Department of the Environment and Climate Change

HM Government of Gibraltar

Gibraltar River Basin Management Plan 2015 – 2021

Annexes

Water Framework Directive

September 2015





Produced in collaboration with Amec Foster Wheeler Environment and infrastructure UK Limited

Report for

HM Government of Gibraltar
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Cover photos (top left to right):

Niskin bottle being used by the Department of the Environment and Climate Change for water sampling: Jonathan Kay.

Sunset from the eastside of Gibraltar: Kevin Gomila.

Bluefin tuna at the southern waters of Gibraltar's SAC: Nicholas Ferrary.

Department of the Environment and Climate Change's Dive Team carrying out a survey over the Northwest Artificial Reef Gibraltar: Clive Crisp.

Shoal of *Boops boops* over Europa Reef: Clive Crisp.

Serranus cabrilla in Seven Sisters Reef: Dr Darren Fa.

Third-party disclaimer

Management systems

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Document revisions

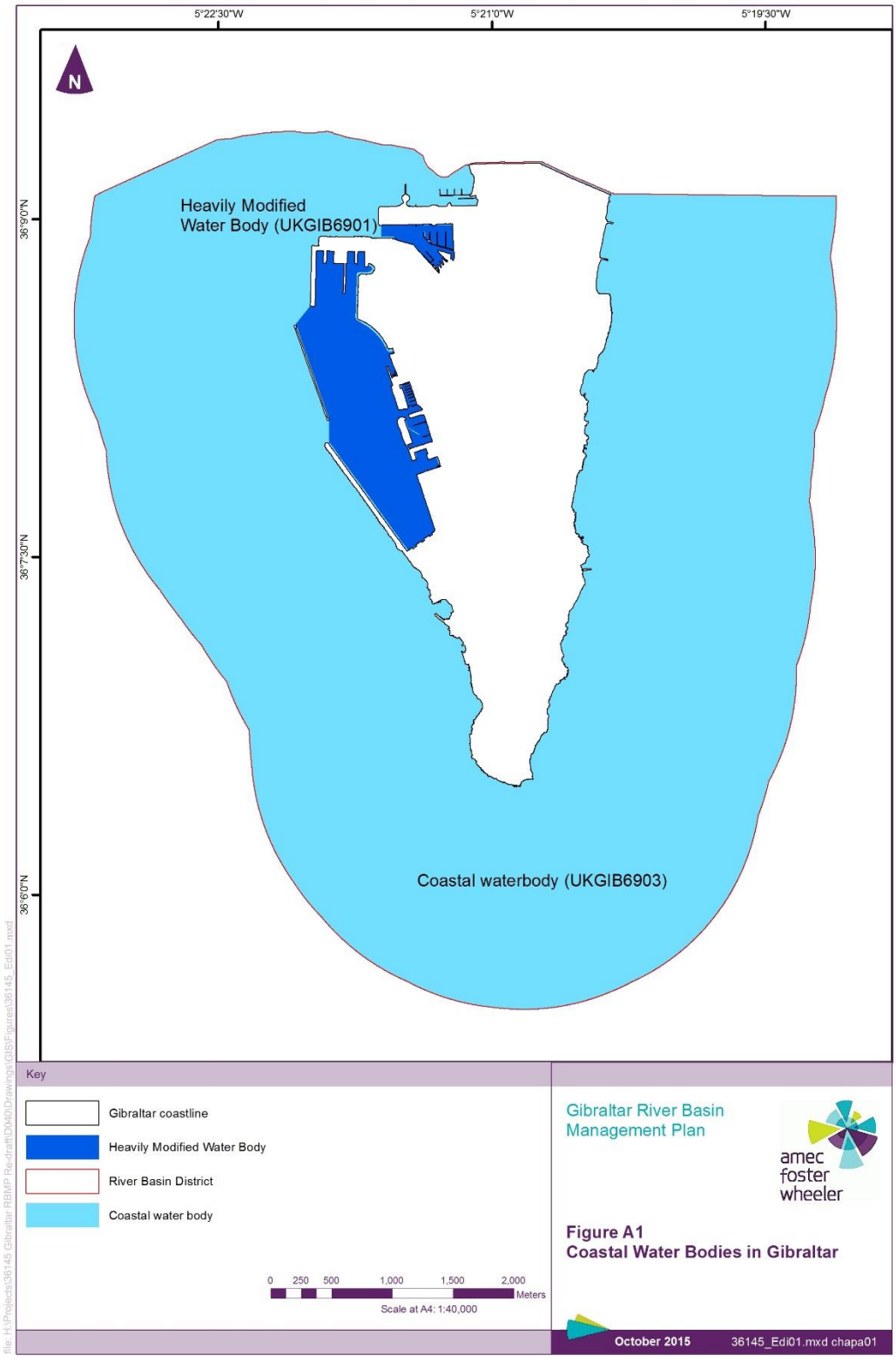
No.	Details	Date
i	First draft to client	July 2015
ii	Consultation draft to client	Sept 2015

Contents

A. Water Bodies in Gibraltar

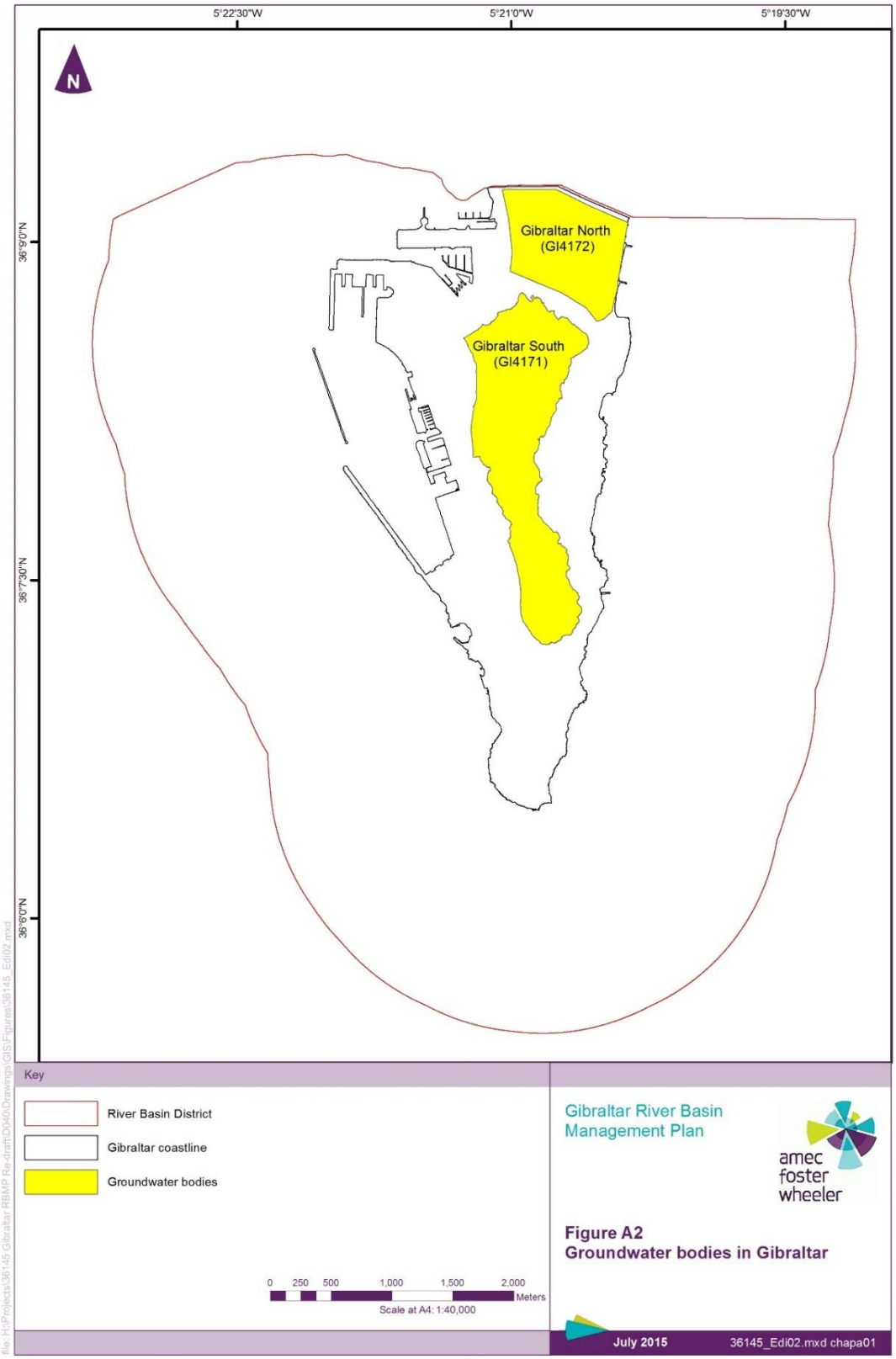
A.1 Coastal Waters

There is one coastal water body (UKGIB6903) and one heavily modified coastal water body (HMWB; UKGIB6901) in the Gibraltar River Basin District (Figure A1).



A.2 Groundwaters

There are two groundwater bodies in the Gibraltar River Basin District (Figure A2): Gibraltar North (GI4172) and Gibraltar South (GI4171).



B. Pressures and Risks

It is important to identify which activities within a River Basin District (RBD) could lead to pressures on the water environment and potentially impact the 'good status' classification. The WFD requires the management of risk to the environment caused by human activity and pressures. The consideration of pressures and risks helps to build up an evidence base that can justify the objectives and the actions to deliver them.

B.1 Introduction

Pressures and impacts have been identified from the first round of the River Basin Management Plan (RBMP). This section reviews and updates the current pressures from human activity in Gibraltar facing the water environment.

Pressures that continue to exist in the Gibraltar RBD are listed below:

- point source discharges (e.g. sewage outfalls and industrial discharges)
- diffuse pollution (including shipping)
- abstraction
- physical modifications (land reclamation, urban development)
- transboundary impacts
- climate change

Climate change issues are discussed separately in Annex G.

B.2 Pressures on Coastal Water Bodies

Table B.1 shows all pressures identified and these are discussed further below the table to provide some background.

Table B.1 Pressures within the coastal environment

Water body	Details	Location	Type of pressure
Coastal Waters	Desalination plant	Waterport	Point source discharge
Coastal Waters	MoD desalination plant	Camp Bay	Point source discharge
Coastal Waters*	Raw sewage	Europa Point	Point source discharge
Coastal Waters	Desalination Plant	Governor's Beach	Point source discharge
Coastal Waters	Bunkering	Gibraltar Bay, outer harbour moles	Point source discharge
Coastal Waters	Combined sewer overflows	South of Little Bay, Catalan Bay, Eastern Beach	Diffuse discharge
Coastal Waters	Contamination from shipping	Outer Harbour, Gibraltar Bay	Diffuse discharge
Coastal Waters	Sewer overflow	Western Beach	Transboundary issue
Coastal Waters	Desalinisation plant	North Mole	Abstraction
Coastal Waters	Reverse osmosis plant	Little Bay	Abstraction
Coastal Waters	Swimming pool	Camp Bay	Abstraction
Coastal Waters	MoD desalinisation plant	Camp Bay	Abstraction
Coastal Waters	Deposition of dredgings	Harbour Moles and Airport	Morphological pressure
Coastal Waters	Manipulation of sediment regime	Gibraltar Bay	Morphological pressure
Coastal Waters	Construction/land reclamation	Main Harbour	Morphological pressure
Coastal Waters	Bunkering	Inner harbour moles and quay	Point source discharge
Harbour & Marina Bay	Shoreline reinforcement	Main Harbour	Morphological pressure
Harbour & Marina Bay	Construction/land reclamation	Main Harbour	Morphological pressure
Harbour & Marina Bay	Contamination from shipping	Main Harbour	Diffuse discharge
Harbour & Marina Bay**	Combined sewer overflows	Main Harbour	Diffuse discharge

* A waste water treatment plant is scheduled to be built here.

** This will be improved in some areas with a new pumping station at Little Bay

Point Sources

The urban environment contains various point source pollution issues, for example from sewage discharges or industrial processes. The assessment of existing point sources has been updated with the most recent information where available.

A key potential source of pollution to coastal waters is the untreated sewage effluent derived from the population of 32,000 and currently discharged into the Coastal Waters Body at Europa Point, at the southern tip of Gibraltar. The Government of Gibraltar has commissioned an Urban Waste Water Treatment Plant to be built at Europa Point by 2017. Once built, the treatment plant will provide secondary treatment.

Discharges from the desalination plants are located at Waterport, with the seawater intakes located at the North Mole, at Camp Bay and at Governor's Beach, where saline water is also disposed of from the plants.

Gibraltar is the largest bunkering port in the Mediterranean, providing a fuel supply to the multitude of commercial vessels (e.g. tankers, cargo ships, cruise ships, etc.) that pass through the Straits. Bunkers are

delivered either by barge while the vessel is at anchor or from shore, thus minimising the need for vessels to anchor.

The information on point sources indicates that the Coastal Waters Body is probably not at risk of pollution from point sources, as the discharges from the point sources have not exceeded discharge conditions or caused failures in the water quality monitoring.

Diffuse sources

Diffuse pollution sources can arise from a wide range of activities associated primarily with land use, but can also arise from numerous or unspecified point sources over a widespread area. A summary of the diffuse sources and the water bodies at risk is presented below.

There are discharges from combined sewer overflows (CSOs) and storm drain outlets, largely confined to the harbour area but some also located in the Coastal Waters. They operate during times of heavy rainfall, discharging a mixture of rainfall, surface run off and untreated sewage to ease capacity issues in the sewerage system. There are five CSOs that discharge to the harbour and one that discharges to Marina Bay. Due to the limited circulation of current in the harbour area and Marina Bay there is a reduction in dispersion in comparison to the open waters of the Coastal Waters Body.

There are potential diffuse sources of pollutants from shipping and yachting from antifouling paints such as TBT. Historically TBT was used in antifouling paint, although the use of paints containing TBT was banned in 2008 by the International Convention on the Control of Antifouling on Ships. The Convention also states that any TBT antifouling paint must be covered up with non-TBT based paint; therefore ships may still have undercoats on their hulls that contain TBT. Paint chippings from boatyards, if discharged directly into the harbour or from untreated drainage from shipyards, can potentially lead to pollution of elements such as TBT if still present on bottom layers of antifouling paint. This, however, should be mitigated by ensuring the shipyard has an effective environmental management plan.

Due to the history of shipping and boatyards in and around the Bay there is also a potential for the sediments on the seabed to contain contaminants including TBT, from settlement of any debris from ships' hulls. Any disturbance of sediments from ship movements or winter storms could potentially release TBT into the waters.

Monitoring of Gibraltar Harbour (HMWB) since July 2009 has indicated that TBT levels exceed the guidance standards. As there is potential for elements to be released from disturbed sediments or from shipping activities in the harbour the HMWB (Gibraltar Harbour and Marina Bay) **is at risk** from diffuse sources of pollution.

Abstraction

The water supply for Gibraltar is supplied by a dual system, entirely from sea water. Desalinated water is used for drinking supplies, with a separate distribution system of sea water used for sanitary purposes. Intakes for the supply system are located in the Coastal Waters and the Gibraltar Harbour. Saline water from the desalinisation process is returned to the coastal waters and the sewage is discharged into the Straits of Gibraltar at Europa Point, where the dispersion is high. This will eventually be subject to secondary treatment once the new waste water treatment plant is built.

In terms of quantity therefore, much of the volume abstracted is returned to the environment. The proportion consumed is considered to be a very small percentage of the available resource, and therefore the status classification of the water bodies is considered not to be at risk from abstraction pressures.

Morphological Pressures

The physical alteration of a coastline due to land reclamation, flood defences, dredging, harbour use, navigation and shoreline reinforcement can lead to damage of coastal habitats.

Specific pressures on coastal morphology are evident in the Gibraltar Harbour and Marina Bay arising from land reclamation and the construction of flood defences (shoreline reinforcement). There has also been land reclamation on the east coast of Gibraltar, just north of Caleta Bay. The original natural coastline of Gibraltar

in the harbour area is now some way from the current shoreline of the harbour. The land reclamation has been essential in order to provide the required harbour area for navigation and to allow the growth of Gibraltar town, as limited land is available due to the topography of the Rock.

Dredging is regulated by the Gibraltar Port Authority and the Department of the Environment and Climate Change. Guidelines on the Assessment of Dredged Material have been prepared by the Government of Gibraltar, which are adopted from the London Convention 1972 and the 1996 Protocol, that is, the disposal of dredged material, and modified accordingly by the Department of the Environment and Climate Change, HM Government of Gibraltar. Dredging does not often occur in the Gibraltar waters but the last dredging event was in 2014 and took place at Coaling Island.

It is considered that the Gibraltar Harbour area is **probably at risk**, as the morphological pressures from navigation, land reclamation and shoreline reinforcement are likely to cause deterioration from high status (hydro-) morphology to a lower status class.

Other parts of the coast not included within the Harbour area are considered to be **not at risk**.

Transboundary Issues

The bathing location at Western Beach is failing to meet Bathing Waters Directive objectives due to the location of a Spanish sewage discharge point which services the Spanish town La Línea de la Concepción in the area of Western Beach. This puts the coastal waters at risk of not meeting good status due to the sewage discharge point. This has been ongoing since 2010 and has now been taken up by the European Commission. Until the problem is resolved, extensive bathing water quality monitoring will continue to take place. In the past, Western Beach has been closed due to the poor water quality; this measure may be required should water quality fall again in the future

A.3 Pressures on Groundwater

Table B.2 lists the potential pressures on the two groundwater bodies.

Table B.2 Pressures on the groundwater environment

Water body	Details	Location	Type of pressure
Southern Groundwater Body	Historic spillages	Comcen Cave Pool	Point source
Northern Groundwater Body	Anthropogenic pollution	Airport	Point sources
Northern Groundwater Body	Urban land use	Airport and cemetery	Diffuse sources
Northern Groundwater Body	Saline Intrusion	Airport	Diffuse sources

Point Sources

Historical spillages of hydrocarbons have been reported to occur to the southern groundwater body, and hydrogeological studies have previously reported the presence of hydrocarbons in the region of Comcen Cave Pool, as a result of a broken pipeline in the 1970s (E.P Wright *et al*. 1994). The monitoring borehole locations with recent data and available for use in the groundwater classification are further north from this point but these do not show any failure against standards for the General Chemical Assessment. Based on the available data of groundwater quality and of potential point sources, the Southern Groundwater Body is, therefore, considered to be probably not at risk from point sources. Remediation works to remove the historical ground contamination commenced in early 2015. These works consist of abstracting the hydrocarbon contaminants through a series of pumps and disposing of this as hazardous waste. Treatment will also take place where there is a large amount of water present in the pumped hydrocarbons. These works are due to be completed in 2017. Following the remediation works, further investigations and monitoring may be necessary to confirm if the whole of the groundwater body is at Good Status.

For the Northern Groundwater Body, there are potential point sources of pollution from the Airport and presence of fuel tanks. However, the monitoring data used for the classification does not show any standards being exceeded in the Northern Groundwater Body quality. The Northern Groundwater Body is therefore considered probably not at risk from point sources associated with the Airport activities.

Diffuse Sources

The Northern Groundwater Body is primarily covered by the airport runway and buildings, the cemetery and some housing development. One monitoring point in the Northern Groundwater Body, located adjacent to the Isthmus Cemetery, exceeds the ammonia threshold and could reflect contamination from the burial ground or leaking sewers. The Northern Groundwater Body (isthmus sands) is considered probably at risk as the area of urban land use suggests diffuse sources are probable.

The Southern Groundwater Body (bedrock groundwater body) is currently considered as not at risk of failing to achieve good status because of diffuse (urban) pressures. This is primarily due to the topography of the rock itself which does not allow urban development. Oil contamination issues are discussed above under point sources.

Abstraction

In the Northern Groundwater Body, up to 12% of the total recharge had been abstracted in the past for human consumption and other purposes. Saline intrusion has occurred in the past but since groundwater abstraction stopped (2009), there is no current risk and the Northern Groundwater Body is likely to recover. There is no risk therefore associated with diffuse pollution from saline intrusion.

Currently, the Northern Groundwater Body only has two minor abstractions. One abstraction, for a laundry business, rarely exceeds 10 m^3 per day and abstraction data for the period 2010 to 2013 suggests rates of close to 2 m^3/d. The other abstraction is for the Gibraltar cemetery, which is estimated as abstracting less than 1 m^3 per day. Abstraction for dewatering has taken place in recent years for allowing tunnelling at the airport; however, effects are likely to be temporary and any impacts on groundwater levels should be reversed by aquifer recharge from rainfall when this activity ceases.

There have been no recent abstractions from the Southern Groundwater Body.

B.1 Summary and Update From First Cycle of RBMP

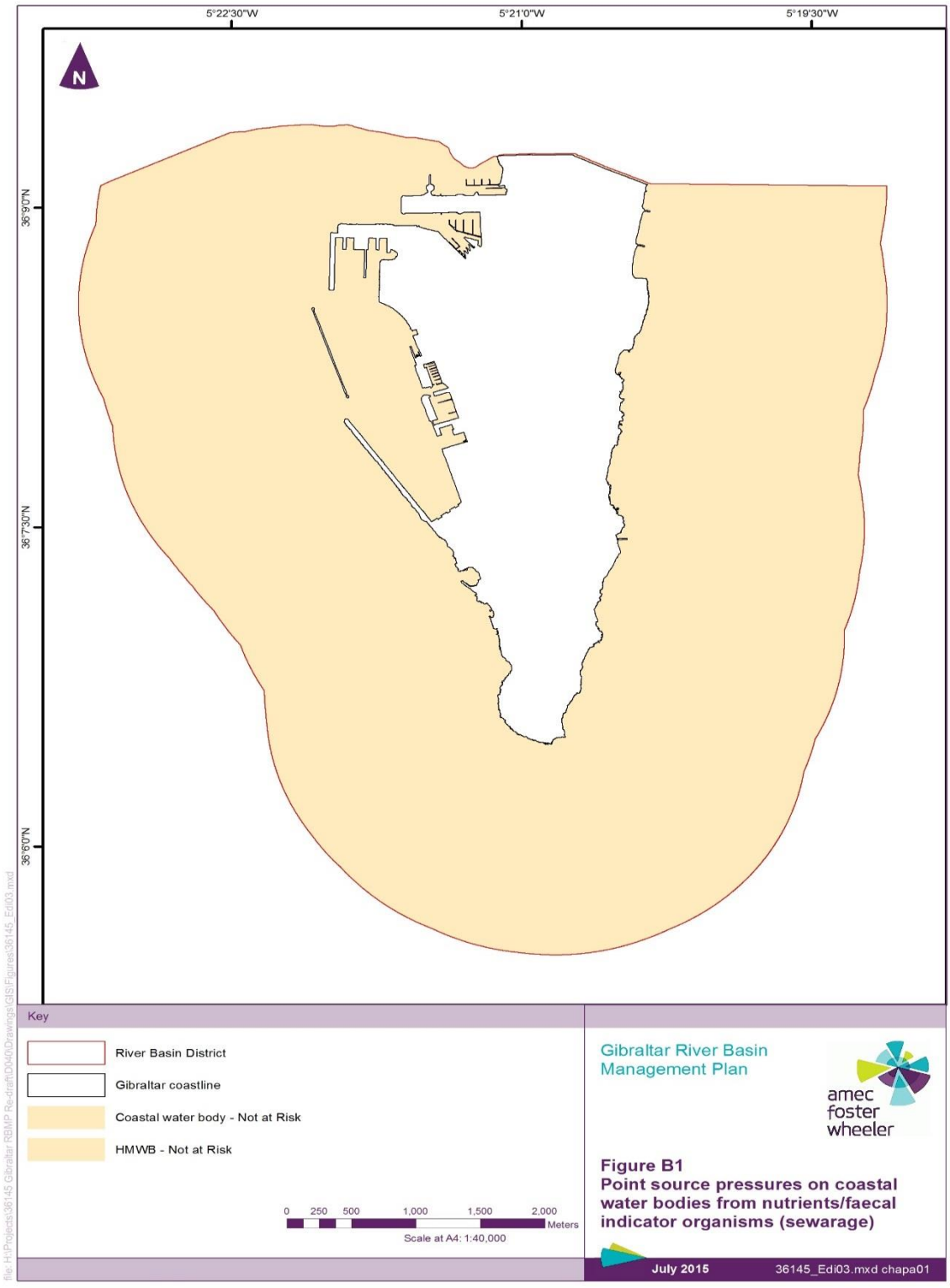
A summary of the pressures affecting each water body is presented in Table B.3.

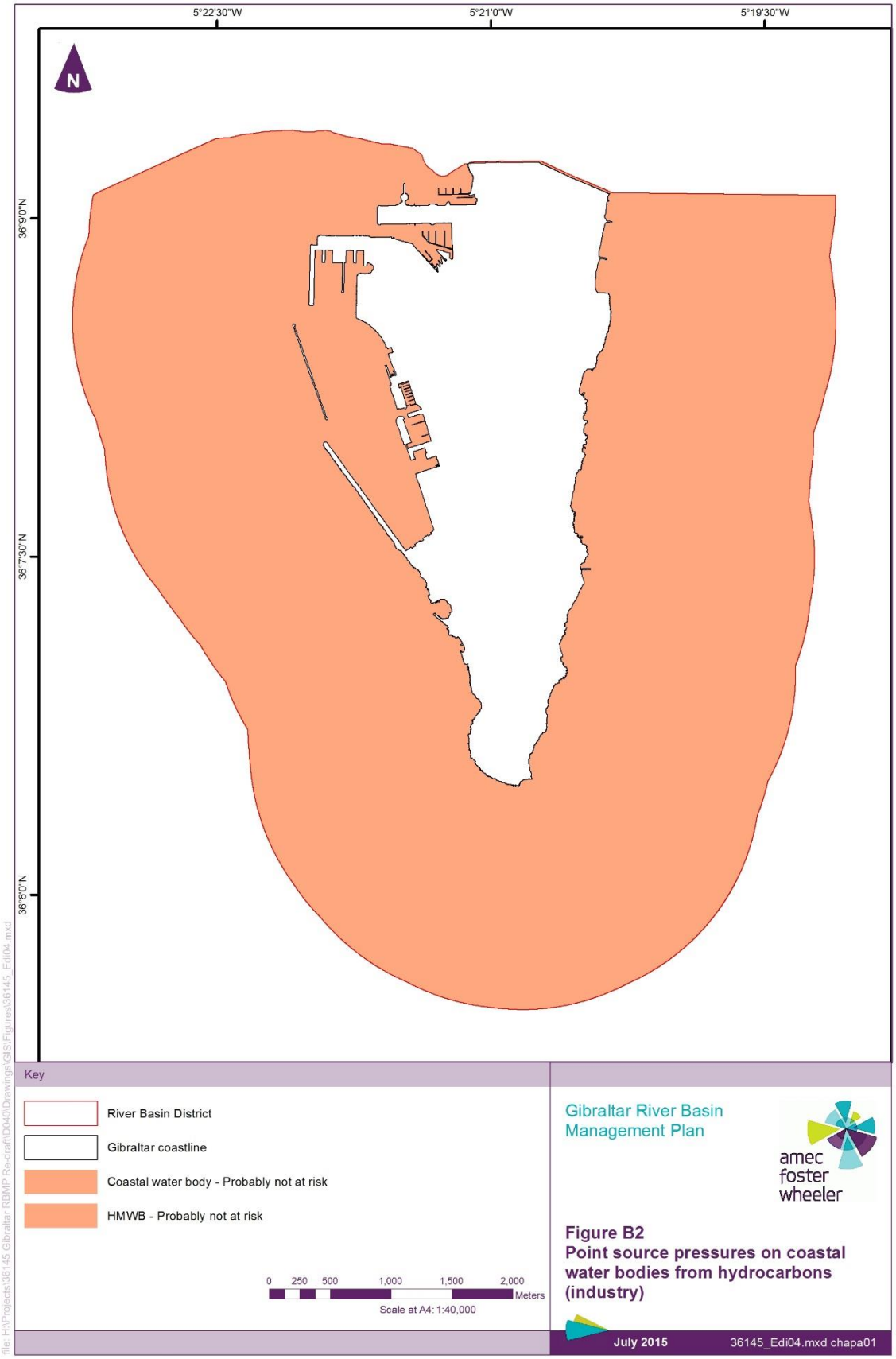
Table B.3 Summary of pressures and update of pressures from the previous RBMP cycle.

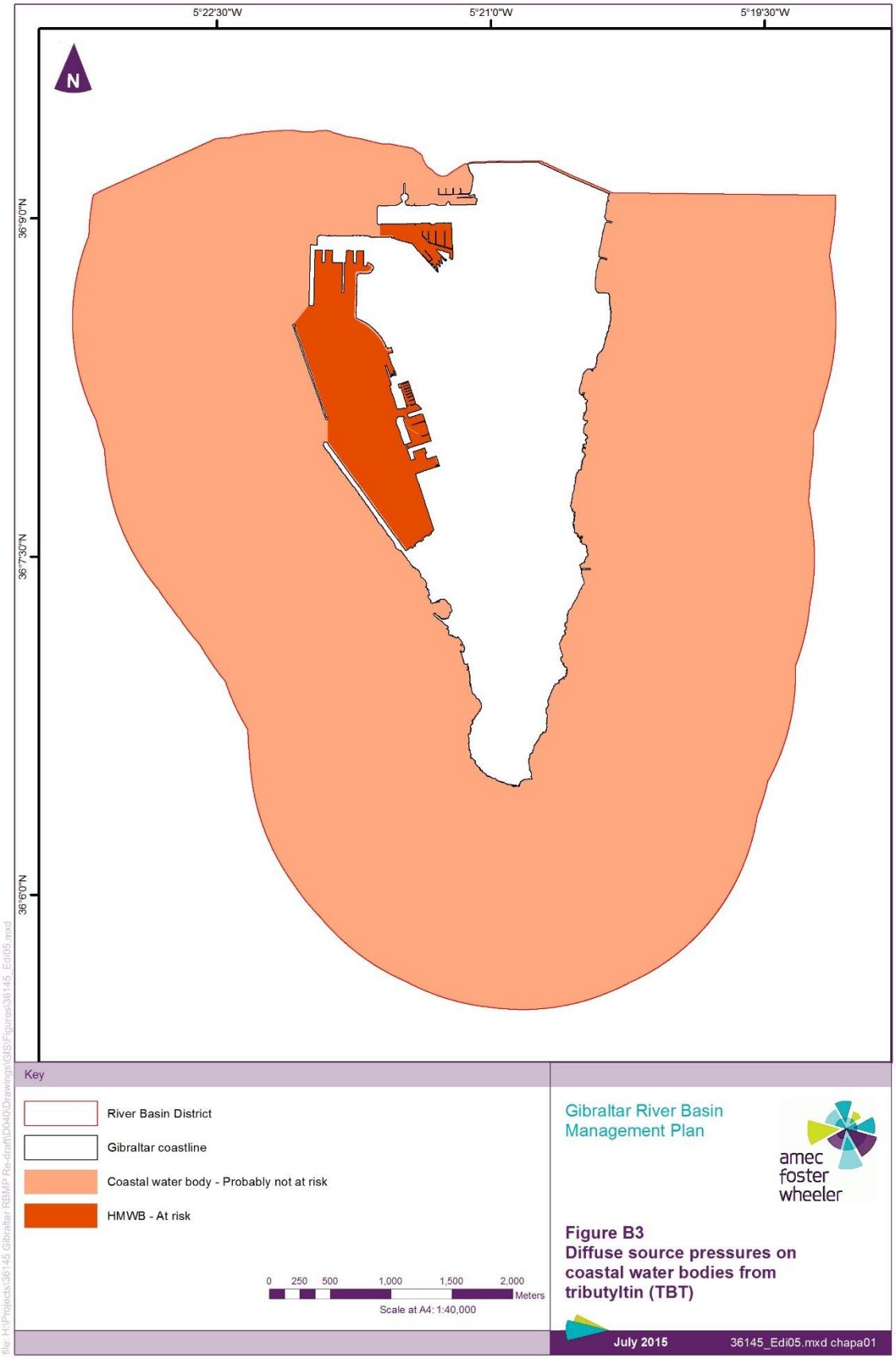
Type of pressure	Specific pressure	Water body	Risk (previous RBMP)	Risk (current RBMP)
Point source	Sewage	Coastal Waters Body	Probably Not at Risk	Not at Risk
	Industrial Discharges	Coastal Waters Body	Probably Not at Risk	Probably Not at Risk
	Bunkering	Coastal Waters Body	(Not assessed)	Probably Not at Risk
	Bunkering	Heavily Modified Water Body	(Not assessed)	Probably Not at Risk
	Hydrocarbon spillages	Groundwater Bodies (N&S)	Probably Not at Risk	Probably Not at Risk
Diffuse source	Shipping & historical contamination (TBT)	Coastal Waters Body	At Risk	Probably Not at Risk
	Sewer overflows	Coastal Waters Body	Probably at Risk	Probably at Risk
	Sewer overflows	Heavily Modified Water Body	Probably at Risk	Probably at Risk
	Shipping & historical contamination (TBT)	Heavily Modified Water Body	At Risk	At Risk
	Urban land use (ammonia)	Northern Groundwater Body	(Not assessed)	Probably at Risk
	Urban land use (ammonia)	Southern Groundwater Body	(Not assessed)	Not at Risk
Abstraction	Intake	Coastal Waters Body	Not At Risk	Not at Risk
	Intake	Heavily Modified Water Body	Not At Risk	Not at Risk
	Licenced abstraction	Northern Groundwater Body	(Not assessed)	Probably Not at Risk
Morphological pressure	Artificial structures (e.g. shoreline defence)	Coastal Waters Body	(Not assessed)	Not at Risk
	Land reclamation	Coastal Waters Body	(Not assessed)	Not at Risk
	Harbour use	Heavily Modified Water Body	At Risk	Probably at Risk
	Land reclamation	Heavily Modified Water Body	(Not assessed)	At Risk
Transboundary issues	Sewage from Spain	Coastal Waters Body	At Risk	At Risk

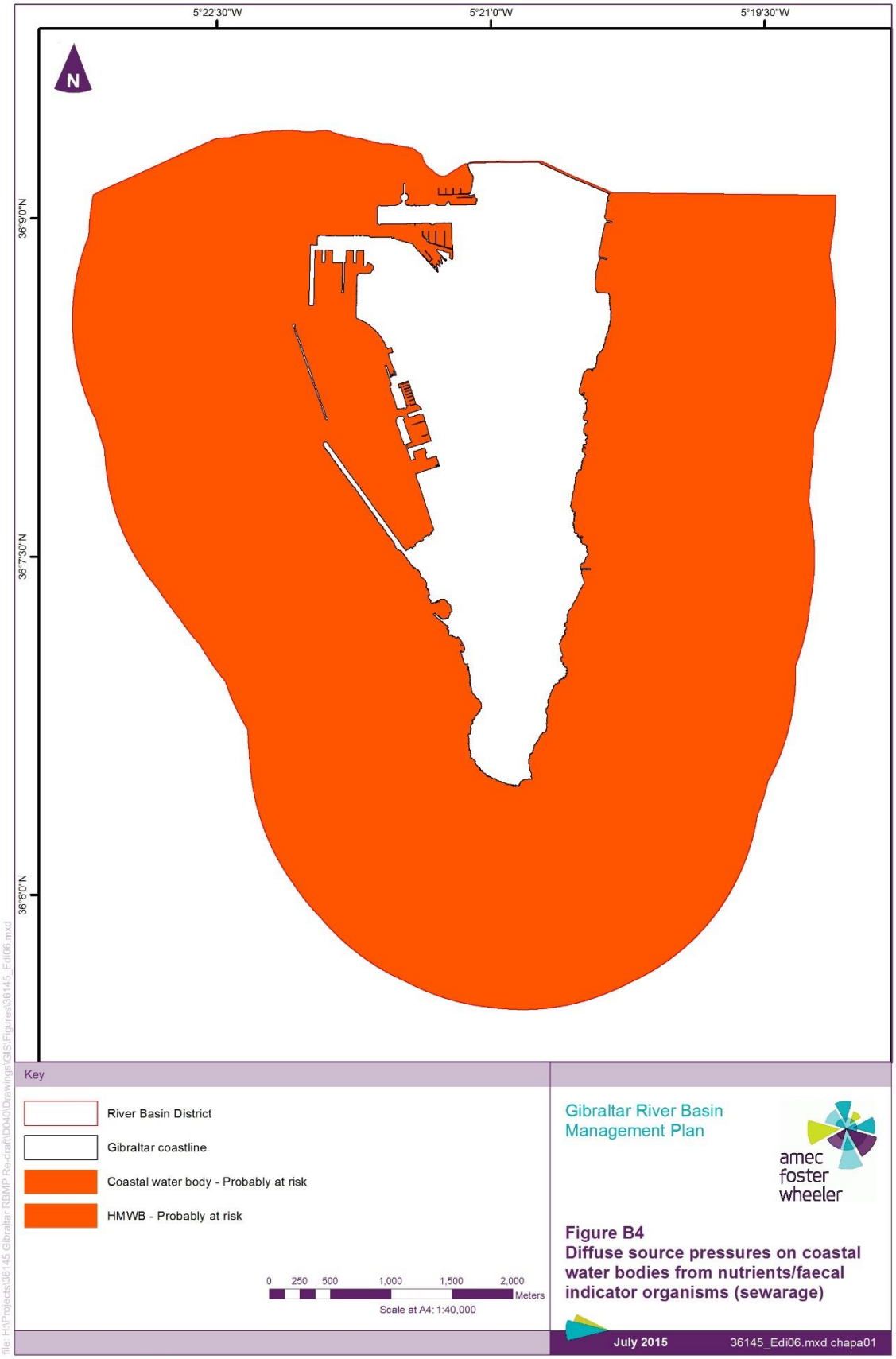
B.3 Mapped Outputs

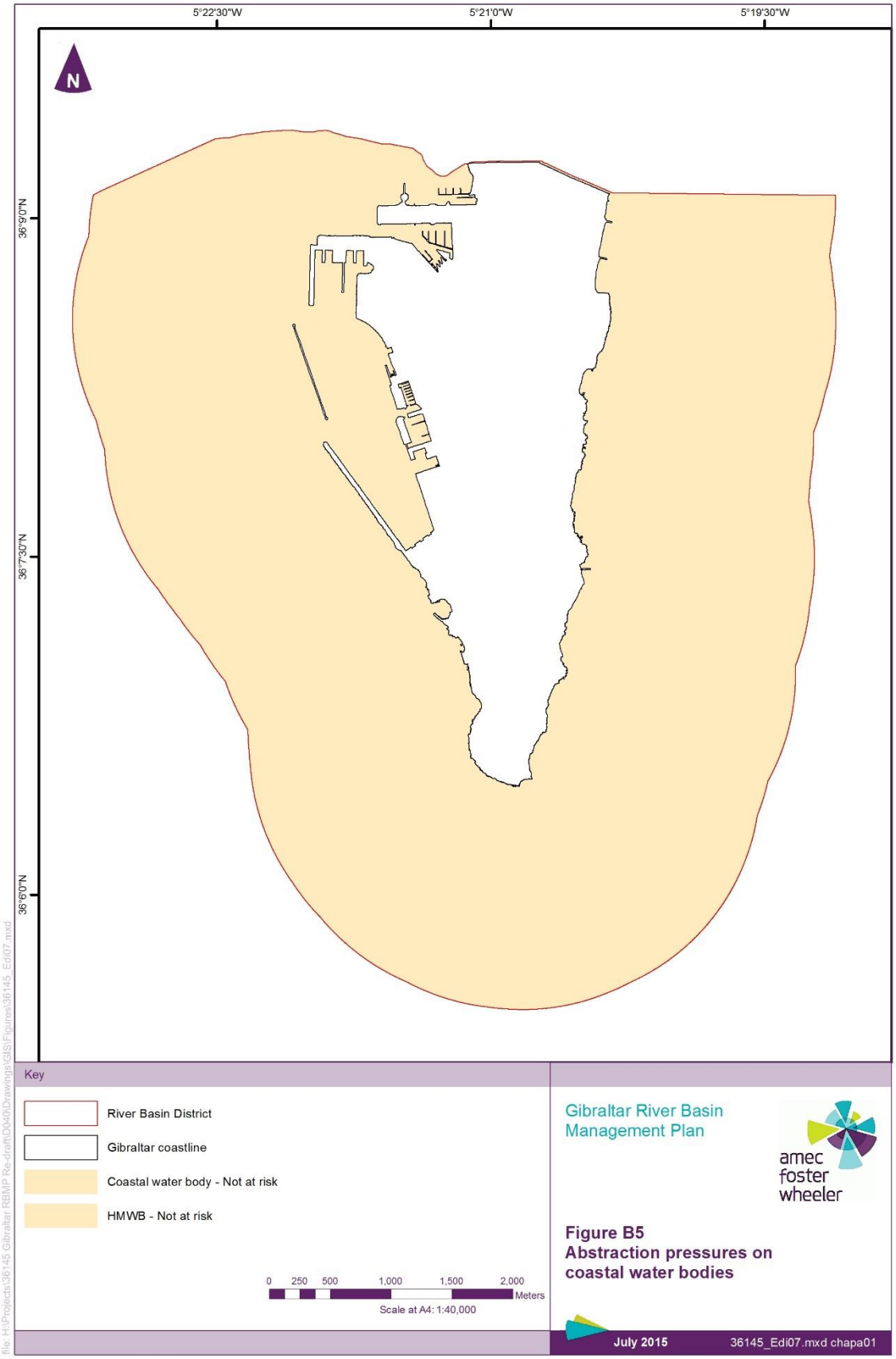
The figures of the current view of risk for the pressures described above are presented on the following pages. These assessments do not reflect the current quality or status of a water body, rather the risk that they may fail objectives as a result of pressures acting on them.

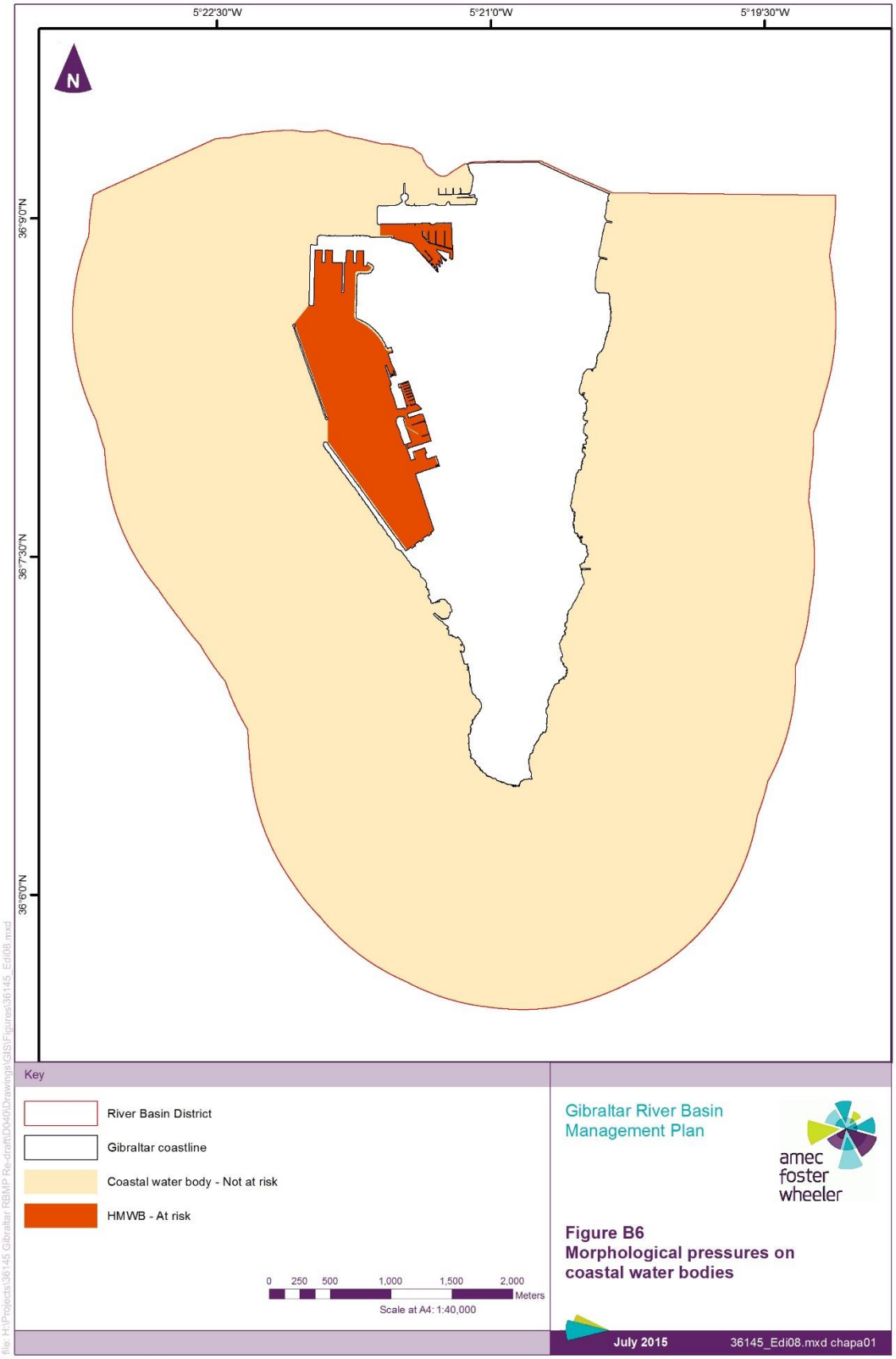


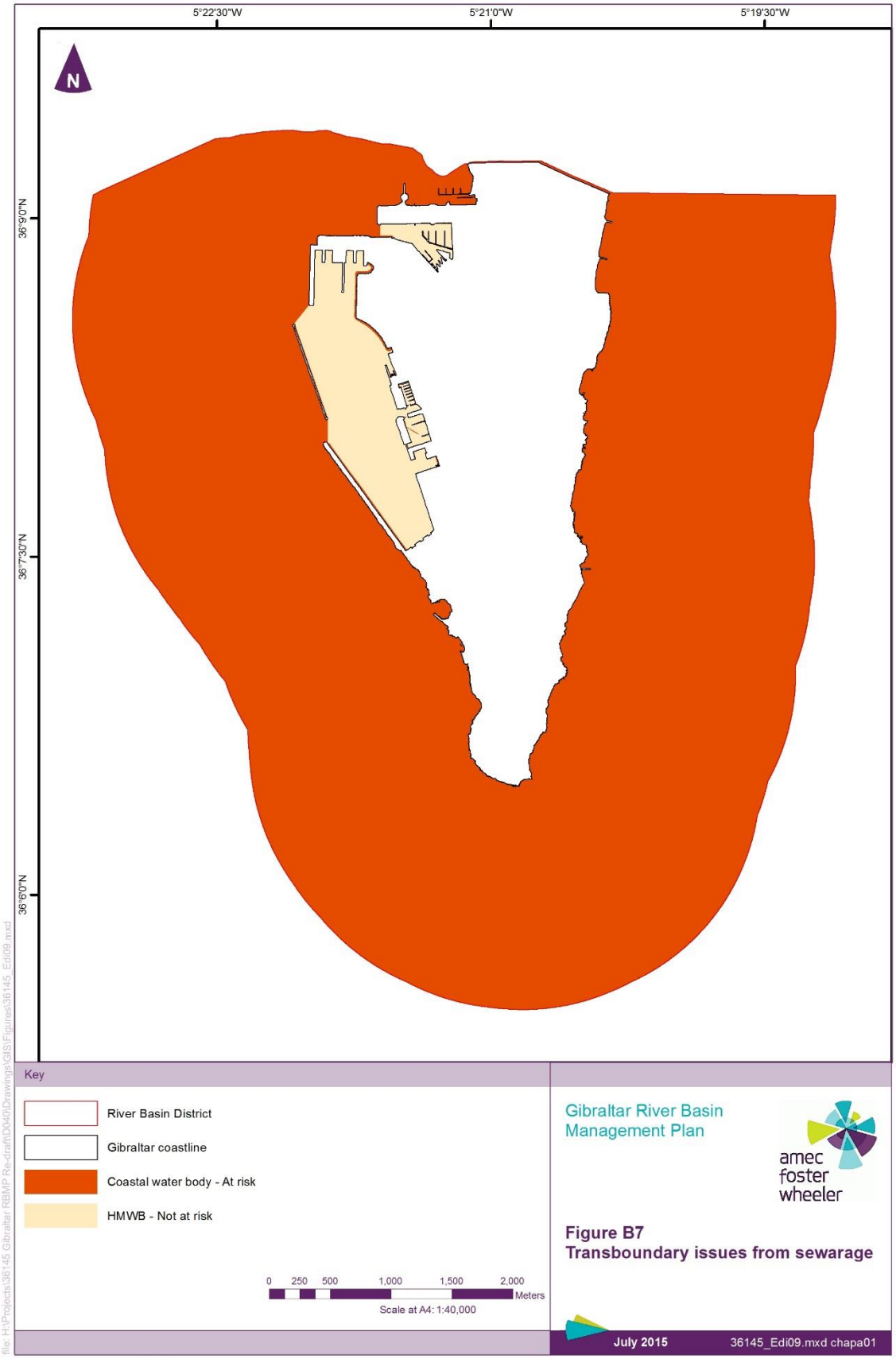


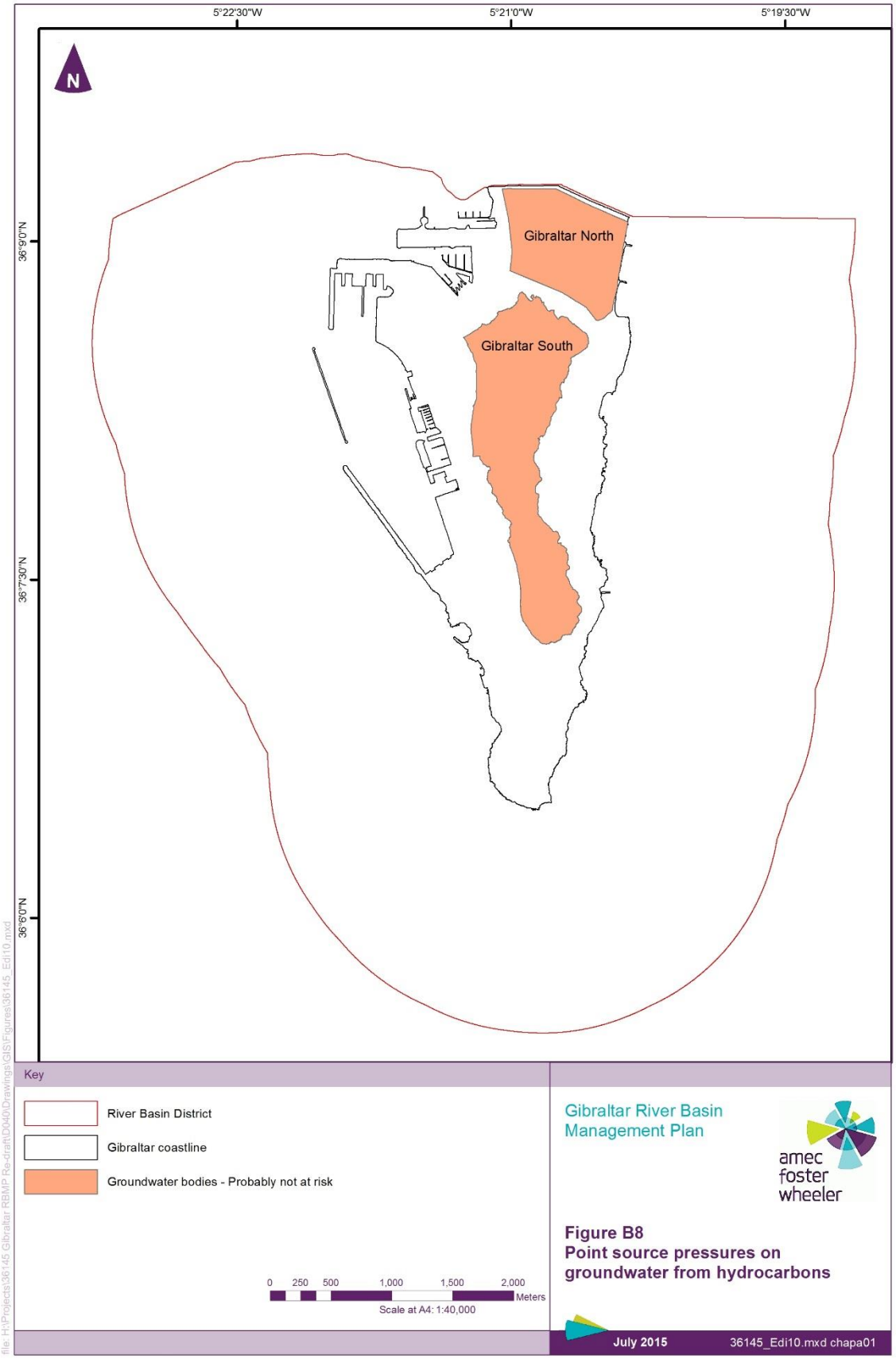


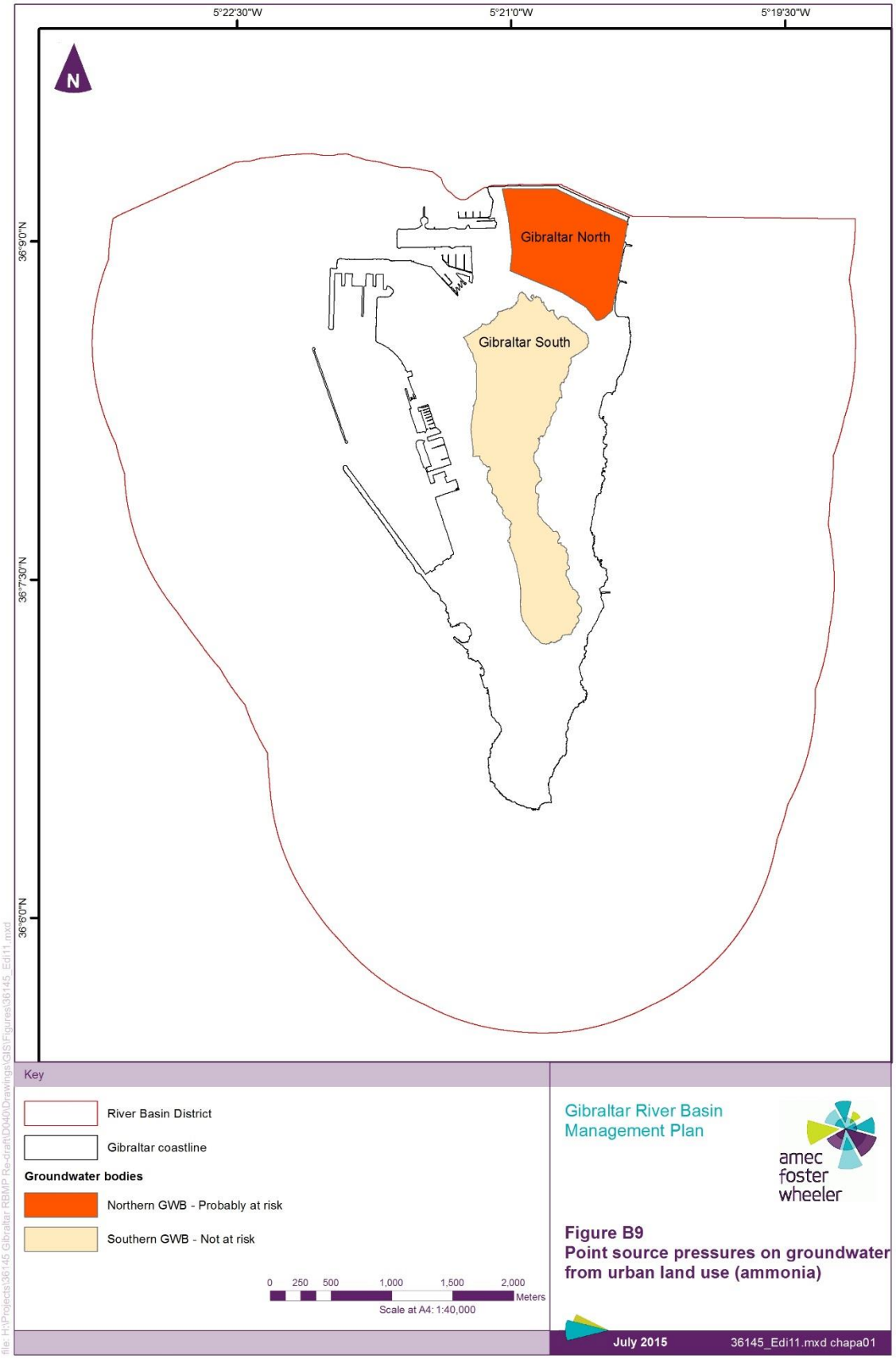


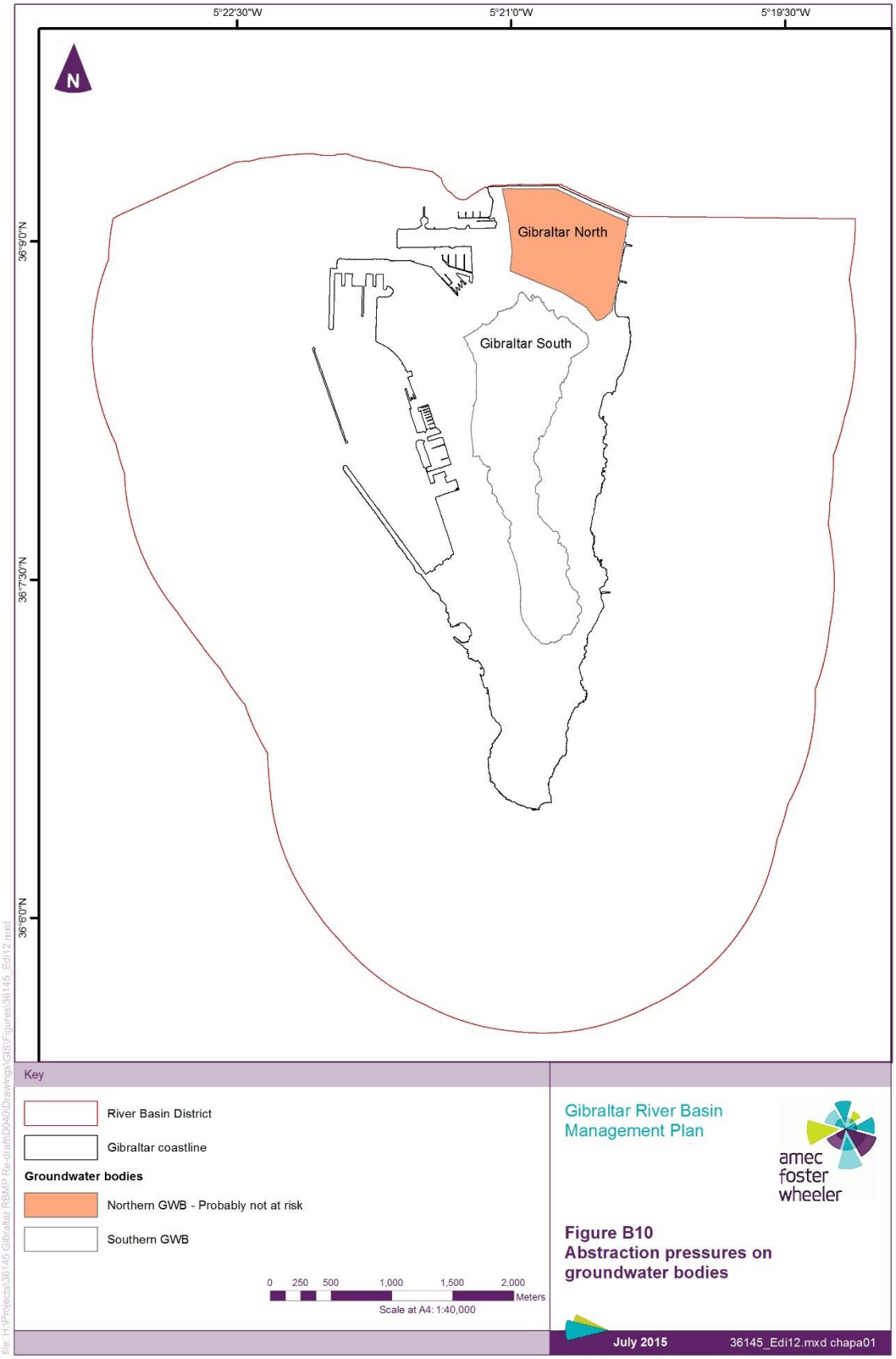












C. Economic Analysis of Water Use

C.1 Introduction

To achieve the environmental objectives of the WFD and promote integrated river basin management, the Directive requires that economic principles (such as the polluter-pays principle), economic approaches and tools (such as cost-effectiveness analysis) and economic instruments (such as water pricing) are applied. This section provides a summary of economic analysis.

Economic analysis of water use includes:

- an overview of the socio-economic importance of water uses in Gibraltar (updated assessment where possible);
- an assessment of the current level of financial cost recovery for water services (updated assessment where possible); and
- economic assessment of programme of measures including cost-effectiveness and cost-benefit analysis of potential measures aimed to mitigate current failures.

C.2 Economic significance of water use

The assessment of economic significance of water use aims to provide an indication of the importance of water to the economy and society as a whole. On one hand, an analysis of how water is used in Gibraltar indicates the importance of water to the economy and wellbeing of people in Gibraltar; on the other hand it potentially points towards significant pressures. The assessment of economic significance of water use helps us understand the nature of water use, as well as informing the development of programme of measures as required by the Water Framework Directive.

Water Use by Different Sectors of the Economy

Provision of water services – water abstraction and storage

In the case of surface water, the majority of abstraction is from the sea, with a proportion of this water directed to desalination plants for treatment to produce potable water. In 2011 to 2013 desalination took place at Waterport and Governor's Cottage with reverse osmosis desalination plants accounting on average for 20% and 80% respectively. No water production using MSF (multi-stage flash distillers) has taken place since 2010[1].

In addition, seawater is also abstracted and distributed without desalination for different uses. Seawater supply from 2008 to 2013 accounted on average for about 60% of total water supply in Gibraltar (potable and seawater supply)[2].

In the case of groundwater, no public groundwater abstraction has been taking place since 2010. In the past, desalinated water was supplemented with freshwater abstracted from groundwater in the north[3].

There is one private groundwater abstraction used by a local laundry with an average annual abstraction of about 720 cubic metres (2011-2013). In comparison to potable water supply over the same time period this constitutes 0.05%.

A large volume of water is stored in Gibraltar making use of reservoirs that were historically used to store the rainwater harvested from the catchments and channels. Today, reservoirs 1 to 4, with a total capacity of

[1] HM Government of Gibraltar, data from AquaGib
[2] HM Government of Gibraltar, data from AquaGib
[3] HM Government of Gibraltar, data from AquaGib

22,727 m^3, are used as service reservoirs to supply the upper town area, the south district, and shipping with fresh water.

The Moorish Castle reservoir (5,682 m^3) is used to supply the lower town area and north/north-east districts. These service reservoirs store the water pumped from the different desalination plants and it is at this stage that the water also receives additional treatment (for example adding chlorine or removing sediment) if required. Reservoirs 5 to 12 are storage reservoirs for the fresh water distribution system, with a combined capacity of 44,318 m^3. Sea water is also stored in a separate set of reservoirs from where it can be distributed.

Provision of water services – wastewater collection and treatment

Water used is collected through the sewage system for which responsibilities are split between AquaGib and the Government (Technical Services). While AquaGib is responsible for pumping sewage, Technical Services manage the combined sewer network and carry out necessary maintenance works. However, no data are recorded by AquaGib or Technical Services on quantities of sewage collected (in pumping stations) and volumes discharged. Only ad-hoc studies on sewage flows and pollution exist in Gibraltar. For billing purposes, AquaGib calculate that all of the potable and sea water supplied is subsequently discharged as sewage, except for potable water supplied to ships.

In the past, wastewater was discharged directly into the sea where it was dispersed by the currents. Currently, a secondary biological wastewater treatment plant is planned for construction in 2017.

In addition to the public sewage network, storm water is either collected and kept separate in some areas of Gibraltar or is collected through a combined wastewater and storm water sewers in other areas, such as Old Town area.

Provision of water services – harbours and flood defence

Gibraltar features a range of engineering activity including harbours and marinas, sea walls and flood defences, where natural water courses or seas are altered to provide or protect human interests.

Water supply and use

In Gibraltar, seawater[4] is abstracted for water supply to domestic, commercial and industrial consumers.

When considering changes in potable water supply from 2009 to 2013, volume of potable water supplied has increased from 1.287 million cubic metres in 2009 to 1.381 million cubic metres in 2013 which is equivalent to 7.3% growth rate[5].

Seawater supply has increased from 1.938 million cubic metres in 2009 to 2.045 million cubic metres in 2013 which is equivalent to 5.5% growth rate. Although, it should be noted that a significant increase has taken place from 2008 to 2009 (from 1.422 million cubic metres in 2008 to 1.938 million cubic metres in 2008). The increase is almost exclusively related to the increased supply from Moorish Castle WS/NF between 2008 and 2009[6].

However, an important trend seems to emerge; volumes of potable and seawater supply have been increasing from 2008 peaking in 2011 followed by a decrease of 2.1% for potable and 5% for seawater volumes (2011-2013). It is noted that volumes of water supply are different from the volumes billed. The difference is associated with distribution losses (i.e. leakage)[7].

Domestic use of potable water by far is the most significant use accounting for more than 62% in 2009. In addition to potable water that is used for cooking and drinking, seawater is used in domestic settings for purposes such as toilet flushing and other sanitary needs where the use of potable water is not essential.

[4] There is only one remaining private groundwater abstraction in Gibraltar for a local laundry
[5] HM Government of Gibraltar, data from AquaGib
[6] HM Government of Gibraltar, data from AquaGib
[7] HM Government of Gibraltar, data from AquaGib

The remaining one third of water is used by commercial sectors (16%) and industrial sectors (<7%) followed by the public sector and hotels. Distribution of potable water use by sectors in 2009 is shown in Figure C.1.

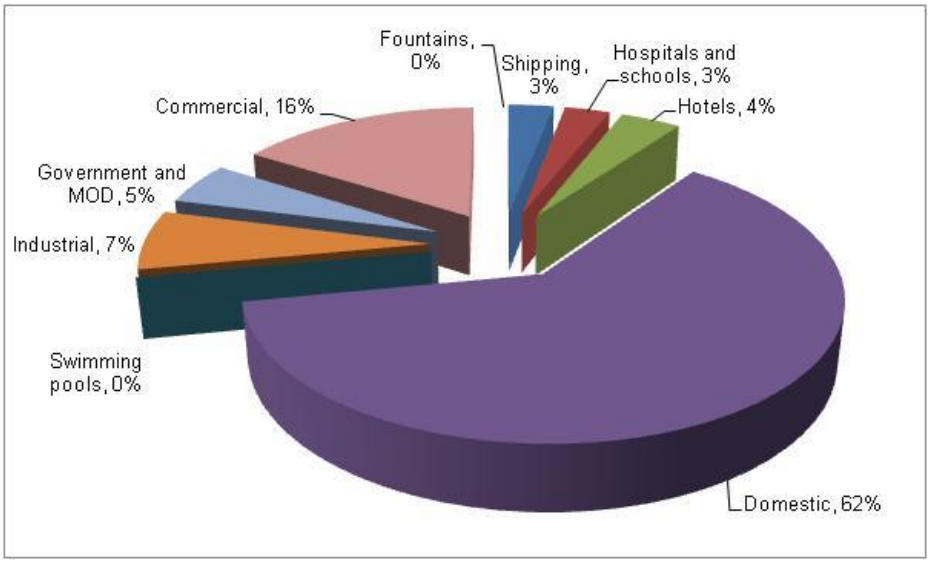


Figure C.1 Volume of potable water used by sector in 2009

Distribution of potable water use by sectors in 2013 is shown in Figure C.2.

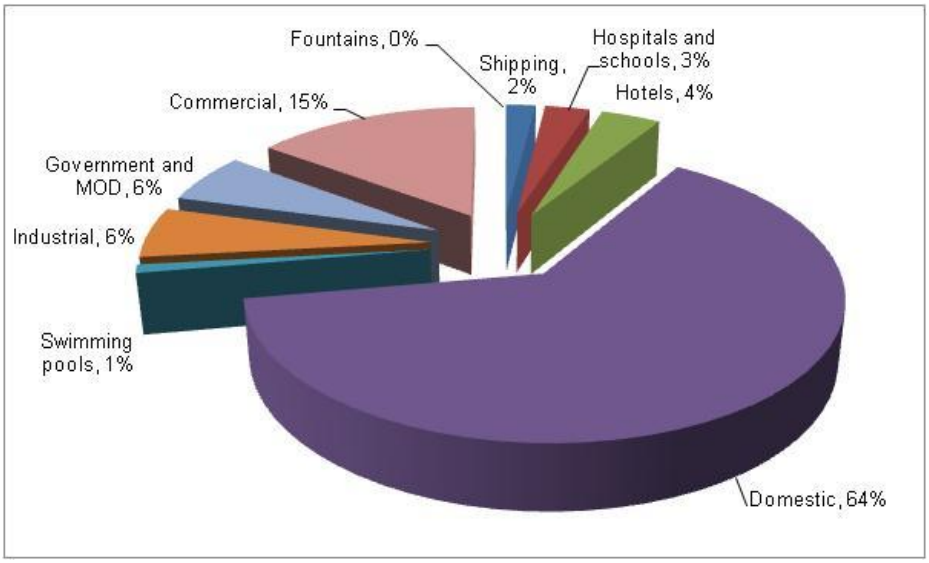


Figure C.2 Volume of potable water used by sector in 2013

Domestic use of potable water has remained the most significant use in Gibraltar accounting for about 64% in 2013, a 2% increase from 2009.

As domestic sector is the largest water user in Gibraltar, demographic changes can have a significant impact on water use. Population of Gibraltar has grown from 23,926 in 1961 to 32,734[8] residents in 2013. Furthermore, 588 people were in direct employment in the MoD in 2013[9].

[8] The number of inhabitants includes families of British servicemen, but do not include the servicemen themselves.
[9] HM Government of Gibraltar (2014). Abstract of Statistics 2013. Statistics Office

The average annual population growth in the time period from 1961 to 2013 was 0.71% per year. The growth rate in the past five years has been much higher reaching 1.47% per year and totalling to 7.3% for the time period from 2008 to 2013[10].

When considering the overall decrease in water supply from 2011 to 2013, it is of particular interest that the number of domestic customers has increased over the same time period by 6.7%. This potentially suggests improved water efficiency and decoupling of demographic growth from water consumption[11].

Converting average potable water supply to litres per person per day for the same period (2011-2013) also shows a relative decrease in per capita potable water supply from 121 litres per person per day in 2011 to 116 litres per person per day in 2013. Average per capita potable water supply over the period equated to 117 litres per person per day. Seawater supply has only decreased from 184 litres in 2011 to 175 litres per person per day in 2013.

Commercial and institutional (including public and governmental organisations) potable water supply account for 24%, with **hotels** accounting for 4% of potable water supply in 2009. In 2013, commercial and institutional sector account for 23%, with **hotels** accounting for 4% of potable water supply.

Finally, **industrial** users and **shipping** accounted for 10% and 8% of potable water supply in 2009 and 2013 respectively.

While the estimates of potable water supply are based on meter readings, the supply of sea water to each sector is estimated according to their use of potable water. Salt water is used directly for firefighting, street cleaning, flushing of sewers, flushing of toilets and other sanitary purposes where the use of potable water is not essential.

The Relative Importance of Different Sectors of the Economy

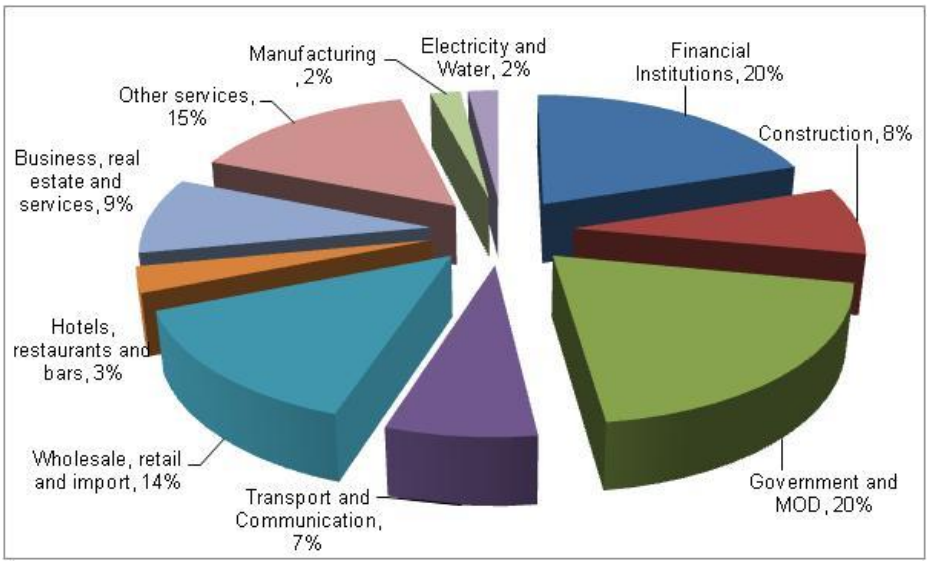
The relative importance of different sectors of the economy is considered below in terms of contribution to the national economy, measured as percentage of gross domestic product (GDP).

GDP measures the value of goods and services produced by labour and property within Gibraltar. It is generally slightly higher than gross national product (GNP), which does not consider the value of goods and services produced by British or Spanish organisations for example, where the money is returned to the other country.

In 2011/2012 GDP was £1,169 million while a provisional estimate for 2012/2013 is £1,280 million. In comparison to 2008/2009 GDP of £896 million this represents a total growth of 42.8% or 10.7% on annual basis. The economy of Gibraltar is dominated by services (including financial), retail and public sector in terms of GDP. In particular, the sectors jointly account for about two thirds of Gibraltar's GDP (Figure C.3).

[10] HM Government of Gibraltar (2014). Abstract of Statistics 2013. Statistics Office
[11] HM Government of Gibraltar (2014). Abstract of Statistics 2013. Statistics Office

Figure C.3 Contribution to GDP by different sectors in 2008/2009



Sectoral contribution to GDP are not estimated on a regular basis in Gibraltar. Rough estimates provided by the Statistics Office suggest that financial services, remote gambling, tourism and shipping are the main contributors to the country's GDP.

The employment in Gibraltar is dominated by services (including financial), retail and public sector accounting for about ¾ of total employment (Figure C.4).

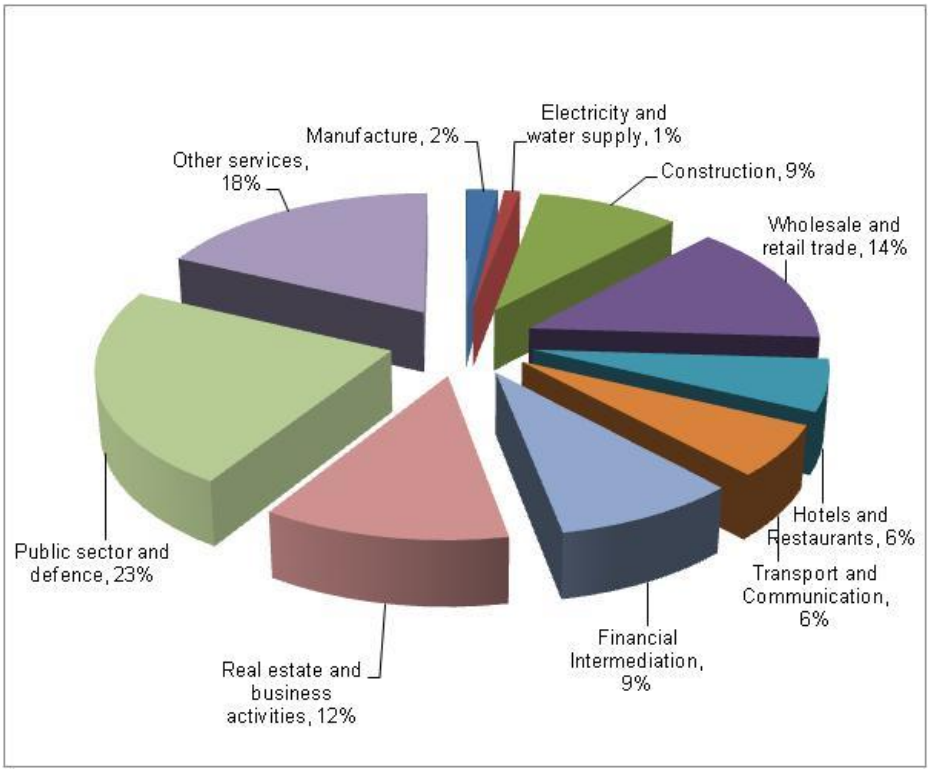


Figure C.4 Contribution to employment by different sectors in 2013

Similarly to the sectoral contribution to GDP, services (including financial), retail and public sector jointly accounted for a significant share of the total employment in 2013 totalling to 77%.

The Gambling and Betting Activities sub-industry within the Other Services Industry recorded 3,276 jobs in 2013, representing 14.3% of total employee jobs.

In comparison to 2008, number of all employees has increased from 20,450 to 22,907 in 2013 constituting a 12% increase. In terms of the sectoral distribution of employment, no significant changes seem to have taken place since 2008. In relative terms, share of construction and real estate within total employment has decreased by 4% and 1% respectively. Employment shares of public sector and other services have increased by 1% and 4%. All other sectors have experienced no change in the relative terms[12].

However, some sectors play a greater role in terms of their contribution to the GDP than in terms of employment. Thus, financial services make a significant contribution to GDP (20%) but does not account for such a large percentage of employment (9% of employment). Conversely, some sectors provide a comparatively higher contribution to the national employment than to GDP; construction sector contribute 8% to GDP while contributing 12.5% to the employment. Also hotels and restaurants contribute more to the employment (5.5%) than to the GDP (3%).

Port activities

Transport and communication sector accounted for 6% of all employment in 2013. Furthermore, shipbuilding alone accounted for 58% of employment in manufacturing sector[13].

Despite the relative reduction in the number of cargo, cruise and other ships since 2008 (by 3.9%), gross tonnage of all vessels has increased by 25.3% from 2008 to 2013. There was a slight increase in the number and volume of bunkers (0.4% and 3.6% respectively) between 2008 and 2011. When considering the number of bunkers serviced from 2008 to 2013, it has increased by 0.4%.

Furthermore, the harbour plays an important role in developing yachting and servicing cruise ships. While the number of cruise ships calls per year has decreased from 222 in 2008 to 173 in 2012 (or by 22%), the number of passengers on board has decreased just by 6% over the same period of time. This has been achieved by a relative increase of the number of passengers that went up from 1.39 thousands on average in 2008 to 1.69 thousands per call in 2012 (representing a 21.1% increase)[14].

Gibraltar port offers a wide choice of yachting facilities including a choice of three marinas and an extensive service and support network. Daily transport connections to the UK and tax-free status of Gibraltar constitute some of the advantages of basing a yacht in Gibraltar.

Ocean Village, Marina Bay and Queensway Quay Marina offer a total of 450 berths with the depths to 4.5 metres capable of taking yachts up to 100 metres in length. The number of yachts on the Registry has increased from 712 in 2008 to 772 in 2011 constituting an increase of 8.4%[15]. However, the number of passengers has decreased from 309 thousands in 2008 to 292 thousands in 2012[16].

Tourism

Tourism is a key sector in Gibraltar's economy, supporting jobs in hotels, restaurants, retail and recreation. In 2013, about 20% of all employees were employed in hotels and restaurants and wholesale and retail trade sectors[17].

Between 1971 and 1982, when the border with Spain opened for pedestrians on a restricted basis, the number of tourists arriving by air and sea had fluctuated but remained at just over 100,000 people per year.

[12] HM HM Government of Gibraltar (2014). Abstract of Statistics 2013. Statistics Office Government of Gibraltar (2014). Abstract of Statistics 2013. Statistics Office
[13] HM Government of Gibraltar (2014). Abstract of Statistics 2013. Statistics Office
[14] Gibraltar Port Authority http://www.gibraltarport.com/statistics; HM Government of Gibraltar (2014). Abstract of Statistics 2013. Statistics Office
[15] Gibraltar Port Authority http://www.gibraltarport.com/statistics
[16] Gibraltar Port Authority http://www.gibraltarport.com/statistics
[17] H.M. Government of Gibraltar (2013). Employment survey report 2013. Statistics Office, October 2013

Between 1982 and 1986, when the border was fully re-opened, numbers grew to just over half a million. However, the growth that has occurred since then has taken the number of visitors to more than eleven million people each year. Visitors arriving by land constitute the absolute majority of all visitors; in 2013, arrivals by land accounted for 96% of 11.1 million visitor arrivals[18]. In 2013, visitors contributed to total tourist expenditures of £207.2 million.

C.3 Cost Recovery of Water Services

Water Services

Article 9 of the WFD requires Member States to ensure the implementation of the principle of cost recovery of water services including financial, environmental and resource costs. The Directive also stipulates that water pricing has to provide an incentive for the rational water use by 2010. Furthermore, the Programme of Measures under the RBMP also needs to include steps planned to ensure the compliance with the principle of cost recovery if relevant.

According to the WFD, water services include water abstraction, impoundment, storage, treatment and distribution as well as collection, treatment and discharge of wastewater. Water services, therefore, cover public and private water supply and wastewater collection and treatment.

The statutory duties for the provision of water lie with the Government of Gibraltar, with the provision of some water services contracted to AquaGib Limited for a thirty year period from 1991. While all assets associated with water supply (including desalination plants and reservoirs) are owned by and are statutorily vested in the Government, the responsibility for maintenance and development of assets lies with AquaGib. In particular, AquaGib holds responsibility for potable water production and distribution, sea (salt) water supply and distribution and sewage pumping while the Government of Gibraltar is responsible for the operation and maintenance of the distribution (sewer network) system. There are no wastewater treatment services in Gibraltar at present. However, an urban wastewater treatment plant is planned to be constructed by 2017.

In addition, the Ministry of Defence (Gibraltar) also provides water and sewage services. The Ministry of Defence produces, stores and distributes potable and sea water supplies to the garrison population in Gibraltar as well as operates its own network of sewers and sewage pumping stations, which all ultimately discharge to the Government of Gibraltar trunk sewer.

In the case of the housing developments, it is the developer who bears the costs of all new water infrastructure, which are then passed on to the users.

Financial Costs of Providing Water Services

Financial Costs of Water Services

The financial costs of water services, including capital and O&M costs, typically are associated with the costs of supply, e.g. water abstraction, treatment and distribution costs.

The capital costs paid by AquaGib have been assumed to represent the bulk of the annual contribution to the overall cost of capital. Other elements of financial costs include depreciation, administrative costs (including to other organisations with a role in the control of water use), and taxes and subsidies.

The financial costs are collected by AquaGib, and presented in the Table C.1 below, the most significant of which are payroll and energy and fuel costs. Overall, the cost of potable water is £0.448 per 100 litres.

[18] H.M. Government of Gibraltar (2014). Tourist survey report 2013. Statistics Office

Table C.1 Financial Costs (Operating and Capital Costs) of AquaGib in 2009/2010

	Potable water	Sea water	Sewage pumping	Totals
Operating costs	£5,625,248	£1,771,739	£989,815	£8,386,802
of which:				
Payroll	£2,736,322	£1,008,634	£573,617	£4,318,573
Energy and fuel costs	£1,370,395	£82,516	£57,978	£1,510,889
Purchases of materials etc.	£699,130	£202,799	£135,141	£1,037,070
Repairs and maintenance costs	£61,103	£27,045	£46,201	£134,349
Other operating costs	£758,298	£450,745	£176,878	£1,385,921
Capital costs	£448,182	£317,692	£125,239	£891,113

No updated information on financial costs of water services could be obtained from AquaGib for the 2009/2010 to 2014/2015 time period.

Administrative costs, which include the costs of billing customers, are met by AquaGib and included in the operating costs.

It should be noted, however, that the AquaGib costs of sewage pumping presented in the table above do not reflect the entirety of the costs associated with sewage collection and discharge since AquaGib does not hold responsibility for the maintenance of the sewer network. Such general maintenance of the distribution (sewer network) system and associated costs are attributed to the Technical Services Department (TSD) of the Gibraltar Government. There is no set budget for the maintenance and the costs change on a yearly basis (e.g. due to more or less maintenance as a result of faults, etc.). No information could be obtained on the financial costs of provisioning water services by the Ministry of Defence (Gibraltar).

No information was obtained on subsidies to water services, and therefore they have not been included in the estimates of cost recovery.

Water Services Charges and Revenues

All potable water use is metered, and charges include a standing monthly fee and a volumetric charge. While the standing charge has been constant since 2005, volumetric charge has increased by than 19% since 2005.

A two-tier volumetric charge for potable water is applied to domestic water users, with one rate for the first 4,500 litres used each month and a higher rate for volumes above this level. The difference between the primary and secondary rate is 2.5 times. The design of such a charge incorporates the incentive properties affecting large water consumers while respecting the basic needs for potable water. According to the information on potable water use in 2013 by different sectors, domestic use accounted for more than 64% of water supply followed by commercial and industrial uses. Industrial and all other users are charged for potable water based on a single volumetric rate.

The trends in potable water charges that aim to cover the costs of potable water production, storage and distribution between 2004 and 2015 are presented in the Table C.2.

Table C.2 Trends in Potable Water Prices

		2004		2005		2008		2010		2015	
		£/ 100 litres	standing charge per month	£/ 100 litres	standing charge per month	£/ 100 litres	standing charge per month	£/ 100 litres	standing charge per month	£/ 100 litres	standing charge per month
A	Shipping	£0.50	0	£0.58	0	£0.667	0	£0.690	0	£0.69	0
B	Hospitals and schools	£0.50	£4.00	£0.58	£5.00	£0.667	£5.00	£0.690	£5.00	£0.69	£5.00
C	Hotels	£0.35	£4.00	£0.41	£5.00	£0.471	£5.00	£0.487	£5.00	£0.49	£5.00
D	Domestic (primary note 1)	£0.18	£1.50	£0.21	£3.00	£0.241	£3.00	£0.249	£3.00	£0.25	£3.00
	Secondary	£0.45		£0.52		£0.598		£0.619		£0.62	
E	Swimming pools	£1.00	£4.00	£1.16	£5.00	£1.334	£5.00	£1.381	£5.00	£1.38	£5.00
F	Industrial	£0.40	£4.00	£0.46	£6.00	£0.529	£6.00	£0.548	£6.00	£0.55	£6.00
G	Government and MoD	£0.50	£4.00	£0.58	£5.00	£0.667	£5.00	£0.690	£5.00	£0.69	£5.00
H	Commercial	£0.40	£4.00	£0.46	£6.00	£0.529	£6.00	£0.548	£6.00	£0.55	£6.00
I	Fountain	n/a	n/a	£0.145	0	£0.166	0	£0.172	0	Not provided	Not provided

Note 1: Primary rate for the first 4,500 litres per calendar month

AquaGib bills all consumers of potable water and collects and retains the revenues from the application of the potable water tariffs. No data on revenues were provided by AquaGib for the years 2008-2014 in addition to the 2004/2005 data presented in the characterization report. However, information on billed potable water was obtained from publicly available data (Table C.3).

Table C.3 Revenues

	2004/2005				2014
	Potable water	Sea water	Sewage pumping	Totals	Totals
Revenues	**£5,112,026**	**£1,903,000**	**£905,000**	**£7,920,026**	N/A
of which:					
Revenues (potable water)	£5,102,026			**£5,102,026**	**£6,661,108**[19]
Revenues (salt water)		£1,903,000		**£1,903,000**	N/A
Revenues (sewage pumping)			£875,000	**£875,000**	N/A
Other revenues	£10,000		£30,000	**£40,000**	N/A

Revenues from potable water seem to have increased by 31% in the time period from 2005 to 2014. However, it should be noted that the volumes of water billed have increased by 14% over the same period of

[19] Source: Government of Gibraltar: https://www.gibraltar.gov.gi/new/statistics-topic-area-2015

time and water charges have increased by 19%. In the absence of data on revenues from provision of water services, the levels of cost recovery per different sectors were estimated using 2014/2015 year charges (please refer to the next sections).

The costs associated with seawater and sewage pumping services that AquaGib provides, on the other hand, are recovered through separate fees paid by the Government (that come from a specific vote provided by Government) (see the Table C.4).

Table C.4 Payments to AquaGib by the Government of Gibraltar for sewage pumping services

Year	Total Costs (Sewage pumping)	Total Costs (Seawater pumping, storage and distribution)
2003	£876,931	
2004	£917,621	
2005	£973,899	
2006	£1,114,062	
2007	£1,217,582	
2008	£1,257,846	
2009	£1,456,619	
2010	£1,530,681	
2011		~£1,700,000

No information could be obtained on the yearly ad-hoc costs of operation and maintenance of the distribution (sewer network) system by the Government or on the costs and revenue sources of provisioning water services by the Ministry of Defence (Gibraltar).

Cost Recovery by Water Service

The lack of the data on the water company's financial costs and revenues from provision of different water services since 2004/2005 precludes the update of cost recovery ratio calculations. In 2004, the calculated cost recovery ratio for potable water supply was 107%, the lowest in comparison to sea water and sewage pumping.

The AquaGib costs of sewage and sea water pumping are covered through the payments from the Government. In 2004 the cost recovery ratio for sewage pumping was 142% and 139% for sea water pumping.

The calculated overall cost recovery ratio was 118% and with sewage pumping featuring the highest cost-recovery ratio (142%).

In addition to the services provided by AquaGib, the Government of Gibraltar incurs financial costs of operating and maintaining the distribution (sewer network) systems which are covered from the budget.

Cost Recovery by Water User

Each water user pays a standing charge and a volumetric charge (based on the quantity of potable water with which they are supplied) which constitute a mechanism for the cost recovery, i.e. the charges comprise the revenues of the water supplier.

In accordance to the WFD all water users need to provide "an adequate" contribution to the costs of water services including financial and environmental and resource costs. Table C.5 below provides a summary on the financial costs and assesses these on a 'per cubic metre of water supplied' basis.

Table C.5 Financial Costs and Costs per Cubic Metre, 2009/2010[20]

Year	Potable water	Sea water	Sewage pumping	Totals
Operating costs	£5,625,248	£1,771,739	£989,815	£8,386,802
Capital costs	£448,182	£317,692	£125,239	£891,113
Volume of water supplied m^3	1,356,641	1,761,388		
Costs per cubic metre	£4.48	£1.19		

This indicates that the average cost of supplying potable water is the highest per cubic metre, which would fit with expectations given the high costs of desalinating the water. Costs for supplying sea water are lower, as these relate only to abstraction and maintenance of the distribution system. Costs for sewage pumping per cubic metre are not assessed as there are no new data on sewage pumping volumes in 2009/2010.

The volumetric charges imposed on each user group (2014/2015) are then compared to the average costs per cubic metre. The average cost of production is an appropriate estimate of the costs of supply to all sectors, as the abstraction and treatment requirements do not differ by sector (Table C.6).

Table C.6 Volumetric Charges and Level of Cost Recovery by Sector for potable water, 2014/2015

		Volumetric charge (per m^3)	Above/ below level required for cost recovery
A	Shipping	£6.9	Above
B	Hospitals and schools	£6.9	Above
C	Hotels	£4.9	Above
D	Domestic	£2.5	Below
		£6.2	Above
E	Swimming pools	£13.8	Above
F	Industrial	£5.5	Above
G	Government and MoD	£6.9	Above
H	Commercial	£5.5	Above
I	Fountain	n/a	n/a

According to the information presented above, in the majority of cases, the sector pays more than the average cost of production. Domestic (primary) water use rates are the exception to this.

The WFD requires “an adequate contribution of the different water uses, disaggregated into at least industry, households and agriculture, to the recovery of the costs of water services” by 2010. As demonstrated by the calculations, it is possible to say that while households pay slightly lower than the average cost of production of potable water, industry as a whole does pay more than costs per cubic metre.

In the case of domestic customers, the number of customers on the secondary rate payments constitutes on average about 30% (2008-2013) of the total number of domestic customers billed for potable water (primary and secondary rate payers)[21].

[20] No updated information on financial costs was provided by AquaGib

Recovery of the costs of supply of sea water and collection and discharge of wastewater cannot be calculated by sector as the revenues from different sectors are not known. AquaGib obtains a separate fee for sea water supplies and sewage pumping from the Government with the cost recovery ratios in 2004 being 139% and 142% respectively. Therefore, in aggregate the costs of these services are recovered. However, as AquaGib receives the payment from the Government rather than end users, it is impossible to assess the contribution of different sectors to the recovery of financial costs. Similarly, as the costs of operating and maintaining the distribution (sewer network) systems are covered by the Government directly relative contribution of different sectors to the costs of this service cannot be assessed.

Environmental and Resource Costs of Providing Water Services

In addition to financial costs of water services, the associated environmental and resource costs also need to be covered.

According to the definition used in the UK, environmental costs are defined as residual environmental damage costs after the current mitigation costs. The resource costs, on the other hand, reflect current and future water availability (in terms of quantity and quality). In the context of the WFD both these costs occur only when the status of water bodies is below good.

In Gibraltar, environmental and resource costs are related to the nature (and impact) of water abstraction and supply as well as of wastewater discharge.

Resource costs

Resource costs are typically related to the depletion of water sources; as virtually all of the water supplied is taken from the sea, the impact of the abstraction on the water body is not noticeable. Furthermore, according to information provided by AquaGib, there has been no groundwater abstraction since July 2009, so all water is abstracted and desalinated from the sea. While sea water desalination is likely to have some adverse environmental impacts, in particular associated with additional energy use and carbon emissions, resources costs attributed to water services in Gibraltar are likely to be negligible or none at all.

Environmental costs

On the other hand, different water services in Gibraltar potentially may give raise to some environmental costs.

First of all, there could be some potential adverse environmental effects associated with the discharge of untreated sewage (e.g. nutrients, bacterial loads). In addition to the damage to environment, this could also affect the amenity of bathers swimming around the coast, or cause additional costs of treating potable water as a result of pollution to the salt water. In practice, wastewater is discharged to the sea into an area of high natural dispersion, which would not be acceptable if there were negative environmental impacts. It can be, therefore, expected that the environmental costs associated with wastewater discharge in Gibraltar are negligible. Furthermore, in order to ensure compliance with the Urban Wastewater Directive, a secondary wastewater treatment plant is planned in 2017.

Secondly, adverse environmental impacts could be associated with sea water desalination, including, in particular, costs of carbon emissions and other damage costs associated with additional energy use. It should be noted the forthcoming construction and operation of the UWWTP in Gibraltar will also be associated with embodied and operational carbon emissions.

In particular, sea and brackish water desalination is one of the most carbon intensive water supply options with treatment of seawater claimed to be twice as energy intensive as treatment of brackish water. According to the Environment Agency scientific report on GHG emissions of water supply options (Environment Agency, 2008), carbon emissions associated with desalination (using reverse osmosis and nano-filtration) were 2.2 to 3.4 tonnes of CO_2e per Ml or 2.2 to 3.4 kg of CO_2e per m^3 (for the schemes assessed). Overall, the carbon footprint of seawater desalination was estimated at 2.80 tonnes of CO_2e per Ml (or 2.8 kg of CO_2e per m^3). These estimates, however, include both capital and operational carbon costs of desalination plants. Capital carbon costs cover the carbon embodied in materials, emissions associated with manufacture and

[21] Source: Government of Gibraltar: https://www.gibraltar.gov.gi/new/statistics-topic-area-2015

construction as well as construction energy usage. Operational carbon costs, on the other hand cover the energy involved in operation of the plant based on power supply (electricity conversion factor of 0.48 kgCO_2e per kWh quoted by Defra [Defra, 2013[22]]). It should be noted, however, that in the case of desalination plant, operational carbon emissions constitute a major proportion of total emissions (the split is about 95% Opex and 5% Capex, i.e. Opex emissions were 2.66 kg of CO_2e per m^3).

Using 2.66 kg of CO_2e per m^3 as an indicative figure, the carbon emissions associated with potable water production in Gibraltar in 2013 can be calculated. In particular, in 2013 potable water production was 1,415,737 m^3 resulting in 3,766 tonnes of CO_2e emissions (Table C.7).

The latest valuation of the cost of carbon (Department of Energy and Climate Change, 2009[23]) for non-traded sectors (non EU Emissions Trading Scheme) could be used to assess these emissions in monetary terms. The central estimate for the social costs of CO_2 is £54/t for 2013 (this, however, increases over time).

Table C.7 Estimated annual costs of carbon (2013) for seawater desalination

CO_2 emitted (t) per year	Cost per tonne (£)	Total cost (£)
3,766	54	203,364

Therefore, any measures that result in a reduction of potable water production and supply from seawater desalination would result in energy saving and hence carbon emission reduction. In particular, according to the Climate Change Programme for Gibraltar (2005), an ongoing modernisation programme of all fresh water distribution system will result in leakage reduction. Furthermore, it is noted that the continued use of seawater instead of fresh water (the ratio is about 1.5:1) where it is not essential such as for firefighting is contributing to energy savings. In particular, sea water is used for firefighting and toilet flushing representing a considerable reduction in the requirements for desalination and the consequent CO_2 emissions if potable water were to be used for such purposes.

In addition to the damage associated with carbon emissions, energy use is associated with some further external (damage) costs including, for instance, damage (such as impacts on health, crops, etc.) associated with other air pollutants (NO_x, SO_2, NMVOCs, PM_{10}, NH_3) and other non-environmental social costs for non-fossil electricity-generating technologies. The EEA[24] estimate that the external (damage) costs of costs associated with energy production which are not reflected in electricity prices but which society must bear ranges from 2.2-8.7 pence/kWh on average or 1.1-3.7 Eurocent/kWh (gas) and 1.6-5.1 Eurocent/kWh (gas)[25].

The external costs of electricity production have fallen considerably between 1990 and 2005 in almost all Member States. Since 2005, it is reasonable to assume as electricity prices continue to represent better the social cost of electricity and that the upper range might again fall slightly. In absence of better data, the 2005 range could still be used (inflated to current prices) but it is acknowledged that the high end may be an overestimate. It should be noted, however, that the external cost of electricity also takes into consideration climate change damage costs associated with emissions of CO_2. Therefore, using the range in addition to the carbon cost estimated above would result in a double counting.

[22] Defra (2013). Government GHG Conversion Factors for Company Reporting: Methodology Paper for Emission Factors, July 2013
[23] DECC (2009). Carbon Valuation in UK Policy Appraisal: A Revised Approach, Climate Change Economics, Department of Energy and Climate Change July 2009
[24] EN35 External costs of electricity production http://www.eea.europa.eu/data-and-maps/indicators/en35-external-costs-of-electricity-production-1
[25] These correspond to 1.8-5.9 Eurocent/kWh (2005 prices) on average or 2.5-10 Eurocent/kWh (diesel) and 1.25-4.2 Eurocent/kWh (gas).

D. Current State of Waters

This annex presents the current status of the water bodies in the Gibraltar River Basin District in a series of maps. The monitoring locations are also presented. Annex E presents more detail on the objectives of each of the four water bodies, whilst Annex F lists the protected areas established under other directives and shows their relevant monitoring locations.

D.1 Classification Method

Status classification is a method of reporting on the quality of the environment and can indicate where improvements may be required. The methods used for classification are described in the main report in Section 4.1.

The Directive sets a target of aiming to achieve at least 'good status' in all waters. For surface waters there are two separate classifications for water bodies; ecological and chemical. For a surface water body to be in overall 'good' status both ecological and chemical status must be at least 'good'. Ecological status is recorded on a scale high, good, moderate, poor and bad; chemical status is recorded as good or fail. If a water body is characterised as 'less than good' ecological status it is also reported how certain it is the water body does not meet good status.

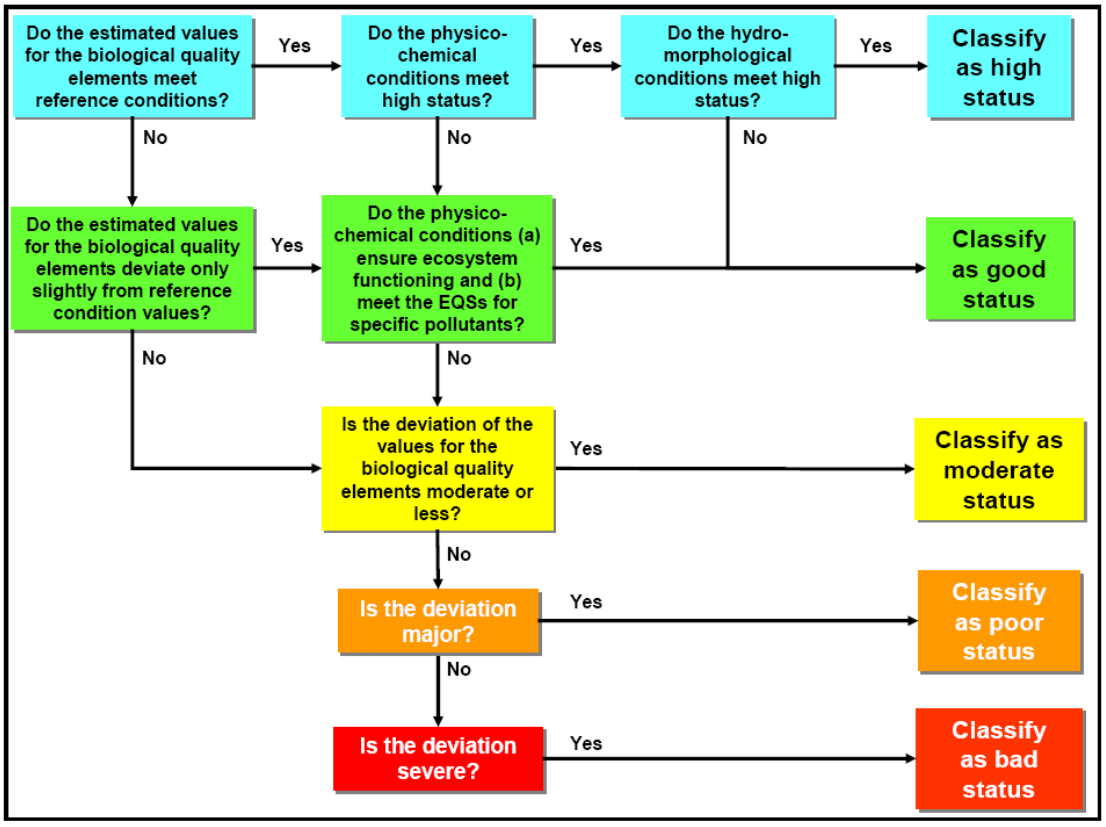
For groundwater, there are also two separate classifications for water bodies; quantitative and chemical. For a groundwater water body to be in overall 'good' status, both quantitative and chemical status must be 'good'. Groundwater status is recorded as good or poor.

Ecological Status (Coastal Waters)

Ecological status is recorded on the scale of high, good, moderate, poor or bad. 'High' indicates largely undisturbed conditions and the other classes represent increasing deviation from this natural condition – from here on described as 'reference condition'. The ecological status classification for the water body, and the confidence in this, is determined by the worst scoring quality element. The ecological classification is summarised in Figure A1 below and comprises:

- the condition of biological element, e.g. benthic invertebrates, phytoplankton;
- concentrations of supporting physico-chemical elements, e.g. oxygen, dissolved inorganic nitrogen; and
- concentrations of specific pollutants, e.g. copper, chromium, zinc, ammonia.

Figure D.1 Decision tree illustrating the criteria determining the different ecological status classes



Chemical Status (Coastal Waters)

The chemical status is assessed by compliance with environmental standards for chemicals that are priority substances and priority hazardous substances and other substances carried over from the Dangerous Substance Directive, which are listed in the Priority Substance Daughter Directive 2008/105/EC. Chemical status is recorded as good or fail. The chemical status classification for the water body, and the certainty in this, is determined by the worst scoring chemical.

Chemical status assessment is required in water bodies only where priority substances and other specific pollutants are known to be discharged in significant quantities. Only the substances detected in the monitoring from January 2012 to July 2014 have been used for the chemical status classification, as presented in Figure 4.6 of the Main Report.

Priority Substances

Priority substances must comply with Environmental Quality Standards in order to achieve good status under the Water Framework Directive. The Directive on Environmental Quality Standards (2008/105/EC), also known as the Priority Substances Directive, lists 33 priority substances (or groups of substances), of which 13 have been identified as priority hazardous substances. This Priority Substances Directive has been amended by Directive 2013/39/EU which lists 45 priority substances of which 21 have been identified as priority hazardous substances. In addition, revised EQS for existing priority substances have been implemented.

The newly identified priority substances and their EQS should be taken into account in the establishment of supplementary monitoring programmes and in preliminary programmes of measures to be submitted by the end of 2018. With the aim of achieving good surface water chemical status the revised EQS for existing priority substances should be met by the end of 2021. EQS for newly identified priority substances should be met by 2027. The amendment Directive takes into account Article 4(4) to (9) of the WFD, which includes provisions for extending the deadline for achieving good surface water chemical status or achieving less stringent environmental objectives on the grounds of disproportionate cost or socio-economic need, provided that no further deterioration occurs in the status of the affected bodies of water.

The classification for priority substances undertaken in this second cycle of River Basin Management Planning has been assessed against both the current EQS and amended EQS. The results from the amended EQS have been used, thus ensuring compliance by 2018. The newly identified priority substances will be assessed in the third cycle of River Basin Management Planning.

Ecological Potential (Heavily Modified Water Body)

For the harbour water body that has been designated as heavily modified (HMWBs see Annex I), the status must be classified according to the ecological potential rather than status. UKTAG have adopted the 'mitigation measures approach' for classifying heavily modified and artificial water bodies.

This approach first assesses whether actions to mitigate the impact of physical modification are in place to the extent that could reasonably be expected. If this mitigation is in place, then the water body may be classified as achieving good or better ecological potential. If this level of mitigation is not in place, then the water body will be classed as moderate or worse ecological potential.

Before an overall ecological potential classification is applied, the second step is for the results of the mitigation measures assessment to be cross-checked with data from biological and physico-chemical assessments.

In principle, there are four potential classes: good, moderate, poor and bad. The ecological quality required for Good Ecological Potential depends on the mitigation that can be put in place without a significant impact on the benefit provided by the water use responsible for the water body's heavily modified physical characteristics or on the wider environment.

Chemical and Quantitative Status (Groundwater)

The achievement of good status in groundwater involves meeting a series of conditions which are defined in the Water Framework Directive (2000/60/EC) and Groundwater Directive (2006/118/EC). In order to assess whether these conditions are being met, a series of tests has been designed for each of the quality elements defining good (chemical and quantitative) groundwater status.

There are five chemical and four quantitative tests. Each test should be applied independently and the results combined to give an overall assessment of groundwater body chemical and quantitative status. The worst case classification from the relevant chemical status tests is reported as the overall chemical status for the groundwater body and the worst case classification of the quantitative tests reported as the overall quantitative status for the groundwater body. The worst result of these two is reported as the overall groundwater body status. Groundwater bodies are at either good or poor status.

For the Gibraltar groundwater bodies, only one test has been used out of the five chemical tests (for General Chemical Assessment) and only the Groundwater Resource Balance has been used out of the four quantitative tests. Further information is provided in Section 4.1 of the main report.

Groundwater Trend Assessment

For groundwater bodies that have been identified as being at risk of failing to meet their environmental objectives for groundwater quality, there is a requirement to identify any significant and sustained upward trends in pollutant concentrations. An environmentally significant trend is one that could lead to a groundwater body failing to meet its environmental objectives before 2027 (the end of two river basin cycles) if measures are not put in place to reverse the trend.

The assessment has been made following the procedure outlined by the UKTAG Groundwater Trend Assessment, Working Paper (UKTAG, 2012). Groundwater quality available for the period 2008 to 2014 (6 years) for the two groundwater bodies in Gibraltar and trend assessment has been carried out for this River Basin Cycle. Only datasets covering a period of over 6 years and with a proportion of less than limits of detection (LOD) results of below 80% were analysed. Due to the variability in sampling frequency, the annual mean was used to assess trends using the non-parametric Mann Kendall (non-seasonal) and Sens tests. The resulting trends were predicted forward to 2027, and identified significant upward trends we visually assessed. Through this final step significant upward trends for cadmium and lead were identified as caused by an increase in the LOD value for these parameters between 2013 and 2014, probably due to a change in laboratory methods, so the results were discounted. Significant upward trends in sodium and

chloride at monitoring point 2 (North Frontier Well) are potentially linked to the dewatering which has taken place in recent years for tunnelling at the airport.

D.2 Monitoring Network

There are three surveillance monitoring sites in the Coastal Waters Body and one located within the harbour (HMWB). Monitoring of physico-chemical parameters is undertaken monthly, while samples for priority substances, marine sediment and phytoplankton samples are taken at quarterly intervals. This programme has been ongoing since July 2009 and Tables D.1 and D.2 below show the elements that are monitored. The indicative locations of the four surveillance sites are presented in Figure D2.

Benthic invertebrate monitoring was undertaken in July and August 2010; no benthic invertebrate monitoring was undertaken during the second cycle of the RBMP. This is in accordance with Annex V (1.3.1) which states that if the body concerned (Coastal Waters Body) reaches good status and there is no evidence that impacts on the water body have changed, then surveillance monitoring will be carried out once every three river basin management plans. Benthic invertebrate monitoring will take place in the third river basin management plan cycle (2021 – 2027).

The Department of the Environment and Climate Change has recently commenced a new biota monitoring programme focusing on fish and bivalve samples. Samples will be analysed for priority substances with environmental quality standards listed for biota as specified under Annex II of Directive 2013/39/EU, as regards priority standards in the field of water policy. The first set of results for biota monitoring will be finalised in late 2015. In addition, the department has also recently started works on the reintroduction of seagrass species within the Coastal Water Body. Apart from creating new habitat, this project will also explore additional options of bioremediation with the use of seagrass. Although this project is still in its early stages, continued monitoring, surveillance and analysis will feed into the monitoring network as well as the third cycle of river basin management planning.

The Northern groundwater body contains four monitoring points and the Southern groundwater body contains one monitoring point. In the 2009 assessment there were three monitoring points in the Southern Groundwater Body, and five in the Northern Groundwater Body but these have been lost from the network due to access problems (Figure D3). The annual mean of bi-monthly to quarterly monitoring data for qualitative status assessment for these monitoring points for the period October 2008 to August 2014 have been used here. The parameters assessed include the WFD Annex 1 and 2 substances; nitrate, individual and total pesticides, arsenic, cadmium, lead, mercury, ammonium, sulphate, trichloroethylene and tetrachloroethylene. Other parameters include: sodium, potassium, chloride, nitrite, magnesium, zinc, tetrachloromethane, bromoform, chloroform, bromodichloromethane, dibromochloromethane and trichloroethene.

For quantitative status, the groundwater body resource test comprises a comparison of abstraction with recharge to the groundwater body to assess if water abstraction is too high. No groundwater is abstracted from the Southern Groundwater Body. Prior to 2009, water was abstracted from the Northern Groundwater Body for potable supply and sanitation, although this operation has now ceased. Abstraction for laundry purposes from the Northern aquifer continues to take place. This abstraction is licensed and does not exceed more than 12,000 litres a day. A small abstraction for the cemetery is also in operation of less than 1,000 litres per day. This information has been used to inform the groundwater body resource test and the quantitative status.

Table D.1 Physico-chemical and specific pollutant monthly monitoring parameters

Physico-chemical parameters	
Depth	Total dissolved solids
Temperature	Total suspended solids
Nutrient status - Total N, Total P, NO_3^-, NO_2^-, NH_4^+, PO_4^{3-}	Dissolved Oxygen (DO)
Salinity	Transparency
Conductivity	Chlorophyll-a
Specific Pollutants	
Ammonia	Copper
Chromium ***	Zinc

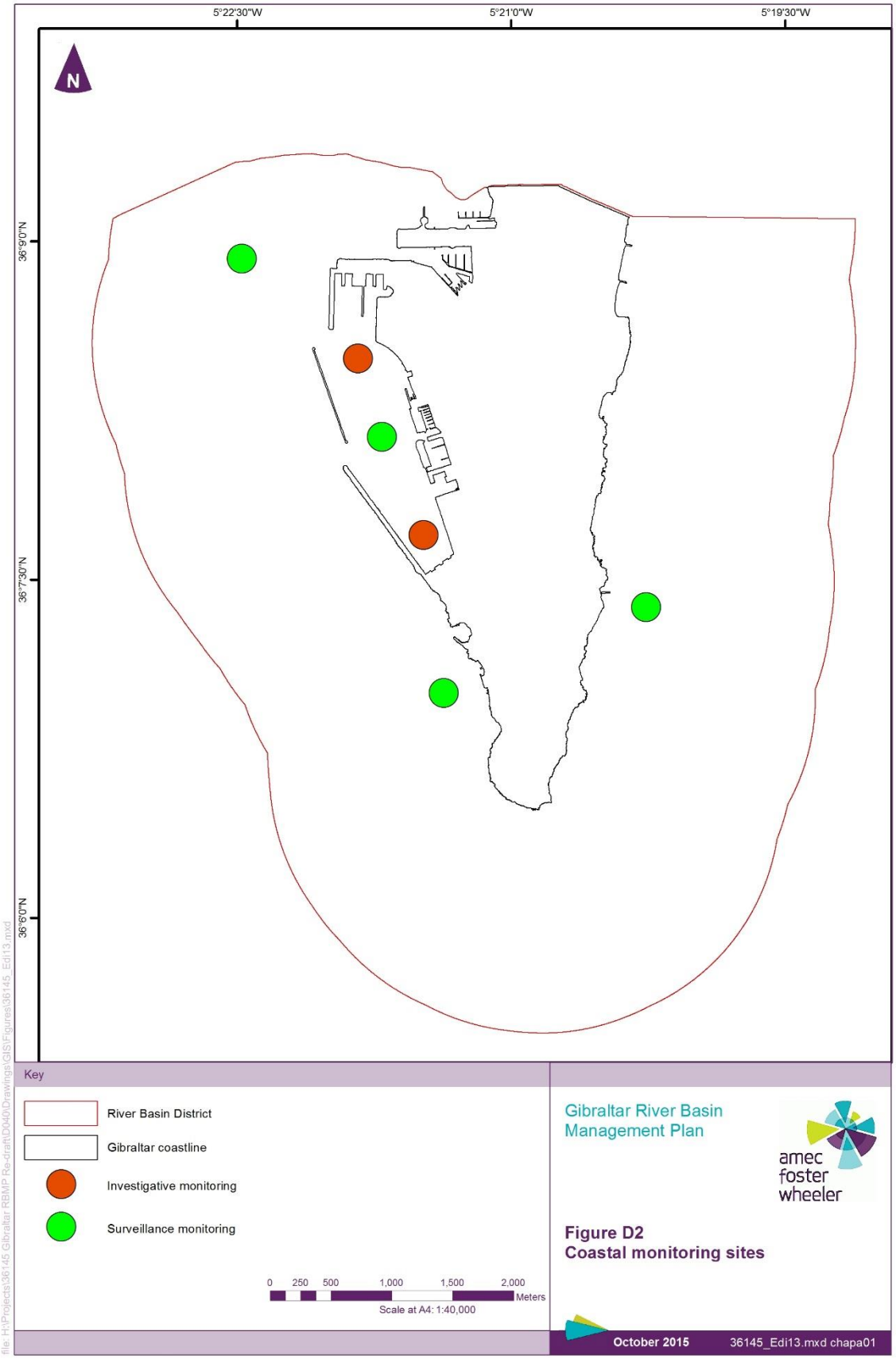
Note that for substances marked *** the analytical detection limit is greater than the environmental quality standard (including under Priority Substances Directive amendment 2013/39EU.

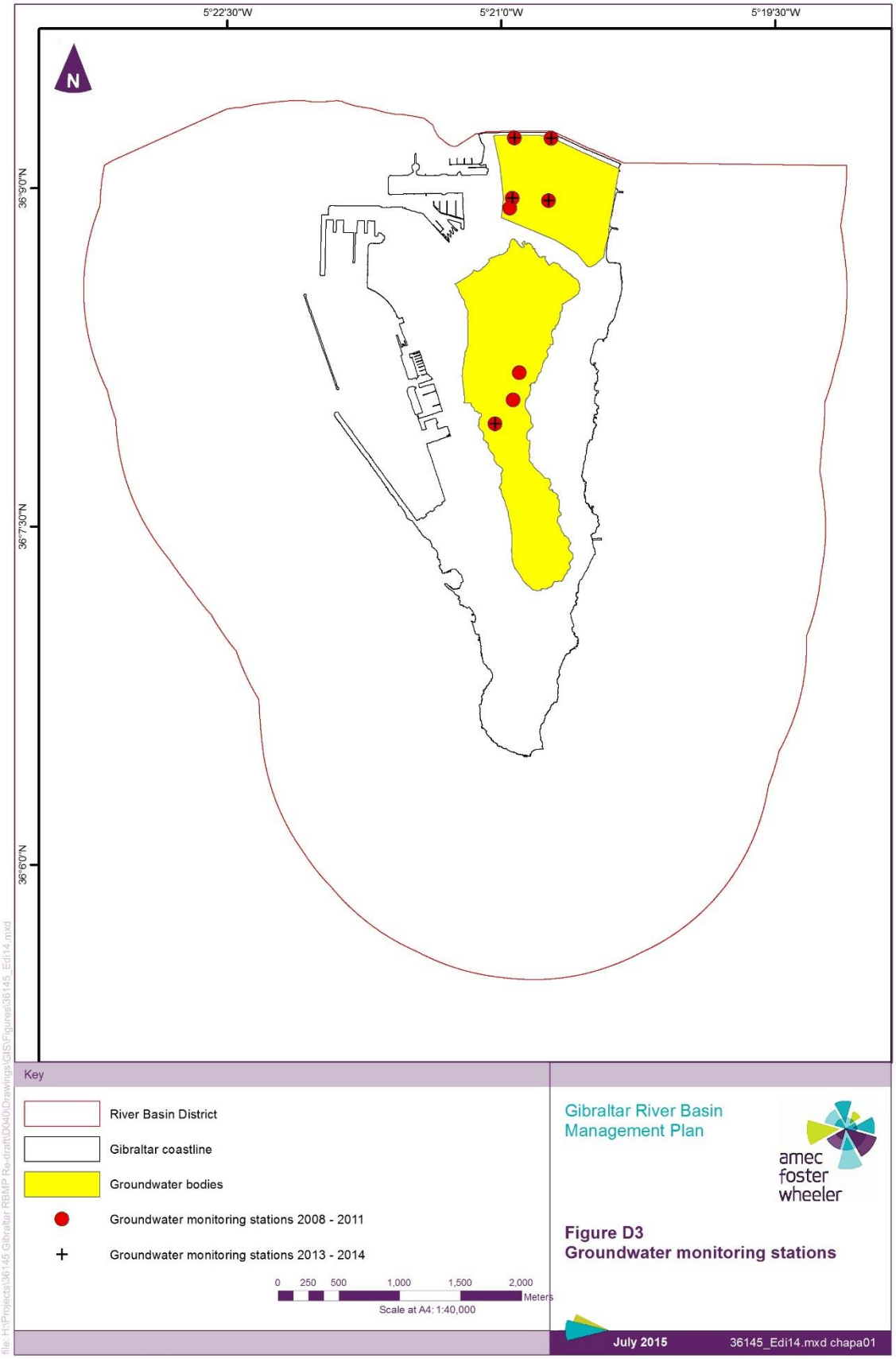
Table D.2 Priority substances quarterly monitoring parameters

Category	Substance	Category	Substance
Priority substances			
Pesticides	Alachlor	Chlorinated hydrocarbons	1,2-Dichloroethane
	Atrazine		Dichloromethane
	Chlorfenvinphos		Hexachlorobenzene
	Chlorpyrifos-ethyl		Pentachlorobenzene ***
	Chlorpyrifos-methyl		Trichlorobenzenes (1,2,4-Trichlorobenzene)
	Endosulfan (alpha-endosulfan) ***		Trichloromethane (Chloroform)
	Hexachlorobutadiene	TBT	Tributyltin compounds (tributyltin-cation) ***
	Hexachlorocyclohexane (alpha, beta, delta, epsilon, gamma) ***	Other hydrocarbons	C_{10-13}-chloroalkanes
	(gamma-isomer, Lindane)		Benzene
	Simazine	BDEs	Brominated diphenylethers
	Trifluralin	DEHP	Di(2-ethylhexyl)phthalate
Metals	Cadmium and its compounds	Urons	Diuron
	Lead and its compounds		Isoproturon
	Mercury and its compounds	Phenols	Nonylphenols (4-(para)-nonylphenol)
	Nickel and its compounds		Octylphenols (para-tert-octylphenol) ***
Polynuclear(1) aromatic hydrocarbons	Anthracene		Pentachlorophenol
	Fluoranthene***		
	Naphthalene		
	(Benzo(a)pyrene)***		
	(Benzo(b)fluoranthene) ***		
	(Benzo(g,h,i)perylene)		
	(Benzo(k)fluoranthene)***		
	(Indeno(1,2,3-cd)pyrene) ***		

Note that for substances marked *** the analytical detection limit is greater than the environmental quality standard (including under Priority Substances Directive amendment 2013/39EU.

(1) Under Priority Substances Directive amendment 2013/39EU, for PAHs benzo(a)pyrene can be considered as a marker for the other PAHs, therefore only benzo(a)pyrene needs to be monitored for the corresponding AA-EQS.





D.3 Coastal Water Types and Reference Conditions

In the first cycle of the River Basin Management Process, the coastal water type (eco-region) and reference conditions were set for Gibraltar's coastal waters. The eco-region assigned to Gibraltar's coastal waters is the Mediterranean Sea eco-region. This was determined through using System A (Annex II of the Directive) and based on mean annual salinity and mean depth using the following criteria:

Mean Annual Salinity

- <0.5 - freshwater
- 0.5 to <5 - oligohaline
- 5 to 18 - mesohaline
- 18 to < 30 - polyhaline
- 30 to <40 - euhaline

Mean Depth

- Shallow waters <30m
- Intermediate (30 to 200 m)
- Deep >200m

Salinity levels within Gibraltar coastal waters generally lie within the euhaline range. Depths within one nautical mile of the coast are quite variable ranging from less than 50 metres to over 200 metres (intermediate). Therefore, the coastal water type is considered as Mediterranean euhaline intermediate.

Reference conditions (equivalent to high status) were set as those conditions applicable to the adjacent Spanish coast. Although Gibraltar's coastal waters demonstrate characteristics of the Mediterranean Sea eco-region (e.g. relicts of seagrass meadows), the unique hydrological regime within the Bay of Gibraltar, where Mediterranean waters are influenced by Atlantic waters, results in distinctive mixtures of typically African, Mediterranean and Atlantic species to co-exist (Smith and Fa, 2004). These conditions apply to the adjacent Spanish coast and biological reference conditions have also been harmonised with those being applied more widely in the area.

D.4 Confidence and Precision of Monitoring

Coastal Waters

Surveillance monitoring has taken place over three years (2012 to 2015) and data has been processed for minimum one year, as required by Annex V of the WFD, allowing status to be assessed with a high degree of certainty for most parameters.

Even if some results are recorded as less than LoD, measured values exceeding the LoD may be high enough for it to be certain that the overall mean will exceed the annual average (long-term standard) but, in other cases, this may not be the case, as the range of possible mean values may extend from less than to greater than the EQS.

For some priority substances, developments in analytical techniques have not kept pace with the environmental quality standards (EQS) being set and limits of detection (LoD) remain higher than the standards. This is the case for the following parameters: endosulfan, hexachlorohexane, sum benzo(g,h,i)perylene & indeno(1,2,3-cd)pyrene, pentachlorobenzene, octylphenols and tributyltin (TBT).

For all parameters except for those listed above, where all results were recorded as less than the LoD; the parameters can be recorded as having achieved good status (pass) with high confidence.

For parameters listed above with LoD exceeding the EQS, where all results are recorded as less than the LoD, the status has been reported as good but uncertain. When concentrations exceeding the detection limits are recorded, as for TBT, failure to comply is certain if any of these levels exceed the maximum

allowable concentration (short-term EQS). Taking into account the final year's monitoring data (June 2013 to July 2014), one single reading for TBT in the Coastal Waters exceeded the maximum allowable concentration. This reading was obtained from the sampling location directly outside of the HMWB (Gibraltar Harbour) one day after dredging operations had taken place, while other sampling locations did not show elevated levels. The HMWB fails for TBT, and investigative monitoring has shown that the high levels of TBT are from historical contamination in sediment, therefore it is likely that the failure at this single sampling location was due to short term local factors and is not representative of the water body as a whole. All other results for the Coastal Waters Body were less than the LoD (0.0005 µg/l) but this is still higher than the EQS (0.0002 µg/l). On this basis the status of the Gibraltar Coastal Waters Body has been recorded as good (uncertain).

Chromium levels in the Coastal Waters Body have been recorded as good (uncertain). This results from a single, high reading that causes the annual average to fail but not the 95 percentile. However, the annual average fail is uncertain, as lab analysis was for total chromium, and the WFD EQS is for chromium VI. Therefore, it is difficult to determine with certainty what percentage of the high reading is attributed to chromium VI. The most likely cause of the high chromium reading is from a paint particle entering the water body during maintenance works from one of the many vessels that transit through the Gibraltar Straits.

Groundwater

The confidence in status assessment for groundwater bodies in the UK is linked to the number of monitoring points in the GWB. In the UK, any assessment of general chemical quality based on 6 or fewer monitoring points was made with low confidence (or low certainty), although, the UKTAG guidance on monitoring network design does not stipulate a lower limit on the number of monitoring points in a GWB (UKTAG, 2005).

It is noted that neither of the Gibraltar GWBs have more than 6 monitoring points, but that the water bodies are relatively small, i.e. less than 1 hectare in size, compared to UK groundwater bodies. Given the small footprint of the groundwater bodies and considering that the Northern Groundwater Body contains four monitoring points the chemical assessment result for this body is given with high confidence. As the Southern Groundwater Body contains only one monitoring point the status assessment is given with low confidence.

Following UKTAG Guidance (UKTAG, 2012) for groundwater trend assessment monitoring point datasets for individual determinands which comprise more than 80% LoD values are excluded from the analysis. Where datasets contained less than 80% LoD values, half the LoD value was used in the aggregation of data for trend assessment. A visual assessment of trend analysis plots was also made to sense check the outcomes, for example through inclusion of LoD data in analysis where detection limits have changed through the period of monitoring.

D.5 Water Body Tables Explained

Section D.6 contains the water body classification results. This is composed of several elements, as outlined above, and results are summarised in three tables covering coastal waters, HMWB and groundwater. The entries in the tables are explained in Tables D.3 and D.4. The tables also contain objectives for each water body; however, the rationale behind each objective is described in greater detail in Annex E.

Table D.3 Surface water tables explained

Waterbody Category:	Type of waterbody (e.g. coastal)	**Surveillance site:**	Monitoring locations (see map A6)
Waterbody ID and Name:	Unique code of the waterbody submitted to the EU, and specific water body name		
Current Overall Status:	The overall classification status for the water body, based on one year of monitoring data (2013 to 2014)		
Status Objective (Overall):	The overall status objective for the water body		
Status Objective(s):	The ecological status (or ecological potential for the Heavily Modified water body)		
Justification if overall objective is not good status by 2015:	The reason why an alternative status has been set		
Protected Area designation:	States whether part of the water body contains a Protected Area Designation (objectives for protected areas are presented in Annex D)		
Hydro-morphological designation:	States is the water body is Heavily Modified / Not Designated		
Reason for designation (HMWB only)	States reason for heavily modified designation, based on Annex I		
Ecological Status			
Current Status (and confidence in this assessment)	Presents current ecological status, based on methodology set out in Section 3.1.1 of the Main Report. The levels of certainty in the classification are described in Section 1.3 of Annex A)		
Biological Elements			
Element	**Current status (and confidence)**	**Predicted Status by 2015**	**Justification for not achieving good status by 2015:**
Provides a breakdown of the biological elements available and used for the classification, with the status objectives for each element.			
Supporting Elements			
Element	**Current status (and confidence)**	**Predicted Status by 2015**	**Justification for not achieving good status by 2015:**
Provides a breakdown of the specific pollutants and physio-chemical elements available and used for the classification, with the status objectives for each element.			
Only present for Heavily Modified Water Body			
Ecological Potential Assessment			
Current Potential	**Predicted Potential by 2015**		**Justification for not achieving good status by 2015:**
Ecological potential and prediction of when good potential will be achieved			
Mitigation measures that have defined ecological potential			
Mitigation Measure			*Status*
Lists mitigation measures needed for HMWB to meet Good Ecological Potential. The status of each measure is listed as either being **in place** or **not in place**. Measures listed as not being in place are included in Annex C as being required to meet the status objectives. Measures that are not applicable are not listed. Such measures have been assessed in Annex I, but have been ruled out for having either a significant impact on the use of the HMWB, or a significant environmental impact (or both).			
Chemical Status			
Current Status (and confidence in this assessment)	Presents current chemical status, based on methodology set out in Section 3.1.1 of the Main Report. The levels of certainty in the classification are described in Section 1.3 of Annex A)		
Chemical elements			
Element	**Current status (and confidence)**	**Predicted Status by 2015**	**Justification for not achieving good status by 2015:**
Provides a breakdown of the priority substances available and used for the classification, with the status objectives for each element. If required a justification is provided for not achieving good status by 2015.			

Table D.4 Groundwater tables explained

Waterbody Category:	Type of water body (i.e. groundwater)		
Waterbody ID and Name:	Unique code of the waterbody submitted to the EU, and specific water body name		
Current Overall Status:	The overall classification status for the water body		
Status Objective (Overall):	The overall status objective for the water body		
Status Objective(s):	The chemical status for the groundwater body		
Justification if overall objective is not good status by 2015:	The reason why an alternative status has been set		
Protected Area Designation:	States whether part of the water body contains a Protected Area Designation (objectives for protected areas are presented in Annex D)		
Quantitative Status			
Current Status (and confidence in this assessment)	Presents current quantitative status, based on methodology set out in Section 3.1.3 of the Main Report. The levels of confidence in the classification are described in Section 1.3 of Annex A)		
Quantitative Elements			
Element	**Current status (and confidence)**	**Predicted Status by 2015**	**Justification for not achieving good status by 2015:**
Provides a breakdown of the quantitative elements available and used for the classification, with the status objectives for each element. For Gibraltar groundwater bodies, only the groundwater resource balance is used (see Section 3.1.3 of Main Report)			
Chemical Status			
Current Status (and confidence in this assessment)	Presents current quantitative status, based on methodology set out in Section 3.1.3 of the Main Report. The levels of confidence in the classification are described in Section 1.3 of Annex A)		
Chemical elements			
Element	**Current status (and confidence)**	**Predicted Status by 2015**	**Justification for not achieving good status by 2015:**
Provides a breakdown of the chemical elements available and used for the classification, with the status objectives for each element. For Gibraltar groundwater bodies, only the general chemical assessment (GCA) is used (see Section 3.1.3 of Main Report)			
Pressures and Risks			
Pressures	**Risk Category**	**Element against which assessed**	
Provides a summary of pressures facing water body that could lead to status not being good and risks for each element			

D.6 Classification Results

In the Gibraltar River Basin District, for the second cycle of River Basin Management Planning, Table D.5 outlines the overall results of water body status classification. The mapped outputs of the classification results are shown in Figures D.4 to D.7.

Table D.5 Results of water body status classification for both the first and second cycle of RBMP

Water body name	Water body ID	Type	Previous overall status	Status 1	Status 2	Current overall status
Coastal Waters Body	UKGIB6903	Coastal	Good Status	Good Ecological Status	Good Chemical Status	Good Status
Gibraltar Harbour & Marina Bay	UKGIB6901	Heavily Modified (Coastal)	Moderate Potential	Good Ecological Potential	Fail Chemical Status	Moderate Potential
Gibraltar North	GI4172	Groundwater	Good Status	Good Quantitative	Good Chemical Status	Good Status
Gibraltar South	GI4171	Groundwater	Good Status	Good Quantitative	Good Chemical Status	Good Status

The mitigation measures approach has been used to identify the HMWB as being at Good Ecological Potential. However, as the certainty of failure of chemical status is high in the harbour area, the physico-chemical elements must be considered in the overall potential, which leads to a Moderate Potential classification.

The confidence in status assessment for groundwater bodies in the UK is linked to the number of monitoring points in the groundwater body (GWB). In the UK, any assessment of general chemical quality based on six or fewer monitoring points was made with low confidence (or low certainty), although, the UKTAG guidance on monitoring network design does not stipulate a lower limit on the number of monitoring points in a GWB (UKTAG, 2005).

Neither of the Gibraltar GWBs has more than six monitoring points, but the water bodies are relatively small, i.e. less than one hectare in size, compared to mainly much larger UK groundwater bodies. Given the small footprint of the groundwater bodies and considering that the Northern Groundwater Body contains four monitoring points the chemical assessment result for this body is given with high confidence. As the Southern Groundwater Body contains only one monitoring point the status assessment is given with low confidence.

Groundwater Quantitative Confidence in Status Assessment

Groundwater quantitative assessment is good with high confidence, due to the very small abstraction compared to recharge for the Northern Groundwater Body. There is no abstraction from the Southern Groundwater Body, and therefore this test was not carried out here.

Groundwater Qualitative Confidence in Status Assessment

There are three exceedances of the chloride threshold value (188 mg/l based on UK natural background in lieu of Gibraltar based data) at monitoring points located within both groundwater bodies. The Southern Groundwater Body is known to be naturally brackish and with no abstraction to bring about anthropogenic saline intrusion, the status assessment for this groundwater body for the general chemical test is good, but with low confidence due to the low number of monitoring points. In the Northern Groundwater Body, only two monitoring points exceed the chloride threshold value. Between 2011 – 2012, this freshwater aquifer was locally dewatered to enable the construction of a tunnel beneath the airport runway, and this may have led to localised saline intrusion from beneath the freshwater lens close to the monitoring point 5 (Beside Runway). It is likely that once the dewatering is completed chloride levels should reduce with freshwater replenishment

of the aquifer from rainfall. The chloride threshold value exceedance at monitoring point 2 (North Frontier Well) appear skewed by one single very high result.

There is also an exceedance of the total pesticides threshold value at monitoring point 5 (Beside Runway) for the insecticide DDT (pp) based on data for the period 2013 to 2014.

For the general chemical assessment these exceedances of threshold values should be used to assess the extent impact over the whole groundwater body. For both chloride and DDT(pp) the extent of the impact on groundwater chemical quality is constrained to the eastern edge of the Northern Groundwater Body, and is unlikely to cover more than 20% of the body. Therefore the status of this groundwater body is set to good, but with low confidence.

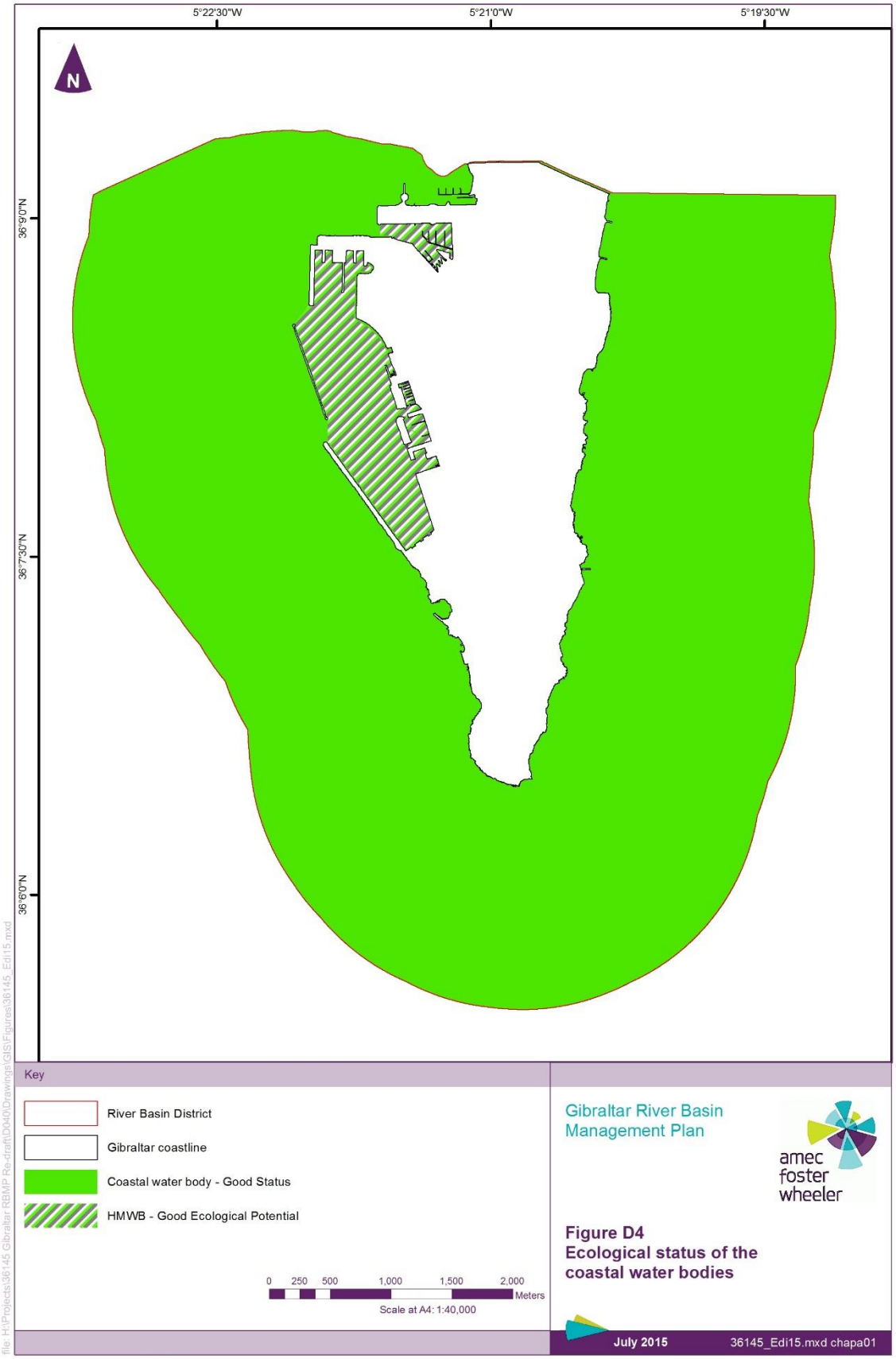
Groundwater Trend Assessment

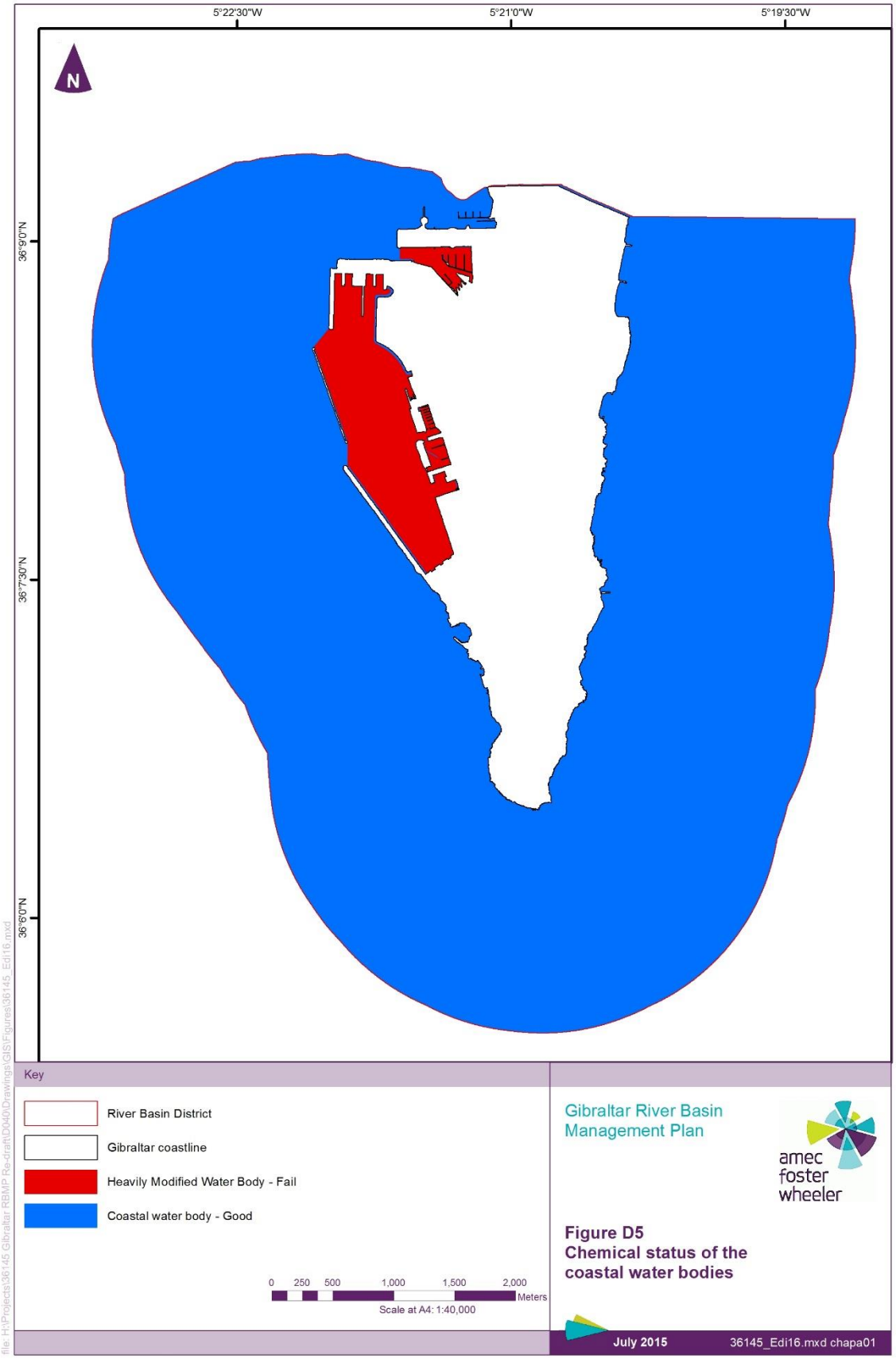
The assessment of trends in groundwater quality for the Northern Groundwater Body has identified increasing significant trends in cadmium, lead, zinc, sodium and chloride at the monitoring point 2 (Northern Frontier Well) and 4 (Four Corners Well). On review of the cadmium and lead data, the upward trend is seen to be caused by an increase in the limit of detection for the method of analysis of these parameters in 2013 to 2014. This is probably linked to a change in analytical methods.

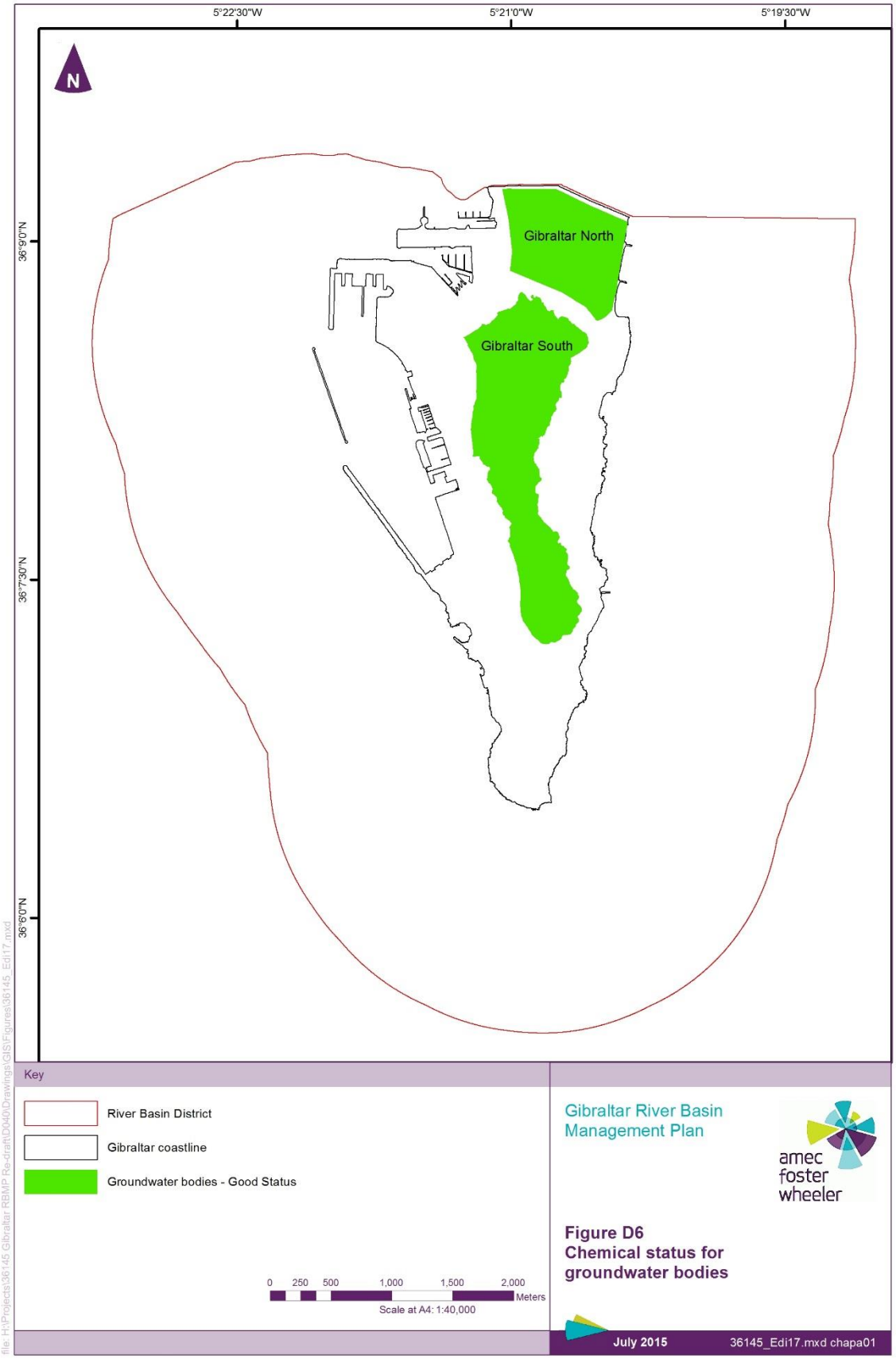
Significant upward trends have been identified for zinc at monitoring points 2 and 4 in the Northern Groundwater Body using both Sens Test and Mann Kendall test results. Predicted values to 2027 based on the identified trends at both monitoring points, suggest exceedance of the threshold value for zinc (3.75 mg/l). Current concentrations are well below this threshold value.

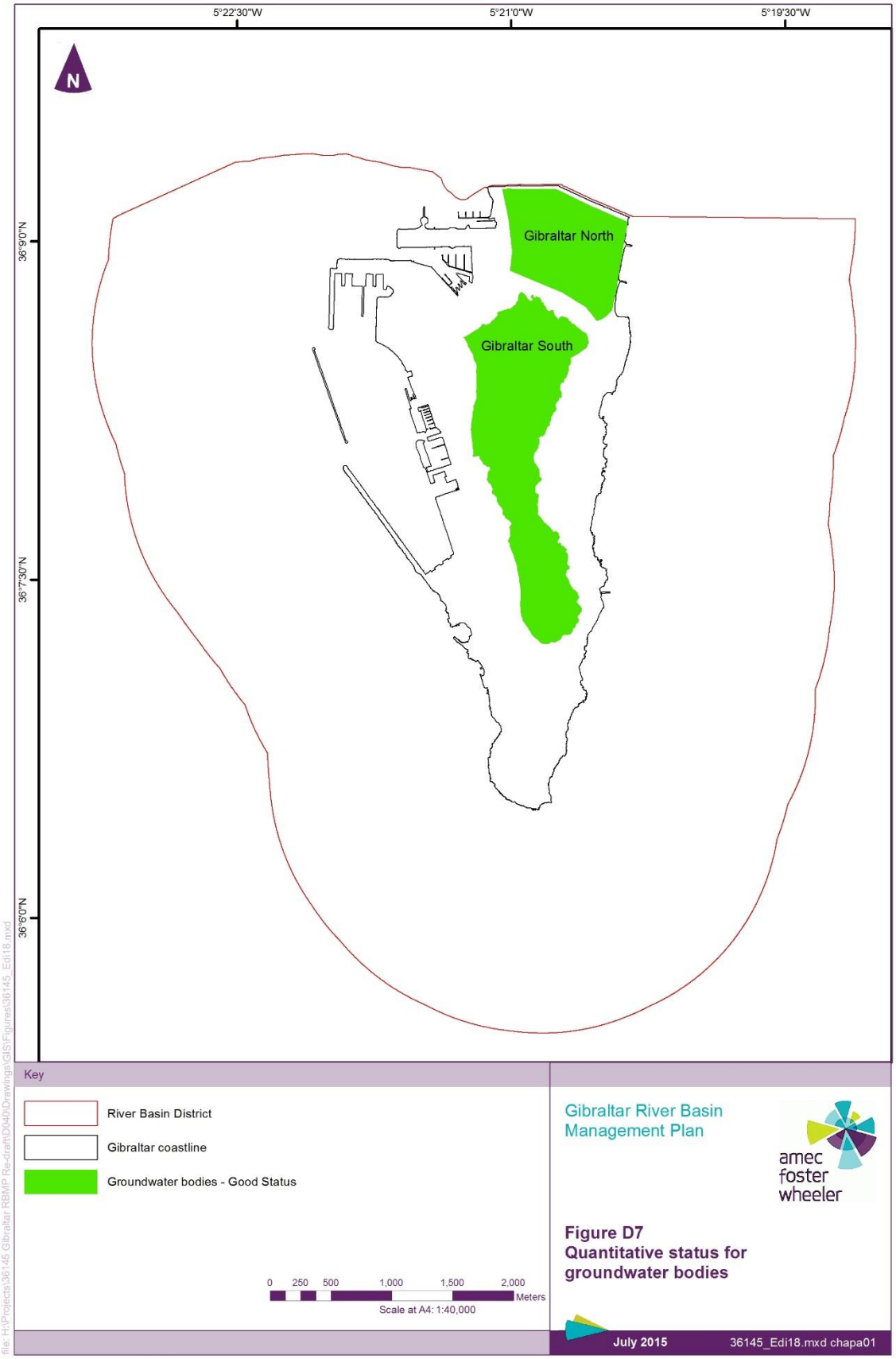
At monitoring point 2 in the Northern Groundwater Body, a significant upward trend has been identified for chloride and sodium, however visual assessment suggests that the trend is likely to be temporal, as concentrations have fallen significantly in 2013 to 2014, following a peak in 2010 to 2012. As previously noted, dewatering around tunnelling work at the airport is likely to have affected the delicate balance in the Northern Groundwater Body sand and gravel aquifer between the fresh water lens and the underlying saline wedge. Cessation of this activity is likely to return chloride and sodium concentrations to background. For this reason, these trends are not considered to be sustained.

In summary, the predicted trend on zinc concentrations at two monitoring points (i.e. covering more than 20% of the body) could lead to failure to achieve status objectives in 2027 for the Northern Groundwater Body under the general quality assessment. Other identified trends are either likely to be temporary or linked to changes in analytical methods, but should still be monitored to confirm this assessment.









Water Body Tables

Tables D.6, D.7 and D.8-9 contain the classification results for the Coastal Waters Body, HMWB, and groundwater body respectively, broken down by each individual characterisation element.

Table D.6 Water body table for Gibraltar Coastal Waters (UKGIB6903)

Waterbody Category:	Coastal	**Surveillance site:**	Sites 1, 2 & 3
Waterbody ID and Name:	UKGIB6903 Gibraltar Coastal Waters		
Current Overall Status:	Good		
Status Objective (Overall):	To maintain Good Status		
Status Objective(s):	To maintain Good Ecological Status		
Justification if overall objective is not good status by 2021:	N/A		
Protected Area Designation:	Southern Waters are a Special Area of Conservation (Habitats Directive). Seven bathing areas designated under the Bathing Waters Directive.		
Hydro-morphological Designation:	Not designated as Heavily Modified		
Ecological Status			
Current Status (and certainty that status is less than good)	Good		
Biological Elements			
Element	**Current status (and certainty that status is less than good)**	**Predicted Status by 2021**	**Justification for not achieving good status by 2021:**
Phytoplankton	Good	Good	
Benthic macro-invertebrates	Good	Good	
Supporting Elements			
Element	**Current status (and certainty that status is less than good)**	**Predicted Status by 2021**	**Justification for not achieving good status by 2021:**
Dissolved Inorganic Nitrogen	High	Good	
Dissolved Oxygen	High	High	
Un-ionised ammonia	Good	Good	
Chromium	Good (uncertain)	Good	
Copper	Good	Good	
Zinc	Good	Good	

Chemical Status			
Current Status (and certainty that status is less than good)		Good (uncertain)	
Chemical elements **			
Element	**Current status (and certainty that status is less than good)**	**Predicted Status by 2021**	**Justification for not achieving good status by 2021:**
Lead	Good	Good	
Nickel	Good	Good	
Mercury	Good	Good	
TBT	Good (uncertain)	Good	
Benzene	Good	Good	
Di(2-ethylhexyl)phthalate	Good	Good	
Nonylphenols	Good	Good	

** Other priority substances analysed but not detected are listed in Table D.2. Apart from those where the analytical detection limit is higher than the environmental quality standard (and where status is therefore uncertain), these substances are all at good status.

Table D.7 Water body table for Gibraltar HMWB (UKGIB6901)

Waterbody Category:	Coastal	**Surveillance site:**	Site 4
Waterbody ID and Name:	UKGIB6901 Gibraltar Harbour and Marina Bay		
Current Overall Potential:	Moderate		
Status Objective (Overall):	Good Potential by 2027		
Status Objective(s):	Good Ecological Potential by 2027		
Justification if overall objective is not good status by 2021:	Disproportionately expensive		
Protected Area Designation:	None		
Hydro-morphological Designation:	Heavily Modified		
Reason for HMWB designation	Ports & Harbour, Navigation, Flood Protection, Land Reclamation, Recreation		
Ecological Potential			
Current Potential (and certainty that status is less than good)		Good	
Biological Elements			
Element	**Current status (and certainty that status is less than good)**	**Predicted Status by 2021**	**Justification for not achieving good status by 2021:**
Phytoplankton	Good	Good	
Benthic Invertebrate	Good	Good	
Supporting Elements			
Element	**Current status (and certainty that status is less than good)**	**Predicted Status by 2021**	**Justification for not achieving good status by 2021:**
Dissolved Inorganic Nitrogen	High	High	
Dissolved Oxygen	High	High	
Un-ionised ammonia	Good	Good	
Chromium	Good (uncertain)	Good	
Copper	Good	Good	
Zinc	Good	Good	
Ecological Potential assessment			
Current Potential	**Predicted Potential by 2021**		**Justification for not achieving good status by 2021:**
Good	Good		
Mitigation measures that have defined ecological potential			
Mitigation Measure			*Status*
Dredging and disposal strategy			In place
Vessel management			In place

Chemical Status			
Current Status (and certainty that status is less than good)		Fail (certain)	
Chemical elements **			
Element	**Current status (and certainty that status is less than good)**	**Predicted Status by 2021**	**Justification for not achieving good status by 2021:**
Lead	Good	Good	
Mercury	Good	Good	
TBT	Fail (certain)	Fail	Disproportionately expensive
Di(2-ethylhexyl)phthalate	Good	Good	

** Other priority substances analysed but not detected are listed in Table D.2. Apart from those where the analytical detection limit is higher than the environmental quality standard (and where status is therefore uncertain), these substances are all at good status.

Table D.8 Groundwater body table for Gibraltar North (GI4172)

Waterbody Category and Map Code:	Groundwater		
Waterbody ID and Name:	GI4172 Gibraltar North		
Current Overall Status:	Good		
Status Objective (Overall):	To maintain good status		
Status Objective(s):	To maintain good status		
Justification if overall objective is not good status by 2021:			
Protected Area Designation:	Not designated		
Quantitative Status			
Current Status (and confidence in this assessment)		Good (high confidence)	
Quantitative Elements			
Element	**Current status (and confidence)**	**Predicted Status by 2021**	**Justification for not achieving good status by 2021:**
Groundwater resource balance	Good (high confidence)	Good	
Chemical Status			
Current Status (and confidence in this assessment)		Good (low confidence)	
Chemical elements			
Element	**Current status (and confidence)**	**Predicted Status by 2027**	**Justification for not achieving good status by 2021:**
GCA	Good (low confidence)	Poor (zinc exceedance)	
Pressures and Risks			
Pressures	**Risk Category**	**Element against which assessed**	
Diffuse pollution from urban land use	Probably at risk	General Chemical Assessment	
Point source (hydrocarbon spillage)	Probably not at risk	General Chemical Assessment	

Table D.9 Groundwater body table for Gibraltar South (GI4171)

Waterbody Category:	Groundwater		
Waterbody ID and Name:	GI4171, Gibraltar South		
Current Overall Status:	Good		
Status Objective (Overall):	To maintain good status		
Status Objective(s):	To maintain good status		
Justification if overall objective is not good status by 2021:			
Protected Area Designation:	Not designated		
Quantitative Status			
Current Status (and confidence in this assessment)		Good High Confidence	
Quantitative Elements			
Element	**Current status (and confidence)**	**Predicted Status by 2021**	**Justification for not achieving good status by 2021:**
Groundwater resource balance	Good (high confidence)	Good	
Chemical Status			
Current Status (and confidence in this assessment)		Good	
Chemical elements			
Element	**Current status (and confidence)**	**Predicted Status by 2027**	**Justification for not achieving good status by 2021:**
GCA	Good (low confidence)	Good	
Pressures and Risks			
Pressures	**Risk Category**	**Element against which assessed**	
Point source (hydrocarbon spillage)	Probably not at risk	General Chemical Assessment	
Diffuse pollution from urban land use	Not at Risk	General Chemical Assessment	

E. Water Body Status Objectives

This annex sets out the environmental objectives for all four water bodies in the Gibraltar River Basin District and the reasoning behind each objective. This annex also describes the process used to develop WFD objectives for the second cycle of River Basin Management Planning.

E.1 Setting of Objectives

Overall objectives

The default environmental objectives as defined in Article 4 of the WFD are summarised in Table E.1.

Table E.1 WFD Objectives

Surface waters	Groundwater
Prevent deterioration in status for water bodies	Prevent deterioration in the status of groundwater bodies
Aim to achieve good ecological and good surface water chemical status in water bodies by 2015	Aim to achieve good quantitative and good groundwater chemical status by 2015 in all those bodies currently at poor status
For water bodies that are designated as artificial or heavily modified, aim to achieve good ecological potential by 2015	Implement actions to reverse any significant and sustained upward trends in pollutant concentrations in groundwater
Comply with objectives and standards for protected areas where relevant	Comply with the objectives and standards for protected areas where relevant
Reduce pollution from priority substances and cease discharges, emissions and losses of priority hazardous substances.	Prevent or limit the input of pollutants into groundwater

In identifying and setting realistic objectives for Gibraltar's four water bodies, the procedure outlined below has been followed:

- identification of default objectives as set by the WFD;
- identification and assessment of pressures and risks of failing to meet default objectives;
- identification and appraisal of actions needed to meet default objectives; and
- setting of specific objectives for the Gibraltar RBD.

Where water bodies are currently already at Good Status, the default objectives are applied because existing mechanisms are in place to protect the environment that will enable compliance with the no deterioration objective.

For water bodies that are less than good status overall, the objective for the element failing the good status is reviewed. Pressures on the water bodies have been identified and are summarised in Annex B. These are assessed alongside existing mechanisms and actions (summarised in Annex H) that protect the water environment in appraising specific objectives for Gibraltar.

The methodology used to set the specific objectives for Gibraltar's River Basin Districts (RBD) is taken from the UK River Basin Management Plans. This approach uses the Common Implementation Strategy (CIS) Guidance Document Number 20 (EC, 2009) and the River Basin Planning Guidance published by Defra and Welsh Assembly Government in 2006 and 2008.

Prevent or Limit Discharges to Groundwaters (re Groundwater Directive)

Article 6 of the Groundwater Directive (2006/118/EC) requires that Member States put in place measures that prevent the input of hazardous substances to groundwater and limit the input of all other substances to groundwater in order to ensure that such inputs do not cause deterioration or significant and sustained upward trends in the concentration of the pollutants in groundwater. These status objectives are implemented through legislation (e.g. the Groundwater Regulations in the UK) which applies conditions to authorisations for discharges of substances to ground.

Groundwater quality monitoring is required to assess the effectiveness of the measures introduced to prevent the deterioration of the status of groundwater.

Permitted Deterioration of Status under the Terms of Article 4(7)

One of the objectives of the WFD is to ensure the status of water bodies is protected from deterioration. Other than in very exceptional circumstances, this objective must always be met, including for example, when the deterioration is caused by physical modifications. This objective applies to all water bodies no matter what their status.

However, in specific circumstances, the WFD does provide for exemptions or reasons why this objective may not be met but even in these cases it is necessary to comply with a number of conditions before this derogation can be relied upon.

Although protecting the water environment is a priority, some new physical modifications may provide important benefits to human health, human safety and sustainable development. Such benefits can include:

- public water supply;
- flood defence/alleviation;
- hydropower generation; and
- navigation.

It is sometimes not possible to undertake such activities without causing deterioration of water body status, or preventing the water body from reaching its environmental objectives. The benefits such developments can bring need to be balanced against the social and economic benefits gained by maintaining the status of the water body. Under Article 4(7) of the Directive, it must be demonstrated that the following conditions are met:

- all practicable mitigation has been incorporated;
- there are no significantly better environmental options;
- the scheme is of overriding public interest and/or the benefits of the scheme outweigh the benefits of WFD compliance;
- the reasons for the modifications to the water body are reported in the River Basin Management Plan.

No developments occurring between January 2012 and July 2014 were identified as likely to cause deterioration in the ecological status or potential of water bodies within the Gibraltar River Basin District.

E.2 Coastal Waters Body

The classifications of the Gibraltar Coastal Waters and Gibraltar Harbour & Marina Bay are presented in Annex D. The Coastal Water Body also contains Bathing Waters and part of the Southern Waters of Gibraltar Special Area of Conservation. The objectives of these protected areas are summarised in Annex F.

The objectives for the surface water bodies are to:

- prevent deterioration in status for all water bodies;
- for the coastal water body, maintain good status;

- comply with objectives and standards for protected areas where relevant; and
- reduce pollution from priority substances and cease discharges, emissions and losses of priority hazardous substances.

E.3 Heavily Modified Water Body

Where it is not possible for a water body to achieve good status because of substantial alterations made for specified purposes such as navigation, water storage, flood defence and land drainage, the Directive recognises that the benefits of such uses need to be retained and allows these water bodies to be designated as Heavily Modified Water Bodies (HMWBs).

For such water bodies good ecological potential (GEP) can be set as the environmental objective. This objective therefore takes into account the constraints imposed by the physical structure of the water body. Good ecological potential is not a derogation but represents an alternative objective to good ecological status (GES). Derogations form GEP itself can be justified on the basis of technical feasibility or disproportionate costs of measures to reach GEP.

The Moderate Potential for the HMWB results from the failure to meet the Environmental Quality Standard (EQS) for TBT, within the priority substances element of Chemical Status. The overall target of Good Potential for the Heavily Modified Water Body is delayed until 2027.

The decision process for setting the HMWB objectives is presented in Figure E.1, which is based on the decision tree for the failing element (priority substances) taken from the UK RBMPs. The process also takes into consideration disproportionate cost and technical infeasibility, as recognised in Article 4(4) of the WFD. Investigative monitoring has identified the source of TBT (historical contamination) and a technically feasible solution is available (remedial dredging); however, the costs of the measures are disproportionately expensive (code C2 in Figure E.1). This is described in detail in Annex H.

The objectives for the HMWB are to:

- prevent deterioration in status for the HMWB;
- achieve good ecological potential by 2027; and
- reduce pollution from priority substances and cease discharges, emissions and losses of priority hazardous substances.

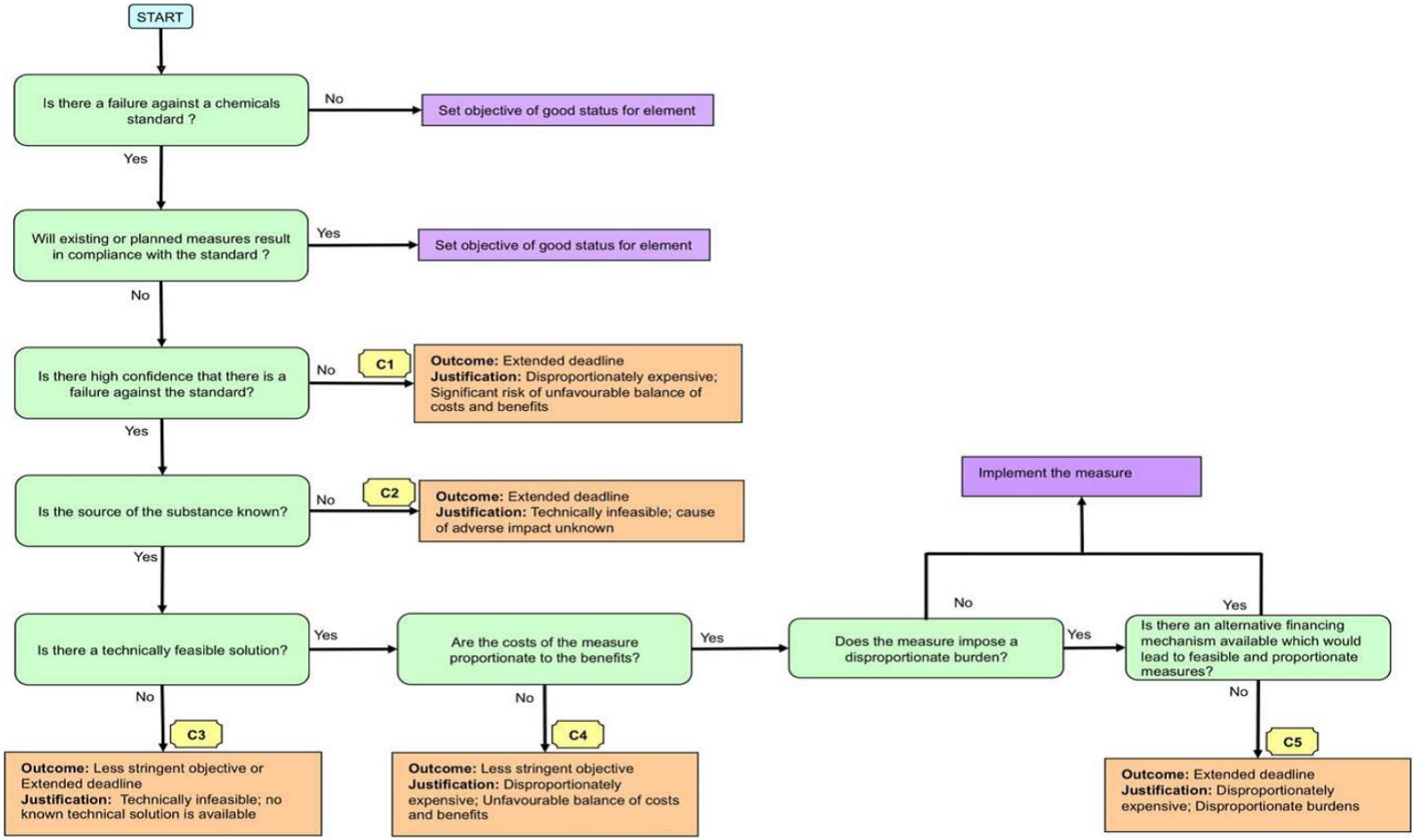
E.4 Groundwater Body

The classification of the two groundwater bodies is presented in Annex D, and pressures identified are summarised in Annex B. The classification, based on available monitoring data, identifies that the two water bodies are at good status overall, with both quantitative and chemical status being good.

The default WFD objectives are, therefore, appropriate; these include the following objectives that are relevant to Gibraltar:

- prevent deterioration in the status of groundwater bodies; and
- prevent or limit the input of pollutants into groundwater.

Figure E.1 Decision process for objective setting for Priority Substances



E.5 Protected Areas

The Directive specifies that areas requiring special protection under other EC Directives are identified as protected areas. These areas have their own objectives and standards. Article 4 of the Water Framework Directive requires Member States to achieve compliance with any standards and objectives set for each protected area by 22 December 2015, unless otherwise specified in the Community legislation under which the protected area was established. Where a protected area also has a surface water or groundwater objective the most stringent objective applies.

The objectives reported in this annex are those related to WFD water body status only. However, where a protected area coincides with a water body, this is indicated in the water body tables in Annex D. It is not possible to link the water body status objectives in this annex with the protected area objectives since the two sets of objectives are not always directly comparable. In addition, in some cases the size and scale of water bodies under the WFD are not the same as waters identified as protected areas. More information about protected areas and their objectives and standards are shown in Annex F.

F. Protected Areas

This annex sets out the environmental objectives for protected areas in the Gibraltar River Basin District.

F.1 Introduction

Article 4 of the Water Framework Directive requires that Member States achieve compliance with any standards, objectives and requirements made for protected areas under their specific designation in relation to the water environment by 2015, unless otherwise specified in the Community legislation under which the individual protected areas have been established.

Article 6 requires a register of protected areas to be included within the River Basin Management Plan; this shall subsequently be kept under review and up to date. Protected areas to be included in the register are:

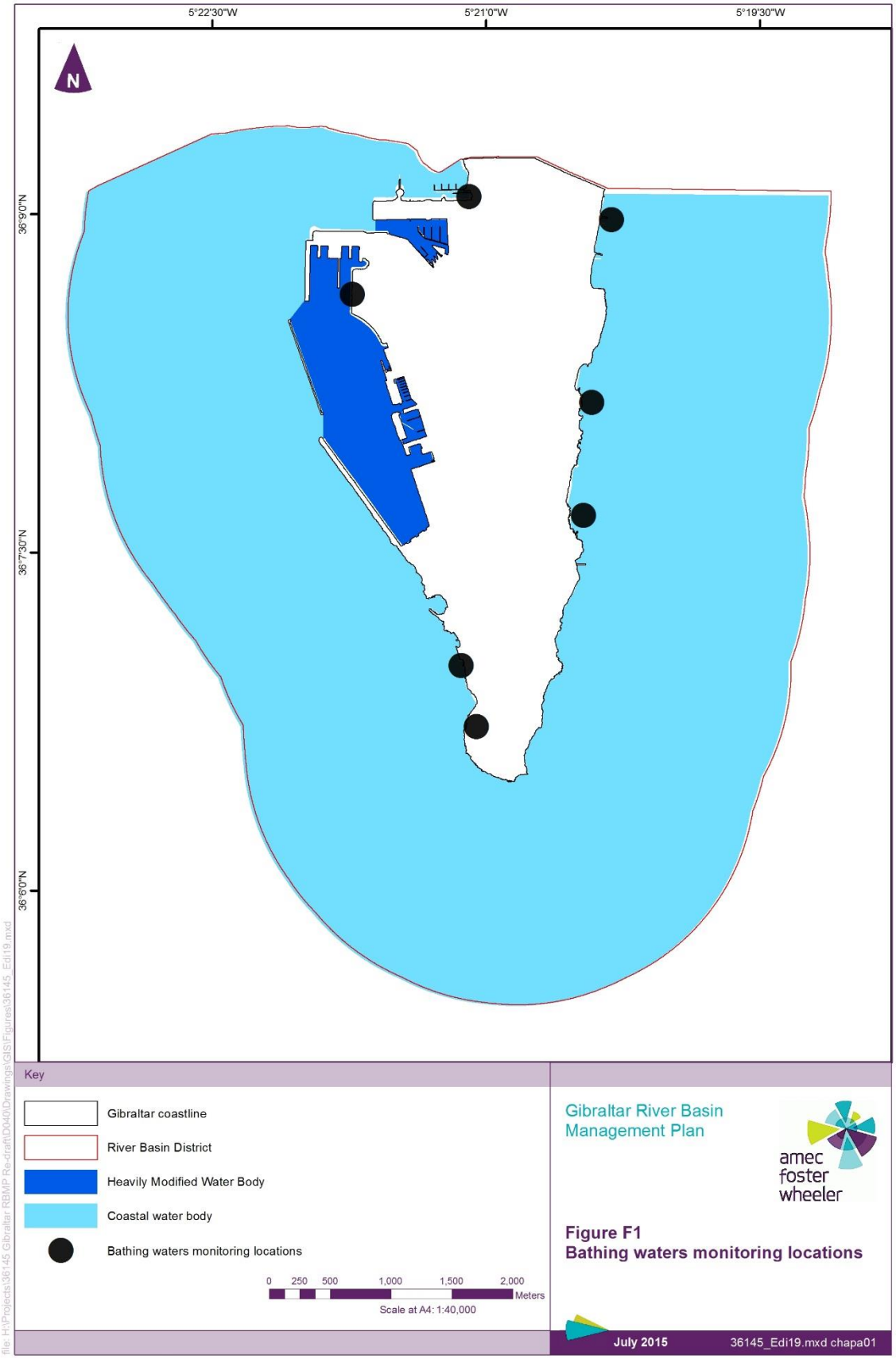
- Drinking Water Protected Areas (all bodies of water used for providing more than 10 m^3 a day on average for human consumption, or serving more than 50 persons);
- Shellfish Areas (designated for the protection of economically significant aquatic species);
- Bathing Waters (designated under Directive 2006/7/EC);
- Nutrient sensitive areas (including areas identified as Nitrate Vulnerable Zones under the Nitrates Directive or areas designated as sensitive under Urban Waste Water Treatment Directive); and
- Habitats Directive Sites (areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection including relevant Natura 2000 sites).

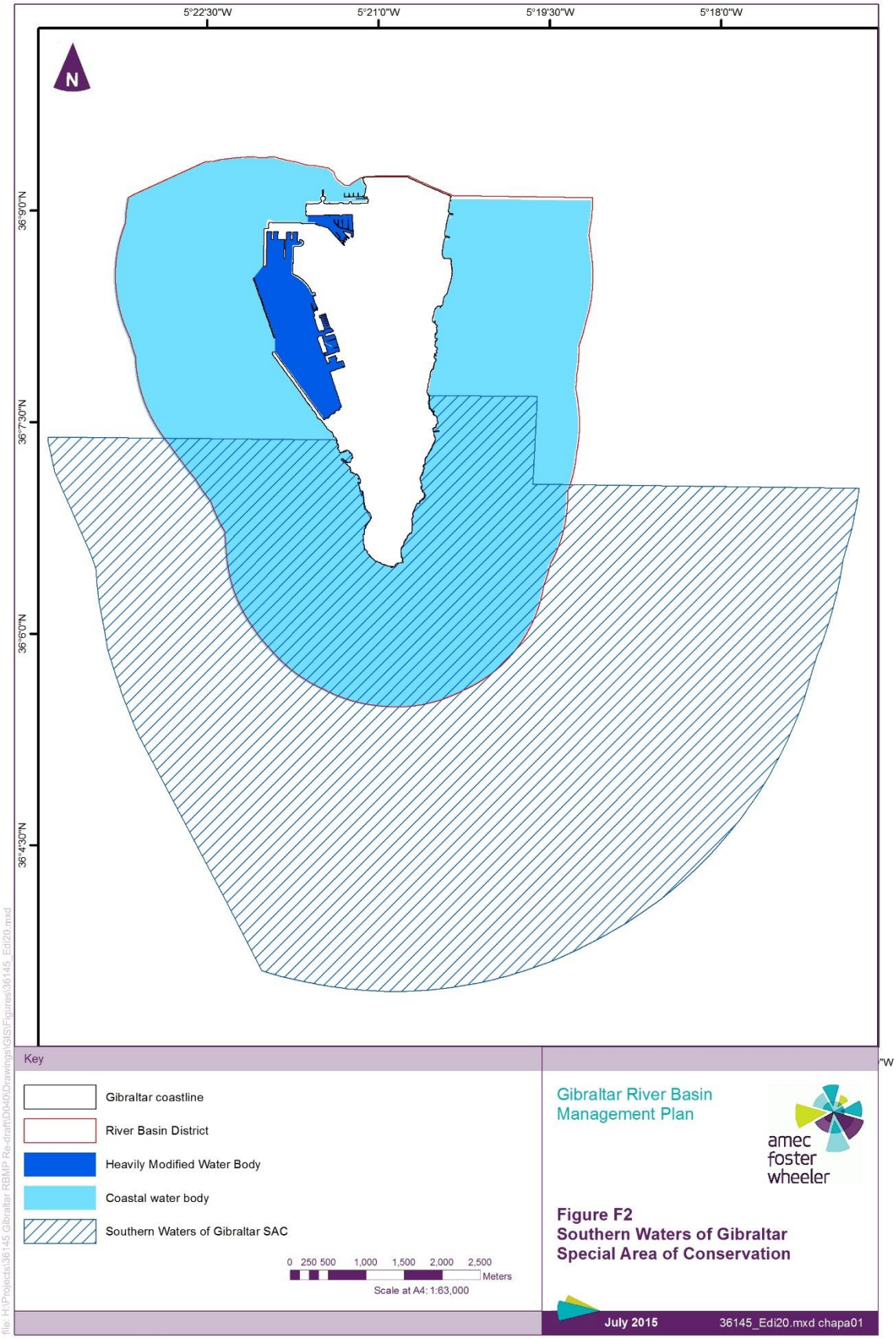
In Article 8, the WFD requires Member States to ensure monitoring programmes are established for protected areas and are supplemented by those specifications contained in Community legislation under which the individual protected areas have been designated.

F.2 Types and Locations of Protected Areas

In the Gibraltar River Basin District there are:

- no drinking water protected areas;
- no areas designated under the Freshwater Fish Directive and no Shellfish Waters;
- seven Bathing Water areas and monitoring locations (shown in Figure F1);
- no nutrient sensitive areas;
- one water dependent site designated under the Habitats Directive (92/43/EEC) and the Commission Decision 2006/613/EC (shown in Figure F.2).





F.3 Objectives

Drinking Water Protected Areas

Under Article 7(1) of the WFD, Member States are required to identify water bodies that are used for public water supply "providing more than 10 m^3 per day as an average or serving more than 50 persons". The aim of this article is to protect and improve the raw water quality of groundwater, rivers and lakes, to minimise treatment costs and therefore improve the cost efficiency of supply. As all drinking water in Gibraltar comes from sea water, which is not fit for human consumption in its raw state, costly treatment will always be required. Furthermore, the reverse osmosis process for desalinating the water for human consumption will also remove any additional pollutants. For these reasons, the Coastal Waters Body has not been designated as a drinking water protected area.

Bathing Waters

The revised Bathing Waters Directive (2006/7/EC) came into force in March 2006, replacing the previous Directive (76/160/EEC), which was repealed December 2014. The Directive asks Member States to fully implement the requirements of the Directive by 2015 and standard EU symbols are to be used across all bathing waters by 2016. The revised Directive was transposed into Gibraltar law by the Environment (Quality of Bathing Water) Regulations 2009. The objectives of the revised Directive are to preserve, protect and improve the quality of the environment and to protect human health.

These objectives will be achieved by meeting the 'sufficient' quality standards of the revised Bathing Waters Directive and by increasing, where possible, the number of bathing waters classified as 'excellent' or 'good'. The revised Directive requires only two parameters to be analysed (intestinal enterococci and *Escherichia coli* (*E.coli*)), instead of the nineteen analysed in the previous Directive. Intestinal enterococci is the common term now used for the group of bacteria previously called faecal streptococci. These two parameters will be used for monitoring and assessing the quality of the identified bathing waters and for classifying them according to their quality. Other parameters may possibly be taken into account as appropriate, such as the presence of cyanobacteria or microalgae.

The revised Directive requires data from the last four years to be used to assess compliance, therefore an assessment of data from 2010 onwards has been undertaken to predict whether Gibraltar's bathing waters are compliant with the revised Directive.

These results are presented in Table F.1.

Habitats Directive

The EU Habitats Directive (92/43/EEC) was transposed into Gibraltar law by the Nature Protection Act 1991. Under Commission Decision 2006/613/EC, the Southern Waters of Gibraltar were approved as a Site of Community Importance (SCI) in the Mediterranean bio-geographical region. The marine SCI was later designated as an SAC by the Gibraltar Government following the completion of the Southern Waters of Gibraltar Management Scheme.

The conservation objective of the Southern Waters of Gibraltar is that of ensuring that the status of European features are maintained or achieve favourable conservation status allowing for natural change.

F.4 Compliance and Monitoring Results

Bathing Waters

Designated Bathing Water areas in Gibraltar are monitored on a weekly basis from the 15th April to the 30th October each year. Under the previous Directive's assessment protocol, all bathing waters apart from Western Beach meet at least the Mandatory Values. Western Beach failed to meet Mandatory Value from 2010 to 2013. Two bathing waters met the more stringent Guide Values on at least one occasion. It should be noted that the Bathing Pavilion has only been included in assessments since 2012.

As described above, the Directive bases its values on the previous four years; therefore, data from 2010 to present have been used to establish an assessment of quality under the revised guidelines. For comparison, the results of the 2013 assessment have been included alongside the predicted values.

Table F.1 Bathing Water Compliance

Bathing Water	Compliance under previous Directive – 2013 results (guidance pass, mandatory pass, fail)	Compliance under new Directive (excellent, good, sufficient, poor)
Camp Bay	Mandatory pass	Good
Catalan Bay	Mandatory pass	Good
Eastern Beach	Guide pass	Excellent
Little Bay	Mandatory pass	Good
Sandy Bay	Mandatory pass	Good
Western Beach	Fail	Poor
Bathing Pavilion	Guide pass	Four-year data period not available

Habitats Directive

Monitoring has been taking place to comply with WFD requirements at three points around the coast of Gibraltar and at one location within Gibraltar Harbour. Two of the coastal monitoring locations, just south of Sandy Bay and Camp Bay, are located within the marine SAC.

The Southern Water of Gibraltar Management Scheme (2011) states that the specific needs of the Habitats Directive, i.e. monitoring the conservation status of listed habitats and species, is being implemented but needs to be augmented. The monitoring programme also covers locally important marine species and communities not listed in the Habitats Directive since these also play a critical role in maintaining the biodiversity and resilience of EU listed features e.g. reefs.

There are two Annex I habitats found in the Southern Waters of Gibraltar: reefs and submerged (or partially submerged) sea caves. These are being monitored as part of the Annex I Habitats Monitoring Programme.

A monitoring programme for marine species listed in Annex II and IV of the Habitats Directive is also being carried out.

F.5 Actions (Measures)

Six of the seven Bathing Waters (the exemption being Western Beach) are compliant with the requirements of the revised Directive. The poor quality of Western Beach has previously been attributed to an intermittent point source discharge of sewage from the neighbouring town of La Linea De La Concepción, Spain. This has been ongoing since 2010 and has had a significant negative impact on Western Beach. The matter has now been taken up by the European Commission. Until the problem is resolved, extensive bathing water quality monitoring will continue to take place. In the past, Western Beach has been closed due to the poor water quality; this measure may be required should water quality fall again in the future.

The Environmental Agency continues to be responsible for the water quality monitoring and reporting of these sites under the revised Directive. The actions identified for the Bathing Waters are:

- continued monitoring
- bathing water reporting (ongoing)
- compliance with new standards (by 2015)
- creation of bathing water profiles (by 2011)
- beach signage (by 2016)

G. Climate Change

This annex provides a qualitative assessment of climate change impacts on the pressures, actions and achievement of Water Framework Directive objectives in the River Basin Management Plan.

G.1 Introduction

The water environment is particularly vulnerable to the effects of climate change. It is already possible to observe trends in climatic factors that are having impacts on the water environment, as a result of global warming.

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2014) concluded the following.

- Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. The period from 1983 to 2012 was likely the warmest 30-year period of the last 1400 years in the Northern Hemisphere, where such assessment is possible (medium confidence).
- The evidence for human influence on the climate system has grown since the IPCC Fourth Assessment Report (AR4). It is extremely likely that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in GHG concentrations and other anthropogenic forcings acting together.
- Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify and global mean sea level to rise.
- Compared to past IPCC reports, the AR5 assesses a substantially larger knowledge base of scientific, technical and socio-economic literature. The ability to simulate ocean thermal expansion, glaciers and ice sheets, and thus sea level, has improved since the AR4, but significant challenges remain in representing the dynamics of the Greenland and Antarctic ice sheets. This, together with advances in scientific understanding and capability, has resulted in improved sea level projections in this report, compared with the AR4. There is overall consistency between the projections from climate models in AR4 and AR5 for large-scale patterns of change and the magnitude of the uncertainty has not changed significantly, but new experiments and studies have led to a more complete and rigorous characterization of the uncertainty in long-term projections.

The predicted effects of climate change globally include surface temperature projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level to rise. Regional key risks and potential for risk reduction in the Europe region (inclusive of the Western Mediterranean) to consist of increased damages from river and coastal floods, increased water restrictions and increased damages from extreme heat events and wildfires (IPCC, 2014).

In the Fourth Assessment Report (IPCC, 2007), Mediterranean-type ecosystems, characterised by cool, wet winters and hot, dry summers, were identified as being among the most likely to be impacted by climate change, with an overall result in losses of biodiversity and range contraction of species. According to the latest projections in the Fifth Assessment Report, future risk to ecosystems and their services is indicated to be high by the observation that natural global climate change at rates lower than current anthropogenic climate change caused significant ecosystem shifts and species extinctions during the past millions of years on land and in the oceans (high confidence). Many plant and animal species will be unable to adapt locally or

move fast enough during the 21st century to track suitable climates under mid- and high range rates of climate change. A large fraction of terrestrial, freshwater and marine species faces increased extinction risk due to climate change during and beyond the 21st century, especially as climate change interacts with other stressors (high confidence) (IPCC, 2014)

By the mid-21st century, under a scenario of 2°C global warming relative to pre-industrial temperatures, shifts in the geographical range of marine species will cause species richness and fisheries catch potential to increase, on average, at mid and high latitudes (high confidence) and to decrease at tropical latitudes and in semi-enclosed seas (Figure 2.6a) (medium confidence). In addition Coastal systems and low-lying areas will increasingly experience submergence, flooding and erosion throughout the 21st century and beyond, due to sea level rise (very high confidence) (IPCC, 2014).

Climate change will inevitably affect the conditions and pressures that the Water Framework Directive seeks to manage in the water environment. Climate change impacts may not be strongly felt during the first river basin management cycle up to 2015 and may not be easily distinguishable from normal climatic variations. However, decisions and investments made during this period may have a lifetime that extends for many decades. Over this extended period, towards the end of cycle two (to 2021) and through cycle three (to 2027), the climate in Gibraltar could change significantly. Therefore, if climate change is not considered now, this could result in poor investment decisions in terms of actions and limit the extent to which Water Framework Directive objectives are achieved.

In April 2009 the European Commission presented a White Paper on adapting to climate change which presents the framework for adaptation measures and policies to reduce the European Union's vulnerability to the impacts of climate change. The White Paper highlights the need “to promote strategies which increase the resilience to climate change of health, property and the productive functions of land, inter alia by improving the management of water resources and ecosystems.”

The accompanying Policy paper on Water, Coasts and Marine issues provides an in-depth analysis of the role of water and ecosystems in the transmission of potential climate change impacts to the economy and society. As part of the actions included in the White Paper, a Guidance document on adaptation to climate change in water management was adopted in December 2009 by Water Directors of EU Member States to ensure that the River Basin Management Plans (RBMP) are climate-proofed.

G.2 Approach to Dealing with Climate Change

The Government of Gibraltar prepared a Climate Change Programme (2008) as part of its commitments under the Kyoto Protocol. Gibraltar has collective EU obligations under this Protocol that are enacted through EU environmental directives. In addition to these, the Government has signed up to Kyoto in a more direct manner by having the UK’s ratification of the Protocol extended to Gibraltar.

The Gibraltar Climate Change Programme (GCCP) has been prepared in consultation with the Climate Change Forum, a technical advisory group created by the Government that presents an exchange of views and information, so that appropriate decisions may be made using the relevant technical and scientific foundations. Through the Programme, the Government strives to achieve a balance between accommodating the requirement for development whilst preserving the natural environment through promotion of sustainable development in Gibraltar.

The GCCP was prepared after the publication of the Fourth Assessment Report (IPCC, 2007) and as yet has not been updated to reflect the Fifth Assessment Report (IPCC, 2014).

The programme assesses ways in which Gibraltar can realistically cut down its emissions of greenhouse gases, conserve energy and protect and enhance the natural environment and is based on a number of basic broad principles which include:

- adoption of a balanced partnership approach, encouraging all sectors of the community to play their part;
- focus on flexible and cost effective policy options which are able to work together to form an integrated package; and

- taking a longer term view by looking at targets beyond the EU's Kyoto commitment period and monitoring the need for Gibraltar to adapt to possible impacts of climate change.

The GCCP presents the following policies to tackle the effects of climate change:

- land use policy
- soil protection policy
- energy conservation policy
- transport and traffic management policy
- policy on the promotion of environmental education and awareness
- policy on waste management
- development and flood risk policy.

G.3 Summary of Climate Change Impacts

The predicted effects of climate change in the Europe region (including the Western Mediterranean) are described in the Introduction section.

Over the period 1901–2010, global mean sea level rose by 0.19 [0.17 to 0.21] m. The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia (*high confidence*). It is *very likely* that the mean rate of global averaged sea level rise was 1.7 [1.5 to 1.9] mm/y between 1901 and 2010 and 3.2 [2.8 to 3.6] mm/y between 1993 and 2010.

Global mean sea level rise by the end of the century relative to 1986–2005 will likely be in the ranges of 0.26 to 0.55 m for to 0.52 to 0.98 m, depending on the RCP scenario, with a rate during 2081 to 2100 of up to 8 to 16 mm/y (medium confidence). These ranges are derived from CMIP5 climate projections in combination with process-based models and literature assessment of glacier and ice sheet contributions (IPCC, 2014)

Previous research following the IPCC AR4 showed the central value of 0.48 m being adopted by the Technical Services Department was within the predictions of the Climate Change 2007: IPCC Fourth Assessment Report, and in the light of the available evidence the value of 0.48 m was considered a reasonable figure to apply to Gibraltar. Considering the updated calculated figures in the Fifth Assessment Report (IPCC, 2014), despite the potential range for sea level rise being greater from 0.26 m to 0.98 m, the midpoint value of 0.48 m would still seem appropriate.

Lower average rainfall is not expected to affect the water resources for Gibraltar, which are entirely from sea water; however flora and fauna may be affected by lower rainfall.

Further to the summary above, climate change impacts on lower river flows in summer and subsequent decreased discharge of freshwater from Spain into the Bay will affect the sea temperature, salinity, CO_2, nitrate and phosphate concentrations within the marine environment. This will in turn have a knock on effect on marine flora and fauna as well as the supporting terrestrial populations. Furthermore, higher temperatures will dry soils and increase salinization and generate a higher incidence of wind-blown soil erosion.

G.4 The Impact of Climate Change on Identified Pressures

Annex B describes the identified pressures on the coastal water bodies and groundwater bodies in the Gibraltar River Basin District. This section assesses the impacts of climate change on those pressures and on the associated risk level that the pressure could impact on WFD objectives. It should be recognised that there is a high degree of uncertainty surrounding the exact effects that climate change will have on the environment, therefore a qualitative scale is used to determine if climate change will have a very low, low, medium, high or very high impact on the risk level, or no change. Although estimates of average global sea level rise for the end of the century have increased in the Fifth Assessment Report (IPCC, 2014) compared

to the previous Fourth Assessment Report (IPCC,2007) used in the previous RBMP, the effect of the sea level rise on identified pressures remains the same as outlined in the previous RBMP.

Point Sources: Sewage Discharges

Currently sewage is discharged from Gibraltar at Europa Point into an area of high natural dispersion. There have been no reported failures at Bathing Waters in the south of Gibraltar nearest to the discharge point, indicating that the discharge is not currently affecting water quality status objectives. The effects of climate change likely to affect the sewage discharge include the increased storminess/rainfall intensity and increased water temperature, which could affect the volume of sewage disposed and the quality/chemical reactions of the sewage. Population growth within Gibraltar in the future will also result in increased levels of sewage.

A secondary treatment waste water treatment plant is planned to be constructed in 2017 to further improve the quality of sewage discharged into the coastal waters. The design of the works have addressed potential climate change effects and future population levels. The potential effect of climate change on this point source pressure is therefore considered to be **very low.**

Point Sources: Industrial Discharges

The impacts of climate change such as changes to rainfall patterns and sea temperature are not expected to change the level of risk associated with industrial discharges pressures on the water environment. Rises in sea level could potentially impact on the ability to discharge, depending on the level of the current discharge location. Adaptation to this change could be relatively easy to achieve however, by changing the discharge height.

The climate change impacts on this pressure are considered to be **low.**

Diffuse Sources: Shipping and Historical Contamination

The main risk to the Coastal Waters including Gibraltar Harbour & Marina Bay arises from diffuse pollution from shipping and historical contamination, with historical contamination of sediments identified as the source of tributyltin (TBT) contamination in the water body. Climate change impacts such as changes in sea temperature, salinity, pH and sea chemistry (CO_2, nutrients, etc.) could potentially affect the behaviour of TBT in the marine environment. However, due to the uncertainty regarding how TBT behaviour might react to climate change impacts, it is not possible to assess the impacts of climate change on this pressure.

Diffuse Sources: Combined Sewer Overflows

Overflows from the sewerage system have been identified as a diffuse pressure on water quality in Gibraltar Harbour & Marina Bay, as in combination the discharges could lead to a risk of failing WFD objectives. The risk level from sewer overflows could potentially increase as a result of climate change and from increasing population. Although average rainfall values are predicted to fall, the frequency and intensity of rainstorms is predicted to increase. With increased intensity, there may be an increase in the need for combined sewer overflows, to prevent capacity issues in the sewerage system. The increased frequency of spills from overflows could therefore potentially impact on both nutrients and biological elements. As discussed above however, the construction of a new treatment works might increase the capacity of the sewerage system and reduce the need for frequent spills. Until this is in place, improvements in the risks associated with sewage overflows cannot be guaranteed.

Changes in sea temperature and salinity levels could potentially affect the effects of sewage discharges in the water environment and the ability of biological elements to react to sewage. Sea level rise could also potentially affect the ability of overflows to perform during high tides that coincide with heavy rainfall, as many of the overflows are submerged within the harbour.

Climate change is predicted to have a **medium/high** impact on the risks from sewer overflows on meeting WFD objectives.

Abstraction

Abstraction pressures from the seawater intakes used for public water supply are not considered to be a risk to meeting WFD objectives, due to the proportion of supply used against the resource availability. Climate change impacts are not expected to change this risk level – **no risk.**

Morphological Pressure

Extensive physical modifications are present along the Gibraltar coastline (including the Harbour and Marina Bay), and have been ongoing for much of the history of development in Gibraltar. The modifications include development of the harbour for the port and navigation, land reclamation for necessary development and economic growth, and shoreline reinforcement for flood defences. The pressures from these land uses are likely to increase in the future, as further reclamation might be required to facilitate growth. For example, Gibraltar might experience increased tourism as a result of increasing summer temperatures. Development in response to this may increase the pressure on the coastal water bodies and the harbour. Sea level rise could lead to increased flood risk; however, the flood defences in the harbour have recently been repaired and built to a level higher than predicted sea level rise.

Climate change is predicted to have a **medium** impact on the risks from physical modifications on meeting WFD objectives.

Point Sources: Hydrocarbon Spillage

Historical spillages have been recorded in the Southern Groundwater Body; however, the current water quality indicates that WFD objectives are being met. The impacts of climate change, which could affect the water table levels and water temperature in the groundwater, are not considered to impact on the potential for spillages or leaks into groundwater – **no change.**

Diffuse Sources: Urban Land Use

The development of land in the Isthmus area in the future could potentially increase pressure on the groundwater quality in the Northern Groundwater Body. The airport terminal was redeveloped to accommodate increased passenger numbers, and a new access road to Gibraltar is currently being constructed beneath the runway. Such development could potentially increase the risk of pollution from leaks or accidental spillages during construction, or from the introduction of new pathways into the aquifer. Rising sea levels could also potentially increase the salinity levels within the groundwater, due to anticipated connectivity between groundwater levels and sea levels.

Increases in temperature and reduced average rainfall are anticipated to dry soils and increase soil erosion. This could potentially affect the behaviour of certain mineral reactions within the soil, identified as potential contaminants of the groundwater from the cemetery.

Climate change is predicted to have a **medium** impact on the risks from urban land use on meeting WFD objectives in the Northern Groundwater Body.

G.5 Climate Change Adaptation Strategies

On April 2013, the European Commission adopted an EU strategy on adaptation to climate change. The strategy aims to make Europe more climate-resilient, by taking on a coherent approach and providing for improved coordination. The EU Adaptation Strategy focuses on three key objectives:

- promoting action by Member States to adopt comprehensive strategies;
- 'climate-proofing' action at EU level by further promoting adaptation in key vulnerable sectors; and
- better informed decision-making by addressing knowledge gaps about adaptation and further developing the European climate adaptation platform (Climate-ADAPT).

The EU Cities Adapt is a new project being carried out for DG Climate Action which will provide capacity building and assistance for cities in developing and implementing an adaptation strategy. The aim of the

Adaptation Strategies is to expand the knowledge base of the likely impacts of climate change, raise awareness throughout Europe on the importance of preparing for climate change, facilitate capacity building and sharing lessons learned and tools developed during the project. Gibraltar has now been through the training phase of the project which aims to build capacity in climate change adaptation.

H.M. Government of Gibraltar recognises that Gibraltar has a duty to safeguard its living and built environment for future generations. As such, it is developing a strategy to enable Gibraltar to adapt to the impacts it is likely to experience, through the creation of an adaptation working group. The aim of the Working Group is to collate information on the present and predicted future weather patterns for Gibraltar, and thus interpret this information on climate change and predict possible impacts for Gibraltar and how to adapt to them. The findings were presented to the EU in June 2013. This has led to the formation of the "Climate change task force", made up all major stakeholders from both the public and private sector, with the aim to achieve a carbon neutral footprint for Gibraltar. Following on from this, the Government of Gibraltar is currently working on a number of projects outlined below in order to form the basis of a working climate change strategy, including:

- Climate Change Resilience Strategy – to commence as from January 2015;
- Energy Efficiency Campaign – the department has started a new awareness campaign part of which focuses on water consumption and saving and the associated impacts especially given the environmental costs of desalination locally;
- National Energy Efficiency Actions Plan;
- Greenhouse Gas Inventory; and
- engaging consultants on possible renewable energy initiatives, although this is very much still in development.

Successful adaptation to the impacts of climate change on water will be dependent on effective national and European water regulations such as the EU Integrated Marine Policy (and its environmental pillar, the Marine Strategy Framework Directive) as well as integration of water management into other sectoral policies such as energy policies. The Recommendation concerning Integrated Coastal Zone Management in Europe and the newly reformed Common Fisheries Policy will also have to factor in and address adaptation as a priority.

Measures that have already been implemented in Gibraltar to help reduce CO_2 emissions include:

- an ongoing modernisation programme of the fresh water distribution system that will result in leakage reduction; since most of Gibraltar's potable water is produced by desalination, any leakage reduction will result in a saving in energy;
- encouragement of waste reduction and introduction of further recycling, aimed at reducing the amount of municipal waste going to landfill, thereby reducing amounts of methane and other greenhouse gases arising from this practice;
- the recent introduction of a new modern bus transport system; This transport system is free for all locals and was introduced as an incentive to reduce dependency on private transportation in Gibraltar.; and
- the continued use of seawater instead of fresh water for the conveyance of sewage and for other purposes such as firefighting, e.g. where the use of potable water is not essential. Since most of Gibraltar's potable water is produced by desalination this measure results in a considerable saving in energy.

The Gibraltar Climate Change Programme includes advice on water efficiency that should be implemented within households and business users, such as fixing dripping taps, carrying out water audits and use of water saving devices such as dual flush toilets etc. A coordinated approach to improving water efficiency from the Government and the water company, AquaGib, could also be developed to further promote water savings that would result in reduced carbon costs associated with supply production.

H. Programme of Measures

This section outlines the actions for managing the identified pressures on water environment and for contributing toward meeting the objectives of the WFD.

H.1 Introduction

The actions have been identified for pressures considered to be in some way a potential risk to the water bodies in the Gibraltar River Basin District. Annex B identifies the pressures to the environment and risks on a scale of not at risk, probably not at risk, probably at risk and at risk. Actions are listed for all pressures probably not at risk or greater and represent on the ground activities, many of which are existing regulations and controls to protect the environment.

This section is supported by the assessments undertaken in the following sections of the Plan:

- Annex E, Water Body Status Objectives; and
- Annex F, Protected Areas.

H.2 Basic Measures

We can all individually take action to help protect and improve the water environment. By aiming toward more sustainable use of water in the home and at work, the environmental (carbon) cost of desalinating water can be more efficiently managed, whilst efficient use of water will also help to minimise the volume of wastewater produced and discharged to the sea. Water efficiency in the home can be improved through the use of low flow fixtures, such as taps, showers, toilets and washing machines/dishwashers, etc. Our behaviour, such as turning off taps when brushing teeth or shaving, using cold water taps when hot water isn't a necessity and washing the car less often, is equally important in saving water and energy use.

Potable and salt water supply in Gibraltar is provided by AquaGib Ltd under a License Agreement with the Government of Gibraltar issued under the provisions of the Public Health Ordinance. The water company is responsible for treating water to the required standard for drinking purposes.

The Ministry for Health, Environment and Climate Change is the governmental body responsible for the Water Framework Directive implementation in Gibraltar. Nevertheless there are various departments responsible for ongoing actions to maintain environmental quality. These include the following.

- *The Department of the Environment and Climate Change*: advises on the transposition of EU Directives and management of their requirements. Apart from dealing with EU Directives, the Department is also tasked with monitoring contracts between Government and service providers which affect the general state of the environment including all environmental protection, enforcement and management issues in areas such as waste, wildlife & habitats, and any other issues related to biodiversity/conservation management.
- *The Environmental Agency*: plays an important role in delivering the environmental policies of the Government of Gibraltar, and is also responsible for the enforcement of a number of Environmental and Public Health legislations. In addition, the Environmental Agency is contracted to inspect, monitor and manage public health and environmental matters such as monitoring of bathing water beaches.
- *Technical Services Department*: provides technical support to the Government and to other Departments in a number of areas, including Highways, Infrastructure, Engineering & Design, Mechanical and Geographic Information Systems.

Other departments in the Government with responsibilities relevant to the protection of the environment include:

- Town Planning (including the Development and Planning Commission);
- Gibraltar Maritime Administration; and
- Gibraltar Port Authority.

Additionally, a Water Framework Directive working Group (WFDWG) has been established to develop a monitoring network for Gibraltar. The WFDWG is made up of a panel of local professionals, scientists, and Government officials. The Group was specifically established to provide on-going technical and scientific advice to the Government on the development and implementation of the Water Framework Directive.

The promotion of sustainable development and the use of sustainable drainage systems for managing surface water in both new and existing development will help to reduce the impacts associated with urban run-off.

Table H.1 summarises the pressures on the environment from the different sectors, and the responsibility for maintaining or implementing actions to protect and improve the water environment in Gibraltar.

Table H.1 Table of actions – coastal waters

Pressure	What will happen?	Where will it happen?	By when?	Lead organisation and partners
Main sewage discharge (nutrients, faecal indicator organisms)	No deterioration of sewage discharges.	Europa Point (Gibraltar Coastal Waters)	Implemented	HM Government of Gibraltar, Technical Services Department
Main sewage discharge (nutrients, faecal indicator organisms)	Construction of an Urban Waste Water Treatment Plant that will undertake secondary sewage treatment.	Europa Point (Gibraltar Coastal Waters)	2017	HM Government of Gibraltar
Combined sewer overflows (nutrients, faecal indicator organisms)	Improvements to surface water connections to reduce flooding, subsequently will reduce sewer spills.	Wellington Front	Implemented	HM Government of Gibraltar, Technical Services Department
Combined sewer overflows (nutrients, faecal indicator organisms)	Improvements to surface water connections to reduce flooding, subsequently will reduce sewer spills once exact point source discharge locations have been determined with Technical Services Department.	South of Little Bay, Catalan Bay, Eastern Beach	Ongoing	HM Government of Gibraltar, Technical Services Department
Combined sewer overflows (nutrients, faecal indicator organisms)	Improvement to surface water connections to reduce flooding and sewer spills through the construction of a new pumping station at Little Bay.	Main Harbour	Ongoing	HM Government of Gibraltar, Technical Services Department
Hydrocarbon spillages through bunkering	Storage control of hydrocarbons. Spill response plans.	Gibraltar Harbour & Marina Bay Gibraltar Coastal Waters	Implemented	HM Government of Gibraltar
Harbour use (land reclamation, morphological pressure)	Planning applications and regulations to control further land reclamation and shoreline reinforcement. Comply with Town Planning (Environmental Impact Assessment) Regulations 2000 (which implements the EIA Directive and its amendments)	Gibraltar Harbour & Marina Bay	Implemented	HM Government of Gibraltar, through Town Planning
Harbour use (shipping)	Comply with the relevant licences as required by the Gibraltar Port Authority and Maritime Administration	Gibraltar Harbour & Marina Bay Gibraltar Coastal Waters	Implemented	Gibraltar Port Authority Gibraltar Maritime Administration
Dredging	Compliance with Guidelines for the Assessment of Dredged Material.	Gibraltar Harbour & Marina Bay Gibraltar Coastal Waters	Implemented	HM Government of Gibraltar, Department of Environment and Climate Change

Table H.2 Table of actions – groundwater bodies

Pressure	What will happen?	Where will it happen?	By when?	Lead organisation and partners
Urban land use (ammonia, hydrocarbons)	Planning applications and regulations to control construction and development	Isthmus (Northern Groundwater Body)	Implemented	HM Government of Gibraltar, Department of Environment and Climate Change / Town planning
Urban land use (ammonia, hydrocarbons)	Groundwater protection advice/ discharge control	Isthmus (Northern Groundwater Body) The Rock (Southern Groundwater Body)	Implemented	HM Government of Gibraltar, Department of Environment and Climate Change / Town planning
Historic spillages (ammonia, hydrocarbons)	Remediation works adjacent to the Naval Base to address historic spillages.	The Rock (Southern Groundwater Body) – Comcen Cave Pool	Ongoing	Ministry of Defence
Hydrocarbon spillages	Storage control of hydrocarbons. Spill response plans.	Isthmus (Northern Groundwater Body) The Rock (Southern Groundwater Body)	Implemented	HM Government of Gibraltar

Table H.3 Table of actions – protected areas

Pressure	What will happen?	Where will it happen?	By when?	Lead organisation and partners
Sewage discharge at Western Beach emanating from Spain (*E.coli*, faecal streptococci)	Actions required in the adjacent Spanish River Basin District to prevent sewage discharges directly into the Gibraltar River Basin District especially at Western Beach.	Western Beach	Ongoing	HM Government of Gibraltar
General impacts from human activity	Bathing Water Monitoring and Reporting	Camp Bay, Catalan Bay, Sandy Bay, Eastern Beach, Western Beach	Ongoing	Environmental Agency
Environmental protection	Public awareness campaigns / beach signage	Camp Bay, Catalan Bay, Sandy Bay, Eastern Beach, Western Beach	2015	Environmental Agency
General impacts from human activity	Continued SAC monitoring	Southern Waters of Gibraltar SAC	Ongoing	HM Government of Gibraltar, Department of Environment and Climate Change
Fishing activities	Implementation of Marine Protection Regulations 2014	All marine protected areas (SAC and MCZs)	Implemented 2014	HM Government of Gibraltar, Department of the Environment and Climate Change
Shipping & historical contamination (TBT)	Continued monitoring to ensure ships have the International Anti-Fouling System Certificate before work is undertaken. Continued appropriate disposal of scrapings to hazardous waste facilities	Gibraltar Harbour & Marina Bay	Implemented	GibDock Ltd, HM Government of Gibraltar, Department of Environment and Climate Change
Shipping & historical contamination (TBT)	Monitor and enforce on ban on marketing of TBT as a biocide. Imports of TBT in biocides controlled under the Rotterdam Convention PLC Procedure.	Gibraltar harbour & Marina Bay	Implemented	GibDock Ltd, HM Government of Gibraltar, Department of Environment and Climate Change

Policy and legislation

Policy, legislation and financial tools for environmental protection and improvement are the mechanisms used for achieving WFD objectives. Many of the policies and legislative requirements for environmental protection are already in place, and regulations or consents for certain activities already exist. It is important that these mechanisms continue to meet the WFD objective of 'no deterioration'.

The European directives relevant to the water environment are summarised below. The mechanisms for implementing the directives in Gibraltar are also set out in each section.

Bathing Waters Directive

The revised Bathing Waters Directive (2006/7/EC) came into force in March 2006, replacing the previous Directive (76/160/EEC), which was repealed December 2014. The Directive asks Member States to fully implement the requirements of the Directive by 2015, and standard EU symbols are to be used across all bathing waters by 2016. The revised Directive was transposed into Gibraltar law by the Environment (Quality of Bathing Water) Regulations 2009. The objectives of the revised Directive are to preserve, protect and improve the quality of the environment and to protect human health.

These objectives will be achieved by meeting the 'sufficient' quality standards of the revised Bathing Waters Directive and by increasing, where possible, the number of bathing waters classified as 'excellent' or 'good'. The new directive also requires Member States to draw up a management plan for each site to minimise risks to bathers, based on an assessment of the sources of contamination that are likely to affect it. A profile for each bathing water based on the physical, geographical and hydrological characteristics of the bathing water and assessing the risks of pollution is also required and has been produced by the Department of the Environment and Climate Change.

Annex F presents the locations and results of the Bathing Waters found in the Gibraltar River Basin District. The Environmental Agency[26] is responsible for the water quality monitoring and reporting of these sites.

Environmental Impact Assessment Directive

The EIA Directive (85/337/EEC) has been in force since 1985 and applies to a wide range of defined public and private projects. Since then, Directive 2014/52/EU (the new EIA Directive) was enacted on 14th April 2014 and must be implemented by all Member States by 16th May 2017. The new Directive amends all previous EIA Directives and in doing so sets out a new procedural, assessment and consultation requirements for all stages of the EIA process. The Directive sets out a process for developments to identify and assess the resulting likely significant effects on the environment from the proposals, which are then considered by the Competent Authority in the decision making process for planning application.

The previous Directive 2009/31/EC is transposed into Gibraltar law under the Town Planning (Environmental Impact Assessment) Regulations 2000. The Government's Environmental Action and Management Plan sets out the steps that should be followed to comply with the EIA process in Gibraltar.

Habitats Directive

The Habitats Directive (92/43/EEC) sets out the protection of species and environmental sites and forms the cornerstone of Europe's nature conservation policy. The aims of the Directive are to encourage biodiversity, and for the designated sites and species to meet 'favourable conservation status'. Areas designated under the Directive are known as Special Areas of Conservation (SACs).

The Southern Waters of Gibraltar have been officially designated as an SAC. This means that the Member State is required to ensure no deterioration of the site and that any development requires the assessment of significant effects on the site (through an Appropriate Assessment if significant effects are likely).

The requirements of the Directive have been transposed locally under the Nature Protection Act 1991 Part IIA. The Southern Waters of Gibraltar Management Scheme summarises the process taken by the Department of the Environment and Climate Change in complying with the Directive obligations.

[26] www.environmental-agency.gi/environmental_monitoring.htm

Floods Directive

The EU Floods Directive (2007/60/EC) was published in October 2007 and lays down a framework for the reduction of flood risks to human health, the environment and economic activity within Member States. It requires Member States to undertake a *preliminary flood risk assessment* for each River Basin District (including associated coastal zones) to identify areas that are considered to be at 'significant' flood risk. The Environment (Assessment and Management of Flood Risks) Regulations 2010 transpose the Directive into local legislation.

The Gibraltar Preliminary Flood Risk Assessment is available on the Government website[27]. The Department of the Environment and Climate Change will continue to be consulted on relevant planning applications that may require an assessment of flood risk, to ensure applications comply with the requirements for considering flood risk and climate change.

Marine Strategy Framework Directive

The aim of the Marine Strategy Framework Directive (MSFD) 2008/56/EC is to achieve good environmental status in marine waters by 2020, and to more effectively protect the marine environment. It was introduced in 2008 and its objectives are in parallel to the Water Framework Directive, such that the status and objectives for coastal waters set in the river basin management planning cycle will also comply with the requirements of the MSFD.

The MSFD established European Marine Regions, for which Member States are required to develop strategies. The Gibraltar Coastal Waters are located within the Western Mediterranean Sea sub-region of the Mediterranean Sea Marine Region. The Marine Strategy Regulations 2011 transpose the Directive into local legislation. The Department of Environment and Climate Change of the Government is designated the Competent Authority for Gibraltar for the purposes of the Directive and of these Regulations and is responsible for the preparation of the Marine Strategy.

Groundwater Directive

In addition to the Water Framework Directive, a Groundwater Daughter Directive (2006/118/EC) was introduced in 2006 to provide further support to the objectives for good status in groundwater. The original Groundwater Directive (80/68/EEC) for protecting groundwater from dangerous substances was repealed in 2013. The new directive will continue to restrict these substances entering groundwater, applying to either deliberate disposal or accidental spillage.

The Daughter Directive is transposed into law in Gibraltar through the Environment (Protection of Groundwater) Regulations 2009.

Integrated Pollution Prevention and Control (IPPC) Directive

The IPPC Directive (2008/1/EC) is aimed at preventing, reducing and eliminating pollution at source and is aimed at helping industries to operate in a more environmentally sustainable manner. The 2008 directive repeals the former IPPC Directive 96/61/EC. In 2010, the Directive was reassessed and integrated with six other EU directives regulating large industrial sites into the Industrial Emissions Directive (IED) (2010/75/EU). The Pollution Prevention and Control Regulations 2013 transposes the IED into Gibraltar law.

The Environmental Agency is responsible for regulating activities which fall under the requirements of the Act and the Directive. The Agency's aims under these regulations are to:

- protect the environment as a whole;
- promote the use of "clean technology" to minimize waste at source; and
- encourage innovation, by leaving significant responsibility for developing satisfactory solutions to environmental issues with industrial operators.

[27] www.gibraltar.gov.gi/new/sites/default/files/1/15/Preliminary_Flood_Risk_Assessment_Report.pdf

Once a permit has been issued, other parts of IPPC come into play. These include compliance monitoring, periodic permit reviews and variations of permit conditions.

Strategic Environmental Assessment Directive

Directive 2001/42/EC requires the environmental effects of a broad range of plans and programmes to be assessed, where significant effects are likely. The plans will be subject to consultation. The Directive is transposed into Gibraltar law by the Environment Act 2005.

The aim of the Directive is “to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development”.

The plans that require assessment under this directive are plans and programmes subject to preparation and/or adoption by an authority at national, regional or local level (or which are prepared by an authority for adoption, through a legislative procedure by Parliament or Government) and plans or programmes required by legislative, regulatory or administrative provisions.

The River Basin Management Plan therefore falls under the requirement to be assessed under the SEA Directive.

Efficient and Sustainable Use of Water

The Gibraltar Climate Change Programme sets out how the Government is committed to undertake a number of measures that aim at reducing greenhouse gas emissions. In recognition that the water supply system in Gibraltar is relatively energy intensive, measures have already been identified to control emissions of CO_2 in relation to water supply. These include reducing leakage in the supply system, to reduce wastage and hence save energy at the desalinisation plants; and continuing use of salt water where potable water is not essential.

Whilst there is no direct pressure regarding the availability of water resources, the promotion of sustainable water use will contribute toward the climate change incentives by reducing energy costs in water production.

The Environmental Protection (Energy End-Use Efficiency) Act 2009 requires the Minister for the Environment to publish guidelines for energy savings of 9% by 2016 in Gibraltar. The Act is aimed at the energy industry; however, it has been recognised that the water supply system in Gibraltar is particularly energy intensive and therefore any savings in water demand will also translate into energy savings.

The Gibraltar Climate Change Programme has introduced advice and measures on water efficiency that should be implemented in households and business users, such as fixing dripping taps, carrying out water audits and use of water saving devices such as dual flush toilets, etc.

Point Sources

Industrial discharge consents are controlled by the Integrated Pollution and Prevention Control Act 2001 the Public Health (Discharges to the Aquatic Environment) Regulations 2004 and the Public Health (Water Framework) (Amendment) Regulations 2010.

The Environmental Action and Management Plan also sets out the policies on pollution to the environment, including the water environment, stating that the Polluter Pays principle will be enforced and fiscal penalties will be imposed upon those who are responsible for negligent pollution incidents.

Any new development requiring a point source discharge will also have to comply with the IPPC requirements, and potentially be subject to Environmental Impact Assessment, which would be assessed by the Government of Gibraltar.

A new secondary sewage treatment works is planned for the main sewage discharge at Europa Point, which will be subject to discharge quality consent conditions, which will be regulated by the Government of Gibraltar.

All discharges to the marine environment are regulated by the Government of Gibraltar via the Department of the Environment and Climate Change.

Diffuse Sources

Some of the identified diffuse pressures on the marine environment include multiple point sources, such as sewer overflows. As discussed in Section 1.4 above, all outfalls to the marine environment are regulated by the Government of Gibraltar. Mechanisms already in place for reducing spillages from sewer overflows include de-silting of the gully and sewer network. A term maintenance contract, overseen by the Technical Services Department, specifies how many times a year de-silting of gullies should be undertaken. In respect of the sewer network, de-silting occurs as and when required to improve capacity. It is the responsibility of the Technical Services Department of the Government to maintain the sewer network conditions. Improvements are also planned for the network as part of the Wellington Front Flood Alleviation scheme. These improvements are designed to reduce flooding but as a by-product will also improve the capacity of the sewers and therefore reduce the frequency of sewer overflows into the harbour.

The use of sustainable drainage systems, where appropriate, on new developments could help to prevent further capacity problems in the sewer network, by controlling surface water discharges at source. Such systems can provide multiple environmental benefits not only on water quantity but on water quality, aesthetic quality and biodiversity. For example green roofs can be used to control rainwater falling on building roofs, but also contribute toward habitat creation and energy reduction by providing building insulation.

Town Planning and Building Control, the Environmental Agency and the Department of the Environment and Climate Change are responsible for ensuring new developments comply with Building Regulations and Approved Code of Practice, which includes appropriate control for the discharge of sewage, oils and lubricants.

Shipping movements in and out of the harbour and in the Gibraltar Coastal Waters are regulated by Gibraltar Port Authority and Gibraltar Maritime Administration. Vessels must be licensed for bunkering in Gibraltar Waters, which is one of the busiest bunkering ports in the Mediterranean. In November 2002 a Bunkering Code of Practice was introduced and a Bunkering Superintendent appointed to police all operations in the Port. Port Operator Licences are also required for activities within the port, including ancillary provider services, tug services, diving, ferry services, yacht charters, mooring, ship repairs and waste management.

Physical Modification

The modification of the coastline in the harbour area has been ongoing for much of the recent history of Gibraltar, for the purposes of navigation, flood defence and recreational use. Projects which propose land reclamation for development are required to comply with planning laws including Environmental Impact Assessments. The Government of Gibraltar will consult on any such plans through the Town Planning and Building Control Department and Development and Planning Commission.

Development must also comply with the Development and Flood Risk policies of the Climate Change Programme, which require applicants to demonstrate how the proposed development will be protected from inundation where they are at potential risk of flooding. Consideration is also required of the environmental effect of any coastal defence works that are required, including possible secondary effects elsewhere along the coast as a result of the development of defence works.

Dredging activities must comply with the Guidelines on the Assessment of Dredged Material, and application will be assessed by the Government of Gibraltar. The quality of the dredged material is also assessed to determine the most appropriate disposal method to prevent any detrimental environmental impact.

International Convention on the Control of Harmful Anti-fouling Systems on Ships

The International Convention on the Control of Harmful Anti-fouling Systems on Ships came into force in September 2008, and prohibits the use of harmful organotin compounds in anti-fouling paints used on ships, including TBT. The Convention also establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems. All ships and yachts entering Gibraltar waters must be

certificated to demonstrate that they comply with the Convention. Gibraltar Port Authority and Gibraltar Maritime Administration are responsible for ensuring all vessels are compliant and certified. Furthermore, any vessel entering the shipyards in the harbour will be required by the ship yard operator to produce certification.

Accidental Pollution

The busy shipping activity in the Port of Gibraltar means that there is a potential risk of pollution from oil spills. The Port of Gibraltar has a regularly exercised Gibraltar Oil Spill Contingency Plan and is an Associate Member of Oil Spill Response Ltd of Southampton. The Plan is overseen and managed by the Gibraltar Port Authority. Other departments such as the Department of the Environment and Climate Change, the City Brigade and the Environmental Agency play central roles in the execution and coordination of the Oil Spill Contingency Plan where such incidents occur.

Transboundary Cooperation

The protected area objectives for the Western Beach Bathing Water are not currently being met, due to a continuous sewage discharge from the Spanish side of the border, which usually should operate as an emergency overflow only. This has been ongoing since 2010 and has had a significant negative impact on Western Beach. The matter has now been taken up by the European Commission. Until the problem is resolved, extensive bathing water quality monitoring will continue to take place.

H.3 Supplementary Measures

Gibraltar's HMWB fails the chemical status with high confidence due to the elevated levels of tributyltin (TBT). During the first cycle of the RBMP, investigations were undertaken to determine the source of TBT causing the failure of the water body by taking sediment samples at three locations across the harbour. The results of the sediment sampling show high levels of TBT, up to 13,000 µg/kg, with the highest concentrations at the southern end of the harbour, close to the dry docks. The source of the TBT is thought to be historical, from antifouling paints applied to the hulls of vessels, before their ban under the International Convention on the Control of Harmful Anti-fouling Systems on Ships and prior to any Environmental Management Systems being implemented at the dry docks. The TBT-based paint most likely entered into the sediment via the dry docks whilst a vessel was docked in for repairs/repainting. The hull would have been stripped of paint, treated and re-antifouled on a regular, maintenance basis. Once maintenance activities were complete, the dry dock would have been flooded, with no prior cleaning of the dock, thus discharging the TBT-based antifoul paint scrapings into the harbour and allowing them to accumulate in the sediments over time.

Tributyltin compounds are considered to be highly toxic to many marine organisms at low concentrations and several studies have shown their effects to lead to shell malformations in oysters, imposex in marine snails (whereby female gastropods develop male sex organs), reduced resistance to infections (e.g. in flounder) and effects on the human immune system.

A study has been undertaken by the Antwerp Port Authority (APA) on an integrated approach for the removal of TBT from harbours and waterways at the Port of Antwerp, as a European LIFE-Environment project, entitled 'TBT-Clean'. The study looked at determining the release of TBT from sediments during dredging operations, testing several treatment technologies for cleaning TBT-contaminated sediments, checking the reuse possibilities for cleaned sediments and finally assessing the environmental impact of alternatives for TBT. This study will be used in assessing options for the remediation of TBT-contaminated sediments in Gibraltar's harbour.

There are two potential options for addressing the TBT issue in the harbour: business as usual, or remedial dredging. The following sections explore these options in further detail.

Options 1: Business as Usual

Since the start of monitoring in Gibraltar in July 2009, TBT levels in the water column have fluctuated over the years, ranging from <0.0005 µg/l to 0.159 µg/l, although the latter high value was a one-off reading that

occurred after a dredging event took place in the harbour. The next highest level recorded over the five year monitoring period was 0.0355 µg/l. The average TBT level recorded over the five years is 0.0048 µg/l. For coastal waters the annual average (AA) EQS is 0.0002 µg/l, and maximum allowable concentration (MAC) EQS is 0.0015 µg/l. In total, 34% of samples registered below the MAC. As explained in Annex D, section D.4, the limits of detection (LoD) for levels of TBT are higher than the AA (LoD = 0.0005 µg/l), so compliance with the AA cannot be demonstrated with certainty.

Figure H1 shows a plot of TBT levels of all samples obtained in the five year monitoring period. The trendline shows a gradual decrease in TBT levels over the monitoring period. The high level recorded of 0.159 µg/l has been excluded as it is a single outlier that is not representative of the overall trend.

Figure H.1 TBT levels per sample obtained over a period of five years (July 2009 to July 2014) with associated trendline. Maximum allowable concentration (MAC) EQS is also displayed.

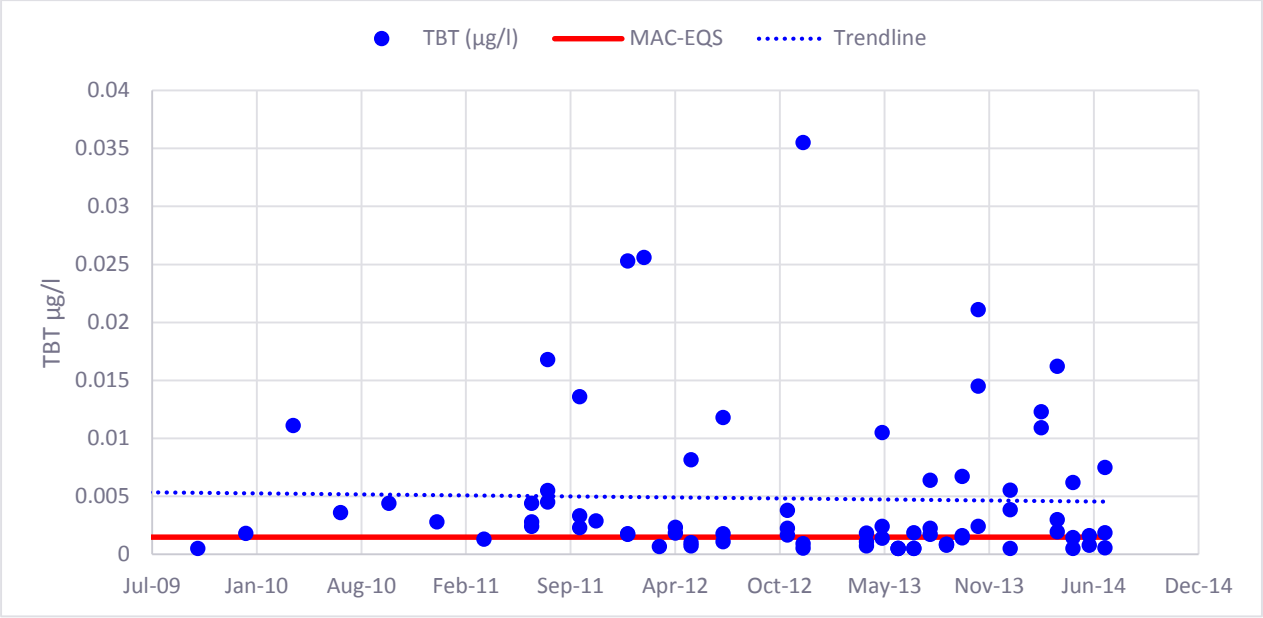
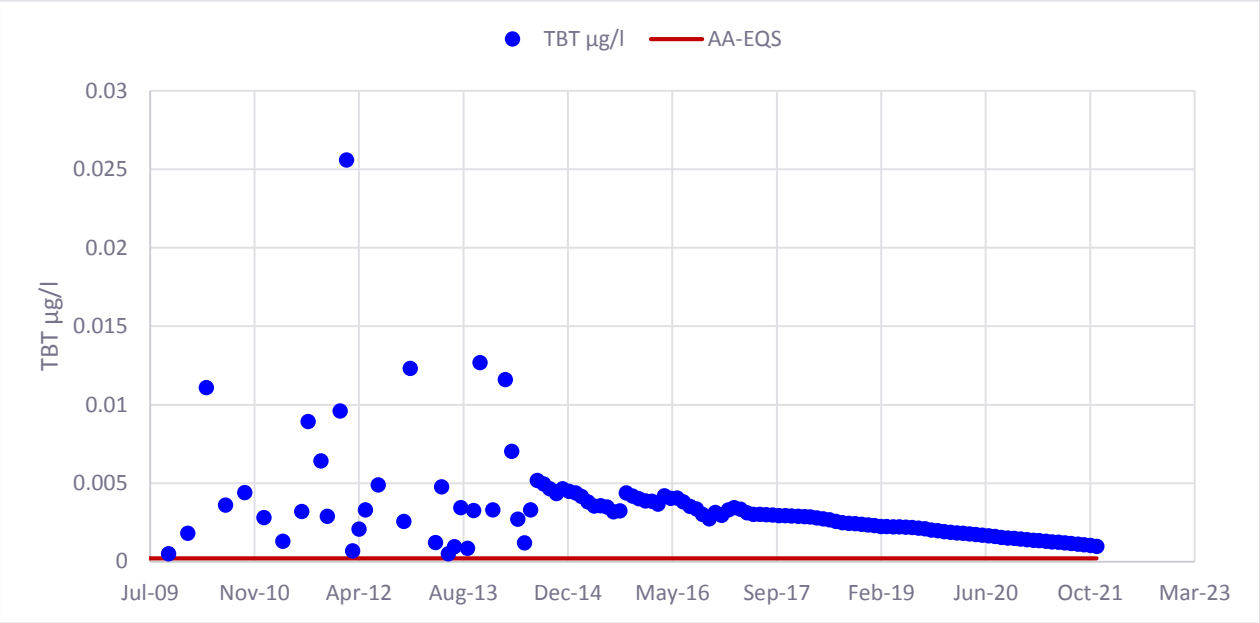


Figure H2 shows a “rough and ready” plot forecasting the levels of TBT to the year 2021. TBT levels have been calculated as an average across the three monitoring locations in the HMWB (see Figure D2). Whilst this is not a reliable forecast of TBT levels, it does reflect the fact that TBT levels are decreasing. Continual (operational) monitoring will verify if this is the case.

Figure H.2 TBT levels averaged across monitoring locations per month, with associated annual average (AA) EQS.



Whilst it can be argued that there is a benefit in trying to bring forward the reduction of TBT levels through options such as remedial dredging, there is a strong case against this due to the adverse environmental impacts associated with activities such as dredging. A dredging event for a small land reclamation caused the high level of TBT of 0.159 µg/l to be recorded. This high level of TBT in the water column was also recorded in the Coastal Waters Body just outside of the harbour at a level above MAC (see Annex D, section D.4).

The Government of Gibraltar is also conducting investigations into reopening of culverts located on the south mole of the harbour. The intention is to increase water circulation and flushing with the aim of improving water quality through increasing the distribution and dilution of contaminants and thus accelerate the natural process of breakdown of TBT in the water column.

The South Mole, constructed in the 1880s, is 340 m in length, with repair berths along the breakwater to accommodate vessels up to 150,000 deadweight tonnage (dwt). Two culverts were constructed through the base of the South Mole, at the corner adjoining No. 1 Dock, to allow a through-current and prevent floating debris accumulating in front of the docks (Fa and Finlayson, 2006). As the culverts are no longer maintained, they are now in a state of disuse and disrepair.

The Department of the Environment and Climate Change is currently in the process of investigating the possibility of reopening the culverts in order to increase water circulation within the harbour (with particular emphasis on the south area of the harbour). The preliminary stage of the investigation will involve carrying out a survey to establish the overall structural integrity of the culverts. The survey will be conducted using ROVs and, if the conditions are found to be satisfactory, the culverts will be reopened with a one-way flow system which will allow a flow rate to enter into the harbour in order to increase water circulation.

Option 2: Remedial dredging

Remediation, or clean-up dredging, is a form of dredging designed to remove contaminated sediments, thus improving water quality and restoring the health of aquatic ecosystems, not without adverse effects, however. The very act of dredging causes resuspension of contaminated sediments which sustains the risk for remobilization of TBT to the water phase. In Gibraltar's harbour, the more commonly available type of dredging method is using a split barge with clam-shell crane. This type of dredging method was used for the construction of a small boats marina and land reclamation within the harbour (June 2014). This particular method is not the most environmentally accepted method for dredging contaminated sediments, as it does not minimise the resuspension of sediment during operations and thus does not minimise the remobilisation of contaminants into the water column.

It is estimated that an area of approximately 550,000 m^2, approximately half the harbour, would have to be dredged to a depth of 1 m. This would equate to about 1,100,000 tonnes of sediment.

The remobilisation of TBT is a very complex process as it depends on both sediment characteristics, such as TBT concentration, pH, grain size distribution, and organic matter, as well as water characteristics such as pH, salinity, and temperature. Lab-scale experiments conducted at the Port of Antwerp show that the risk of TBT remobilisation into the water column is minimal when the pH of the water phase is lower than 8.2. At a higher pH, the risk of releasing TBT to the water phase increases, with the effect becoming more pronounced when higher amounts of solids are re-suspended. At Gibraltar's harbour, the average water pH of 8.4 (even during winter months) consequently poses a higher risk, with high TBT release very likely and therefore dredging is not recommended and should be avoided if possible.

Dredging poses other, direct and indirect, environmental effects apart from the remobilisation of TBT into the water column. Direct effects include the removal or destruction of habitat and benthos, changes to bathymetry/topography and the removal or destruction of any archaeological assets. Indirect effects include smothering of sensitive species from the re-suspension of sediment and increase in turbidity causing potentially negative effects on sensitive species such as fish. Previous studies in the harbour have also identified the presence of protected species, such as the sea pen *Pinna nobilis* (listed in Annex IV of the Habitats Directive), and *Pinna rudis* (listed in Annexe II of the Barcelona Convention and in the Bern Conventions). Dredging in the harbour can have a direct negative impact upon protected species requiring extensive surveys and potential species relocation prior to any remedial dredging.

The benefit of remedial dredging would be the removal of the source of TBT causing the failure of the HMWB thus allowing the HMWB to reach good potential within the second cycle of the RBMP. However, the negative impacts of dredging (as described above) outweigh the benefits of reaching good potential within this cycle.

Finally, once the contaminated sediment has been dredged from the harbour, the sediment will have to be treated and cleaned for safe disposal. In practice, the dredged sediments would need to be shipped/transported to Europe for treatment and disposal due to lack of space and treatment facilities in Gibraltar.

H.4 Monitoring Programmes

Investigative Monitoring

During the first cycle of River Basin Management Planning, investigative monitoring in the harbour (HMWB) was undertaken to determine the source of TBT into the water body as per article 8 and annex V, section 1.3.3 of the WFD. Investigative monitoring was carried out as follows:

- monitoring of TBT in the monthly water quality surveys (it was only monitored quarterly);
- monitoring of two additional sites in Gibraltar Harbour for water quality;
- determining with the laboratories if an improved detection limit can be achieved; and
- monitoring of sediments for TBT.

TBT monitoring was increased to a monthly frequency, with two additional sites in the northern and southern ends of the harbour (see Figure A6). TBT levels in sediment were also monitored on a quarterly basis to determine if the source of TBT is historical contamination from antifoul paint discarded from the adjacent dry docks, which is now locked into the sediment and released into the water column during disturbance, such as dredging or storm events.

Investigative monitoring was carried out for a minimum of a year (from 2012 to 2014) and it has been determined that the source of TBT contamination is from TBT locked within the sediment, with the highest concentration of TBT in sediment found in the southern end of the harbour, close to the dry docks. As the source of TBT has been identified, the reason behind undertaking investigative monitoring of the HMWB is considered to be fulfilled and, therefore, investigative monitoring of TBT is now considered complete.

Ongoing discussions with the laboratories will be carried out until an improved detection limit can be achieved.

Operational Monitoring

As per Article 8 and in accordance with the requirements of Annex V of the WFD, operational monitoring shall be undertaken in order to:

- establish the status of water bodies identified as being at risk of failing to meet their environmental objectives; and
- assess any changes in the status of such bodies resulting from the programme of measures.

It is proposed that for the second cycle of the RBMP, operational monitoring is undertaken at the HMWB to determine the status of water body following the implementation of the programme of measures, which includes investigations into opening a culvert in the harbour wall to allow greater water circulation and dilution. Operational monitoring locations shall be the same as for investigative monitoring (see Figure A6).

Surveillance Monitoring

As per Article 8 and in accordance with the requirements of Annex V of the WFD, surveillance monitoring shall be undertaken in order to:

- ensure the efficient and effective design of future monitoring programmes;
- assess long-term changes in natural conditions; and
- assess long-term changes resulting from widespread anthropogenic activity.

It is proposed that for the second cycle of the RBMP, surveillance monitoring of the Coastal Waters Body continues at the same locations and sampling frequency as the first cycle of RBMP (Figure D2). However, the list of priority substances monitored should be updated according to Directive 2013/39/EU amending the Priority Substances Directive.

H.5 Cost Effectiveness and Cost Benefit Analysis

Cost-effectiveness (CEA), Cost-Benefit (CBA) and Disproportionate Cost Assessments (DCA)

The WFD calls for extensive application of economic appraisal tools to support water management and policy decisions, in particular for the application of cost-effectiveness and cost-benefit analysis. Annex III of the Directive stipulates that the most cost-effective combination of measures should be included in the programme of measures based on estimates of potential costs of such measures.

In the context of the WFD, **Cost-effectiveness Analysis (CEA)** is used to make judgements about the most cost-effective programme of measures which could be implemented to achieve the target EQS. In general terms, CEA of identified alternative supplementary measures would result in their relative ranking in terms of cost-effectiveness (i.e. identifying the least cost pathway to ensure set environmental objectives are met). However, even the most cost-effective set of measures may still be associated with disproportionate costs.

While the main objective of the WFD is to ensure that all waters reach ‘good status’, the Directive recognises that achievement of this aim in all water bodies might be unrealistic. Article 4 of the WFD envisages the possibility of exemptions, or in other words the setting of alternative objectives, when good status in a body of water cannot be achieved due to natural processes/conditions, lack of technical feasibility or disproportionate costs of available measures.

In general terms, Article 4 allows for extension of the deadline for achievement of the objectives or setting less stringent environmental objectives that can be justified on the basis of disproportionality analysis. In particular,

- deadlines established may be extended until the year 2027 for the purposes of phased achievement of the objectives, if completing the improvements by 2015 or 2021 would be disproportionately expensive (Article 4(4)), and
- less stringent environmental objectives may be set if achievement of the required objectives would be infeasible or disproportionately expensive (Article 4(5)).

The hierarchy between these exemptions is important; less stringent objectives should be set only in cases when extension of the deadline does not help in achieving good status.

Appraisal of Supplementary Measures

The first cycle of river basin management planning in Gibraltar included only investigative and monitoring activities in the Programme of measures. Following the collection of additional data, failure of Gibraltar's HMWB to comply with good chemical status has been confirmed due to elevated levels of TBT.

Importantly, the source of the TBT causing failure is thought to be historical, from antifouling paints applied to the hulls of vessels, before their ban under the International Convention on the Control of Harmful Anti-fouling Systems on Ships and prior to any Environmental Management Systems being implemented at the dry docks. Regular ship maintenance activities carried out in dry docks have historically resulted in discharging the TBT-based antifoul paint scrapings into the harbour and accumulating in the sediments over time.

Two potential options have been identified to address the TBT issue in the harbour:

- business as usual, or
- remedial dredging.

Business as usual

Analysis of the past trends and forecasting of TBT levels to the year 2021 suggest anticipated continuous reduction of TBT levels in the Coastal Waters Body. It is, however, noted that assuming that the current trend continues forecasted TBT levels in December 2021 would be 0.000981 µg/l (versus the annual average (AA) EQS of 0.0002 µg/l).

At the same time, ongoing activities by the Government of Gibraltar aimed at reopening of culverts located on the south mole of the harbour would result in an increased water circulation thereby accelerating the natural process of TBT breakdown. At this stage it is unclear as to the feasibility of reopening the culverts. If they are reopened, it is anticipated that this would aid in reducing TBT levels in the water column and thus helping achieve EQS. However, it is difficult to determine at this stage just how effective this will be, and improvement in water quality through a reduction in TBT will only be determined through operational monitoring. Therefore, it is difficult to comment whether the reopening of the culverts will aid towards the HMWB achieving good status by 2027.

The Government of Gibraltar is commencing investigation works to assess the current state of the culverts. The costs of reopening culverts will be contingent on the findings of investigative studies. In general terms, the costs of investigation and manual cleaning versus the costs of investigation and use of underwater machinery could range from 10,000 to 50,000 Euro, based on average costs of diver surveys and use of remotely operated vehicles (ROVs).

Remedial dredging

The second, alternative course of action to ensure achievement of the environmental objectives set would include remedial dredging which involves the removal and appropriate treatment of contaminated sediments. The commonly used dredging method in Gibraltar involves using a split barge with clam-shell crane.

In order to remove contaminated sediments about half of the harbour would need to be dredged resulting in an estimated 0.55 million m^3 of sediment removed.

A study for the Antwerp Port Authority (APA) on an integrated approach for the removal of TBT from harbours and waterways at the Port of Antwerp considered a range of alternative dredged sediment treatment technologies. The summary findings are presented in the table H.4 below.

In practice, dredged sediments would need to be shipped to Europe for treatment and disposal due to lack of space and treatment facilities in Gibraltar.

Table H.4 TBT contaminated sediment treatment techniques (Note 1)

	Conclusions	Applicability	Costs Note 2
Dewatering & disposal	Currently used technology		170 Euro/tonne of dry matter
Lagooning & bioremediation	Cost-effective at low and moderate TBT contamination levels	Sediments are dried by evaporation in open air (on large lagooning fields and periodically turned over to aerate)	100 Euro/tonne of dry matter
Mechanical dewatering & thermal treatment	Most effective alternative to treat high concentrations of TBT	Mechanical dewatering followed by the use of thermal desorption unit	220 Euro/tonne of dry matter
Hydro-cycloning, mechanical washing & thermal treatment	Cost-effective at low and moderate TBT contamination levels	Physical separation of fine and coarse components (reducing volume) followed by thermal treatment	185 Euro/tonne of dry matter

Note 1: Source - TBT CLEAN (2007). LIFE02 ENV/B/000341. Development of an integrated approach for the removal of tributyltin (TBT) from waterways and harbours: Prevention, treatment and reuse of TBT contaminated sediments. Task 3554. Cost-benefit analysis.
Note 2: costs inflated to 2014 prices

Costs of dredging itself can range substantially; a study carried out by Rosengard *et al* (2010) on remedial contaminated sediment dredging reports costs ranging from 35 to 655 Euro per cubic metre[28] with the average costs of 320 Euro per cubic metre. Another cost estimate from Falmouth harbour[29] suggests dredging costs at about 460 Euro per cubic metre. Estimated dredging costs of contaminated sediments in Gibraltar are presented in the Table H.5 below.

Table H.5 Dredging costs of TBT contaminated sediment

	Values	Units
Volume	550000	m^3
Unit costs:		
Low	35	Euro per m^3
Medium	260	Euro per m^3
High	655	Euro per m^3
Average	320	Euro per m^3
UK harbour	460	Euro per m^3
Total dredging costs:		
Low	19,250,000	Euro

[28] Costs inflated to 2014 prices and converted from USD to Euro.
[29] Costs in 2014 prices, converted to Euro. Source: http://www.westbriton.co.uk/Falmouth-Harbour-test-dredge-branded-failure/story-20935102-detail/story.html (accessed 08/07/2015)

	Values	Units
Medium	143,000,000	Euro
High	360,250,000	Euro
Average	176,000,000	Euro
UK harbour	253,000,000	Euro

Estimated costs of dredging TBT contaminated sediments could range from 19 to 360 million Euro (one-off).

Following dredging TBT contaminated sediments would need to be transported and treated abroad, such as UK, France, etc. Table H.6 below highlights costs of treating TBT contaminated sediments.

According to the TBT Clean study, wet density of dredged sediments ranges from 1.3 to 1.45 tonnes per cubic metre while dry matter content is between 40-50%. The estimated volume of 0.55 million cubic metres of dredged sediment in Gibraltar then equates to 0.756 million tonnes (total weight) or 0.340 million tonnes dry weight.

Table H.6 Costs of treatment of TBT contaminated sediment

	Total costs, Euro
Dewatering & disposal	57,853,125
Lagooning & bioremediation	34,031,250
Mechanical dewatering & thermal treatment	74,868,750
Hydro-cycloning, mechanical washing & thermal treatment	62,957,813

Depending on the choice of remediation technique, total costs of treating dredged sediments could range from 34 to 75 million Euro. In total, estimated costs of dredging and treating contaminated TBT sediments could range from 53 to 435 million Euro. These financial costs would come in addition to adverse environmental impacts of dredging described in section H.3.

Justification of Derogations

The WFD sets out a complex and strict procedure for justification of exemptions and the argument of technical feasibility constitutes the first test. In assessing technical feasibility, one should take into account complexities and uncertainties pertaining to the natural systems and interactions between natural and human environments and make a judgement on whether the measures proposed would result in achieving the target objective.

Disproportionality analysis constitutes the second test and plays a major role in the justification of alternative objectives. However, the absence of a definition of “disproportionate costs” or “disproportionately expensive” in the Directive introduces certain challenges[30] and raises a number of fundamental questions. First of all, the reference chosen with respect to which costs of the measures are compared to is important. Overall, possible approaches include:

- comparison of costs of most cost-effective measures proposed to the benefits of improved ecological status (WATECO guidance document suggests that potential (time and objective) derogation from the Directive’s environmental objectives should be based on assessment of costs and benefits and costs of alternatives for providing the same beneficial objective);
- view on disproportionality exclusively in the light of affordability of those affected by the measures; or

[30] CIS WATECO guidance document is the first source to partially address the issue of “disproportionality”

- a combined approach when assessment of costs and benefits related to the measures is followed by evaluation of the distribution of costs and ability-to-pay of the parties concerned.

In the UK, a combined approach of Net Present Value for the programs of measures, assessment of economic viability and impacts on the sectors as well as distributional assessment of costs and benefits is used in river basin management planning (EA WAG, 2014 based on RPA (2004)[31]).

The choice of the threshold at which costs are considered to be disproportionate is also critical for the outcomes of the assessment. The WATECO guidance document (EC, 2003) on application of economic analysis within the WFD suggests that *disproportionality* should not begin at the point where costs simply exceed quantifiable benefits.

In general terms, Benefit –Cost Ratio (BCR)>1 means that the benefits of the proposal outweigh the costs while BCR<1 would indicate that the total costs of measure outweigh the benefits. However, using the decision rule of BCR<1 as an indication of disproportionate costs may not be appropriate as discussed above. It would, effectively, mean that any schemes where costs outweigh the benefits even by a pound could be perceived as disproportionate.

In the UK, a threshold of 0.5 when considering whether any of the cost-effective measures identified are, in fact, disproportionately costly has been adopted. In practice, it means that the costs need to be at least twice the value of the benefits before it can be said that a measure is significantly non cost beneficial[32].

Carrying out remedial dredging in Gibraltar would be *technically feasible*, however, financial and environmental costs of such approach would be excessive.

In particular, total, estimated *costs of dredging and treating contaminated TBT sediments* could range from 53 to 435 million Euro. Secondly, it is widely recognised that the removal of sediments through dredging may have *adverse impacts on marine species and habitats*. Impacts may be due to physical or chemical changes in the environment at the dredging site. The extent of such impacts depend on the characteristics and sensitivity of the area dredged, as well as the dredging technique used.

During remediation dredging the main impact upon the environment occurs during excavation; removal of sediment and the vertical transport of the dredged material to the surface of the water, with the potential of increasing turbidity and release of TBT into the water column. Whilst the latter can be minimised through careful consideration of the type of equipment used, the former (removal of sediment) cannot be mitigated against. Previous studies have identified the presence of protected species (the sea pen *P. nobilis* and *P. rudis*), which would be destroyed through the dredging process. Alternatively, these organisms can be translocated, but there is no guarantee the translocation process would not also have an adverse impact upon the protected species.

Asides from the negative impact on protected species, the ecological status of the HMWB would also be negatively affected from the dredging process. Current status of the HMWB is Good Ecological Potential; remedial dredging would result in significant deterioration in ecological potential of the water body through the removal of half of the upper layer of sediment in the harbour.

[31] RPA (2004). CEA and Developing a Methodology for Assessing Disproportionate Costs. Report for Defra
[32] Environment Agency (2014). Water Appraisal Guidance; Assessing Costs and Benefits for River Basin Management Planning. May 2013

I. Planning Review

A central part of river basin planning is to review existing policies and plans already in place for protecting the environment. This annex provides an illustrative overview of relevant policies and methods that aim to protect and enhance the environment, as a start to aligning these processes with the aims and objectives of the Water Framework Directive.

The plans discussed in this annex are not exhaustive and this document should be seen as a living document in which future guidance and plans will also align with aims of delivering sustainable water management, whilst considering economic and social issues. By considering relevant parallel policies, the WFD also aims to ensure that both public bodies, private organisations and individuals work together for a sustainable future. This section focuses on the following key spatial planning processes:

- urban land use planning;
- flood risk and coastal erosion management; and
- marine planning.

I.1 Urban Land Use Planning

The Gibraltar Development Plan was approved in 2009 by the Government of Gibraltar and is intended to guide land use planning over the next 10 years. It constitutes a Planning Scheme as provided for by section 5 of the Town Planning Act 1999.

The Plan is divided into the following four sections:

- general policies;
- area specific policies and proposals;
- the Old Town Plan; and
- the Old Town Design Guide.

The policies and proposals are interrelated and based upon strategic principles surrounding population/housing, tourism, employment, transport, shopping, quality of life and the environment. The latter of these principles is to:

> *Recognise the special character of Gibraltar's natural, built and cultural environment as a valuable resource and to ensure that this is not significantly adversely affected by new development.*

It is recognised within the Plan that there is a delicate balance between the preserving of the significant areas of environmental importance in Gibraltar, including the Upper Rock, and the need for development from the densely populated urban area and the high daily influx of tourists. Some of the general policies on the environment and where the water environment is relevant are listed below.

- **Policy ENV1 – Effect on the Environment.** The effect on the environment of development proposals shall be a prime consideration in determining applications.
- **Policy ENV2 – Environmental Impact Assessments.** Applications for development proposals that are likely to have a significant impact on the environment by virtue of the nature of the

proposed development and its proposed location, must be accompanied by an environmental impact assessment.

- **Policy ENV 6 – Development and Flood Risk.** Planning permission for development in areas considered to be at risk will only be granted where the Applicant can demonstrate that the proposed development will be adequately protected from inundation. Any protective measures required must not have an unacceptable effect on the environment, including possible secondary effects elsewhere on the coastline arising from the proposed protection measures.
- **Policy ENV7 – Air and Water Quality.** Planning permission will only be granted for development proposals that could potentially have a significant adverse effect on air or water quality if it can be demonstrated, to the satisfaction of the Competent Authority, that appropriate mitigation measures can be implemented to minimise such effects.
- **Policy ENV8 – Protection of Water Quality in the Vicinity of Sea Water Intakes.** Proposals in the vicinity of seawater intakes, existing or future, will need to take particular account of the need to ensure that there is no adverse effect on sea water quality.
- **Policy ENV11 – Biodiversity.** The protection and enhancement of biodiversity shall be an important consideration in the determination of planning applications.
- **Policy ENV14 – Sites of Ecological Value.** Planning permission for development that would have a significant adverse effect on identified sites of ecological value will not normally be granted.
- **Policy ENV15 – Sites of Community Importance / Special Areas of Conservation**. Planning permission will not normally be granted for development that will affect the integrity of a designated site of community importance/special area of conservation, as shown on proposal maps.

A final Environmental report was prepared by an independent environmental consultant on behalf of the Development and Planning commission. The report is the outcome of an assessment of the environmental effects of the Development plan at a strategic level. Under the Environment Act 2005, that transposes Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (Strategic Environmental Assessment (SEA) Directive), it is a requirement, having prepared an Environmental Report, to make available a Post Adoption SEA Statement; this was therefore published in Dec 2009.

I.2 Flood Risk and Coastal Erosion Management

EU Floods Directive

The EU Floods Directive (Directive 2007/60/EC) has been linked to the Water Framework Directive both in terms of scale (WFD River Basin Districts are the level at which risks must be assessed) and timing, requiring flood risk assessments to be reviewed periodically in conjunction with River Basin Management Plans. The WFD has a broad aim to contribute to 'mitigating the effects of floods and droughts', in addition to its primary focus on achieving good ecological status and preventing deterioration of existing status classifications. The EU Common Implementation Strategy for the Water Framework Directive also supports the implementation of the Floods Directive, through a separate working group.

The Floods Directive can be viewed as the means by which the EU hopes to achieve the effective consideration of floods in parallel with the WFD river basin planning process. A Preliminary Flood Risk Assessment has been prepared for the Gibraltar River Basin District, as required by Articles 4 and 5 of the Floods Directive. Following the preliminary assessment, it was concluded that there are no areas in Gibraltar that are at a significant future risk of flooding, hence there are no significant flood risk zones in Gibraltar.

I.3 Other Planning Processes

Section I.1 above summarizes the land use plans for Gibraltar which include policies for development and flood risk.

Furthermore, the Gibraltar Climate Change Programme states that:

> *Where development is proposed in areas considered to be at risk, the Applicant will need to demonstrate how the proposed development shall be protected from inundation. Consideration will need to be given to the environmental effect of any coastal defence works that are required, including possible secondary effects elsewhere along the coast*.

I.4 Marine Planning

The Marine Strategy Framework Directive (MSFD) (2008/56/EC) came into force in 2008 and aims to achieve Good Environmental Status in Europe's seas by 2020. A Commission Decision was made in September 2010 outlining the criteria for achieving Good Environmental Status (2010/477/EU). As required under Article 5.2(a) of the MSFD, the Government of Gibraltar published the Initial Assessment and Proposals for Good Environmental Status in British Gibraltar Territorial Waters in December 2012. By the end of 2015, as per Article 5.2(a)(iv), the Government of Gibraltar will be publishing the Monitoring Programme for ongoing assessment and regular updating of targets (in accordance with Article 11(1)).

The promotion of Integrated Coastal Zone Management (ICZM) is also being rolled out by the Commission following a number of demonstration projects. These ICZMs should include national strategies to improve the overall planning, management, sustainability and quality of coastal zones. In order to further promote sustainable development of coastal zones, the commission adopted on the 12th March 2013 a draft proposal for a directive establishing a framework for maritime spatial planning and integrated coastal zone management.

The Government of Gibraltar has produced a Southern Waters of Gibraltar Management Scheme to enable the Relevant Authorities to carry out their responsibilities and functions, in line with the requirements of the Nature Protection Act 1991 and the Proposed Marine Leisure Act 2011 with regard to the nature conservation features for which the Southern Waters of Gibraltar European Marine Site has been designated. The Scheme presents a summary of issues affecting the Special Area of Conservation and how these issues are and will be managed.

In line with the Government of Gibraltar's commitment to regulate fishing, diving and other marine activities, the Government published the Marine Protection Regulations 2014 as well as the Tuna Preservation Regulations 2014. The regulations form part of a wider Government strategy to protect the marine environment in Gibraltar as required under international, European and regional legislative frameworks. Both regulations are instruments of the Nature Protection Act 1991.

I.5 Other Actions Plans

The Government of Gibraltar's intention is to create a sustainable future in which present and future generations can enjoy a rich, diverse & healthy environment in Gibraltar and therefore has established an Environment Charter. The Charter contains a set of commitments, which Government strives to achieve as the result of a series of guiding principles. An Environmental Action and Management Plan has since followed on from the charter, and has been developed by Government to guide the implementation of the Environment Charter. It establishes general policy goals, specific actions and measures, and in this way mirrors the objectives of the WFD.

J. Consultation and Engagement

J.1 Introduction

The WFD requires consultation to be undertaken on the draft River Basin Management Plans before final publication. In the final plan, this section will be updated with a summary of the organisations and authorities that were consulted on the plan, and whether a response was received.

J.2 Consultation Process

Table J.1 below outlines the consultation process and outcome for the second cycle of the RBMP.

Table J.1 Consultation responses

Organisation	Contact	Response received
Organisation 1		
Organisation 2		
Organisation 3 etc.		

K. Competent Authorities

This annex presents the contact details and responsibilities of the competent authorities for river basin planning within Gibraltar, in the context of planning for environmental and coastal water quality protection.

K.1 Details and Responsibilities of Competent Authorities

Table K.1 below identifies the competent authorities for Gibraltar's coastal waters and groundwaters, and outlines the responsibilities of each authority.

Table K.1 Competent authorities

Name and address	Legal status	Responsibilities
Government of Gibraltar, Ministry for the Environment, Department of the Environment and Climate Change **Duke of Kent House, Line Wall Road, Gibraltar**	Governmental Body, part of the Crown	Primarily responsible for implementation of the River Basin Management Plan in line with Article 13 of the Water Framework Directive. The Department of the Environment and Climate Change advises on the transposition of EU Directives, and is also responsible for monitoring contracts between Government and service providers which affect the general state of the environment.
Environmental Agency **37 Town Range, Gibraltar**	Formed in July 1995 from the Environmental Health Department	Responsible to the Minister for the Environment and plays an important role in delivering the environmental policies of the Government of Gibraltar. The Agency is also responsible for the enforcement of a number of Environmental and Public Health legislations and for environmental monitoring.

K.2 Contact Details

Primary point of contact:

Stephen Warr – Senior Environment Officer, Department of the Environment and Climate Change.

Jonathan Kay – Environment Officer, Department of the Environment and Climate Change.

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