operatives
8. Local Councils
9. National Statistics Office
10. Works Division
11. Civil Protection Department
12. Lands Department
13. Joint Office
14. Administrative Law Enforcement (Police)
15. University of Malta
16. NGOs
17. MAP/PAP/RAC
18. FAO
19. CIHEAM
20. European Commission
21. UNCCD Secretariat
22. Media
23. Teachers
24. Geography Teachers' Association

Annex 7 KEY ISSUES

Secure Ecological Integrity for the rural landscape into the foreseeable future

KEY ISSUES	PROBLEM	CAUSES	ZONE OF INFLUENCE	ACTIONS TO IMPLEMENT
Maintain rubble walls	Terraces and retaining rubble walls are an ancient source of agricultural capital which is being steadily eroded	Marginal economic returns; land abandonment; fragmentation; speculation	Entire NW	Immediate repairs to areas, which are most severely affected as identified in Erosion Risk Map.
Facilitate farmers' need to drain fields during severe storms	Watercourses are often obstructed by accumulations of material and this impedes normal drainage	Watercourses often act as natural sinks and dumping grounds for all sorts of refuse; including agricultural refuse	Fields located in low elevations	"Surgical" clearing of accumulations of refuse from watercourses to permit adequate drainage
Safeguard the ecological integrity of watercourse habitats in agricultural areas	Conflict arises when watercourses are cleared since such sites are rich in biodiversity and are rare in the Maltese dry environment	Some valley cleaning programs have been criticised for indiscriminate heavy-handed earthmoving exercises	Watercourses and low lying areas	Train contractors and/or public workers in selective watercourse cleaning. Provide effective supervision during clearing operations
Recover eroded soil from sediment traps located across watercourses	Eroded sediment is highly prized by farmers for soil replenishment and should be distributed equitably	Some soil and other sediment is inevitably lost during storms and is often carried off to landfills along with unsorted debris	Watercourses	Sort sediment from watercourses before disposal in landfills

Ensure Economic Viability for the rural landscape sector

KEY ISSUES	PROBLEM	CAUSES	ZONE OF INFLUENCE	ACTIONS TO IMPLEMENT
Aid farmers to rebuild rubble walls and maintain field terraces	Terraces and retaining rubble walls are an ancient source of agricultural capital which is being steadily eroded	Cost of rebuilding walls and terraces are often prohibitive and these are often allowed to fall into disrepair	Entire NW	Consider financial and other aid packages to help farmers to rebuild rubble walls. Explore legal provisions for placing responsibility on owners.
Strengthen legislation and enforcement that prevents soil from being buried under new construction	Soil cannot be legally traded but an indirect market exists for the commodity	Soil protection measures create economic anomalous situations which may work against the spirit of the legislation	Rural sector	Create an effective soil storage depot and distribution facility in the Dept. of Agriculture
Prevent further fragmentation of field units	Laws of inheritance result in fragmentation of productive fields into marginal entities	Speculation; lack of agreement amongst beneficiaries of inheritances	Entire Maltese islands	Legal & economic provisions that discourage fragmentation & economic incentives ensure the survival of viable farms and even consolidation of existing fragments
Explore and invest in water-efficient irrigation systems	Irrigation water is costly and pushes up the price of agricultural produce. This problem is expected to become even more serious	The islands are located in a semi-arid climatic zone and IPCC approved climatic models predict even longer periods of drought	Entire Maltese islands	Encourage drip irrigation, mulching, planting of drought resistant crops. Drafting of a drought mitigation and management plan. Promotion of use of second class water.
Provide economic incentives for storage of surface water runoff	Surface storage of stormwater runoff reduces the risk of soil erosion and provides water for irrigation during seasonal drought	Sealing of surfaces because of urban and peri-urban expansion creates a higher coefficient of runoff. Roads also act as channels in rural areas	Entire Maltese islands	Construction of stormwater reservoirs needs to be addressed during road planning and culvert design. Farmers need to be involved at such stages and cost efficient solutions are very likely.
Provide economic incentives for constructions that permit aquifer recharge	Farmers compete with national domestic water supplier for scarce water from aquifers. Most farmers' complain that their wells have run dry.	Aquifer recharge has decreased substantially due to sealing of surfaces during urbanisation	Entire Maltese islands	Partial responsibility for aquifer recharge may be shifted to the agricultural sector since it uses increasingly higher proportions of aquifer reserves. Studies need to explore the efficiency of combining such measures with soil conservation measures.

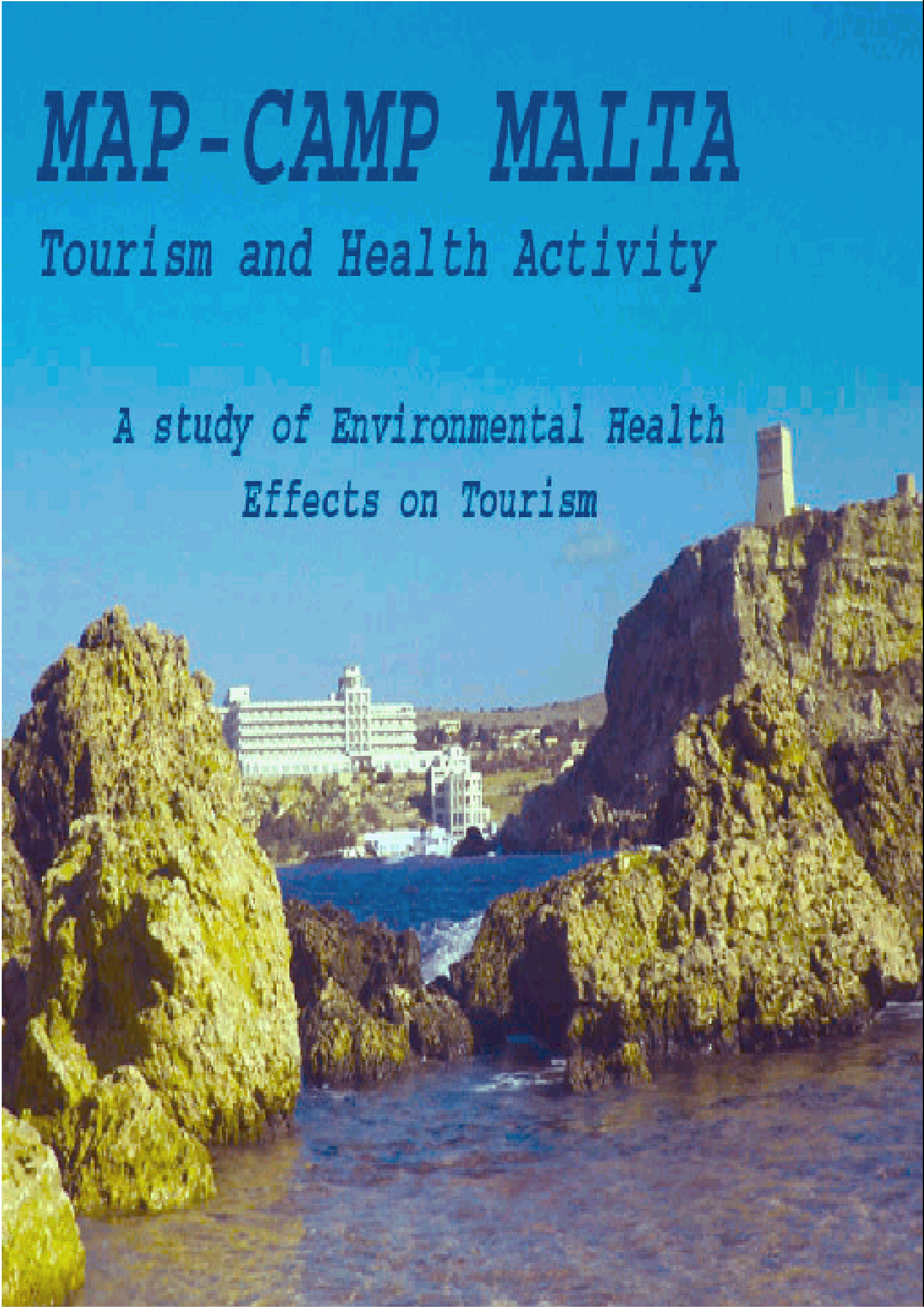
Ensure Social Equity for the rural community

KEY ISSUES	PROBLEM	CAUSES	ZONE OF INFLUENCE	ACTIONS TO IMPLEMENT
Empower farmers to rebuild and maintain rubble walls	Sound construction of rubble walls is an art which has virtually disappeared in Malta	Farmer average age has increased steadily over the last few years; marginal earnings prohibit major capital expenditure on farms	Entire Maltese islands	Support existing training courses aimed at teaching dry rubble wall construction. Gear such courses at retaining rubble walls which support terraces rather than cosmetic road verge walls.
Ensure greater security in land tenure to promote land stewardship	A firm link has been established between insecurity of tenure and soil erosion and land degradation.	Farmers with insecure tenure are far less likely to invest in serious soil conservation measures since they may not enjoy the returns from their investment	Entire Maltese islands	Communicate to landowners and farmers their legal contractual responsibilities regarding leases and third party liability incurred from breached rubble walls.
Control recreational activity that leads to soil erosion	Some in/formal recreational activity contributes in/directly to soil erosion. Legal provisions and enforcement may be lacking in some cases.	Off-road driving, building of hunting hides and trapping sites, snail foraging, etc have been linked to soil erosion	Entire Maltese islands	Enforce and strengthen current legislation regarding rubble-wall protection and off-road activity. Monitor and control spread of trapping sites. Enforce legal provisions regarding prohibition of trapping sites on state-owned land.
Ensure equitable access to water resources by farmers	Farmers complain that they are at a disadvantage when competing with national domestic water supplier. Most farmers' complain that their wells have run dry. Registration and control of boreholes is often by-passed.	Malta's climatic regime falls into the semi-arid zone and climatic instability is a daunting prospect. Growing demand for higher quality market garden produce and horticulture necessitates irrigation.	Entire Maltese islands	Explore possibilities offered by drought management techniques. Ensure greater efficiency in irrigation practices. Increase surface and underground stormwater storage facilities.

MAP-CAMP MALTA

Tourism and Health Activity

A study of Environmental Health Effects on Tourism



CONTENTS

List of Acronyms

EU	European Union
GDP	Gross Domestic Product
GP	General Practitioner
IRTOI	Incoming Resort Tour Operators Association
MHRA	Malta Hotels and Restaurants Association
WHO	World Health Organisation

ACKNOWLEDGEMENTS

It would be an impossible and endless task to attempt to name all those both in Malta and abroad who in one way or another contributed precious time and effort towards the compilation of this report. However, some persons deserve special mention.

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Appreciation is also due to to all the team, including the field workers and the administrative team for their eagerness and enthusiasm whilst carrying out this project. I am indebted to the doctors at the Health Information Department including Dr. Renzo Pace Axiaq, Dr. Alexandra Distefano, Dr. Miriam Gatt as well as the staff of the Public Health Department including Dr. Malcolm Micallef, Dr. Mark Muscat, Mr. John Attard Kingswell, Mr. Charles Bonnici and Mr. Paul Spiteri. Also invaluable to this project were my colleagues at Health Policy and Planning, Ms Vicki Calleja and Mr. Peter Paul Borg whose technical input and support in producing this document was undoubtedly an asset.

Last but not least, thanks are due to all the stakeholders that actively participated through advice, forwarding information or through active collaboration in this project. Amongst these are the Malta Hotels and Restaurants Association, The Malta Tourism Authority, The Tourism Ministry, Skal Club and IRTOI, all the General Practitioners responsible for hotels in the North West of Malta.

Dr. Lucianne Licari
Consultant, Environmental Health

Helsinki Declaration
On Environment and Health
(paragraphs 10 - 11)

…….''We will intensify co-operation with other governmental authorities such as those responsible for agriculture, energy, industry, transport, and tourism in order to integrate environment and health issues into their existing policies as an important step towards sustainability.

We are convinced that there is a pressing need for a more comprehensive, integrated approach to creating health and ecologically sound local communities and for a much better understanding of the interplay of the many factors contributing to their well-being. We will act in response to UNCED's call for countries "to develop plans for priority actions based on co-operative planning by the various levels of government, non-governmental organisations and local communities'"

1. INTRODUCTION

1.1 Preamble

1.1.1 Tourism has become one of the most important economic sectors in the European Region, both for employment and contribution to the GDP and as a major item of consumer demand. More than any other industry, tourism depends for its success on the quality of the natural and built environment. Tourism can bring economic benefits; in many areas it is the greatest economic activity and source of employment. By its very nature, however, it may also have adverse effects on the environment and so jeopardise its own future development.

1.1.2 Tourism has been defined by many organisations and academics, though the most widely accepted definition locally is that proposed by **'***The Structure Plan for the Maltese Islands Tourism topic study'*, September 2000, Mathieson & Wall:

"The movement of people from one place to another, which is not their normal place of residence, for leisure, educational, health or business purposes, the facilities and services developed to cater for the requirements of such travellers, the relationships developed during their stay at the destination and the economic, social and environmental impacts resulting from such activity."

1.1.3 World-wide, tourism is the third most important item in world trade, surpassed only by oil and motor vehicles. Countries of the WHO European Region comprise 20 of the 40 in the world with the most tourist arrivals. Most of the Northern and Western European countries are net spenders on tourism; others including a number of Mediterranean countries, Austria, Ireland and Switzerland are net earners from tourism. Tourism makes a major contribution to GDP in Austria, Greece, Portugal, Spain, Switzerland and Turkey. In countries such as France and Italy the contribution is below 3% of the GDP.

1.1.4 The vast majority of tourism in the EU still focuses on the coast of the Mediterranean Sea. This accounts for 35% of total international tourism and is the most important tourist destination in the world. The number of tourists to the Mediterranean tripled from 54 million to 157 million between 1970 and 1990 and grew six-fold in some countries such as Greece. The major destinations are the coasts of Spain, the Balearic Islands, southern France, Liguria and the northern part of the Italian Adriatic coast and Sicily. Other popular areas include Cyprus, Israel, Malta and Turkey and account for most of the remaining tourist arrivals. In Northern Europe, parts of the French and Belgian Atlantic seaboard and resorts in the Netherlands and the United Kingdom attract large numbers of tourists.

1.1.5 In addition, sporting holidays of all types have grown, but the most popular activities remain skiing and winter sports. Despite the ever-increasing number of tourists to the Mediterranean coast which has resulted in almost doubling in the numbers of arrivals to the Mediterranean, present day evidence suggests a trend away from passive 'sun and sea' holidays in Europe with an increase in longer, more active holidays in distant countries. In addition, factors such as the poor environmental state of part of the Mediterranean coast, and rising prices suggest that the growth rates may start to decline.

1.1.6 Tourism is a very volatile and complex trade and the rise in numbers of arrivals can be attributed to a number of factors. The first is the increased leisure time. Although

annual leave entitlement is unlikely to increase in Europe, the length of the working week is expected to decrease. This will lead to more short breaks and domestic tourism. The second is demographic change, particularly the increasing number of retired people with an acquired taste for travel, better health and higher pensions than in the past. Social factors are also relevant - for example higher female work participation rates and trends towards later marriage mean that many young couples have higher disposable incomes. An increasing interest in education, the environment and different cultures is leading to a growing interest in more environmentally sensitive types of tourism. Finally, reductions in the cost of travel, improved continental transport links and increased access to private transport, are leading to more European travel.

1.1.7 More than any other industry, tourism depends on the quality of the human and natural environment and resources for its continued success. The paradox of tourism is that, as countries or particular resort areas attract mass tourism, the resulting adverse impact on the environment may undermine the future earnings from that source unless careful planning and management of resources makes development of tourism sustainable. On the other hand, sustainable tourism offers the opportunity to achieve cultural/environmental conservation and improve on the socio-economic fabric of local residents. It goes beyond provision of services such as hotels, transportation services, restaurants and attractions, seeking to preserve the historical and archaeological sites, stimulating the interest of visitors and residents alike.

1.1.8 Contributing to nearly 25% of the annual GNP, Malta must strictly adhere to the objectives of 'sustainable' tourism. While it can proudly boast about its agreeable warm weather conditions, its beautiful and clear bathing waters ideal for diving expeditions, it must conserve what is unique to its islands. Limitations of space do not allow Malta to promote itself as a 'tourist resort' and the small size of its bays cannot compete with the vast stretches of sand offered by other Mediterranean countries. It can however, through preservation of its environment, and ongoing care and promotion of its rich archaeological, historical and cultural heritage, find a market amongst those seeking out newer and more stimulating experiences.
The high concentration of such features and the wealth of the historical experience to be made in a short span of time can be offered by no other Mediterranean country. Promotion of such an experience is only possible through adequate preservation and conservation and careful planning of tourism ensuring that it continues to sustain the very market that it seeks to attract.

1.2. Purpose and General Objectives of the Tourism and Health Activity of CAMP Malta

1.2.1 The aim of the Tourism and Health Activity within the Coastal Areas Management Programme was to study those Environmental Health issues that were specifically highlighted by the local tourism sector during meetings held in October 1999. The project aimed to identify key issues that are important to the Tourist visiting the Mediterranean. Findings were substantiated through questionnaires, complemented by data gathering and by detailed analysis to corroborate findings in these questionnaires. The final aim of this activity was to make recommendations about local tourist policies, encouraging efficient management of tourism resources, useful not only to the northwest of the island but also to other Mediterranean states. Moreover, it was to identify potential *'follow-up*' studies that would continue to enhance the synergism between the tourism and public health sectors, thereby protecting the health of the visitor.

1.2.2 The objectives of this study were set out as follows:

- To contribute to sustainable development of tourism in Malta, reducing/eliminating potential impacts on health of the resident population and tourists in the northwest area;
- To contribute to the protection of the environment and rational use of tourism resources, improving health conditions and increasing the level of sanitary protection and control;
- To formulate recommendations for land use and future development of tourism taking into consideration the relevant health aspects identified;
- To formulate proposals for a follow-up of the activity.

1.2.3 This report therefore includes:

- A detailed report on the major complaints of tourists visiting the area. This will be collated to a study highlighting the most common medical complaints by tourists in a sample of hotels in the northwest;
- A detailed analysis of the environment in the northwest including monitoring of bathing water samples, sand samples, and drinking water samples;
- A detailed report of the hygiene of the kitchens in a random sample of the hotel and restaurant kitchens in the northwest as well as the state of hygiene of street vendors in this area;

- A detailed report of the environment in the northwest that highlights environmental problems detrimental to tourism. This includes analysis of problems such as lack of cleanliness, lack of municipal waste control, lack of rodent control, and the problem of sewage overflows. The report also analyses the main bathing areas of the northwest, including their public health standards and their status when compared to Blue Flag criteria;
- A list of recommendations or short – medium term action plans where possible.

1.3. Institutional Framework

The undertaking of such a Project requires a formal organisational structure with well defined allocation of tasks and responsibilities. The structure adopted for the Malta study is described in some detail below, so that it may be of use (or improved upon) by those interested in replicating such studies in other areas/countries. In the present study, the following persons filled the roles as follows:

1.3.1. Project Leaders – Dr. Lucianne Licari, Dr. R. G. Xerri, Mr. Louis Vella

These were responsible for the continuous overview of the project.

1.3.2. National Team Leader – Dr. Lucianne Licari

This person was the focal point for this activity. Main responsibilities included:

- co-ordinating with other team leaders on other thematic activities, including active participation in other horizontal activities;
- focal point for other thematic groups, for CAMP consultants and for all field workers on the activity;
- responsible for the continuous follow-up of the project;
- organisation of regular meetings of the team;

- public information about the activity, including organisation of regular meetings with stakeholders;
- ensuring adequate collation of data;
- data analysis and the final reporting of the study.

1.3.3. Co-ordination officers – Mr. John Attard Kingswell and Mr. Frank Farrugia

These persons were responsible for the co-ordination of all field officers during the study period including:

- regular communication and meetings with team leaders and fieldworkers;
- collection and input of all questionnaires onto a central database;
- collation of reports of all on-site inspections;
- collation of data about rodent control including frequency of calls and treatments during the bathing season;
- collection of all public health notifications of gastric illnesses;
- collation of data of all environmental health monitoring programmes from the Department of Public Health;
- collation of written media reports on tourism.

1.3.4. Field Workers – Mr. Mark Cutajar, Ms Graziella Borg and Mr. Malcolm Vella Haber

These officers were responsible for carrying out the following functions:

- beach inspections and observation report of the tourist environment twice a month during study period;
- sand Sample collection once monthly throughout the study period;
- collation of complaints made to the district health offices with regards to sewage overflows in the northwest during the study period;
- submission of all reports to the Central Information Officer and close co-ordination with him and demands made by the study itself;
- active participation in setting up indicators for the Tourism and Health Sector.

1.3.5. Food Safety Officers – Mr. Hadrian Bonello, Mr. Clive Tonna and Mr. Sandro Sammut

These officers were responsible for carrying out the following functions:

- submission and regular collection of risk and injury questionnaires to hotels throughout the study period;
- inspection of a random sample of fixed and mobile kiosks in the northwest during the study period;
- inspection of kitchens in a random sample of hotels and restaurants in the northwest area, including the issuing of a risk assessment classification to these outlets;
- submission of all reports to the Central Information Officer and close co-ordination with him and demands made by the study itself;
- active participation in setting up indicators for the Tourism and Health Sector.

1.3.6. Rodent Control Officer – Mr. Nigel Cassar

This officer was responsible for carrying out the following functions:

- regular weekly inspection of three stretches of beaches for rodent populations during the study period;
- regular baiting and monitoring of takes weekly during the study period;

- submission of all reports to the Central Information Officer and close co-ordination with him and demands made by the study itself;
- active participation in setting up indicators for the Tourism and Health Sector.

1.4. Financial resources allocated to Tourism and Health activity

1.4.1. The activity was awarded **$US 10,000** for implementation. The Maltese government contributed **$US 21,267.91** in kind.

1.5. Methodology

1.5.1 The Tourism and Health activity was included in the MAP CAMP Malta project at a much later stage than the other horizontal activities. It was the first time that Tourism and Health was included in a CAMP Project. The Sub-regional Centre on Health, Environment and Tourism (awaiting WHO status as a WHO collaborating centre) was awarded the project.

1.5.2 The team leaders under the guidance of the national team leader identified a core group of persons that were essential to the implementation of the project. The first persons to be identified were the project leaders and co-ordination officers who met regularly in the initial stages to plan out the field work and studies required by such a survey. Questionnaires were drawn up, pilot areas for the beach studies were identified and parameters to be used in sampling techniques were established. Inspection techniques were also established and a random sample of hotels, restaurants and kiosks was drawn up for the purpose of the study. This helped to identify the number of field workers that was required. Six field workers were chosen on the basis of a point system awarded during the interviews. Additional officers for implementing other stages of the project were also identified and these included a communication officer, who was a full-time member of staff at the Health Division in Malta and other Health Inspectors and employees of the Environmental Health Branch Disease Surveillance Branch and Food Safety Branch of the Department of Public Health. Principal Medical Officers and a Consultant at the Health Information Department were also readily available for data analysis of Hospital records and other data that was relevant to the study.

1.5.3 The contract established that the Tourism and Health Activity would run from February 2000 till March 2001, with a final report to be published and launched by end of June 2001. The actual field work was carried out during the bathing season i.e. from end of May 2000 till end of October 2000. The project plan included four phases:

1.5.3(i). Phase I – Detailed formulation

The first phase ran till end of April 2000 and included the detailed formulation of the project as well as the identification of the major players and their training. Questionnaires were prepared and sampling sites identified. Frequencies and methods of sampling were established and fixed. During this preparatory period, interviews with relevant stakeholders were held. These included hotel owners represented by the Malta Hotels and Restaurants Association (MHRA), Mayors and other members of Local Councils in the northwest, District Health Inspectors, Officials from the Health Division and the Environment Protection Department, the Tourism Ministry, and the Malta Tourism Authority were held. Other associations or Tour

Operators were also contacted but active participation was forthcoming from the Incoming Resort Tour Operators Association (IRTOI) and from the SKAL Club.
All General Practitioners who practised at the hotels in the northwest were contacted personally and individually informed of the project. This ensured their full collaboration in filling out the relevant questionnaires. Beaches to be inspected were identified (including two rocky stretches) and bathing sites for the rodent control survey were spray-painted at the three rocky stretches. This ensured easy follow-up of the same sites during the 20 week period of the study. The information packs and GP questionnaires were distributed to the hotels participating in the survey and each hotel manager was personally informed of the project and what was expected from the receptionists during the study period.

1.5.3(ii). Phase II – Implementation

The actual project was performed throughout the bathing season i.e. defined locally as from the 15th May and 31st October 2000. During this phase all the active field work was performed. This included:

- filling in and collection of the GP questionnaires from the hotels concerned;
- on-site inspections of beaches, hotels, restaurants and food kiosks;
- regular sampling of water (bathing water and drinking water), and sand.

1.5.3(iii). Phase III – Integration

From 1st November to 31st December 2000, collation of all data was carried out by the project co-ordinators and project team leader. This data was analysed and trends studied. The GP questionnaires and environmental inspections were analysed and hotel, restaurant and kiosk inspections were given risk factor gradings. Beaches inspected for the purpose of this study, were compared to the Blue Flag Criteria. All previous public health records as well as hospital admissions and environmental criteria were collected for a minimum period of three years and trends were established. Regular meetings with stakeholders were held to keep them fully informed of how the data analysis was progressing.

1.5.3(iv). Phase IV – Final Reporting

The final report was drawn up by the National team leader and discussed with the project co-ordinators and Project leaders over the period of January – April 2001.

1.5.4 The final report has thus identified the environmental health problems being experienced by the tourist in Malta. The recommendations carried within it, will hopefully offer all stakeholders an idea on how to present a 'healthier' package to the tourist.

It also identifies the need for new policies in the field of tourism and health mainly in the northwest which will be taken up by the relevant departments or organisations. Finally, it makes suggestions on the possibility of a follow-up activity.

2. TOURISM IN MALTA

2.1 Tourism in the Maltese islands has grown from a mere 12,583 tourists in 1959 to a record 1,214,230 in 1999. This increase has not been regular and has shown various fluctuations over the years. The last fluctuations were evident over the past six years when there was a marked decrease in tourists from 1,176,223 in 1994 to 1,053,788 in 1996. Arrivals over the last eight years have risen by 34%.

2.2 In 2000, there was a new record of tourist arrivals, this standing at 1,215,712. The distribution of these arrivals by month as compared to previous 5 years can be seen in the table below:

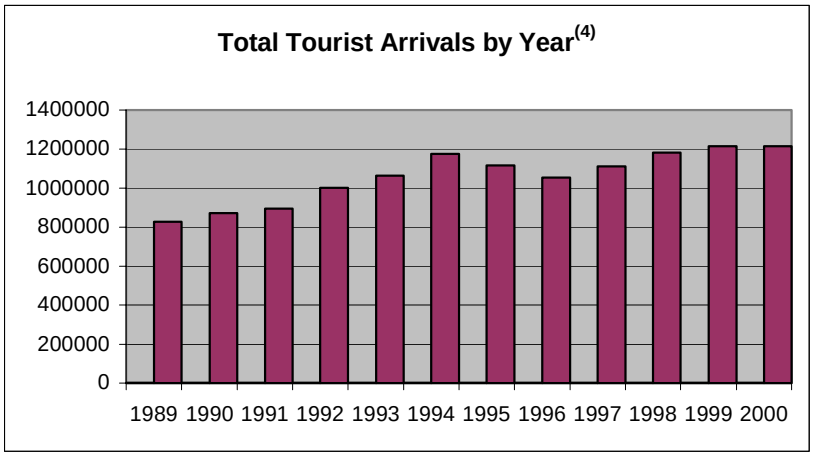
TOTAL TOURIST ARRIVALS BY MONTH

MONTH	1995	1996	1997	1998	1999	2000
January	40,874	39,174	36,497	38,194	44,691	44,717
February	53,314	54,801	51,872	55,808	59,207	55,487
March	83,923	84,033	82,611	78,546	91,637	82,066
April	112,079	90,540	105,614	109,113	104,886	117,640
May	105,120	97,541	117,477	115,642	116,919	112,802
June	110,028	101,061	98,609	113,375	118,230	120,703
July	134,477	123,643	135,073	145,047	149,477	152,763
August	140,557	139,943	149,251	158,643	159,169	155,321
September	121,307	115,557	115,329	126,920	129,315	132,526
October	102,732	96,794	101,081	111,306	115,377	111,747
November	59,971	59,273	63,789	71,410	73,390	68,067
December	51,589	51,428	53,958	58,236	51,932	61,873

Source: Malta Tourism Authority (2000) Annual Report and Financial Statement, 2000.

2.3 The bar chart on the previous page depicts the fluctuations in tourist arrivals since 1989, and clear demonstrates the rise in tourist arrivals over the past 5 years. This has inevitably led to an increase in licensed tourist accommodation and total guest-nights, which have increased by 11% and 8% respectively, although the annual length of stay of tourists has decreased from 12.1 days to 9.3 days. In terms of number of beds, these have increased from around 41,000 beds in 1989 to 46,884 beds in March 2001.

2.4 The share of beds has also changed, there being an increase from 3.4% to 6.3% in the five star category and another significant increase in the four-star category. The three-star category and the self-catering sector have however been affected by these increases and the share of total beds in the former has decreased from 22.1% in 1989 to 18.1% in 2000. In 1982, self-catering flats accounted for 51.3% of total annual guest-nights whilst in 1997, this had decreased to 30.9%[(1)]. Currently the average annual occupancy as indicated by the Malta Tourism Authority stands at 56%.



Source: Malta Tourism Authority (2000) Annual Report and Financial Statement.

2.5 Foreign earnings from tourism account for over 25% of total exports of goods and services[3]. Gross earnings from tourism increased from Lm157.4 million in 1990 to Lm249.8 million in 1997[3]. This has increased to Lm271.4 million in 1999[4]. Tourist expenditure per capita has increased from Lm180.6 in 1990 to Lm224.8 in 1997 but decreased to Lm215.2 in 1998[5]. In 1999, tourist expenditure per capita was Lm223.5 and till September of 2000, it stood at Lm211.7[4]. The estimate of full-time employees in tourism is in the region of 41,451. This includes both direct and indirect employment as well as induced and government related employment[6].

2.6 The country of origin of Malta's main tourists has also changed. Whilst previously Malta was traditionally reliant on the UK market, this has gradually changed since the share of arrivals from UK has decreased from 61% in 1989 to 35% in 1999. There was an increase of tourists from Continental Europe these accounting for 52% of the total share in 1999. German, Italian, French and Benelux countries have also gradually increased their market share over the last years, together with a gradual increase from long-haul markets like Australia, Canada and USA. Malta has also seen significant increases from markets that are not usually considered as the main tourist markets to Malta. In fact their share of total annual arrivals has doubled over the last 10 years and this is mainly due to the success of new markets like Russia and Austria.

2.7 When analysing the year of this study (2000), there were some changes that caused concern. Though the year started off with the German and other continental markets making up for losses incurred by the United Kingdom, the performance of the German market particularly in autumn became a source for concern. As the year progressed the UK market started to consolidate and by Summer had shown substantial increases[4]. The changes are listed below:

PERCENTAGE DISTRIBUTION BY NATIONALITY		
Country of Origin	**1995**	**2000**
UK	41.32%	35.27%
Germany	16.82%	16.84%
Italy	8.73%	7.61%
France	6.53%	6.24%
Netherlands	4.08%	5.8%
Libya	3.33%	3.56%
Austria	1.80%	2.31%
Belgium	1.97%	2.20%
Switzerland	1.66%	1.81%
Sweden	0.76%	1.65%
Irish Republic	1.27%	1.63%
USA	0.98%	1.58%
Russia	0.95%	1.54%
Denmark	1.57%	1.41%
Australia	0.71%	0.89%
Norway	0.62%	0.75%
Japan	0.19%	0.70%
Greece	0.31%	0.68%
Canada	0.47%	0.60%
Finland	0.50%	0.48%
Spain	0.72%	0.45%
Ukraine	0.04%	0.20%
Others	4.67%	6.33%

Source: Malta Tourism Authority (2000) Annual Report and Financial Statement.

Tourist arrivals by country of origin for 2000	
UK	1.5% increase
France	3.5% increase
USA	3.8% increase
Germany	3.6% decrease
Italy	0.2% decrease
Netherlands	1.8% decrease
Switzerland	6.3% decrease
Norway	8.9% decrease

Source: Malta Tourism Authority (2000) Annual Report and Financial Statement.

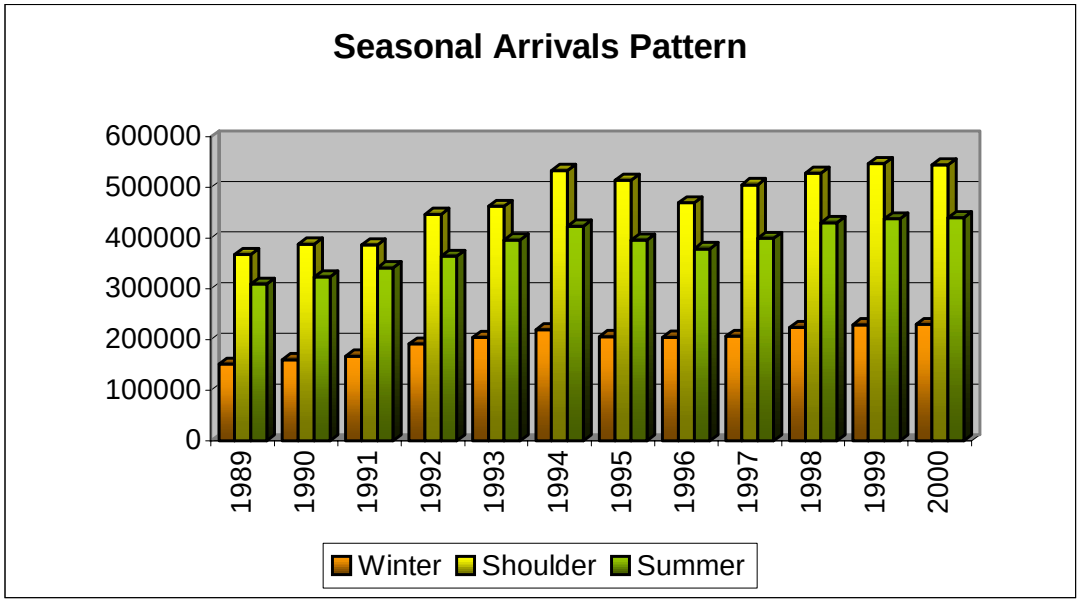
2.8 Product diversification has helped in this successful increase in tourists from other countries. Malta, always renowned for the sun and sea, has gradually started to develop a number of markets. These include: the Conference and Incentive travel business; the cultural and historic market, the diving market, the educational market (learning English), yachting and Mediterranean cruises.

2.9 The Tourism Development Plan for the Maltese Islands produced in 1989 has aimed to change from a mass tourism product to a higher quality one. One of the three main strategic elements of this development plan is seasonality. The seasonal distribution of tourist arrivals has improved slightly over the last decade. This has resulted in a decrease in the summer peak with a minimal increase in the shoulder and winter months (see table below). However, it is unfortunate that the shift has not been as pronounced as expected.

% SHARE OF TOURIST ARRIVALS FOR EACH SEASON					
Season	***1989***	***1992***	***1994***	***1996***	***1999***
Winter (Nov. – Feb.)	18.2%	19.1%	18.7%	19.4%	18.9%
Shoulder (Mar. – Jun. & Oct.)	44.4%	44.6%	45.4%	44.6%	45.3%
Summer (Jul. – Sept.)	37.3%	36.3%	36.0%	36.0%	35.8%

Source: Malta Tourism Authority (2000) Annual Report and Financial Statement.

The bar graph below demonstrates the gradual change in pattern of the seasonal arrivals[(4)]:



Source: Malta Tourism Authority (2000) Annual Report and Financial Statement.

2.10 Another important change has been the daily number of tourists staying on the islands during peak season. The daily number of tourists on the islands during peak season has increased from 43,000 in 1989 to over 55,000 in 1999[(1)]. This has undoubtedly increased the pressure on the infrastructure during peak months and it is mainly the upper sector of the hotel accommodation that has been affected by these numbers.

2.11 The main localities affected by these increases are usually those areas in the North West of the island. The highest concentration can be found in St. Paul's Bay area, which includes Bugibba, Qawra, and Xemxiija, though Mellieha receives a moderate share too. The localities of residence of tourists are not necessarily the main site of tourism activity. According to the tourist survey, their activities take them mainly to the southern part of the island. This activity also changes in accordance to the season of their stay e.g. 18.8% of tourists coming in November, indicated that they were staying in St. Paul's Bay as compared to 28.3% during the month of August.

2.12 Tourist arrivals by age group can be seen in the table below:

TOURIST ARRIVALS BY AGE GROUP					
<14 yrs	**15 – 24yrs**	**25 – 39yrs**	**40 – 64yrs**	**>65yrs**	**TOTAL**
94,922	153,797	311,155	510,471	145,368	1,215,713

Source: Malta Tourism Authority (2000) Annual Report and Financial Statement.

In the under 14 year group and the 25 – 39 year group, the most arrivals occurred in August, whilst in the 15 – 24 year group, most arrivals occurred in July. In the 40 – 64 year group the most arrivals were registered in September while >65 years, May proved to be the most popular[(4)].

2.13 Forecasting future tourist arrivals is important to determine the demands, and thereby adapt to the requirements of the market. Undoubtedly this is not easy and one can only look at trends. The World Tourism Organisation has indicated that the share of international tourism to the Mediterranean is decreasing (33% of global arrivals in 1990 as compared to 30% in 1995). The forecast of global arrivals for 2010 is 21%. The World Tourism and Travel Council (WTTC) estimate that between 2000 – 2010 annual tourist arrivals to Malta will increase by 1.1%[(1)].

TOURISM INDICATORS FOR SELECTED YEARS			
Tourism Indicators	***1989***	***1994***	***1998***
Tourist arrivals	828311	1176223	1182240
Accommodation beds	40840	43787	46527
Unlicensed beds (est.)	9000	6000	6000
Average length of stay	12.1 days	10.2 days	9.5 days
Total guest nights	9871966	11950631	11325611
Total earnings (million)	Lm143.8	Lm241.9	Lm254.4
Per capita spent	Lm173.6	Lm205.6	Lm215.2
Direct employment	8196	8154	9445
% of exports of goods and services	26.5	24.3	2.7
Beds in Malta	35155	41301	43665
Daily no. of tourists (peak month)	43000	49988	55269
British market (% of arrivals)	59.5	45	37.96
Cruise Passengers	54528	62820	114064
No. of cruise ships	146	155	214
No. of hours in harbour	1481	1501	1970
%days spent in 5 star hotels	4.5	2.9	6.3
%days spent in 4 star hotels	13.4	19.2	25.2
%days spent in 3 star hotels	21.6	18.3	13.2
%days spent in flats/private res.	32.9	31.3	29
%days spent in complexes etc.	22.5	25.5	22.3
Beds in 5 star accommodation	1409	1674	2998
Beds in 4 star accommodation	6175	9688	10161
Beds in 3 star accommodation	9026	8099	8141
Beds in complexes etc	11799	14500	12765
Beds in flats/self catering	7626	5992	6016
Seasonality pattern – Winter	18.2%	18.7%	18.9%
Seasonality pattern – Shoulder	44.4%	45.4%	44.7%
Seasonality pattern – Summer	37.3%	36%	36.4%

Source: Planning Authority (2000) The Structure Plan for the Maltese Islands – Tourism Topic Study: Consultation Draft.

2.14 This issue is therefore of major concern to a small island like Malta where capacities to attract high numbers of visitors are limited. Careful watch on the local market is therefore necessary while trying to continue to develop unique selling propositions to distinguish Malta for the other destinations. The development of tourism indicators is one way in which Malta monitors the state of its tourism market.

2.15 In the "Annual report and Financial Statement" published by the Malta Tourism Authority, 2000 the Chairman Dr. John C. Grech writes:

> ***"Quality and consistent delivery of quality across the board will determine Malta's success or otherwise in Tourism and should thus remain at the top of the national agenda. Today's tourists, whatever their country of origin or socio-economic profile, insist on value for money."***

This study has aimed to do just that. By identifying failures in the field of environmental health and making recommendations for future policies and action plans to decrease the public health hazards faced by the tourist, this report will hopefully help to add to the national commitment of a better quality product. It is hoped that the overall findings will be of use to all stakeholders involved be they central government, local authorities, the private sector or other organisations.

Recommendations

R.2.1 Tourism is not usually compatible with conservation of the environment. Ironically, it is the unique and well-preserved areas that attract the higher amount of tourists. This, in itself, should drive us to continue to move towards a more sustainable Tourism Industry. This can be done in a number of ways. The Carrying Capacity Study of the Maltese Islands, carried out by the Maltese Tourism Authority should be published without further delay, as this will form the cornerstone of many interdepartmental policies and strategies. Sustainable tourism needs to recognise, accept and work around the limits imposed by the islands' carrying capacity, which it must constantly and fully respect.

R.2.2 The tourism industry must find ways in which it can continue to contribute to heritage conservation and enhancement, to the preservation of natural resources. In doing so, it will serve as a model for other economic sectors and hence, influence their practices. The preservation of natural resources may be one way, and should include the definition of protected areas. By supporting the local economy, specifically down to the level of Local Council funds, such areas could be preserved. If central and local governments were to work closer together, this would ensure an improvement in behaviour amongst towards one of respect for the environment.

Through more direct involvement of the residents within such communities, one would enhance ownership and pride in local council areas besides helping to develop new forms of employment.

R.2.3 A sustainable tourism strategy must find ways in which to include realistic action programmes and plans which also target the environmental health aspect of tourism. Indicators for Tourism and Health have started to be produced by this activity, but should continue to be built upon and should become an integral way of monitoring performance and impact of the tourism industry. Moreover, ***development of environmental health indicators*** may help to predict the deteriorations in the environment which would result in negative health effects on the tourist.

R.2.4 While it is important to design and test innovative packages that would promote Malta abroad, it is more important to ***give priority to improving existing facilities and services before developing new ones. Introduction of quality checks and improvement procedures based on feedback and setting of standards should come first.*** A list of new themes and sites with a potential for tourism should always be done with full respect and understanding of local traditions. Hence, a complete change in policy from the present one of developing large-scale tourism to that of ***favouring small-scale tourism developments using existing resources and reflecting the natural and historic heritage in style, design and setting should be considered.***

R.2.5 More emphasis needs to be made on recreation opportunities for tourists that reflect the environmental conditions. Tourists generally travel to Malta because of our climate which allows easy outdoor activities. Hence, where appropriate, ***new outdoor activities should be identified and promoted. Walking and cycling holidays*** would *probably* appeal to young and more environmentally orientated North Europeans. This would obviously involve the building of cycling tracks where possible. However, by ***involvement of local environmental movements, specifically designed maps backed by adequate signage along suggested***

pathways/walkways would help one to discover Malta in a unique and informal manner.

R.2.6 In all circumstances, particular ***attention must be paid to the quality of on-site information, including sign-posting, brochures, visitor centres and guiding services***, which can have a significant influence on visitor experiences and behaviour. ***Information offices should be established within important Local Council areas or in important tourist areas and should be easy to identify and readily equipped with all necessary information at all times***. Networking amongst a number of such offices as well as with other important departments may help to offer a more efficient service to the visitor through ***the provision of 'one-stop' shops within the larger villages or at important, popular tourist sites.***

R.2.7 It is important to ***encourage the use of environmentally friendly management in local accommodation offered to the tourist.*** Waste should be reduced by avoiding use of individually wrapped products and favouring fresh ones. Recycling should be encouraged - used water from showers, baths and kitchens can be recycled and reused for toilets etc. Use of environmentally-friendly products should be encouraged. Energy consumption may be decreased through the use of solar panels, and low-energy bulbs for lighting, etc. Such initiatives are still very new to Malta, though certain hotels are already investing in such environmentally friendly ways. It is important that such measures and the reasons for them are explained to the guests at every available opportunity, through brochures, signs in lobbies and rooms. This would provide an advertisement in its own right. Such measures need to be encouraged by Central government to be successful. ***"Eco-taxes"*** may help to ensure that non environmentally friendly products are not used by hoteliers and restaurants. ***Subsidies*** on solar panelling and other environmental initiatives would help to promote their use.

R.2.8 It is also important to ***develop and communicate Eco-label and Certification schemes amongst the tourism industry. Examples of good practice (e.g. in accommodation, guided tours or local foods and products) should be 'loudly' acclaimed. Promoting those with such awards would encourage others to follow suit.*** This could be done through enhanced marketing of awarded facilities, services and entrepreneurs. Co-operating with external information services, networks and media will help to multiply the advertising effect of such awards.

R.2.9 Non-polluting means of transport are becoming more readily available and accessible. ***Non-polluting vehicles such as bicycles or small electric cars should be used within tourist areas*** that are affected by heavy traffic loads and hence noise and air pollution from transport. ***Car sharing*** is a possibility even though this is still a new concept on our island. This idea, widely promoted across the continent involves the hiring of an electric car, which is opened by means of an electronic key/code supplied to the purchaser of the service on booking or on arrival at the airport. **I*ncreasing pedestrianisation*** of certain zones helps to encourage tourist activity and hence such zones should be increased, possibly backed up by frequent internal shuttle services by clean vehicles. ***Tours of sensitive areas such as Valletta, Mdina, and other historical sites could be done on small electric standee buses*** which **would** be cheaper and less polluting.

R.2.10 The Institute of Tourism Studies should ***continue to train and encourage local people seeking jobs in this sector, on environmental health impacts of the***

activity. These persons will serve as valid observers of the environment and its effect on the Tourism industry, through the personal contact they have with the visitors they work for. Visitors would readily report complaints, changes and problems in the environment that they have encountered to people who are 'up-front' and work closely with them. Ways of ***tapping such information must be sought since they provide unique sources of information that may allow preventive actions to be taken early enough. One possibility could be the filling in of standardised environmental complaint forms placed on an internet site of the Tourism or Environment Ministry or on the site of the Malta Tourism Authority.*** It should be ensured that such forms are easy to fill, and not time consuming.

3. ENVIRONMENTAL HEALTH IMPLICATIONS OF TOURISM

3.1 Since the Stockholm Conference on the Human Environment in 1972, there has been continuing National and International concern about the state of the environment and the health status of nations and the interaction between them. In 1989, the Ministers of Environment and Health of all Member States of the World Health Organisation were called to Frankfurt to officially discuss and recognise the importance of this interaction. This led to the unanimous approval of the European Charter on Environment and Health. At this key conference, Ministers committed themselves to collecting and analysing any data on the environment and the potential impact this was having on the public health of their countries. More importantly, they recognised the need to act upon this data and agreed to meet five years later.

3.2 The Second European Conference on Environment and Health was held in Helsinki in 1994. Here, countries committed themselves to develop a National Environmental Health Action Plan known as the NEHAP. Malta was among the first countries in Europe that completed the NEHAP, in accordance with the Helsinki Declaration. This plan was unique in that it recognised that there was a range of influences on public health, which had to be taken into account by many sectors. These included economic sectors which, through their effect on the environment resulted in a vicious circle that hit back on the individual's health. This, in turn, had impacts on the economic sector involved.

3.3 During the drafting process of our NEHAP, the Tourism sector was recognised to be one of the most important stakeholders. Contributing to nearly 25% of the annual GNP, the Tourism Industry is understandably one of Malta's main economic sectors**.** Malta proudly boasts about its agreeable warm weather conditions, its beautiful and clear bathing waters, as well as its rich archaeological, historical and cultural heritage.

Gozo, the sister Island, known in Greek Mythology as the Island of Calypso, is the place where '*time stands still*'. Although just twenty minutes away by ferryboat, Gozo has retained much of its rural and agricultural nostalgia. However, one will recognise that all this wealth must be scrupulously preserved in order to retain and maintain its *magical* effect, and this can only be achieved by ensuring that t*ourism* is kept at "sustainable levels". Unfortunately, official records show that for its size, Malta has one of the highest population and traffic densities in the world. Hence, one would appreciate the importance of preserving a healthy and sustainable state of the environment so as to ensure that the tourism industry remains buoyant.

3.4 While the importance of preserving our natural environment is obvious, the detrimental effect on Tourism by public health issues is **not** yet sufficiently recognised. Episodes of ill health among visitors to surrounding Mediterranean States have undermined the value of the tourism product with the resulting effect being loss of revenue, negative publicity for the region and litigious actions by affected visitors and tour operators. Ever increasing numbers of arrivals to this Region, increase the chances of importing diseases that to date were rare or unknown in the Mediterranean Littoral basin. Moreover, global changes in information technology including Internet are forcing increased attention to and recognition of such illness events in this region.

3.5 The need for closer working ties between the tourism and public health sectors, to create and maintain an enabling environment for sustainable and profitable tourism development, is becoming more obvious. Unfortunately this alliance is still in its early

stages locally and is markedly lacking in the whole sub-region. Such an alliance of the Tourism and Public Health sectors within the Mediterranean basin would facilitate improved health and socio-economic development from which many benefits could be derived. Such benefits would include:

- minimization of health and environmental health risks;
- improved environmental management practices in the tourism sector;
- increased public and private sector capacity to protect human health and manage environmental health issues through training of professionals working in environmental health related-matters including environmental health officers, hotel workers etc.;
- increased public awareness of health and tourism issues and promotion of the adoption of health and friendly behaviours;
- increased private sector participation in national tourism and environment programs;
- mobilization of technical and financial resources.

3.6. When it comes to Environmental Health Policies, one must be aware of what are the main issues to be targeted. Amongst the many some deserve particular mention:

3.6.1. Bathing water

The Mediterranean Sea has an obvious impact on our countries together, since we all share this small enclosed but increasingly polluted sea that is so important to our economy. Many of our visitors come specifically seeking our bathing waters and our diving industry is in fact thriving due to the clear conditions which prove to be popular amongst the Northern Europeans. Unfortunately, health effects such as gastric illnesses, earaches and skin infections are on the rise in the Mediterranean due to the outflow of untreated sewage into this enclosed sea. This is one environmental health issue that requires co-operation between the sectors of tourism, environment and health as well as education at local, national and regional levels. We need to ensure and advertise clean and safe beaches and marinas for the public. We need to educate local authorities, private tourism operators and the public about the need and the means to protect the coastal and lacustrine environments. We need to promote a basis for voluntary environmental action in communities.

3.6.2. Drinking Water

Water Issues are a prime concern in the Mediterranean region. Much of the region has relatively low rainfall. Population growth and economic expansion result in pressures to move, store, and remove water from its natural places and apply it to human needs. This re-arranging of natural resources has impacts on species and fragile ecosystems, and species that depend on them, are threatened. Tourism itself uses water and more often than not, consumption is significant, especially in the cases of large resorts and golf courses in arid regions. It is often the case that tourism's demands on water can be better managed, but it is hard to ask a community to conserve water when an adjacent development for visitors uses water profusely. Tourism must take the lead in water conservation, and once that lead is demonstrated, it needs to work closely with nearby countries.

3.6.3. Food Safety

Our bitter experiences in Malta within hotels and restaurants arise partly from the lack of food safety programmes and standards of hygiene for street-vended foods. Many a time, the Public Health Department is called out to investigate outbreaks of gastro-enteritis within hotels only to find that the source is not necessarily the hotel itself.

The trend is that tourists usually spend their day outdoors, dining at some other restaurant or buying street-vended foods. When this results in gastroenteritis, it is usually the hotel that is one of the first sites to be investigated and may even result in the hotel's kitchen or the restaurant being closed to the public until the source is identified. This is an unfortunate incident since hoteliers would have invested time and money into ensuring a safe environment for their business, only to have their name tarnished by a careless "traditional" kiosk found down the road or at some village festa. On a small island like Malta where news travels fast, innocent gossip amongst islanders can have immediate and dramatic effects on businesses, even before public health officials take any action.

The result is often a significant and ongoing downturn in business even if it is later proven that there was no scientific basis linking the food poisoning outbreak to the particular building. It is then too late to immediately reinstate public confidence in the particular hotel or restaurant involved. Though it would be unfair to blame **all** kiosk-owners or street vendors for every outbreak of food poisoning, regulation of this sector has now become a priority.

3.6.4. Air Pollution

Air Pollution threatens the health of some natural resources and the quality of visitor experience. We in the Mediterranean enjoy an image of blue skies. Loss of this habitat would result in our guests losing trust that our national heritage is being protected, and losing the sense of value in the tourism experience that our industry provides. Tourism and public health sectors **must** work together to eliminate the reality and prevent the formation of a wrong perception of air pollution. Moreover, when the source of that pollution is many miles away, we must work beyond our geographical boundaries to have a common voice.

3.6.5. Disease Surveillance in public places

Another public health disease that often comes to the mind of the hoteliers is their vulnerability to Legionnaires Disease. Outbreaks of Legionnaires disease arising on this island are rare. There have been 15 cases from 1989 till May 2000, (2 of which were imported). A case of Legionnaires creates strong media interest and panic and may result in cancellations of tourist visits, especially if the source is not quickly identified. Media interest in *Legionella* tends to make national news and press interviews of family members of victims does not help, especially when questions asked include enquiring into where they have been. Innocent references to a specific hotel can have immediate and dramatic effects on the economic status of this hotel and on our tourism industry.

3.6.6. Health and Safety in Public Places

It is international practice to require places of assembly to be healthy and safe in order to avoid disasters. Countries that fail to provide such health and safety measures periodically have serious incidents involving many deaths at venues such as night-clubs, soccer grounds, etc. Large out-doors public events also naturally pose public health risks and need to be well managed. Indoor assemblies require adequate advertising of safety procedures and exits, to ensure that all persons who are "foreign"to these venues are safe.

3.7. Only a few Environmental Health issues have been highlighted here to demonstrate the importance of preserving public health for the sake of the Tourism Sector. The result of such policies would be none other than a better quality tourism product which would contribute to more sustainable tourism and economic development of Malta and surrounding Mediterranean states.

3.8. Civil litigation is becoming increasingly common. The recent spate of insurance claims following such episodes is costly in terms of human and financial resources. One must admit that prevention is much cheaper both in terms of human lives, business and industry costs and costs to the public sector. Prevention is however dependant on knowing where faults can occur - hence the advantage of HACCP (Hazard Analysis at Critical Control Points) the preparation of high-risk food.

3.9. Malta's tourism package has always heavily depended on the state of its environment – our warm climate has been sought by the older generation seeking a place for retirement especially during the winter months. The high concentration of archaeological and historical remains within such a small area brings the tourist who longs to see more of the past. Families are attracted to our small size and to our relatively safe outdoor life, making it easier for them to enjoy a relaxing holiday with their young ones.

3.10. It is sad to note though, that we have still to learn how to preserve these attractions. We must learn to preserve the little that we can offer. We must learn to recognise that solutions to environmental problems are costly, and costs will increase exponentially as environmental quality declines further. The sooner we are able to do ***our*** small part, the sooner we will halt our environmental and health degradation. Only then, will we be in a position to adequately predict future changes in our environment and environmental health. And only then will we be able to address options and funding requirements not only for solutions but also for prevention.

3.11. We must also remember that what our Tourism package offers, is heavily affected by and reliant on surrounding states. Environmental Health issues are common to the whole Mediterranean and episodes of ill-health among visitors to the surrounding Mediterranean States have undermined the value of the tourism product in this region with the resulting effect being loss of revenue, negative publicity for the region and litigious actions by visitors and tour operators. Some changes including the migration of species and the diseases that they carry are already evident.. The issue of the Tiger mosquito (which has a potential to transmit maladies affecting humans such as Encephalitis, Dengue fever and Yellow fever, as well as dog heartworm) transported into Italy in 2000 by a cargo of tires is one such example.

3.12. Technology today allows easy access to data and ongoing risk analysis but this must be conducted in unison amongst all Mediterranean states and must be recognised as an essential part of ensuring the Tourist economy by protecting public health. The Tourism and Health Activity of CAMP-Malta aimed to identify such risks and pave the way for surrounding states. By starting to identify the problems in common to this Region and making suggestions on how to address such issues there is a framework for the Region to continue to build upon.

By suggesting standards that can be set for different environmental health issues as well as by presenting a basic list of health indicators that would help to monitor such standards, this publication hopes to result in improved environmental health standards in the Tourism industry of the Mediterranean. This would enhance the possibility of ensuring a higher quality tourism product that can be sold as a common package for the whole of the Mediterranean Region.

Recommendations

R.3.1 With the increase in international travel, there is an increasing risk to hygiene and health which Medicine must learn to face, not only with scientific measures, but also from the viewpoint of organisation, and legislation. Naturally, methods used to deal with the protection of the health of the tourists *differ* according to whether one is dealing with *receiving* or *sending* tourists. Whilst the information to the latter is slowly but surely being well-developed by the Disease Surveillance Branch of the Department of Public Health, the health of the incoming traveller has not yet been targeted. ***A centre dealing specifically with tourist health is desperately needed.*** Such a centre would co-ordinate the needs of outgoing travellers, providing the required information about vaccinations, illnesses to be found at point of destination, and precautions to be taken. However, the main emphasis of such a centre would be to act as the focal point for incoming travellers. Tourists would be provided with useful advice and up-to-date information to prevent illnesses and accidents.

R.3.2 The idea of this centre has long been thrown around and efforts are still underway to acquire WHO recognition for the one proposed in 1998. The Health Authorities should continue to strive for such a unique opportunity of serving the Mediterranean community as well as the local one. ***In the interim period, such an idea should not be lost and a small branch or unit could still be developed to serve the local needs.***

R.3.3 ***Health Promotion leaflets, brochures, and audiovisual aids should continue to be produced and distributed by the Health Promotion Department***. Non-communicable and other chronic diseases are becoming as important as the communicable or more acute diseases in the traveller. This is because of the increasing age of charter tourists. Tourists with non-communicable diseases often require, and ***expect*** a high quality medical service. They should therefore be adequately informed, probably by their travel agency, concerning the environmental health problems that they may expect to face in our country. This involves our extreme temperatures and tropical climate, and dusty/windy environment amongst other features. Such information could be made readily available not only through the travel agents or tour operators, but also within hotel lobbies and rooms.

These same brochures should encourage those that are on medication to buy sufficient drugs at home and to bring with them written information about their disease, in case deterioration should occur during their holiday.

4. IMPLEMENTATION PHASE

4.1. Food Safety

4.1.1 Diarrhoeal diseases and other food borne infections and intoxications constitute the most important and frequent for of illness in tourists. A joint FAO/WHO expert Committee report on Food Safety (1984) called ***"The Role of Food Safety in Health and Developments"*** states:

> ***"Travellers' diarrhoea is now a widespread phenomenon, affecting about 20 to 50 per cent of all travellers"***

It was estimated that tourists coming to the Mediterranean area from the rest of Europe run a risk of developing diarrhoea that is 20 times higher than in their home countries. It is assessed that the number of tourists visiting the Mediterranean seacoast will continue to increase and this will therefore make it more difficult to sustain the appropriate function of public health services including food safety systems.

4.1.2 Visitors to the Mediterranean area in 1987 numbered some 250 million, with the majority of food-borne illness in tourists being of microbiological origin, resulting from food which had been mishandled at some time in the food chain. It has been estimated that two fifths of all international travellers suffer from diarrhoea while abroad, with 30 per cent of sufferers actually being confined to bed, and a further 40 per cent even forced to change their itinerary.

4.1.3 The real extent of the problem is still unknown. Reporting systems of food-borne diseases are inadequate and not more than 5% of acute incidents are notified in most European Countries. In the majority of Mediterranean countries the surveillance and monitoring of food borne diseases is still at an early stage of development and in addition most of the current activities in this area are orientated towards the health protection of the local population. There is also significant hesitation to disseminate freely the results of surveillance because of the fear of negative publicity and its impact on tourism.

4.1.4 In Malta, the Department of Public Health within the Health Division is officially responsible for food safety, including catering inspections and investigations of food poisoning outbreaks. The Food Safety Branch works closely with the Disease Surveillance Branch when investigating a report of food poisoning. Local medical practitioners are duty bound to report any form of diarrhoea arising in two or more people, especially when food is thought to be the source of the problem.
A full-scale investigation into such a report is fairly rapid and efficient. Most of the time, investigating officers are on the spot of investigation within one hour of the case being reported. Interviews with the persons concerned as well as with the food catering staff, are carried out as discretely and effectively as possible. The premises, especially the kitchen, are inspected for possible flaws or failures in food hygiene practices. Moreover, samples of water and food left over in the food preparation area are analysed in an attempt to identify the source of the problem.

4.1.5 A full report is drawn up and all those concerned are informed of the results. Unfortunately it is often the case that such incidents pass by unreported, and when they are – it is often too late since all food leftovers will have been removed from the preparation area and the ill tourist will often have been treated by some

general practitioner. Hence laboratory linking of the food source to the tourist's complaint can sometimes only be speculative.

4.1.6 In some countries from which tourists come, efforts are made to identify the infections they bring back. The difficulty here is the failure of some tourists to mention to physicians that they have been abroad. To add insult to injury, the interchange of disease surveillance information amongst Mediterranean countries and the tourists' home countries is often slow or even absent. This delayed information is useless for disease prevention and control.

4.1.7 The phenomenal growth of the tourist industry over recent years has seen the development of supporting infrastructures to enable receiving countries to meet the tourists' needs. This has necessitated substituting traditional forms of catering to meet the increased demand for prepared forms of food that can be readily available to large numbers of people during relatively short periods of time. Such centralised food preparation requires that large quantities of food be prepared in advance of the anticipated demand.

4.1.8 Unfortunately, large-scale catering practices, unless properly regulated, can be hazardous due to the nature of food prepared and the methods used for storage and handling for quick service. Such food production or mass catering where there is an inadequate technological and physical infrastructure can, under certain circumstances, mean that a single contaminated source can affect large numbers of people at one time.

4.1.9 One must remember that it is such spectacular outbreaks of food borne illness that attract media interest which as a consequence can draw unsolicited publicity with consequent loss of public confidence. Such publicity often results in adverse economic implications for the tourism industry.

This situation therefore emphasizes the need for adequate arrangements to be made in tourist areas for food and water safety.

4.1.10 The Department of Public Health has taken a proactive stance in the local food industry by carrying out yearly inspections in all catering establishments. Kitchens are thoroughly reviewed for basic requirements and hygiene practices and a risk factor grading is given to all establishments (i.e. Hotel and Restaurant kitchens). All premises inspected are allowed to remain open only if they are found to be safe enough to do so. When a catering establishment fails or when it is involved in an investigation of food-poisoning, no food preparation is allowed at such a site until basic infrastructure amendments are made, staff examined and educated thoroughly on clean food practice.

4.1.11 For the purpose of the Tourism and Health Activity, inspections of kitchens and food preparation areas were carried out in the same format as done in previous years by the health authorities. This was to enable adequate comparison of the state of such premises to previous years to identify those premises that had deteriorated or improved upon their risk factor gradient. It was physically impossible to inspect all the northwest area in such a short period of time, so a sample of hotels, restaurants and kiosks was drawn up for the purposes of this study.

4.1.12 25 hotels, 75 restaurants and 10 kiosks were inspected between the months of May and September 2000. All catering establishments were inspected twice. The

first inspections were carried out in May and June, whilst the second inspections were carried out in August and September. Each report was recorded on a risk assessment program specifically designed for the project. As previously stated, this was designed in such a way to enable adequate comparison of such data to previous years thereby allowing one to assess any overall improvement in the food industry business. The Food Safety Branch of the Public Health Department supplied the team with similar data obtained over the identical months of the study in the previous four years and from the same establishments inspected by this study thereby allowing comparison to take place.

4.2. Disease Surveillance

4.2.1 Beach Inspections

4.2.1(i). Beaches are a vital resource for the Tourism industry in Malta. The Maltese islands have few natural resources and tourism provides one of the few realistic opportunities for earning foreign exchange and for broadening the nature of employment.

The islands do offer a variety of attractions, including the unique architectural and historical heritage of Valletta and the Grand Harbour, dramatic inland and coastal scenery and special interest holidays such as diving and cultural holidays. However, the traditional beach holiday is still a major component of much advertising literature, and the beaches remain the focus of activity for many visitors and residents.

4.2.1(ii). The coastline of Malta is under considerable development pressure. Anderson & Schembri (1989) estimate that 30.5% of the coastline is obscured by development, 8% is dominated by industry and 3% is dominated by pollution by oil and dumping. Beaches are of very limited occurrence, forming only a small contribution to the island's coastline. Ironically, the very presence of tourists, is degrading to the inherent beauty and cleanliness of beaches which attracts visitors in the first place.

4.2.1(iii). Whilst most of the tourism activity in the Maltese islands is carried out in coastal areas, certain activities are also carried out directly along the foreshore. This is related to swimming and sunbathing activity and the use of sea-craft (e.g. jet skis, paddle boats, etc.) Sandy beaches are very popular with tourists as well as local residents, though surveys indicate that the latter are finding the beaches somewhat crowded [(7)].

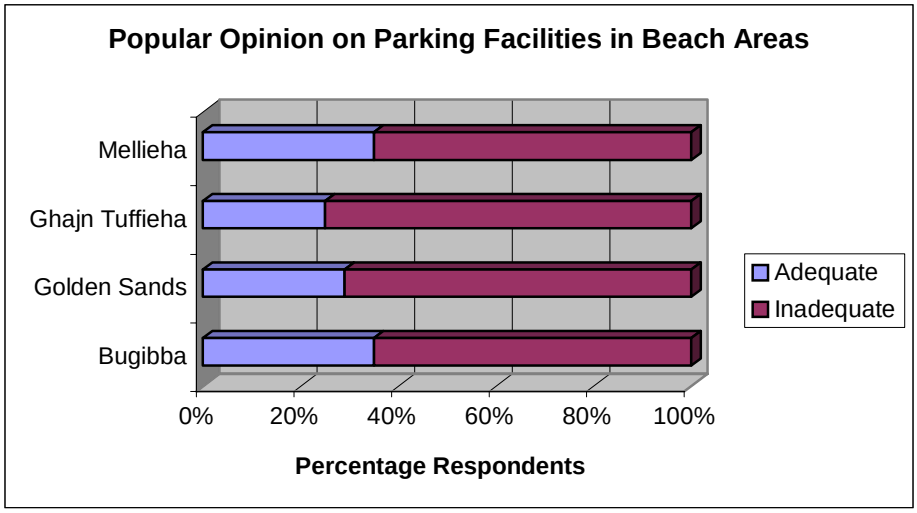
4.2.1(iv). Tourists have also indicated that the beaches are not as expected, particularly because of the number of people and the lack of basic facilities e.g. showers, toilets, availability of first aid and telephones. Although it is acknowledged that beach users demand certain facilities, it is not always possible to provide such facilities in all localities due to the sensitivity of particular locations[(7)].

4.2.1(v). The local Ministry for Tourism and other tourism associations have indicated that capacity along certain stretches of coast can be increased, although no supporting evidence has been put forward as to the way the additional capacity might be made available. The sensitive coastal habitats can be disrupted if indiscriminate rock cutting interventions are carried out along the foreshore. Nonetheless, even these may need to be considered provided they do not result

in significant adverse impacts and are kept to a minimum. Use of wooden walkways over rocky stretches may also help to increase the availability of coastline for tourists and locals alike, with the least disruption to the environment.

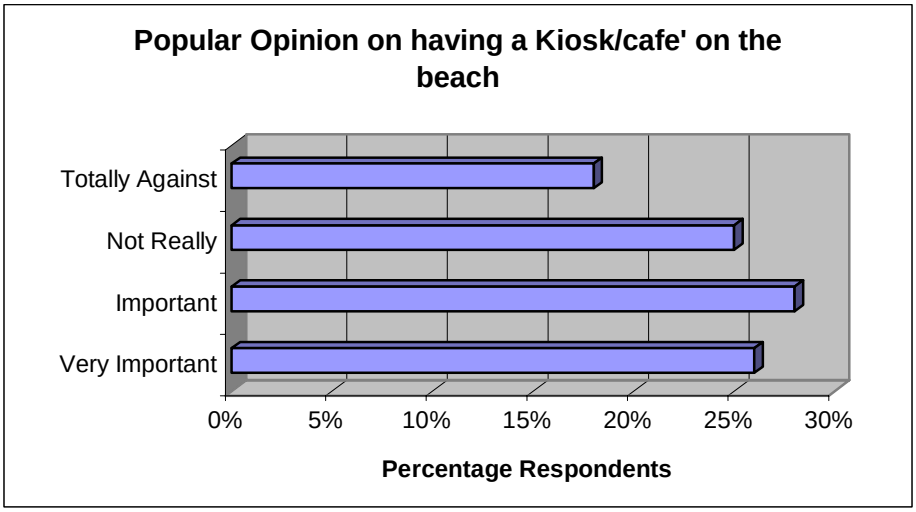
4.2.1(vi). Sandy beaches do remain in high demand and it is unfortunate that the current status is not meeting the requirements of the high tourist demand. Even more unfortunate is the fact that some sandy stretches have almost totally lost their sand as a result of specific developments.
Replenishing such beaches is an important consideration but must not be done hastily in view of environment impact assessment studies that must be done first. These would help to identify current coastal dynamics and therefore establish the feasibility of such an intervention.

4.2.1(vii). More importantly, the provision of adequate beach facilities at the popular northwest beaches is an investment that will reap the right fruit. These provisions include toilet facilities, showers, lifeguards and safety facilities. Most of the beaches in the North West are of a high standard when compared to the European Blue Flag Criteria but run short on one aspect or another. This report will show in later chapters that minimum investment is required to upgrade the popular coastline of the northwest to Blue Flag standards.



Source: Malta Tourism Authority Background Study to Beach Carrying Capacity.

4.2.1(viii). In view of the above, the beach inspection sheet was set out in a way to identify what was lacking in the beaches studied for the purpose of this activity. The aim was to identify the shortcomings and thereby make recommendations that could be taken up by relevant authorities or organisations to ensure that the northwest does become fully aligned to the Blue Flag criteria.



Source: Malta Tourism Authority Background Study to Beach Carrying Capacity.

4.2.1(ix). For this purpose, 6 sandy beaches and 2 rocky beaches were inspected every fortnight from May to September 2000. Every fortnight three sand samples were taken from each sandy beach inspected. Bathing water and drinking water samples were also taken on a weekly basis from the relevant study areas. All results relevant data and ensuing reports were inputted into a program specifically designed for the project.

4.2.1(x). The Environmental Health Branch of the Public Health Department had been running a bathing water quality programme and a drinking water quality programme for many years, and since the data at this branch was adequately recorded on a data base, this allowed easy access for comparison to the data gathered during the study period.

4.2.2. Rodent control

4.2.2(i). Three stretches of coastal area were identified in the northwest. The rodent control officer assigned to this study identified permanent sites for baiting. The baiting sites had to be in heavily populated areas of the rocky stretches, and yet the bait had to be placed in such a way that it would be safe from beach users. It was essential that the bait could not be tampered with, as this was the indicator used for measuring the rodent population involved.

4.2.2(ii). The rodent campaign involved treating each of the three stretches with rat poison at twenty sampling points. Luminescent paint markings helped to ensure that the baiting sites could be identified even when all the bait was taken up. Inspections were carried out on a weekly basis with records of the severity of takes kept on a database. Every four weeks each point was re-treated with fresh bait.

4.2.2(iii). In previous years, due to lack of manpower, baiting of such sites usually occurred on request or whenever a complaint of rodent siting was lodged at the district health office. Such baiting was therefore done as a ‘one-off’. Records of complaints lodged by residents were available at the Rodent Control Unit of the Public Health Department and were used for comparison to those lodged during the period of study of this activity.

4.2.2(iv). During 2000, the study was innovative in that it ensured regular weekly inspections of all the baited areas. The amount of bait that was taken up was recorded at each site for the twenty-week study period.
Through this it was not only possible to get an idea of the local rodent population but also allowed one to calculate the extent of baiting required to control such a population and hence provide a healthy, safe and rodent free environment to both locals and visitors.

4.2.2(v). It was unfortunate that such an intensive campaign of rodent inspection and baiting had not been done before and hence there is no baseline data for comparison. However, as the results in the annexes show, it does leave much food for thought in that only through such an intensive campaign of weekly inspection is it possible to secure a rodent free zone for bathers and barbequers. Comparison of local complaints with regards to rodent sightings confirmed this.

4.2.3. General Practitioners' Questionnaires

4.2.3(i). At the start of their travel, tourists may be healthy, or in the middle of an incubation period of an infectious disease or even ill. Infected or ill persons could be sources of infection for other tourists, when they are travelling together and have close contacts. On board a plane, or ship, tourists may be infected by other passengers, crew members or may even acquire infectious agents from the environment[10].

4.2.3(ii). Having arrived at their destination, tourists may get infections from the local population or from the environment, or can themselves introduce infective agents in the recipient population or environment. Tourists who have acquired infectious diseases can bring them back home, endangering the health of their close contacts.

4.2.3(iii). The priorities of infectious diseases in tourists are not yet clearly defined. They depend mainly on environmental health, state of health of the recipient population and the contacts of tourists with the local people. It has been shown that acute respiratory infections of viral or bacterial origin may affect as many as from 6 to 86% of tourists travelling in groups by air or by sea.[8,9,10,11] Outbreaks of influenza or influenza-like disease are not rare among tourists and other travellers, but more information is needed to assess the extent of the problem in relation to etiological agents, geopolitical areas, season, mode of transport, environmental health, state of health of the recipient population and the tourist population.

4.2.3(iv). Due to the vast expansion of tourism and the tourist industry more attention should be paid to the protection of tourists' health particularly during their visits to developing countries. This is more and more obvious to judge by the tragic letters received by WHO in 1988 about tourists' deaths due to Enteric infections and Legionellosis in the Mediterranean Area[10].

4.2.3(v). Information on the health of tourists upon their return from holidays is seldom available. In Malta, records of all hospital admissions are kept by the Health Information Department of the Health Division, such a programme being known as the Hospital Activity Analysis (HAA). The same department is also responsible for keeping a Mortality Register, from where information on deaths in tourists occurring in Malta can be obtained. The Department of Public Health, through its Disease Surveillance Branch, keeps a database (using Epi-Info) of infectious diseases reported by GPs and Resident Medical Officers of the local hospital.

4.2.3.(vi) However, there are loopholes in this data collection. The Prevention of Disease Ordinance (Chapter 36 section 7) states that:

"Every medical practitioner attending on or called in to visit the patient shall forthwith, on becoming aware that the patient is suffering from a disease to which the Part of the Ordinance applies, send to the Superintendent a certificate stating the name, age and address of the patient, and the disease from which, in the opinion of such medical practitioner, the patient is suffering"

Unfortunately, not all doctors actually do report on the cases they see during the course of their practice. There is very little motivation to do so and enforcement of this law is markedly lacking. Hotel doctors are particularly busy and may have pressures from the employing hotel not to report on illnesses they are called to see, for fear of bad publicity. Moreover, not all complaints attended to by these general practitioners are required by law to be reported to the Superintendent of Public Health.

4.2.3(vii). It was with this in mind, that the Tourism and Health Activity felt the need to draft questionnaires for hotel doctors. Most of the serious ailments in tourists were picked up through the HAA database since such ailments would warrant admission. However, to get a clearer view of the more common problems treated by GPs that do not warrant hospital referral, such questionnaires were required.

4.2.3(viii). The questionnaires were drafted during the months of February to April. They were structured so as to take very little time to fill in, and involved placing a mark against the relevant history (Annex I). On agreement with the Malta Hotels and Restaurants Association, the names of the hotels used as a sample were to remain anonymous on these questionnaires. This would allow more active participation by the hotels chosen and would give the GP more freedom to fill in the details required.

4.2.3(ix). Since each hotel had specific doctors assigned to it, it was easy to obtain the list of GPs who attended to ill tourists at the sampled hotels. All these GPs were briefed individually on what the whole activity was about and informed on what they were expected to do.

4.2.3(x). The folders containing the questionnaires were distributed to the sample of hotels in May 2000, just before the start of the field work phase. All Hotel Managers were briefed about the activity and informed that they and their staff were responsible to remind the attending GP to fill in the form before leaving the hotel. These folders contained self-addressed envelopes which were collected on a monthly basis by the field workers, who then forwarded those collected to the data manager of the activity. Note was taken of those hotels that did not forward any questionnaires at the end of each month when it was verified that no GP calls had been made during the relevant month.

4.2.3(xi). All data from these questionnaires was analysed during the period of October to December. Results of these questionnaires can be seen at Annex II.

4.2.3(xii). The Disease Surveillance Branch provided information and records, for the past four years, in connection with food poisoning outbreaks and legionnaires disease.

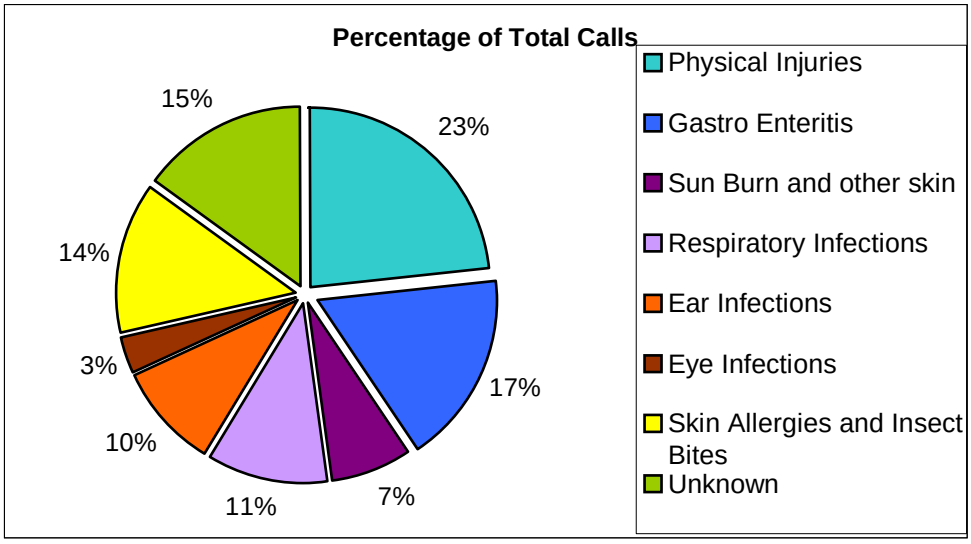
5. HEALTH IMPLICATIONS ON TOURISM

5.1. Disease Surveillance

5.1.1. General Practitioners' questionnaires

5.1.1(i). 40 hotels were involved in the survey carried out over the field-work period of May to October. Nine GPs were responsible for filling in the questionnaires at the Hotel reception desk. The overall response of the GPs was satisfactory. Most GPs took an active interest in the survey and requested feed-back at the end of the study.

5.1.1(ii). ***Physical injuries*** were the most common ailments seen to by the GPs. These accounted for **23.4%** of ALL calls carried out during the study period. 8.5% of these injuries were at the poolside, 1.06% on the street, while the site of the other 12.76% of the injuries was unspecified.



5.1.1(iii). Slip/fall injuries accounted for 59.1% of the physical injuries. 30.76% of the slip/fall injuries occurred at the poolside while another 30.76% of these injuries were grievous injuries and included:

- a fractured shoulder (referred to hospital);
- a knee effusion (swelling)
- a sprained ankle
- heavy bruising of the back.

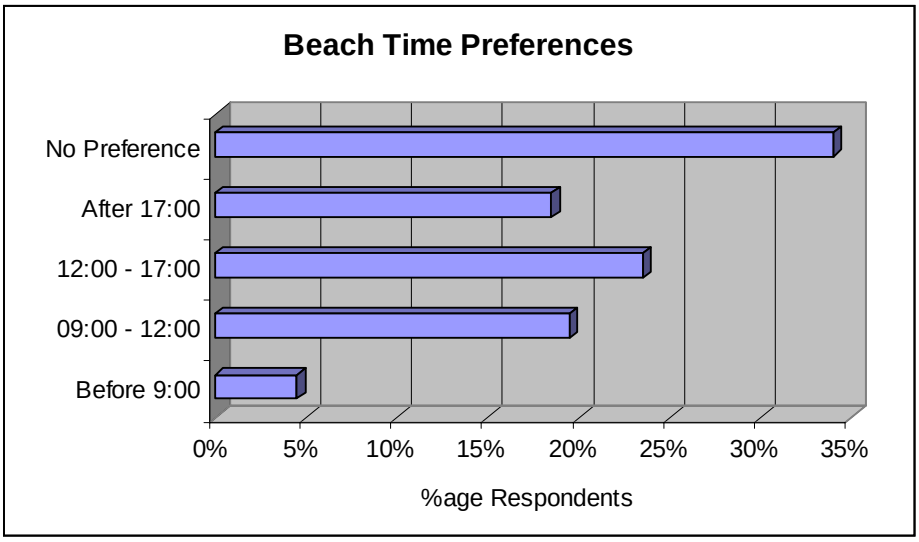
40.91% of physical injuries seen included cuts/lesions of which 18.18% occurred at the poolside, while 13.63% of the cuts and lesions required sutures

5.1.1(iv). Complaints of ***Gastroenteritis*** during the study period accounted for 17.02% of all GP calls. Only 12.5% of these illnesses were directly related to food intake from a restaurant or kiosk, 50% of which were specified as being viral in origin whilst 18.75% were indicated as NOT being food related. Another 18.75% were recorded as unspecified gastroenteritis. Most of the cases occurred in tourists

over 25 years of age, these accounting for 68.75% of all gastroenteritis cases. Only one child (i.e. <15 years) was reported to be complaining of gastroenteritis

5.1.1(v). **13.82%** of all calls were due to **Skin Allergies/Insect Bites**. 69.23% of these complaints were due to insect bites whilst 23.08% were allergies. There was only 1 case recorded as "other" skin complaint. Surprisingly, the GP was called out mostly for the ***25 – 40yr*** group for insect bites as there was only 1 call for insect bites in the ***<15yr*** group

5.1.1(vi). Another common call for the GPs was that of ***Sunburn, Sunstroke and other Skin Complaints.*** These accounted for **7.45%** of all calls seen by GPS. Of these, only 28.6% took precautions including T-shirt, umbrella or sunblock. Another 71.43% of these complaints resulted from *full day exposure to the sun* (ie. 9am – 5pm or 11am – 3.00pm). The majority (80%) of the latter were children ***below*** 15yrs of age.

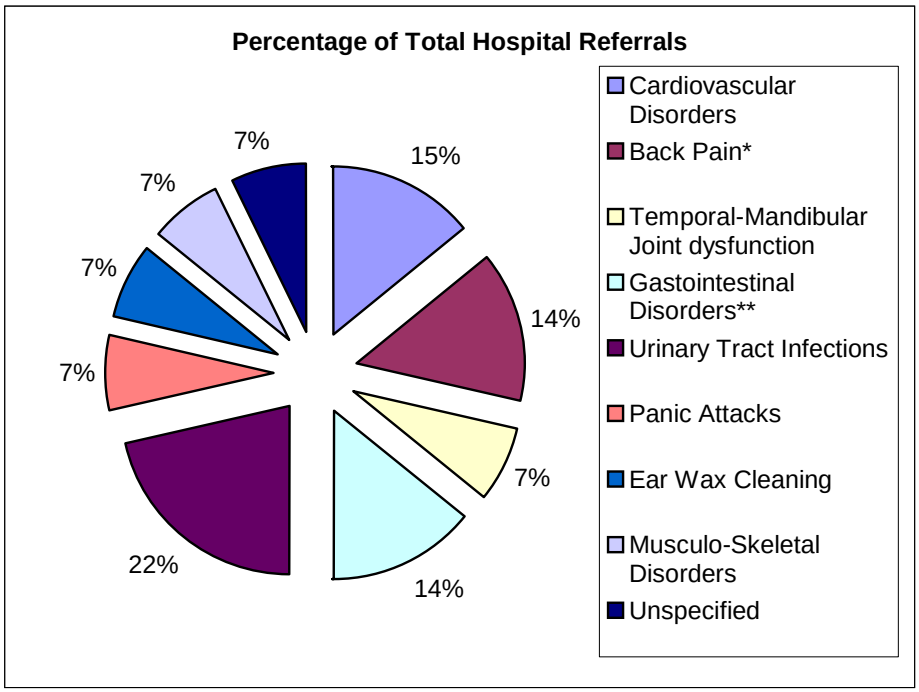


Source: Malta Tourism Authority Background Study to Beach Carrying Capacity.

5.1.1(vii). ***Respiratory infections*** seen to by GPs during the study period accounted for **10.64%** of all hotel visits. None of these were asthmatic attacks and none could be related to the environment such as dust pollution or strong chlorine smell of the pool. 60% were specified as NOT being of environmental origin, whilst 20% were imported.

5.1.1(viii). ***Ear and Eye infections*** were quite common in the younger age group and together accounted for **11.70%** of all calls. 9.57% of all calls were tourists complaining of ear infections, 77.8% of these being under 15 years of age. Only 1 case was specified to be of pool origin and 1 case of ear infection actually resulted in vertigo (labyrinthitis). Eye infections accounted for 3.19% of all calls, but only 1 case was directly related to a dusty environment.

5.1.1(ix). GPs in the northwest were also called out to see more serious ailments, some of which warranted a **visit to the local hospital or hospital admission**. These involved **14.89%** of all cases included:



* Prolapsed Disc and Sciatica
** Bleeding per rectum and Haemorrhoids

5.1.1(x). GPs were called in to see more female tourists than males during the study period. The most frequent age group was the age group between 25 and 40 which accounted for 28.72% of cases seen with patients below 15years of age being the next most visited group accounting for 24.46%. The age group least involved were the **15 – 25 year** group who accounted for only 4.25%.

5.1.1(xi). When analysing the data by age group, the most common ailment in the **below 15year group** were ear infections and accounted for 30.43% of complaints in this group over the whole study period. This is to be expected since children usually spend long hours in the pool or sea and hence are more exposed to pollutants therein. Moreover, the structure of the canal is such that it is easier for them to acquire ear infections than adults. 26.09% of this age group complained of physical injuries, also easily explained by the more active lifestyle of such an age group

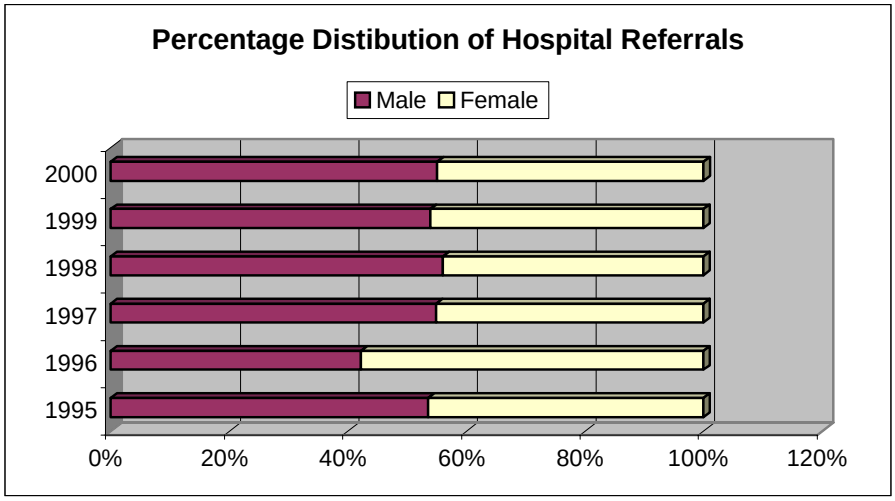
5.1.1(xii). The most common complaint in the **25 – 40yr group** was that of gastroenteritis symptoms, accounting for 29.63% of complaints in this group.
This group is usually the group that is most active socially – the 'wine and dine' group and this may be the reason for such a high percentage of such symptoms. The **41 – 64yr** group in contrast mainly complained of medical illnesses these accounting for 25% of complaints in this group while the **65+** group mainly complained of physical injuries, these accounting for 35.71% of all complaints in this group. The latter could be explained by the decreased reaction time and agility together with the increased fragility of bone in this age group.

5.1.2 Hospital Activity Analysis

5.1.2.(i) The Hospital Activity Analysis programme has been run by the Health Information Department since 1993. This database records all admissions into the general hospital in Malta together with relevant data which includes, sex, age, date of admission and date of discharge and diagnosis. These records were studied for

the purpose of this report from 1995 till 2000. The aim was to identify all non-residents and record changing trends in hospital admissions.

5.1.2.(ii) In **1995** there were ***194*** admissions in non-residents as compared to ***666*** in **2000**. This can be explained by better reporting and recording systems both on the wards at the general hospital as well as within the department. However, one cannot ignore the rise in hospital admissions occurring in non-residents and when looking at the increasing numbers of certain diagnoses, one recognises the need for creating new policies to target specific diseases/disorders in a preventive manner.



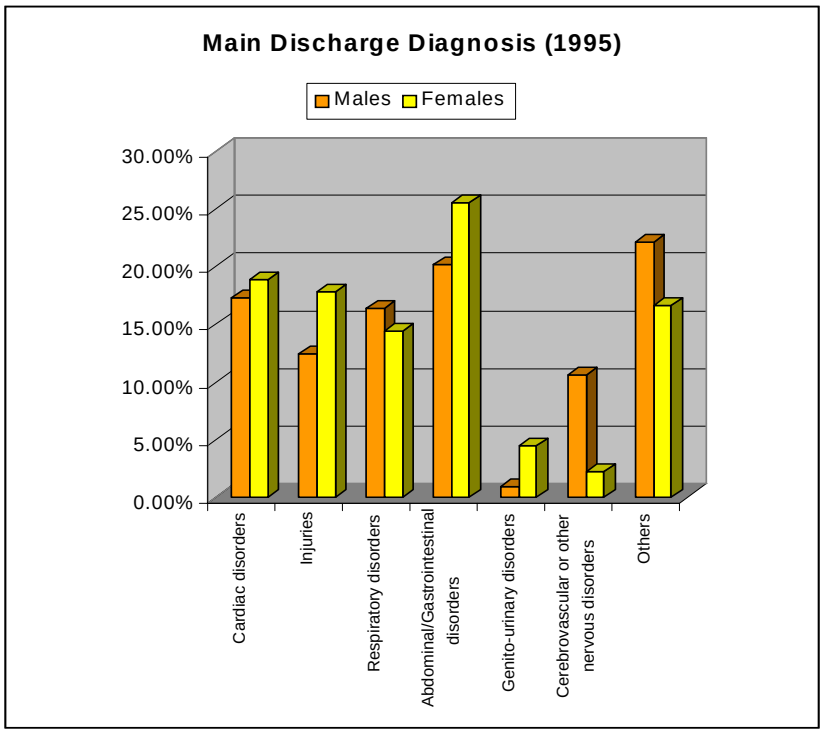
Source: Hospital Activity Analysis, Department of Health Information

5.1.2.(iii) The most common admissions in **1995** were acute myocardial infarction of which there were 16 admissions. The majority of admissions were ***male*** **(53.61%)** as compared to ***females*** **(46.39%)**. The most common complaint in both sexes was acute myocardial infarction (4.12% of *all* admissions). The table overleaf shows the most common admissions in 1995

MAIN DISCHARGE DIAGNOSIS – 1995	**No of Admns**
Acute Myocardial Infarction	16
Symptoms involving the Respiratory system	11
Abdominal/Pelvic symptoms other than dig/urin systems	10
Fractures of leg	9
Non-infective gastroenteritis and colitis	9
Head injury, NOS and other unspecified intracranial injuries	8
Angina Pectoris	7
Cardiac dysrhythmias	6
Appendicitis	6
Symptoms involving the urinary system	6
General symptoms of malaise, PUO, dizziness	5
Other diseases of the respiratory system	5
Other superficial injuries, falls, open wounds	5
Acute but ill-defined cerebrovascular disease	4
Concussion/contusion	3

Source: Hospital Activity Analysis, Department of Health Information

5.1.2.(iv) When analysing further the main causes for admission in **male and females,** these can be seen in the following graph:



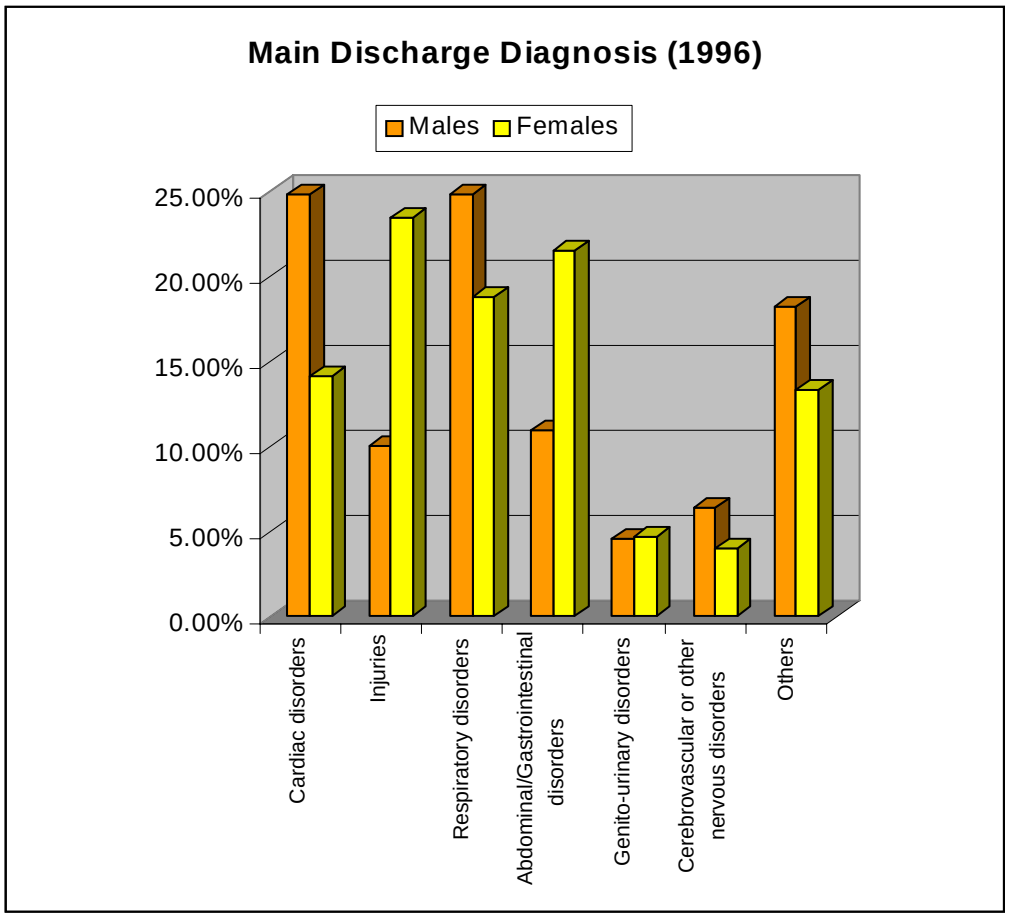
When analysing by **age**, the youngest admission was <1 year old whilst the oldest was 89 years old. The main causes for admission in 1995 can be seen in the table on page 50

5.1.2.(v) In **1996**, the main cause for all admissions were respiratory symptoms accounting for 20.16% of all cases reported in 1996. Cardiac cases involved 19.77% of all cases; 17.44% were abdominal cases whilst 17.83% were injuries. The following table the most common admissions in 1996

MAIN DISCHARGE DIAGNOSIS – 1996	**No of Admns**
Symptoms involving the Respiratory system	22
Acute Myocardial Infarction	19
Abdominal/Pelvic symptoms other than dig/urin systems	15
Angina Pectoris	11
Asthma	9
Fracture of the ankle	9
Other diseases of the respiratory system	8
Head injury, NOS, and other/unspecified intracranial injuries	6
Diabetes Mellitus	5
Fracture of neck of the femur	5
Intestinal obstruction, without mention of hernia	5
Other forms of chronic ischaemic heart disease	5
Gastrointestinal haemorrhage	5
General symptoms (e.g. syncope, dizziness PUO and Malaise	5
Acute but ill-defined cerebrovascular disease (stroke)	5

Source: Hospital Activity Analysis, Department of Health Information

5.1.2.(vi) The majority of admissions in 1996 were **female (57.75%),** as compared to **males (42.25%).** When analysing further the main causes for admission in **male and females,** these can be seen in the following graph:



Source: Hospital Activity Analysis, Department of Health Information

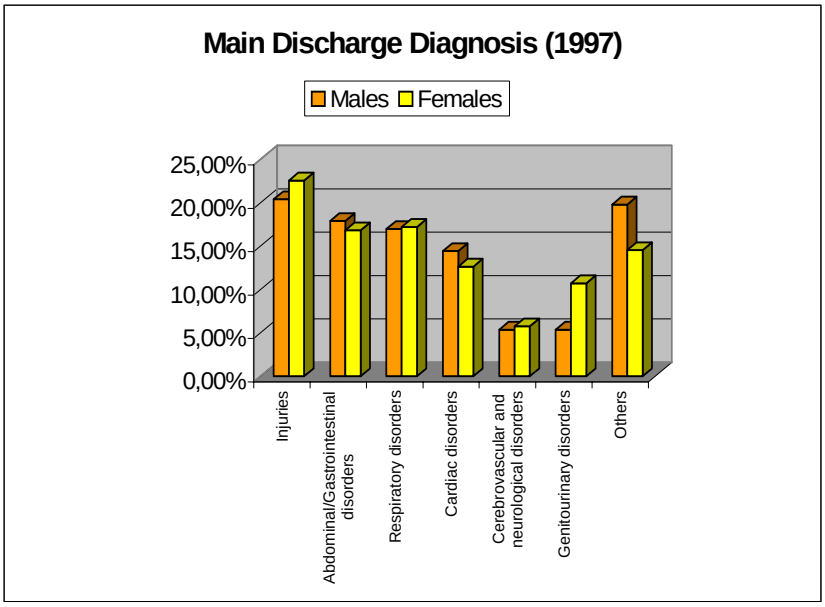
When analysing by **age**, the youngest admission was 1 year old whilst the oldest was 86 years old. The main causes for admission in 1996 can be seen in the table on page 50.

5.1.2.(vii) In **1997**, there were 581 admissions to hospital in non-residents. When analysing ***all*** admissions, the main causes for admission in ***both sexes*** for 1997 were: 21.17% Injuries mainly fractures; 17.38% Gastrointestinal disorders; 17% Respiratory disorders; 13.42% Cardiac disorders; 7.4% Genito-urinary disorders. 4.14% Cerebral or nerve disorders.

MAIN DISCHARGE DIAGNOSIS – 1996	**No of Admns**
Symptoms involving the Respiratory system	43
Head injury, NOS, and other/unspecified intracranial injuries	37
Abdominal/Pelvic symptoms other than dig/urin systems	31
Cardiac Dysrhythmias	18
Acute Myocardial Infarction	17
Angina Pectoris	16
Fracture of the ankle	15
Asthma	15
General symptoms (e.g. syncope, dizziness PUO and Malaise	15
Other diseases of the respiratory system	14
Symptoms involving the Urinary System	13
Heart Failure	12
Fracture of neck of the femur	11
Gastrointestinal haemorrhage	9
Chronic Airway Obstruction	9

Source: Hospital Activity Analysis, Department of Health Information

5.1.2.(viii) These were mainly **male 54.9%** as compared to **female 45.1%**. When analysing further the main causes for admission in **male and females,** these can be seen in the following graph



Source: Hospital Activity Analysis, Department of Health Information

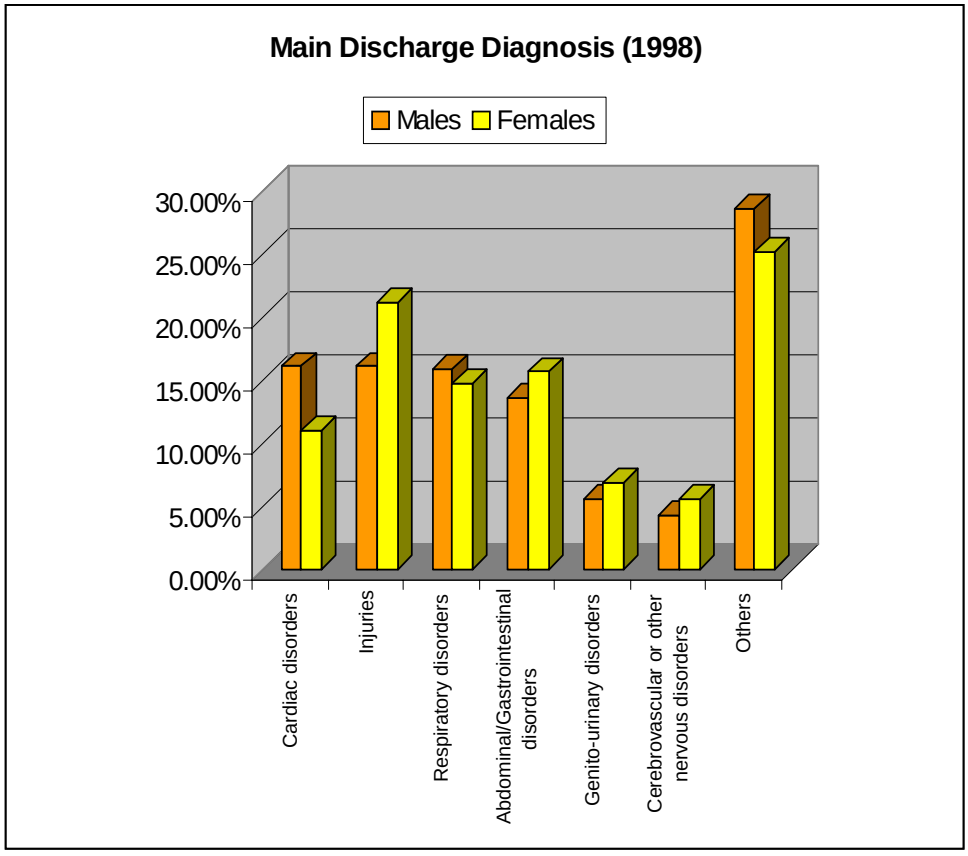
When analysing by **age**, the youngest admission was <1 year old whilst the oldest was 88 years old. The main causes for admission in 1997 can be seen in the page 50:

5.1.2.(ix) There were 699 admissions in all, mainly **males** who accounted for **56.1%** of the admissions. The list of main discharge diagnosis for all admissions in **1998** can be seen in the table below.

MAIN DISCHARGE DIAGNOSIS – 1998	**No of Admns**
Head injury, NOS and other/unspecified intracranial injury	43
General symptoms (e.g. syncope, dizziness, PUO, malaise	40
Symptoms involving the resp. system and other chest symptoms	36
Abdominal/pelvic symptoms other than dig/urin systems	30
Acute myocardial infarction	27
Asthma	21
Angina Pectoris	20
Fracture of ankle	19
Heart failure	19
Other diseases of the respiratory system	16
Symptoms involving the urinary system	15
Non-infective gastroenteritis and colitis, NOS and NEC	12
Cardiac dysrhthmias	12
Chronic airways obstruction	11
Disorders of fluid, electrolyte and acid-base balance	10

Source: Hospital Activity Analysis, Department of Health Information

5.1.2.(x) When analysing further the main causes for admission in **male and females,** these can be seen in the following graph:



Source: Hospital Activity Analysis, Department of Health Information

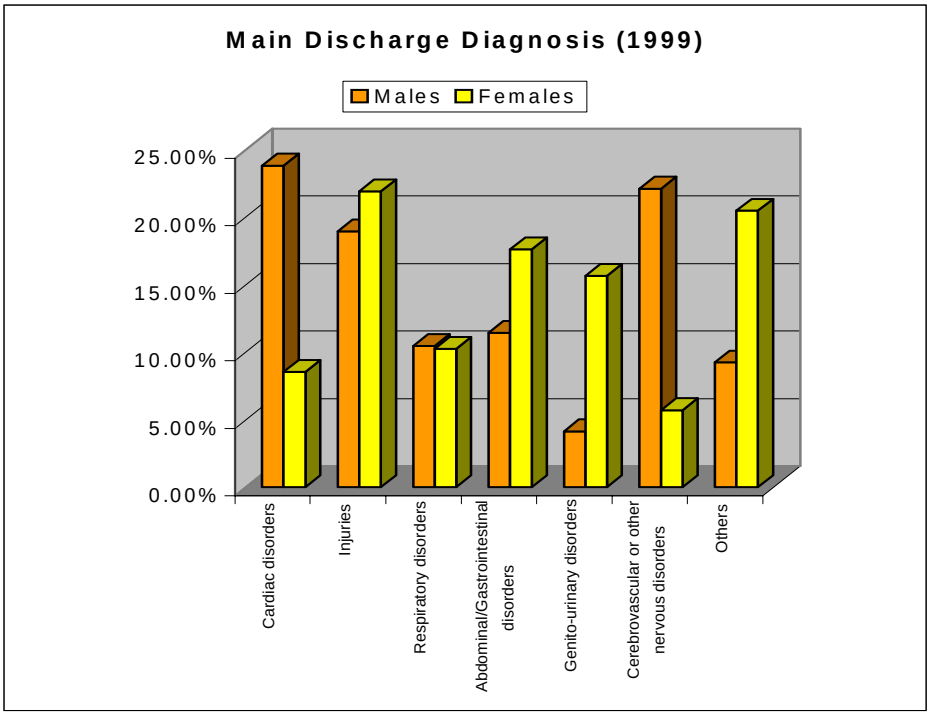
When analysing by **age**, the youngest admission was <1 year old whilst the oldest was 96 years old. The main causes for admission in 1998 can be seen in the table on page 50

5.1.2.(xi) In **1999** there were 764 admissions, 412 of these being male. Females accounted for 46.07% of all admissions as compared to 53.9% males. The main discharge diagnosis for this year is tabled below:

MAIN DISCHARGE DIAGNOSIS – 1999	**No of Admns**
Pain in throat and chest/chest pain unspecified	57
Other and unspecified injuries of head	36
Single spontaneous delivery	24
Abdominal and pelvic pain/other and unspecified abdominal pain	22
Angina pectoris/unstable angina	21
Acute myocardial infarction	21
Asthma	20
Other non-infective gastroenteritis and colitis	20
Other respiratory disorders	19
Syncope and collapse	18
Fracture lower leg,	18
Stroke not specified as haemorrhage or infarction	14
Abnormalities of breathing/dyspnoea	13
Epilepsy	12
Fracture of femur/neck of femur	11

Source: Hospital Activity Analysis, Department of Health Information

5.1.2.(xii) When analysing further the main causes for admission in **male and females,** these can be seen in the following graph



Source: Hospital Activity Analysis, Department of Health Information

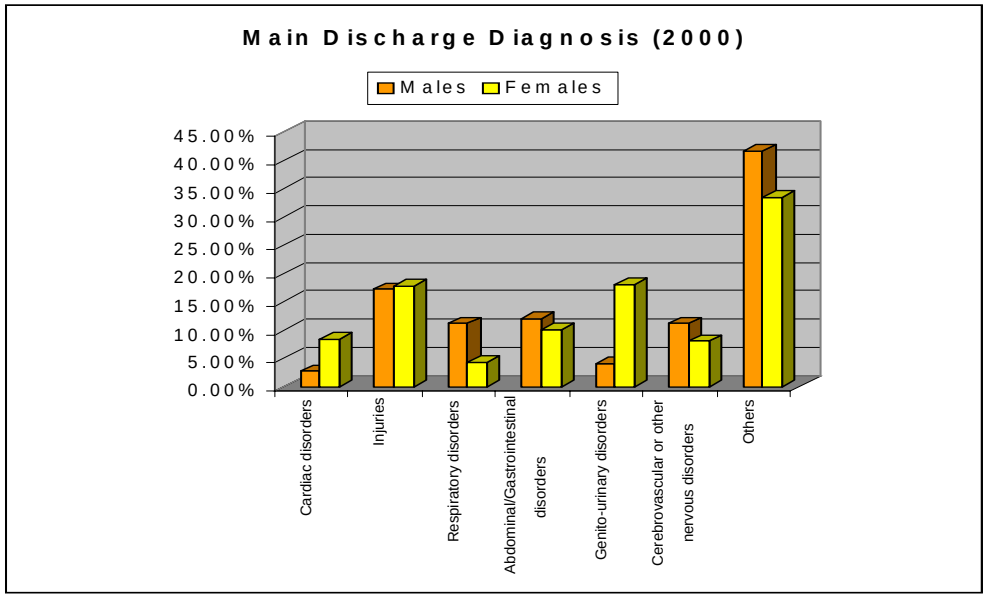
When analysing by **age**, the youngest admission was <1 year old whilst the oldest was 91 years old. The main causes for admission in 1999 can be seen in the table page 50

5.1.2.(xiii) In **2000,** there were 666 admissions into hospital, 367 ***(55.11%)*** were ***males*** and 299 ***(44.9%)*** were ***females***. The main discharge diagnosis for this year can be seen in the table below.

MAIN DISCHARGE DIAGNOSIS – 2000	**No of Admns**
Pain in throat and chest pain unspecified	37
Other and unspecified injuries of the head	28
Single spontaneous delivery	18
Other non-infective gastroenteritis and colitis	18
Angina Pectoris	14
Acute myocardial infarction	14
Fracture of lower leg, including ankle	14
Stroke not specified as haemorrhage or infarction	12
Other respiratory disorders	12
Abdominal and pelvic pain	12
Epilepsy unspecified	11
Abnormalities of breathing/dyspnoea	11
Atrial fibrillation and flutter	11
Fracture of femur	9
Convulsions	8

Source: Hospital Activity Analysis, Department of Health Information

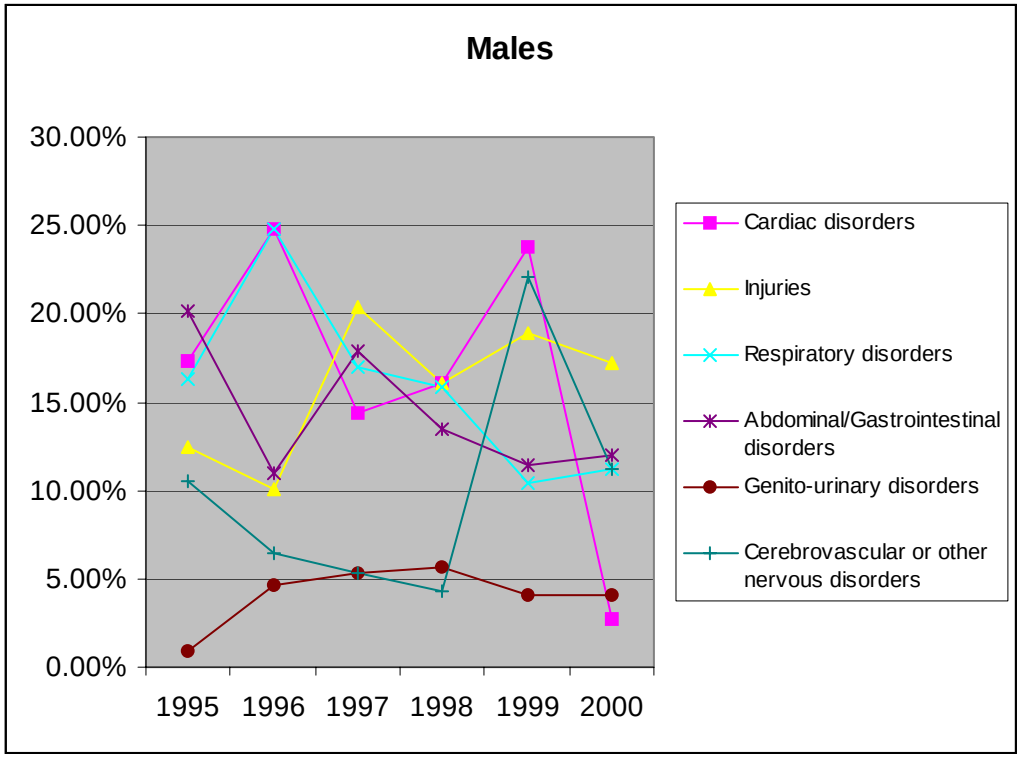
5.1.2.(xiv) The main causes for hospital admission in **males and females** for the year 2000 are shown in the following graph:



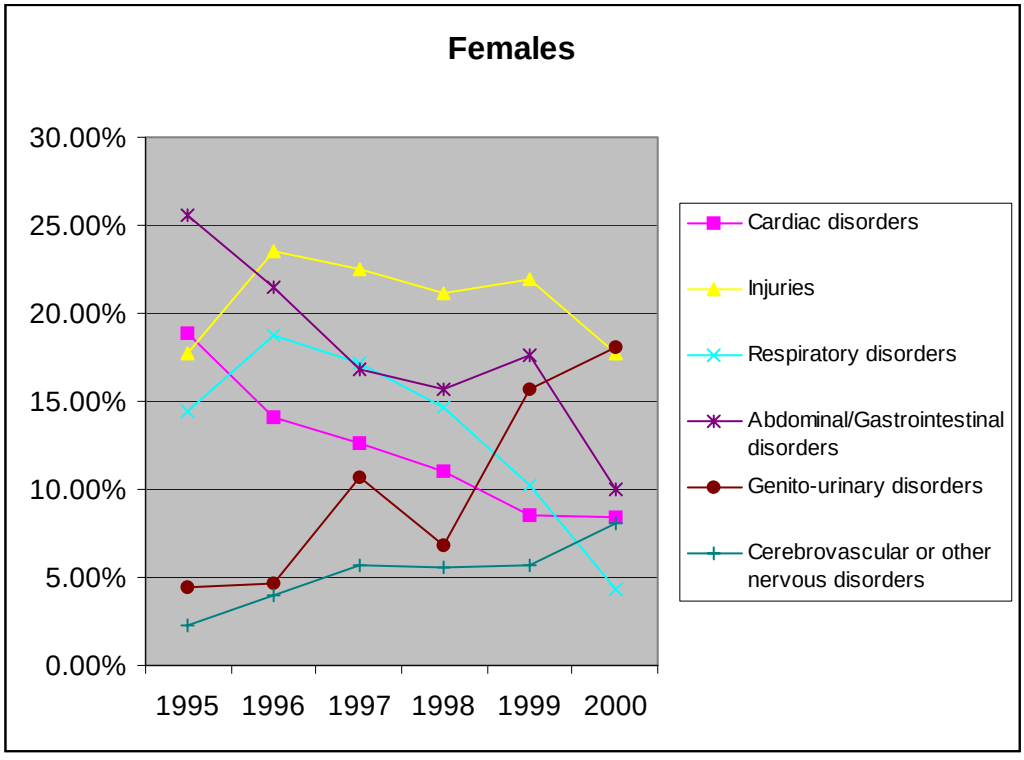
Source: Hospital Activity Analysis, Department of Health Information

Comparison of Most Common Disorder on Discharge by age			
Year	***Age Group***	***Most common disorder on discharge***	***% of all admissions in that age group***
1995	**</=14 years**	Abdominal/Gastrointestinal	55.56%
1996		Injury (mainly head injuries)	66.66%
1997		Injury (mainly head injuries) and Abdominal disorders	26.47%
1998		Injury	28.57%
1999		Abdominal/Gastrointestinal	40%
2000		Abdominal/Gastrointestinal	30.56%
1995	**15 – 24 years**	Abdominal/Gastrointestinal	35%
1996		Injuries	40.91%
1997		Injuries	26.09%
1998		Injuries	23.61%
1999		Genitourinary mainly pregnancy related disorders	28.36%
2000		Genitourinary mainly pregnancy related disorders	32.20%
1995	**25 – 40 years**	Abdominal/Gastrointestinal	25%
1996		Abdominal/Gastrointestinal	25%
1997		Abdominal/Gastrointestinal	26.74%
1998		Injuries	26.26%
1999		Injuries	25.90%
2000		Genitourinary mainly pregnancy related disorders	31.37%
1995	**41 – 64 years**	Cardiovascular	26.79%
1996		Respiratory	22.34%
1997		Injuries	21.05%
1998		Injuries	22.75%
1999		Cardiovascular	28.10%
2000		Cardiovascular	29.66%
1995	**=/> 65 years**	Cardiovascular	27.59%
1996		Cardiovascular	29.63%
1997		Respiratory	23.91%
1998		Respiratory	38.84%
1999		Injuries and Cardiovascular	24.85%
2000		Cardiovascular	26.21%

Five year trend of the most common disorder on discharge:



Source: Hospital Activity Analysis, Department of Health Information



Source: Hospital Activity Analysis. Department of Health Information

5.1.3. Infectious Disease Register

5.1.3.(i) The Infectious Disease Register first started within the Health Information Department in 1991, moving on to the Public Health Department in 1993. This database records all reports on infectious diseases received through the process of official notifications from GPs, the hospital wards or from Health Information Department. The disease register has slowly grown and expanded to include a number of diseases since originally it was simply a hepatitis B database.

5.1.3.(ii) The most important aspect of this Register for the purpose of this study are the food poisoning/food outbreaks records. These will be discussed in section 5.2 as they directly relate to the hotels and catering inspections carried out during the study period by the field workers.

5.1.3.(iii) ***Legionnaires' Disease***

One of the first infectious diseases that comes to a hotelier's mind is Legionnaire's Disease. When looking into records at the public health department, it was interesting to note that there were no cases of Legionnaire's recorded in non-residents in Malta. Neither were there any reports of Legionella in tourists from their insurance agencies or GPs on returning back to their home towns. However, there was a rise in Legionella cases in **local** residents. The cases recorded on the data base can be seen in the table below (NB **only *three cases*** were ***imported!***)***.*** This may be important to note since it may be a warning signal about the negative potential of the disease that currently seems to be on the rise.

10 year Trend of Legionella Infections in LOCAL Residents	
Year	**No of cases**
1990	2 cases
1991	Nil
1992	Nil
1993	Nil
1994	Nil
1995	Nil
1996	Nil
1997	Nil
1998	2 cases (1 imported)
1999	3 cases
2000	10 cases (2 imported)

Source: Disease Surveilance Branch, Public Health Department

5.1.3.(iv) ***Gastroenteritis cases and outbreaks of foodpoisoning:***

When analysing the Public Health Department records for individual cases of gastroenteritis and outbreaks, these can be summarised in the table below:

No. of GASTROENTERITIS CASES (whole year)	
1997	8 cases in NW cf to 25 cases in all Malta
1998	6 cases in NW cf to 18 cases in Malta
1999	5 cases in NW cf to 18 cases in Malta
2000	7 cases in NW cf to 19 cases in Malta*
No. of OUTBREAKS OF FOODPOISONING **(whole year)**	
1997	2 outbreaks in NW cf to 5 outbreaks in Malta
1998	1 outbreak in NW cf to 2 outbreak in Malta
1999	6 outbreaks in NW cf to 10 outbreaks in Malta
2000	5 outbreaks in NW cf to 12 outbreaks in Malta*

*1 of which was imported

No. of GASTROENTERITIS CASES during study period (ie end May – end October)	
1997	6 cases in NW cf to 17 cases in all Malta
1998	5 cases in NW cf to 15 cases in Malta
1999	4 cases in NW cf to 15 cases in Malta
2000	6 cases in NW cf to 11 cases in Malta
No. of OUTBREAKS OF FOODPOISONING during study period **(ie end May – end October)**	
1997	2 outbreaks in NW cf to 4 outbreaks in Malta
1998	1 outbreak in NW cf to 1 outbreak in Malta
1999	2 outbreaks in NW cf to 2 outbreaks in Malta
2000	4 outbreaks in NW cf to 8 outbreaks in Malta

5.1.3.(v) In **1997** , there were 25 cases of gastroenteritis in all Malta *(excluding cases involved in outbreaks*). These were broken down as follows:

8 Salmonella - 32%
17 Unspecified food poisoning - 68%

8 cases occurred in the North West of the island i.e.32%, 2 of which were Salmonella.

There were 5 outbreaks investigated in all Malta in 1997, which involved 147 cases (62 males and 73 females), with 2 outbreaks (69 cases) being in the North West of the island.

5.1.3.(vi) In **1998,** there were 18 cases of gastroenteritis. These were broken down as follows:

8 Salmonella – 44.44%
8 Unspecified – 44.44%
1 Toxic food poisoning – 5.56%
1 Campylobacter – 5.56%

6 of these cases occurred in the North West of the island ie 33.33% and 3 of these were registered as cases of Salmonella food poisoning.

There were 2 outbreaks in all Malta in 1998, 1 of which occurred in the North West and was registered as due to Salmonella. It only involved 3 males and 2 females.

5.1.3.(vii) In **1999,** there were 18 cases of gastroenteritis. These were broken down as follows:

7 Salmonella – 38.89%
11 Unspecified – 61.11%

5 of these cases occurred in the North West of the island ie 27.78% and 3 of these were registered as cases of Salmonella food poisoning and 2 Unspecified.

There were 10 outbreaks in all Malta in 1999 which involved 57 cases, 5 of which were due to Salmonella. 6 of these outbreaks occurred in the North West and involved 32 cases ie 13 males and 19 females.

5.1.3.(viii) In **2000,** there were 17 cases of gastroenteritis. These were broken down as follows:

1 Salmonella – 5.88%
16 Unspecified – 94.12%

9 of these cases occurred in the North West of the island ie 52.9% and were registered as Unspecified food poisoning.

There were 11 outbreaks in all Malta in 2000 which involved 55 cases, only 1 was due to Salmonella. 5 of these outbreaks occurred in the North West and involved 30 cases i.e. 14 males and 16 females.

5.1.3.(ix) ***Other infectious diseases***

The following table adequately demonstrates the lack of infectious diseases in non residents.

DISEASE	**1997**	**1998**	**1999**	**2000**
AIDS	1	3	4	0
Malaria	4	0	1	5
Tuberculosis*****	3	1	5	1
Chickenpox	0	2	5	2
Meningitis******	2	3	1	3
Hepatitis A	1	2	0	2
Hepatitis B	1	0	0	0
Typhoid	0	0	0	0
Leishmaniasis*******	1	0	0	0

* Pulmonary and non-Pulmonary TB
** Meningococcal and other Bacterial Meningitis
*** Both Visceral and Cutaneous Leishmaniasis

Source: Disease Surveillance Branch, Public Health Department

5.2 Food Safety

5.2.1 **25 Hotels, 75 Restaurants & Snack Bars and 10 Kiosks** from the North West of Malta were randomly sampled from the number of the same catering establishments available in that same area. Each of the premises sampled, was inspected twice during the four-month project period. Inspections were carried out according to local laws and regulations namely ***The Food, Drugs & Drinking Water Act*** and ***The Food Hygiene Regulations***.

5.2.2 From records kept at Food Safety Branch the results of the hotel inspections were compared to previous inspections. Official recording of Risk Assessment Inspections for the other catering establishments was only started at the end of last year and thus records of previous years were not available for comparison. It is worth noting that the current system of inspections being carried out by the Public Health Department is very stringent. All records of inspections are kept on a database and a Risk Assessment Percentage can be drawn up. This allows a grading system to be applied to the catering establishments. A detailed written report is forwarded to the licensee/operator of each establishment with recommendations for improvement.

No of Hotels in each Grade Category

Grade	1998	1999	2000	
			1st inspection	2nd inspection
A	0	0	0	0
B	1	4	4	3
C	18	14	18	14
D	6	5	3	8
E	0	2	0	0
F	0	0	0	0

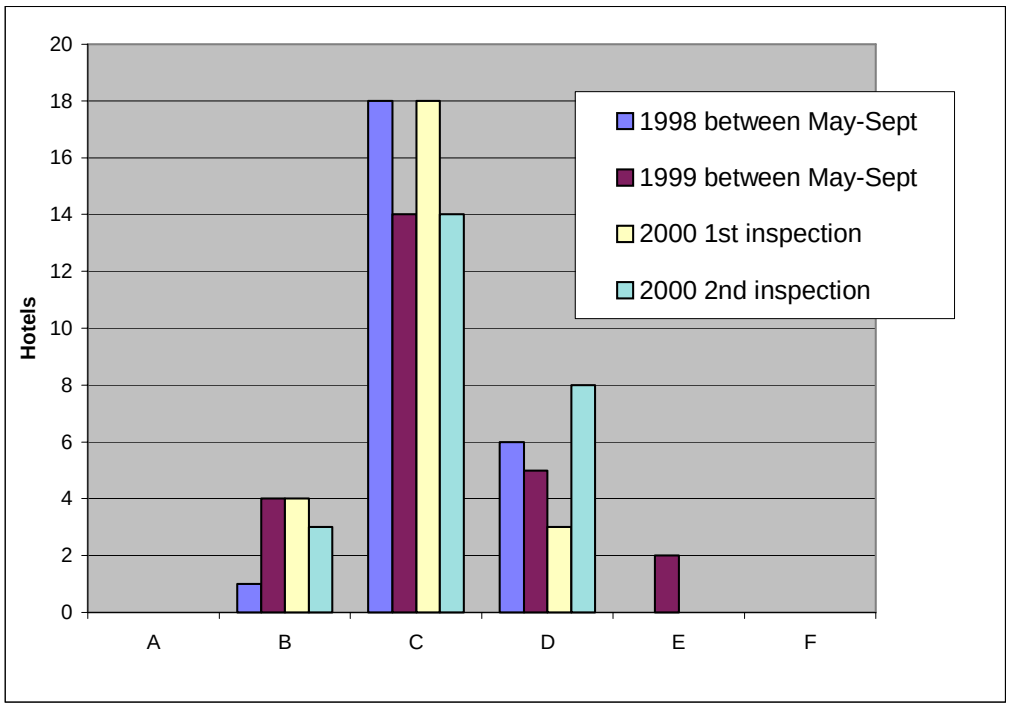
Source: Catering Establishments Inspections, 2000. Food Safety Branch, Public Health Department

No. of Restaurants, Snack Bars & Kiosks in each Grade Category

Grade	1st inspection	2nd inspection
A	1	1
B	2	6
C	37	40
D	27	23
E	11	12
F	4	3

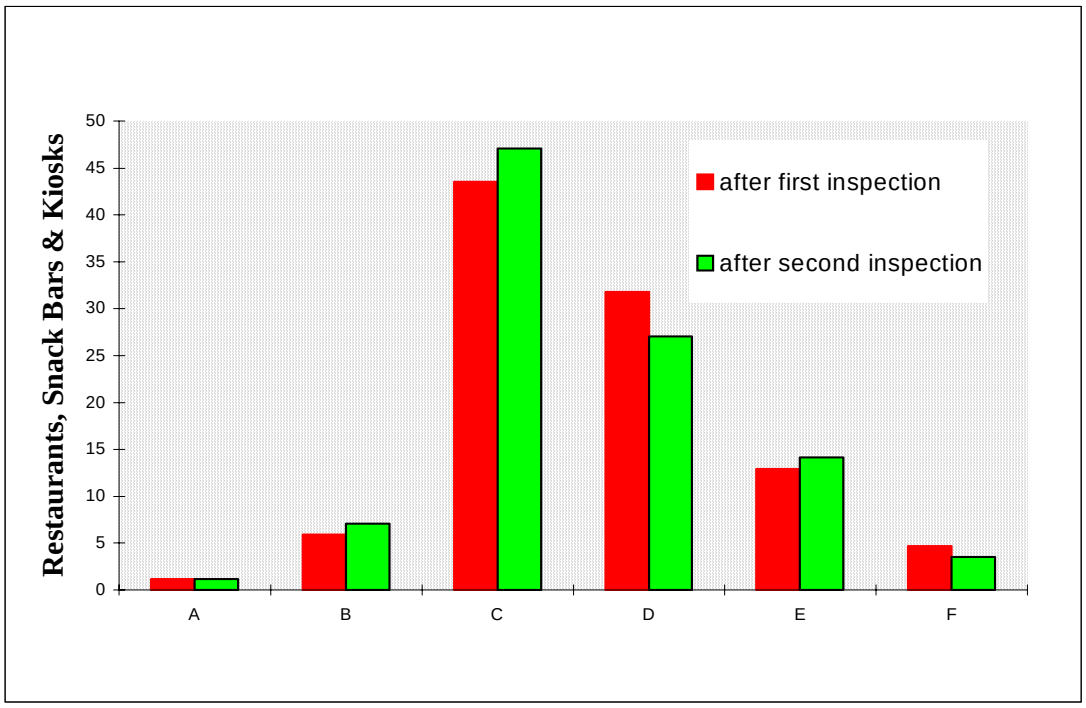
Source: Catering Establishments Inspections, 2000. Food Safety Branch, Public Health Department

Graph - Hotel inspections



Source: Catering Establishments Inspections, 2000. Food Safety Branch, Public Health Dept

Graph – Restaurants, Snack Bars & Kiosks



Source: Catering Establishments Inspections, 2000. Food Safety Branch, Public Health Dept

5.2.3 The Catering Establishments are given a rating from Grade A to Grade F, with Grade A being the best grade possible. Before such a grading is awarded, the premises are given a risk assessment factor expressed as a percentage. These are as follows:

Risk Assessment Factor	Grading
Up to 29%	A
30% to 39%	B
40% to 49%	C
50 – 59%	D
60% to 69%	E
70% and over	F

5.2.4 The graphs clearly show that during the summer months the Catering Establishments' standard of hygiene did not deteriorate despite the increased workload. There was an increase in the number of hotels having a B grading and no hotels were found to be below the acceptable standard of grade C. Those that remained with a grade D, following a second inspection were close to the borderline and required minimal improvements to reach grade C.

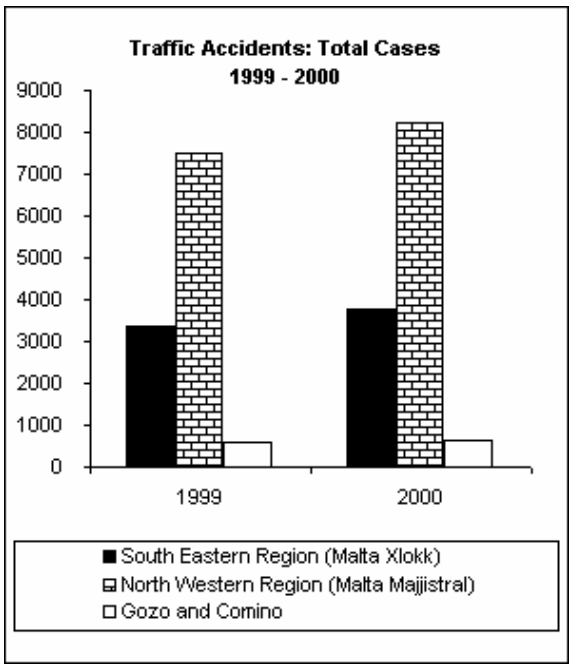
5.2.5 The Restaurants, Snack Bars & Kiosks inspected, registered improvements by the second inspection. This was the first time that these establishments were included in such inspections.

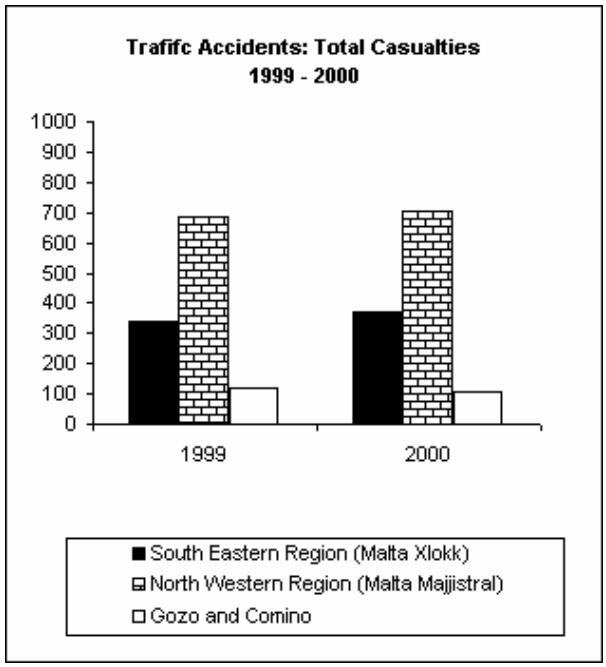
5.3 Road Traffic Accidents [(13)]

5.3.1 Traffic accidents in tourists or non-residents were not readily available and hence only an overall view of the picture of road traffic safety can be presented here. The number of traffic accidents from January to December 2000 reached 12,654. This was increase of 1,198 or 10.5 percent over the previous year. The number of casualties increased by 38 to 1,184.

5.3.2 The total number of slight injuries for the year was 925, of which 535 were males and 390 were females. In the 15-24 and 25-39 years age groups, there were 156 and 161 males with slight injuries. The number of injured females in the same age groups reached 135 and 99 respectively. There were also 259 persons who suffered from grievous and fatal injuries. Of these, 170 were males while 89 were females.

5.3.3 The major number of traffic accidents occurred in the North West Region of the island as can be seen in the graphs below.





Source: National Statistics Office.

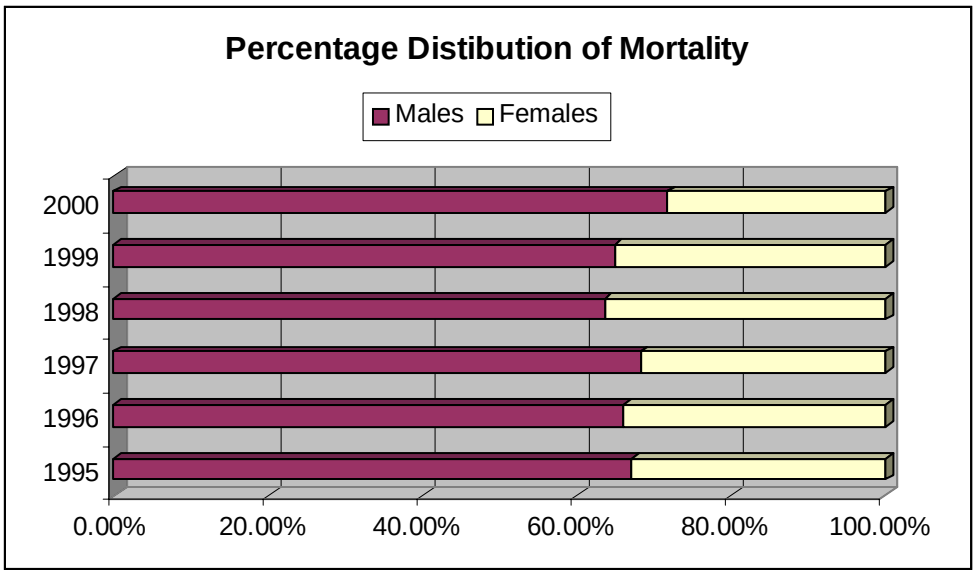
5.3.4 When analysed by gender and age, the casualties from Traffic accidents were as seen in the table below.

Casualties by Gender and Age in Malta - 2000				
	Slight	**Grievous**	**Fatal**	**Total**
TOTAL				
Age unknown	72	10	1	83
<14yrs	64	11	1	76
15 – 24yrs	291	84	6	381
25 – 39yrs	260	57	4	321
40 – 59yrs	177	46	1	224
>60yrs	61	36	2	99
Total	925	244	15	1184
MALE				
Age unknown	23	5	1	29
<14yrs	39	7	1	47
15 – 24yrs	156	53	4	213
25 – 39yrs	161	46	4	211
40 – 59yrs	123	26	1	150
>60yrs	33	21	1	55
Total	535	158	12	705
FEMALE				
Age unknown	49	5	0	54
<14yrs	25	4	0	29
15 – 24yrs	135	31	2	168
25 – 39yrs	99	11	0	110
40 – 59yrs	54	20	0	74
>60yrs	28	15	1	44
Total	390	86	3	479

Source: National Statistics Office

5.4 Mortality in Tourists [14]

5.4.1 The Mortality Register is kept updated by the Health Information Department and ICD coding is used for this database. The register was first placed on computer in the late 1980s and was regularly upgraded to the efficient system that it is today. All deaths are registered through a death certificate which must be signed by a medical doctor and sent through the official registry office on the island to the Health Information Department. All personal details are found on this form together with the main cause of death as well as secondary and where necessary tertiary cause of death. The database only registers the main cause of death but all personal files of the deceased are accessed where relevant details are lacking or where confirmation of the cause of death is required.



Source: Mortality Register. Department of Health Information.

5.4.2 There were ***85 deaths*** from non-residents in **1995.** The male to female sex ratio was 2:1 with 57 male deaths and 28 female deaths. The age range was 74 years with a minimum value of 24 years and a maximum of 98 years. The mean age was 66 years and the median 68 years. 58.8% of cases occurred outside the usual residence while 37.6% during or after hospitalisation. The greatest number of deaths occurred in March while June had the lowest number.

5.4.3 With regards to causes of death, 54.1% of all deaths were due to heart disease. 10.59% were due to respiratory disorders; 9.41% were accidental deaths which included drowning at sea (3.53% of all causes of death) and 9.41% were due to cerebrovascular/ neurological disorders. There was one female death (35years) from AIDS.

5.4.4 There were ***65 deaths*** from non-residents in **1996.** The male to female sex ratio was 2:1 with 43 male deaths and 22 females. The age range was 67 years with a minimum value of 15 years and a maximum of 82 years. The median was 67 years. 49.2% of cases occurred outside the residence while 40% during of after hospitalisation. The greatest number of deaths occurred in December while November there were no deaths

5.4.5 With regards to the causes of death, 44.6% of all deaths were due to diseases of the circulatory system, 20% were due to injuries (which included 7.7% falls from one level to another, and 6.15% drowning), 16.9% were due to respiratory disorders. There were no deaths from sexually transmitted diseases.

5.4.6 There were ***85 deaths*** from non-residents in **1997.** The male to female sex ratio was approximately 3:1 with 58 male deaths and 27 females. The age range was 88 years with a minimum value of 14 years and a maximum of 102 years. The median was 65 years. 54.12% of cases occurred outside the residence while 21.2% during hospitalisation. The greatest number of deaths occurred in December (12 deaths) while the least occurred in July and September (3 deaths each).

5.4.7 With regards to the causes of death, 65.89% of all deaths were due to diseases of the circulatory system. These included acute myocardial infarction (30.59% of all deaths) and chronic ischaemic heart disease (18.82% of all deaths). 15.3% of the deaths were due to injuries (mainly drowning – 8.2% of all deaths); while 9.41% were due to respiratory disorders. There were 2 deaths from HIV disease resulting in infectious and parasitic diseases.

5.4.8 There were ***66 deaths*** from non-residents in **1998.** The male to female sex ratio was approximately 2:1 with 42 male deaths and 24 females. The age range was 83 years with a minimum value of 3 years and a maximum of 85 years. The median was 79 years. 53.03% of cases occurred outside the residence while 42.42% during hospitalisation. The least number of deaths occurred in January and February (1 death each) while the greatest occurred in March and December (11 deaths each).

5.4.9 With regards to the causes of death, 53.03% of all deaths were due to diseases of the circulatory system. These included acute myocardial infarction (27.27% of all deaths) and chronic ischaemic heart disease (18.18% of all deaths). 13.64% of the deaths were due to injuries while respiratory disorders and abdominal disorders accounted for 12.12% each of all deaths. There were no deaths from HIV Diseases.

5.4.10 There were ***57 deaths*** from non-residents in **1999.** The male to female sex ratio was approximately 2:1 with 37 male deaths and 20 females. The age range was 55 years with a minimum value of 30 years and a maximum of 86 years. The median was 51 years. 56.14% of cases occurred outside the residence while 40.35% during hospitalisation. The least number of deaths occurred in December (2 deaths) while the greatest occurred in February and April (7 deaths each).

5.4.11 With regards to the causes of death, 68.4% of all deaths were due to diseases of the circulatory system. These included acute myocardial infarction (31.58% of all deaths) and chronic ischaemic heart disease (21.1% of all deaths). 10.53% were due to cerebral disorders while 5.26% of the deaths were due to injuries (mainly drowning), and respiratory disorders each. Abdominal disorders accounted for 3.51% each of all deaths. There were no deaths from HIV Diseases.

5.4.12 There were ***39 deaths*** in non-residents in **2000.** The male to female sex ratio was approximately 2:1 with 28 male deaths and 11 females. The age range was 72 years with a minimum value of 16 years and a maximum of 88 years. The median was 63 years. 48.72% of cases occurred outside the residence while 51.3% during hospitalisation. The least number of deaths occurred in August and November (1 death each) while the greatest occurred in May (7 deaths).

5.4.13 With regards to the causes of death, 61.54% of all deaths were due to diseases of the circulatory system. These included acute myocardial infarction (15.4% of all deaths) and chronic ischaemic heart disease (28.21% of all deaths). 2.56% were due to cerebral disorders while 12.82% of the deaths were due to injuries (mainly drowning), and 7.69% were due to respiratory disorders. Abdominal disorders accounted for 7.69% of all deaths. There were no deaths from HIV Diseases.

Recommendations

R.5.1 It is highly likely that a tourist will be confronted with at least one kind of accident during his "tourist period". This could be a minor "indoor-accident" or "sport and leisure accident" or a major "transport accident". Accidents are the 3rd leading cause of death in Europe and unquestionably, a large number of these mortality statistics include tourists [(15)]. Moreover, accidents are gaining in importance because communicable disease is better controlled. There is a secular increase in injury mortality and morbidity due to accidents. Since serious accidents are rare events for the individual, they do not appear to be the problem. It is the non-fatal injuries that consititute a greater drain on the national health services, mainly in the longer term if they become debilitating injuries. ***Since accidents and injury are usually predictable and hence preventable, it is important to study epidemiological data as this is essential to any planning, implementation and evaluation of services for the prevention of accidents.*** However, it is just as important to raise awareness amongst the tourists. Whilst with communicable diseases, the tourist's responsibility or contribution is minimal, with accidents he is *as responsible* as the host country. Hence the importance of finding ways to ***educate the tourist about travelling and having fun in a safe manner.***

R.5.2 It is just as important to ensure that we, the host country provide as safe an environment as possible. The GP questionnaires' ***(section 5.1.1.)*** clearly demonstrates physical injuries as the leading cause for GP visits. Many were at the poolside, easily explained by the lack of legislation with regards to public pools. ***It is recommended that the new Public Health Act to be adopted in mid 2002 should include Public Pool Regulations. These would ensure that the pool water is well-maintained and that all safety features required at the poolside are present*** e.g non-slip surfaces, surrounding railings to allow open and closing times around the pool, showers at the poolside etc. Another issue highlighted by the study was the large amount of grievous injuries seen to by GPs. Heavy construction presently underway in the North West may be a contributing factor. Pavements are either non-existent or full of holes and missing slabs. These are easy stumbling features for the distracted tourist. ***It is important that all unsafe surfaces in pedestrianised areas or meant for pedestrian use, should maintained at all times***, a responsibility that the Local Council should give priority to.

R.5.3 With regards to accidents occurring within or in the vicinity of hotels, it is of utmost importance that ***hotel staff have basic 'First Aid' training and that all hotel staff know how to call the nearest paramedics in case of emergencies. First Aid Courses should be organised for such staff on a regular basis but could easily be inserted into the curriculum of the tourist students at the Institute of Tourist Studies. It is recommended that all elderly travelers should be encouraged to have a good health insurance*** before travelling especially when there are no bilateral or multilateral agreements between the countries. More importantly, ***all travel agents must ensure that such travelers always carry a Health ID card (when and if necessary)*** as this would be useful should the elderly traveler not be able to communicate with the medics in case of need.

R.5.4 The high incidence of GP calls for sunburn and sunstroke means that the tourist is still unaware of how harmful the Maltese Summer sun is. The educational leaflets produced by the Health Promotion Department two years ago should be

reprinted and redistributed amongst all sectors involved directly and indirectly with Tourists. ***A way must be found to ensure that the "slip, slap, slop" campaign (a.k.a. "Minn jixxemmex, jitkemmex" Campaign) catches the tourist's attention. The setting up of permanent signs on all popular beaches may be one way together with distribution of leaflets on the local airline, at the airport, in hotel lobbies and rooms.***

R.5.5 Elderly travelers are increasing, since they see vacations as a possibility of socialising but more importantly, as a means of restoring their health. *(See Section 5.2.1.(x) which records the eldest tourist for that year as being 96 years old!).* The needs of this group are somewhat particular in that their bodies react differently to their surroundings. ***It is therefore being recommended that elderly travelers should always have a Geriatric Assessment prior to travelling and that they should be informed of this by local tour operators at the time of booking.*** The Geriatrician would not only be able to assess the state of health of the traveler but may also be useful to give advice to the tourist on what schedules he would be able to follow and what activities best to avoid. Moreover, ***Tour guides should seek the advice of Geriatricians when they have elderly tourists in their group as this would help them to better plan and adapt the tour schedules to the needs of the elderly.*** This may require detail such as the planning of specific individual dietetic needs as well as suggestions for altered physical activity e.g. gym based activities. When one sees the table on page 50, it is obvious that the elderly travelers were admitted to the general hospital mainly suffering from cardiac disorders. Exposure to heat, especially the prolonged sojourn in our hot and humid climate, causes a drop in blood pressure, an increase of heart rate and may lead to considerable elevations of cardiac output. Hence, latent heart failure may aggravated due to the heat load, especially if linked to fatigue. Though these admissions place a significant burden on our coronary care unit, (- there is only one on the island) the desire of the elderly to travel, should not be curtailed.

R.5.6 ***It is recommended that there should be a referral point for Health Tourism within the Health Division. This unit, or branch could also help to promote a number of health services to tourists. Therapeutic effects on the cardiovascular system have been described in favourable climates, at sea level, in the absence of air pollution, and often combined with moderate physical exercise and various physiotherapeutic procedures. Malta provides the ideal setting for the elderly or those in recuperating from surgical procedures.***

R.5.7 in 2000, there was an alarming rise in the number of Legionella infections notified in local residents. There were no records available for similar infections in non-residents. However, this rise entails further study. A leaflet called "A code of practice for the prevention of Legionnaires' Disease in hotels and other establishments" was distributed by the Department of Health in March 1999. However, enforcement procedures and annual inspections to review records of maintenance are still to be set up. Of higher priority is the need for a policy regulating fountains and small pools in public places such as gardens and parks. Although pretty to look at, these water fonts are rarely well maintained and may prove to be a source for infection if not regularly monitored. **The Local Councils should be made reponsible for their adequate upkeep and regular monitoring and as much a possible, the number of permits for such fountains, water spouts or pools should be decreased.**

R.5.8 Gastric Illnesses in the form of individual food poisoning reports or outbreaks are still quite common in tourists. Inspection of catering establishments during the fieldwork period of this study and compared to previous records show that there is a highly efficient and stringent inspection of food outlets and kitchens. ***It is recommended that reports of such inspections are more user friendly for the licencee/owner of the establishment to whom they are sent. Clear explanations about the risk factor grading awarded to the outlet is a prerequisite.*** However, *Section 5.1.3.(iv)* demonstrates a slight increase in outbreaks in the year of study as compared to the previous 2 years. The possible cause for this could be street-vended foods. Mobile and fixed kiosks are still not part of the routine biannual inspections. ***A policy for public health certification of street-vendors is urgently required. These outlets should be inspected twice yearly and given a risk factor grading like other catering establishments, and any improvements required should be closely followed up.***

R.5.9 With regards to road traffic accidents in tourists, a lot can be said about the influence of environment-related factors which impact on traffic safety. Driving on the left side of the road in contrast to the North of Europe may be confusing. However, other factors such as the climate and the microclimate of these islands are also of importance. These include the level of humidity, high temperatures during summer months, air pollution, and strong gusting winds. The microclimatic features include, for example, the large number of roads with unsuitable infrastructure, making them especially unsafe for the elderly with slower reflexes or the young, frivolous, fast driver. ***Such problems can be faced through the provision of adequate and readily available information for elderly tourists on a fly and drive holiday. It is the tour operators' duty to ensure that the elderly traveler is aware of the local legislation and driving culture, as well as the general state of the roads.*** The Tour operator/ guide/ hotel front office should help such tourists to plan out the main routes along whichthey will be driving, warning them of potential road works etc along the way. They should encourage foreign drivers to: wear the right clothing and shoes; eat the right meals (especially in the hot summer months at midday if intending to drive); and to refrain from smoking while driving.

6 ENVIRONMENTAL IMPLICATIONS OF TOURISM

6.1 State of Bathing Water in NW (13)

6.1.1 Throughout 2000, as in previous years, a coastal water surveillance programme was conducted by the Public health Department. The programme mainly runs through the bathing season i.e. the third week of May until the end of October, which corresponded to the same study period during which all fieldwork for this study was done. In all a total of 96 sampling points were monitored but for the purposes of this study, only the points in the North West will be referred to.

6.1.2 Samples were collected from all points on a weekly basis and analysed for faecal coliform bacteria once a week. These points were followed up in such a way that if the initial laboratory results indicated a high faecal coliform count or if there were reports of visual evidence of sewage contamination, repeat samples were taken to confirm the state of the bathing water. Those sites found temporarily unfit for bathing water were, in fact, monitored daily until found to be free for any signs of sewage contamination.

6.1.3 Sites that were temporarily not fit for bathing in the North West can be seen in Table 6.1:

Table 6.1: Areas considered temporarily unfit for bathing

Area	*Period from*	*No. of Stations Involved*	*Total no Of days Involved*	*Total no of site days*
St. Paul's Bay (Tax-Xema)	08 June – 12 June	1	4	4
Qawra (Salina Bay)	15 June – 18 June	1	4	4
St. Paul's Bay (Tax- Xema)	19 July – 23 July	1	5	5
Qawra (Salina Bay)	16 Aug - 17 Aug	1	2	2
St. Paul's Bay (Siren's Area)	20 Sept – 24 Sept	2	5	10
St. Paul's Bay (Tax-Xema)	22 Sept – 26 Sept	1	5	5

Source: Department of Public Health. Bathing Water Quality Report, 2000

6.1.4 Also monitored were total coliforms, faecal streptococci and Salmonella. The Bays were compared to Barcelona Convention as well as to the EU criteria. According to Barcelona Convention Criteria, bathing waters are classified into two categories based on whether or not such areas comply with the stipulated criteria. Coastal areas are considered fit for bathing if - on the basis of at least ten samples per year (collected during the bathing season) - a concentration of 100 faecal coliforms per 100 mls. of seawater is not exceeded in at least 50% of the samples or a concentration of 1000 faecal coliforms per 100 mls. of seawater in at least 90% of the samples (Barcelona Convention Criteria).

6.1.5 Moreover, these stations are further classified into First Class Areas and Second Class Areas. A first class area is a station which faecal coliform counts are less than 100 per 100 mls. in at least 95% of a minimum of ten samples collected throughout the whole bathing season. Second class areas are stations, which conform with the Barcelona Convention Interim criteria i.e. in which faecal coliform counts are less than 100 per 100 mls. in at least 50% of the samples and less than 1000 per 100 mls. in at least 90% of the samples, calculated on a minimum of ten samples taken throughout the whole bathing season. A third class area includes those stations, which do not conform with the Barcelona Convention Criteria.

6.1.6 The EU Bathing Water Directive (76/160/EEC) classifies waters into 2 categories according to whether a site has passed or failed a set of criteria. A site complies with the requirements of the Directive if 95% of the samples taken are in conformity with the imperative values given in Annex I of the Directive. In addition to this classification, another assessment is made of such sites according to the quality criteria listed in the table below as laid down by the Commission.

Table 6.2: Colour coding as s pecified by the European Commission	
Orange	Beaches with insufficient sampling, but where the samples taken are in conformity with the parametric values
Red	Beaches from where the samples taken are not in conformity with the pa rametric values
Green	Beaches where 95% of the samples taken are in conformity with the imperative values given in Annex I of the Directive
Blue	Beaches in compliance with the imperative value and on top of that also conform with the stricter guide values at a level of 80% for the parameters total and faecal coliforms and 90% for other parameters
Black	Beaches where bathing is temporarily prohibited because of a potential danger to public health but where water is monitored and necessary action is taken to remedy the problem.

Source: Department of Public Health. Bathing Water Quality Report, 2000

6.1.7 In the North West, the six sandy beaches that were monitored as well as the two rocky stretches were classified in the way presented in the table below.

6.1.8 The sampling site at table 6.3 has as of this year been declared a non-bathing site. It is in the inner most part of the Qawra rocky stretch and due to being a main salt manufacturing area, is full of undisturbed waters. Bathing does not usually occur at this actual site, though there are some jetties further up where people may practice their water sports (see Figure 6.1)

Table 6.3: Classification of Water Quality at Sample Beaches			
Bay	*No of Samples Taken*	*Barcelona Criteria*	*EU criteria*
Gnejna Bay			
(jetty close to car park)	23	1	Blue
Ghajn Tuffieha			
(Below rocky area)	22	1	Blue
(Jetty at bottom of stairs)	23	1	Blue
Golden Bay			
(Below rocky area)	22	2	Blue
(Below hotel lido)	23	2	Blue
Along **Paradise Bay**	23	1	Blue
In front of Hotel complex	23	1	Blue
Armier			
(Close to snack Bar)	23	1	Blue
Mellieha			
Pt. Below hotel complex	23	1	Blue
Along the bay	23	1	Blue
Along the bay	23	1	Blue
Along the Bay	23	2	Blue
From Jetty	23	1	Blue
Slipway at			
Dawret it-Tunnara	23	2	Blue
Qawra			
Beach below Fra Ben pt.	23	1	Blue
Along Beach	23	2	Blue
In front of Triq ir- Rizzi	23	2	Green
Jetty at Cens tal-Gebel	23	2	Red
In front of last salt-pan	23	2	Red

Source: Department of Public Health. Bathing Water Quality Report, 2000

Figure 6.1: Qawra Rocky Stretch

Source: Aerial Survey of Maltese beaches, 1998. Malta Tourism Authority

6.1.9 Another bathing area in the North - West that did not form part of the beach survey, but which gave some cause for concern was St. Paul's Bay. Specifically the jetty along St. Francis Street and the area adjacent to the water polo club, as these had a Barcelona classification of two and where thus marked as green code under the EU criteria. (See figure 6.2)

Figure 6.2: St. Paul's Bay

Source: Aerial Survey of Maltese beaches, 1998. Malta Tourism Authority

6.2 Beach Inspections

6.2.1 Beaches are a vital resource for the Tourism industry in Malta. For a country without natural resources, tourism is undoubtedly monitored very closely to ensure that the revenue from this industry does not decrease. Most of the tourism activity in the Maltese islands is carried out in coastal areas with most of this activity being along the foreshore. Sandy beaches are very popular with tourists as well as local residents, though surveys indicate that the latter are finding the beaches somewhat crowded.

6.2.2 The Beach User Survey carried out by the Malta Tourism Authority in 1998 was highly indicative of the way residents and non-residents feel about our beaches. During this survey, 5998 persons from all walks of life were interviewed on the beaches during the month of August. 3750 of these were tourists while the remaining 2248 were locals. The largest number of questionnaires were filled out at Mellieha Bay, or as it is known locally Ghadira, this being the most popular

beach in Malta. The surveys were carried out at different times of the day and on all days of the week [14] .

6.2.3 The first thing noted by the survey was that Tourists frequented sandy beaches mainly during the week, most especially in the mornings. On public holidays and weekends, 73% of the interviewees were locals. From those interviewed, 59.2% answered that they preferred sandy beaches and 32.4% rocky beaches. Of those who preferred sandy beaches, many commented about the dirty state of the sand, lack of space to put up their own umbrellas, need for restricted barbecue areas, and need for public conveniences on the beach which should be kept clean at all times. 85% of the tourists interviewed said that they would not mind paying for using public conveniences and public showers provided they were kept clean at all times. Other comments made were about the importance of having kiosks/cafes on the beach and the high prices charged by these outlets [14] .

6.2.4 Beach litter is known to be a major problem in coastal resource management (Fluharty, 1994). It renders the beach landscape visually unattractive and can pose significant risks to human health. Items reported from Maltese beaches include used hypodermic syringes, sanitary towels and condoms. It can damage fragile beach, near-beach and even global ecosystems (Relsh et al., 1994; Levy, 1989) and gases liberated from abandoned freezers and aerosol cans include some chemicals such as CFCs which are harmful to the global ozone layer.

6.2.5 The management of beach litter demands knowledge and understanding of the amount, nature origins and persistence of this beach litter. Detailed surveys carried out elsewhere have identified some recurrent trends, including increasing diversification of composition of litter, a significant increase in the importance of plastics, a widening geographical distribution of origins of litter, and a relatively short survival time of most types of litter in the marine environment.

6.2.6 Only preliminary surveys of beach litter have as yet been carried out in Malta, and these have not been reported in detail. For example, Axiak (1995) mentions a survey of two beaches at Fomm ir-Rih on the west coast in 1991 and 1992. The mean density of the litter was 60 -- 650 gm sq. Plastic litter made up the largest part of the whole with wood also being significant. Litter was found to be of both local and ship-borne origin (7) .

6.2.7 A study of Maltese beach litter was carried out by Vince Gardiner of the Department of Environmental and Geographical Studies of Roehampton Institute, London in 1995. The aim of this study was to identify the basic characteristics of Malta's beach litter and to assess existing litter management policies. Four Beaches were studied, two of which were Golden Bay and Ghajn Tuffieha in the North West of the island (7) .

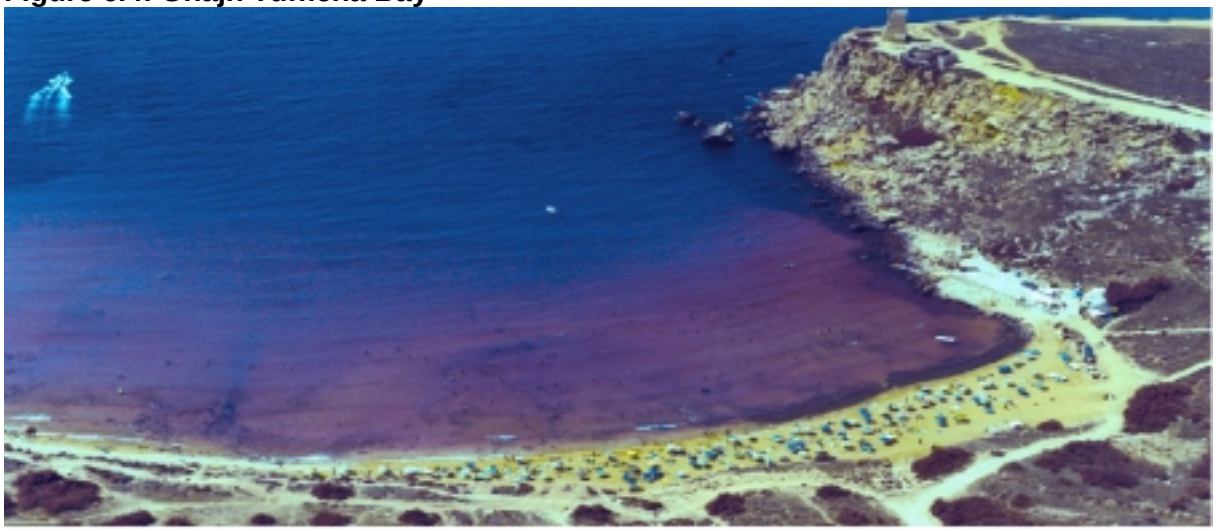
6.2.8 Golden Bay is a heavily commercialised beach overlooked by a hotel, with shops, cafes and a water-sports centre. There is a large car park at the top of the cliff joined to the beach by a short stretch of road and path. The beach is intensively used by the hotel and visitors and part of the beach is marked off for use by hotel residents only. Ghajn Tuffieha by contrast has only a small informal car park and the remains of a derelict hotel at one end plus a water-sports hire centre. There is no restriction to public access, which is down a long series of steps.

Figure 6.3: Golden Bay

Source: Aerial Survey of Maltese beaches, 1998. Malta Tourism Authority

6.2.9 The visual impact of litter on Ghajn Tuffieha beach was marked, as were variations in litter density both across and along the beach. Along the water's edge there was a fair amount of debris mainly made up of comminuted leaves and small particles of solid debris often discolouring the water. The middle of the beach was noticeably less littered whilst at the back of the beach there was a marked concentration of litter with increased concentrations around the steps giving access to the beach (7)

Figure 6.4: Ghajn Tuffieha Bay



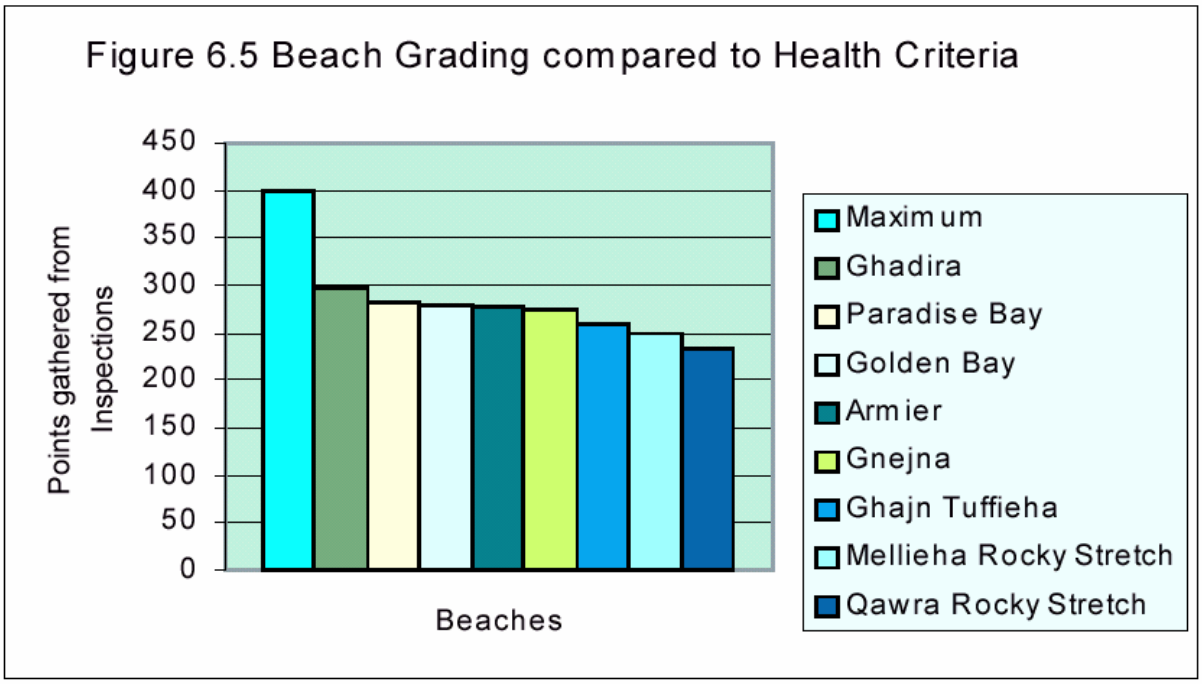
Source: Aerial Survey of Maltese beaches, 1998. Malta Tourism Authority

6.2.10 Golden bay showed a different picture in that there was better management of the beach. Litter bins are present at Golden Bay though there is no regular distribution of these bins. The presence of the hotel seemed to contribute positively in that there was regular manual cleaning of the area of beach closest to these outlets by the bar owner and the hotel employees.

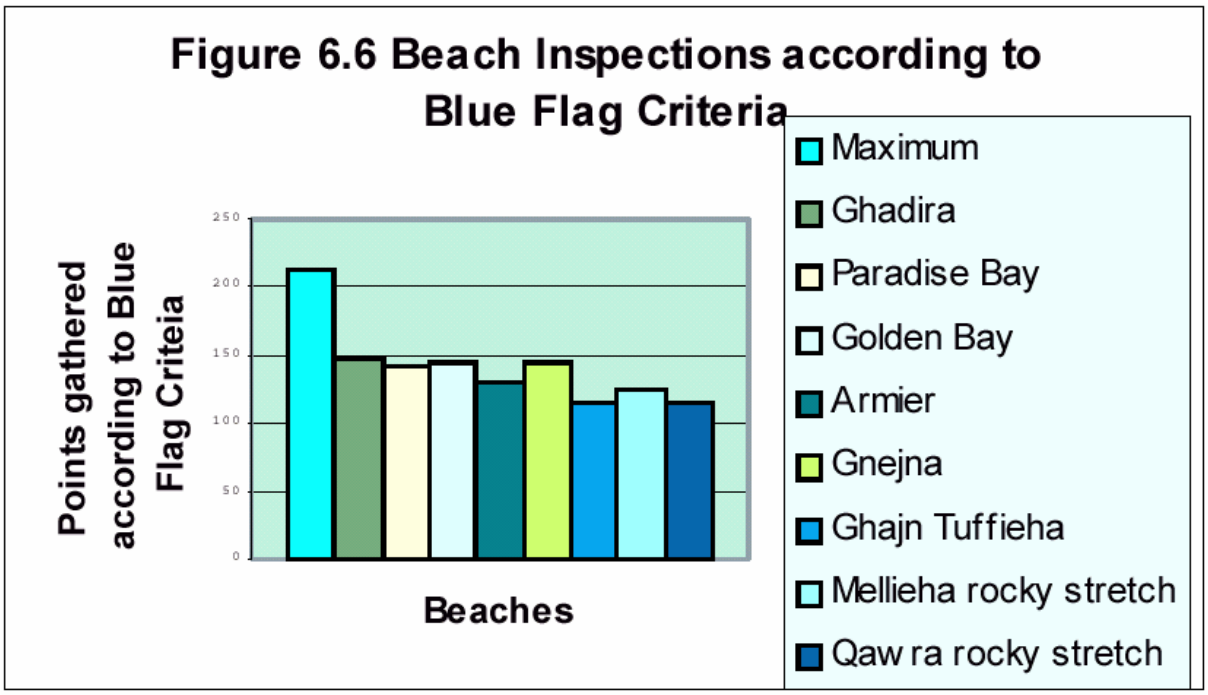
6.2.11 The Tourism and Health study carried out beach inspections on six beaches in the North West during the bathing season of 2000. The analysis of the data collected during this survey can be seen in Annex II. These beaches were

awarded points for the state of their beaches in accordance to the inspection sheet drawn up for this survey in Annex I.

6.2.12 As part of this survey, sand sampling was performed on a twice monthly basis at all beaches of the study throughout the fieldwork period. Samples were taken for microbiological analysis and these included: Total coliforms, Faecal coliforms, Staph aureus and Salmonella. The results of such samples, tabled in Annex II, show that all samples were free from microbiological contamination.



6.2.13 When compared to Blue Flag Criteria, Ghadira Bay was the beach that best met most of the requirements of the Blue Flag Criteria. Paradise Bay and Golden Bay achieved the next best grading, followed by Armier, Gnejna and Ghajn Tuffieha. The rocky stretches left much to be desired as compared to Blue Flag, with the Mellieha Rocky stretch being of better standard than the Qawra rocky stretch.



6.2.14 With regards to cleanliness of the beach, Paradise Bay scored the most points, followed by Ghajn Tuffieha, Ghadira, Qawra Rocky Stretch, Gnejna, Armier, Mellieha Rocky Stretch and Golden Bay. It must be emphasised that since Gardiner's report detailed above, an Non-Governmental Organisation -- GAIA Foundation, was awarded custody for a few years of Ghajn Tuffieha Bay. This has contributed to the improvement in the aesthetic appearance of the bay as well as to protection of the environmentally sensitive flora and fauna of the beach.

Figure 6.7: Ghadira -- Northern Corner of Bay

Source: Aerial Survey of Maltese beaches, 1998. Malta Tourism Authority

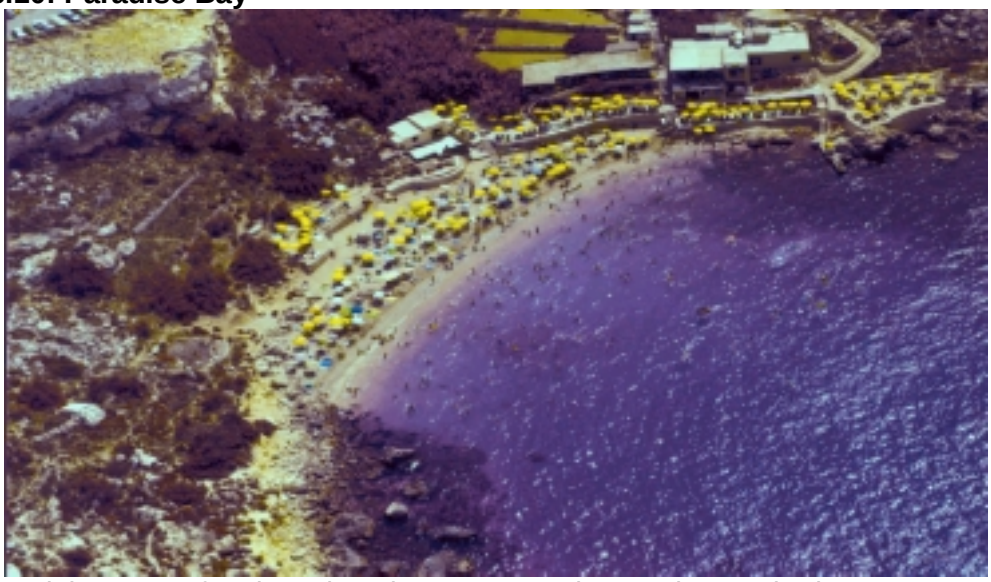
Figure 6.8: Ghadira -- Central Stretch

Source: Aerial Survey of Maltese beaches, 1998. Malta Tourism Authority

Figure 6.9: Ghadira -- Southern Corner of Bay

Source: Aerial Survey of Maltese beaches, 1998. Malta Tourism Authority

Figure 6.10: Paradise Bay



Source: Aerial Survey of Maltese beaches, 1998. Malta Tourism Authority

6.2.15 With regards to amenities, Gnejna offered the best shower and toilet facilities, followed by Ghadira and Mellieha Rocky stretch, whilst life saving facilities were best at Armier, followed by Golden Bay and Ghadira. Shade provision was best at Golden Bay followed by Ghadira and Ghajn Tuffieha whilst safe access to the water line was best at golden Bay, followed by Ghadira and Ghajn Tuffieha. With regards to availability of public information and warning signs, Golden Bay scored the highest points followed by Ghajn Tuffieha and Paradise Bay.

Figure 6.11: Armier Bay

Source: Aerial Survey of Maltese beaches, 1998. Malta Tourism Authority

Figure 6.12: Gnejna Bay

Source: Aerial Survey of Maltese beaches, 1998. Malta Tourism Authority

Figure 6.13: Another angle of Gnejna Bay

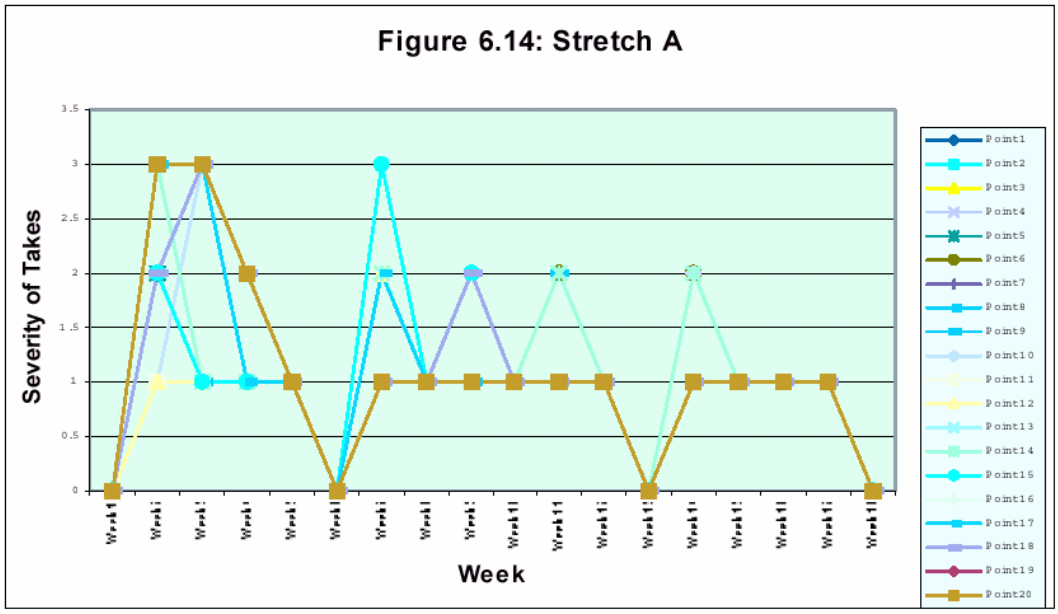
Source: Aerial Survey of Maltese beaches, 1998. Malta Tourism Authority

6.3 Rodent Control

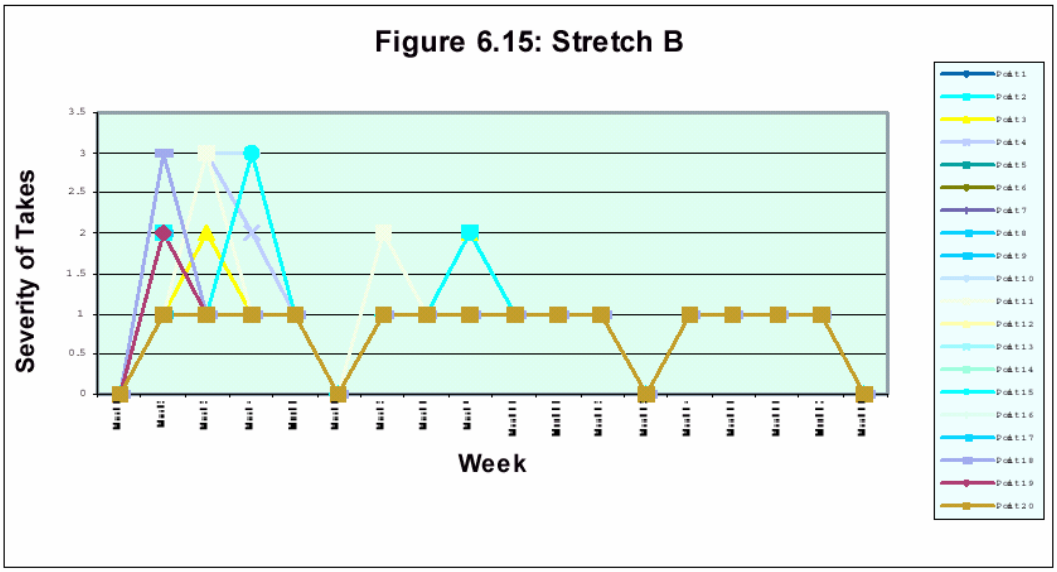
6.3.1 Three stretches of coastal area were identified in the North West. The rodent control officer assigned to this study identified permanent sites for baiting and spray painted the area. The baiting sites had to be in heavily populated areas of the rocky stretches, and yet the bait had to be placed in such a way that it would be safe from the curious hands of children frequenting the beach. It was essential

that the bait would not be removed as this was the indicator used for measuring the size of the rodent population.

6.3.2 The first stretch studied, Stretch A - Figure 6.17, was the rocky coast line at Qawra starting in front of the Suncrest Hotel up to Fra Ben. As can be seen in the graph below, re-baiting took place approximately every 5 -- 6 weeks. The severity of takes reflects the heavy rodent population in the area. The graph adequately demonstrates how the population of rodents in the area was controlled by the end of the field work since the severity of takes had decreased.



6.3.3 The second stretch studied, Stretch B -- Figure 6.18, was the rocky coastline between the Fra Ben to the Dolmen Hotel. This stretch of beach differed from Stretch A in that the rodent population seemed to be heavier at the beginning of the study seen from the severity of takes. However, the population was controlled much faster through re-baiting and hence severity of takes were less during the consequent weeks as can be seen reflected in the peaks on figure 6.15.



6.3.4 Stretch C was on the other side of the bay i.e. at St. Paul's Bay known as the Simar area and stretched from Xemxija Church inwards towards the bay. Here the picture was different in that the rodent population was scarce and severity of takes low at the beginning of the study period. Towards the middle of the study, the severity of takes increased, probably due to the increase in barbecue remains on the beach, as well as due to the possible birth of new rodents to the small resident family. However, this population was controlled immediately with severity of takes coming down to a minimum acceptable value within 1 -- 2 weeks of re-baiting and then remaining so.

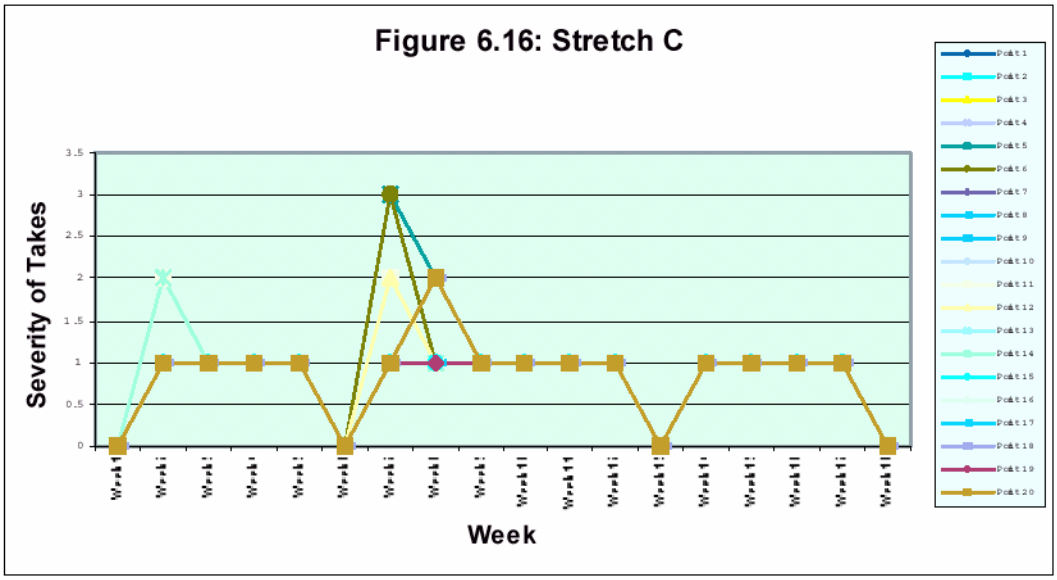
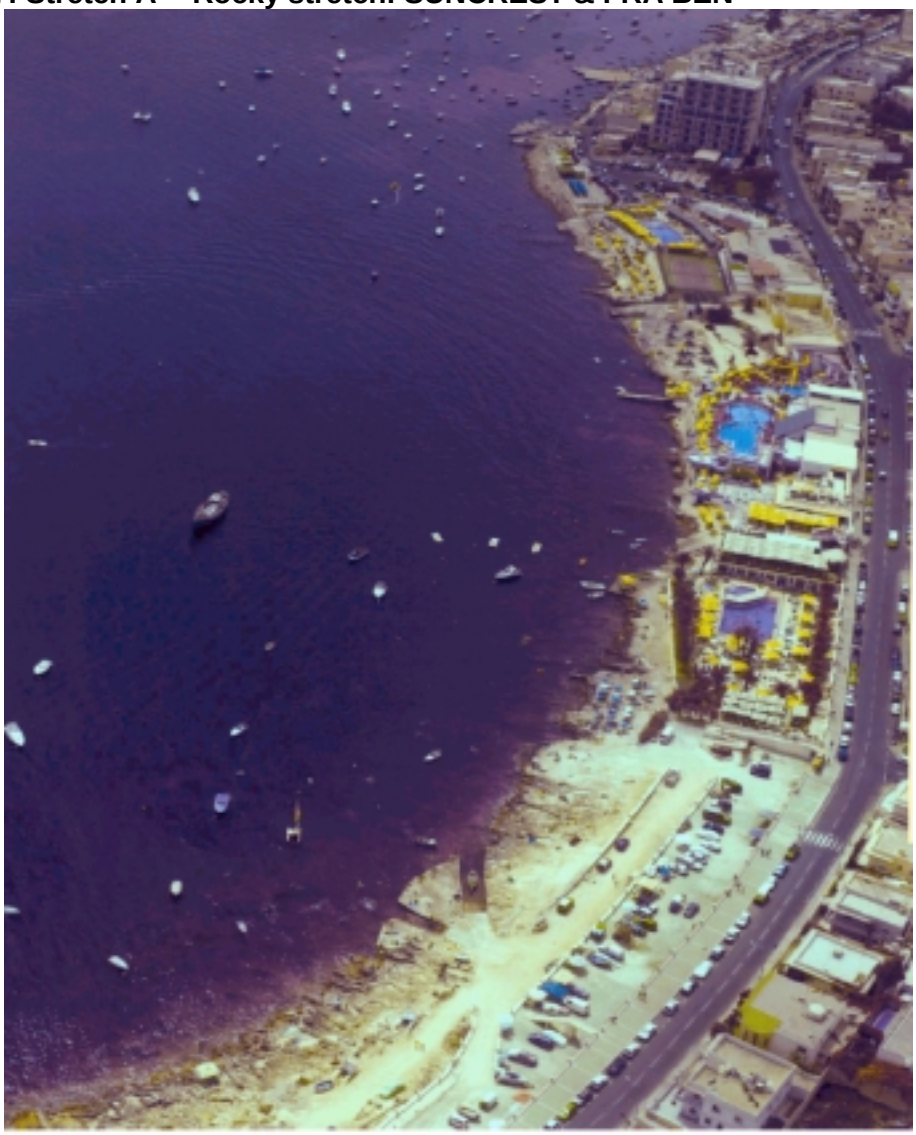


Figure 6.16: Stretch C

6.3.5 When comparing all three stretches, Stretch A is the most popular part of Qawra for barbecues during the summer months and would explain the heavier infestation of rodents in this stretch as compared to Stretch B and C above. Stretch B is a quite rocky domain and not easily accessible to bathers or day trippers. Moreover there is very little access to the shoreline and would involve climbing down sharp ragged rocks for bathing. Barbecues are not so common along this stretch for this reason and hence food remains would be more scarce than at Stretch A. This may explain why the rodent population is more significant at A, despite this being a well-developed stretch of coastline (see Figure 6.17). The large amount of hotels along stretch A, may be an additional attraction for rodents due to the large amounts of food remains, waste in skips and possibly liquid discharges that may occur from this heavily developed area.

6.3.6 Stretch B is mostly rocky and also has some wild vegetation which may account for the rodent population there, this being an adequate site for them to live safely away from the development that lies further down the stretch. Stretch C is mainly a concrete or rocky jetty, easily accessed by cars, as well as boats and there is very little vegetative cover. This may explain the relatively low population found at this stretch.

Figure 6.17: Stretch A -- Rocky stretch: SUNCREST & FRA BEN

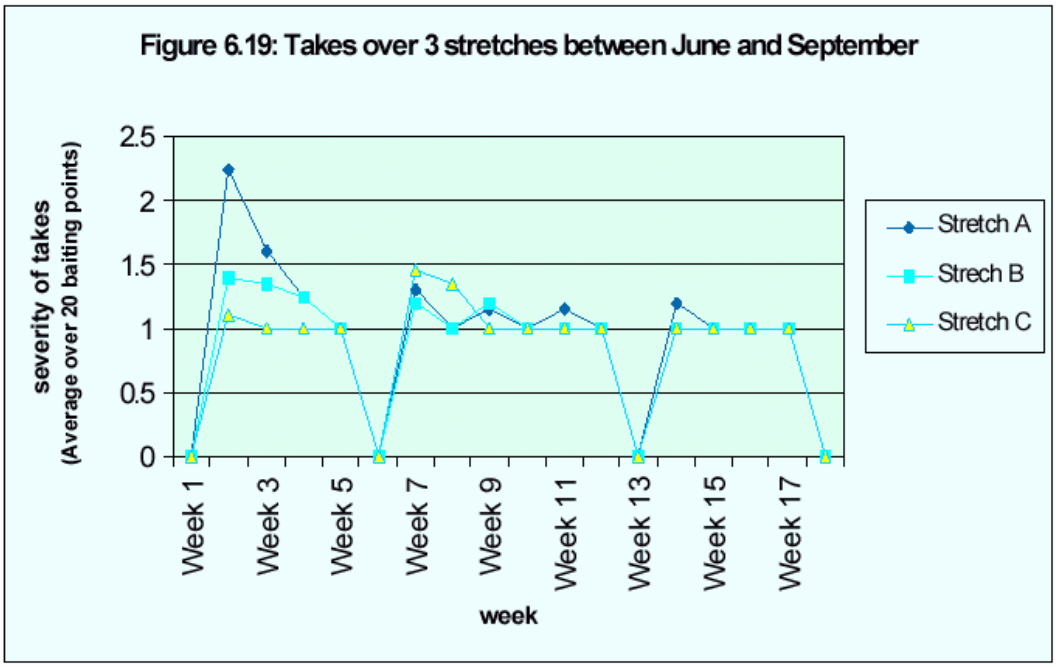


Source: Aerial Survey of Maltese beaches, 1998. Malta Tourism Authority

Figure 6.18: Part of Stretch B -- Fra Ben

Source: Aerial Survey of Maltese beaches, 1998. Malta Tourism Authority

6.3.7 The differences can be seen in the graph below, which is an average of severity of takes of the three stretches studied.



6.3.8 As explained in chapter 4, baiting of such sites before the study, usually occurred on request whenever a complaint was lodged at the district health office. Such baiting was therefore done as a `one-off'. The system used during this study period paid off and is clearly reflected in the records of complaints available at the Rodent Control Unit of the Public Health Department. There was a marked decrease in complaints lodged in these areas as compared to previous years (see Table 6.5).

6.4 Drinking Water

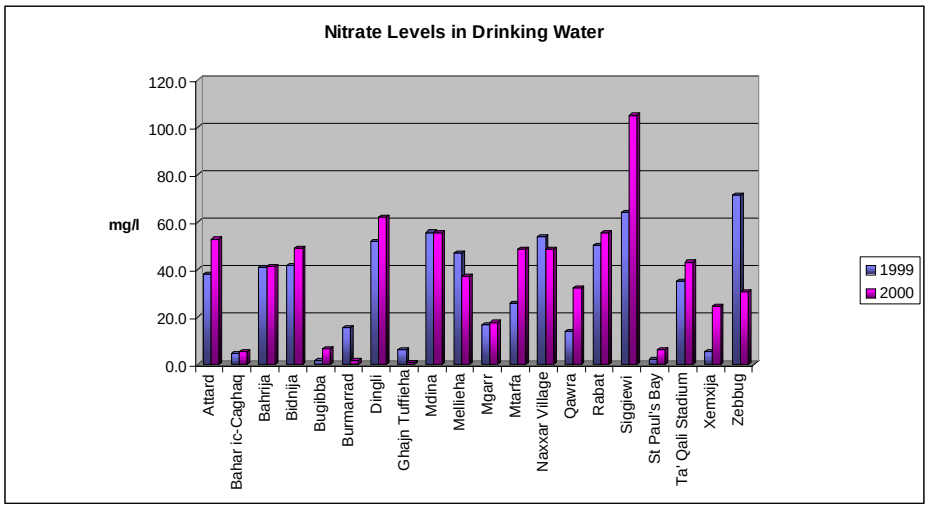
6.4.1 The Department of Public Health regularly monitors tap water arriving at the consumer end in all Local Council areas in Malta and Gozo. The main purpose of this programme is to issue health warnings to the public when the W.H.O levels of microbiological parameters are exceeded and hence, when there is a threat to public health. The programme monitors 2 streets in every Local Council area for microbiological analysis every two weeks.

6.4.2 When looking at the microbiological data, drinking water in the North West of the island was of little concern in the year 2000. There was only one incident that required intervention by the departments concerned which occurred in Zebbug, Malta in January. During this month a large number of streets within this town were informed that they had to boil their tap water before consuming it and were also advised to flush out their roof tanks and refill them with new water. This episode lasted approximately two weeks with results clearing up towards the end of January. There were no other official warnings issued in the year 2000

6.4.3 The Department of Public Health also monitors some chemical parameters. These are: Fluorides every six months,
Nitrates every three months,
Chlorides, Sodium, Conductivity monthly.

6.4.4 When analysing the data for levels of Nitrate in ALL villages in Malta, for the year 2000, there were less villages exposed to levels that were above the W.H.O. recommended limit of 50mg/l. Whereas in 1999, there were 16 sites in Malta and 7 sites in Gozo that exceeded these limits, in 2000 there were only 11 sites in Malta and 5 sites in Gozo with higher levels of nitrates. In fact, most of the villages were well below the WHO average. This is reflected in the yearly average:

Malta yearly average = 34.11mg/l
Gozo yearly average = 45.84mg/l
Maltese Islands yearly average = 39.97 mg/l.

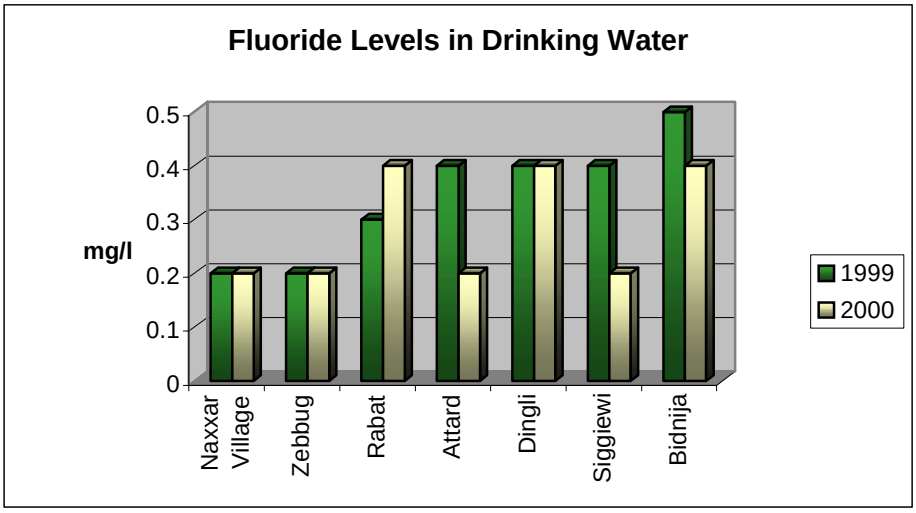


Source: Drinking Water Monitoring Programme. Department of Public Health

6.4.5 With regards to the other chemicals monitored, chlorides and sodium are generally high but this is of little consequence to health since the total daily intake of tap water is usually low in the Maltese population.

6.4.6 Fluorides were well below the W.H.O. limit in Malta in 2000 while the levels were found to be higher than 1.5mg/l guideline of W.H.O in only six villages in Gozo in 1999. This is mainly due to the fact that Gozo water supply is still dependent on ground water. The yearly averages are:

Malta yearly average = 0.27mg/l
Gozo yearly average = 1.47 mg/l
Maltese Islands yearly average = 0.87 mg/l



Source: Drinking Water Monitoring Programme. Department of Public Health

6.5 Waste

6.5.1 Municipal Solid Waste[18]

6.5.1.(i) Municipal solid waste can be defined as waste that includes

- Domestic or household waste (waste produced from premises that are exclusively used for human habitation)
- Waste that results from street sweepings and from other public cleansing activities (open air markets etc)
- Commercial waste (waste that is generated by retail and wholesale outlets, light manufacturing and servicing industry and small industrial plants)
- Institutional waste (waste generated by schools, offices etc)

6.5.1.(ii) Although this waste stream is usually considered to be non-hazardous, it is a known fact that MSW contains hazardous materials, such as batteries, paint residues, neon tubes, medicines, pesticides, cleaning chemicals and used oil. Since 1995, the responsibility for the collection of MSW was vested on the Local Councils.

6.5.1.(iii) There are no long term accurate statistics on the level of MSW generated in Malta. The state of Environment report (1998) however provides estimated quantities of this waste stream that were accepted at public waste disposal sites in Malta between 1990 and 1997. Accurate data on the quantities of these wastes received at the landfill facility of Maghtab and the composting plant at Sant Antnin are only available since September 1997 and May 1993 respectively when weigh-bridges became operational at each of these facilities

6.5.1.(iv) The State of the Environment Report (1998) estimates that during 1997, approximately 86,434 tonnes and 9,687 tonnes of municipal solid waste were accepted at the public waste deposit site of Maghtab and at the Sant Antnin Composting Plant respectively. Their total amount, that is 96,121 tonnes constituted approximately 10% by weight of the total waste that was accepted at both sites and on a population of 347, 625, this was equivalent to a waste

generation rate of approximately 0.76 kg/ca.day or of approximately 5.30kg/ca.week or of approximately 275kg/ca.year.

6.5.1.(v) When compared to Europe, Malta ranks amongst the lowest producers of municipal waste among European countries even when the influx of tourists is not taken into account. In fact domestic waste production in Europe ranges from 0.75 to 2.73kg/ca.day. This equates to approximately 5.23 to 19.15 kg/ca.week and to approximately 272 to 996 kg/ca. year.

6.5.2 Airport wastes[18]

6.5.2.(i) Airport wastes are typically of two types. Those generated at the airside and are predominantly food remains and packaging wastes from the meals served on the aircraft and other packaging wastes. Included within this type are industrial wastes generated from the maintenance workshops and hangers. The second type are those generated from landside activities and include wastes coming from terminal operations and facilities such as retail outlets, offices, catering and other commercial outlets. These comprise mainly dry packaging with some food wastes, and waste food generated by the catering contractor for the preparation of aircraft meals.

6.5.2.(ii) All air and landside operations at the Air Terminal are controlled by the Malta International Airport plc. (MIA) and the terminal caters for some 2.5 million passenger movements per year equivalent to some 29,000 aircraft movements.

6.5.2.(iii) The State of the Environment Report (1998) through information supplied by the Malta International Airport plc. and the inflight catering contractor estimates that waste arisings requiring disposal from aircraft and from the preparation of aircraft meals amount to:

- 220 tonnes/year of airside dry waste from aircraft cleaning operations
- 620 tonnes/year of airside aircraft food wastes
- 500 tonnes/year of landside terminal and industrial dry waste
- 160 tonnes/year of landside catering wastes generated as part of the food preparation process

6.5.3.(iv) The Maghtab landfill records indicate that an amount of approx 440 tonnes/year of airport waste was received at the landfill site during 1998/1999. This is appreciably below the amount of waste quoted above and supposedly being generated at the airport.

6.5.3.(v) It should be noted that the waste generation pattern at the airport fluctuates with the tourist season and reaches a peak during the months of mid-June to mid-September when it is estimated that about 36% of the total yearly amount is generated during that period. It is estimated that the monthly average of 18.3 tonnes for airside dry waste can reach a maximum generation for this category of waste of 24 tonnes during the peak months of July and August.

	Jan-Mar	Apr-Jun	Jul-Sept	Oct-Dec
1998				
Tourist Arrivals (1,182,240)	172,548	338,130	430,610	240,952
% distribution	14.6	28.6	36.42	20.38
MSW generated (136,457 tonnes)	28,390	33,037	39,110	35,920
% distribution	20.81	24.21	28.66	26.32
1999				
Tourist Arrivals (1,220,298)	195,535	340,035	437,961	246,767
% distribution	16.02	27.87	35.89	20.22
MSW generated (150,758 tonnes	35,147	39,913	40,155	35,543
% distribution	23.31	26.47	26.64	23.58

Source: A Solid Waste Management Plan for Malta, 2000. Ministry of Environment.

6.5.3.(vi) The table above gives a comparative analysis of tourist arrivals in Malta and MSW generation by quarter for the years 1998/1999. From this table it can be deduced that the fluctuation of tourist arrivals is reflected in the volume of MSW that is generated. In fact, the variation in MSW production from one quarter to another follows the same pattern as that recorded for tourist arrivals.

Recommendations

R.6.1 The new directive for Bathing Water currently being discussed by the European Commission, shifts the emphasis from regular monitoring of sandy beaches and bathing waters, to one of integrated beach management. Interdepartmental collaboration is being encouraged to ensure adequate management of all aspects of beaches. There is a shift of emphasis from reactive strategies and public information to preventive strategies and public participation and information. ***It is therefore recommended that, under the leadership of the Health Division and the Environment Protection Department, and together with all stakeholders concerned, a policy should be drawn up whereby Beach Management Committees can be planned for and eventually set up for the upkeep and monitoring of the popular beaches in the North West.***

R.6.2 Sand is a common source of infections, especially fungal infections in the Mediterranean region. Skin contact with dirty sand and/or polluted bathing water is relatively common, especially in children. ***A regular microbiological monitoring programme of sand quality should be set up at all the popular sandy beaches.*** This would help assure the public that there is no risk of skin infection for children who spend hours playing in the sand.

R.6.3 ***All efforts should be made to acquire official Blue Flag Grading for our beaches.*** This study shows that all beaches inspected were **not** up to blue flag standard. However, all team members and field-workers were convinced that ***minimal investment in the form of human and financial resources together with ongoing education and involvement of all locals though the Local Councils, would help ensure that such criteria are attained.*** Moreover, if the recommendation to set up Beach Management Committees made in R.6.1 is implemented, this will help ensure that beaches in the North West will attain the Blue Flag status.

R.6.4 **Comparison of each beach to the Blue Flag Criteria will be listed below with recommendations for that particular beach.**

R.6.4.1 GHADIRA

A highly populated beach, Ghadira has all the main requirements of the blue flag, though these are not adequately maintained. Beach litter bins are present though not in adequate numbers for the size of the beach and the amount of persons frequenting the beach. Beach debris, especially barbeque debris is particularly high and hence ***beach cleaning should be carried out more frequently.*** Toilets are present and well maintained but ***shower facilities must be set up on each of the three stretches characterising the beach. Medical and Life saving services need to be present more regularly.*** There is appropriate demarcation of water sports areas, but ***water line accessibility is poor*** especially when walking along the shoreline from one stretch to another. The high amount of shade provided by the private establishments, allows very little space for day trippers who usually find that the shoreline is obstructed by umbrellas and deckchairs. ***Public Information signs are markedly lacking and need to be introduced at regular intervals along the beach***

R.6.4.2 GNEJNA

Gnejna bay is a relatively clean beach, with no episodes of sewage outflows into the sea or on the beach. Litter bins are abundant and well-maintained and toilets are relatively clean, with wash-hand basins. There is adequate sun protection and beach density is not too high. However there are a number of shortcomings that can easily improved. ***Medical and life saving services need to be allocated to this beach at least over the busy weekend, as these are non-existent throughout the summer. Shower facilities and possibly more toilets and wash hand basins must be set up.*** The beach debris is quite high due to high incidence of parties, and barbeques on the sandy beach. Moreover, the number of submerged obstructions encountered while wading into the water is particularly dangerous. ***There is the need for an intense beach cleaning campaign at the beginning of each bathing season to clear such sand and water debris.*** There was no clear cut-off line for water sports and the anchorage of the vessels is less than one km from shore. ***It is recommended that a section of the beach is demarcated by fluoting buoys for use by water sports. Moreover, public information signs should be set up which would provide adequate information for both locals and visitors.*** This could include information highlighting the hidden hazards of the particular beach, such as strength of currents etc. as well as maps to indicate where the most important amenities can be found.

R.6.4.3 PARADISE BAY

Paradise Bay is a very clean beach with very little beach debris. Beach litter-bins are well-maintained and there were no episodes of sewage outflows, or sea water contamination by sewage in the year under study. Animal population is scarce and hence there are no complaints of animal litter on the beach. The toilets are clean and well-maintained, with adequate wash-hand basins. Adequate shade is provided through umbrellas though beach density is high. ***It is recommended that certain amenities require improvement to acquire blue flag status. These include Medical and Life saving services, which are non-existent, as are shower facilities.*** The anchorage zone is well-maintained, though it can be improved and the seclusion zone for water sports is also present (though at the start of the study, it was not being enforced). Due to the high beach density, beach and water line accessibility is markedly lacking throughout the season and requires some demarcation for easier access to waterline. It is also recommended that ***public information signs should be installed and regularly maintained*** with details that are important for both visitors and locals.

R.6.4.4 GHAJN TUFFIEHA

Though relatively clean with well maintained bins and little beach debris, this bay has quite a few shortcomings. There is a need to make this beach markedly safer by ***introduction of Medical and Life saving services. All basic amenities must be installed including toilets, showers and telephones. The seclusion zone for water sports needs to be delineated. There are public information signs which are set up by the resident beach management committee (Gaia Foundation) but these should be regularly updated and include advice to bathers with regards to hidden hazards, daily state of currents etc.***

R.6.4.5 GOLDEN SANDS

This bay is a very popular bay and hence beach density is usually very high. Though litter bins are present, beach cleanliness is not ideal. ***Litter bins have to be better maintained and beach debris, cleared out at the beginning of each bathing season. Toilets, though available are not well maintained and shower facilities non-existant.*** Medical and Life saving services are present but ***there is a need for public information signs, and clear delineation of the hazards of such a bay.*** Water-line accessibility is poor and ***there is the need for demarcation of water sports with buoys.***

R.6.4.6 ARMIER

This bay, though small, rates very well when compared to blue flag criteria. Litter-bins are present and well maintained, though ***beach debris and submerged obstructions are abundant and require clearance at least at the beginning of the bathing season.*** Amenities are readily available and include toilets, showers and telephones. ***However, the toilets need better upkeep.*** Medical and Life Saving services are constantly present and there is adequate provision of shade, ***though the beach and water line needs to be made more accessible***. ***The seclusion zone for water sports needs to be better demarcated and the anchorage of boats of one km from shore needs to be enforced. Public information signs are markedly lacking and need to be set up and regularly maintained.***

R.6.4.7 ROCKY STRETCHES

The rocky stretches were characterised by lack of amenities, shade provision, and lack of easy access to waterline. Medical and Life saving services are not provided and beach cleaning from barbeque remains is somewhat lacking. Litter-bins are scarcer on these stretches. The issue of upgrading rocky beaches in the North West needs serious consideration. ***Environmental groups argue against certain measure facilitating accessibility to the shoreline and concrete platforms are*** **definitely** ***not the answer. However,*** the issue of taming the rocky shoreline for recreational use must be addressed with the utmost urgency, if we are to continue to promote our clean seas as a main tourist attraction. ***Ways of setting up all requirements of the blue flag criteria with minimal environmental degradation should be studied and implemented.***

R.6.4.8 GENERAL Recommendations on Blue Flag Criteria

When comparing all beaches in the North West to Blue Flag Criteria, there are still a number of shortcomings that require adequate planning and then implementation. **Local Councils must be more involved in the upkeep of such beaches not only from an environmental point of view but also in management of local plans at beaches within their confines.** They should be adequately trained for a variety of local pollution incidents, and given adequate information of who they must contact, when and how, what to do or NOT to do in the interim period. **Moreover Local Councils should be responsible for information to the public.** This requires regular information to locals and visitors on pollution incidents, sensitive areas in the locality, information on laws governing the management of beaches with a customer care line to handle any complaints about breaches of these laws. **Local Councils should also be responsible for organising regular educational activities for locals and visitors about the beaches they manage.** Blue Flag criteria stipulate a minimum of five educational activities per year, though it is not specified what format these should take. Other issues that the Local Councils should start to concentrate on include: **policies on**

camping, delineation of areas to be used for parking, or as car-free zones. Safe and easy access to both beach and waterline is markedly lacking at nearly all beaches, especially for the physically impaired and those on wheelchairs. Telephones, adequate skips for recyclable materials, public telephones and adequate zoning of beaches for the different users are other suggestions that the Local Council may wish to implement. Admittedly, this is a long list for a small group of persons with limited funds to handle. However the suggestion of having Beach Management Committees, involving NGOs, Local Council and Governmental Representatives and other stakeholders may allow burden sharing and bring about better results.

R.6.5 *Section 6.3*, discussing the merits of regular rodent inspection and baiting speaks for itself. ***The Department of Public Health should ensure that there is more appropriate distribution of human resources to popular stretches of coastline and sandy beaches during the summer months. It is suggested that a programme of action is drawn up for all the officers in the Rodent Control Section of the Environmental Health Branch, so as to ensure that there is continuity and responsibility for such work.***

R.6.6 Discharge of liquid and solid wastes from sailing boats may create problems especially in bays frequented by leisure craft. ***It is recommended that a policy for the adequate disposal of such waste be drawn up and enforced.*** Oil spills, mainly from ships passing through Maltese waters, may also result in oil spills of different sizes. ***It is recommended that contingency plans for dealing with minor or major oil spills are adequately rehearsed and that it is clear who is responsible for what.***

R.6.7 It is highly unlikely that the tourist is at risk from adverse health effects arising from drinking tap water. Tourists usually purchase bottled water and this habit has gradually become local custom too. Microbiological contamination of tap water is fortunately a rare event and all precautions taken are immediate, with the public adequately informed. Drinking water has very rarely been thought to be responsible for an outbreak of gastroenteritis or food poisoning. However, chemical pollution is still a problem for the *local* residents. Since the health hazards from drinking water are dependent on the total daily intake accumulating over a number of days, it is highly unlikely that a tourist would suffer negatively from our water. However, ***it is recommended that the local water supplier should continue to minimise the levels of contaminants as fast as possible.***

R.6.8 Special efforts are needed to ensure a high quality of town planning in order to retain the attractiveness of holiday resorts. ***Building licensing procedures should ensure that tourist establishments and holiday houses are built according to high architectural standards. Parks and gardens should be developed and maintained especially in tourist areas.*** A pleasant physical environment no doubt contributes beneficially to the mental health of tourists and decreases psychosocial stress, which is important especially for people from overcrowded, polluted cities. However, to ensure a pleasant physical environment with parks and gardens, ecological conditions favouring growth of vegetation should be maintained and this includes soil conservation, cycle balance and ambient air quality that is not detrimental to foliage. Insect bites are a nuisance and the population of biting

insects needs to be controlled. Infections may also be transmitted by stray dogs. ***We must therefore ensure an appropriate balance of the fauna especially birds and insects, to prevent proliferation of unwanted species such as mosquitoes, flies, other insects or acarids, rodents and stray dogs and cats.***

R.6.9 Preservation of the Maltese environment can only occur through a full knowledge of its needs and sensitivities. ***An inventory of important and/or sensitive sites is already being drawn up but should be made public to ensure adequate conservation of such areas.*** Further research on such sites would allow protection of such vulnerable areas, by the formulation of policies and the incorporation of detailed strategies into existing regional and national plans.

7. CONCLUSION

7.1 Tourism and the Disabled

7.1.1 Society has yet to accept disabled persons as full citizens largely due to historic attitudes which have called upon them to provide charity and not acceptance. If we are to change our attitudes and those of society as a whole, it is imperative that we create an environment where no description or specific terminology is required for those with special needs. If we want to serve the tourist, we must be fully prepared for the disabled tourist, knowing fully well that the able-bodied of today may be the disabled of tomorrow.

7.1.2 The Maltese Environment still leaves much to be desired when it comes to providing facilities with easy access for wheelchairs, strollers or trolleys. Cut-away ramps on pavements to make crossing roads possible and ramps alongside or over existing steps are becoming more common as well as sonic equipment on traffic lights for sight impaired. However, these outdoor adaptations must be mirrored indoors, especially in public places. It does not require much expense for a hotel or catering establishment to adapt to these special needs. The right furniture is a necessity. Lounges and lobbies should have mixed furniture with chairs suited to the elderly and disabled. Tables should facilitate use by a person in a wheelchair. Counters should ideally be 75cm high or should have a cut-away section which will allow wheelchair travelers to be served with ease

7.1.3 Doors usually require a width of at least an 80 centimeters whether one is disabled or not. Someone carrying suitcases can take up more door space than someone in a wheelchair. This also applies to automatic doors as well as those for rooms. Handles should be of the lever variety and telephones can easily be placed so as to be easily used by those in wheelchairs, as can washbasins, water-closets and urinals. All this and much more can be done without large capital expenditure and will allow travelers with special needs to know that they are accepted.

7.1.4 Such adaptations should be standard requirements for new public buildings including hotels, museums, meeting halls etc. Other standards should include direct access from the street without unnecessary changes of level, elevators large enough for a wheelchair to enter with control panels at an agreed height of 122cm to their top with well spaced control knobs, braille floor numbers starting from ground level etc. Audio signals and escalators are additional features.

7.1.5 Where steps or changes of level are essential, there should be a ramp. This is useful for many people who are not disabled, but who have trolleys with luggage or strollers with children. When it comes to hotels the guest-rooms should be accessible to all - clear entrance and doors with 80cm opening, no sills from the corridor into the room and only the minimum for the bathroom (2.5cm) with sloped sides for preferences. Over and above, it is recommended that 4% of all rooms be properly equipped with trapezes, grab bars and accessible fittings specifically for the disabled.

7.1.6 Carpets in guest-rooms should be either without pile or not more than 0.5cm thick and must be firmly attached to the floor. Bedside lights and other light switches must be easily controlled by a disabled person in bed. The same applies to room telephones, which should also have a visual signal as well as a sonic one for the deaf

and hard of hearing. Fire and emergency alarms should also be fitted with a flashing light for the same reason.

7.1.7 The disabled traveler is not someone apart. He or she travels with family and friends or is a member of a group and cannot be separated from them. Therefore the responsibility for providing the services they require rests on the shoulders of those who are in the business of tourism and travel such as airlines and other providers of transportation, hotels and restaurant operators, museums, theatres and other places of entertainment.

7.1.8 One must remember that there are some kinds of disablement which are not usually thought of in the same way as others. These are normally stable people with medical conditions, which allow the more optimistic to enjoy full lives and to participate in tourism within limits. Examples of such conditions include Kidney Disease, (where a person needs to have regular dialysis, which can be provided in many hospitals so long as notice is given), Congestive Lung Disease and Cardiovascular conditions which require oxygen supplies to be readily available. Information about such medical back-up is therefore important and should be easily obtained by such travelers, so that they can make their travel plans in the knowledge that supplies are available.

7.1.9 As a last point, it is of utmost importance that all Tourist Literature published must present a *true* picture. Officials compiling this literature should be expected to verify the accessibility of hotels and restaurants for disabled. The use of wheelchair signs on such magazines or brochures must have a clear and distinct meaning that the disabled can feel comfortable at such an establishment without requiring humiliating or unacceptable means of accommodating the particular tourist for that particular stay.

7.2 Tourism and Quality of Life

7.2.1 Travelling has become a way of life among people and a major economic factor for the Maltese islands. Tourism activity through tourists' expenditure is likely to generate employment, investment, seasonal price changes, short term savings, household income and taxation revenue. The assessment of the impact of tourism expenditure on an economy depends on the way that expenditure is allocated to the different tourism suppliers. It is a well-known fact that an injection into an economy such as tourism expenditure flows through that economy in a way that goes deeper than simply the initial injection [(6)].

7.2.2 The table below provides a breakdown of the allocation of each segment's output. In most cases, the output produced by each segment, in the first round of transaction, is purchased by tourists. However, in the case of catering establishments, a substantial share of their revenue is earned through services rendered to and purchased by Maltese people. This amounts to LM 27.70 million out of the Lm 62.76 million earned by catering establishments during 1998. The remaining Lm 35.06 million was generated by tourists [(6)].

7.2.3 The socio-economic benefits of tourism are usually proportional to their scale (volume, numbers, currency benefits) and the rewards are reaped instantaneously. The problem, is however created by the "disbenefits" in terms of ecological degradation, which often vary non-linearly with the scale of usage of tourist resources and which are manifested only slowly. The danger is that the "so far so

good" patterns tend to become entrenched over time, making it difficult to regulate or to change by the time the "disbenefits" become manifest. We are witnessing now some long-term trade-offs between tourist development and environmental degradation as well as more subtle effects on all participating and conflicting interest groups.

7.2.4 Tourism is the consequence of an increasing living standard. With this rise the sensitivity for the quality of life of both guests and hosts also increases. The quality of life, a much-used, but not uniformly understood, concept is composed of various goals. "Quality of life" is often identified with living standards, which includes as a substantial component in all official definitions (UN, OECD, etc) inter alia: the use of free time, i.e. vacations. A clean, stable, rich and secure environment and humane conditions in the organisation of life are categorically listed among them.

Tourism Sectors' Contributions [6]

	Accomodation	**Catering**	**Car Hire**	**Air Malta**	**Other Services**	**Total**
(A). Total GNP+ Imports [a]	86.00	24.49	4.95	39.84	77.90	233.18
(B). Total Imports + Outflows [b]	5.72	3.64	0.51	28.11	55.73	93.71
(C). Total Government Income [c]	25.47	7.73	1.53	3.95	5.06	43.74
(D). Total Savings [d]	19.21	2.59	1.20	0.11	4.42	27.53
(E). Total Households Income [e]	35.6	10.52	1.71	7.66	12.69	68.19
Total:**B+C+D+E**	86.00	24.49	4.95	39.84	77.9	233.18
TOTAL GNP: C+D+E	**80.28**	**20.85**	**4.44**	**11.72**	**22.17**	**139.46**
TOTAL INPUT/OUTPUT (REVENUE [f])	**125.98**	**35.06**	**9.17**	**6**3.50	**85.78**	**319.49**
GNP as a %ge of total revenue (Direct Impact)	**63.72%**	**59.46%**	**48.42%**	**18.46%**	**25.85%**	**43.65%**
Employment (FTE)	**8700**	**5170**	**527**	**1302**	**3662**	**19362**

[a] includes recreation, shopping, other transport excluding car hire, tourist handling services

[b] Wages net profits, depreciation, indirect taxes and imports of goods and services

[c] Imports of goods and services and a share of net profits

[c] Mostly income tax, a proportion of wages and net profits but also some indirect taxes such as VAT and sales taxes

[d] Depreciation and a share of net profits

[e] A share of wages and net profits

(f) This is only the share of the revenue to these sectors arising from tourists' expenditure

7.2.5 After satisfaction of the primary material needs, there appears the concern with the social values labelled as subjective indications i.e. quality of life. This can be viewed in 2 ways:

- Perception of fulfilment of individual ideas and wishes, or how one experiences his own life independently of the real situation, and
- The factual economic resources available for the satisfaction of one's own wishes;

Nutrition, individual attainment of health, habitat, harmony within the family, working conditions, use of free time, discomfort, frustration and input of non-market goods such as personal security are all relevant here.

7.2.6 Already in 1958, before the advent of mass-travel the German writer H.M. Enzensberger wrote in his theory of tourism:

> ***"the virtue man expects from tourism is destroyed as soon as it is challenged by its use"*** and ***"all that one expects: customs of the people, landscape, food, hospitality, all that was, is different with the arrival of the first tourist"***

Tourism is now a mass phenomenon. Two thirds of tourists categorically abhor package holidays, yet two thirds are mass tourists. Only a minority is seriously interested in the country and its people.

7.2.7 Conversely, the host country cannot possibly be interested in the stream of ever-changing mass-tourists. The relations are reduced purely to the economical side [(17)]. This is adequately demonstrated in the study carried out by the Malta Tourism Authority ***"The Maltese Population's Perception of Tourism in Malta"***. This survey demonstrates that 71% of the Maltese population consider tourism to be essential with a further 28% rating it as very important. More than 80% believe that everybody benefits from tourism and a further 14% mentioned sectoral benefits.

7.2.8 The main benefits identified by this study are economic: availability of job opportunities, cultural exchange and attaining recognition from other countries. However, although 51% of the respondents stated that they were affected positively by tourism, respondents perceive a number of problems arising from tourism activity. These include: pressure on infrastructure, traffic/parking, overcrowding, increase in prices, deterioration of values and beach related problems.

7.2.9 The demands of the tourist are forever increasing. One speaks of *"holiday blues"* and *"vacation trauma"* and the main reasons are usually obvious. The country visited was either too full, too noisy, too dirty, too unfriendly or too insecure. One of the distinctly mentioned facts that has emerged from investigations is environmental deficiencies. The tourist expects to relax from his daily routine in a peaceful and clean surrounding with excellent service, to retreat, to "own" the place for himself, he wants solitude but also expects new and fulfilling adventures and experiences and the thrill of noisy activities [(17)]. The balance between these is very difficult to achieve without consequences.

7.2.10 As tourism growth is irreversible the question of environment becomes one of prime importance. The tourism industry has grasped the dangers better than the tourists themselves. However, it seems that some tourists believe that in a paid arrangement, the price for environment despoilment is included. What the tourist

does not expect is to be accused of environmental degradation. Furthermore, he does not expect to suffer health consequences from the environmental degradation caused by his own activity.

7.2.11 There is, of course, a growing realisation that the loss of quality of life will be more acutely perceived and people will have second thoughts. Humanisation of travel with changes to *"soft tourism"* may eventually help. However, there is always room for growth but it is more difficult when environmental precautions must be taken. Not all tourists get hepatitis, enteritis, salmonellosis and not everyone is disappointed. Many will actually return. But gradation in quality of a tourist resource is happening and without consciousness for the need to change, in the end there will only be losers left.

Difference between Rough and Soft Travelling (Geo 10, 1980)[19]

Rough Travelling	**Soft Travelling**
Mass Tourism	Individual, Family and small group travel
Little time	A lot of time
High-tech means of transportation	Adequate slow means of transportation
Fixed programmes	Spontaneous decisions
Extroverted	Introverted
Imported lifestyle	Local life style
"Places worth seeing"	Adventures
Easy going and passive	Hard going but active
Less or none intellectual preparation	Previous interest in the visiting country
No foreign language	Learning languages
Feeling of superiority	Eager to learn
Shopping	Bringing presents
Souvenirs	Memories, sketches, new understanding
Snapping photos and picture postcards	Taking photos, drawing and painting
Curiosity	Sensitivity
Noisy	Quiet

7.2.12 From the environment and environmental health point of view, the whole philosophy of constant tourist growth will always be in question. As Gro Harem Brundtland, Director General of World Health Organisation said when still Prime Minister of Norway:

> ***"We must break away from the 'react and cure' to the 'anticipate and prevent' approach of the environmental problem instead. There are limits imposed by nature which we must respect, otherwise important life-support systems may be irrevocably damaged"***

Recommendations for Future Studies

R.7.1 The Tourism and Health activity was an exercise in interdepartmental co-operation and sharing of information and resources. Such a study would never have been successful without the constant support and back-up from other organisations, departments and Ministries. Moreover, this study has helped to consolidate working relationships in the field of tourism. ***The Health Division has been more constantly involved in Tourism policy-making in the past year or so. It is recommended that such a fruitful setting is not lost.*** To the contrary, it should be exploited and fields of interest to Health and Tourism should be investigated and developed.

R.7.2 This study has produced a wealth of information about health statistics in tourists and non-residents. However, this project has only skimmed the surface and has barely identified the problems we should be dealing with. There is a lot more that can be determined from the health statistics gathered by various governmental organisations, than has been included within this report. ***It is therefore recommended that each section is studied in more detail, to allow cost-effective policies to be drawn up for the provision of the right health services for our tourism market.***

R.7.3 ***The Health Division together with the Ministry of Tourism and the Malta Tourism Authority should investigate the possibility of enhancing "Health Tourism".*** Though still a relatively new concept for Malta, the high quality of our Medical Services and the high medical proficiency of Maltese doctors and specialists are an advertisement in their own right. This, together with the Maltese culture of friendliness and hospitality and the warm climate ***undoubtedly*** form the right ingredients for health tourism to be successful.

R.7.4 Much has been said above about ***providing a better tourism product for the disabled.*** This may require heavy investment by all concerned but incentives for hotels and catering establishments that are willing to take on such changes, would help to increase this sector.

R.7.5 ***It is highly recommend that a similar study is carried out in the East of Malta.*** This area, also a popular tourist resort on these islands presents a totally different scene to the one studied during this survey. The east is mainly characterised by five star hotels and presents few sandy beaches, though the rocky shores are heavily frequented. The area is quite popular throughout the *whole* year due to its nightlife, and hence the population under study there would be younger, more happy-go-lucky and may present a totally different set of health problems than in the relatively quieter North West. Moreover, the environmental pollution in this area is different. Traffic congestion, noise and air pollution are evern more prominent.

R.7.6 Gozo, may prove to be another interesting setting that can be compared to this North West study. Gozo is known for its slower pace of life. Hence, environmental contamination is probably less, though fast catching on. Moreover, the tourist industry on this island is heavily dependent on the Maltese themselves. ***A study of the Tourism, Environment and Health effects in Gozo may therefore produce some interesting results of the effects of internal tourism.***

R.7.7 The study presented in this document was the first of its kind. Even underr the auspices of CAMP, such an activity had never been awarded previously. This undoubtedly has led to certain disadvantages. While feeling honoured to have been the first group to be trusted with such a study, the Tourism and Health team have always been fully aware of the possibility of improving upon what has been produced herein. Despite this, the Team hopes that this document will be of interest to all stakeholders involved locally and may prove to be a cornerstone for other countries who will be awarded CAMP projects in the future. There have been a lot of lessons learnt and hence the document is full of recommendations that may be useful to policy makers in all related fields. **It is recommended that as many of the recommendations in this document are implemented by Government departments and NGOs.**

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Annex I

Questionnaires and Inspection sheets

TO BE FILLED UP BY THE MEDICAL PRACTITIONERS VISITING THE PATIENT. NO INDICATION OF THE PATIENTS' IDENTITY AND HOTEL IS TO BE GIVEN.

Male ☐,Female☐ <15 ☐ 15-25 ☐ 25 - 40 ☐ 40-65 ☐ >65 ☐

Type of Injury (a) Physical ☐ (b) Exposure ☐ (c) Medical ☐

		YES or ✓		
(a) Physical	Near -drowning		**If yes indicate where**	Hotel Poolside ☐ Beach ……..…☐
	Major impact incl. Head and back injuries			
	Slip/fall injuries			
	Cuts, lesions,			
(b) Exposure	Sunburn, sunstroke		If yes, exposure time and	09.00 to noon ☐ 11.00am to 3.00pm ☐ 3.00pm to 5.00pm ☐
			If protection was available	Hat ☐, Sun block ☐ T shirt ☐, Umbrella ☐
(c) Medical	GI illnesses Diarrhoea (Mild/severe)		If yes state the possible origin if food related	Street vended ☐ Restaurant ☐ Hotel ☐
	Ear infection			
	Eye infection			
	Respiratory		If yes state if	Pool related (high chlorine ☐, Environ. (airborne dust) ☐
	Skin		If yes state	Rash ☐, Allergy ☐, Insect bites ☐, jellyfish☐, Impetigo ☐, Other ☐
	Cardiovascular			
	Other			

_____

MD

SAMPLING POINTS, PARAMETERS AND FREQUENCY OF SAMPLING

Bathing water sampling points will be those taken by the Public Health department during the bathing season with the same frequency in the North West of the Island.

Microbiological parameters to be analysed include:
- Total Coliforms
- Faecal coliforms
- Strep Faecalis
- Salmonella
- Enteroviruses

Chemical parameters to be analysed include:
- Nitrates and Phosphates,
- Ammonia, Nitrogens,
- Dissolved Oxygen,
- olfactory and visual findings including transparency and turbidity pH, colour, tar balls, visual mineral oils,

Drinking water sampling points will be the same taken by the Public Health department throughout the year in the North West with the same frequency.

Microbiological parameters to be analysed include:
- Total coliforms and faecal coliforms

Chemical Parameters to be analysed include:
- Salinity, Nitrates, and fluorides.

Sand Sampling Points have been identified as follows:

SANDY BEACHES	**No of Samples per week**
Gnejna	1
Paradise Bay	1
Armier	1
Ghadira Bay	2
Xemxija	1
TOTAL	**6**
ROCKY BEACHES	
Ghadira Bay (beneath Mellieha Bay Hotel	1
Qawra (between Fra Ben and Dolmen Hotel)	1
TOTAL	**2**

Sand will be sampled for the following
Microbiological Parameters
- Faecal coliforms, Faecal strep and Total coliforms
- Staph aureus
- Salmonella
- Pseudomonas
- Candida
- Phages

METHODOLOGY TO BE EMPLOYED BY THE FIELD OFFICERS

Observations during Sand Sampling

1. Beach Density (Actual beach density will be measured and substantiated by aerial photographs. Research into such previous studies will be carried out to compare trends)
2. Beach cleanliness (type of bins, capacity, niusance factor, type of strewn litter, flotsam, dead seaweed, presence of oil slicks, left overs from BBQs, etc)
3. Wind and current direction (nil/mild/strong….sea breeze/land breeze)
4. Address questionaire to five tourists per inspection
5. Availability of shower facilities
6. Anchorage and sea craft in use (number of power driven boats, scooters, windsurfers and proximity to bathers, seclusion zones for craft etc)
7. Availability of toilet facilities (structural, hygiene and cleanliness, wash hand basins, attendants and water supply)
8. Availability of sun and sand protection (umbrellas and deck chairs etc)
9. Availability of medical and life saving support services (baywatch, telephone, first aid, presence and standard of hazard signs)
10. Beach and Water line accessibility (passageways protecting against sand burns, availability to the disabled including specific parking sites, etc)

NB *– Points 1 and 6 are to be evaluated at every inspection whereas, points 7 onwards will provide general information which remains unchanged over the period. Check list will be prepared accordingly*

OBSERVATIONS DURING BEACH VISIT

BEACH		**Visit no.**	**DATE / /**
Inspector			**TIME**

INSERT ✓ IN ANY ONE OF COLUMNS A, B or C

	Observation	☺	A	😐	B	☹	C
1	Current direction	Land breeze		None		Seabreeze	
2	Wind speed	Strong		Mild		None	
3	Beach debris (floating algae, sanitary plastics, visible grease balls, BBQ's left overs	None		Small qty		Large qty	
4	Beach litter bins	Available & adequate		Available but not adequate		Not available	
5	Beach litter bins maintained	Very well		Fairly well		Poorly	
6	Animal population (stray dogs)	None		Few		Significant	
7	Sewage outflows	None		Not visible but suspected		Visible	
8	Toilets	Available & adequate		Available but inadequate		None	
9	Toilets maintenance	Very well		Fairly		Filthy	
10	Wash hand basins with clean water in toilets	Available & adequate		Available but inadequate		None	
11	Shower facilities	Available & adequate		Available but inadequate		None	
12	Medical and life saving services	Available all day		Available few hours		None	
13	Sun and Sand protection (hire of umbrellas and deckchairs)	Available & adequate		Available but inadequate		None	
14	Beach/ water line accessibility (protection against hot sand burn)	Very good		Adequate		Poor	
15	Submerged obstructions (boulders, rock)	None		Sparse		Significant qty	
16	Clarity and availability of public info. and warnings.	Very good		Adequate		Poor	
17	Anchorage within 1 km of beach	None		Sparse		Crowded	
18	Seclusion zone for water sports (power boats, jetskis)	Not necessary		Available		Not available	
19	Beach Density	Few		Well spread		Crowded	

Analysis of the Catering Trade in the North West Area

1. Inspections of a random sample of 5*, 4*, 3*, 2* Hotels (including guest houses and tourist complexes)
2. Inspection of a random sample of restaurants (includes snack bars, speciality restaurants.
3. Inspection of a random sample of fixed kiosks, the whole population being 33

NB – *Two food safety officers will be involved here. An approximate breakdown of the catering establishments in the North West area is as follows*

Takeaways		*20*
Hotels	*93*	
Restaurants		*173*
Pizzerias		*4*
Snack Bars		*62*
TOTAL	*335*	

EXISTING KIOSKS IN THE NW OF MALTA

Armier	J. Tanti
Bahar Caghaq	Joseph Mifsud
Bahar Caghaq	Tony Kiosk
Bugibba	Anthony Kiosk
Bugibba	Edwin Souvenir Kiosk
Bugibba	Guzi Kiosk
Bugibba	Harmony
Bugibba	Mare Azzurro
Bugibba	Tanti Super
Bugibba	Tony Kiosk
Cirkewwa	Tanti s-sultan
Ghajn Tuffieha	Beach Bay
Ghajn Tuffieha	Cristal
Ghajn Tuffieha	Gelateria
Gnejna bay	Malata 4 Seasons
Gnejna bay	Western Kiosk
Mellieha Bay	Champion
Mellieha Bay	Framon Kiosk
Mellieha Bay	Gelateria
Mellieha Bay	George Tanti
Mellieha Bay	La sosta
Mellieha Bay	Marea Beach Club
Mellieha Bay	P. Tanti
Mellieha Bay	Sun Dancer
Qawra	Blue Seas
Qawra	Express Burgers
Qawra	Joseph Tanti
Qawra	Mr C. Agius
Qawra	Tanti super
Qawra	The Muffins
St Paul's Bay	Gelateria Espresso
St Paul's Bay	P. Tanti
St Paul's Bay	Xemxija Bay
Torri l-abjad	Liberty Kiosk
Xemxija Bay	Gelateria Espresso

REPORT OF INSPECTION OF KIOSK

Kiosk Number…….

Date of Inspection / / 2000 (Insert Code Number)…….

	Very Good	Good	Fair	Poor	not applicable
Risk Weighting	**1**	**2**	**3**	**4**	**NA**

Insert a number from 1 to 4 in column D in answer to every question which is applicable as per above table

A	B	C	D
	Structural	location – contamination from environmental conditions	
		floors -	
		walls	
		ceilings -	
		windows / doors tight fitting	
		ventilation	
		Lighting	
		ambient Temperature in stall	
	Personal Hygiene	head gear	
		Overall	
		frequent hand washing	
	First Aid Facilities	available and well stocked	
	Appliances	fridges / freezers -	
		Fryers	
		sink for utensils	
		whb available	
		hot and cold water over whb	
		condition of worktops	
		shelving	
	Food Preparation	separation of raw and cooked food	
	Food Serving	displayed pre-packed foods	
		displayed 'open' food	
		displayed chilled / frozen food	
		use of disposable cutlery	
	Waste Manag.	waste water discharge	
		solid waste disposal	
		toilets staff and/or customers	
		washhand basin (whb)	
		hot and cold water supply over whb	
	Water Supply	govt. mains	
		direct / roof tank	
		Reservoir	

TOTALS							
GRAND TOTAL	**(A)**						
OUT OF (Number of Questions answered x 4)	**(B)**						
PERCENTAGE RISK	**(A / B x 100)**						

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Interviewer