

# Assessment of the ability of the Water Resources Tax to cover the costs for compliance with the Water Framework Directive

Catarina Marquez <sup>(1)</sup>; Ana Galvão <sup>(1)</sup>; António Monteiro <sup>(1)</sup>

<sup>(1)</sup> CERIS, Instituto Superior Técnico, Universidade de Lisboa, catarina.marquez@tecnico.ulisboa.pt, an.galvao@tecnico.ulisboa.pt, antonio.jorge.monteiro@tecnico.ulisboa.pt

## Abstract

The European Commission developed a water policy that prioritizes the cleaning of water bodies and makes sure that they will remain in good quality. The Water Framework Directive (WFD) has as a main objective to ensure that, until the end of 2015, every water body in the European Union is in a quality state equally or higher than “Good”. In Portugal, this policy led to the creation of the River Basin Management Plans (RBMP) published for the first time in 2012.

Each RBMP has a Programme of Measures in which four types of measures are defined: base, supplementary, additional and complementary, the first ones being considered fundamental to achieve the goals proposed. Funds should therefore be partly raised by the Water Resources Tax (WRT).

Revenues should be applied in order to improve the efficiency of water use, the quality of water resources and to ensure the good quality of the water bodies. At the same time, that value should be used to amortize investment and exploration costs as well as to cover the services of administration and management.

The present dissertation has as a main objective to evaluate the compliance of the measures defined under the scope of the WFD and also in which extension the WRT allows to cover the costs of its application. The area of study is the Hydrographic Region 4 that includes the river basins of Mondego, Vouga and Lis rivers.

**Key-words:** Water, Water Framework Directive, River Basin Management Plan, Water Resources Tax.

## 1. Introduction

Water is at the center of sustainable development. According to United Nations water is a primary natural resource which essentially every social and economic activity and ecosystems functions depend on. Water resources and its services promote poverty reduction, economic growth and environmental sustainability. It is possible to say that water contribute to the improving of social well-being and inclusion, touching subsistence of millions of people.

By 2050 an 55% increase of water consumption is expected, mainly due to industrial production, energy production and domestic use. If there is not a good management and awareness of the value of water consequences will be the unsustainability of the system, the affecting of water quality and availability, and the questioning of the water resources ability to create benefits. (United Nations 2015)

The concept of water consumption give us the indication of the amount of water that is used by the economy in the sense that after it comes in the “economy” it won't come back to be part of water resources and oceans. This happens because the water can be embodied in products, it can evaporate, transpire or simply be consumed. (United Nations 2011)

To ensure that there are funds available to execute the necessary measures of control and maintenance of the water bodies' quality, the Water Resources Tax (WRT) was created. This financial instrument has as objective to encourage the efficient use of water resources by being added to the water price of the area of utilization. In the same way, WRT should take in consideration the social-economic and environmental situation, as well as the geographic and climatic conditions of the region. The revenues received by the collection of the Tax need to be applied to improve water use and its quality. At the same time, portion of this value should be used in the amortization of investment and exploration cost as well as to cover the services of administration and management.

The RBMP is elaborated to prevail on periods of six years and during three cycles, in total 18 years. 2015 represents the final year of the first cycle, being a year of evaluation of what was done until now. The application of the Programme of Measures was affected by financial restrictions felt in Portugal, because of this, the targets defined for the first cycle could be bellow expected. This way it's fundamental to understand in which way the funds received by the WRT are enough to execute the base measures. Until 2013, it was expected to implement 89 measures of the total 186, however only 47 measures were applied, this meaning 53% of what was programmed.

The present work has as objective to present the results of the dissertation that analysed the compliance of the measures defined within the scope of the WFD and in which extension the WRT covers the costs of measures application.

## **2. Framework**

### **2.1. Water Framework Directive**

The European Commission decided to create a new water policy with the intention to depollute water bodies and to ensure a good quality state through monitoring. The Water Framework Directive (WFD) 2000/60/EC was then drafted and transposed into national law by the Water Law (decree-law nº 58/2005) having as objective to ensure a “good” state or good potential of the water bodies until 2015, using the Programme of Measures of the RBMP.

According to the European Commission the main objectives in consideration are the protection of aquatic ecology, protect unique and value habitats, secure drinkable water resources as well as the bath waters. The last 3 objectives referred are only applied in some water bodies. This entity advocate that

one requirement of the WFD is that the Environment should be protected at the higher level and in its whole. (European Commission 2015)

The WFD defines a plan of community action regarding the water policy, considering water not as a commercial product but as patrimony that should be preserved and treated as one. So, an objective of the WFD is the creation of a framework to the protection for surface, transitional, coastal and underground water, considering the next objectives:

- Avoid a continuous degradation of the aquatic ecosystems, promoting its protection and improving of quality, as well as the terrestrial and wetlands directly depending on this ecosystems;
- Promote a sustainable water consumption think about water resources protection available on the long run;
- Consider a reinforcement of the protection and improvement of aquatic environment through measures of gradual reduction of discharges, emissions and loss of priority substances. Consider as well the termination or elimination of discharges, emissions and loss of priority substances by phases;
- Ensure a gradual reduction of underground water pollution and avoid the decline of its state;
- Contribute for the mitigation of the consequences of floods and droughts, supporting surface and underground water supply in good quality, to reduce the pollution of underground water. To protect sea and territorial water making sure that international agreements are complied;

(Article 1 of DL nº 58/2005)

## **2.2. Water Resources financial and economic regime**

Economic valorisation of the water is useful for the creation of policies in different areas, for instance, evaluate the efficiency for the development and distribution of water resources, taking in consideration the value of water used and who are those consumers. Water value should be affected by the activities that influence its quality. (United Nations 2011)

Each member state should ensure that the true price of water is applied, this means that should be considered the value of abstraction and distribution of drinkable water as well as the collection and treatment of waste water. (European Commission 2015) This regime applies the internalization of the cost associated to the activities that may harm the quality and quantity of drinking water, allowing cost recovery of the public services with an advantage for the users and the cost of the water services, including scarcity costs.

To motivate the consumers to use the water resources efficiently a tax is applied on the water price. Its value should take in consideration social, environmental and economic effects of cost recovery and also geographic and climatic characteristics of the area.

The water resources tax (WRT) has two main points of incidence, the first is the private use of public domain goods, considering the amount of public good used and its economic value; the second, are the activities that have the possibility of have a negative impact on the quality and quantity of water. The

activities considered are the discharge, directly or indirectly, of effluents on water resources; the extraction of inert materials of the State public hydro domain as well as the occupation of lands or water plans that are part of public domain.

According to the Article 79 of the DL nº 58/2005 the revenues retrieved by the WRT are applied on financing actions of improvement of water use, quality of water resources and water state and associated ecosystems to cover the amortization costs of investment and exploration of infrastructures needed and at the same to ensure a good operation of the services of administration and management.

The computation of the WRT result from the sum of 5 components, given by the next equation:

$$Tax = A + E + I + O + U \quad (1)$$

The component A is related to private utilization of water in hydric public domain that belongs to the State. Its value is determined by the base value of volume ( $m^3$ ) that is abstracted, especially the volume that is deviated or used for hydroelectric or thermoelectric production, multiplying the value by the scarcity coefficient applicable.

The component E corresponds to taxation of the discharge, directly or indirectly, of effluents on the water resources and that may have a negative impact. Its value depends on the quantity of pollutants in the discharge (kg).

The third element of the equation, I, is related to the extraction of inert from the hydric public domain, using the volume ( $m^3$ ) as the base value of extracted inert. The component O is applied when there is occupation of the hydric public domain, considering as well the creation of water plans. Its value depends on the occupied area ( $m^2$ ).

The last component, U, correspond to the private use of the water, independently of legal regime related to the public planning and management, and that can have a significant impact. The value is determined by applying the base value in volume ( $m^3$ ) that is abstracted, deviated or used for energy production.

From the value received, 50% it's destiny to water resource protection fund, 40% to the Hydrographic Region Administration (ARH) responsible by the region and 10% to the Water Institute.

### **3. Study Area**

#### **3.1. Hydrographic Region characterization**

The RBMP in study is a plan for the hydrographic region 4, more specifically the river basin of the rivers Vouga, Mondego and Lis and a total area of 11 477 km<sup>2</sup> cover 68 municipalities, 39 completely. The biggest river basin is the Mondego, followed by the Vouga and Lis.

The water needs of the urban systems include domestic use (food, personal hygiene and private gardens), public and industrial supply (building of public services, cleaning the streets and firefighting) and services. Nowadays, the needs of the urban supply system vary with the capitacion value (between 130 a 170 L/hab.day) for the study area and considering the population of 2008, the needs are areas

138.1 million litres per year, which means an average diary consumption of 378 321 m<sup>3</sup> (Mendonça & Cabral 2012)

Besides urban consumption there are other activities that cause pressure in the water resources, for instance, agriculture and cattle breeding and industrial activities. According to the Portuguese classification of economic activities (Instituto Nacional de Estatística 2007) the primary types of activities in the region are: retail and wholesale markets; construction; other activities of services and manufacturing industry.

The last one, although it's only 5.7% of the business volume, represent the activity with higher water consumption. Summing all the activities and their needs the total consumption of water on the hydrographic region is 506.9 million cubic meters. The higher consumer is the agriculture (56%) followed by the public supply system (25%). (Francisco 2012)

### 3.2. River Basin Management Plan of the Region 4

The region of study has 224 water bodies distributed between natural water, highly modified and artificial. In the Table 1 it's possible to verify that the rivers at a natural state that exist in a higher number.

*Table 1 - Number of water bodies at the river basin of Mondego, Vouga and Lis (Raposo et al. 2012)*

	Rivers	Reservoir	Transitional water	Coastal water	Total
Natural	191	0	6	5	<b>202</b>
Highly modified	7	8	4	0	<b>19</b>
Artificial	3	0	0	0	<b>3</b>
<b>Total</b>	<b>201</b>	<b>8</b>	<b>10</b>	<b>5</b>	<b>224</b>

With the WFD more importance was given to the monitoring of water bodies, being considered a fundamental requirement to accomplish the objectives and to make sure the measures and well applied. In the case of surface water should be analysed biological, physicochemical and hydromorfologic components. For the underground water should be monitored the groundwater level, conductivity and pollutants concentrations.

According to the Annex V of the WFD there are 3 types of monitoring network for surface water (Raposo et al. 2012):

- Monitoring – evaluate the state of water bodies and check the variations at a long term;
- Operational – determined which is the water body state with the possibility of not accomplish the environmental objectives and at the same time gather information about the consequences of the implementation of the programme of measures;
- Investigation – study anomaly situations for which are not given justification by the others types of monitoring;

In the same Annex two types of monitoring network for underground water bodies are defined:

- Chemical state – includes monitoring and operational types, previously referred;

- Quantitative state;

In addition to the networks referred, the DQA recommends the follow-up of the protected areas, like the ones that are related to human consumption, aquaculture and recreational activities. The Table 2 presents the number of stations of monitoring and the number water bodies included. Looking to the table it's possible to conclude that from the 205 water bodies only 35% are monitored, regarding the reservoirs where 6 in 10 are monitored.

Table 2 - Number of stations that belong to the monitoring and operational network and number of monitored water bodies (Agência Portuguesa do Ambiente 2015)

Monitoring network		Categories				
		Rivers	Rivers (reservoir)	Transitional water	Coastal water	Lakes (lagoons and affluent of lagoons)
Monitoring network	Monitoring stations	49	6	35	8	-
	Monitored water bodies (%)	37	5	10	5	-
Operational network	Monitoring stations	49	1	0	0	-
	Monitored water bodies (%)	34	1	0	0	-
<b>Total of water bodies</b>		<b>205</b>	<b>10</b>	<b>10</b>	<b>5</b>	<b>-</b>
<b>Monitored water bodies (%)</b>		<b>35</b>	<b>60</b>	<b>100</b>	<b>100</b>	<b>-</b>

### 3.3. State evaluation

Through the evaluation of the status of the water bodies is possible to classify the water bodies based in the ecologic status and this way determine the quantity of water bodies already conform to environmental objectives defined by the WFD, in other words, if they present a status equal or higher than "Good".

Coastal water already accomplished the objective for all water bodies (40% are in an "excellent" state and 60% are "good". Regarding the rivers, 70% are already "good" but 25.1% of this category are yet to get there. The percentage of each state can be consulted at the Figure 1. The situation of the transitional water is the most concerning once 50% of those are in a mediocre state, revealing the need to invest to change the situation. The main reason for the water bodies to be below the threshold defined is the existence of biologic elements and a physicochemical parameter, BOD5 (Biochemical oxygen deficiency) (Raposo et al. 2012)

Based on the classification of the measures it was defined that until 2015 none of the water bodies should be below the mediocre level, until 2021 they all should be above "acceptable" and at 2027 none below "good".

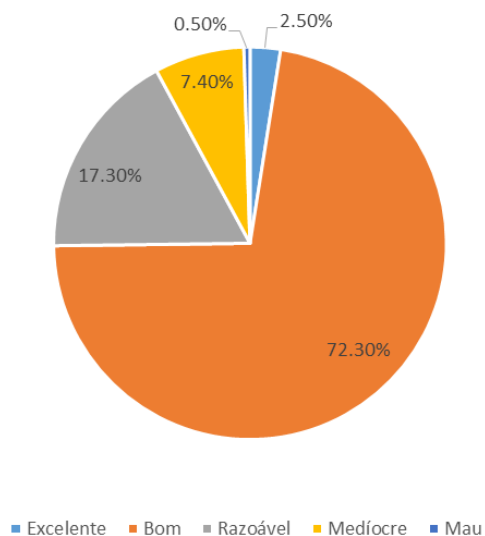


Figure 1 - Ecologic status of the water bodies. Percentage of water bodies by class of quality (Raposo et al. 2012)

### 3.4. Financial Programme

According to the evaluation done by the RBMP, the 47.6 million of cubic meters of water for irrigation were not enough to recover the costs of the supply system since it didn't consider the amortization cost of public investment. The WRT charged to agriculture it's not enough to cover the administrative costs of monitoring actions. At the same time, the lower the price, higher the consumption. (Mendonça & Cabral 2012)

The economic sector that has the higher contribution for the WRT is the industry with 39.4% and 43.7% in 2009 and 2010 respectively.

Between 2012 and 2014 there were revenues of 12 million euros from the WRT. Observing the Table 3 it's possible to conclude that this value is decreasing, maybe cause by an increase of behaviours with better water resources management. The non-paid value of WRT is also increasing.

Table 3 - Determined values and paid values of WRT for the period of 2012-2014 (Source: APA)

Year	Determined value	Paid value	Non-paid value	% non-paid value
2012	4 350 872.76	4 147 349.53	212 323.63	4.87
2013	4 152 453.31	3 887 698.44	268 603.14	6.46
2014	3 992 277.50	3 628 732.73	363 544.77	9.11

In preparation for the second cycle of RBMP was to create a document (Qsiga - significant questions for water management) that identifies the main questions and problems that can compromise the WFD's objectives. The Table 4 presents the number of measures implemented during the last 6 years.

Table 4 - Number of measures executed until the end of 2013 (Agência Portuguesa do Ambiente 2014)

Measure's types		N.º of measures	Budget (mil €)	N.º of measures planned until 2013	N.º of measures executed until 2013	% execution
Base	Structural interventions	58	258 172	33	24	73
	Application of the law	13	2 180	7	6	86
	Monitoring and studies	48	57 950	17	5	29
Supplementary	Structural intervention	29	443 402	11	4	36
	Application of the law	5	2 896	3	2	67
	Monitoring and studies	25	10 994	12	5	42
Adicional	Structural interventions	0	0	0	0	0
	Application of the law	2	69	1	1	100
	Monitoring and studies	4	3 069	3	0	0
Complementary	Structural intervention	1	240	1	0	0
	Application of the law	1	900	1	0	0
	Monitoring and studies	0	0	0	0	0
<b>Total</b>		<b>186</b>	<b>779 872</b>	<b>89</b>	<b>47</b>	<b>53</b>

From the 89 planned measures were only executed 47, this represents 53%, from which 61% were base measures, 43% supplementary, 25% additional and none of the complementary measures. The class with higher percentage of execution is the base measures with structural interventions and application of the law.

### 3.5. Methodology

As mentioned in chapter 2 the objective of the WRT is to finance actions of improvement and increase water use efficiency, to amortize investment and exploration costs of the infrastructures and to ensure a good function of administration and management services. This way is possible to evaluate how the charge value covers the costs. To be able to make some conclusions about the application of the revenues of the WRT and how it affects the compliance of the WFD this methodology was developed.

The first step is to analyse the Programme of Measures, the managing entities and how many measures each one is responsible for, also, the monetary value of each measure. It's evaluated the number of measures, the entity responsible by its execution and funds needed. Another aspect analysed is the entities responsible for the financing of the measures, this way it's possible to find out the total value of investment each entity has during the duration of the cycle.

Taking in consideration the funds from entities to apply the measures, like ARH that value comes from the WRT, the next step is to compare the number of measures realized until now and the ones that were



programmed to happen: if the value of WRT charged is enough to support the execution of measures and how can this problem be solved.

## **4. Results**

The Programme of Measures has 186 measures divided in four types: base, supplementary, complementary and additional. Each measure has a File that registry every information about it. At the first phase the measures are analysed that have ARH-C has only or partly, responsible, and 57 measures were identified, from which 30 are exclusively from ARH-C.

By analysing the Programme of Measures it was possible to observe that until 2015, or the end of the first cycle, there was the need to invest 11 381 thousand euros, approximately 11 M€ for the measures that ARH-C is considered a responsibly entity. It's possible to determine that the majority of the measures only need the initial investment. The total value until the end of the cycle is 10 million and 845 thousand euros.

At the second step the measures are evaluated that have ARH-C as the font of financial support. To make all of this measures happen 5 million euros during the first cycle are needed, from that 3 million have origin at the revenues of the ARH-C, could be from WRT, licenses and environmental reports publish.

From the 186 measures, 77 refer to the area of monitoring and studies. 48 are base measures, meaning that they are essential to accomplish the targets defined. The remaining measures are supplementary and additional, 25 and 4 respectively. From the 77 measures, 41 are under responsibility of the Portuguese Environmental Agency, through ARH-C or Water Institute.

In the period between 2009 and 2015 the investment needed of 35 155 000 euros, approximately 35 million euros, for the next cycle (2016-2027) it's needed 24 million euros. In total, APA has to invest 39 million euros.

## **5. Conclusion**

The first cycle of the RBMP occurs between 2009 and 2015, but in Portugal, the plans only started in 2012. Until the end of 2013, only 47 of the 89 planned measures were executed, one of the reasons for this could be the economic crisis in the country and since 2011 we were under supervision of Troika, causing restrictions and limitations on the application of funds into the Programme of Measures.

The water price applied today doesn't correspond to the real value of water price, this means that the consumers are paying less, once we should have in consideration the socioeconomic situation and the geographic location. This situation puts in jeopardy the sustainability of the system of water supply and drainage of waste water. The WRT has as main objective to motivate the consumers to efficiently use the water resources.

In the period of 2012 to 2014, APA had 12 million of euros of revenues from the WRT, through the years this value has been decreasing which could be a reflection of a more efficient use of water resources.

In the Programme of Measures 57 measures were identified that have ARH-C as project-execution agency, this measures need an investment of 11 million euros. The second phase of the project is to analyse the financial programme of the measures that have ARH-C has a funding source, being this value equally to 3 million coming from the WRT and other public revenues. The monitoring network is essential to ensure a good state of the water bodies although from the 205 existent rivers only 35% are controlled. Of the total of 186 measures, 77 are actions of monitoring and studies, of those, 41 are under the responsibility of APA through ARH-C or the water institute. For the duration of the 3 cycles (2009-2027), the Portuguese Environmental Agency has to invest 39 million euros to ensure that the measures are executed.

Stressing that the revenues from the WRT, between 2012 and 2014, are around 12 M€ and analysing the cost of investment for ARH-C for the period of 2009 to 2015 is about 3 M€, this means that there was a possibility to execute all the measures planned. In the long-term, assuming that the revenues of the WRT stay constant, the execution of monitoring measures and its investment could be in jeopardy since 39 million euros are needed to invest until 2027. Besides this portion we have to consider the other type of measures, increasing this way the total amount of money that have to be invested, this value could be superior to the revenues, questioning the viability of the Programme. It's important to refer that the previous values only consider the investment cost, disregarding the maintenance cost and others as well as the future socioeconomic scenario.

## References

- Agência Portuguesa do Ambiente, 2015. *Plano Nacional da Água*,
- Agência Portuguesa do Ambiente, 2014. *Questões significativas da gestão da água (Qsiga) - Região hidrográfica do Vouga, Mondego e Lis*,
- Assembleia da República, 2005. *Decreto-Lei nº58/2005 - Lei da Água*,
- European Commission, 2015. Introduction to the new EU Water Framework Directive - Environment - European Commission. Available at: [http://ec.europa.eu/environment/water/water-framework/info/intro\\_en.htm](http://ec.europa.eu/environment/water/water-framework/info/intro_en.htm) [Accessed July 13, 2015].
- Francisco, M.D., 2012. *Plano de Gestão das Bacias Hidrográficas dos rios Vouga, Mondego e Lis Integradas na Região Hidrográfica 4 - Caracterização Socioeconómica*,
- Instituto Nacional de Estatística, 2007. *Classificação Portuguesa das actividades económicas Rev. 3*,
- Mendonça, A. & Cabral, N., 2012. *Plano de Gestão das Bacias Hidrográficas dos rios Vouga, Mondego e Lis Integradas na Região Hidrográfica 4 - Análise Económica das Utilizações de Água*,
- Raposo, C., Matos, J.S. & António, M., 2012. *Plano de gestão das bacias hidrográficas dos rios Vouga, Mondego e Lis integradas na região hidrográfica 4 - Relatório síntese*,
- United Nations, 2015. *United Nations World Water Development Report 2015: Water for a Sustainable World*,
- United Nations, D. of E. and S.A., 2011. *SEEA-Water System of Environmental-Economic Accounting for Water*,

