

Draft Water Catchment Management Plan for the Maltese Islands

March 2010

(FINAL DRAFT)

The Purpose of this Document

This document describes the main issues for the management of water resources in the Maltese Islands and proposes actions or measures needed to deal with these issues. This plan spells out the possible steps needed to protect, enhance and improve the water environment of Malta and Gozo. Instead of focussing on groundwaters and surface waters individually, this plan is holistic in its approach since it considers the integrated management of groundwaters and surface waters at the water catchment scale. This document also provides a proposal on how this plan is to be implemented.

This document invites you, the public, to submit comments on this first draft plan. Your contributions in turn will help us create an effective Water Catchment Management Plan.

How to respond

Submissions on issues related to **groundwater** and **drinking water** can be sent to:

Malta Resources Authority
Millennia, 2nd Floor
Aldo Moro Road, Marsa
MRS 9065

Alternatively comments can be sent by email to: enquiry@mra.org.mt

Comments related to **coastal waters** and **protected areas** can be sent to:

Directorate for Environment Protection
Malta Environment and Planning Authority
P.O. Box 200,
Marsa, MRS 1000

Or by email to: water@mepa.org.mt

All submissions need to reach the MRA or MEPA by end **September 2010**.

All comments should be marked "*Consultation on the First Draft Water Catchment Management Plan*"

All Comments and suggestions will be published at the end of this consultation period on <http://www.mepa.org.mt/topic-waterpc>

The availability of more information

More detailed information on the implementation of the Water Framework Directive in the Maltese Islands can be obtained from the Malta Environment and Planning Authority website. Reports addressing the characterisation of surface and groundwaters are available at the following webpage:

<http://www.mepa.org.mt/topics-water-islands>

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Acronyms

BQE	Biological Quality Elements
BRGM	Bureau de Recherche Géologique et Minière
EU	European Union
HMWB	Heavily Modified Water Body
IPPC	Integrated Pollution Prevention and Control
MEPA	Malta Environment and Planning Authority
MRA	Malta Resources Authority
MRRA	Ministry for Resources and Rural Affairs
MSA	Malta Standards Authority
MTA	Malta Tourism Authority
NGO	Non Governmental Organisation
NSO	National Statistics Office
OPM	Office of the Prime Minister
POM	Programme of Measures
RO	Reverse Osmosis Desalination
TSE	Treated Sewage Effluent
UNFCCC	United Nations Framework Convention on Climate Change
UWWD	Urban Waste Water Directive
WCMP	Water Catchment Management Plan
WCD	Water Catchment District
WFD	Water Framework Directive
WSC	Water Services Corporation

1 A Water Catchment Management Plan for the Maltese Islands

1.1 The Water Framework Directive

The aim of this plan is to set out ways how to protect, enhance and improve the water environment of Malta and Gozo. The Water Framework Directive requires each Member State to prepare a River Basin Management Plan for each water catchment district within its territory. As there is no permanent river in Malta, the River Basin Management Plan has been renamed the *Water Catchment Management Plan* (WCMP) for the Maltese Islands.

The Water Framework Directive (WFD) requires Member States to achieve environmental goals or objectives in all waters that have been designated as water bodies under the Directive. These environmental objectives can be grouped as:

- **Achieving good status for all water bodies by 2015**; and if this is not possible, aim to achieve good status by 2021 or 2027. '**Good status**' means good ecological status for surface waters up to one nautical mile from the coast; good chemical status for all territorial waters, good chemical and good quantitative status for groundwaters; and good ecological potential for heavily modified water bodies.
- Prevention of the deterioration in the quality of aquatic ecosystems, their protection and the improvement of the ecological condition of all waters;
- The **reduction and progressive removal of hazardous pollutants** and priority substances into the aquatic environment within a 20 year time frame from the date of adoption of the WFD;
- The achievement by 2015 of all objectives and compliance with relevant threshold values for **areas that are protected** under other European directives (see Chapter 3).

In order to reach these objectives, the WFD proposes a general planning process at the river basin or water catchment scale. This process combines:

- The preparation of actions or measures needed to protect or improve the quality of our waters. These need to be implemented within the first WFD cycle. Each planning cycle takes 6 years. These measures are revised during each subsequent cycle.
- The progressive preparation of relevant planning documents that are updated during each planning cycle, and
- A consultation and participation process of the public and interested parties.

The different stages considered during the WFD planning process leading to the formulation of this first Water Catchment Management plan include the following:

- The **characterisation of the water catchment**: presents the actual status of water bodies in the Maltese Islands along with the main pressures and impacts (Chapters 2 and 4) for each water body.

- The **monitoring programme** (Chapter 5) aims at assessing the status of all water bodies and at checking whether the environmental objectives that have been defined are being effectively achieved. The main characteristics of this monitoring programme are also presented in the WCMP.
- The **definition of the environmental objectives** (Chapter 6 and 7) proposed for the water catchment district (the whole of Malta) along with the means of achieving these objectives within the period **2009-2015**;
- The **programme of measures** (PoM) (Chapter 8), defines the actions necessary for addressing the pressures identified and in so doing achieve the environmental objectives set for each water body. The programme of measures will make this plan operational;
- An **economic analysis** (Chapter 9 and 10) is required to understand the tradeoffs between economic development, environmental protection and sustainability. This plan will also determine how costs to provide water services, such as sewage and water supply, can be recovered. An economic assessment is also needed in order to assess the most cost-effective combination of actions or measures needed to protect and improve the quality and quantity of our waters, and thus to consider significantly better environmental options that do not entail disproportionate costs.

A series of technical documents have been produced to support this plan. These documents provide the steps taken to reach the findings of the above chapters. For a full list of these supporting documents refer to Chapter 14.

1.2 National strategy for the implementation of the Water Catchment Management Plan

The Water Framework Directive (2000/60/EC) transposed as Legal Notice 194 of 2004 “The Water Policy Framework Regulations 2004” define the **Malta Resources Authority** (MRA) as the competent authority for groundwater and inland waters; with the exception of inland surface waters protected under the Development Planning Act (1992 as amended) or the Environment Protection Act (2001). Such inland surface waters are placed under the competency of the **Malta Environment and Planning Authority** (MEPA), which is also responsible for coastal waters.

The role of the competent authorities is to coordinate, prepare and produce the Water Catchment Management Plan and report to the European Commission on the implementation of this plan. In addition to the pivotal role of these two authorities, the active involvement of stakeholders and the general public has been imperative to the development of this plan. In fact several stakeholders and the public (see chapter 12) have been consulted during its preparation. Their involvement will not stop with the publication of the plan but will be a continuous process till the end of the first planning cycle (6 years). The success of this WCMP depends fully on the cooperation of several different stakeholders and the public itself.

The WCMP has legal value and a political aim: it gives the administration, the local authorities and the general public, directions and objectives to be achieved in the field of water management. This plan’s objectives have to be in line with other relevant environmental and sectoral policies in order to guarantee an integrated framework for water resource management. For this reason the Water Catchment

management plan was built on the sectoral plans, policies and programmes included in Box 1.1 below

Box 1.1: Integrating the Water Catchment Management Plan into sectoral policies, plans and programmes

The objectives of other water-related European Directives:

- Groundwater Directive (2006/118/EEC)
- Nitrates Directive (91/676/EEC)
- Bathing Water Directive (2006/7/EC)
- Drinking Water Directive (98/83/EC)
- Floods Directive (2007/60/EC)
- Marine Strategy Framework Directive (2008/56/EC)
- Waste Framework Directive (2006/12/EC)
- Sewage Sludge Directive on the protection of the environment and in particular of the soil when sewage sludge is used in agriculture (86/278/EEC), as amended by 91/692/EEC
- Landfill Directive (1999/31/EC)
- Integrated Pollution Prevention and Control Directive (96/61/EC)
- Urban Wastewater Treatment Directive (92/271/EEC)
- EU Directive concerning the placing of plant protection products on the market (91/414/EEC)
- EU Directive on the conservation of wild birds (79/409/EEC)
- EU Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC)
- EU Directive on energy end-use efficiency and energy services (2006/32/EC)
- EU Directive on the Energy Performance in Buildings (2002/91/EC)
- EU Directive on the promotion of the use of energy from renewable sources (2009/28/EC)
- EU Directive on the control of major-accident hazards involving dangerous substance (96/82/EC), as amended by Directive 2003/105/EC

Links with national plans or programmes dealing with the management of waste, resources and climate change strategies were also considered. These included:

- A Draft Sustainable Strategy for the Maltese Islands 2006-2016
- National Strategic Reference Framework 2007 - 2013
- National Reform Programme 2008-2010
- Operational Program I (Structural Funds and the Cohesion Fund 2007-2013)
- The Maltese Code of Good Agricultural Practice
- Solid Waste Management Strategy for the Maltese Islands (September 2001)
- Agriculture Waste Management Plan for the Maltese Islands (June 2008)
- National Rural Development Strategy for the Programming period 2007-2013
- Fisheries Operational Programme for Malta 2007-2013
- Supplementary Planning Guidance: Agriculture, Farm Diversification and Stables (2007)
- First National Communication to the UNFCCC including National Action Plan (2004)
- National Energy Efficiency Action Plan (2008)
- Structure Plan for the Maltese Islands (1990)
- Draft Landscape Assessment Study of the Maltese Islands (2004)
- Draft Environmental Health Action Plan (2006)

The **responsibility of the implementation of this plan** is shared between three major groups of players:

- a. Targeted *primary stakeholders* comprising of government agencies and regulatory authorities that have a leading role in implementing the measures that were defined in the Programme of measures. Primary stakeholders also have a communication role in facilitating communication through existing formal or informal networks down to secondary stakeholders and, in some cases, also to the general public.
- b. *Secondary stakeholders* identified as those agencies or bodies that would have a secondary role in implementing the measures or would be directly or indirectly influenced by the measures and thus are likely to control their successful implementation.
- c. The third group consists of representatives of the general public and opinion leaders which are considered instrumental in disseminating information and in raising awareness of the general public. This group is also expected to encourage the fostering of environmental stewardship.

Each citizen has a role to play in the successful implementation of this plan. It is acknowledged that it is therefore important that the general public becomes fully acquainted with it and is involved in its implementation whenever relevant.

2 Characterisation of the Water Catchment District of the Maltese Islands

2.1 Establishing the Water Catchment District

The Water Framework Directive establishes the river basin as the natural hydrological and geographical management unit for an integrated approach to water management. The Directive requires each Member State to identify individual river basin districts and prepare a River Basin Management Plan for each water district within its territory.

Malta has no large and permanent river systems. Inland surface water systems are small and linked to the dynamics of several dry river valleys, locally called *widien* and their associated catchments. Given their very small size, the Maltese Islands were integrated into one water catchment district under Article 3 of the WFD for the purposes of the implementation of the WFD (see sub regulation 3 (1) of LN 194/2004). Coastal waters up to one nautical mile from the baseline and all groundwaters are included in this district (Map 2.1).

2.2 Water Bodies: Designation and Characterisation

The basic unit of management within a water district is the **water body**. All waters covered by the Directive are divided into water bodies, the boundaries of which encompass as much as possible a homogenous water environment or **water type**.

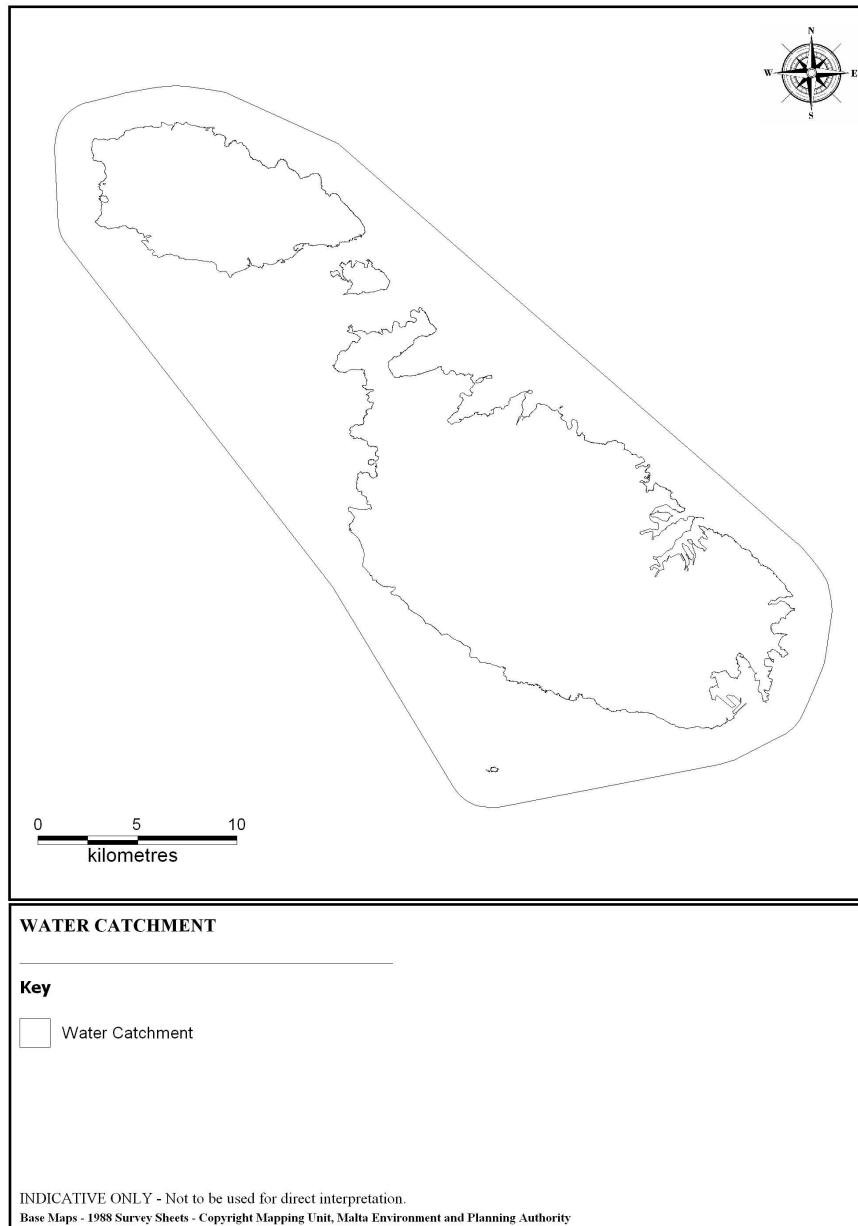
Water bodies for surface and groundwaters were initially identified in 2005 as part of the initial characterisation of waters required by the WFD. The initial designations were revisited during the preparation of this management plan and amended on the basis of updated information and a better understanding of the requirements of the Directive. The number of water bodies being designated in Malta in the first WCMP in each category are shown in Table 2.1.

Table 2.1
Number of water bodies designated by Malta in the first Water Catchment Management Plan by category

	Water Categories				
	Surface Waters				Groundwater
	Rivers	Lakes	Transitional Waters	Coastal Waters	
Natural Water Bodies	0	0	0	7	15
Heavily Modified Water Bodies	0	0	0	2	Not applicable

Map 2.1

The Water Catchment District for the Maltese Islands



2.3 Characterisation of surface water bodies

2.3.1 Coastal water bodies

The coastal waters around the Maltese Islands have been divided into 9 distinct water bodies. The boundaries for the water bodies were determined on the basis of the predominant physical and ecological characteristics, as well as on the nature and magnitude of pressures on the coastal water environment. As much as possible coastal water body boundaries were selected to be contiguous with sub-catchments (Map 2.2). The list of coastal water bodies is shown in Table 2.2.

Coastal water bodies are classified into 4 different types defined by the predominant physical characteristics of the water mass, namely exposure, water depth and predominant currents. The definition of such water body typologies for surface waters is a requirement of the Directive and a fundamental tool that allows the definition of type-specific reference conditions and type-specific ecological status of the water body. Typologies thus enable comparison of like with like, not only on a national but also at the European scale.

Table 2.2

Coastal Water Bodies in the water catchment district

WB Code	Name of the coastal water body	Spatial Extent (km²)
MTC 101	Il-Punent ta' Ghawdex	45.0
MTC 102	Ir-Ramla l-Hamra	23.1
MTC 103	Il-Fliegu ta' Kemmuna	83.9
MTC 104	Il-Mellieha - Tas-Sliema	58.6
MTC 105	Il-Port il-Kbir - Il-Port ta' Marsamxett	11.4
MTC 106	Ix-Xaghjra - Wied il-Ghajj	19.2
MTC 107	Il-Port ta' Marsaxlokk	15.7
MTC 108	L'Irdumijiet ta' Malta	98.0
MTC 109	Il- Qammieh - Fomm ir-Rih	43.0

2.3.2 Inland surface and transitional waters

In as much as the Directive covers all waters, even very small systems¹, inland surface and transitional waters in Malta were initially considered for designation as water bodies and management under the WFD.

Most inland surface waters in the Maltese Islands are linked to the dynamics of several river valleys or '*widien*' and their associated catchments, and for transitional waters, to coastal processes. Within a territory of 316km² in a southern Mediterranean climate, inland surface and transitional waters are very small streams, water courses or standing waters that flow or receive water flow for limited periods of time during the year. Very few watercourses or streams are permanent due to their connection with springs that form from blue clay outcrops in perched groundwater systems and are most common in the northern and north western parts of Malta where perched aquifers are present.

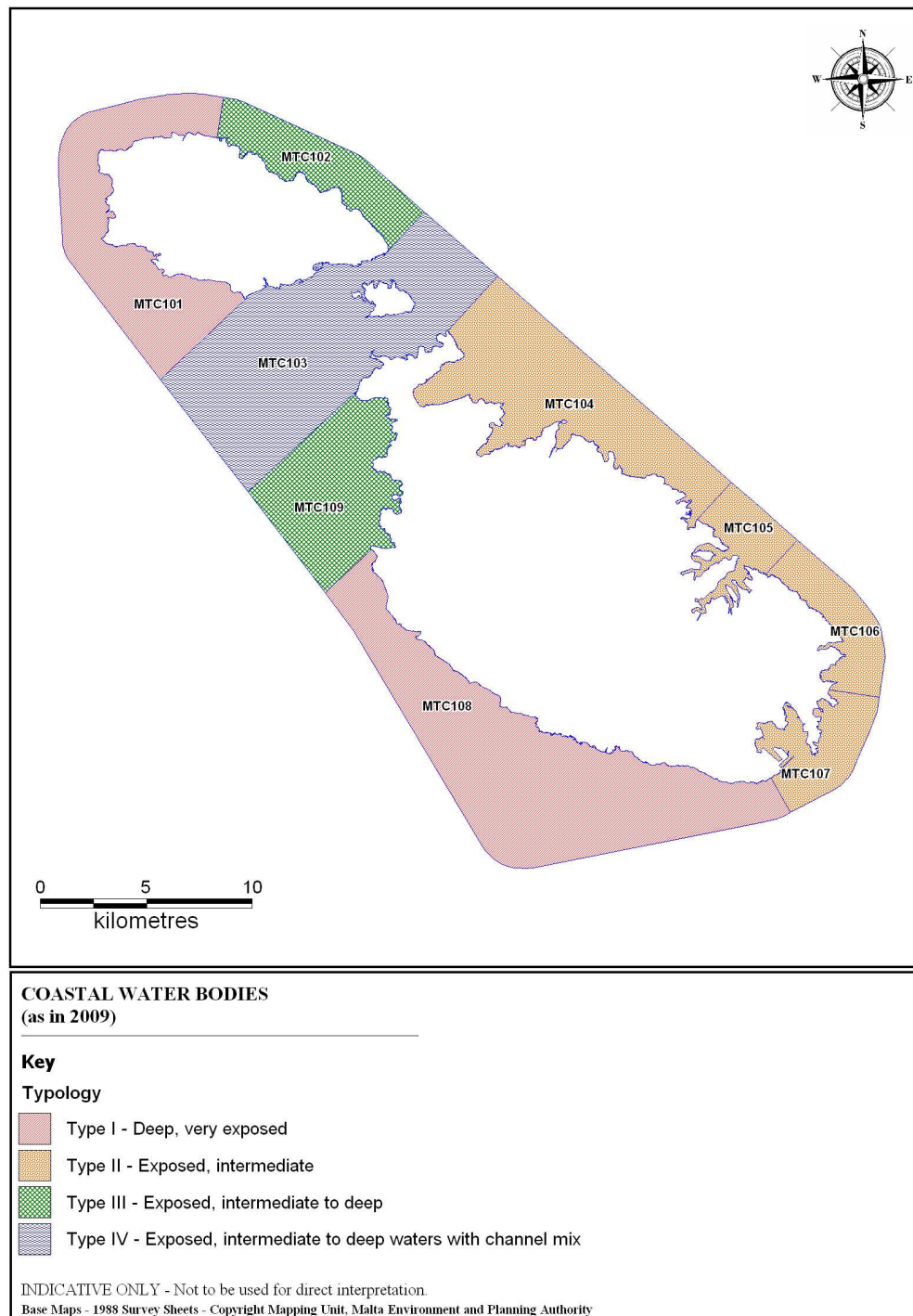
¹ The Water Framework Directive (Annex II – system A) presents two size threshold levels:

- i) for small Rivers the size typology threshold is based on a catchment area of 10-100km²
- ii) for small lakes the size typology is based on the surface area of 0.5-1km²

The inland surface waters found in the Maltese Islands are smaller by several orders of magnitude than these thresholds for smallest water bodies at European scale.

Map 2.2

The Coastal Water Bodies of the Maltese Islands



Being a scarce and exploited resource in the Maltese Islands, valley systems and other inland small water systems merit protection. They constitute important features in the landscape and provide significant ecosystem services such as flood protection, water for irrigation of fields; and areas of recreational value. Inland surface and transitional waters often are of great ecological importance because they harbour a number of species and habitats of conservation value. Indeed, many inland waters have been scheduled as Areas of Ecological and/or Scientific Importance and are also part of Natura 2000 sites designated under the EU Habitats and Birds Directive.

2.3.2 Assessing the water bodies designated in the Article 5 Report

In its Article 5 report of 2005, Malta preliminary designated 10 inland surface water bodies under the WFD (see Article 5 Report – <http://www.mepa.org.mt/topics-water-islands>) for which 3 'transitional waters', 4 'lakes' and 3 'rivers' were identified (see Map 2.3). Nine of these water bodies are now part of the NATURA 2000 network through the provisions of the Habitats and Birds Directives or both, through *LN 311 of 2006 Flora and Natural Habitats Protection Regulations*.

As water-dependent NATURA 2000 sites (that is, they harbour protected species and/or habitats that depend on the presence of water for their survival) nine of these water bodies are listed in the register of protected areas established by Article 6 of the WFD and consequently, should be managed under both the WFD and the Nature Directives. In practical terms, this means that the separate objectives of good water status of the WFD and favourable conservation status of the Nature Directives should all be achieved within these sites. In many instances, these objectives will compliment each other; where objectives differ or conflict, the most stringent applies. Applying the WFD objectives to water-dependent NATURA 2000 sites also introduces the requirement to achieve water-related objectives in 2015 – the same deadline for achieving good status in WFD water bodies.

The assessment of ecological status² as required by the WFD proved difficult for inland surface and transitional waters. This was because of a significant lack of historical scientific data on the biological indicators and supporting physico-chemical quality elements defined by the WFD. Furthermore, the WFD requires the definition of undisturbed reference conditions³ for each type of inland surface water body identified. Reference conditions are very difficult, if not impossible, to establish in the local scenario – many inland water systems have been irreversibly degraded, mostly through urbanisation, and no data exists to determine what these systems would look like in an undisturbed state. Moreover the WFD requires that reference conditions are established for each water body type (i.e. different reference conditions for lakes, rivers and transitional waters). Each water body, however, is inherently different, even within the same grouping or type. This means that any quality element is expected to operate differently in each water body, making it impossible to establish a typical reference condition.

Thus, the ecological status of the designated water bodies cannot, at present, be described with the scientific precision and confidence required by the prescribed

² Ecological Status is defined as an expression of the quality of the structure and the functioning of aquatic ecosystems associated with surface waters, classified according to Annex V. The assessment of ecological status as defined by the WFD is based on the status of a number of biological, physico-chemical and hydromorphological components of the aquatic system (called 'quality elements' in the Directive) of which biological elements are given the greatest weighting.

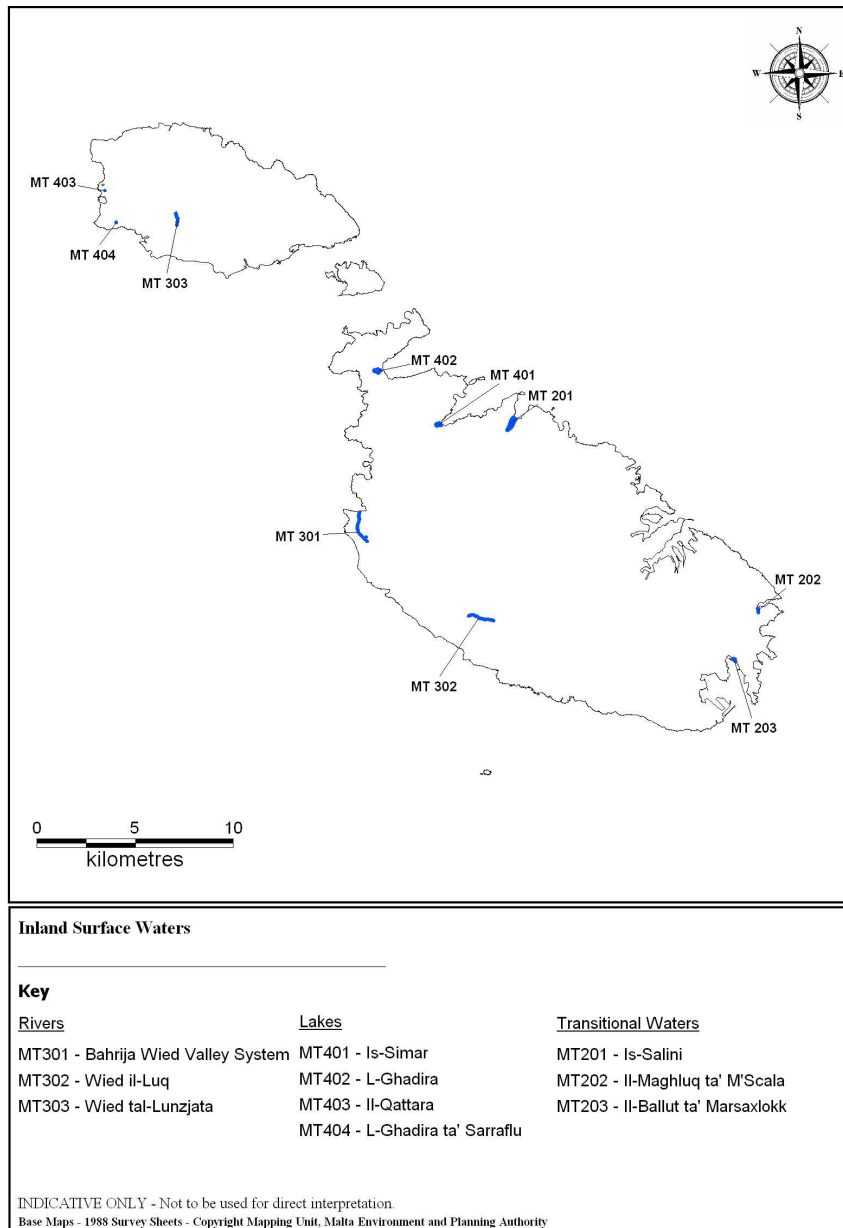
³ Type-specific reference conditions are obtained by reference to a water body of the same type at high ecological status and therefore it is a water body that has suffered very little human alterations.

WFD methodology. It is therefore not possible for Malta to apply the WFD assessment of good ecological status to these water bodies. In 2010 Malta will be launching detailed baseline surveys for the 3 streams and the data gathered from these surveys will help to define the appropriate monitoring and assessment regime for these waters, given their unique characteristics.

In parallel, the implementation of Habitats Directive in these water bodies will help to achieve at least to a degree the purposes of the Water Framework Directive, The Habitats Directive requires Member States to set up actions or measures to maintain or restore habitats and species to 'favourable conservation status.' By achieving favourable conservation status in these very small water bodies, the quality of water shall improve. and thus it is expected that the the purposes of the WFD as reflected in Article 1 – to prevent further deterioration and to protect and enhance the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems – will to a degree be achieved.

Malta is currently working to develop management systems to restore these ecosystems to the favourable conservation status for their protected habitats and species. Management measures should be in place by 2013. The management options for these water bodies will be revisited once more scientific data is obtained through monitoring programs that are being set up to collect baseline data.

Map 2.3
Inland surface waters as designated in 2005



2.4 Characterisation of Groundwater bodies

2.4.1 Background

The Maltese Islands are mainly composed of two porous and fissured limestone formations, the Upper Coralline Limestone and the Globigerina/Lower Coralline Limestone; separated by a relatively thin layer of clayey and marly material known as the Blue Clay formation. The lithologically different natures of these formations, together with their geological position, give rise to two broad aquifer types:

- the Upper Aquifer (also known as the Perched Aquifer) at the bottom of the Upper Coralline Limestone formation. The bottom layer of this aquifer is the Blue Clay

formation. In the northern part of the island of Malta, due to the general geological structure, this aquifer is in direct contact with sea-water.

- the Lower Aquifer (also known as the Sea-Level Aquifer) is contained in the lower limestone units (porous and fissured Globigerina and/or Lower Coralline Limestone). It is partly covered by the perched aquifer with a rather thick unsaturated zone in between. This aquifer is normally in direct contact on its boundaries with sea-water.

2.4.2 Identification of the main groundwater bodies

The delineation of groundwater bodies in the Maltese Water Catchment District was strictly based on geological boundaries, and resulted in the initial identification of sixteen hydro-geologically separate aquifer blocks. These are outlined in Table 2.3 below and presented in Map 2.4.

Table 2.3

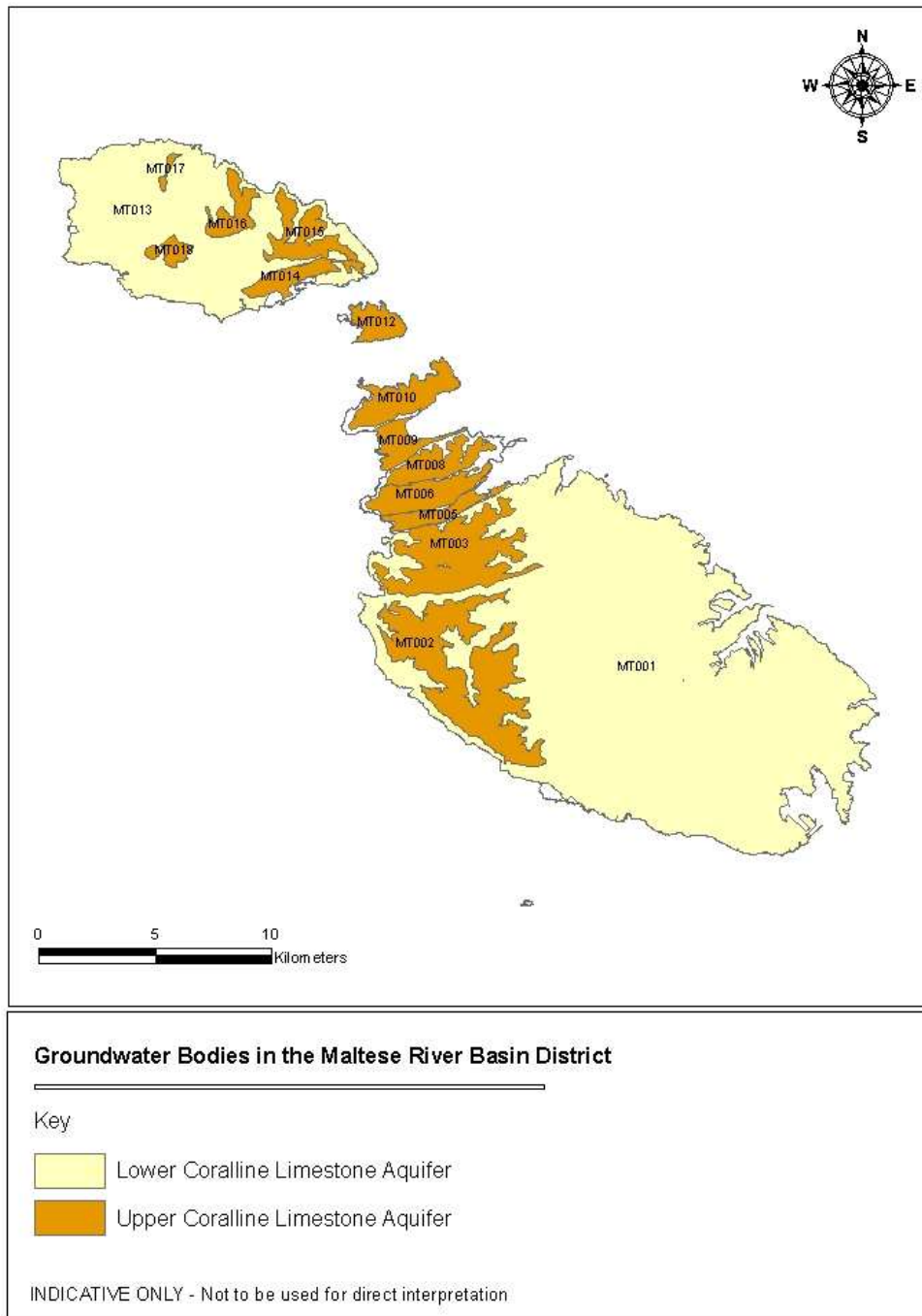
Groundwater bodies in the Maltese water catchment district

GWB Code	Name of the groundwater body (GWB)	Spatial Extent (km²)
MT001	Malta Mean sea level	216.6
MT002	Rabat-Dingli Perched	22.6
MT003	Mgarr-Wardija perched	13.7
MT005	Pwales coastal	2.8
MT006	Mizieb Mean Sea Level	5.2
MT008	Mellieha perched	4.5
MT009	Mellieha coastal	2.9
MT010	Marfa coastal	5.5
MT012	Kemmuna Mean Sea level	2.7
MT013	Gozo mean sea level	65.8
MT014	Ghansielem perched	2.7
MT015	Nadur perched	5.0
MT016	Xaghra perched	3.0
MT017	Zebbug perched	0.4
MT018	Victoria-Kercem perched	1.5

Studies undertaken as part of the WFD's further characterisation process leading up to the development of the Water Catchment Management Plan, have indicated that the geological structure previously defined as MT011 – the Mqabba-Żurrieq perched groundwater body, can, to all effects, not be considered as a body of groundwater. This since the function of this structure is primarily that of retarding percolating groundwater to the main mean sea level groundwater body and its effective annual groundwater yield is below the 'significance' thresholds indicated in the Directive.

Map 2.4

Designated groundwater bodies in the Maltese water catchment district



2.4.3 Development of conceptual models

Hydrogeological conceptual models are simplified representations, or working descriptions, of a hydrogeological system. These models are an important tool in water catchment management, in as much as they provide the basis for the assessment of pressures and their impact on the groundwater body and also direct the development of monitoring networks. Conceptual models provide an

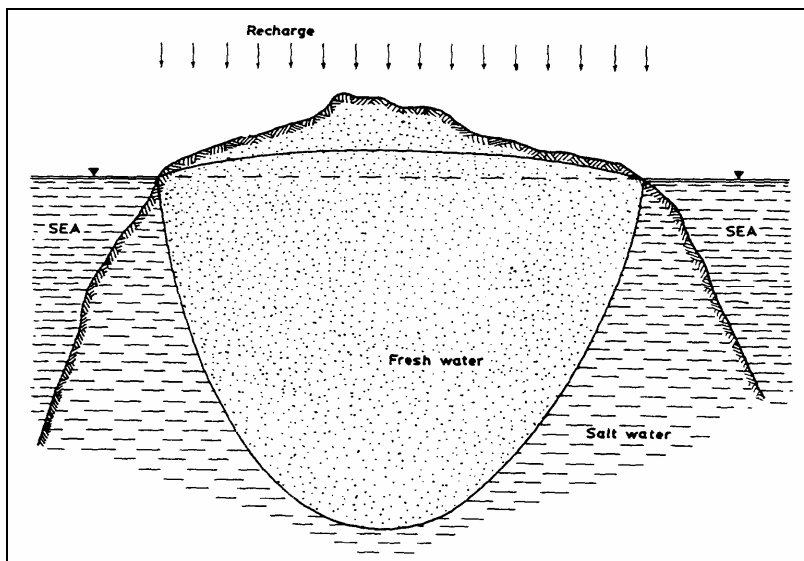
understanding of how the hydrogeological system works and therefore also directs the assessment of the status of the groundwater body.

Regional conceptual models were developed for the three main groundwater body typologies identified in the Maltese Water Catchment District. These models were based on existing hydrogeological information and were used to direct the development of monitoring networks and the status assessment process.

2.4.4 Sea Level Groundwater Bodies

In their simplest form, sea-level groundwater bodies are considered to take the shape of a lens of fresh-water floating on the denser saline water, closely following the Ghyben-Herzberg model (Figure 2.1). These groundwater bodies are therefore in direct contact with sea-water both in the horizontal and in the vertical direction; making them highly prone to the intrusion of saline waters through natural diffusion processes and also in response to pumping activities.

Figure 2.1
Simple scheme for a Ghyben-Herzberg Groundwater Body (Source: UNESCO)



This basic model was the starting point for the development of a more detailed conceptual model for the sea level groundwater bodies, which assumes that:

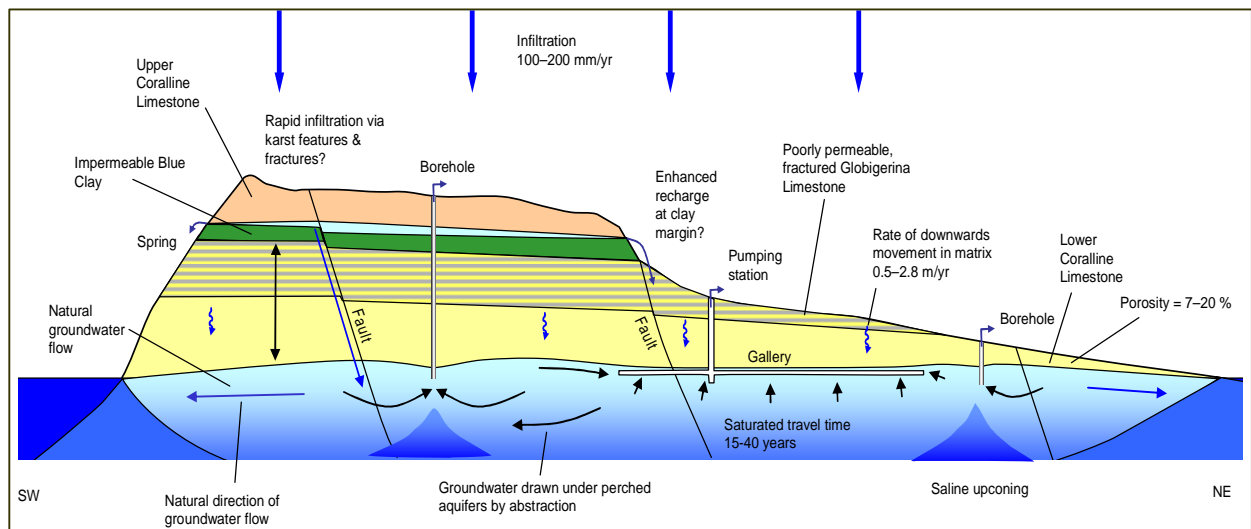
- The Lower Coralline Limestone is present across the whole island.
- It is capped in certain areas by the overlying impermeable Blue Clay and the Greensand and more extensively by the less permeable strata of the Globigerina Limestone.
- the water table is controlled by abstraction and is presently up to only 3m above sea-level in places. This means that here the aquifer is protected by the overlying strata, rather than being confined in a hydraulic sense. Abstraction also leads to saline upconing and an increase in salinity.

- the relatively low porosity means that the rate of downwards movement in the aquifer matrix will be greater than in the perched aquifers, but the unsaturated travel time will be long in the thicker parts of the aquifer. The limited detection of coliforms indicates that the rapid transport from the surface to the aquifer is limited.
- Chlorofluorocarbon (CFC) data shows that residence times in the saturated zone are in the range of 15-40 years. Combined with the low estimates of transmissivity from pumping tests, this suggests that movement in enlarged solution features is limited.
- there are a number of possible mechanisms for recharge to the part of the aquifer capped by the Blue Clay, where groundwater appears to be of similar age to the rest of the aquifer:
 - o slow infiltration through the Blue Clay from the upper aquifer;
 - o enhanced recharge at the edge of the Blue Clay or the Middle Globigerina;
 - o rapid infiltration along faults and fractures.

A schematic representation of the conceptual model is provided in Figure 2.2.

Figure 2.2

A conceptual Model of a sea-level groundwater body

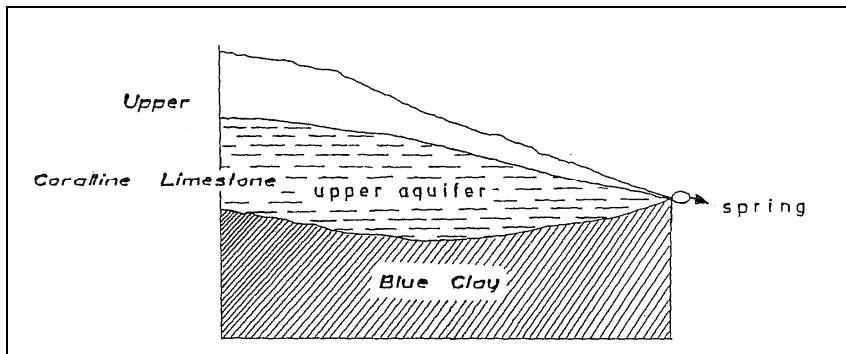


2.4.5 Perched Groundwater Bodies

Similar detailed conceptual models were developed for the main perched groundwater body systems. In their simplest form, these conceptual models assume the development of a saturated zone in the lowest horizons of the Upper Coralline Limestone sustained by the underlying Blue Clay formation (Figure 2.3).

Figure 2.3

Simple scheme for a perched groundwater body (source: IGN)

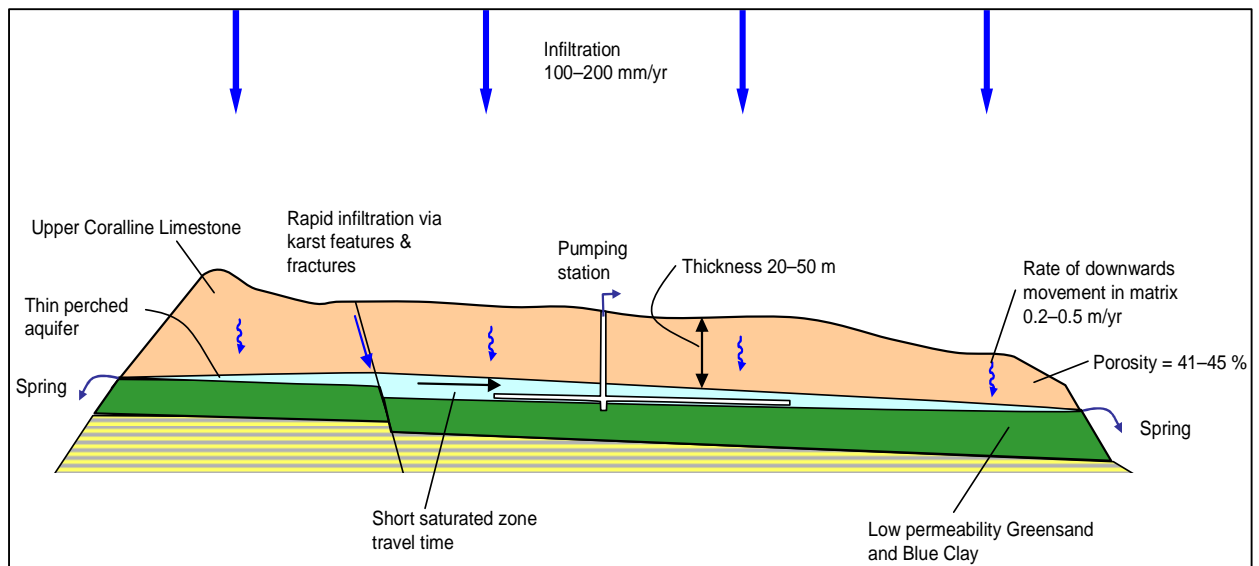


The conceptual model for the perched aquifers as developed as part of the further characterisation process, therefore assumes:

- these aquifers are present in the areas where the Upper Coralline Limestone outcrops and are of limited saturated thickness;
- the high detection rate of coliforms suggests a short residence time, with rapid transport from the surface through fractures being a distinct possibility;
- the lower permeability and high porosity means that the rate of downward movement in the aquifer matrix will be slow and the travel time in the unsaturated zone will be long in the thicker parts of the aquifer.

A schematic representation of the conceptual model for a perched groundwater body is provided in Figure 2.4.

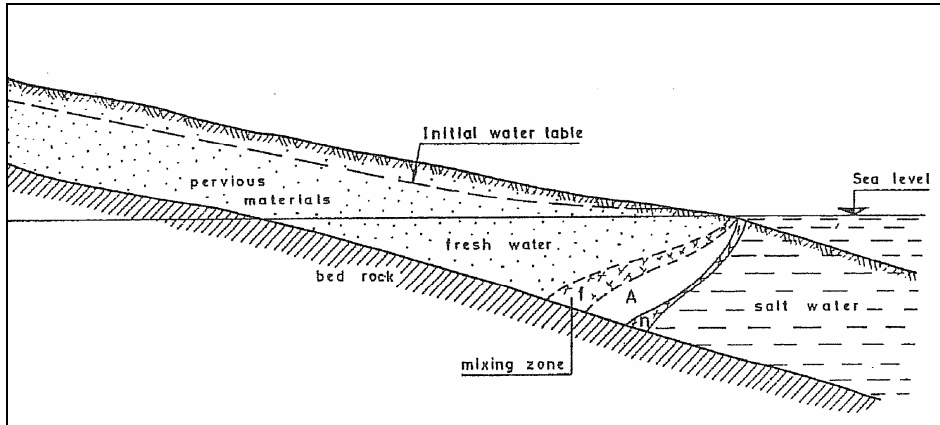
Figure 2.4
Conceptual Model of a perched groundwater body



Coastal groundwater bodies can essentially be considered as 'perched groundwater bodies', where due to the geological structure of the island the aquifer formation has been depressed to below sea-level at one of the ends (Figure 2.5). Therefore, this situation introduces a new boundary condition at the coast, where freshwater is now bounded by the denser sea-water and the interface takes the form of a coastal wedge.

The conceptual model for the coastal groundwater bodies is therefore similar to that developed for the perched aquifer systems, being characterised by shallow depths to the saturated zone and relatively short travel times from the surface to groundwater. However, the limited contact with sea-water introduces the sea-water intrusion factor, where lateral intrusion particularly through fractures and solutional openings in the Upper Coralline aquifer is considered to be an important factor affecting the quality of the groundwater body.

Figure 2.5
Simple scheme for a coastal groundwater body (Source: UNESCO)



3 Protected Areas

Several EU Directives require the designation of areas of surface waters and groundwaters for specific protection. One of the objectives of the Water Catchment Management Plan is to meet the specific requirements of all protected areas lying within the water catchment management district that have been designated as requiring special protection under other EU legislation.

3.1 NATURA 2000 areas

The Habitats and Birds Directive both require that Malta identifies Special Areas of Conservation and Special Protection Areas for the conservation of specific habitats and species. In some cases the survival of some of these habitats and species are directly dependent on the status of water. Where this is the case, the site was included within the protected area register of the WFD (Map 3.1 & Table 3.1).

Water-dependent species are those that live their entire life-cycle within a body of water, as well as those species that have at least one aquatic life-stage or that require water for foraging. Such species include for instance the freshwater crab (*Potamon fluviatile lanfranco*) and the painted frog (*Discoglossus pictus pictus*).

Water-dependent protected habitat types included in the register were:

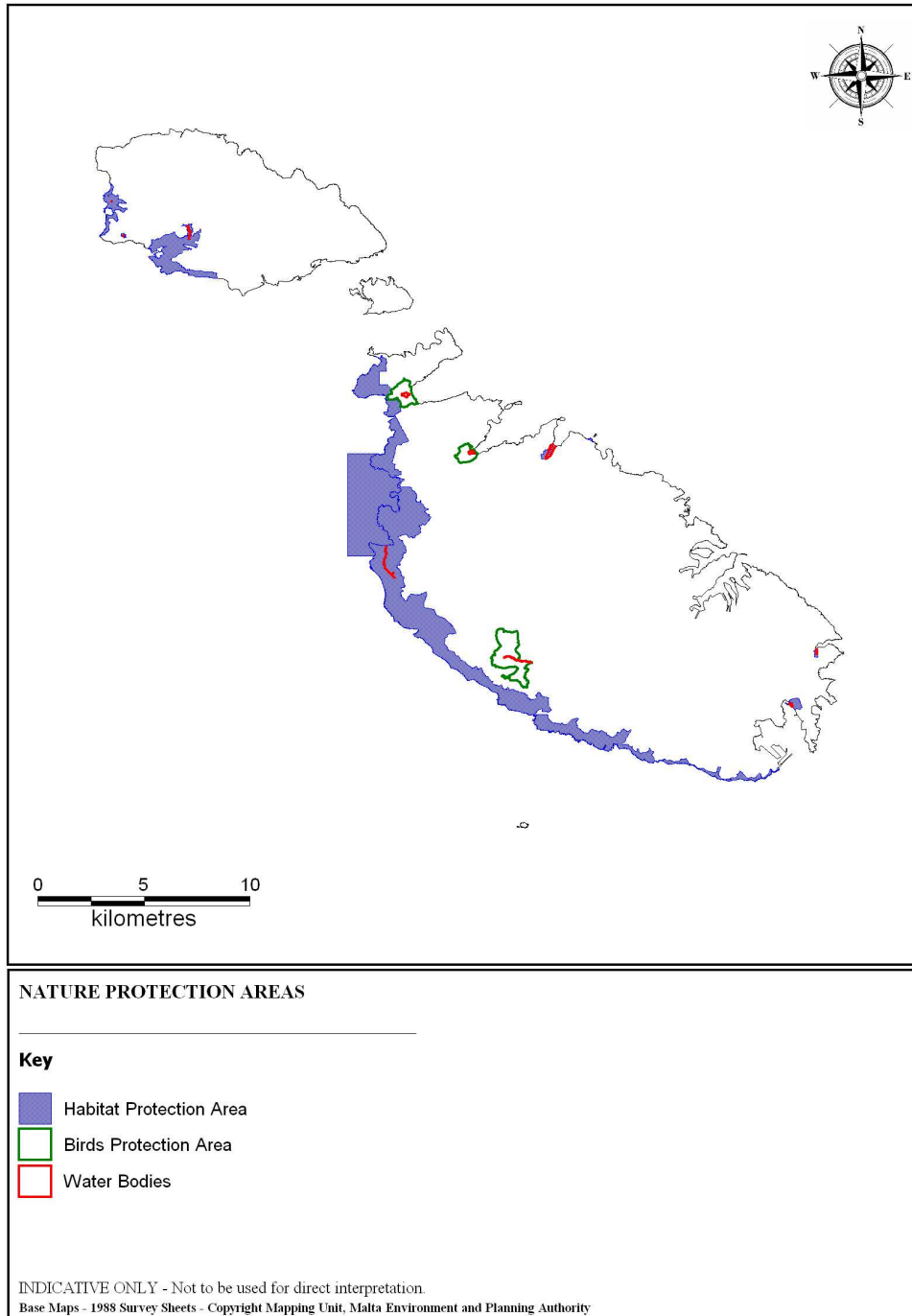
- Habitats that occur entirely within surface water systems; such as water courses (for example the Baħrija water course, Wied Il-Luq, and Wied Lunzjata) and standing water pools (e.g. L-Għadira),
- Habitats that depend on the frequent inundation of coastal waters; such as transitional marshlands and wetlands (e.g. Is-Salini, Il-Magħluq ta' Marsascale and Il-Ballut ta' Marsaxlokk).
- Habitats that depend on a connection with percolating water; such as permanent freshwater pools (Il-Qattara, L-Għadira ta' Sarraflu).

Table 3.1
Protected Natura 2000 sites

Protected Area Type	Name	UNIQUE_ID	Area (HA)
Natura 2000 - SAC	Ballut - Marsaxlokk	MT 0000014	23.34
Natura 2000 - SAC	Il-Magħluq ta' Marsascale	MT 0000023	4.42
Natura 2000 - SAC	Is-Salini	MT 0000007	23.67
Natura 2000 - SAC /SPA	Is-Simar	MT 0000006	58.30
Natura 2000 - SAC/SPA	L-Għadira Area	MT 0000015	97.74
Natura 2000 –SAC/ SPA	Buskett Girgenti area	MT 0000018	225.38
Natura 2000 - SAC	Malta Coastal Cliffs 1/8: Qammieh Area	MT 0000024	2316.29
Natura 2000 - SAC	Dwejra-Qawra Area (incl. Hagret General)	MT 0000019	86.93
Natura 2000 - SAC	Xlendi - Wied tal-Kantra Area	MT 0000020	296.30
Natura 2000 - SAC	Rdum Majjiesa – Ras ir-Raheb	INT 025	9520.00

Another important Natura 2000 area listed in the Protected area register was the Marine Protected area of Rđum Majjiesa to Ras ir-Raheb. This particular site was designated as an SAC since it supports a representative selection of all major biotopes occurring in the Maltese marine environment including the *Posidonia* and *Cymodocea* seagrass meadows.

Map 3.1
Terrestrial Natura 2000 areas and protected waters



3.2 Recreational (bathing) areas

A requirement of the Bathing Water Directive 2006/7/EC is to achieve specific mandatory water quality standards for the protection of bathers. The objective for Bathing Water protected areas is to achieve a bathing water class of at least 'sufficient' by the end of 2015. Malta is also expected to take feasible actions as considered appropriate with a view of increasing the number of bathing waters classified as 'excellent' or 'good'.

In total there are 36 coastal bathing areas around the Maltese Islands, where water quality is monitored and classified in accordance with the requirements of the Bathing Water Quality Directive. The total number of monitoring points for bathing waters is 86 and their location is shown in Map 3.2. In 2008 98.9% of Malta's bathing waters met the mandatory values of the EU Directive. This was an increase of 3.4% from the previous year. 94.3% of bathing areas met the more stringent values, registering an increase of 4.6% from the previous year.

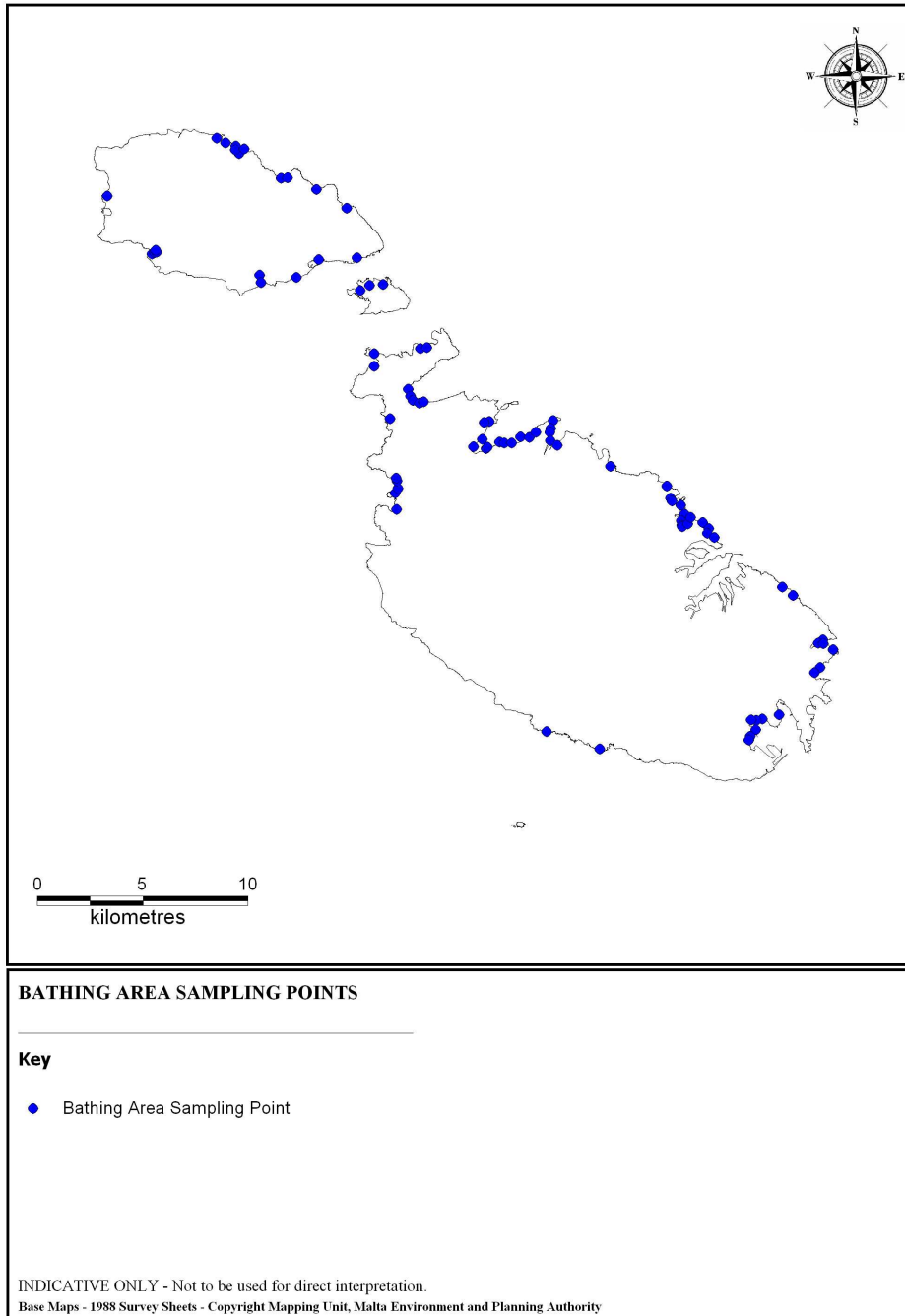
Table 3.2
Bathing areas as monitored by the Department for Environmental Health

Related WFD Water body	Name	Related WFD Water body	Name
MTC 107	Pretty Bay		
MTC 107	St. George's Bay	MTC 109	Ghajn Tuffieha
MTC 108	Ghar Lapsi	MTC 109	Gnejna
MTC 106	Marsacala Bay	MTC 109	Golden Bay
MTC 107	Marsaxlokk Bay	MTC 103	Little Armier
MTC 107	St. Thomas Bay	MTC 104	Mellieha Bay
MTC 108	Wied iz-Zurrieq	MTC 104	Mistra Bay
MTC 106	Xghajra	MTC 104	Qawra
MTC 104	Bahar Ic-Caghaq	MTC 104	Salini
MTC 104	Balluta Bay	MTC 104	St Paul's Bay
MTC 104	Pembroke	MTC 103	Comino
MTC 104	Sliema	MTC 101	Dwejra
MTC 104	Spinola Bay	MTC 102	Marsalforn
MTC 104	St Julian's	MTC 102	Xaghra
MTC 109	Anchor Bay	MTC 102	Nadur
MTC 103	Armier	MTC 102/MT 103	SE Gozo
MTC 104	Bugibba	MTC 103	S Gozo
MTC 103	Cirkewwa	MTC 101	Xlendi Bay

Apart from these designated bathing areas, the Malta Maritime Authority has also defined 26 swimming zones around the Maltese Islands. The purpose of these swimming zones is to guarantee the safety of bathers. All of these lie within the bathing areas identified by the Department for Environmental Health.

Map 3.2

The location of Bathing area sampling points in the Maltese Islands



3.3 Nutrient-sensitive areas

There are two types of nutrient-sensitive protected areas:

1. Areas that have been designated under the Urban Waste Water Treatment Directive (91/271/EEC).
2. Areas that have been designated under the Nitrates Directive (91/676/EEC).

The general objective of the Urban Waste Water Treatment Directive is to protect the environment from the adverse effects of sewage discharges from urban and industrial conglomerates. The emission standards for discharges to a UWWTD designated Nutrient Sensitive Protected Area must be achieved within seven years of the designation of that area. UWWTD nutrient sensitive sites were designated through L.N. 340/2001 (see Table 3.3) which means that the emission standards of discharges should be achieved in 2012. In the case of Malta, wastewater discharged in the Qammieh Point – Ras ir-Raheb sensitive zone is already treated to the specific emission standards.

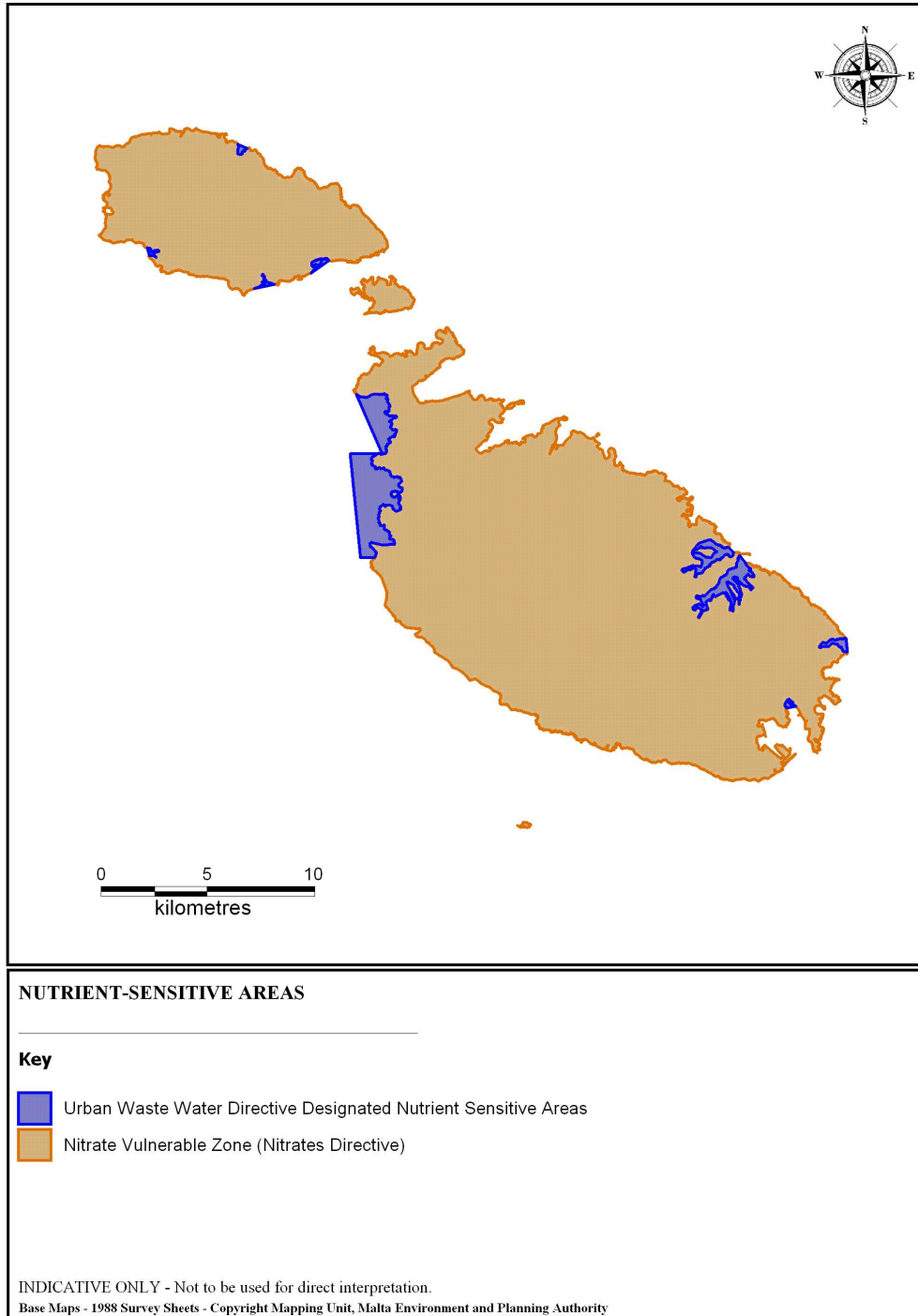
Table 3.3
UWWTD Sensitive Areas

Protected Area Type	Related WFD water body	Name	Date of Designation
Urban Waste Water Sensitive zone	MTC 107	Marsaxlokk Bay	2005
Urban Waste Water Sensitive zone	MTC 106	Marsacala Bay/Wied il-Ghajn Bay	2005
Urban Waste Water Sensitive zone	MTC 105	Marsamxetto and the Grand harbour	2005
Urban Waste Water Sensitive zone	MTC 109	Qammieh Point till Ras ir-Raheb	2005
Urban Waste Water Sensitive zone	MTC 103	Mgarr Harbour	2005
Urban Waste Water Sensitive zone	MTC 101	Mgarr ix-Xini	2005
Urban Waste Water Sensitive zone	MTC 101	Xlendi Bay	2005
Urban Waste Water Sensitive zone	MTC 102	Marsalforn Bay	2005

The general objectives of the Nitrates Directive is to reduce water pollution caused by nitrates from agricultural sources and prevent any further quality deterioration in these waters. The Nitrate Directive requires Member States to implement action programmes within 5 years of designating a Nitrate Vulnerable Zone (NVZ). Malta has designated the whole territory of Malta and Gozo as being nitrate vulnerable. Malta is required to revise its action programme if it becomes apparent that, unless revisions are made, the objectives of the Nitrates Directive will not be achieved.

Map 3.3

Nutrient sensitive areas defined in the 'Urban Waste Water Treatment' Regulations and the 'Protection of Water against pollution caused by nitrates from agricultural sources' Regulations



3.4 Areas designated for the protection of economically significant aquatic species.

Malta has not designated any surface waters within the water catchment district for the protection of economically significant aquatic species. The 25 nautical mile fisheries protection zone established through Act no.24 July 1978 is outside the boundaries of the catchment district and hence will not be described here.

3.5 Drinking Water Protected Areas

The Water Framework Directive under Article 7 requires that '*water bodies used for the abstraction of drinking water*' be designated as protected areas. This designation process therefore entailed the identification of all the groundwater bodies which are currently being utilised by the Water Services Corporation for the abstraction of water intended for human consumption (Map 3.4). These groundwater bodies are presented in table 3.4 below.

Table 3.4

Groundwater bodies used for the abstraction of water intended for human consumption.

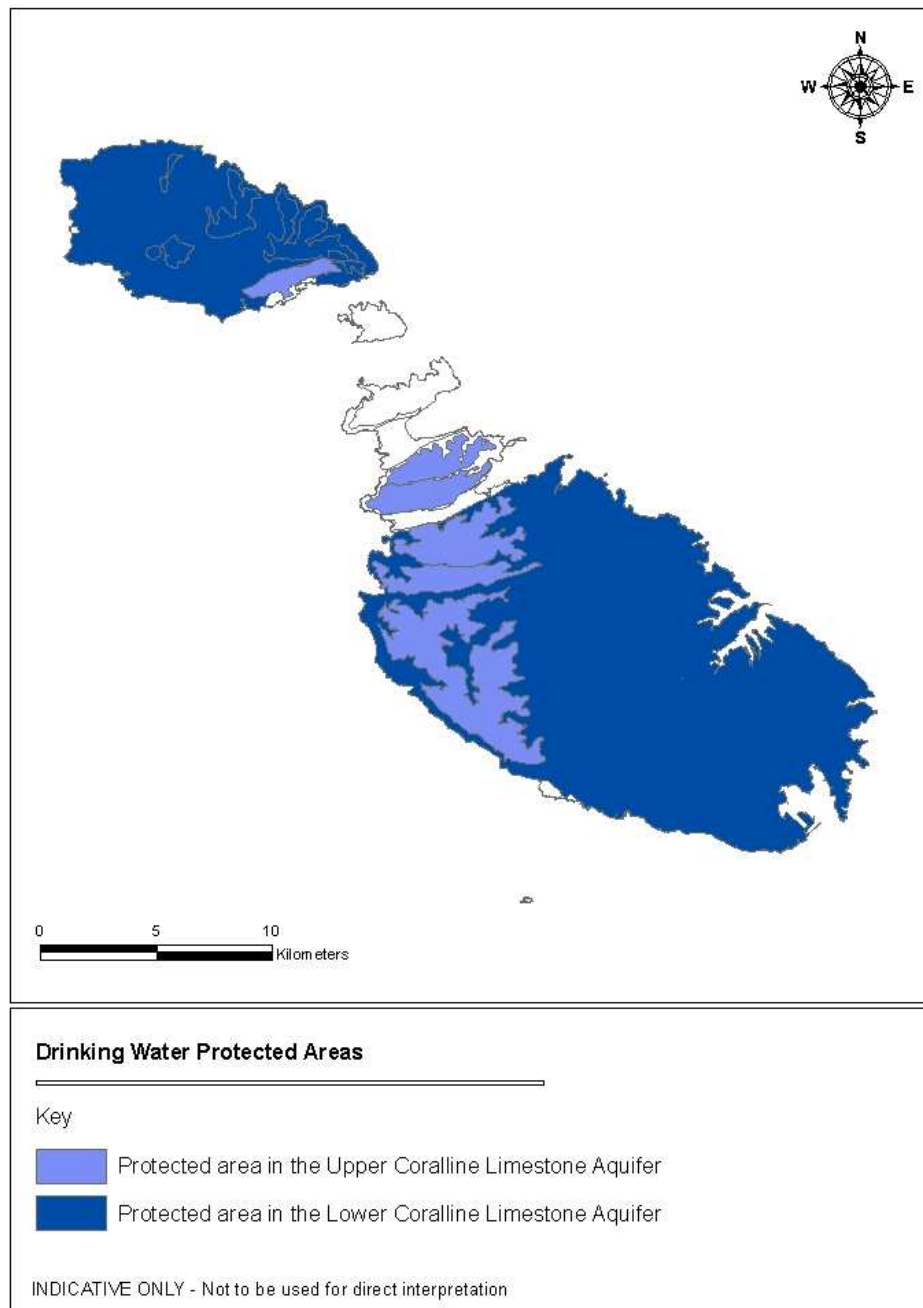
Groundwater Body Code	Groundwater Body Name
MT001	Malta Main Mean Sea Level
MT002	Rabat-Dingli Perched
MT003	Mgarr-Wardija Perched
MT006	Mizieb Mean Sea Level
MT008	Mellieha Perched
MT013	Gozo Mean Sea Level
MT014	Ghajnsielem Perched

It is noted that the list includes the Rabat-Dingli perched and the Mellieha perched groundwater bodies, where groundwater abstraction for potable purposes has been discontinued since 2000 due to their extremely high nitrate concentration. It is envisaged however that with the adoption and full implementation of the Action Program required by LN343 of 2001 on Nitrates from Agricultural Sources, the nitrate content in these groundwater bodies will progressively decrease making these groundwater sources once more potentially utilizable for the public distribution network.

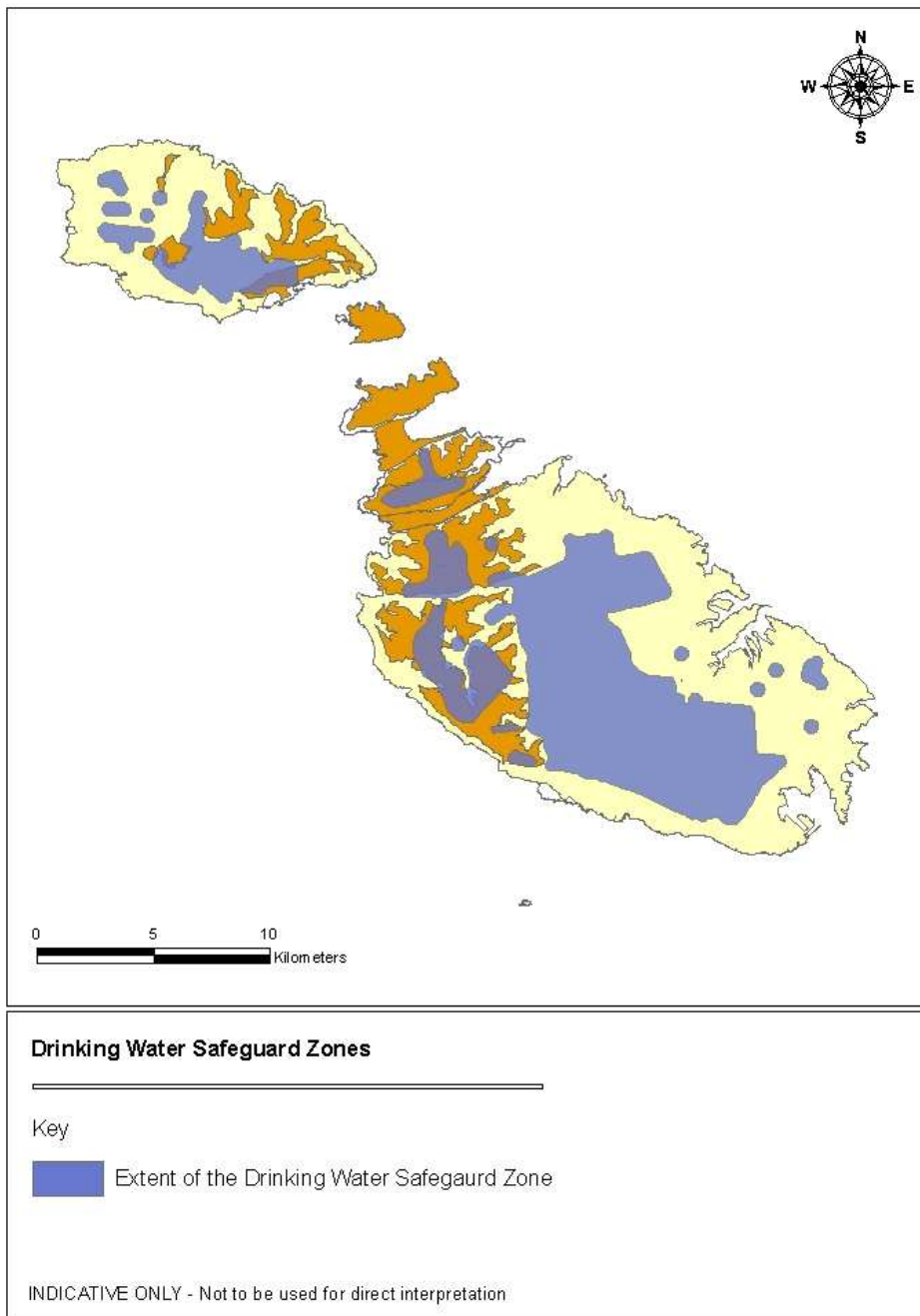
3.5.1 Drinking Water Safeguard Zones

The WFD also allows the establishment of 'safeguard zones' wherein Member States may focus the application of pollution prevention measures. In the Maltese Water Catchment District such a "safeguard zone" has long been established and is more commonly known as the "groundwater protected zone". This zone was established on the basis of the location of the public groundwater abstraction zones. Abstraction of groundwater creates a zone of influence centred around the abstraction source throughout which, groundwater flow is diverted to the source. The extent of this zone of influence was estimated through the use of numerical groundwater body models (Map 3.5). Thus, the Groundwater Protection Zone was determined by constructing a 300m buffer zone around each public abstraction source and subsequently joining these buffer zones together.

Map 3.4
Drinking water protected areas



Map 3.5
Drinking Water Safeguard Zones in the Maltese Water Catchment District



4 Pressures and Impacts on our waters

4.1 Introduction

Human activity impacts on the environment; in some situations, our water environment faces pollution and deterioration in both qualitative and quantitative terms. Some pressures, mainly of an industrial nature, have altered the water environment limiting the attainment of good status within a water body and in some cases further thwarting anthropogenic and ecological use of the water body.

The pressure and impact assessment shows whether there is a likelihood that a water body would be at risk of failing to meet the Water Framework Directive's environmental objectives by 2015, unless appropriate measures are taken.

'At risk' does not imply that the water body can be readily classified as being of poor status. However, it draws our attention to priority issues or areas where appropriate management measures are needed to ensure that good status is achieved. Thus, the pressures identified here are those that alone, or in combination, have the potential to cause impacts which would prevent the objectives of the WFD from being achieved. Through mitigating the impacts identified, the actions or Programme of Measures described in Chapter 8 aims at achieving good status.

4.2 Pressures and Impacts on Surface Waters

4.2.1 Background

The main issues responsible for placing coastal waters in the Maltese islands 'at risk' of failing to achieve the environmental objectives of the Directive primarily involve:

- (i) point source pollution from urban and industrial sources such as urban waste water discharges, sewage overflows, and direct discharges from industries
- (ii) diffuse sources from industrial sources and urban runoff
- (iii) hydromorphological alterations - These are pressures that bring about morphological alterations in the depth, width, quantity, structure and substrate of an inland surface water or coastal water body.

As for protected inland surface waters, the main pressures comprise the following:

- (i) Nitrate contamination of surface waters through crop production and animal husbandry practices
- (ii) Surface and groundwater abstraction leading to the deterioration of freshwater flows in water course environments.
- (iii) Hydromorphological changes or physical modifications of surface water environments brought about by urban development.

Table 4.1

The main pressures which contribute towards coastal water bodies being classified as at risk of failing to achieve the environmental objectives of the Directive

Code WB	Name of the water body (WB)	Risk Review	Significant pressures			
			Point source pollution	Diffuse source pollution	Hydromorphological pressures	Biological pressures
MTC 101	Il-Punent t'Ghawdex	Not at risk		X		?*
MTC 102	Ir-Ramla l-Hamra	Not at risk		X		?
MTC 103	Il-Fliegu ta' Kemmuna	Not at risk	X	X	X	?
MTC 104	Il-Mellieha-Tas-Sliema	Not at risk	X	X	X	?
MTC 105	Il-Port il-Kbir Marsamxett	At risk	X	X	X	?
MTC 106	Ix-Xaghja	At risk	X		X	?
MTC 107	Il-Port ta' Marsaxlokk	At risk	X	X	X	?
MTC 108	L'Irdumijiet ta' Malta	Not at risk		X		?
MTC 109	Il-Qammieh – Fomm ir-Rih	Not at risk	X	X	X	?

? – Extent of pressure is not known

'At risk' does not imply that the water body can be readily classified as being of poor status, but it does draw our attention to priority issues or areas where appropriate management measures are needed to ensure that good status is achieved.

Table 4.2

A summary of the main pressures found in protected surface waters

Name of surface water element located within a protected area	Significant pressures				
	Point source pollution	Diffuse source pollution	Quantitative pressures	Hydromorphological pressures	Biological pressures
Bahrija Valley System	X	X	X		X
Wied il-Luq		X	X	X	

Wied tal-Lunzjata		X	X		
Ballut Ta' Marsaxlokk		X		X	
Il-Magħluq ta' Marsascale	X	X	X	X	X
Is-Salini	X	X	X	X	
Is-Simar	X	X	X		
L-Għadira		X		X	
L-Għadira ta' Sarraflu		X			X
Il-Qattara		X			X

4.2.2 Point sources of pollution

The principal point sources of pollution in surface waters in Malta occur on the coast from urban and industrial sources. Historically, the discharge of municipal wastewaters into coastal waters has been the most visible form of pollution. With the implementation of the Urban Waste Water Directive (91/271/EEC) the impacts of wastewater discharged in these waters are being mitigated. It is expected that by the end of 2010 all municipal wastewater will be treated and only second class treated wastewater will be discharged in coastal waters.

Today, the only **urban waste water outfall** on the Islands that discharges untreated municipal wastewaters is located at Wied Għammieq and is the principal and most significant point source in MTC 106. The sewage is released into the sea via a submarine pipe that runs perpendicular to the coast. When the submarine outfall is not operating, sewage is discharged directly at the shore.

The release of untreated wastewaters results in microbiological and nutrient pollution in the coastal waters of Xgħajra. While there is no evidence of extensive nutrient enrichment in the area, very likely because of the nature of the exposed coastline, there are indications of pollution. Studies⁴ carried out involving the assessment of Chlorophyll a levels monitored by satellite remote sensing, exhibited low chlorophyll a levels along the MTC 106 (Ix-Xgħajra) water body up to Żonqor point, revealing that there isn't a significant increase in productivity due to the discharge of raw sewage. Nevertheless a region of elevated chlorophyll a levels was found in the immediate vicinity of the sewage outfall at Wied Għammieq.

With the operation of the South Malta Waste Water Treatment Plant the waters in MTC 106 are expected to show some immediate improvement, particularly in water quality as sewage will no longer be released into the sea untreated. Whilst this measure will remove the most significant source of pollution in our waters, it will take time for the water body to recover. The biwater body requires time to recover due to anthropogenic and ecological cycles. It is probable, though information on the rate of

⁴ Axiac and Delia, 2000. Assessing the compliance with CD 76/464/EEC and other related water quality Directives with reference to Marine Discharges in Malta, Ministry for the Environment

recovery is not known, that this water body is at risk of failing to achieve Good Status by 2015.

In the context of **industrial point source pollution**, most industries in Malta are located inland and are either connected to the municipal sewerage system or have a specific waste management regime for the effluents generated on site (e.g. land-filling of hazardous liquid waste or transportation). In effect, the majority of authorised direct discharges of industrial effluents in surface waters are limited to installations that are located within the two main harbours (MTC 105 and MTC 107). These include the two power stations, that of Delimara and at Marsa; the majority of fuel terminals, the Malta Shipyards and a number of Integrated Pollution prevention and control (IPPC) installations.

The wide spectrum of wastewater streams from the **power stations** give rise to both chemical and thermal water pollution. In the case of both power stations, the most significant discharge in terms of quantity is that of cooling waters. These waters contain antifouling agents such as chlorine and clam-trol. Heavy metals are of particular concern especially copper, nickel and organotins.

Fuel handling practices at fuel terminals are also major point sources. Out of the nine fuel terminals on the islands, seven directly discharge their effluent into coastal waters. The majority of these premises are located in the harbour areas. The main pollutants are polycyclic aromatic hydrocarbons and liquefied gas. Whilst in at least one installation there is an indication of a high level of heavy metals due to the nature of the oils that the installation handles. Oil spill incidents have been reported to result mostly from land-based operations due to oil storage and fuel handlings. These are dealt with under diffuse sources of pollution.

Another significant installation in terms of point source marine contamination is the **Malta Shipyards**. These are momentarily not in operation due to the process of privatisation, however until recently they were one of the largest ship repairing yards in the Mediterranean and therefore a major contributor to historical chemical contamination of the harbour region (MTC 105), not excluding severe hydromorphological changes that significantly altered the natural harbour environment (refer to section 4.2.5). The various operations the shipyard employed generated a wide range of waste streams which were mostly discharged directly to sea through two main outlets in MTC 105.

Some smaller scale activities linked with shipyards are still in operation and therefore some of these pollutants are still being discharged into this coastal water body.

There are two other smaller scale shipyards still in operation. Although these are not major contributors to direct marine discharges, diffuse sources of pollution via stormwater runoff are expected to result in marine contamination.

Other point sources include discharges from **reverse osmosis desalination plants**. Discharges from municipal desalination plants and cumulative discharges from hotels are both considered to be contributors to marine pollution, though the impact of these discharges is not expected to be significant and warrants further study.

Landfills and spoil grounds are also point sources of pollution. With respect to sites related to waste management, chemical monitoring of the marine waters lying in the vicinity of the former Magħtab waste dump indicates that there are elevated concentrations of heavy metals, cadmium, copper and zinc in locally occurring mollusc species and sediments above background levels.

A report by Wasteserv and Scott Wilson⁵ claims that it is highly probable that these contaminants end up in the marine environment via surface runoff from the landfill that enters the sea during heavy rainfall events. The low hydraulic gradients present in the mean sea level aquifer restricts the rate of groundwater discharge to the sea and therefore a groundwater-marine discharge of leachate from the landfill is less likely.

As regards marine waste disposal the potential impacts of the national spoil ground located off Xagħjra is unknown. The **spoil ground** is used for the dumping of inert material (i.e. rock and rubble originating from excavation and demolition works). Dumping of spoil at sea is regulated such that it can only be dumped at this designated spoil ground. However dumping at other unofficial offshore locations and the spillage of spoil from waste barges on their way to the spoil ground have been reported to occur.

Marine based **fish farming** may also have detrimental effects on the marine environment through the generation of particulates and soluble wastes from excess food and fish wastes. The impacts, are however, deemed to be localised and not of concern at the water body level.

According to some studies (Axiaq and Delia, 2000) the impact of present day sea-based fish farming activities on the water column is minimal. This was observed for both enclosed inshore waters and offshore sites, indicating that good water circulation and dispersive characteristics is sufficient to prevent the build-up of significant pollution levels from aquaculture practices.

The Fisheries Operational Programme for Malta (2007-2013) has recognised the need to relocate aquaculture farms which are currently situated close to the coast and inside bays to the southern part of Malta at a distance of approximately 6km away from the coast. The objective is to reduce conflicts with other coastal users and also to reduce impacts to the marine ecosystem whilst simultaneously provide more space for further investment.

4.2.3 Diffuse sources

The most prominent diffuse sources in our surface waters are derived from a wide spectrum of activities. These include storm water, sewage overflows, agricultural activities, and oil pollution from industrial activities.

Stormwater flows within urban catchments carry a significant amount of pollutants from a wide range of surfaces that are exposed to a number of activities, such as roads, industrial areas, waste dumps etc. Flooding episodes often exacerbate the problem of stormwater quality due to the incursion of storm water into the sewerage infrastructure. The rainwater drains of several residences are connected illegally to the sewerage network and as a consequence inundate the sewerage network such that raw sewage over flows into streets and is carried away to coastal environments.

Agricultural pollution sources emanate from **fertilisers** and **pesticides** use essentially. The appropriate timing of their application on fields and proper on-site management of manure on the farm are two fundamental practices that would limit the extent of these pollution sources.

⁵ WasteServ and Scott Wilson. 2004. Rehabilitation strategies, Magħtab, Qortin and Wied Fulija Landfills.

The main pollutant sources from crop production activities are fertilisers and pesticides that are washed away to the sea via stormwater runoff. Excess fertiliser use and their application at the wrong time cause nitrates and phosphates being lost to the marine environment. The largest occurrences of pesticide runoff are expected to be highest in the western part of Malta.

Animal waste is also of major concern due the leaching of high levels of nitrates into groundwater bodies. On-situ manure disposal are common occurrences and thus nitrates can easily leach to groundwater supplies (refer to section on nitrate contamination of groundwater below), and be washed to the coast via valley watercourse channels. Nitrates in groundwater also end up in inland surface water environments via natural springs, most common in the North and North western parts of Malta and the Xlendi area in Gozo.

Industrial diffuse sources mainly consist of oil pollution from diffuse activities. Oil pollution may occur due to major or moderate accidents involving marine traffic, incidents of spills from inshore based activities, illegal discharges of ballast waters, losses of fuel and oils from small water crafts and land based storage and operations dealing with fossil fuels.

The central Mediterranean has intensive maritime traffic with an associated risk for incidents and oil spills. Despite the fact that the area around Malta and the Sicilian Straits is one of the most oil polluted regions in the Mediterranean due to a large number of oil slicks discharged from passing ships, no major oil spill has been reported in Maltese territorial waters.

Minor oil spills have been witnessed in Marsamxett, Grand Harbour, Marsaxlokk, and Birzebbugia. Intense boating activities in the summer months constitute a significant and chronic input of oil. Using UV spectrofluorimetric analysis heavy oil contamination was found in MTC 105 due to the fuel handling activities in these areas. The development of yacht marinas in the Marsamxett area may have led to a five-fold increase in oil pollution load in the sediments in Pieta and Msida over this same period.

Bunkering activities are another source of diffuse pollution. Bunkering operations are carried out in the port areas (MTC 105, MTC 107) at yacht marinas and in designated near-shore sites on at the boundaries of MTC 107, 106, 104 and 103, and 109. Vessels carrying petroleum products, or in a non gas free condition, are bunkered 12 miles offshore at Hurd's Bank. The total quantity of oil bunkered on an annual basis was reported to be 400,000 metric tonnes, of which 65% is undertaken, offshore (Axiaq, 2004). There exists a degree of risk of accidental oil pollution from fuel terminals and bunkering operations. It is worth noting, however, that to date only minor incidents have occurred and these have not resulted in oil spillage.

4.2.4 Quantitative resource pressures

The WFD also categorises pressures for surface waters into quantitative resource pressures that are brought about by modifications in the flow regime of a surface water body through abstraction or regulation.

A number of protected inland surface waters areas are subject to intensive groundwater abstraction that has led to the deterioration in freshwater flows in water course environments. Some perennial water courses have in fact been rendered temporary due to abstraction pressures. Changes in flow regime can drastically alter the few existing fresh water dependent ecosystems on the Islands. Natura 2000 site

Wied il-Luq, for instance has in fact been susceptible to a change in flow due to abstraction for agricultural purposes.

Another pressure that leads to the disruption of surface water flows is development that encroaches upon valley systems

4.2.5 Hydromorphological pressures

Hydromorphological alterations are physical developments or pressures that bring about morphological alterations in the depth, width, quantity, structure and substrate of an inland surface water or coastal water body. Hydromorphological alterations to a water body can take place through coastal engineering works, dredging, channel modifications, and beach replenishment. Such alterations can bring about irreversible changes in the water body through the smothering of benthic environments, the removal of substrate, changed in water currents and even changes in water levels in the case of protected inland surface waters.

Hydromorphological status is of significance particularly in the case of heavily modified water bodies (Refer to Box 4.1). In the case of Malta the two harbours (Port il-Kbir and Port tal-Marsamxett; Port ta' Marsaxlokk) were designated as heavily modified since the criteria referred to in Box 4.1 apply to both ports.

The harbours are subject to continuous morphological change, not to mention the historical impacts on the morphology of the harbours ever since the Knights of St. John used the harbour as the major point of defence during the 16th Century. Dredging continuously takes place; land has been reclaimed for the building of weirs, platforms, quays and also for the carrying out of ship repairs. The port of Marsaxlokk has also been subject to intensive physical alteration with the development of the Freeport and oil terminals. Changes to the coastline within established port areas are inherent for their continued commercial operations especially in order to retain competitiveness within the Mediterranean.

4.2.6 Biological pressures

Biological pressures are those that have a direct impact on living resources, either quantitatively or qualitatively such as the introduction of alien species. The invasion of alien species is a problem associated mainly with bunkering activities. Very few national studies exist on the impact of alien species within the marine environment and so the extent of the pressure and the associated impacts cannot be readily quantified. A number of invasive species, however, have been identified to occur within the marine and coastal environment around the islands. These include algae, fish, molluscs, and bryozoan species.

BOX 4.1: Heavily Modified Water Bodies

The WFD defines three types of objectives:

1. Good Ecological Status in surface waters
2. Good Chemical Status for groundwater and surface waters
3. Good Quantitative Status for groundwater bodies

These are not applicable to all water bodies. There are water bodies that '*as a result of physical alterations by human activity, are substantially changed in character and cannot, therefore, meet "good ecological status"*'. The WFD acknowledges that such water bodies may not achieve the above objectives and therefore permits Member States to designate heavily modified water bodies (HMWB) and sets the environmental objective of these water bodies as "good ecological potential", which has to be achieved by 2015.

Good ecological Potential is a less stringent objective than good ecological status. This is because it makes allowances for ecological impacts resulting from alterations to the physical environment that are necessary to either support a specific use, or must be maintained in order to avoid effects on the wider environment. This means that appropriate objectives can be set for the management of pressures on condition that the adverse ecological impacts caused by any physical alteration can be appropriately mitigated without undermining the benefits they serve.

Those water bodies that are likely to fail to achieve Good Ecological Status but which show no hydromorphological changes were not designated at Heavily Modified Water Bodies.

Therefore in order for a water body to be designated as such the following criteria apply:

- The failure to achieve good status results from physical alterations to the hydromorphological characteristics of the water body and not due to chemical pollution.
- The water body must be **substantially changed** in from its natural condition such that the change in character is extensive/widespread or profound and therefore permanent and irreversible.

4.3 Pressures and impacts on groundwater

4.3.1 Background

The main issues responsible for placing groundwater in the Maltese islands 'at risk' of failing to achieve the environmental objectives of the Directive primarily involve:

- (i) pollution by nitrates;
- (ii) intrusion of saline waters; and
- (iii) over abstraction.

These impacts arise due to a number of pressures, primarily related to anthropogenic activities occurring on the groundwater body's recharge area. It should also be noted that Malta, due to its high population density presents a mixed-land use scenario, which is not common in larger continental countries. Various potentially polluting activities are thus commonly found operating side by side, and large areas of pristine land are generally lacking.

Table 4.3

The main pressures which contribute towards groundwater bodies being at risk of failing to achieve the environmental objectives of the Directive.

Code WB	Name of the water body (WB)	Risk Review 2009	Significant pressures			
			Ponit source pollution	Diffuse source pollution	Water Abstraction	Sea-Water Intrusion
MT001	Malta Mean sea level	At risk	X	X	X	X
MT002	Rabat-Dingli Perched	At Risk	X	X	X	
MT003	Mgarr-Wardija Perched	At risk	X	X	X	
MT005	Pwales Coastal	At risk		X	X	X
MT006	Mizieb Mean Sea Level	Not at risk		X	X	X
MT008	Mellieha Perched	At risk		X		
MT009	Mellieha Coastal	At risk		X		X
MT010	Marfa Coastal	At risk		X		X
MT012	Comino Mean Sea Level	Not at risk		X		X
MT013	Gozo mean sea Level	At risk	X	X	X	X
MT014	Ghansielem Perched	At risk		X	X	
MT015	Nadur Perched	At risk		X		
MT016	Xaghra Perched	At risk		X		
MT017	Zebbug Perched	At risk		X		
MT018	Victoria-Kercem Perched	At risk		X		

'At risk' does not imply that the water body can be readily classified as being of poor status, but it does draw our attention to priority issues or areas where appropriate management measures are needed to ensure that good status is achieved.

4.3.2 Quantitative Aspects

Water balance estimations indicate that the main groundwater bodies on the islands are being heavily over-abstracted. Groundwater abstraction can be subdivided into abstractions by the public and private sectors.

Public groundwater abstraction sources are managed by the Water Services Corporation, which is the public utility responsible for the supply, production and distribution of water in the Maltese Islands. These sources are metered and their volumetric abstraction data is submitted annually to the Malta Resources Authority. A plan of the location of these sources is presented in Map 4.1. Moreover it is noted that all these sources qualify as 'significant abstraction points' under the WFD due to the fact that their annual abstraction volume exceeds the Directive's 3,650m³ 'significance' threshold.

The private sector, which includes the agricultural (irrigation and animal husbandry), industrial, tourism and the commercial sector; utilizes marked volumes of groundwater. However, limited data exists on these abstraction sources and their real abstracted volumes; and consequently all water use figures for these sectors

have been estimated and modelled on water demand. An indication of the extent of private abstraction can be obtained from the number of registered sources in three registration exercises carried out during the 1940's, 1997 and 2008. Although these figures cannot be automatically translated into abstraction volumes, they do indicate an increase in the spread and extent of private abstraction.

Over abstraction is particularly problematic in the sea-level and coastal groundwater bodies; since it leads to saline intrusion. In fact, all coastal and sea-level groundwater bodies have relatively high levels of sea-water related parameters such as chloride and sodium.

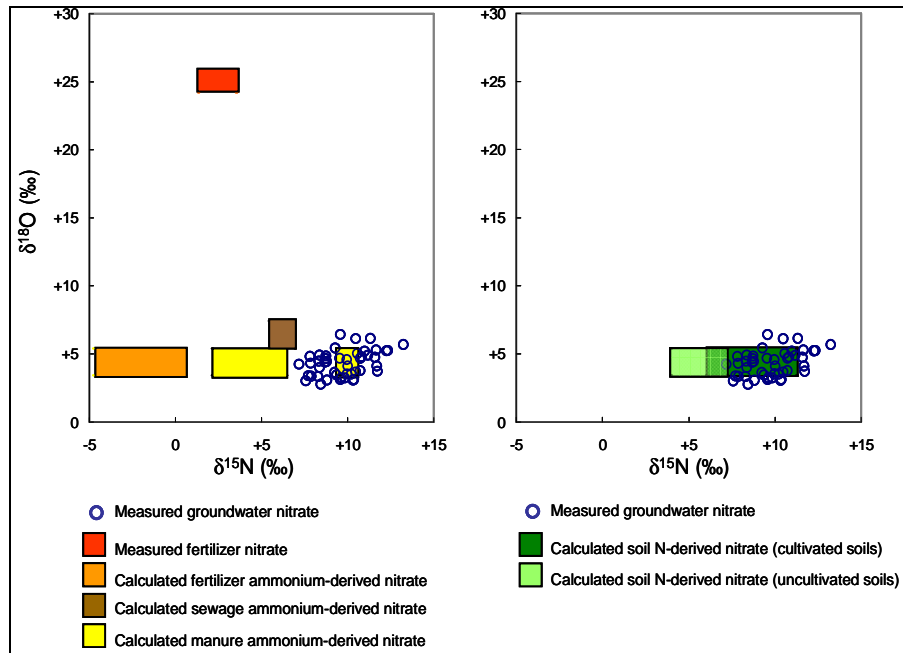
4.3.3 Diffuse sources of pollution

The two main diffuse sources of pollution that can be identified in the Maltese Islands are arable agricultural areas and urban land areas. Map 4.2 provides an overview of the spatial extent of these two main land-uses on the island.

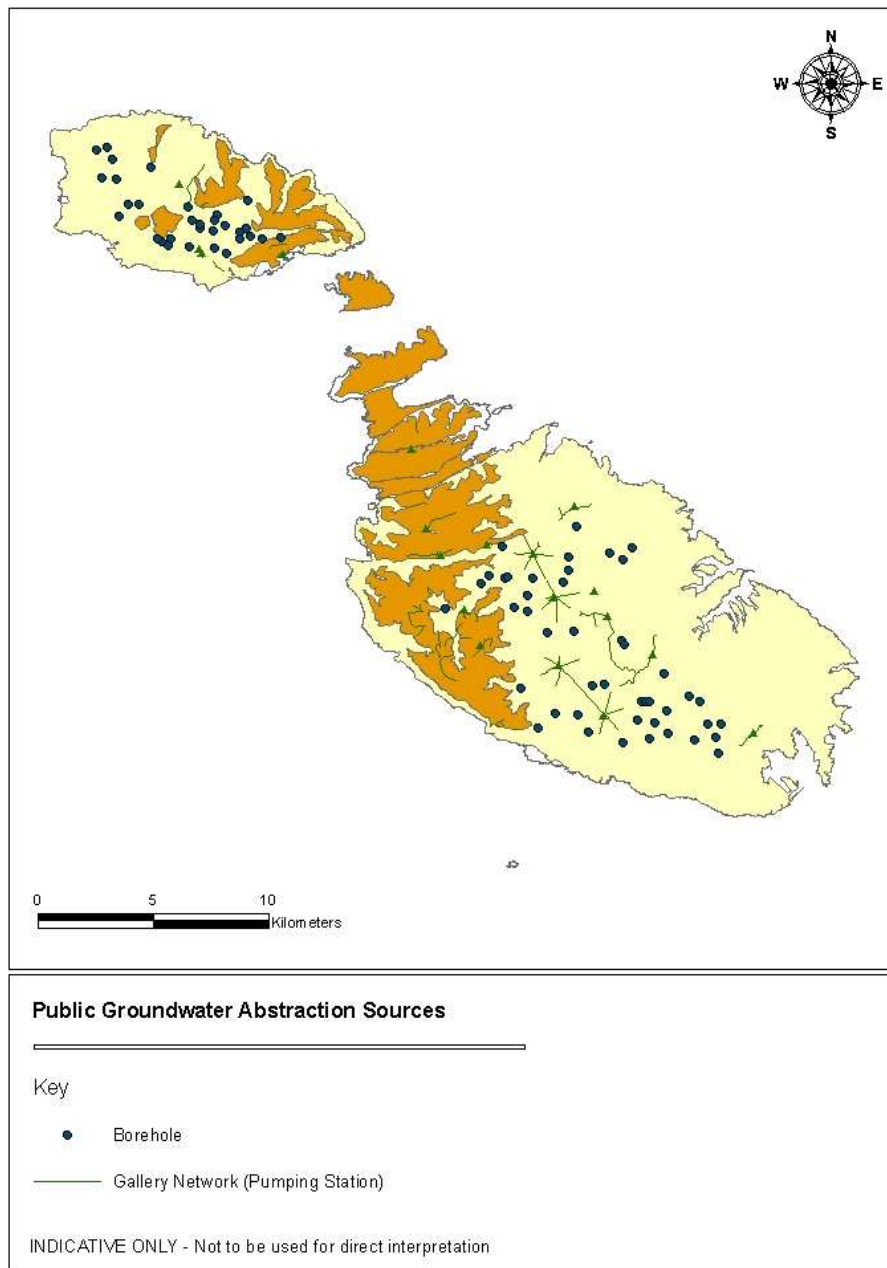
In fact, the results of an investigation of Nitrate contamination in groundwater using nitrogen and oxygen isotopes has showed that the leaching of nitrate from cultivated soils is likely to be the most important source of nitrate contamination, although derivation from animal wastes could not be discounted. The isotope data do not rule out inorganic fertilizers and/or animal wastes as the original source of the nitrogen. The data are compatible with a process whereby nitrogen from inorganic fertilizers and/or animal wastes is assimilated into the soil organic nitrogen pool, and takes on the isotopic composition of this pool during the cycling of nitrogen attendant on cultivation, before nitrification and leaching to the underlying groundwater. These results are illustrated graphically in figure 4.1.

Figure 4.1

Results from N-isotope investigations indicate arable agriculture and animal manure as the main sources of nitrate pollution in groundwater. (Source: British Geological Survey)



Map 4.1
Public groundwater abstraction sources

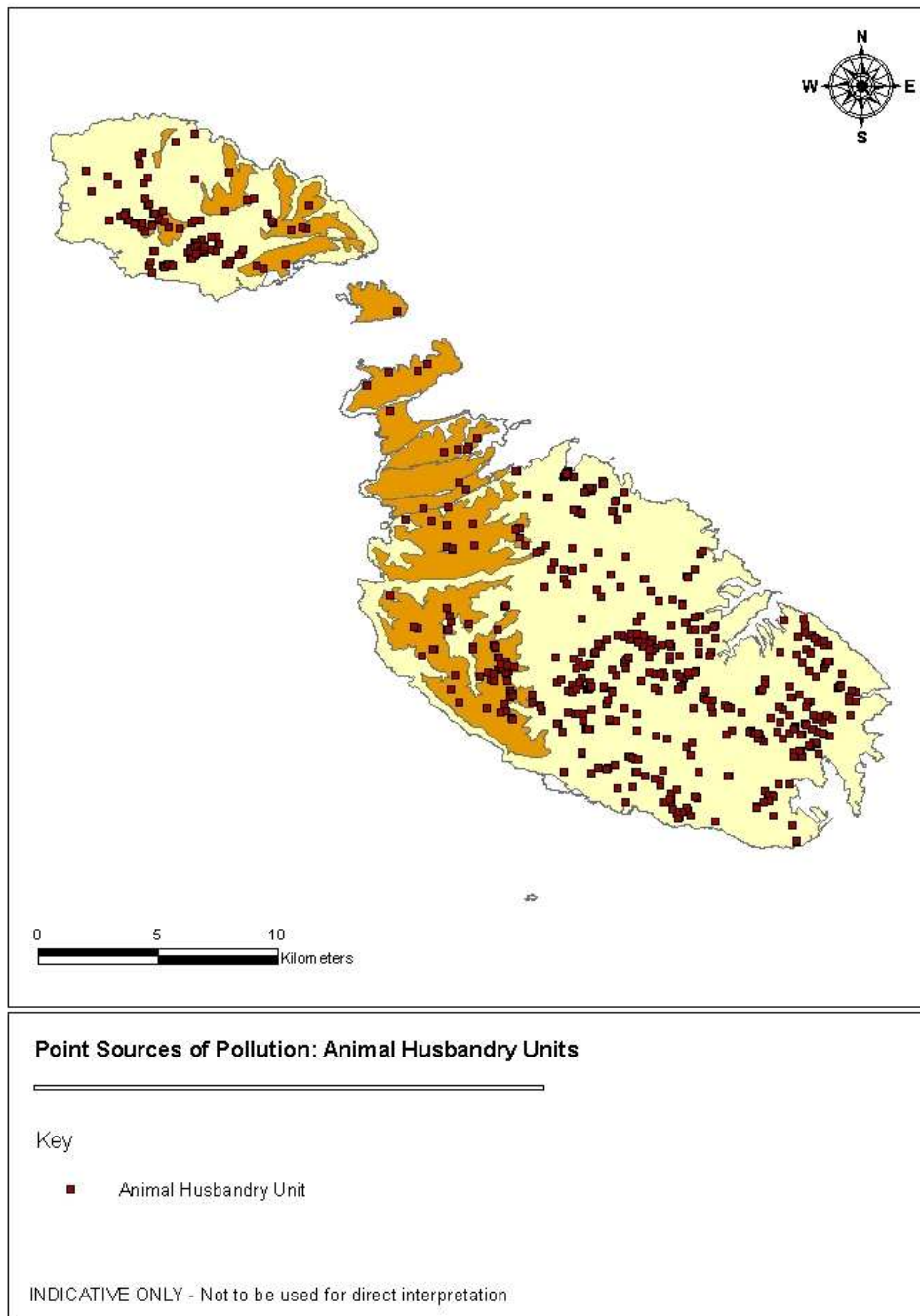


4.3.4 Point sources of pollution

As with diffuse sources of pollution, potential sources of nitrate contamination such as animal rearing facilities and urban sewer systems are the most important point pollution sources from a national perspective. Map 4.2 illustrates the spatial distribution of animal rearing facilities on the island.

Other potential point sources of pollution such as industrial sites and fuel storage facilities have also to be considered, particularly when considering local situation at abstraction sources.

Map 4.2
Animal husbandry units in the Maltese Islands



5 The WFD monitoring networks

5.1 Introduction

The Water Framework Directive requires monitoring programs of surface waters, groundwaters and protected areas within a water catchment district that would provide a comprehensive and reliable overview of their status. The monitoring program should enable the classification of status of the water bodies designated under the WFD (see Chapter 6 for a description of status). In addition, monitoring programs are required to establish long-term trends in natural conditions and the impacts of human activities.

The WFD sets a detailed and specific framework for the design and implementation of monitoring programs that includes the components of the water environment (referred to as quality elements in the Directive) that should be monitored in surface waters, groundwaters and protected areas, minimum frequencies of monitoring and standard methods for sampling and analysis.

5.2 Types of Monitoring

Three types of monitoring programs or networks are required for all water bodies, each with a different goal. Quality elements to be monitored are physical, chemical and biological, as relevant in the different water categories.

Surveillance monitoring can be described as the background monitoring of a water body. In surveillance monitoring sites, all quality elements as relevant to either surface waters or groundwaters are measured. The key objective of surveillance monitoring is to establish the status of water bodies and long-term trends in natural conditions. Surveillance sites are monitored over a period of one year in each six-year cycle of the WFD.

Operational monitoring targets individual pressures or groups of pressures in water bodies. The objective of operational monitoring is to determine the nature of the impacts of significant pressures on the quality elements. Unlike surveillance monitoring, the quality elements to be monitored in operational networks should be those that respond to the pressure or pressures being investigated. Operational monitoring is required only in those water bodies that are considered to have a status less than the good status required by the Directive. In these water bodies, the results of operational monitoring can be used to determine the status of the waters, rather than surveillance monitoring.

Investigative monitoring is necessary whenever a quality element results to be of less than good status and the reason is unknown and also to determine the impacts of accidental pollution.

5.3 Monitoring of surface waters

A total of eleven surveillance and operational monitoring sites have been established within the coastal waters of the Maltese Islands, with one to two monitoring sites per water body (Map 5.1). No investigative monitoring sites have been identified to date.

For the first monitoring event, operational monitoring sites located within water bodies that have been identified to have moderate, poor or bad status (see Chapter 6, Section 6.1) will function as part of the surveillance network. This means that all quality elements will be monitored at these stations and the data collected will be used to estimate the actual status of the water body and to inform future monitoring programs.

Priority and priority hazardous substances as defined in Annex 10 of the Directive and other chemical pollutants will be monitored only in those water bodies where there is a significant point source of pollution, such as the south sewage outfall in MTC 106 and industrial installations in MTC 105 and MTC 107, as well as in those water bodies where diffuse chemical pollution could be significant (MTC 103 and MTC 104).

The first cycle of surveillance and operational monitoring will be launched in 2010. All coastal surveillance and operational monitoring sites will be monitored for all parameters at the frequencies set out by the Directive. In addition, a baseline survey of national coastal waters will also be carried out with particular emphasis on the collection of scientific data required to develop national classification systems for coastal surface waters (see Chapter 6).

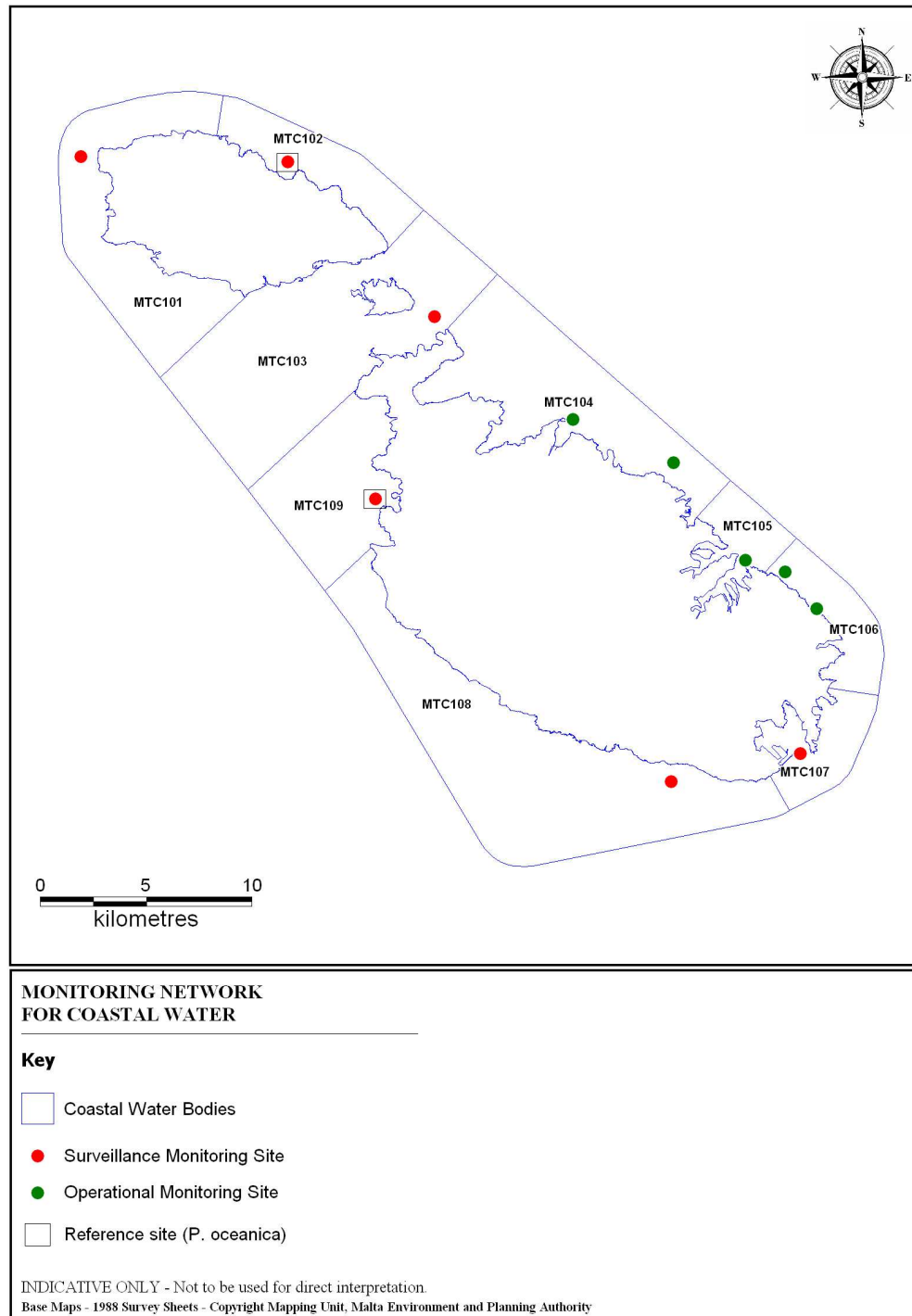
For the inland surface waters identified by Malta in 2005, monitoring in accordance with the current regime under the WFD has proven to be not possible. The absence of reference conditions, which are associated with and obtained from pristine sites that have no or very minor anthropogenic alterations, as well as historical data for these inherently and discretely different water bodies has led to the development of an alternative monitoring approach. Malta will be undertaking baseline studies for inland waters as a first step to accumulate enough data to enable it to develop a national monitoring program that is in line with the objectives of the WFD.

5.3.1 Identification of reference sites in coastal waters.

The Directive requires the identification of reference sites for the monitoring of the quality elements in pristine conditions, that is, where human impact on the environment is negligible. The main objective is to monitor over the long-term the variability in natural conditions which will help to define and adjust for the natural variation in the measured values of the different quality elements. Reference sites have to be type-specific, that is reference conditions have to be identified for each quality element in each of the four typologies defined for coastal waters.

Type-specific reference monitoring sites for *Posidonia oceanica* have been tentatively identified for the relevant coastal water types in areas considered to be relatively pristine and where the healthiest meadows can be found locally as supported by existing scientific data. It was not possible to identify reference monitoring sites for other quality elements. These will be identified when the monitoring data from the first surveys are analysed.

Map 5.1
Coastal Waters monitoring network



5.4 Monitoring of groundwater

5.4.1 Background

Article 8 of the Water Framework Directive defines a requirement for the establishment of programmes for the monitoring of groundwater. These monitoring programmes are intended to provide the necessary information to enable the Environmental Objectives (Article 4 of the WFD) to be met, and in particular the assessment of groundwater quantitative status, chemical status and the identification of significant, long-term trends in natural conditions and trends resulting from human activity in groundwater bodies.

The Directive allows the grouping of groundwater bodies for Monitoring purposes, provided that the monitoring information obtained provides for a reliable assessment of the status of each water body in the group and the confirmation of any significant upward trend in pollutant concentration.

The results of the Article 5 'Characterisation' assessment indicated that all bodies of groundwater in the Maltese Water Catchment District can be considered to be 'at risk' of failing to achieve the objectives of the Directive. In as much, the provisions of the Directive allow grouping only for those water bodies which are sufficiently similar in terms of aquifer characteristics, pathway susceptibilities, pressures and confidence in their risk assessment.

As a result of this analysis, groundwater bodies in the Maltese Water Catchment District were grouped in seven agglomerations as outlined in table (5.1) below.

Table 5.1
Grouping of groundwater bodies based on their characteristics

Group Code	Component GWB Code	Name of Component Groundwater Bodies
MT0_G01	MT001	Malta Mean Sea Level
MT0_G02	MT002	Rabat-Dingli Perched
MT0_G03	MT003, MT006, MT014	Mgarr/Wardija Perched, Mizieb Mean Sea Level, Ghajnsielem Perched
MT0_G04	MT005, MT009, MT010	Pwales Coastal, Mellieha Coastal, Marfa Coastal
MT0_G05	MT008, MT015, MT016	Mellieha Perched, Nadur Perched, Xaghra Perched
MT0_G06	MT017, MT018	Zebbug Perched, Victoria-Kercem Perched
MT0_G07	MT012, MT013	Kemmuna Mean Sea Level, Gozo Mean Sea Level

The Directive requires the establishment of a monitoring network which is representative of each groundwater body. The amount of monitoring required thus needs to be proportional to the difficulty in judging the status of the groundwater body, the presence of adverse trends and the implications of errors in such judgements, in particular with regard to the setting up programmes of measures.

Consequently, different approaches for establishing monitoring networks have been adopted in the Maltese Water Catchment District, in order to take into consideration the relative importance of the groundwater bodies with particular reference to those

water bodies which sustain freshwater ecosystems and those which are utilised as sources of 'water intended for human consumption'. The conclusions of this analysis are outlined hereunder:

- (i) In the sea-level groundwater bodies a monitoring density of one site per sixteen square kilometres was established. This, to allow for detailed investigations on spatial variations in the quality of these water bodies and also to permit further future upgrades in the resulting monitoring networks.
- (ii) In the perched groundwater bodies a minimum threshold of three monitoring points for each groundwater body grouping, with at least one monitoring point in each groundwater body was established. An additional, 'qualitative status' monitoring point was established in the case of the Rabat-Dingli perched groundwater body to provide effective coverage to the surface water systems that this body sustains.

The number of proposed monitoring sites in each groundwater body or grouping are presented in the table below:

Table 5.2
Number of proposed monitoring sites per groundwater body

Group Code	Total Number of Monitoring Sites	Quantitative Monitoring Sites	Surveillance Monitoring Sites	Operational Monitoring Sites	Protected Area Monitoring Sites
MT0_G01	108	15	15	15	50
MT0_G02	14	6	4	4	0
MT0_G03	14	3	3	3	5
MT0_G04	9	3	3	3	0
MT0_G05	9	3	3	3	0
MT0_G06	9	3	3	3	0
MT0_G07	55	7	7	7	34

5.4.2 Monitoring for Quantitative Status

The Directive identifies 'water level' as the main metric for determining groundwater quantitative status. The quantitative monitoring network adopted in Malta was therefore planned to utilise 'groundwater levels in gauging boreholes' as the basic parameter for measuring quantitative status.

Existing groundwater water-level monitoring networks as operated by the Water Services Corporation were therefore utilised to monitor water level in the main sea-level groundwater bodies. Most of these monitoring stations measure water-level continuously by means of an electronic data-logging setup.

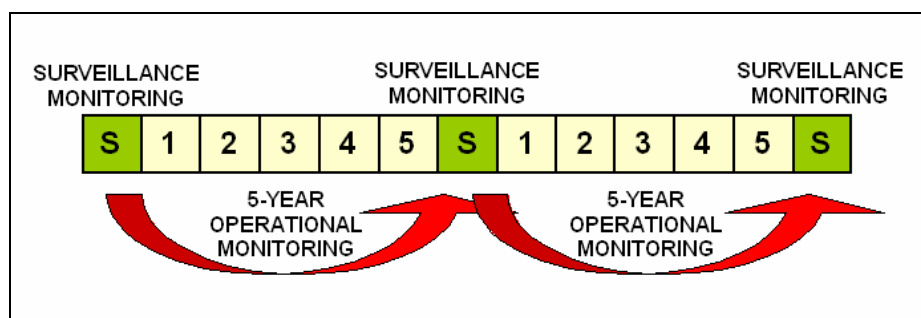
It was planned to extend these networks to the other minor aquifers, with an initial monthly monitoring frequency. It was also planned that groundwater flow from springs will be used, where possible, to supplement the water level readings in the perched groundwater bodies; since due to the particular geological structure of the aquifers, the latter are expected to be at best inappropriate for status determination. The proposed groundwater quantitative monitoring network is presented schematically in Map 5.2

5.4.3 Monitoring for Qualitative Status

The groundwater monitoring strategy adopted in Malta envisages a six-year cycle starting with a 'Surveillance' monitoring exercise which is then complemented by five years of 'Operational' monitoring.

Surveillance monitoring is required to validate the risk assessments developed in the Article 5 'Characterisation' Reports and thereby confirm the status of all groundwater bodies or groups of bodies. This monitoring exercise, conducted once every six-years, will entail a full qualitative analysis of the status of the groundwater body. Moreover, this monitoring programme should assess long-term trends in natural conditions and in pollutant concentrations resulting from human activity.

Figure 5.1
WFD surveillance monitoring network



Operational monitoring will be carried out during the five-year periods between Surveillance Monitoring; and can be considered as a specific monitoring exercise focused on assessing the specific identified risks to the achievement of the Directive's objectives. This monitoring exercise will be carried out twice every year during this five-year period and will be specifically modelled for each groundwater body according to the indications obtained from the Surveillance Monitoring programme and the pressures and impacts assessment.

Following the results of the Surveillance Monitoring programme, which was carried out in 2009, it has been determined that Operational Monitoring will focus on:

- (i) the core determinands outlined in the Directive; and
- (ii) a suite of selected determinands, the presence of which at levels which pose a risk to the achievement of 'good status' has been encountered during the surveillance monitoring exercise or where the pressures and impacts analysis has indicated the presence of a potential risk of pollution. Full details on these determinands are presented in the table below.

Table 5.3
Selected monitoring determinands

Group Code	Selected Monitoring Determinands
MT0_G01	Na, Cl, B, F, Pb, Cu, Zn
MT0_G02	Pb, Cu, Zn, TPst
MT0_G03	Na, Cl, B, Pb, Cu, Zn, TPst
MT0_G04	Na, Cl, B, Pb, Cu, Zn, TPst
MT0_G05	Pb, Cu, Zn, TPst
MT0_G06	Pb, Cu, Zn, TPst
MT0_G07	Na, Cl, B, F, Pb, Cu, Zn

The set-up of Operational Monitoring Programme will moreover be flexible enough to adopt any other parameters whereby any risks are identified from studies carried out during the planning cycle.

5.5 Monitoring in Protected Areas

In the first water catchment cycle, monitoring in drinking water protected areas will basically adopt all the monthly monitoring activities carried out by the Water Services Corporation on all boreholes and pumping stations being utilised for the abstraction of water intended for human consumption.

However, following the first results coming out from the surveillance and operational monitoring networks, the Protected Area monitoring methodology will be reviewed and proposals for modifying the system to better reflect the quality of the abstracted water will be formulated.

5.6 Implementation Strategy

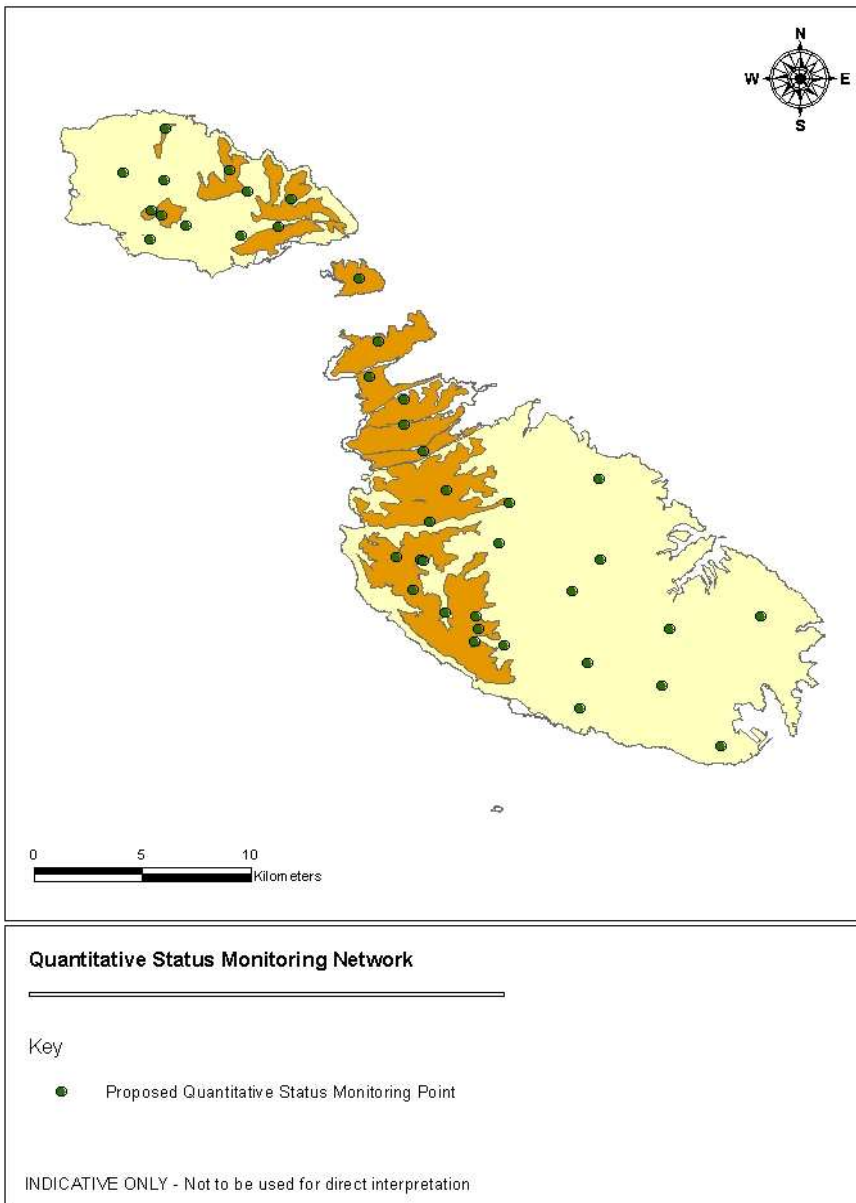
5.6.1 Quantitative Monitoring Network

Water level monitoring has only to date been implemented in the main sea-level groundwater bodies. In fact, an automated water level measuring network (using gauging boreholes) is operational in the Malta, Mizieb and Gozo Mean Sea Level aquifer system.

The main problems which have hindered the full implementation of quantitative monitoring in all water bodies relate to the fact that as expected, field investigations on water level measurements have proven that this 'metric' is not adequate for monitoring quantitative status in the minor perched and coastal groundwater bodies. The monitoring methodology will thus be adapted to include flow measurements from springs as the main measurement used in these smaller units. It is expected that the implementation of this new network (Map 5.2) will span the 1st Water Catchment Cycle with full implementation envisaged in time for an analysis of status to be included in the 2nd Water Catchment Management Report.

Map 5.2

Quantitative Status Monitoring in Groundwater bodies

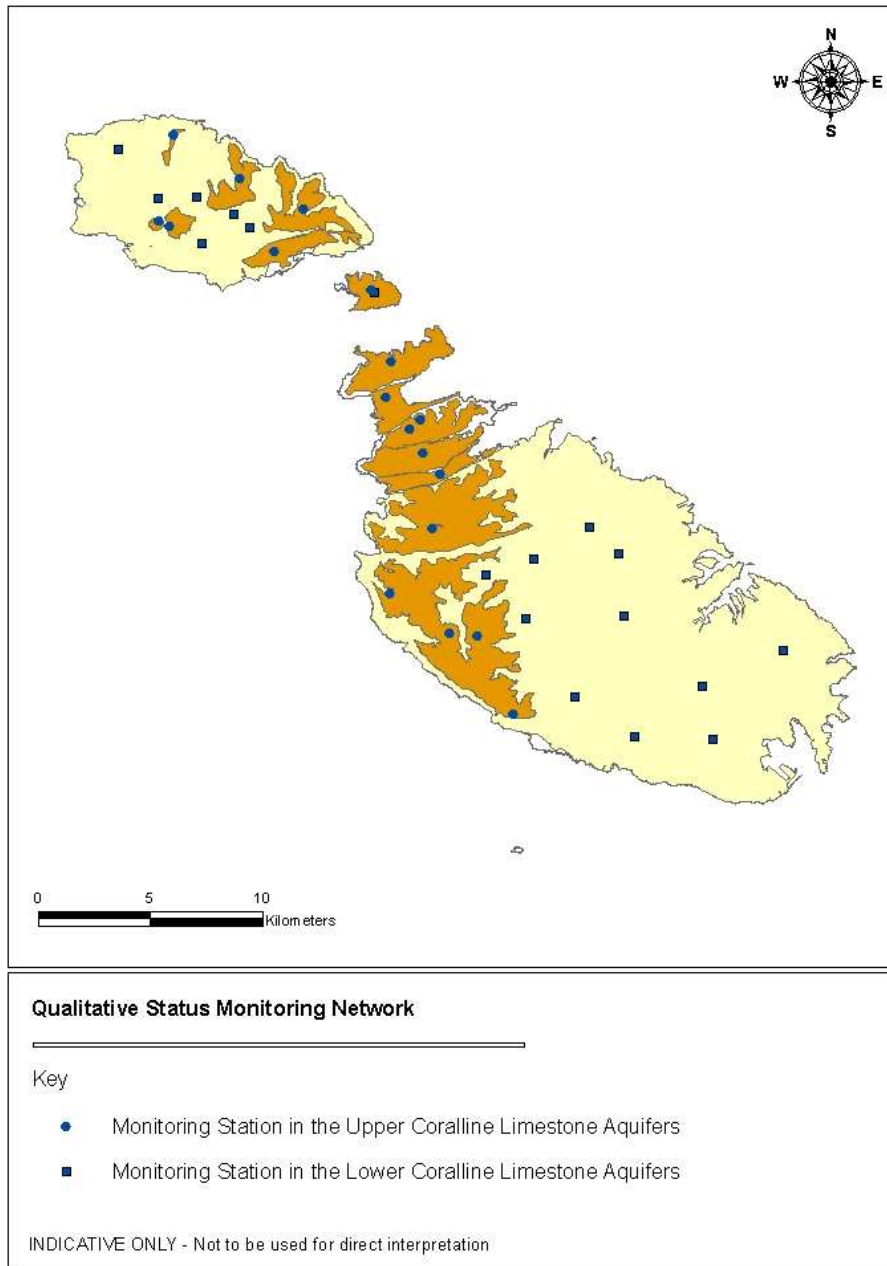


5.6.2 Qualitative Monitoring Network

Qualitative Monitoring was implemented in all groundwater bodies, with a surveillance monitoring exercise being carried out in 2009. A lower monitoring density than originally planned was achieved in certain groundwater bodies, mainly due to logistical reasons. However it is expected that the planned monitoring density will be achieved within the first cycle of operational monitoring (2010).

It should also be pointed out that a number of stations which were identified in the original monitoring report under Article 8 of the WFD were changed and this mainly due to logistical considerations according to practical conditions encountered on the field. Full details of these changes are provided in the related technical document.

Map 5.3
Groundwater Qualitative status monitoring network



5.6.3 Drinking water Protected Area Monitoring

All groundwater sources utilised for the abstraction of drinking water are regularly monitored through a monthly monitoring exercise carried out by the Water Services Corporation. The monitored parameters are chlorides, nitrates and conductivity. The results of this monitoring network are also regularly reported to the Authority (MRA).

6 Determining the status of our waters

6.1 Background

The determination of the status of the water body through water monitoring is key to the WFD process. The status of the water body will determine the type of action that Member States need to take in order to maintain or improve its condition. It also provides the basic information for the application of exemptions or derogations to the main objective of the WFD for all water bodies that is the achievement of good status by 2015.

6.2 Determining the status of surface waters

For surface water bodies, two major qualitative components need to be separately described: ecological and chemical status. Ecological status in surface waters is determined principally by the status of the biological quality elements, nutrient status as well as hydromorphological conditions. Chemical status refers to the concentrations of priority and priority hazardous substances in the water column – a good chemical status means that the measured concentrations for all priority substances correspond to the environmental quality standards given in Directive 2008/106/EC.

6.2.1 Development of national methods for assessing ecological status in coastal waters

One of the key objectives of the monitoring program is to enable the classification of the ecological status of a water body in one of five status classes – high, good, moderate, poor and bad - with scientific precision and confidence. Biological quality elements have the greatest weighting in the classification of water bodies, that is to say they are the most important elements to consider.

Four biological quality elements are monitored in coastal waters in the Mediterranean. These are the seagrass *Posidonia oceanica*, macroalgal communities and benthic invertebrates in shallow waters and phytoplankton.

For each of these quality elements, Malta is required to develop a classification system, with the high status corresponding to the values of the measured parameters in reference (i.e. pristine, or with very little human impact) condition. The lower four quality classes in the classification scheme are expressed as a ratio to the reference condition. Assessment methods can be different in the different member states, however the classification scheme are compared between member states within the same ecoregion (for example, the Mediterranean Sea) through an elaborate process called “intercalibration”. This is to ensure that the class boundaries established by the national classification systems are consistent with the normative definitions of the status as given in the Directive and that they are comparable between Member States.

As part of the WFD monitoring in 2010, Malta will be collecting the necessary scientific data on the four biological quality elements, supporting physico-chemical parameters (such as nutrient status, acidification, temperature and salinity) and hydromorphological factors to develop the national assessment methods and thus be in a position to participate in the second phase of the intercalibration exercise that is currently ongoing.

6.2.2 Establishing the ecological status of coastal waters

The monitoring program for coastal waters will be operational in 2010, and no monitoring data was available to determine the status of the water bodies as required by the WFD.

In 2006 Malta developed a draft method, including a classification scheme as described above, for the assessment of one quality element in coastal waters, the angiosperm *Posidonia oceanica*. The data collected in this exercise was used to determine the status of the coastal water bodies designated by Malta in the 1st WCMP.

For those water bodies where the presence of *P. oceanica* is not significant (namely Coastal waters Type I – very exposed and deep waters), the assessment of ecological status was based on a qualitative risk assessment of the existing and projected pressures on the four biological quality elements. The methodology adopted was similar to the initial risk assessment carried out in 2005 as part of the characterization process.⁶

The results of this assessment are depicted in Table 6.1. Six of the nine water bodies have good or higher status. It should be mentioned that the monitoring sites of reference conditions for *P. oceanica* are located in water bodies with high status.

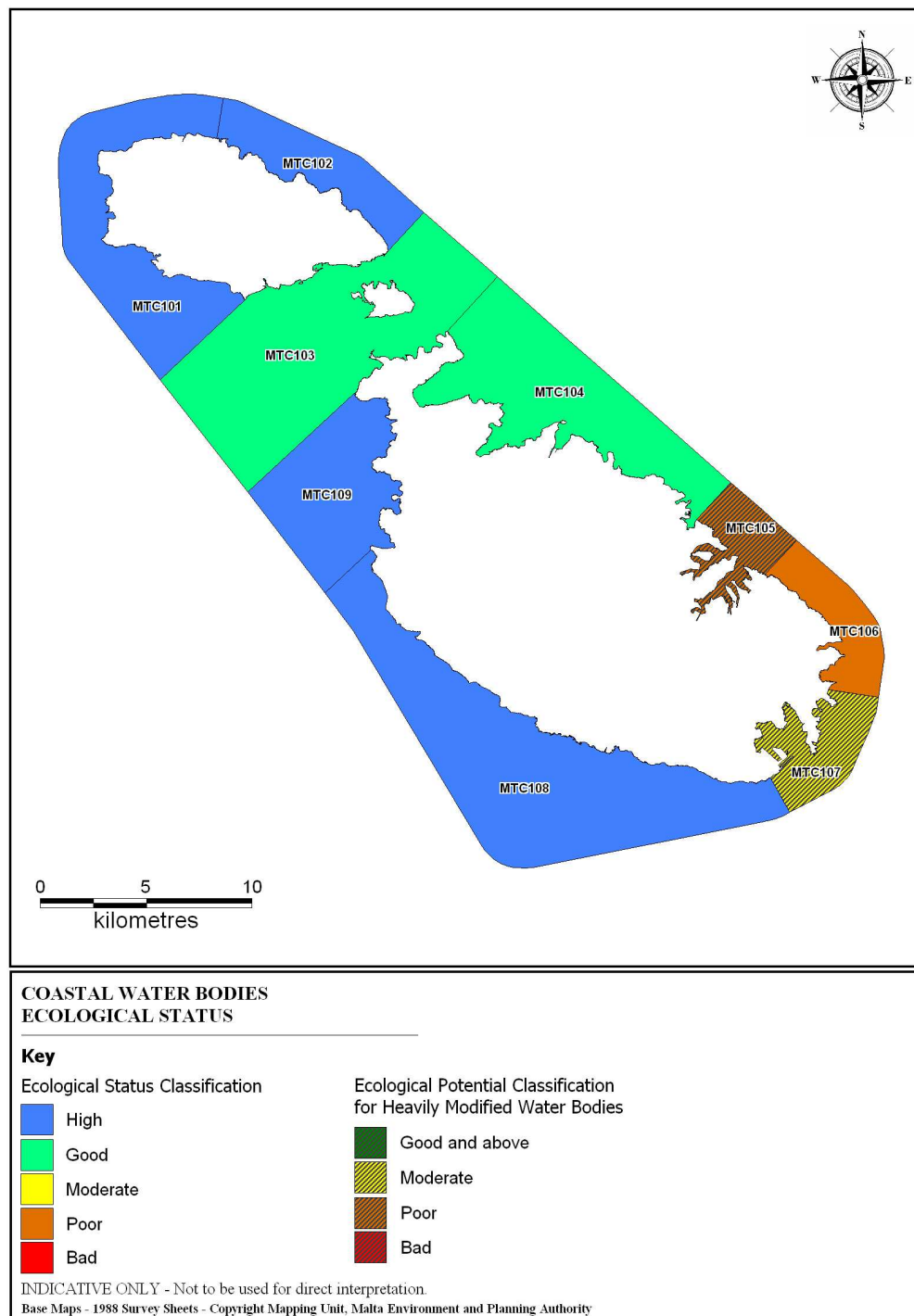
The assessment method indicated that MTC 106 has poor status. Significant impacts in this water body include nutrient and organic pollution from small-scale point sources that can result in nutrient enrichment and negative impacts on all four biological quality elements, particularly within enclosed bays and sheltered coastal areas. The existing sewage outfall in MTC 106 is considered to have a major negative impact on all four biological quality elements.

MTC 105 and MTC 107 are two Heavily Modified Water Bodies (HMWB). The objective of the Directive in HMWBs is to achieve Good Ecological Potential (GEP) which can be thought of as a status that is less than the good status in natural water bodies given the pressures and economic activities within. Nonetheless, MTC 107 was classified with moderate status for *P. oceanica*. This indicator was not assessed within MTC 107, however the qualitative assessment indicated significant risks to water quality and ecosystems associated with harbour and related industrial operations that are higher than in MTC 105; consequently this water body was classified at a lower status, that is in poor status. The relationship of this classification to achieving GEP in these water bodies will be defined as scientific data is collected on hydromorphological, physico-chemical and biological quality elements.

⁶ The method adopted followed the DPSIR method as described in Borja et al. (2006). The European Water Framework Directive and the DPSIR, a methodological approach to assess the risk of failing to achieve good ecological status. Published in: Estuarine and coastal shelf science. Volume: 66 Pages: 84-96.

Map 6.1

Classification of Ecological Status of Coastal Water Bodies



Map 6.2

Classification of Chemical Status of Coastal Water Bodies

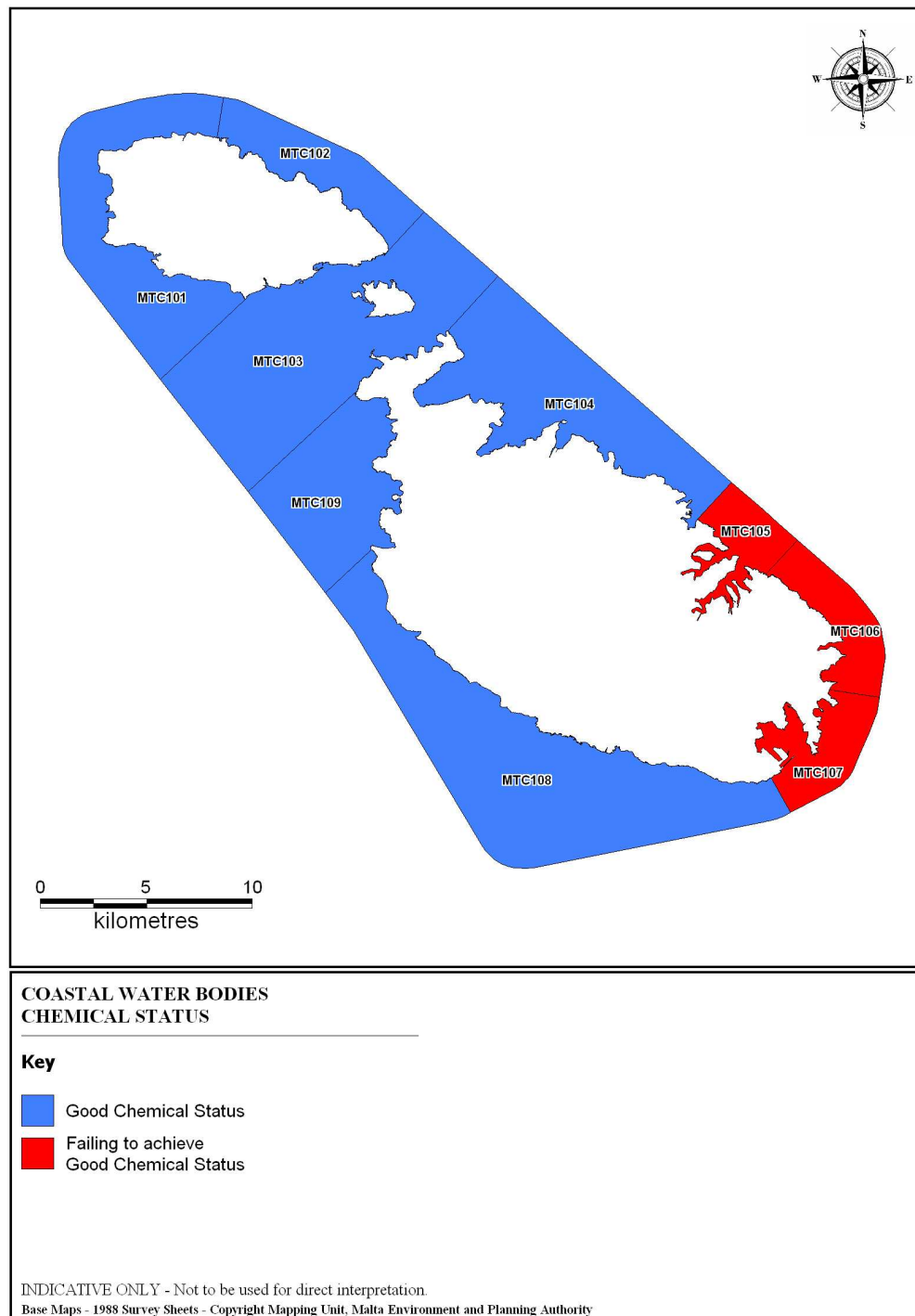


Table 6.1

The ecological and chemical status of coastal water bodies in the Maltese water catchment district

Surface Water Body Name	Surface Water Body Code	Ecological Status	Chemical Status	Level of confidence
Il-Punent ta' Ghawdex	MTC 101	High	Good	High
Ir-Ramla l-Hamra	MTC 102	High	Good	High
Il-Fliegu ta' Kemmuna	MTC 103	Good	Good	Medium
Mellieha – Tas-Sliema	MTC 104	Good	Good	Medium
Il-Port il-Kbir – Il-Port ta' Marsamxett	MTC 105	Poor	Bad	Low
Ix-Xaghjra – Wied il-Ghajn	MTC 106	Poor	Bad	Medium
Il-Port ta' Marsaxlokk	MTC 107	Moderate	Bad	Medium
L'Irdumijiet ta' Malta	MTC 108	High	Good	High
Il-Qammieh – Fomm ir-Rih	MTC 109	High	Good	High

6.2.3 Determining the chemical status of coastal waters

The **chemical status** of coastal waters was assessed for priority and priority hazardous substances in the water column. The results of the qualitative assessment are shown in Table 6.1.

Two major factors were considered in the assessment: (i) the presence and nature of point source and diffuse sources of pollution in the water body and (ii) the exposure of the coastline which will influence how any chemicals released in the water column are dispersed and diluted. The assessment also included a review of existing scientific data.

Discharges of priority hazardous substances and other pollutants through point sources are an important factor in MTC 105 and MTC 107, the two heavily modified water bodies (harbours) where several industrial installations operate and in MTC 106 where the main wastewater outfall is located through which both domestic and

industrial wastewaters reach the coast. In these three water bodies dispersion and dilution of the chemical discharges are probably sufficient to disperse the contaminants in the water column to reach concentrations that are within the environmental quality standards required by the Directive. However, the accumulation of chemicals in sediments and their subsequent release into the water column over time is considered an important factor and can pose a significant threat to the environment, if unregulated.

Consequently, these three water bodies were assessed as not achieving the good chemical status required by the Directive. It is expected that the monitoring program of 2010 will shed new light on the presence and fate of priority substances and other pollutants, including heavy metals, in coastal waters and the results will be used to review the status of the water bodies.

Nonetheless, it should be mentioned here that Malta is taking measures to regulate discharges by requiring all installations to have an environmental permit. This will be described later on in the WCMP.

6.3 Quality standards for the determination of groundwater status

6.3.1 Groundwater Quality Standards

Annex I to the Groundwater Directive (Dir 2006/118/EC) outlines EU-wide quality standards for Nitrate and Pesticide content in groundwater, adopting the limit values of the Nitrates (Dir 91/676/EC) and Plant Protection Products Directives (Dir 91/414/EEC and Dir 98/8/EC).

These quality standards will be adopted in the Maltese Water Catchment District.

Pollutant	Quality Standard
Nitrate	50mg/l
Active substances in pesticides including their relevant metabolites, degradation and reaction products.	0.1µg/l 0.5µg/l (total)

6.3.2 Groundwater Threshold Values

The Groundwater Directive under Annex II requires Member States to establish threshold values for all “pollutants and indicators of pollutions which, pursuant to the characterisation performed in accordance with Article 5 of Directive 2000/60/EC, characterise bodies or groups of bodies of groundwater as being at risk of failing to achieve good groundwater chemical status”.

Part B to the same Annex outlines a minimum list of pollutants and their indicators for which Member States are required to consider establishing threshold values:

Substances or ions or indicators which may occur both naturally and/or as a result of human activities
Arsenic Cadmium Lead

Mercury Ammonium Chloride Sulphate
Man-made synthetic substances
Trichloroethylene Tetrachloroethylene
Parameters indicative of saline or other intrusions
Conductivity

The results of the characterisation analysis carried out under Article 5 of the WFD and historic groundwater monitoring results indicate that:

- (i) Threshold Values will be set for Chloride, Sulphate, Ammonium, Lead, Arsenic and Conductivity, since these parameters have been detected in groundwater.
- (ii) Malta should also consider the establishment of threshold values for the following parameters, which are not included in the minimum list of the Groundwater Directive:
 - Copper and Zinc, due to the presence of these metals in the overlying soils;
 - Boron, due to the effects of sea-water intrusion; and
 - Fluoride, which is naturally present in the sea-level aquifer systems.
- (iii) Cadmium, Mercury, Trichloroethylene and Tetrachloroethylene have never been detected in groundwater in Malta, and thus no threshold values will be proposed for these substances. However, this decision will be revised in subsequent Water Catchment Plans should there be a positive detection of a particular parameter in the periodic surveillance monitoring exercise. In such case, it is being proposed that the Threshold Value be set at 50% of the standard for Drinking Water.

The procedure and issues considered in the development of the Threshold Values are presented below.

6.3.2.1 Sea-water intrusion related compounds

The procedure for setting up Threshold Values for sea-water intrusion related compounds needs to take into consideration the different contact with sea-water experienced by the three main groundwater body typologies in the Maltese islands.

i. Sea-level groundwater bodies

Background levels for the sea-level groundwater bodies need to take into consideration the fact that monitoring stations in these groundwater bodies are not limited to the central regions of the island but cover the whole extent of the water body, even those coastal areas which will be expected to be significantly affected by natural intrusion processes. In as much, it is being proposed that the background levels for these water bodies be set on the basis of the quality results on the Comino Groundwater Body, which being a small relatively unexploited groundwater body is an ideal natural model of the impact of natural intrusion.

The background levels for chloride and sodium content are higher than the established criteria values; and therefore the background levels will be adopted as the Threshold Values for these parameters.

On the other hand, background levels for sulphate, boron and conductivity are lower than the Criteria Values. In the case of these parameters, the Threshold Values were fixed at 50% and 75% of the difference between the background value and the criteria value for chemical and indicator parameters respectively. It was taken into consideration the higher risk to human health of the chemical parameters of the Drinking Water Directive.

ii. Perched groundwater bodies

Background levels for the perched groundwater bodies were obtained from a monitoring station located in a relatively pristine region of these aquifer systems. Since the background levels for the parameters under consideration were significantly lower than the Drinking Water Criteria Value, Threshold Values were fixed at 50% and 75% of the difference between the background level and the criteria value for chemical and indicator parameters respectively.

iii. Coastal groundwater bodies

The small coastal groundwater bodies have historically been utilised exclusively for irrigation. The threshold values were therefore set at the mid-point of the criteria value range for irrigation water, which criteria value were adopted from FAO⁷ figures.

The Threshold Values established under the procedures described above are presented in Table 6.2 below.

Table 6.1
Established threshold values for each groundwater body

Groundwater Body	Threshold Values
Sea-Level Groundwater Bodies	
MT001 Malta Mean Sea Level	Chloride: 1000mg/l
MT006 Mizieb Mean Sea Level	Sodium: 450mg/l
MT012 Kemmuna Mean Sea Level	Boron: 0.6mg/l
MT013 Gozo Mean Sea Level	Sulphate: 475mg/l
	Conductivity: 4500µS/cm
Perched Groundwater Bodies	
MT002 Rabat Dingli Perched	Chloride: 210mg/l
MT003 Mgarr-Wardia Perched	Sodium: 160mg/l
MT008 Mellieha Perched	Boron: 0.5mg/l
MT014 Ghajnsielem Perched	Sulphate: 190mg/l
MT015 Nadur Perched	Conductivity: 2000µS/cm
MT016 Xaghra Perched	
MT017 Zebbug Perched	
MT018 Victoria-Kercem Perched	
Coastal Groundwater Bodies	
MT005 Pwales Coastal	Chloride: 500mg/l
MT009 Mellieha Coastal	Sodium: 450mg/l
MT010 Marfa Coastal	Boron: 1mg/l
	Sulphate: 475mg/l
	Conductivity: 3000µS/cm

6.3.2.2 Heavy Metals

The State of the Environment Report for Malta⁸ (2005) notes that “*The presence of heavy metals such as lead, copper and zinc in soil is an indicator of soil contamination. In 25% of Maltese soils, the concentration of Lead exceeds the limit (100mg/kg) for the application of sewage sludge. 7% of soils exceed the*

⁷ FAO - Ayers and Westcott

⁸ MEPA State of the Environment Report

200mg/kg limit established for Zinc and in 3% of the soils the 100mg/kg limit for Copper is exceeded'.

Since soils are present in the recharge areas of all groundwater bodies, there is the distinct possibility that leaching of heavy metals by recharging water may occur. Background levels for these compounds in groundwater are extremely low, and therefore threshold values are based exclusively on drinking water quality standards, and set at 50% of this criteria value. In the specific case of Zinc, since this metal is still present in abstraction pipe work, it is being proposed to set the threshold value at the level of the WHO quality standard. This Threshold Value will be revised in subsequent water catchment management plan's and lowered to 50% of the quality standard once and if abstraction pipe work is replaced.

Table 6.2
Threshold values for heavy metals in the Maltese Water Catchment District

Groundwater Body	Threshold Values
All groundwater bodies in the Maltese River Basin District.	Lead: 10µg/l Copper: 2mg/l Zinc: 3mg/l

6.3.2.3 Parameters of geogenic origin

Fluoride content in the Malta Mean Sea Level groundwater body is attributed to the presence of the 'phosphorite conglomerate' beds within the Globigerina Limestone formation. In effect, higher levels of fluoride are encountered in those regions of the mean sea level groundwater bodies where these beds are most developed. It is being proposed that Threshold values for Fluoride be established only for the sea-level groundwater bodies and set at the highest value encountered in each groundwater body.

Background levels for Arsenic content are generally lower than the Drinking Water Criteria Value for both main sea-level groundwater bodies although maxima of 7µg/l are encountered in the sea-level groundwater body of Gozo. It has thus been proposed that Threshold Values be established only for the sea level groundwater bodies in Malta and Gozo, and set at 50% and 75% of the Drinking Water quality standard respectively, the latter limit being higher to reflect the higher values encountered in the island of Gozo.

Table 6.3
Threshold values for Fluoride and Arsenic in the Mean sea level aquifers

Groundwater Body	Threshold Values
MT001 Malta Mean Sea Level	Fluoride: 1.5mg/l Arsenic: 5µg/l
MT013 Gozo Mean Sea Level	Fluoride: 2.75mg/l Arsenic: 7.5µg/l

6.3.2.4 Other Parameters

Ammonium is generally considered as an indicator of direct pollution by sewage. Given the relatively long infiltration and residence times of groundwater in Malta, ammonium is not generally encountered in results of groundwater monitoring exercises.

Given the low incidence of ammonium pollution in groundwater, and the importance of this parameter as an indicator of sewage contamination it is suggested that the Threshold Value for Ammonium be set at 50% of the Drinking Water Quality Standards.

Table 6.4

Threshold value for Ammonium in the Maltese Water Catchment District

Groundwater Body	Threshold Values
All groundwater bodies in the Maltese Water Catchment District	Ammonium: 0.25mg/l

6.4 Determination of the status of groundwater bodies

6.4.1 Quantitative status

The identification of 'Quantitative Status' has been primarily assessed on the basis of water balance estimations and this due to the fact that quantitative monitoring networks are only operational in the two main sea-level groundwater bodies. Moreover these calculations are based on water demand estimates, particularly for groundwater abstraction by private operators such as agriculture and industry.

Short term trends in the water levels of the Malta and Gozo sea-level groundwater bodies show the level to be almost stable. However, if longer term trends are considered these show the level to be in decline. One has to note that the floating-lens structure of the sea-level aquifer system works to mask any change in water level; and this since any change in the level of the water-table has a corresponding 36x level change in the interface. The change in volume involved works towards dampening any immediate changes in the water level. In as much, water balance estimations are viewed as an important tool to be used in conjunction with water level measurements for the determination of quantitative status.

Table 6.5

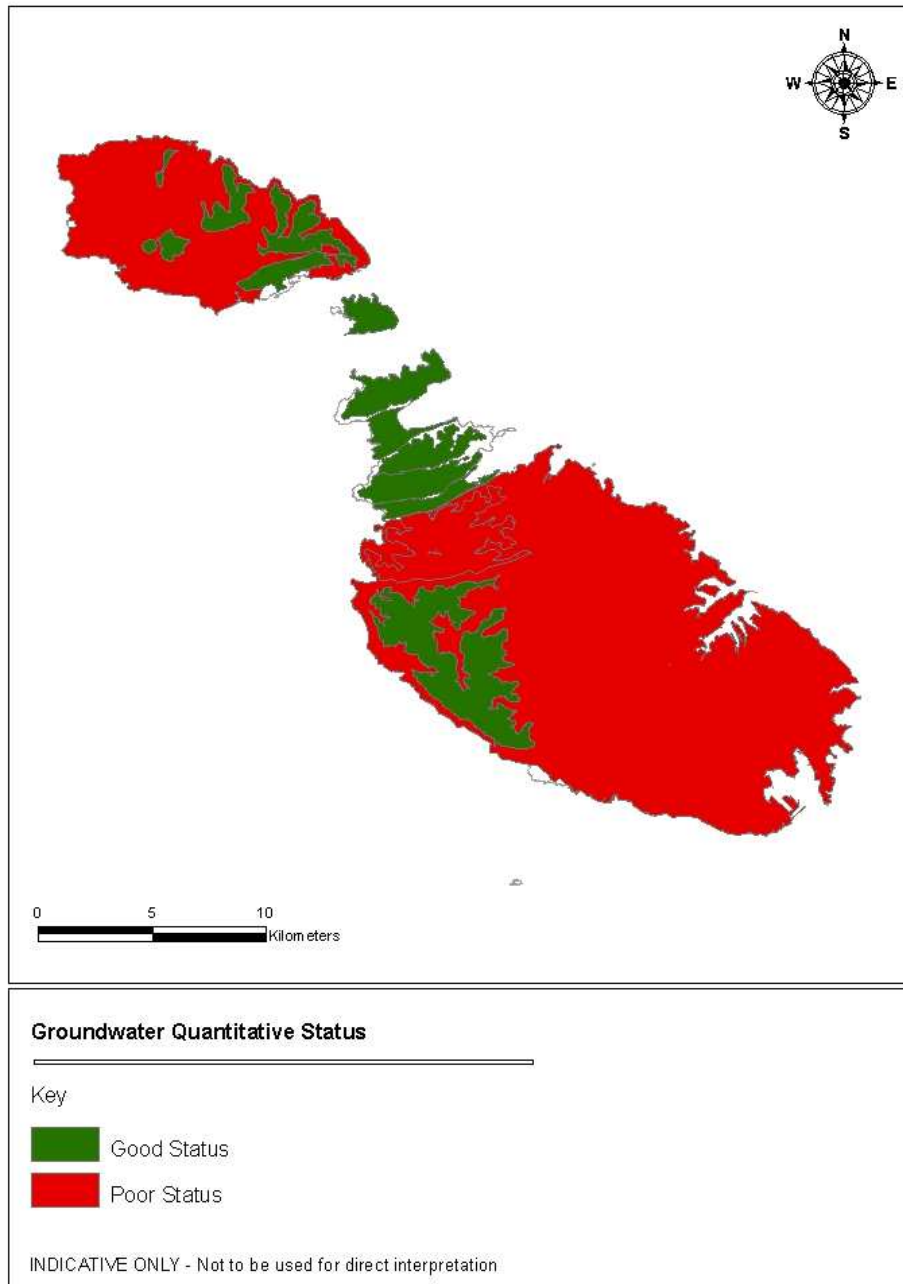
Quantitative balance per groundwater body

GW Body Name	GW Body Code	Size (km ²)	Inflow (hm ³)	Outflow (hm ³)	Balance (hm ³)	Major abstractors
Malta Mean Sea Level	MT001	216.6	34.27	36.65	-2.38	Abstraction for potable & agricultural purposes
Rabat Dingli Perched	MT002	22.6	4.64	4.62	0.02	Abstraction for agricultural purposes

GW Body Name	GW Body Code	Size (km2)	Inflow (hm3)	Outflow (hm3)	Balance (hm3)	Major abstractors
Mgarr-Wardija Perched	MT003	13.7	2.86	3.46	-0.59	Abstraction for potable & agricultural purposes
Pwales Coastal	MT005	2.8	0.69	0.69	0	Abstraction for agricultural purposes
Mizieb Mean Sea Level	MT006	5.2	1.11	0.96	0.15	Abstraction for potable & agricultural purposes
Mellieħa Perched	MT008	4.5	0.75	0.53	0.22	Abstraction for agricultural purposes
Mellieħa Coastal	MT009	2.9	0.69	0.38	0.31	Abstraction for agricultural purposes
Marfa Coastal	MT010	5.5	0.89	0.62	0.27	Abstraction for agricultural purposes
Kemmuna Mean Sea Level	MT012	2.7	0.52	0.30	0.22	Abstraction for agricultural purposes
Gozo Mean Sea Level	MT013	65.8	8.66	9.78	-1.12	Abstraction for potable and agricultural purposes
Għajnsielem Perched	MT014	2.7	0.73	0.34	0.39	Abstraction for agricultural purposes
Nadur Perched	MT015	5.0	1.15	0.58	0.57	Abstraction for domestic & agricultural purposes
Xaghra Perched	MT016	3.0	0.71	0.33	0.38	Abstraction for domestic & agricultural purposes
Zebbuġ Perched	MT017	0.4	0.1	0.03	0.07	Abstraction for domestic purposes
Victoria-Kercem Perched	MT018	1.5	0.39	0.14	0.25	Abstraction for domestic purposes

Map 6.3

Groundwater quantitative status



6.4.2 Qualitative status

i. Malta Mean Sea Level

The Malta Mean Sea Level groundwater body presents wide-spread evidence of pollution caused by Nitrates, with six out of the nine monitoring stations having levels in excess of the relative quality standard. The Threshold Values for Chloride and Electrical Conductivity are exceeded in seven and six monitoring stations respectively, a clear indication of saline intrusion. However, one must note that monitoring in this groundwater body was undertaken in public abstraction wells which are expected to be affected by localized disturbances due to upconing of saline water

beneath the abstraction point. In as much, these monitoring stations cannot be considered as fully representative of the status of the water body, but are more representative of the quality of the abstracted water.

Threshold values for Lead and Ammonium were exceeded in one station, in what is considered to be a localized exceedance. This situation will be investigated in further detail within the operational monitoring exercise.

The Groundwater body should thus be considered to be in 'poor' qualitative status.

ii. Rabat-Dingli Perched

The Rabat-Dingli perched groundwater body is significantly impacted with Nitrate pollution, where levels at three out of four monitoring stations exceed the quality standard. Nitrate content in this groundwater body peaks at around seven times the quality standard at one of the monitoring stations, this to highlight the acuteness of the problem.

The Threshold Value for Chloride is also exceeded at two of the monitoring stations. Since the perched (high) location of this groundwater body exceeds the possibility of saline intrusion, such exceedances can only be the result of anthropogenic activities such as excess fertilisation and irrigation with water derived from the sea-level aquifers. Further studies to trace the sources of chloride in this groundwater body and therefore direct actions to limit such pollution are being recommended in the first river basin cycle.

The Groundwater body is thus in 'poor' qualitative status principally due to its nitrate content.

iii. Mgarr-Wardija Perched

The Mgarr-Wardija perched groundwater body presents high levels of nitrate content in both its monitoring stations, exceeded by almost three-times the established qualitative standard. Also, the threshold value for chloride is exceeded in one of the monitoring stations and as for the previous water body investigations as to the sources of this exceedance are being recommended.

This Groundwater body can thus be considered to be in 'poor' qualitative status principally due to its nitrate content.

iv. Pwales Coastal

Nitrate levels at the Pwales Coastal groundwater body are extremely high, exceeding seven times the 50mg/l quality standard. Moreover, the Threshold Values for Chloride, Sodium and Conductivity are also exceeded by around four times, indicating high levels of saline intrusion.

The Groundwater body is thus in 'poor' qualitative status due to its nitrate content and the intrusion of saline waters.

v. Miżieb Mean Sea Level

Chemical data from the monitoring station in the Miżieb mean sea level groundwater body did not indicate any exceedance of established quality standards. The Miżieb groundwater body can thus be considered to be in 'good' status.

vi. Mellieħa Perched

The monitoring station in the Mellieħa Perched groundwater body presents high nitrate levels, standing at around two times the established quality standard. No other exceedances in further parameters were noted.

This groundwater body can thus be considered to be in 'poor' status due to its nitrate content.

vii. Mellieħa Coastal

Nitrate levels at the Mellieħa Coastal groundwater body are extremely high, exceeding six times the 50mg/l quality standard. Moreover, monitoring results for Chloride, Sodium and Conductivity are in excess of twice the value of the threshold values for these parameters, indicating high levels of saline intrusion.

The Groundwater body is thus in 'poor' qualitative status due to its nitrate content and the intrusion of saline waters.

viii. Marfa Coastal

Monitoring data for the Marfa Coastal groundwater body follows closely the situation encountered in the other coastal water bodies, with exceedances being encountered for Nitrates, Chloride, Sodium and Conductivity. In as much this groundwater body should be considered to be in 'poor' qualitative status due to nitrate contamination and sea-water intrusion.

ix. Comino Mean Sea Level

Chemical data from the monitoring station in the Comino mean sea level groundwater body did not indicate any exceedance of established quality standards. This groundwater body can thus be considered to be in 'good' qualitative status.

x. Gozo Mean Sea Level

The mean nitrate content of the six monitoring stations in the Gozo Mean Sea Level groundwater body can be considered to be equal to the quality standard. Moreover, Nitrate levels at three of the monitoring points exceeded the quality standard. Mean quality data for the groundwater body also shows exceedances for Sodium and Chloride. These exceedances occur in three monitoring stations.

An issue, particular to this groundwater body concerns sulphate, where the Threshold Value is exceeded in three monitoring stations. Further investigations on the origin of this situation are recommended within the first river basin cycle, in order to determine its impact on the status of the water body.

At this stage, this groundwater body should be considered to be in 'poor' status due to nitrate contamination and sea-water intrusion.

xi. Nadur Perched

Water quality data from the monitoring station in the Nadur perched groundwater body only show an exceedance of the quality standard for Nitrate. Thus, the groundwater body should be considered to be in 'poor' status due to nitrate contamination.

xii. Xagħra Perched

Monitoring data from the Xagħra perched groundwater body shows exceedances of the standards for Nitrate and Sulphate. The groundwater body can thus be considered to be in 'poor' status.

Moreover, it is recommended that the origin of the sulphate content in groundwater be investigated within the first river basin cycle to differentiate between the possibilities of geogenic and anthropogenic origins.

xiii. Zebbuġ Perched

The Zebbuġ perched groundwater body presents levels of Nitrate, Chloride and Sodium all in excess of the established quality standards. In as much, the groundwater body should be considered to be in 'poor' status.

xiv. Victoria-Kerċem Perched

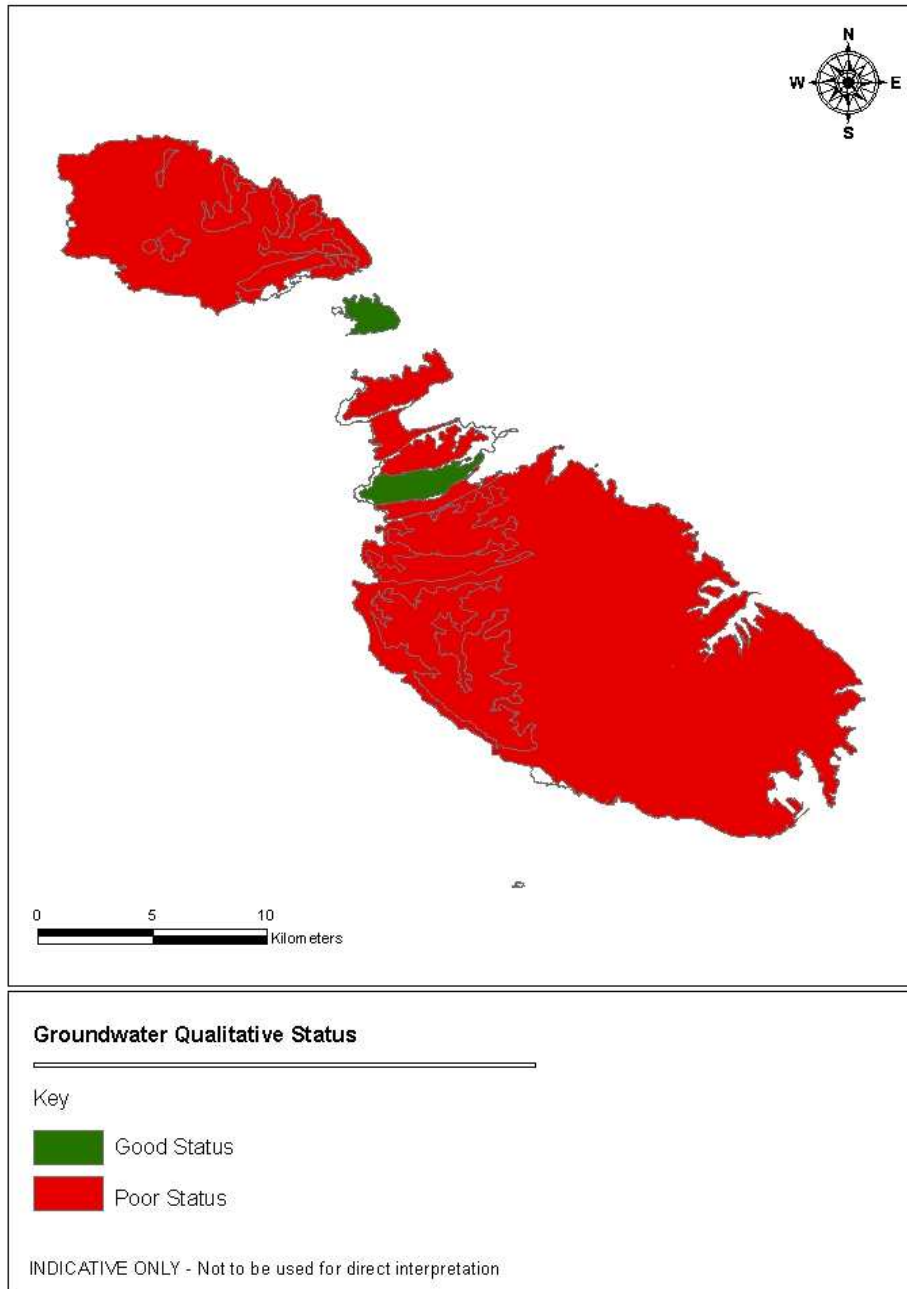
Quality data from both monitoring stations in the Victoria-Kerċem groundwater body exceed the quality standard for nitrate whilst the threshold values for chloride, sodium and conductivity are exceeded in one of the monitoring stations.

Further research on the origin of the chloride related contamination is recommended during the first river basin cycle.

The qualitative status of these groundwater bodies is presented in Map 6.4.

Map 6.4

Groundwater qualitative status



6.4.3 Summary

The outlook of groundwater body status presented in the sub-sections above indicate contamination by Nitrates as the single most important issue affecting the status of groundwater in Malta (Figure 6.1). In fact, Nitrate contamination has been identified as a 'status-failing' issue in thirteen out of fifteen groundwater bodies.

Other important issues which should also be considered are sea-water intrusion surface contamination by sea-water related parameters and quantitative (over abstraction) issues. It should also be noted that saline intrusion and quantitative issues are intrinsically linked in the sea-level aquifer system; where intrusion is a direct consequence of over abstraction.

Figure 6.1
Main issues affecting groundwater status

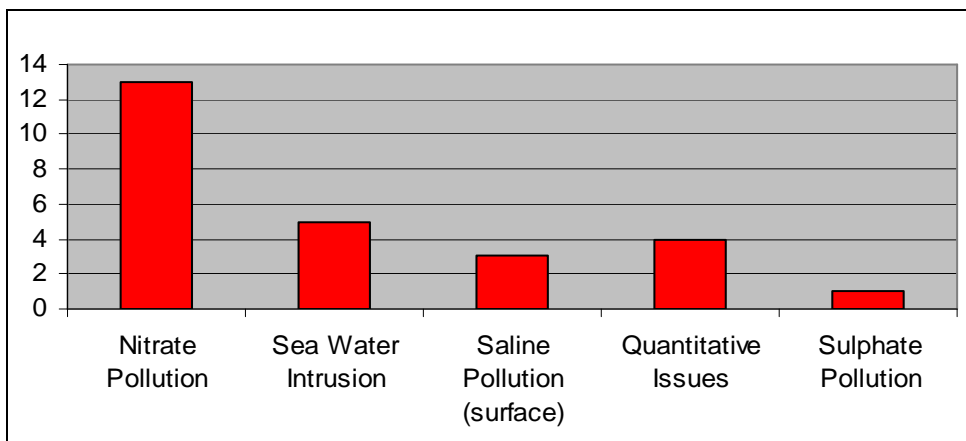


Table 6.6

Qualitative and quantitative status for groundwater bodies

Groundwater Body Name	Groundwater Body Code	Qualitative Issues	Quantitative Issues	Chemical Status	Quantitative Status	General Status	Level of confidence
Malta Mean Sea Level	MT001	Nitrate Pollution	Abstraction exceeds recharge	Poor	Poor	Poor	High
		Sea Water Intrusion					
Rabat-Dingli Perched	MT002	Nitrate Pollution		Poor	Good	Poor	Low
Mgarr-Wardija Perched	MT003	Nitrate Pollution	Abstraction exceeds recharge	Poor	Poor	Poor	Low
Pwales Coastal	MT005	Nitrate Pollution	Abstraction exceeds recharge	Poor	Poor	Poor	Low
		Sea Water Intrusion					
Mizieb Mean Sea Level	MT006			Good	Good	Good	low
Mellieha Perched	MT007	Nitrate Pollution		Poor	Good	Poor	Low
Mellieha Coastal	MT009	Nitrate Pollution		Poor	Good	Poor	Low
		Sea Water Intrusion					
Marfa Coastal	MT010	Nitrate Pollution		Poor	Good	Poor	Low
		Sea Water Intrusion					
Kemmuna Mean Sea Level	MT012			Good	Good	Good	Medium
Gozo Mean Sea Level	MT013	Nitrate Pollution	Abstraction exceeds recharge	Poor	Poor	Poor	High
		Sea Water Intrusion					
Ghajnsielem Perched	MT014	Nitrate Pollution		Poor	Good	Poor	Low
		Saline Pollution					
Nadur Perched	MT015	Nitrate Pollution		Poor	Good	Poor	Low
Xaghra Perched	MT016	Nitrate Pollution		Poor	Good	Poor	Low
Zebbug Perched	MT017	Nitrate Pollution		Poor	Good	Poor	Low
		Saline Pollution					
Victoria-Kercem Perched	MT018	Nitrate Pollution		Poor	Good	Poor	Low
		Saline Pollution					

6.5 Trend Analysis

(i) Sea Level Aquifer Systems

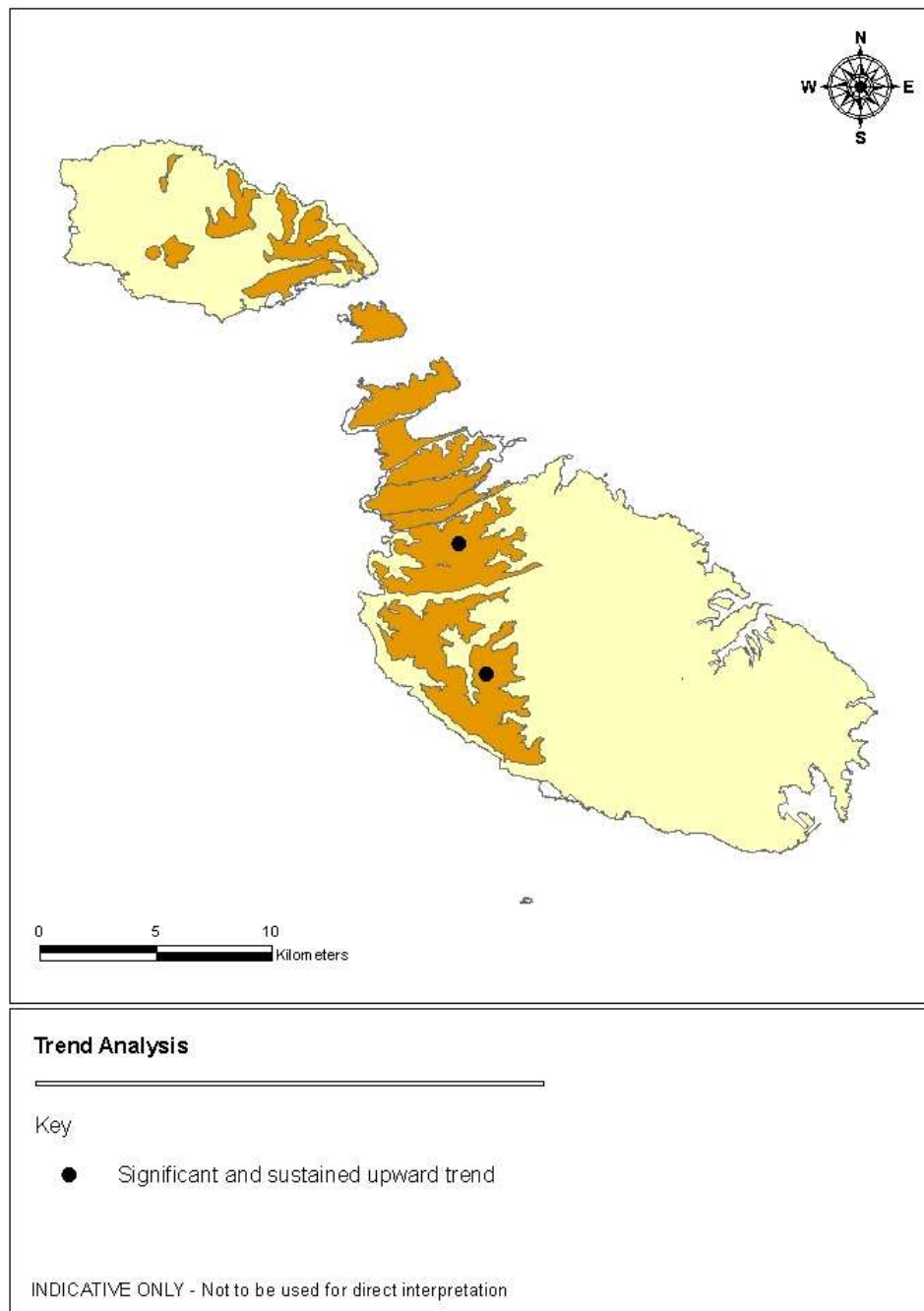
Existing data records obtained from chemical monitoring undertaken in public groundwater abstraction wells indicate that in recent years quality levels for the main parameters of concern (chlorides and nitrates) in the sea-level groundwater bodies are quite stable.

(ii) Perched Aquifer Systems

Limited monitoring data exists for these groundwater bodies, particularly the minor perched systems in the northern regions of Malta and Gozo. However, even from this limited data one can determine a significant and sustained upward trend in the nitrate content of the Rabat-Dingli and Mgarr-Wardija perched aquifer monitoring stations.

More detailed trend analysis will be performed once regular monitoring data from the surveillance and operational monitoring data is available. In as much, a full analysis of trends in water quality in all water groundwater bodies is expected for the second RBMP report.

Map 6.3
Groundwater trend analysis



7 Setting the Environmental Objectives for our waters

7.1 Introduction

The WFD allows for a number of exemptions to the general objectives set in Chapter 1 of this plan. These exemptions allow for less stringent objectives or for the extension of deadlines to achieve good status beyond 2015 provided that a set of conditions is fulfilled by each Member State. This Chapter explores the need to set alternative objectives for those surface and groundwater bodies where ‘good status’ cannot be seen to be achieved by 2015. For surface waters the exemptions being requested relate to time extensions due to the long-term response of natural systems to management action. In the case of groundwaters, exemptions include time extensions and less stringent objectives for small perched and coastal groundwater bodies which are significantly affected by human pollution.

7.2 Setting the environmental objectives for surface water bodies

Malta is requesting exemptions to achieving good status for the five coastal water bodies (table 7.1) that have been identified as having potentially less-than-good ecological status as required by the WFD.

In all five instances exemptions are being requested to extend the deadline for the achievement of good status from 2015 to 2021. This request is being made on the basis of limited information on the actual state of the biological quality elements and the natural response of the biological elements – in particular the response of the *Posidonia oceanica* to the management measures.

Table 7.1
Environmental Objectives and exemptions for Surface waters

Water Body Code	Water Body Name	Environmental Objective (including exemption)	Reason for exemption
MTC 105	Il-Port il-Kbir – Il-Port ta’ Marsamxett	Good Ecological Potential (2021)	Lack of data to define ecological potential, and time required to implement management measures to reduce chemical pollution.
MTC 106	Ix-Xaghjra	Good Status (2021)	Lack of data on most BQEs to define good status and slow recovery rate of biological quality elements, in particular <i>P. oceanica</i>
MTC 107	Il-Port ta’ Marsaxlokk	Good Ecological Potential (2021)	Lack of data to define ecological potential,

7.3 Setting the environmental objectives for groundwater bodies

The generic objective for all groundwater bodies in the Maltese River Basin District is “Good Status”, the achievement of which will need to be staggered due to both natural and economic conditions.

However, in the case of four groundwater bodies it is being proposed that due to the fact that they are significantly affected by human activity, “Less Stringent Objectives” will need to be established (Table 7.2).

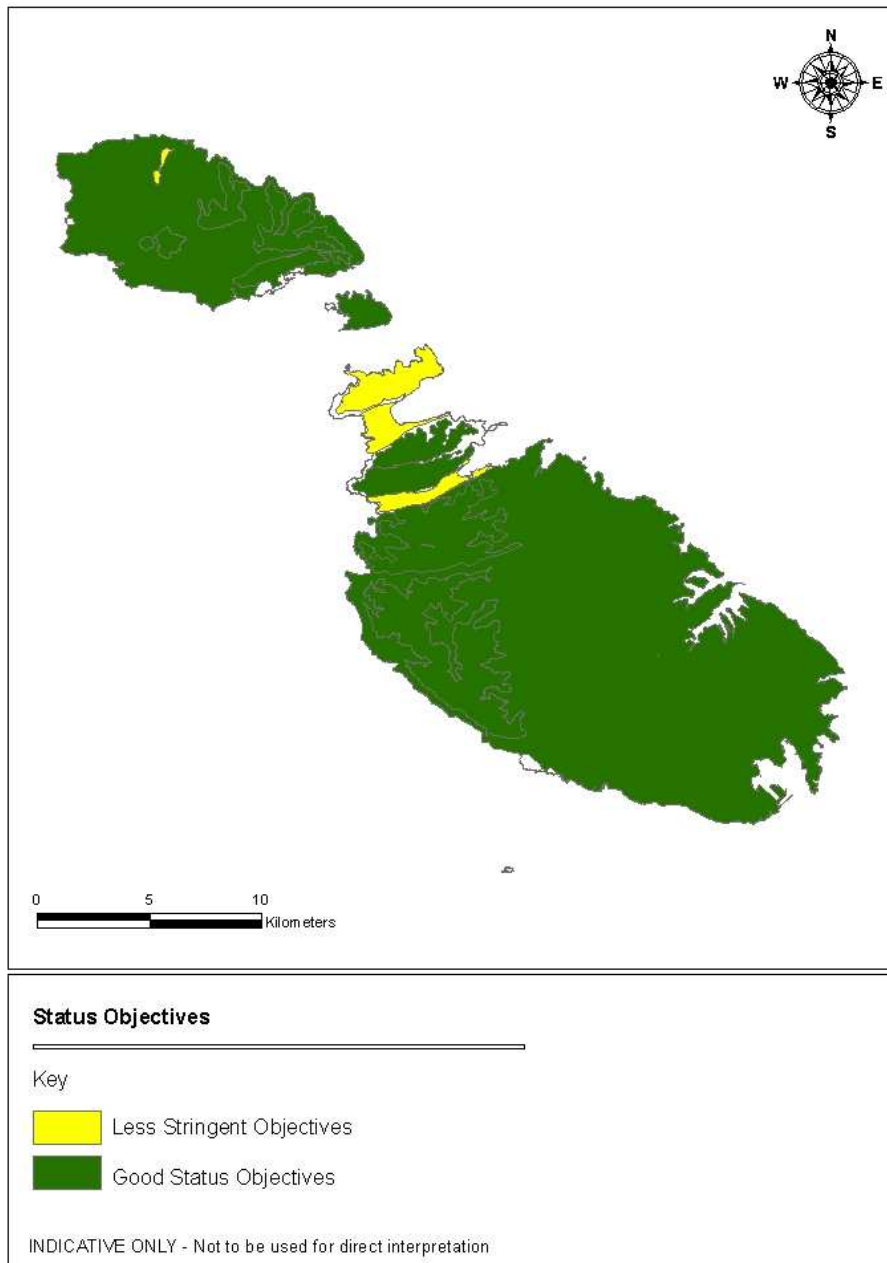
Table 7.2

The environmental objectives for groundwater bodies

Groundwater Body Name	Code	Objectives
Malta Mean Sea Level	MT001	Good
Rabat-Dingli Perched	MT002	Good
Mgarr-Wardija Perched	MT003	Good
Pwales Coastal	MT005	Less stringent objectives
Mizieb Mean Sea Level	MT006	Good
Mellieha Perched	MT008	Good
Mellieha Coastal	MT009	Less stringent objectives
Marfa Coastal	MT010	Less stringent objectives
Kemmuna Mean Sea Level	MT012	Good
Gozo Mean Sea Level	MT013	Good
Ghajnsielem Perched	MT014	Good
Nadur Perched	MT015	Good
Xaghra Perched	MT016	Good
Zebbug Perched	MT017	Less stringent objectives
Victoria-Kercem Perched	MT018	Good

Map 7.1

Status objectives for groundwater bodies in the Maltese water catchment district



7.4 Identifying the need for exemptions and alternative objectives

7.4.1 Exemptions and alternative objectives for groundwater bodies

Groundwater bodies in Malta are characterised by relatively long response times and as such it is expected that the implementation of the management measures envisaged in this plan will not immediately be reflected in an improvement in the status of the underlying groundwater body. The timeframes involved, as inferred from the conceptual models of these groundwater systems, are such as to preclude

the achievement of good status within the first planning cycle for those groundwater bodies which have been assessed as currently being in 'poor' status.

Extensions to the 2015 good status deadlines are thus being proposed for these bodies of groundwater, based on the current understanding of the functioning of these aquifer systems. These proposals will be reviewed at the end of each planning cycle to take into account the real response of the systems to the implemented management measures as determined from the results obtained from the operational monitoring networks.

7.4.2.1 Achievement of 'Good Status' by 2015

The Mizieb Mean Sea Level and the Kemmuna Mean Sea Level groundwater bodies have been assessed as currently being in 'good quantitative and qualitative status'. More importantly, these bodies do not exhibit significant upward trends in their 'nitrate' content, which is the main contaminant identified in the surveillance monitoring exercise to exceed background levels.

Assuming the implementation of the management issues envisaged in this plan, it is thus considered safe to assume that there will not be a significant deterioration in the status of these two water bodies and thus they can be considered as potential candidates for the achievement of good status by 2015.

7.4.2.2 Achievement of 'Good Status' by 2021

The perched groundwater bodies are primarily affected by high Nitrate pollution, mainly as a result of the intensive agricultural activities which they support. The storage volume of these aquifers is quite limited and their response times are considered to be in the 'medium' term.

The implementation of measures regulating the application of fertilisers to land as envisaged in this plan are expected to be reflected in an eventual reduction in the nitrate content of these groundwater bodies. These measures will however have an immediate effect in that further nitrate pollution is halted.

Achievement of 'good status' by 2021 (or when natural conditions permit after the deadline) is thus being proposed as an alternative objective for the following groundwater bodies:

- (i) Rabat Dingli Perched
- (ii) Mellieha Perched
- (iii) Nadur Perched
- (iv) Xaghra Perched
- (v) Victoria-Kercem Perched

This objective will be reviewed at the end of the first planning cycle and confirmed in the second river basin management plan.

7.4.2.3 Achievement of 'Good Status' by 2027

The Malta and Gozo mean sea level aquifer systems are considered to have relatively long response times, by far exceeding the three planning cycles envisaged in the Directive. In as much, it is naturally infeasible to attain 'good status' within the Directive's timeframes. The situation is further compounded by the high storage-

recharge ratio (of the order of 40) of these aquifer systems. In fact simple direct mixing models already indicate time-frames in excess of the third (2027) deadline. A similar situation is envisaged for the Mgarr-Wardija and Ghajnsielem Perched aquifer systems which sustain deep basin structures. However, given the lower storage-recharge ratio, the response times of these systems are expected to be shorter than those for the sea-level aquifer systems.

These indications will be reviewed and updated in each successive planning cycle. However, at this stage, one cannot exclude that following the conclusion of the third planning cycle longer timeframes to the achievement of 'good status' will have to be considered, mainly due to the natural conditions of the aquifer systems.

Achievement of 'good status' by 2027 (or when natural conditions permit after the deadline) is thus being proposed as an alternative objective for the following groundwater bodies:

- (i) Malta Mean Sea Level
- (ii) Mgarr Wardija Perched
- (iii) Gozo Mean Sea Level
- (iv) Ghajnsielem Perched

Furthermore, this group of groundwater bodies (except Ghajnsielem) was identified as failing to achieve the requirements for 'good quantitative status'. Although one should note that it is technically feasible to achieve good quantitative status within the first planning cycle by utilising the islands' spare desalination capacity, this option is not being considered for immediate implementation for the following reasons:

- (i) the solution of quantitative problems by solely increasing water production sends the wrong message that the island's water supplies are unlimited;
- (ii) reverse osmosis production is highly vulnerable to the occurrence of oil spills and therefore one cannot discount the scenario wherein particular desalination plants could be shut due to contamination in coastal waters;
- (iii) desalination is an energy intensive process and such a scenario would increase the emission footprint of the islands;
- (iv) the determination of quantitative status is based on water balance estimates and not on direct measurements;
- (v) water level measurements in a number of gauging stations record stable piezometric levels; and
- (vi) the high storage-recharge ratio of the sea level aquifer systems permits the consideration of longer timeframes for the reduction of the imbalance between recharge and abstraction without the occurrence of catastrophic events.

The following course of action is thus being proposed:

- (i) The first planning cycle will see the implementation of a number of water demand management measures with the aim of curbing the national water demand. Such measures will be spread on all sectors and utilise a variety of tools ranging from actual actions to educational campaigns.

During this cycle, the plan sees also the implementation of a number of measures aimed at increasing the understanding of the spatial distribution of the water demand and the quality requirements of the different users. Such measures include the

enactment of new legislation and regulatory provisions, targeted studies and pilot projects.

(ii) The information acquired during the first planning cycle will then guide the formulation of proposals for tangible actions in the second and third planning cycles.

iv. Less Stringent Objectives

Less Stringent objectives are being proposed for four of the minor groundwater bodies which are considered to be significantly affected by human activities in a way as to preclude the possibility of the achievement of good status. Moreover, due to their small size, their high exploitation levels and their direct contact with the bounding saline waters, these aquifer systems are also influenced by the natural intrusion (diffusion) of saline waters.

It should also be noted that cumulatively these four groundwater bodies represent just around 4% of the total potential groundwater resources of the islands.

Less stringent objectives are thus being proposed for the following groundwater bodies:

- (i) Pwales Coastal
- (ii) Mellieha Coastal
- (iii) Marfa Coastal
- (iv) Zebbug Perched

The status of these water bodies will be reviewed in each planning cycle and presented in each River Basin Management Plan.

Table 7.3

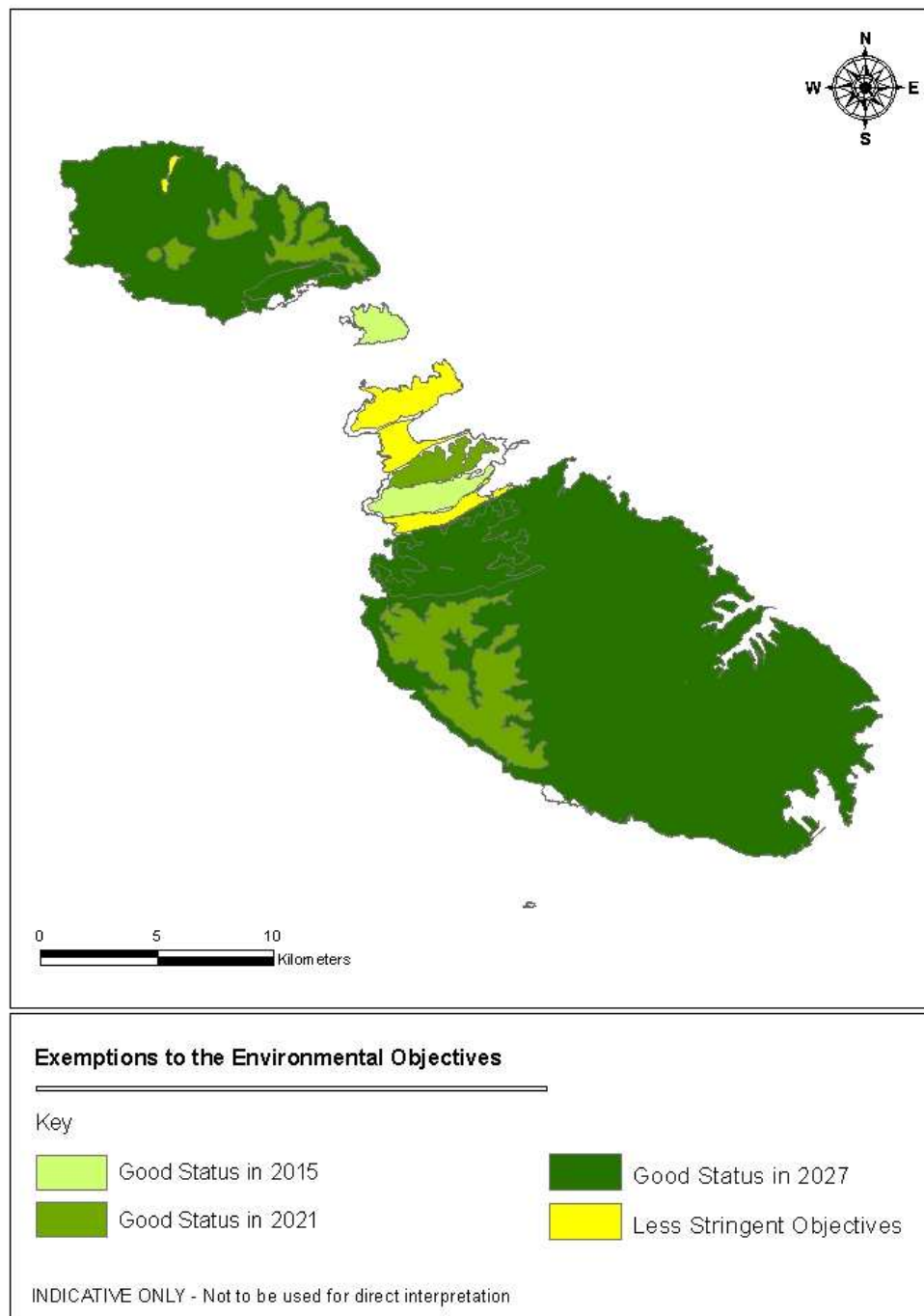
Exemptions and alternative objectives set for groundwater bodies in the Maltese water catchment district

Groundwater Body Name	Code	General Status	Objectives	Date	Exemptions
Malta Mean Sea Level	MT001	Poor	Good	2027 or as soon as natural conditions permit after 2027	Extension of deadlines, NC and DC
Rabat-Dingli Perched	MT002	Poor	Good	2021 or as soon as natural conditions permit after 2021	No exemption required
Mgarr-Wardija Perched	MT003	Poor	Good	2027 or as soon as natural conditions permit after 2027	Extension of deadlines, NC and DC
Pwales Coastal	MT005	Poor	Less stringent objectives	2015	LSO because DC
Mizieb Mean Sea Level	MT006	Good	Good	2015	No exemption required
Mellieha Perched	MT008	Poor	Good	2021 or as soon as natural conditions permit after 2021	Extension of deadlines when NC permits
Mellieha Coastal	MT009	Poor	Less stringent objectives	2015	LSO because DC
Marfa Coastal	MT010	Poor	Less stringent objectives	2015	LSO because DC

Groundwater Body Name	Code	General Status	Objectives	Date	Exemptions
Kemmuna Mean Sea Level	MT012	Good	Good	2015	No exemption required
Gozo Mean Sea Level	MT013	Poor	Good	2027 or as soon as natural conditions permit after 2027	Extension of deadlines, NC and DC
Ghajnsielem Perched	MT014	Poor	Good	2027 or as soon as natural conditions permit after 2027	Extension of deadlines when NC permits
Nadur Perched	MT015	Poor	Good	2021 or as soon as natural conditions permit after 2021	Extension of deadlines when NC permits
Xaghra Perched	MT016	Poor	Good	2021 or as soon as natural conditions permit after 2021	Extension of deadlines when NC permits
Zebbug Perched	MT017	Poor	Less stringent objectives	2015	LSO because DC
Victoria-Kercem Perched	MT018	Poor	Good	2021 or as soon as natural conditions permit after 2021	Extension of deadlines when NC permits

Map 7.2

Exemptions set for groundwater bodies in the Maltese water catchment district



8 Measures needed to improve and protect our waters

8.1 Introduction

To achieve the environmental objectives set out in chapter 1 and 7 of this plan, a number of actions targeting the different water management issues identified are proposed for implementation during the first river basin management planning cycle (2009-2015). The WFD calls this set of actions or measures a **Programme of Measures (PoMs)**.

The following section gives an overview of the key measures several players will carry out in order to improve and protect all waters in the Maltese Islands. Most actions call for the commitment of several organisations. For each action a lead organisation has been identified (see Chapter 13).

The WFD defines two main types of actions or measures:

- **Basic measures** required by the Water Framework Directive and existing European water legislation (such as the Urban Waste Water Treatment Directive or the Nitrates Directive and the Habitats Directive).
- **Supplementary measures.** These refer to additional actions needed, the effects of which are not catered for by basic measures and therefore extra measures are required in order to guarantee protection and improvement in the status of our waters.

8.2 Identifying which measures are required

An analysis of the major pressures and impacts on the water environment (Chapter 4) revealed the most significant water management issues on the Islands. These are the most pressing issues that require a concerted effort in order to achieve 'good status' in all waters. In total, eight main water management issues were identified for the Malta Water Catchment District. The recognition of these issues facilitated the identification of the most appropriate measures or actions required to mitigate impacts and to manage our water environment more holistically.

The eight water management issues are as follows:

1. A non-sustainable management of groundwater resources: the quantitative problem

Over abstraction is problematic for 4 out of 15 groundwater bodies. These water bodies are in fact classified as being at risk of failing to achieve the WFD's directives due to groundwater quantity.

Solving over abstraction problems will require reducing groundwater abstraction by different sectors. Options that may be considered include supply augmentation and demand management alternatives such as increasing water use efficiency, promoting aquifer recharge, or utilising alternative sources of supply such as treated sewage effluent; and rainwater.

2. A deterioration of groundwater quality

As presented in Chapter (pressure and impact chapter) recent trends on groundwater quality have shown high levels of nitrate and chloride concentrations in groundwater. Agricultural activities were identified as the primary contributors to nitrate pollution in groundwater. Secondary to agriculture are leakages from the sewage network. Pollution from chlorides, on the other hand, is directly linked to groundwater abstraction. Indeed increasing salinity levels observed in groundwater quality directly results from over abstraction.

For those substances that exceed EU standards action will be required to either reduce the level of pollution or phase out the use of hazardous substances.

3. Ensuring protection of coastal waters and sustainable development

The contribution of coastal activities to the Maltese economy represents 13% of the GDP and translates to about 15% of total employment. Coastal water quality is key to healthy ecosystems and to support coastal ecosystems services, including recreation and tourism products. On a national level a number of initiatives are already in place to promote the sustainable use of coastal areas, including the successful designation of areas of conservation value as part of NATURA 2000. Integrated coastal zone planning is addressed in the Structure Plan and supporting Local Plan policies that are targeted to reduce conflicting uses and to promote better use of the remaining undeveloped coastline.

However point and diffuse sources of pollution remain a major threat. The transposition of several related EU Directives (such as the IPPC Directive, the Urban Waste Water Directive, the Nitrates Directive, the Environmental Impact Assessment Directive, the SEVESO directive has led to efforts to improve and mitigate against these impacts but supplementary measures are likely to be required in order to reach WFD objectives in some water bodies.

4. Ensuring conservation of ecologically significant surface water systems

Locally surface waters such as the Ghadira reserve, the Bahrija valley system, the Qattara fresh water pool in Gozo etc. support many diverse ecosystems of high ecological and conservation value. Action is required to maintain and in some cases to restore these areas to favourable conservation status as defined by the Habitats Directive to ensure the continued existence of the habitats and species of conservation value that they harbour.

5. Major challenges with the regulatory and institutional frameworks

The implementation of the WFD will require reinforcing the regulatory and institutional frameworks. More significant engagement in water regulation and control is still required to meet the environmental objectives of the WFD, in terms of permitting and other obligations, such as the installation of rainwater harvesting devices and action programmes for specific pollutants.

Institutional capacity building in terms of increased human resources and know-how is also a key requirement for the successful development and implementation of an integrated water policy. There is also a need to move away from the current sector based practices and move towards integrated management of water resources. An integrated approach to water management will set up clear processes and mechanisms to enhance cooperation among all entities and ensure synergies between sectoral measures. Integration is also key to the financing and successful implementation of these measures.

6. Financing of the water sector, cost-recovery and pricing

Addressing water issues will unavoidably incur costs. These costs mainly relate to investment in the required infrastructure and monitoring systems. The cost-recovery principle as outlined in the WFD is being adopted. Please refer to Chapter 9 for more information on this aspect.

7. Institutional and public information and awareness raising

There is limited understanding of the nature and magnitude of current water management problems in the Maltese Islands. Limited information on water management in Malta is available to the general public. A key challenge therefore is to facilitate access to data and knowledge on water management issues. It is also essential that public information is validated and structured.

Technical Information on best available techniques and good practices that might be looked for by the economic sectors is also not readily available. The success of this plan relies a great deal on a well informed public that is willing to contribute to its implementation.

8. Enhancing our knowledge base

Additional information, beyond that which is currently available, is required for the effective implementation of the WFD. Most knowledge gaps arise when trying to understand pressure and impact responses; methods to evaluate the effectiveness of potential measures and to assess the likely environmental and socio-economic implications the implementation of the measures will have.

Environmental monitoring and the ensuing classification of water bodies are the scientific basis for policy and measure development within the WFD. The need to improve the national capacity for environmental monitoring both in terms of technical requirements and infrastructure has therefore become more urgent. Innovative ways to increase collaboration between local and regional research institutions and regulators to address data gaps need to be developed.

In light of the eight significant water management issues identified the measures presented in this plan were designed to:

- 1 Target all **waters, surface, coastal and groundwaters**;
- 2 Help **mitigate and reduce the impact of the most significant pressures** from agriculture, industry (including harbours), tourism (including water-related leisure activities) and households;
- 3 **Strengthen the existing regulatory framework**
- 4 **Enhance what the general public and professionals know about water since water management is complex.** - to ensure data and information are progressively collected in order to take sound water management decisions during the implementation of this plan
- 5 **Raise public and sectoral awareness** on the importance of managing Malta's water resources and the aquatic environment.

Details on the steps that were followed to identify and assess the effectiveness of the measures selected are included in Technical document no. >>>. Lead and competent agencies or authorities identified for the implementation of each measure together with details on each measure are included in the same technical document.

8.3 Key measures to guarantee the successful implementation of this plan


The successful implementation of this plan hinges on the commitment of several players coming from a wide spectrum of sectors to work together. To get the expected results, public authorities will need to give enforcement a priority in terms of organisation, training and when needed, allocation or reallocation of human and financial resources. Achieving the environmental objectives of the WFD will also require rigorous enforcement of existing regulations.

Two pivotal measures key to the achievement of the plans objectives were proposed:

R S	Set up an inter-ministerial water committee to oversee the implementation of Water Catchment Management Plan An administrative framework is required to ensure the effective and timely implementation of the WCMP. The Water Committee will monitor and follow up each measure together with the leading authority and responsible entities during the life time of this plan.
R S	Strengthen the existing environmental and planning regulatory processes to cater for the objectives of the Water Framework Directive This measure will develop and implement a framework to integrate water management objectives into sectoral programmes, plans and policies and in so doing bridge the gap between the environment, resource management and spatial planning.

Key:

Measure category

- R** Regulatory measure
-  Basic measure
- S** Supplementary measure

8.4 Measures needed to improve our water quality

Good coastal water quality is key to healthy ecosystems and necessary to support coastal ecosystem services, including recreational and tourism assets. On a national level a number of initiatives are already in place to promote the sustainable use of coastal areas, including the designation of areas of conservation value as part of NATURA 2000. Integrated coastal zone planning is addressed in the Structure Plan and supporting Local Plan policies that are targeted to reduce conflicting uses and to promote better use of the remaining undeveloped coastline. Basic measures derived from the transposition of several related EU Directives (such as the IPPC directive, the Urban Waste Water Directive, the Nitrates Directive etc.) has led to efforts to improve and mitigate these impacts.

However point and diffuse sources of pollution from various sectors remain a threat. Supplementary measures are therefore required in order to reach the WFD objectives in some water bodies.

8.4.1 Agriculture and animal husbandry sector

Agricultural activities were identified as the primary contributors to nitrate pollution in groundwater and are also a potential source of nitrate contamination in surface waters. The following list of basic and supplementary measures was identified. Most

identified actions emanate from the Code of Good Agricultural Practice that was defined under the Nitrates Directive.

The provisions of the Nitrates Directive however are not considered to be sufficient to achieve the required levels of nitrates in groundwater and protected surface waters. Supplementary measures are therefore also required to further reduce nitrate contamination. Guidance to assist farmers in implementing this suite of measures will be provided via the setting up of advisory services.

It is expected that these measures would also fit into the Nitrates Action Plan and Rural Development Plan, developed by the Department of Agriculture.

■	<p>Farmers required to keep a record of breeding effluent volumes and destination of application to land. Monitoring the quantity of manure produced at farm level and the way it is managed is important. Animal husbandry farmers are expected to keep a record of the volume of effluent produced, the amount of manure applied on their holding, together with the final use of excess manure.</p>
■	<p>Farmers required to keep a record of farming practices This measure aims at managing fertilisers and pesticides at farm level.</p>
S	<p>Construct anaerobic digestion plants for municipal waste and animal waste The Animal Waste Management Plan for Malta identified the need for the setting up of a number of anaerobic digestion plants to treat all animal waste including pig slurry and wastewaters from animal husbandry units. Sewage sludge would be co-treated at the digestion plant.</p>
■	<p>Reduce point source nitrate contamination from livestock units This measure consists of the upgrading of all livestock units in terms of waste management (collection, storage and disposal of waste) in line with the Nitrates Directive Code of Good Agricultural practices.</p>
■	<p>Farmers to draw up and comply with a nutrient management plan Arable farmers are requested to draw up a nutrient management plan which spells out the quantity and timely application of fertilisers on crops. This measure aims to promote the efficient use of nutrients in relation to the requirements of particular crops grown.</p>
■	<p>Promote the use of alternative methods for plant protection other than pesticides Alternative methods for the protection of plants other than pesticides such as mechanical methods, and biological trapping would be promoted.</p>
■	<p>Creation of a perennial system to collect and treat pesticide packaging and non utilised products This measure deals with the appropriate collection of used pesticide packages.</p>
R	<p>Establishment of an advisory service for the farming community This measure will facilitate farmer outreach and the implementation of all agriculture related actions.</p>

8.4.2 Fishing and Aquaculture sector

The development of codes of good practice for fishers and aquaculture practitioners is considered to be a first step at controlling and mitigating impacts associated with these economic activities. The related actions that have been identified in this plan for this sector will be integrated within the Fisheries Operational Programme for Malta.

S	Define and implement good practices for aquaculture This code of conduct will build and consolidate existing good practice and will address key aspects pertaining to aquaculture operations.
S	Define and implement good practices for fisheries within port areas This measure aims at motivating fishers to adopt good practices and good site management within fishing harbours.



8.4.3 Industrial and urban environments



The Environment Directorate of MEPA covers the operations of all industrial activities in Malta with environmental permits covering all media (Air, Water, Wastes).

For the purpose of environmental permitting, enterprises in Malta may be divided into 4 distinct groups:

1. Enterprises which are exempt from being permitted because of their small scale or their low potential for environmental impact.
2. Enterprises with a limited environmental impact which are suitable for regulation through General Binding Rules (GBRs).
3. Enterprises that require a site specific Environmental Permit.
4. Enterprises that are regulated by specific EU legislation such as the IPPC or the Solvents Directive.


Discharge permits to water will be in conformity with the Water Framework Directive's standards and therefore there is a need to identify emission standards for priority substances and other pollutants as defined by the WFD and its daughter Directives.

	Create a pollution abatement programme for priority hazardous substances, priority substances and other substances of concern The measure aims at establishing programmes for pollution abatement and the eventual phasing out of priority substances of concern. An inventory of industrial discharges and environmental data would enable a more complete understanding of which substances would require further action in terms of pollution abatement and the actual phasing out of pollutants.
	Develop tools to link environmental quality standards (chemical) to emission limits for marine discharges As well as setting Environmental Quality Standards (EQS) for coastal waters, the WFD calls for the control of discharges at source through emission standards. There needs to be a scientific process which links emission limits for substances of concern (i.e. substances for which exceedances have been measured in coastal waters) to the EQS that needs to be achieved. This measure calls for a modelling tool to be developed for this purpose.

	<p>Treatment of all urban waste water produced in the Maltese Islands</p> <p>With this measure in place all urban waste water will be treated prior to being discharged to sea. As a result the quality of our coastal waters is expected to improve.</p>
S	<p>Use of a pipe diffuser for discharge of treated waste water into the coastal Environment</p> <p>The use of diffusers ensures adequate dilution of waste water and prevents adverse impacts on the marine environment. The use of a diffuse pipe would also increase the diffusion of the pollutant in cases of malfunction of the treatment plant.</p>
S	<p>Set up an environmental pollution emergency response team</p> <p>An emergency response team of officers is responsible for carrying out immediate on-site assessment in the locality of the reported pollution incident and for the carrying out of pollution mitigation for groundwater, coastal waters and protected inland surface waters environments.</p>
R 	<p>Adopt a regulatory framework for industrial operational practices</p> <p>At present a comprehensive permitting system is in place for those industries that fall under the Integrated Pollution Prevention and Control regulations as defined by the EU. There is however a number of industries that does not fall under this classification scheme and thus there is scope to extend the IPPC permitting to all industrial installations. This will be in the form of General Binding Rules.</p>
R S	<p>Improve the regulatory system for industrial discharges into the public sewerage network</p> <p>The quality of industrial discharges into the sewerage network determines the effectiveness of the treatment of waste water at the sewage treatment plant. At present industrial discharges to sewers are regulated under LN 139 of 2002 'Sewer discharge control regulations'. The WSC issues sewage discharge permits. The objective of this measure is to control the impact of discharges to the sewers by improving the quality of the discharge permits.</p>

8.4.4 Managing the immediate coastal and marine environment

Competition for space along the coast has always been intense and the development of the coastal area has not always been sensitive to the natural environment. Inadvertently this has resulted in significant environmental costs in terms of habitat loss and degradation, extensive modifications to the seabed and degradation in the quality of bathing water.

S	<p>Develop and implement planning and environmental guidance on major coastal engineering works</p> <p>The guidance (including planning and design guidance) will consider the various works on the coast and identify the most important planning and environmental criteria to be considered, identify best practices available and provide a protocol for environmental monitoring programmes. The guidance would be disseminated at planning level.</p>
	<p>Ensure bathing water quality standards in bathing areas</p> <p>Maintaining the classification of bathing sites is crucial for tourism and recreation. The quality of our bathing waters is continuously monitored during the bathing season in accordance with the Bathing Water Directive.</p>

S	Monitor dumping operations at the spoil ground The monitoring of the spoil ground is necessary to ensure that it is being operated in accordance with current regulations and does not pose a significant threat to the marine environment. It is expected that this action will complement and build upon the study to be carried out on the spoil ground (see section 8.8.2)
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8.4.5 Ensuring no deterioration in the water quality of our harbours and marinas

The ports and marinas of the Maltese Islands are essential economic drivers and have been heavily altered due to legacies of coastal development over the years. As highlighted in Chapter 4 these ports and the principal marinas form part of what have been called 'heavily modified water bodies'. Management options for achieving good status in these water bodies must take into consideration the economic importance of harbour activities.

The Identified actions include the following:

S	Develop and implement a protocol for the disposal or reuse of dredged material from harbours The protocol would provide clear and consistent standards and criteria for the assessment of dredged material and appropriate disposal methods. It is expected that the protocol will be implemented through the development and environmental permits issued by MEPA.
S	Develop and implement harbour environmental management plans with Stakeholders An environmental management plan is required to set the necessary framework of good practice for all operations and activities within and adjacent to the harbour area to improve the overall water quality of the harbour and to reach good ecological potential as required by the WFD. The management plan would be integrated within the environmental and planning processes.
S	Develop and implement technical guidance for water pollution control in Marinas The technical guidance would provide clear rules based on best practices on waste management, fuelling practices, and the maintenance of boats to reduce the potential for contamination within marinas.
S	Develop environmental regulations for recreational boating The aim of this measure is to regulate recreational boating in coastal waters through the development of regulations for individual boat owners and the management of swimming zones. In order to protect sensitive flora and fauna that dwell on the sea bed, the setting up of no anchoring zones and zones of ecological mooring would also be considered. Temporal restrictions for anchoring could also be set such as no anchoring of boats in bays at night.

8.5 Measures dealing with the improvement in groundwater quantity

Water balance estimations indicate that the main aquifer systems on the island are under significant quantitative pressures, with annual abstraction exceeding the mean annual recharge. Whilst technical solutions to address this imbalance, such as an increased use of desalinated water, exist and are implementable within the first

planning cycle exist; their economic and environmental sustainability is at best questionable.

The proposed way forward however envisages two main lines of action, namely:
 (i) the launching of a number of initiatives aimed at addressing the main identified data gaps; and
 (ii) the implementation of a number of water demand and supply augmentation projects on a pilot scale.

Although the implementation of these actions will not be sufficient for the achievement of good quantitative status within the first planning cycle; the information and technical experience gathered from the implementation of these measures will guide the development of effective actions to address the imbalance between abstraction and recharge during subsequent planning cycles.

The Identified actions include the following:


<p>S R</p>	<p>Regulation of private water supply operators Legislation has been enacted requiring the registration and licensing of private operators in the water sector. During the first planning cycle, operation-licenses will be issued to these operators which will, amongst others, require complete monitoring and reporting of their operations. This measure will ensure the collation of real-data, on which further regulatory actions can eventually be based.</p>
<p>S R</p>	<p>Metering of private groundwater abstraction sources Legislation enacted in 2007 required the notification of all private groundwater sources. It is planned that during the first planning cycle, all significant groundwater abstraction sources will be metered. This measure will ensure the availability of data both to the user and the Authority (MRA) on which measures incentivising a more efficient use of the abstracted water can be based. It should be noted that current legislation also requires that all drilling within the saturated zone be approved by the MRA.</p>
<p>S</p>	<p>Reduction of losses in the municipal distribution system The implementation of a leakage reduction programme has since 1997 contributed to a significant drop in the municipal water demand. The implementation of this programme will continue during the first planning cycle. Moreover, it will be complemented with a wide (smart) meter replacement programme with the aim of: (i) further curbing apparent losses in the distribution system; and (ii) making consumption data available to the consumer in real time, so as to increase public awareness on consumption patterns.</p>
<p>S</p>	<p>Increase the capacity of rainwater runoff storage facilities Rainwater runoff is considered as an important resource of water in the island. In as much, during the first planning cycle: (i) Incentive schemes will be developed under the Rural Development Programme for the construction of rainwater runoff storage facilities (reservoirs) by the agricultural sector; (ii) Maintenance works on water catchment dams along the island's main valleys will be continued; and (iii) Increased enforcement of existing legislation requiring the construction of water reservoirs with new urban developments.</p>

S	<p>Pilot projects on water demand management and supply augmentation measures</p> <p>During the first river basin cycle, the MRA aims to investigate on a pilot scale the potential of various water demand management and supply augmentation measures. The data and experience gathered through these pilot projects will help guide the development of direct measures on a national scale in subsequent planning cycles.</p> <p>Most of these pilot projects will be implemented through EU-funded research programmes and the Authority will seek the involvement of the main national stakeholders. In fact the Authority is already participating in the submission of three project proposals which, if approved will consider:</p> <ul style="list-style-type: none"> (i) measures to increase the efficiency of water use in the domestic sector; (ii) artificial recharge of the aquifers; and (iii) the use of treated sewage effluent as a source of second class water.
S	<p>Modelling of the Mean Sea Level Aquifer Systems</p> <p>One of the main components of the water balance for a coastal aquifer system is natural discharge to the sea. Since it cannot be directly measured, this discharge has to be estimated.</p> <p>In as much, during the first planning cycle, the Authority will seek to further develop the conceptual model of the aquifer system through the construction of a 3-D numerical modelling. This will ensure the compilation of more reliable estimates on natural water losses and thus better define the sustainable mean annual yield of these systems.</p>

8.6 Measures required to safeguard our Natura 2000 protected areas

Locally surface waters support many diverse ecosystems of high ecological and conservation value. All freshwater habitats are in fact all protected areas and support a significant number of endemic species and communities. The water element in these protected areas is small and particularly vulnerable to habitat modifications, agricultural activities and urban sprawl.

Action is therefore required to maintain and in some cases restore these areas to favourable conservation status as defined by the Habitats Directive in order to ensure the continued existence of the habitats and species of conservation value that they harbour. Identified actions comprise the following:

	<p>Establish ecological flows within sub-catchments supporting Natura 2000 sites</p> <p>This measure will support and be fully integrated within the NATURA 2000 project. It is expected to study and establish ecological flows within selected (Special Areas of Conservation) and Special Protected areas).</p>
S	<p>Carry out a pilot project to promote integrated valley management</p> <p>Integrated valley management is an overriding measure that looks at all aspects of land use and environmental management at sub catchment scale. A pilot study area will be selected in order to create a first sub catchment management plan.</p> <p>Central to the idea of valley management is the need to carry out studies to understand the relationship between the immediate valley environment and its ecosystems with the influences of the pressures and impacts on the sub-catchment scale. The understanding of flow regimes and the establishment of ecological flows within valley systems based on a catchment approach will feed into these IVM plans which would contribute to the restoration of ecological flows within watercourses.</p>

8.6.1 Institutional and Public Information and awareness raising

The success of proposals for changes presented in the present plan will only be possible once we are all made aware of the situation and the stakes involved if water is mismanaged. Increasing citizens' level of awareness on water issues would enable the community at large to support the implementation of the plan.

S	Develop a nation wide awareness campaign on national water issues
S	Raise awareness on the value of water and water conservation in primary and secondary schools
S	Develop an awareness campaign/s for groups of measures This measure is aimed at developing awareness in different sectors to explain the scope of each measure and the envisaged benefits (environmental, Social and economical) arising from its implementation. Best practices related to different activities will also be presented.
S	Set up a National Water Information system The National water information system would have a dual role of providing information to the general public on several water related aspects and also act as an access portal to water quality data (data that is a result of other water-related directives such as drinking water, bathing water etc.)
S	Prepare and implement a full information campaign on good agricultural practices. This campaign focuses on good farming practices: use of fertilisers and pesticides, manure management, water management, irrigation, reuse of treated wastewater. Training and capacity building initiatives together with the development of a communication plan and programme would also be included.

8.6.2 Enhancing our knowledge

Assessments carried out during this first WFD cycle have identified areas where additional information and knowledge is required. It has not been possible, for instance, to adequately assess the ecological and chemical status of coastal water bodies as required by the WFD mainly because of the lack of historical monitoring data and assessment methodologies that are in accordance with the requirements of the Directive. There is a need to improve the national capacity for environmental monitoring both in terms of technical requirements and infrastructures.

S	Study the need for ballast water management, monitoring and control The management of ships ballast water to minimise the transfer of harmful organisms and pathogens and to minimise the build-up of sediments in ballast tanks which may also harbour organisms is necessary. There is a need to quantify the extent of the problem of ballast waters in Malta as well as to identify potential and practical management practices that could be adopted.
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S	<p>Complete a comprehensive database of farm holdings</p> <p>The measure aims at completing the existing database of farm holdings in order to obtain a better view with respect to environmental practices and waste management on the farm. It is expected that all record keeping maintained by the farmers as a result of measures implementable under this plan will feed into this database.</p>
■	<p>Set up a database and inventory of industrial sites</p> <p>This measure focuses on the collection and the sharing of data on industrial units with respect to substances utilised, (incl. priority substances); emissions, discharges and losses of main pollutants.</p>
S	<p>Study the impacts of the national spoil ground off Xaghjra</p> <p>The potential impact of the existing dump site on local waters is not known. This measure, therefore, calls for a study on the impacts of the dump site on the water and sediment quality as well as on supporting species and habitats.</p>

9 The economic importance of water and the principle of cost recovery

9.1 Background

An economic analysis was needed at various stages of development of this Water Catchment Management Plan in order to assist in decisions taken regarding, for instance which measures to implement, and which environmental objectives to forego for less stringent, least costly options. The following two chapters (chapters 9 and 10) will focus on these economic elements. These shall be explored as follows:

This chapter (chapter 9) briefly explains the economic importance of water and in so doing presents the economic issues and tradeoffs at stake due to deteriorating water quality. A full economic analysis was carried out in 2004 as part of the initial characterisation process and therefore a detailed account of the economic baseline scenario is provided in these reports (<http://www.mepa.org.mt/topics-water-islands>).

Different economic sectors compete for good quality water resources, and hence the second part of this chapter will investigate how the development of economic and financial instruments, such as water pricing, can help to ensure the sustainable use of water resources across different economic sectors.

The succeeding chapter (Chapter 10) briefly describes the investment and annual cost of the programme of measures which is being proposed. The measures included in this programme will contribute to achieve the environmental objectives described in the WFD i.e. to stop deterioration and contribute to reaching the good status. It outlines the impact of the programme of measures on the various water users and specifies which measures will be funded from ongoing or projected initiatives. Finally it gives a list of benefits that are envisaged to arise from implementation of the Programme of Measures.

9.2 The role of water in the Maltese economy.

The aim of this section is to assess how important water is for the economy and for the socio-economic development of the water catchment district. A detailed account of the links between economic development and associated pressures/risk assessment per water body is included in the Article 5 report of 2005 for both groundwater and surface waters.

The Maltese economy is becoming increasingly service oriented. In June 2007⁹, the industrial sector contributed to about 24% percent of gross value added while the market/services sector accounted for slightly more than 76% of gross value added. The employment shares (2007) for the agriculture and fishing, industrial, market services¹⁰ and public sectors were 2.4%, 15.8%, 70.8% and 28.9%, respectively.

1. **Supply and Distribution of Potable Water** – this function is currently undertaken by the Water Services Corporation (WSC) and is regulated by the

⁹ Malta in figures, National Office of Statistics, Malta.

¹⁰ Market services include both private and public sector services

Water Supply and Sewerage Services Regulations LN525/04. WSC abstracts groundwater and operates three reverse osmosis desalination plants. WSC produces around 31 Mm³ annually (2008) of which 14.07 Mm³ is pumped from groundwater resources. In addition, it operates existing wastewater treatment plants. Overall, there are 240,000 and 141,000 connections to drinking water and sewage systems, respectively.

The total turnover of WSC amounted to about €36.317 million in 2008, the utility being still heavily subsidised by the government budget for the delivery of sewage and wastewater treatment services. Turnover increased after October, 2008 when the potable water tariffs were revised to more closely reflect the cost of producing and supplying drinking water.

2. **Agriculture** contributes to 1.9% of the total GDP of Malta and 1.2% of the total gainfully employed in 2008¹¹. Out of 17,148 persons employed in agriculture only 1764 worked full time. Overall, Malta has 11,072 farm holdings, with only 190 of them (1.7%) being considered as falling under the intensive agriculture¹² category.

Irrigated land¹³ amounts to 30% (3200ha) of total agricultural land (10,326 ha). Of these, 2810 ha are irrigated at least once yearly according to the Farm Structure Survey of 2007. A large proportion of arable land (58.5%) is used for forage plants (especially wheat), followed by 23.9% for vegetables, 8.9% for potatoes, and 0.3% for flowers and seeds production. Farms used only 7% of billed water consumption. However, a FAO study¹⁴ estimated that agriculture requires 14.5 million m³ of water for irrigation purposes which is obtained mainly from direct abstraction (via individual boreholes) in groundwater. Another 0.5 million m³ is abstracted by farmers engaged in animal husbandry. Only 2 Mm³ of its total water demand is taken from rainwater collected in reservoirs. Another 1.5 million Mm³ of water is taken from the sewerage treatment facility of Sant' Antnin. Hence the total groundwater demand by the agriculture sector is estimated at 15m³ million¹⁵, making agriculture the island's prime user of groundwater.

Malta's agricultural production has been largely dominated by animal husbandry. The decline in the goat population since the early fifties was attributable to increases in forage costs and government legislation to promote cow's milk.

Livestock¹⁶ and dairy farming is based mainly on the intensive production of pigs (65,511 heads), poultry (563,814 layers, broilers 660,215) and cattle (17,777 heads). Animal husbandry activities obtain 75% of water from the main distribution system, the remaining 25% being directly abstracted from groundwater.

3. **Industry** – In 2007, the Maltese industry accounted for 21.5% of the national GDP. The sector consumes 1,346,000 m³ of water supplied by WSC each year. It is estimated that another 1Mm³ ¹⁷ is directly pumped from groundwater every

¹¹ Agriculture and Fisheries, 2008, NSO, 2009 Table 2.2

¹² Modern day forms of intensive crop based agriculture involve the use of mechanical ploughing, chemical fertilizers, plant growth regulators and/or pesticides.

¹³ Data regarding irrigated land were supplied by NSO.

¹⁴ Malta, Water Resources review, FAO, 2006, Table 8, p47

¹⁵ FAO report estimated that the total groundwater abstraction in 2003 equalled 17.5 m3 million

¹⁶ Farm Structure Survey, 2007

¹⁷ Ref Malta Water Resources Review, FAO, 2006, page 47 Table 8

year. The food and beverage industries are the major consumers, consuming 704,247m³¹⁸ of municipal water in 2007 (accounting for 54% of the sector in 2006).

4. **Maritime transport** - This sector contributes to 4.38% of the economy-wide activity. This is expected to increase since the Government of Malta is committed to develop Malta as a maritime centre of excellence by 2015. Marine Transport includes shipping, Freeport transshipment services, bunkering and yachting.

The cruise industry in Malta is also growing with an increase each year in the number of cruise ships and cruise passengers visiting Malta. The number of cruise liners in 2008 totalled 402 (increase by +7% over 2007) with a total of 556 861 arrivals (increase by 14% over 2007) in cruise passenger. Recent trends confirm that larger cruise vessels are calling at Malta with more passengers aboard.

Investments in port facilities since 2008 have led to increases in the amount of cargo handled and in total ship calls. This increase is mainly related to the introduction of several new container services calling at Malta Freeport, and the introduction of a Ro-Ro ferry service between Malta and Italy. The number of vessel calls at the Grand harbour also registered an increase in activity due mainly to the increase of cruise and Ro-Ro vessels calling and VISET Cruise Passenger Terminal and Valletta Gateway Terminal.

5. **Tourism** – The tourism sector plays an important role in the country's development. Tourism expenditure, including induced and government interaction effects, supports full time equivalent jobs 40 000.jobs or 29% of the total workforce¹⁹ Tourism accounts for around 12.3 per cent of the Gross National Product. In 2009 Malta attracted close to 1.2 million tourists²⁰. It is estimated that in any one day in 2009, there were close to 27,500 tourists in Malta. Tourist arrivals boost the population²¹ by an average of 7% throughout the year and by 11% in the peak season. In 2009, tourists visiting Malta generated around 916.4 million Euros in expenditure.

Tourist arrivals peak in July and August, placing additional strains on the country's water resources. It is estimated that a tourist on average consumes three times the amount of water used by a local. This has a considerable impact on surface and groundwater since 46% of the potable water consumed by tourist is derived from groundwater. Tourism also has demands on national waste-water infrastructure.

Coastal and marine tourism is a very significant sector of the tourism product .In 2009 diving tourism alone attracted a total of 60,000²² tourists. This amounts to 5.1% out of the total inbound tourists. Other important activities include beach holidays, yachting and pleasure sailing. Indeed the peak tourist season in Malta is the summer, further highlighting the importance of coastal and marine resources to the tourism sector. .

¹⁸ Source: NSO, News release 046/2009, World Water Day, Table 3

¹⁹ Blake, A., Sinclair, T., Sugiyarto, G., (2003) The Economic Impact of Tourism in Malta, report for the Malta Tourism Authority

²⁰ National Statistics office – Malta, (28th January 2010) News release –Departing Tourists: December, 2009

²¹ Census of Population and Housing 2005, Volume 1: Population- or 29% Valletta: National Statistics office, 2007,xlviii, 216p. ISBN 978-9909-73-51-8

²² MTA Estimates, based on Market profile Surveys, 2009

6 **Fishing and Aquaculture** - The fishing industry accounts to only 0.13% of the GDP. This sector²³, has 1092 active fishing vessels (2006) and 364 full-time fishermen (open-sea fishing) with an additional 1102 persons fishing as secondary activity. The total catch is around 1900 tons of fresh fish (2005) for a total value of fresh fish estimated at 9.04 M€ per year (2005). The national consumption accounts for around 4.4% of total catches of fresh fish. Fisheries resources in the Mediterranean are under threat particularly from overcapacity of the fleets leading to overfishing. Overfishing is very significant for the large, migratory and economically important species of the Mediterranean, particularly the bluefin tuna and the swordfish. Other pressures on fisheries resources arise from marine pollution and the intensive shipping in the Mediterranean Sea.

The aquaculture sector, with a total of 80 cages produces 5100 tons per year at a value of €21.119 M. Most of the production is bluefin tuna from fattening cages. Other species include Sea Bass and Sea Bream. Overall, 130 full time employees²⁴ are working in this sector, complemented by 62 part-time employees.

Overall, it is estimated that 13% of the GDP and 15% of employment is related to coastal water activities.

9.3 Cost recovery

Article 9 of the WFD requires Member States to assess the level of cost-recovery for water services, accounting for financial, environmental and resource costs. Specifically,

'Member states shall ensure by 2010

- That water pricing policies provide adequate incentives for users to use water resources efficiently and thereby contribute to the environmental objectives of this Directive,*
- An adequate contribution of the different water users, disaggregated into at least industry, households and agriculture, to the recovery of the costs of water services, based on the economic analysis conducted according to Annex III and taking into account the polluter pays principle'*

When setting the above two obligations, Article 9, further explains that *'Member states may in so doing have regard to the social, environmental and economic effects of the recovery as well as the geographic and climatic conditions of the region...'*

Furthermore, a possible exemption from these two obligations exists for a *'given water use activity, where this does not compromise the purpose and the achievements of the objectives of this Directive'*. The relevant reasons for this exemption should be reported in the water catchment management plan.

These principles which are entrenched in the Directive have been very successfully applied in Malta for the provision of water services to households, industry and farmers by the water and wastewater treatment providers. The relevant legal

²³ Census of Fisheries, 2006

²⁴ Census of Fisheries, 2006

framework is also in place to apply these principles to private abstractors of groundwater.

9.3.1 *How are costs of water services being recovered today?*

The Directive defines water services as “*all services which provide households, public institutions or any economic activity:*

- a) abstraction, impoundment, storage, treatment and distribution of surface water or groundwater
- b) wastewater collection and treatment facilities which subsequently discharge into surface waters”.

In the light of this definition, therefore, water services in Malta may be considered as being classified in two:

- a) Water and wastewater service providers which supply potable water through abstraction, storage, treatment and distribution of fresh water, whilst collecting and treating wastewater prior to its discharge in coastal waters.
- b) Private abstractors who abstract groundwater for retail to third parties.

There are also a number of other users who abstract groundwater for irrigation or other purposes.

i. Water and wastewater Service providers

The Water Services Corporation (WSC) is the public water utility, established as a body corporate under the Water Services Act XXIII (Chap 355) and which performs this role in terms of the Water Supply and Sewerage Services regulations LN525/04, regulated by the Malta Resources Authority.

WSC supplies potable water and provides sewerage services over the entire Maltese territory with the exception of three small villages which are still not connected to the public sewer. Notwithstanding, these localities are regularly serviced for sewage collection by WSC. All potable water consumers i.e. residential, domestic and non-residential consumers (industrial and commercial) are served with a metered supply of potable water. Presently, the water services Corporation is in the process of introducing a hi-tech *Smart* metering system which will in the medium and longer term improve demand management by consumers.

ii. Recovery of Costs for the Provision of Water Services through the Public Network

The tariff structure of the potable water supply is regulated by the Malta Resources Authority (MRA). The financial cost for the provision of these services is recovered through tariffs for approximately 80%. Government subsidises the remaining financial costs of the Corporation

The financial cost of WSC for supplying water services i.e. the cost of supplying potable water plus the cost of collecting, treating and discharging of municipal waste water. These costs also include a regulatory charge which represents fees charged by the regulator. These fees cover the cost of resource and environmental monitoring, by the regulator

iii. Potable Water tariffs

Potable water tariffs are based on a rising block system (Table 9.1) where a basic volume per capita is allowed at reduced cost whilst any excess is subject to high tariffs. The system is meant to deter wastage and reward water saving

Table 9.1
Tariffs as introduced in December, 2009

Consumer type		Volumes in m3			Unitary rates for individual tiers (in €/m3)		
		1st Tier	2nd Tier	3rd Tier	1st Tier	2nd Tier	3rd Tier
Residential		< 33	>33		1.47	5.41	
		<33	>33		2.3	5.41	
Non-residential		<168	168 to 40 000	> 40 000	2.1	2.5	1.75

Socially disadvantaged consumers receive specific consideration and benefit from government subsidies.

Potable water tariffs are guided by the “user pays” principle. Both residential and non-residential tariffs include a variable volumetric charge and a service charge which covers installation and O&M costs. Service charges are VAT exempt and are paid by both residential and non-residential consumers whenever new service-connections are made. Potable water tariffs are sufficiently disaggregated to ensure adequate contribution to the recovery of costs from the domestic, agricultural and industrial/commercial sectors

Recently, potable water tariffs were revised in 2008 and in 2009. In both revisions the tariffs were designed to recover the production, distribution and administration cost of water services plus a rate of return on capital to take into account future investments required for the provision of potable water services. Other criteria adopted for both revisions, include:

The service provider recovers the full financial cost for the provision of water and wastewater services through tariffs and government subsidy²⁵

- Tariffs are cost based and non-discriminatory between users.
- Inbuilt tariff simplicity²⁶ as compared to the previous situation;
- No cross subsidisation between residential and non-residential consumers overall.

²⁵ Government subsidies include subsidies on water bills paid directly to disadvantaged families plus government subvention. In 2010 a government subvention amounting to €14.176 million will be paid to the Water Services Corporation.

²⁶ Before the October 2008 tariff review, there was a complex list of consumers. Now consumers are classified as residential and non-residential. In 2010, the 'residential' category was divided into two to distinguish between residences which are inhabited and other residences such as common parts or garages that are not attached to houses.

- 30 000 families falling under the Social Assistance categories will continue to benefit from special subsidy.

It needs to be pointed out that some wastewater costs are recovered from the tax paid to government for new service connections to the sewage system. The revenues from this tax are transferred back to WSC to cover part of the costs of wastewater collection and treatment whilst Government subsidises €14.176 million to cover the remaining costs.

The cost recovery of **potable water** supplied to households and industry has increased from 75% to 84% over the period 2005 to 2007. However, following the introduction of the new tariffs in October, 2008, the financial cost recovery of **potable water excluding the cost of wastewater collection, treatment and discharge** for this financial year rose to **94.38%**.

Table 9.2
Changes in financial cost-recovery rates for water and wastewater services (WSC component) in € Million

Year	Cost of production and distribution (M€) ²⁷	Sales (M€)	Cost recovery (%)
2005	55.89	29.043	51.965
2006	54.71	29.046	53.09
2007	51.88	29.393	56.65
2008	56.16	36.317	64.67

In 2008 the **overall cost recovery** i.e. the cost recovery of **all water services including wastewater collection, treatment and discharge by the water and wastewater providers (WSC)** was 65% (Table 9.2) but is estimated to be equal to about 80% in 2010.

(iv) Private groundwater abstractors.

There are also a number of private individuals who abstract groundwater mostly for irrigation. Some of the abstracted water is also retailed to third parties by water-tanker operators, who are now regulated by an operating licence issued by the MRA.

Groundwater monitoring is today governed by new regulations LN241/2010 (Groundwater Abstraction (Metering) Regulations 2010). According to these regulations all groundwater abstraction in excess of 1m³/day are to be metered. Installation and O&M costs for borehole meters are recovered through fees chargeable to groundwater users. Volumetric charges will be introduced after the first year of observation of the volumes abstracted.

²⁷ shows the financial cost of WSC for supplying water services i.e. the cost of supplying potable water plus the cost of collecting, treating and discharging of municipal waste water for the period 2005 -2008. The cost figures given therein are derived from the Audited Accounts of the Water Services Corporation for the years ended September, 2005, September, 2006 and September, 2007 and December, 2008.

9.4 Conclusion

By recovering the costs of water services, the public utility generates revenue both for its efficient operation and cost-effective delivery of service. Tariffs for potable water seek to achieve the objective of sustainable use of water by reducing water demand, discouraging wastage without inducing additional hardships and burdens on the community. Both tariff revisions made in 2008 and 2009 were guided by these principles which are completely aligned with the obligations of the Water Framework Directive.

Abstraction control and the associated measures, introduced recently, are also meant to induce efficiency of water use and deter wastage. This measure will then encourage groundwater abstractors to divert their water demand to treated wastewater thus reducing pressure on groundwater, in particular.

10 Cost of the Programme of measures

10.1 Introduction

This chapter describes the potential investment and the annual cost of the programme of Measures (POM) that Malta will be implementing in the first WFD cycle to achieve the objectives for the water bodies described in chapter 7. Measures included in this programme are expected to stop deterioration of water quality of both surface and groundwaters, besides contributing to the reduction of the groundwater imbalance arising from over-abstraction. A list of the options which could technically lead to good quantitative status of groundwater is also given.

The chapter further describes the criteria used to evaluate the most feasible programme of measures and then discusses the economic impacts of the cost of the chosen POM. Next, measures which are included in ongoing or projected national programmes are identified. Finally, a qualitative list of environmental benefits arising from implementation of the POM is given in section 10.5

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Scenario – building

In generating the scenarios for assessing the best combination of measures, the key variable was the use of measures to achieve good groundwater quantitative status.

Good quantitative status of groundwater can be achieved in the short term in two ways:

- increase substantially the production of potable water through the use of available Reverse Osmosis (RO) capacity. This option does not require additional investment in infrastructure but will increase the annual cost of supply because more water is being produced. RO production induces additional demand for electricity which process generates more greenhouse gas (GHG) emissions;
- polish treated sewage effluent (TSE) for irrigation and possibly aquifer recharge. This option will result in significant investment in infrastructure

Four Options which include the conjunctive use of groundwater with non-conventional water sources namely desalination and treated sewage effluent are identified below:

Option 1: Background scenario + increased RO production only

Option 2: Background scenario + increased RO production and use of polished TSE

Option 3: Background scenario + use of polished TSE only

Option 4: Background scenario only

The background scenario is common to all the above options. It includes a set of basic and supplementary measures for surface waters and groundwaters that are deemed to be cost effective. These background measures help to halt further deterioration and contribute to enhancing the quality of surface and groundwater. The quantitative measures also aim at decreasing the imbalance resulting from over-abstraction. In the other options, the background measures are complemented by additional use of RO (option1), RO&TSE (option 2) or TSE only (Option 3)

The costs and financial implications of the four options were compared. Four criteria were used to assess the relative impact of the induced costs arising from the implementation of the supplementary measures on several sectors. These are:

- the share of costs in terms of the costs incurred to produce and distribute potable water and the collection, treatment and disposal of wastewater
- the share of the annual cost of measures in terms of sectoral gross value added.
- The share of costs of new capital incurred expressed as a percentage of annual Gross Domestic Product (GDP)
- The share of the annual costs of the measures as a share of disposable household income.

Option 4 is being proposed as the best way forward. The basic and the supplementary measures included in this option are described in Chapter 8. Option 1, 2 & 3 which include the use of RO water production or use of TSE are for the time being set aside. Option 1 leads to higher annual costs and the consumption of more electricity results in higher Greenhouse Gas (GHG) emissions. Total reliance on RO production may be strategically unwise. The Maltese islands are in the middle of busy shipping lanes and hence a nearby oil spill accident could cripple completely the potable water supply if it were to be completely dependent on desalination by RO. Options 2 & 3 which include the use of TSE require high infrastructural costs. In view of this, more detailed assessments will be undertaken to identify cost-effective applications for TSE in conjunction with other sources of water supply.

10.2 Economic Analysis: Evaluation of the cost of the POM

The economic analysis assesses the investment and annual costs and gives a description of potential benefits - represented by improvements in the environment - of implementing the Water Catchment Management Plan. These are explained in section 10.5.1 below.

10.2.1 Data limitations

Lack of data constrains the range of analysis that can be carried out. However, the results enable a practical discussion of the proposed set of measures.

10.2.2 Definition of costs

The costs of measures refer to investment costs and annual costs.

Investment costs refer to the capital required to implement a measure e.g. the cost of the infrastructure needed to distribute Treated Sewage Effluent (TSE), or, the cost of constructing a water storage facility.

Annual costs include the annual cost of the investment²⁸; operating and maintenance expenses; indirect costs²⁹ and benefits³⁰. Where feasible, the environmental costs³¹, are also added. Annual costs also include savings or negative costs³² which are incorporated under 'benefits', which have been given a monetary value. The environment and resource costs are often very difficult to assess

10.3 Cost of Basic and Supplementary Measures

The considerations below refer to two sets of measures, namely:

- Firstly, Basic Measures refer to the actions required by the WFD and other EU Directives such as the Nitrates Directive, the Urban Waste Water Treatment Directive, the Bathing Water Directive, the Drinking Water Directive etc. They also include a number of measures such as water use efficiency and/or water conservation measures which will be promoted at national scale.
- Secondly, Supplementary Measures are additional to the basic measures and are meant to enable the achievement of good status required by the WFD.

10.3.1 Cost of the Basic Measures

The projected total investment and annual costs of the measures amount to about €165 million and €14 million respectively.

10.3.2 Supplementary Measures

Supplementary measures include a set of measures targeting issues related to the improvement of: the regulatory framework, water quality, data compilation, evaluation and dissemination. Some supplementary measures cater for water conservation and efficiency of water use. These measures are over and above the efforts already being made by consumers (included under basic measures to conserve and increase water use efficiency.

i. Costs of the supplementary measures

²⁸ The annuity or annual cost of the investment takes account of the lifetime of the investment, the capital outlay and a discount rate of 4%

²⁹ such as loss of output in the case of reduced use of fertilisers

³⁰ a fall in the cost of water that is incurred by consumers when water conservation measures are implemented

³¹ such as the cost of additional CO² emissions that would be created by increased use of the available RO capacity to increase water supply,

³² With the information at hand, it is not possible to derive the monetary value of most benefits emanating from these measures. However, a qualitative list of potential benefits emanating from these measures are listed in section 10.5.1

The projected total investment and annual costs of the supplementary measures amount to about €67 million and €8.5 million respectively

II. Total annual and Investment cost of the basic and supplementary measures

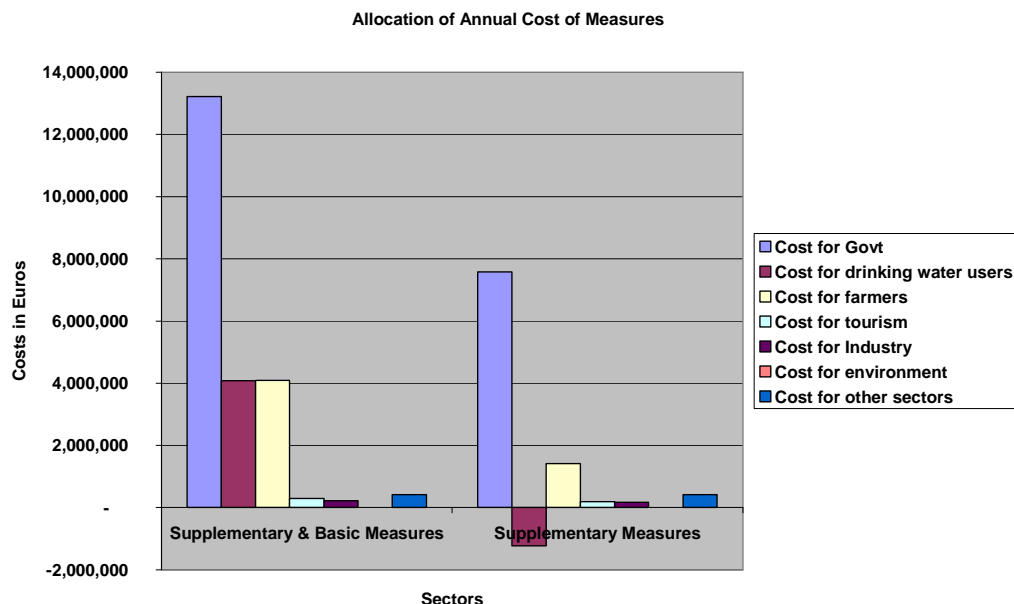
The total annual and investment cost of the Basic and the Supplementary measures amount to €231.8 million and €22.30 million respectively

10.4 Impact of the Proposed Programme of Measures on Economic Sectors

I Allocation of the annual cost of the proposed Programme of Measures

The cost of the basic and supplementary measures will be mostly borne by government through the national budget aided. ***Drinking water users may in fact save money if they use water more efficiently and harvest more rainwater as is being proposed (Fig 10.1, supplementary measures).*** The estimated cost on the industrial and tourist sectors are minimal. Measures are projected to cost about 0.009% and 0.05% of the gross value added of the industrial and tourist sectors respectively.

Fig 10.1



II Investment Cost of the proposed measures as a percentage of Gross Domestic Product (GDP)³³

The economic analysis indicates that the investment cost of the supplementary measures which are being proposed to stop deterioration of the quality of surface water and to reduce the present imbalance resulting from over-abstraction of groundwater amounts to 1.2% of GDP for 2008 at current market price of €5687.168 million. If these costs are added to other capital outlays required to comply with existing obligations under other EU legislation (e.g. nitrate directive or the urban waste water directive), the investment cost of the measures rises to 4 % of the GDP.

III Work in progress and need for additional financial outlays

Most of the basic and supplementary measures included in the Programme of measures that is being proposed for the first WFD cycle are already included in other National programmes such as the Sewage Master Plan for the Maltese Islands and The Rural Development Plan. Some of these programmes are already partially funded under existing initiatives. In fact, it is being projected that additional funds to implement the above programme of measures will amount to between 8 and 10 million Euros.

The activities that are incorporated in other plans or programs include:

³³ The **gross domestic product (GDP)** or **gross domestic income (GDI)** is a basic measure of a country's overall economic output. It is the market value of all final goods and services made within the borders of a country in a given period, normally a year.

- 1) The upgrade of the sewerage infrastructure amounting to €160million, of which €80 million will be spent during the 1st WFD cycle ending 2015.
- 2) Treatment of all municipal wastewaters.
- 3) Reduction of nitrate contamination of groundwater by implementing the measures of the Action Programme as required by the Nitrates Directive
- 4) The construction of anaerobic digestion plants to treat municipal and animal waste. Funds amounting to over €45 million have already been allocated.
5. The maintenance and management of valleys to increase their rainwater storage capacity is currently carried out by The Services Division under MRRA. Government is also exploring the feasibility of increasing strategic rain water storages in the Storm Water Master Plan.
- 6) The development of infrastructure to increase water availability to farmers may be funded under Measure 125 of the Rural Development Plan.

10.5 The expected benefits of the proposed Programme of Measures (PoM)

The implementation of the WFD and of the PoM proposed in the first Water Catchment Plan for Malta will deliver a wide range of benefits to the Maltese society. Estimation of the monetary value of these benefits is not possible with the existing data. Hence, a qualitative list of potential benefits is described below;

- Cleaner beaches and coastal waters that benefit the Maltese society through the provision of cleaner recreational areas and a more attractive tourism product. In particular the treatment of all municipal wastewaters prior to discharge into the sea will have an overall positive health impact as it reduces the risk of harmful microbial contamination in seawater.
- Reduction in pollution from agriculture (both nitrates and pesticides) helps improve the habitat of species of conservation importance and of other ecosystems and species that rely on water.
- The development and implementation of valley management plans will improve the natural character of valleys, thus improving their recreational and tourism potential.
- Better environmental practices for diving and sailing/boating could insure against losses in market segments for these activities.

- Measures aimed at reducing leakages and water demand, in both the agriculture and household sectors, will lead to lower production and distribution costs of water.–The savings made may be passed on to the consumers in the form of lower water prices.
- A decrease in water demand will save energy consumption: every m³ of desalinized water saved is expected to lead to a saving of 3.5 kWh in energy bills for WSC. This is equivalent to a reduction of 3.05kg of carbon dioxide (CO₂) emissions. These savings may result in a reduction in the energy bills paid by consumers.
- In the medium term, reduction in water demand can also lead to lower reliance on desalination, with comparatively lower needs for future (expensive) renewal of existing infrastructure.
A better groundwater quality, in terms of nitrate levels, means that more groundwater can be used in the production of potable water which will lead to lower costs.
- Groundwater reserves of good quality are a contingency for emergency situations where production of potable water from desalination plants ceases. If groundwater reserves are not available Malta would have to rely on the costly importation of potable water.

11 Climate checking our plan

11.1 Background

Water resources are highly vulnerable to changing climatic conditions. For the Mediterranean region, climate change is expected to negatively affect water resources and the socio-economic activity that depends on them. The fact that water resources are already under stress from human activities, renders such resources even more susceptible to climate change impacts. Hence, adaptation of the water sector to climate change impacts is of primary importance.

Climate change may significantly hinder attempts to restore water bodies to good ecological, chemical and quantitative status. Climate change can affect the conditions and pressures that the WFD is seeking to manage and will affect and interact with WFD implementation activities at different stages (Dworak & Leipprand, 2007³⁴). Warranting achievement of WFD objectives within a changing climate requires a good understanding of how climate change may affect WFD processes throughout its implementation.

There is thus a strong link between WFD implementation and adaptation to climate change impacts since, firstly the WFD provides an opportunity for managing long-term impacts of climate change on the water environment; hence providing an opportunity for implementing adaptation action within the water sector. Secondly, adaptation needs to be considered in the WFD implementation to ensure resilience of WFD measures or actions (Chapter 8) to climate change impacts and thus to ensure that WFD objectives will also be met in a changing climate.

Consideration of climate change in the WFD process can also create synergies between WFD measures and national mitigation and adaptation efforts, including adaptation efforts in other sectors.

The main objective of the climate check therefore, is to address climate change impacts on the performance of WFD measures, thus enhancing the potential for achieving WFD objectives within a changing climate. Effects of WFD measures on the environment have not been considered through this climate check. This is the role of a separate environmental assessment which evaluates the effects of the measures on other environmental sectors including biodiversity, waste, landscape and climatic factors.

11.2 Climate Change in the Maltese Islands

11.4.1 Predicted impacts of climate change on the Water Catchment District

The limited availability of local data and information on climate change impacts represents one of the major hurdles to the climate check, which can be partly overcome through consideration of global/regional climate projections and impact scenarios. While these data models³⁵ may not be necessarily applicable to the

³⁴ Dworak, T (Ecologic Vienna) & Leipprand, A. (Ecologic Berlin) (2007) Climate Change and the EU Water Policy – Including climate change in River Basin planning

³⁵ Intergovernmental Panel on Climate Change, 2007. Climate Change 2007 – *Impacts, Adaptation and Vulnerability*; Contribution of Working Group II to the Fourth Assessment Report of the IPCC; ISBN 92-9169-121-6

Maltese Islands in view of their low resolution, they are considered an important source of information providing an indication of the climate change impacts to which Malta may be exposed to.

Temperature & Precipitation: Drought

Locally generated scenarios are quite robust with respect to temperature predictions but much less robust for precipitation. Projected temperature and precipitation changes at the European level, indicate an increase in mean annual temperature of +3.5 to +5 and a change in the annual precipitation ranging from -10% to -40% for the Southern European region. As a result of higher temperatures, decreased precipitation and longer, more frequent dry spells, Southern European regions will be subject to an increase in the frequency and intensity of droughts. The Mediterranean basin will suffer from a decrease in water resources; hence climate change will result in reduced water availability within a region that already suffers from water stress.

Trends in local observational data corroborate with the projected increase in temperature, which is also in line with regional predictions. An increase in atmospheric temperature by the end of the century is thus almost certain for the Maltese Islands.

With regards to precipitation, the scenarios project a decrease of about 2% by 2100 and a shift of precipitation events to shorter time windows. These scenarios are associated with significant uncertainties and should be interpreted with caution. Local observational data may be interpreted as a decrease in the total amount of precipitation but an increasing trend for convective type rainfall or heavy rainfall. While uncertainties prevail, the trends identified from data observations are in line with regional scenarios with regards to both decrease in precipitation and an increase in extreme weather events, which for Malta would mainly translate into heavy rainfall events.

Overall, the Maltese Islands are almost likely to be subject to an increase in temperature coupled to an overall decrease in precipitation; hence the possibility of drought periods. **Given that trends in temperature and precipitation are already evident from observational data, such changes in climate are expected to take place in the short/medium term.**

Sea Level Rise

Global mean sea level has been rising, with a global increase of 17cm recorded during the twentieth century (IPCC, 2007; European Commission, 2007). From 1961 to 2003, the average rate of sea level rise was 1.8 ± 0.5 mm yr⁻¹. Climate contributions, thermal expansion and loss of mass from glaciers, ice caps and the Greenland and Antarctic Ice Sheets constitute the main factors in sea level rise.

Data within the Mediterranean region however shows both decelerations in sea level rise for the 20th century and decreases in sea level in the latter part of the century (IPCC Third Assessment Report 2001). It is suggested that this deceleration may be caused by the increase in density of the Mediterranean Deep Water and air pressure changes linked to the North Atlantic Oscillation. Whichever the cause, long-time series data and site specific studies are necessary in order to verify the occurrence of sea level rise in a specific location.

While the development of regional scenarios for sea level change in the Maltese Islands was not possible, local observations from June 1992 to December 2006 indicate a fall in sea level at an average rate of 0.50 ± 0.15 cm/yr. The time-period of

such observational data is too short to allow appropriate identification of trends in the mean sea level in the Maltese Islands and interpretation of such data should be done with caution.

While there are many uncertainties associated with Sea Level Rise, a precautionary approach is being applied in this case and **an increase in mean sea level around the Maltese Islands is being assumed in the long-term, based on global scenarios.**

Storm surges

The IPCC fourth assessment report predicts an increase in extreme weather events including storm surges. Although such storm surges are not specifically predicted for the Mediterranean region and there are no local scenarios for this parameter, the precautionary principle is also being applied in this case. In this regard, it is being assumed that the **Maltese Islands may be subject to more frequent storm surges in the long term.**

11.4.2 Potential Climate Change Impacts on Water Resources

The following table is an indication of the potential impacts of climate change on water resources as a result of the climatic changes described above.

Table 11.1

Potential climate change impacts on water resources

Temperature (short/medium term): An increase in atmospheric temperature would bring about:	1. An increase in water demand for human activities and agricultural purposes, 2. Resulting increases in evapotranspiration rates may lead to perturbations in the soil water balance, 3. Changes in the physico-chemical conditions of water bodies with subsequent impacts on biological conditions. 4. Increased sea surface temperature in the marine environment can: lead to shifts in species composition and changes in species' life cycle; promote growth of algae and microbes; result in changes in water stratification ³⁶ ; and result in changes in dissolved oxygen mainly due to changes in water stratification and/or water circulation; 5. Higher temperatures, coupled to increased heavy rainfall spells and longer periods of low flows exacerbate many forms of water pollution including enhanced load of nutrients in surface and groundwater. However higher temperatures can also increase the degradation rate of some pesticides and organic pollutants, which may reduce their concentrations in water bodies.
Precipitation (short/medium term):	A decrease in precipitation will impact on the availability of water resources in the Maltese Islands. An increase in heavy rainfall events will lead to flooding. Floods would result in sudden increase in surface water flows thus leading to increased run-off which can have various effects including increased erosion, decreased groundwater recharge and increase in the load of nutrients to waters.

³⁶ It should be noted that according to EEA (2008), the combination of increase in temperature and decrease in run-off is not expected to change stratification conditions greatly because of the compensating effects of increasing temperature and increasing salinity on the density of water.

Drought (short/medium term):	An increase in the frequency of drought periods will impact on the quality and quantity of water.
Sea Level Rise and storm surges (long term):	Impacts related to storm surges are similar to those expected to be experienced for sea level rise. However, while the impacts related to sea level rise will be gradual, storm surges will have a direct instantaneous impact on the coastal environment: <ul style="list-style-type: none"> ▪ coastal erosion; ▪ inundation of coastal areas thus impacting on coastal ecosystems;

11.3 Climate change effects on water resource pressures

11.4.1 Identification of climate change effects on pressures

The main objective of the analysis of the effects of climate change on anthropogenic pressures is to identify the risks of not attaining WFD objectives due to climate change-induced changes in these pressures. Knowledge of such risks posed by potential changes in pressures would ensure that the WCMP measures target both current and future pressures on water resources.

The pressures determined through the characterisation process under consideration include point sources and diffused sources of pollution; water flow regulation or modification, water abstraction and morphological changes

The potential effects of climate change impacts as predicted for the Maltese Islands/Mediterranean region, on each pressure were identified. The risks for such effects to hinder achievement of WFD objectives were also identified and classified as 'High', 'Medium' or 'Low' risks. Climate change impacts that were taken into consideration include:

- increase in water and atmospheric temperature;
- changes in precipitation:
 - decrease in precipitation
 - increase in frequency of heavy rainfall events
- sea level rise/storm surges;

For a full matrix indicating the potential effects of climate change of each pressure refer to Technical document >>>.

11.4.2 Analysis of climate change effects on pressures

There are a lot of uncertainties associated with climate change impacts, hence with the identified effects of climate change on pressures. The majority of the effects are potentially negative in nature. Climate change is thus expected to exacerbate pressures on water resources and it therefore had to be ensured that such increase in pressures is addressed by the measures identified.

Uncertain effects are mainly related to the changes in seawater circulation and/or stratification, which may also lead to changes in the biogeochemical characteristics of the water column (mainly concentrations of carbon, oxygen and nutrients). Apart from the uncertainties as to whether such changes will actually take place, the many variables associated with such changes render it very difficult to determine the exact effect on the pressure. For example a change in current patterns may result in a higher or lower dispersal of pollutants. Also while an increase in temperature may

increase the rate of decomposition of organic matter, such decomposition may be limited by lower oxygen concentrations.

Major risks for not attaining WFD objectives due to climate change were identified as follows:

- the increase in seawater temperature would facilitate the establishment of thermophilic species in Maltese waters, introduced through ballast waters;
- the increase in the frequency of heavy rainfall spells would (i) significantly increase the discharge of pollutants from both point and diffused sources (albeit at a lower discharge concentration) and (ii) result in the construction of infrastructure for the control of floods thus leading to geomorphological changes and water flow modification particularly in valley systems;
- the increase in atmospheric temperature coupled to the decrease in precipitation would result in higher water demand leading to (i) increased groundwater abstraction and (ii) construction of further infrastructure for water storage resulting in geomorphological changes in both valley systems and along the coast and water flow modification within valley systems.

These risks are mainly related to the predicted increase in temperature and changes in precipitation patterns, which are already discernible from observational data of climatic parameters. Such risks are thus expected in the short to medium term and are highly relevant in the first WFD cycle. The climate check should therefore ensure that climate change induced increases or changes in pressures are addressed by the measures or actions presented in Chapter 8 so as to reduce the risk of not achieving WFD objectives.

11.4 Climate Checking the Programme of Measures

The second part of the climate check focussed on climate checking the measures identified in Chapter 8. For this a methodology was developed (see box 11.1). As an outcome a number of recommendations were put forward to ensure that the WFD measures take into consideration climate change effects on pressures and will perform under a changing climate (i.e. measures are climate resilient), or to render the measure amenable to adaptation (see Technical document >>).

BOX 11.1: Methodology to climate check the Programme of Measures

First a screening of the measures presented in the next chapter was guided by the following principles:

1. Measures should be resilient to a wide range of future predicted climate scenarios
2. The outcome of measures should be beneficial regardless of the eventual nature of climate variability and change to avoid irreversible decisions and investments that may not be cost effective under changing climatic conditions

Each measure was then assessed against a set of criteria:

1. Is the measure addressing climate change impacts?
2. Does the measure address the predicted changes in pressures due to climate change?
3. Is the measure likely to cope with a range of future conditions including changes in temperature, precipitation, sea level rise and storm surges
4. Is the measure flexible in a way that it can be changed in the future?

For each criterion the potential outcomes (positive, negative neutral and uncertain) were assessed. This made possible the overall classification of each measure as either being **win-win**, **low regret**, **flexible** or **regret**. The methodology is explained in detail in [guidance document no.>>](#).

The classification of measures as **Win-Win** are those measures or actions which in addition to addressing the changes in WFD pressures to climate change impacts, (if and to performing within a range of changing climatic conditions, are also deemed amenable to adaptation to climate change impacts and are of socio-economic or environmental benefit. As table 11.2 reveals a total of 7 measures were identified as Win-Win. With the taking up of the recommendations presented in the climate check several other measures may still have the potential of being reclassified as win-win.

The majority of the WFD measures have been classified as **low-regret** options. These measures would be beneficial regardless of the eventual nature of climate variability and change. Measures classified as such were those dealing with the development of protocols; the definition of good practices that are not relevant to adaptation to climate change impacts; development of regulatory processes and the enforcement of existing regulations; the setting up of advisory services; the carrying out of studies and improvement of knowledge. In these cases most of the measures could be easily modified to cater for climate change impacts. A number of recommendations in this regard were provided, the majority of which were taken up.

Table 11.2
Outcome of the classification of the WFD measures

Classification Options	Distribution of current measures		Distribution of measures should the recommendations be taken up	
	Number	Percentage	Number	Percentage
win-win	7	11%	20	32%
low-regret	39	63%	41	67%
flexible	14	23%	0	0
regret	1	2%	0	0
unclassifiable	1	2%	1	2%

Flexible options are measures which as currently designed may not perform effectively within a changing climate, either because they are not addressing the predicted climate induced changes in pressures or they are not likely to cope with a range of future climatic conditions. Such measures, however, can be modified to deal with climatic impacts.

Consideration of climate change impacts during the design and development stage of plans and planning guidance, for instance, has the potential to change many of identified Flexible measures into Win-Win measures. Conversely, it should be noted that failure to consider climate change impacts may result in some of these measures becoming Regret measures on implementation. However, the implementation of said management plans and the adoption of the planning guidance in given projects may not be so flexible if they entail the construction of infrastructure such as interceptors and breakwaters. Consideration of climate change impacts would ensure that any measures implemented as a result of the said plans and guidance will also perform in a changing climate.

Regret measures are those measures which may not perform within a changing climate and that once implemented cannot be modified at a later stage. No measures were identified to belong to this category.

The measure “*Setting up of inter-ministerial water committee to oversee the implementation of the WCMP*” could not be classified since this is mainly an

administrative measure that would ensure the implementation of the PoMs and is not influenced by any climate change impacts.

The table below (table 11.3) gives a summary of the climate check classification as explained above. The climate check classification is given as symbols placed before each measure.

Table 11.3

Summary of results of climate check classification of the programme of measures

Agriculture and animal husbandry sector measures	
☹	Farmers required to keep a record of breeding effluent volumes and destination of application to land.
☹	Farmers required to keep a record of farming practices This measure aims at managing fertilisers and pesticides at farm level.
☹	Construct anaerobic digestion plants for municipal waste and animal waste
☹	Reduce point source nitrate contamination from livestock units
☹	Farmers to draw up and comply with a nutrient management plan
☹	Promote the use of alternative methods for plant protection other than pesticides
☹	Establishment of an advisory service for the farming community
Fishing and Aquaculture Sector Measures	
☹	Define and implement good practices for aquaculture
😊	Define and implement good practices for fisheries
Industrial and Urban environments	
☹	Create a pollution abatement programme for priority hazardous substances, priority substances and other substances of concern
☹	Develop tools to link environmental quality standards (chemical) to emission limits for marine discharges
☹	Treatment of all urban waste water produced in the Maltese Islands
☹	Use of a pipe diffuser for discharge of treated waste water into the coastal Environment
☹	Adopt a regulatory framework for industrial operational practices
☹	Improve the regulatory system for industrial discharges into the public sewerage network
Managing the immediate coastal and marine environment	
~	Develop and implement planning and environmental guidance on major coastal engineering works
☹	Ensure bathing water quality standards in bathing areas
☹	Monitor dumping operations at the spoil ground
Ensuring no deterioration in the water quality of our harbours and marinas	
☹	Develop and implement a protocol for the disposal or reuse of dredged material from harbours
~	Develop and implement harbour environmental management plans with Stakeholders

~	Develop and implement technical guidance for water pollution control in Marinas
☹	Develop environmental regulations for recreational boating
Measures dealing with the improvement in groundwater quantity	
☹	Regulation of private water supply operators
☹	Metering of private groundwater abstraction sources
☺	Reduction of losses in the municipal distribution system
☺	Increase the capacity of rainwater runoff storage facilities
☹	Pilot projects on water demand management and supply augmentation measures
☹	Modelling of the Mean Sea Level Aquifer Systems
Measures required to safeguard our Natura 2000 protected areas	
~	Establish ecological flows within sub-catchments supporting Natura 2000 sites
~	Carry out a pilot project to promote integrated valley management
Measures needed to raise awareness	
☹	Develop a nation wide awareness campaign on national water issues
☹	Raise awareness on the value of water and water conservation in primary and secondary schools
☹	Develop an awareness campaign/s for groups of measures
☹	Set up a National Water Information system
☹	Prepare and implement a full information campaign on good agricultural practices.
Measures need to enhance our knowledge base	
☹	Study the need for ballast water management, monitoring and control
☹	Complete a comprehensive database of farm holdings
☹	Set up a database and inventory of industrial sites
☹	Study the impacts of the national spoil ground off Xagħġra

Climate Check classification

- ☺ Win-Win measure
- ☹ Low Regret measure
- ~ Flexible measure
- ☹ Regret Measure

12 Public consultation and stakeholder active involvement

12.1 Introduction

The importance of involving all water users, who are both beneficiaries and actors of a sound water environment, is highlighted in the WFD: *the success of the Directive relies on close cooperation and coherent action at Community, Member State and local level as well as on information, consultation and involvement of the public, including users.*

The WFD introduces three levels of public participation:

1. Public information;
2. Public consultation targeting the wider public;
3. Active involvement of all interested parties (i.e. stakeholders).

Participative water resources management planning as required by the WFD represents an innovation in the Maltese Islands. To implement the principles of the Aarhus Convention in the field of water, the competent authorities have been supported by an EU twinning project. This project assisted in the design of a sound strategy for the active involvement of stakeholders and the public. The strategy was developed with keeping the available administrative, technical and financial resources in mind. Nevertheless, the strategy took into account all three levels of public participation.

This chapter first presents the overall public consultation strategy undertaken to encourage participative planning which led to the development of this first WCMP. This is followed by an overview of the proposed communication framework required to ensure the successful and timely implementation of this plan.

12.2 The requirements of the Water Framework Directive on Public information and Consultation

Article 14 of the WFD states that Member States shall ensure that, for each water catchment district, they publish and make available for comments to the public for 6 months:

2. A timetable and work programme for the production of the management plan.
3. An interim overview of the significant water management issues identified in the river basin.
4. Draft copies of the Water Catchment Management Plan.

On request, the public should also be granted access to background or supporting documents and the information used for the development of this plan.

12.3 Identifying stakeholders and interested parties

In order to mobilise different institutions and the public for the preparation of this plan, public information dissemination was deemed to be a prerequisite. As a first step it was essential that all potential stakeholders and interest groups (including public

bodies) be identified and categorised according to their roles and responsibilities in relation to water resource management in the Maltese Islands.

Stakeholders and the public were categorised into three different groups according to their identified roles in terms of implementation of the Water Framework Directive. The identified three target groups of stakeholders are presented in the Table below and are defined as follows:

- a. Targeted *primary stakeholders* comprised of government agencies and regulatory authorities that have a leading role in implementing the measures that were defined in the Programme of measures. Primary stakeholders also have a communication role in facilitating communication through existing formal or informal networks down to secondary stakeholders and, in some cases, also to the general public.
- b. *Secondary stakeholders* were identified as those agencies or bodies that would have a secondary role in implementing the measures or would be directly or indirectly influenced by the measures and thus are likely to control their successful implementation.
- c. The third group consisted of representatives of the general public and opinion leaders which were considered instrumental in disseminating information and in raising awareness of the general public. This group is also expected to encourage the fostering of environmental stewardship.

Focal points in all key institutions were identified to collaborate firstly, on the identification of the significant water management issues, and secondly, to assist in the preparation of the programme of measures. Identified focal points administered the task of identifying key people from their institution that would need to be involved throughout the different stages of the Water Catchment Management Plan.

Table 12.1

Main stakeholders relevant to the WFD implementation process

Primary stakeholders <i>Government agencies and regulatory authorities that have a leading role in implementing the measures that were defined in the Programme of measures</i>
Office of the Prime Minister Malta Environment and Planning Authority Malta Tourism Authority
Ministry for Resources and Rural Affairs Malta Resources Authority Agriculture Department, Rural Development and Paying Agency Department of Fisheries MRRA Works Division and Valley Management Unit
Ministry for Infrastructure, Transport and Communications Malta Maritime Authority Water Services Corporation
Ministry for Social Policy Department for Environmental Health
Industrial sector Malta Chamber of Commerce and Small Enterprise Malta Enterprise
Ministry for Gozo
Secondary stakeholders <i>Agencies or bodies having a secondary role in implementing the measures or would be directly or indirectly influenced by the measures and thus are likely to control their successful implementation</i>

Ministry for Infrastructure, Transport and Communications Malta Freeport Authority Malta Transport Authority Enemalta
Ministry of Finance, the Economy and Investment Malta Standards Authority National Statistics Office
Valletta Regeneration Corporation
WasteServ Ltd.
Malta Hotels and Restaurant Association
<i>Representative of the general public and opinion leaders considered instrumental in disseminating information and in raising awareness of the general public</i>
Environmental NGOs (Nature Trust, Flimkien Ghal Ambjent Ahjar, Friends of the Earth, Din L-Art Helwa, Bird Life)
All Local Councils

12.4 Breakdown of main actions undertaken to ensure public information and to encourage the active involvement of all interested parties

The public communication strategy drawn up by the Competent Authorities ensured public information dissemination and encouraged the active involvement of stakeholders in each stage of preparation leading up to the creation of the first WCMP as defined by Article 14 of the Water Framework Directive.

12.4.1 Informing the Public on the WFD

Public information dissemination started at the earliest possible. In 2005 the Initial characterisation reports and the preliminary economic analysis for both surface and groundwaters were made available for public review on both the MRA and MEPA websites. The public was invited to comment on the documents presented.

Two public seminars were organised in March 2009 to promote the Aarhus convention and access to environmental information. The main participating agencies invited were composed of NGOs and Local Councils. During these seminars both MRA and MEPA representatives presented the WFD consultation strategy and timetable that would lead to the formulation of the first draft water catchment management plan. Participants were invited to comment and recommend improvements on the consultation strategy itself. They were also encouraged to consult the newly launched MRA/MEPA joint web pages on the WFD: <http://www.mepa.org.mt/water>.

The following is a brief step-wise overview of the stakeholder and public consultations carried out to date which led to the formulation of the Draft Water Catchment Management Plan.

12.4.2 Identification of significant water management issues

With the help of a Twinning Light project in 2007, the main groundwater management issues were identified through direct communication with primary stakeholders. Early in 2009, and within the framework of a second Twinning Light Project with MEPA and MRA as participating agencies, another series of bilateral meetings were organised between stakeholders and MEPA to identify significant coastal and inland surface water management issues. This was followed by a workshop co-organised by MRA

and MEPA in March 2009 and was the official launch of active consultation with the public on the WFD.

As part of the public consultation exercise, a questionnaire identifying the most important water management issues was prepared by MEPA and MRA and used for a 6 month consultation period starting from March 2009. The questionnaire was made available to the public on the MEPA website as well as NGO and local council websites, and was disseminated to the general public by means of a promotional stand at the International trade fair exhibition.

The purpose of setting up WFD dedicated web pages on one website was to provide the public with a single link for consultation on the WCMP and to serve as a showcase of how the joint competencies of the WFD are working together to create the first WCMP³⁷.

12.4.3 Formulation of the Programme of Measures

The MRA finalised a first version of their programme of measures related to groundwater management in 2007. In this context, the MRA organised a series of workshops between January 2007 and July 2007 to support and guide the analytical process.

MEPA consulted interested parties individually through a second series of bilateral meetings held during May and June 2009. Stakeholders were invited to actively contribute to the development of both basic and supplementary measures.

Following feedback received from the bilateral meetings, MEPA held a set of three round-table workshops in July 2009, to get all primary and some secondary stakeholders on board to discuss and agree on the ownership of coastal and inland surface water related measures.

The selection of the measures to be included within the Programme of Measures was based on the above-mentioned consultations. Some measures were deleted or amalgamated within the framework of other complimentary measures, with the aim of selecting the most feasible options for reaching the objectives of this plan.

12.4.4 Consultation on the First Draft Water Catchment Management Plan

The dual competency of the WFD dictates that the first draft WCMP has to be forwarded to the respective ministries, the Office of the Prime Minister and the Ministry for Resources and Rural Affairs for approval; and later to the cabinet prior to the document being issued for public consultation.

A series of activities are envisaged to encourage public consultation on the WCMP. The activities are:

- a general conference with the main target audience being NGOs, local councils, experts in the field of water and the general public;
- information on webpages on the MEPA website (www.mepa.org.mt);
- one-to-one meetings with key stakeholders and experts

A period of six months is being allowed for the public to comment.

³⁷ <http://www.mepa.org.mt/topics-water-home>

13 Implementing this Plan

13.1 Setting up a Water Inter-ministerial Committee

The successful implementation of the actions or programme of measures identified in this water catchment management plan relies on the commitment of several players coming from a wide spectrum of activities to work together. All of the measures presented in this plan are expected to be carried out by the end of 2012.

An administrative framework is therefore required to be set up to ensure the effective and timely implementation of the plan (Figure 13.1). One of the very first steps to create this enabling framework is the setting up of an **inter-ministerial water committee** with a main role to oversee the implementation of the plan. Such a framework would encourage the representation of all regulatory bodies responsible for the implementation of the measures.

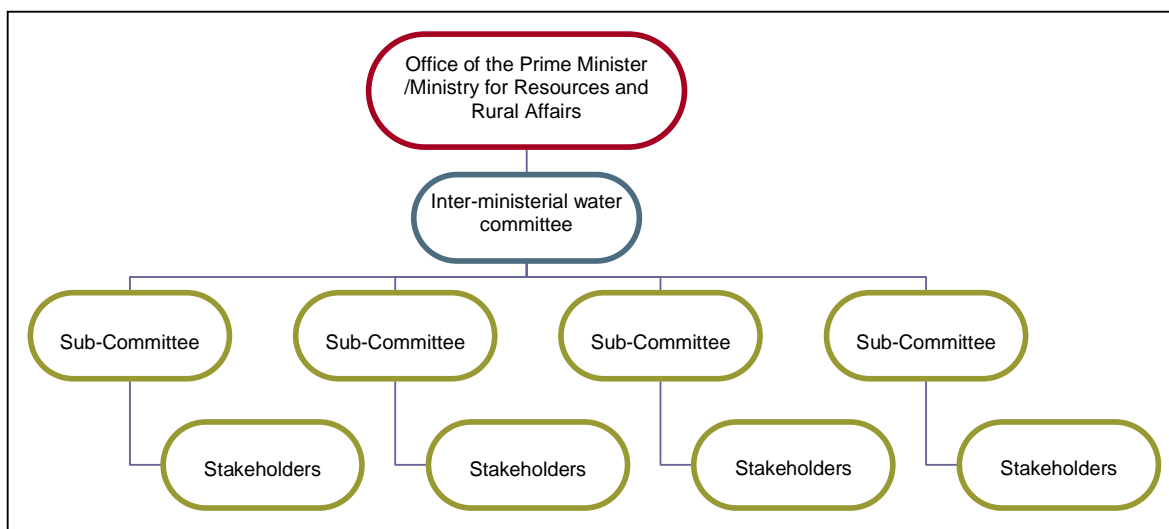
The main responsibilities of the inter-ministerial committee on water would be to:

1. Oversee the implementation of the water related directives and ensure integration of the measures into each entity's business plan (including time frames for implementation).
2. Advise on the integration of WFD principles and objectives in sectoral policies, plans and programs and to recommend mechanisms that enable implementation of measures for adoption.
3. Monitor the progress of implementation and report to the competent authorities and ministries.
4. With the help of assisting sub-committees, identify constraints that hinder implementation and recommend alternative measures by reviewing sub-committees reporting and recommendations on implementation of respective measures.
5. Inform the Water Catchment Management Plan implementation process of other issues that are likely to affect implementation.

The majority of the measures set out in this plan involve a wide spectrum of players and will be undertaken by a large number of public bodies. It is expected that these implementing agencies would record their progress and communicate these to the inter-ministerial committee. To facilitate this process there is a need to set up sub-committees that would assist and inform the inter-ministerial committee. The sub-committees would work with other local entities and stakeholders to help integrate the measures of this plan into local plans and strategies.

It is important that the sub-committees welcome the input of local players and stakeholders to drive action at the local level. The linking of the water catchment management plan with other plans and programmes thus should also be encouraged. This would guarantee maximum input and involvement from other parties. For this reason the sub-committees would encourage stakeholders to include this plan's considerations into their respective plans, policies and strategies.

Figure 13.1
The proposed administrative framework set up for implementing the first water catchment management plan.



13.2 Additional national measures

The dovetailing of measures with national plans and programmes would be a major task of the inter-ministerial committee. These plans and programmes include:

- A Draft Sustainable Strategy for the Maltese Islands 2006-2016
- National Strategic Reference Framework 2007 - 2013
- National Reform Programme 2008-2010
- Operational Program I (Structural Funds and the Cohesion Fund 2007-2013)
- The Maltese Code of Good Agricultural Practice
- Solid Waste Management Strategy for the Maltese Islands (September 2001)
- Agriculture Waste Management Plan for the Maltese Islands (June 2008)
- National Rural Development Strategy for the Programming period 2007-2013
- Fisheries Operational Programme for Malta 2007-2013
- Supplementary Planning Guidance: Agriculture, Farm Diversification and Stables (2007)
- First National Communication to the UNFCCC including National Action Plan (2004)
- National Energy Efficiency Action Plan (2008)
- Structure Plan for the Maltese Islands (1990)
- Draft Environmental Health Action Plan (2006)

13.3 Prioritisation of measures

Some measures included in this plan are obligatory as they originate from existing legislation. These consist of all basic measures and some supplementary actions that follow national legislation and statutory plans. Other measures call for voluntary action, especially in areas where the degree of impact of human activity is not believed to be very significant at the water body level.

Due to the difference in the nature of importance of the measures identified in this plan it is not expected that the measures will be implemented all at once. The inter-ministerial committee will see to it that the measures are implemented by means of a

phased approach. Table 13.1 gives an indication of when each measure is expected to be implemented together with a list of the respective implementing lead authority and involved agencies.

13.4 Need for further investigation, monitoring and studies

In developing this plan there will be a need to investigate several areas of water management. A lacuna on the degree of impact and the implications of certain pressures on the various water environments calls for the carrying out of investigations and studies. Further monitoring or investigative monitoring is also called for. For example there is a need to study ballast water management; the impacts of the national spoil ground off Xagħjra and also the impacts of the discharge of desalinated reject on the immediate marine environment.

Certain studies identified in this cycle may trigger the need for further actions to be taken during the first cycle and even the second cycle of the Water Framework Directive, wherever feasible. This would enhance the second water catchment management cycle since existing data gaps in the knowledge of impacts of pressures on the marine environment would gradually close. Technical studies focusing on resolving impacts through best practice would then be fed into the programme of measures for the second cycle. The actions proposed in the second cycle would be based on a better understanding of the interactions between what causes the problem, the extent of the problems caused, and the water environment.

13.5 Reporting on implementation progress of the plan









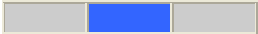


With results obtained from the monitoring network established under article 8 of the WFD, and feedback derived from the inter-ministerial committee, it would be possible to check whether the actual implementation of the plan is functioning and whether there is a positive trend towards the achievement of the environmental objectives set out in this plan.

The progress of this plan will be communicated to you by the end of 2012 when a formal interim report will be published on the competent authority's websites (MEPA and MRA). The aim of this interim report would be to describe progress in implementing the programme of measures set out in this plan. It would set out any additional actions established since the publication of this plan as a result of the additional studies and monitoring that were carried out; and assess the progress made towards the achievement of the environmental objectives.






Table 13.1

Proposed list of measures, Implementing agencies and expected start of implementation

Measure	Lead Authority/ies	Involved agencies	Start of implementation of measure		
Regulatory Measures					
Set up an inter-ministerial water committee to oversee the implementation of Water Catchment Management Plan	OPM; MRRA	MRA, MEPA, All regulatory authorities	<div><div>2010</div><div>2011</div><div>2012</div></div>		
Strengthen the existing environmental and planning regulatory processes to cater for the objectives of the Water Framework Directive	MEPA	OPM; MRRA	<div><div></div><div></div><div></div></div>		
Measures related to Agricultural and animal husbandry practices					
Farmers to keep a record of breeding effluent volumes and destination of application to land.	MRRA Department of Agriculture and Rural Affairs	MEPA, MRA	<div><div></div><div></div><div></div></div>		
Farmers required to keep a record of farming practices	MRRA Department of Agriculture and Rural Affairs	MEPA, MRA	<div><div></div><div></div><div></div></div>		
Construct anaerobic digestion plants for municipal waste and animal waste	MRRA, Wasteserv	MEPA,	<div><div></div><div></div><div></div></div>		
Reduce point source nitrate contamination from livestock units	MRRA Department of Agriculture and Rural Affairs	MEPA, MRA	This measure has already started		
Farmers to draw up and comply with a nutrient management plan	MRRA Department of Agriculture and Rural Affairs	MEPA, MRA	<div><div></div><div></div><div></div></div>		
Promote the use of alternative methods for plant protection other than pesticides	MRRA Department of Agriculture and Rural Affairs	MEPA, MRA	<div><div></div><div></div><div></div></div>		
Establishment of an advisory service for the farming community	MRRA Department of Agriculture and Rural Affairs	MEPA, MRA	<div><div></div><div></div><div></div></div>		
Measures related to fisheries and aquaculture practices					

Define and implement good practices for aquaculture	MRRA; Department of fisheries and Veterinary Affairs (MRRA); MEPA	Aquaculture cooperatives; Malta Aquaculture Producers Association	
Define and implement good practices for fisheries	MRRA; Department of fisheries and Veterinary Affairs (MRRA); MEPA		
Measures related to Industrial practices and urban environment pressures			
Create a pollution abatement programme for priority hazardous substances, priority substances and other substances of concern	MEPA; MRA, WSC	Malta Standards Authority, Malta Chamber of Commerce, Enterprise and Industry, GRTU, Malta Enterprise	
Develop tools to link environmental quality standards (chemical) to emission limits for marine discharges	MEPA	Malta Chamber of Commerce, Enterprise and Industry, GRTU, Malta Enterprise	
Treatment of all urban waste water produced in the Maltese Islands	WSC	MEPA, Relevant Local Councils	This measure has already started
Use of a pipe diffuser for discharge of treated waste water into the coastal Environment	WSC	MEPA, Relevant Local Councils	
Adopt a regulatory framework for industrial operational practices	Malta Standards Authority, MEPA	Malta Chamber of Commerce, Enterprise and Industry	
Improve the regulatory system for industrial discharges into the public sewerage network	WSC	MRA, MEPA, Malta Chamber of Commerce, Enterprise and Industry; Malta Enterprise, GRTU	
Measures to manage the immediate coastal and marine environment			
Develop and implement planning and environmental guidance on major coastal engineering works	MEPA	Transport Malta	
Ensure bathing water quality standards in bathing areas	Bathing Water Committee, Department for Environmental Health	MEPA, WSC, Local Councils	This measure has already started
Monitor dumping operations at the spoil ground	MEPA	Transport Malta	
Develop and implement a protocol for the disposal or reuse of dredged material from harbours	MEPA	Transport Malta	
Develop and implement harbour environmental management plans with Stakeholders	Transport Malta	MEPA, Port Operators, Shipyards, Ministry for Gozo, Department of Fisheries and Veterinary Affairs,	

		Enemalta, Works Division (MRRA) and Local Councils	
Develop and implement technical guidance for water pollution control in Marinas	Transport Malta	MEPA, Marina operators, MTA	
Develop environmental regulations for recreational boating	Transport Malta, MTA	Department for Environmental Health; Wasteserv, Port marina operators, Local Councils	
Measures dealing with the improvement in groundwater			
Regulation of private water supply operators	MRA		This measure has already started
Metering of significant private groundwater abstraction sources	MRA	MRRA	
Reduction of losses in the municipal distribution systems	WSC		This measure has already started
Increase the capacity of rainwater runoff storage facilities	MRRA	MRA	This measure has already started
Pilot projects on water demand management and supply augmentation measures	MRA	WSC, MRRA, Local Councils	
Modelling of the Mean Sea Level aquifer systems	MRA		
Measures required to safeguard our Natura 2000 protected areas			
Establish ecological flows within sub-catchments supporting Natura 2000 sites	MEPA (National Terrestrial Protected Areas Steering committee)	Local Councils, Environmental NGOs	
Carry out a pilot project to promote integrated valley management	MRRA (Stormwater management Unit)	MEPA, MRA, Local Councils, Environmental NGOs	
Measures needed to raise awareness and enhance our knowledge base			
Develop a nation wide awareness campaign on national water issues	MRA and MEPA		
Raise awareness on the value of water and water conservation in primary and secondary schools	MRA	Department of Education (Ministry of Education, Employment and the family)	
Develop an awareness campaign/s for groups of measures	MRA and MEPA		
Set up a National Water Information system	MRA and MEPA		

Prepare and implement a full information campaign on good agricultural practices.	MRRA Department of Agriculture and Rural Affairs	MEPA, MRA, Malta Standards Authority	
Study the need for ballast water management, monitoring and control	Transport Malta; MEPA		
Complete a comprehensive database of farm holdings	MRRA Department of Agriculture and Rural Affairs		
Set up a database and inventory of industrial sites	MEPA; MRA	WSC, GRTU, NSO,	
Study the impacts of the national spoil ground off Xaghjra	MEPA	Transport Malta	

14 Further Information

14.1 Contact points

The Water Framework Directive (2000/60/EC) was transposed into Maltese legislation as Legal Notice 194 of 2004 (Water Policy Framework Regulations, 2004). These regulations define the **Malta Resources Authority** as the responsible authority for inland waters including groundwaters.

The **Malta Environment and Planning Authority** is responsible for coastal waters and inland surface waters protected under the Development Planning Act or the Environment Protection Act.

Addresses:

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