



Monitoring and Evaluation of the River Basin Management Plans in Portugal: A Contribution to the Definition of a Model from the Case of River Ave.

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Abstract: In the actual context, after the publication of Water Framework Directive, the River Basin Management Plans (RBMP) stands out as recent and innovator instrument in the water management. Of the competences to elaboration, accompaniment, approbation, execution and supervision of this management instrument, the intervention of various entities in the process is detached. The degree and the reach of intervention of each entity in this process it is clearly definite: The Institute of water supervises the execution and checks the fulfilment of deadlines of the elaboration and review by Administrations of Hydrographic Regions; the National Water Council and the Hydrographic Region Councils accompany and emit the respective opinions before approval. The River Basin Management Plans are planning instruments of water that, aiming the management, the protection and the environmental, social and economic valorisation of waters (in the watershed), understand and establish programs of measures of base and measures additional. The programs of measures are adapted the characteristics of the basin, the impact of human activity the status of surface water and groundwater and are justified by economic analysis of the uses of water and by cost-benefit analysis of conditionings and restrictions impose these utilizations. For the execution of the proposals actions in RBMPs is important develop methodologies that may accompany, monitor and assess the planned measures. This paper want exhibit an applied matrix for the river Ave, for contribute in the development of a model valid for others hydrographics regions of Portugal.

Key words: river basin management plans; program of measures; water resources management.

1. INTRODUCTION

The River Basin Management Plans (RBMPs) are planning instruments that provide an integrated approach to the management of water resources. The RBMPs are establishes by Water Framework Directive (WFD) 2000/60/CE (UE, 2000), the main instrument to conduct and to orient the politic of water in the European Union.

The RBMPs are instruments of the planning of water, which establish: 1. Characterization of the surface water and groundwater; 2. The identification of pressures and description of significant impacts of human activity on the status of surface water and groundwater; 3. The geographical location of protected areas; 4. The identification of the monitoring networks; 5. The programs of measures and actions planned for the achievement of environmental objectives; and others aspects.

RBMPs require careful monitoring and evaluation of the outcomes of environmental policies and programs under implementation. This involves gathering observations and measurements that help to assess what happened and what impacts (positive or negative) resulted from application of measures interventions. However, the monitoring and evaluation the RBMPs aren't mentioned in this WFD and in others laws, such as Portuguese water law (n° 58/2005). This issue is complicated, because the implementation the program of measures needs the evaluation and monitoring, otherwise, we do not know what is being done and what results are being generated by these activities.

Monitoring is critical for environmental management. Environmental management decisions are dependent on monitoring; the same holds for reporting for legal purposes and reporting the environmental performance (Verschoor and Reijnders, 2001).

Without proper data stewardship, the data capture programs should be underexploited and undervalued. A systematic approach to designing the program monitoring to evaluate the program of measures of the RBMPs contributes to making the program effective and efficient.

In addition, environmental management decisions are dependent on monitoring. In this context, it is important to monitor for promote more adequate water use and better protection of water quality and associated ecosystems.

This paper describes a tool developed, a matrix, to evaluate and monitor the program of measures of the RBMP to river Ave. This paper principally considers river basin planning and the management of water resources. Nevertheless, the discussion is also relevant to the definition of a model valid for others hydrographics regions of Portugal.

2. FRAMEWORK

2.1 Legal supports

In Portugal, with the need for to ensure an integrated water management, was created, in 1994, the decree law n° 45. This law has as objective to regulate planning process of the water resources and the elaboration and approbation of the river basin plans. Portugal made 15 river basin plans in the year 2000. However, in the same year the European parliament and the council established a framework for community action in the field of water policy.

The Water Framework Directive (WFD) 2000/60/CE, was adopted in 2000, and it establishes a new regulatory framework for the management of water bodies throughout the European Union. This directive is a main instrument for to conduct and to orient the politic of water in the European Union. The Directive introduces new principles, and a more holistic approach to water quality comprising both ecological and chemical status (Collins et al., 2012). The directive institutionalizes ecosystem-based objectives and planning processes at the level of the hydrographic basin as the basics for water resource management. This directive adopts the river basin as unit basic of water management and too determines the creation of hydrographic region.

For Portugal the Water Framework Directive represents a challenge and an opportunity for the modernization of the systems of water resources management. This directive was implemented to the internal entitlement by Portuguese water law n° 58/2005 (the previous was the 1919). This new law aims at providing the means for the sustainable management and protection of the water resources to be undertaken by regional water management authorities with assigned territories designed around river basins. This law of water made a revision about all legislation of water management in Portugal, and establish a new institutional framework of water management.

One of the innovative aspects is the creation of the River Basin Management Plans (RBMPs), which establish program of measures to improve the status of water bodies. These RBMPs identifying and assessing the pressures on the aquatic environment, and outlining a program of measures that will be implemented to ensure the compliance with the Directive, are to be drawn up every 6 years (Kallis and Butler, 2001). The content of the RBMPs is establishes by ordinance n° 1284/2009, provided in water law.

The monitoring and evaluation the RBMPs plays an integral part in its success. According to (Collins et al., 2012), the need for integration of monitoring using ecological elements, the use of risk in the design of monitoring programs, the collection of monitoring data to inform decision making and the active engagement with stakeholders are highlighted as some of the challenges of the water framework directive. What to Portugal provides new insight into how to manage the issue of water resources.

2.2 The river basin management plans and the program of measures of river Ave

Through the water law n° 58/2005, were created for Portugal 10 hydrographic region, which comprise the watershed of the river Minho and Lima (RH1); Cávado, Ave and Leca (RH2), Douro (RH3); Vouga, Mondego and Lis (RH4), Tejo (RH5), Sado and Mira (RH6); Guadiana (RH7); streams of Algarve (RH8), Açores (RH9) and Madeira (RH10). The hydrographic regions of Lima and Minho, Douro, Tejo and Guadiana are members of international watersheds shared with the Kingdom of Spain.

The watershed of river Ave, object of our study, is inserted in RH2 (Cávado, Ave e Leça). This hydrographic region is bounded by the Spanish territory in the east, the Atlantic Ocean to the west, the hydrographic region of the North Lima and Minho and Douro hydrographic region to the south (RBMP, 2012). The sub-basin Ave, which is part of this study, has 1391 Km² and a population density of 488 hab./Km², encompassing 19 counties. The main water line in this sub-basin is the river Ave, which rises in the Serra Cabrera and travels 101Km to the estuary at Vila do Conde (RBMP, 2012).

The RBMPs are plans that too establish program of measures to improve the status of water bodies. The program of measures was prepared according to WFD, Portuguese water law and with the ordinance n° 1284/2009. The elaboration of RBMP of the hydrographic region 2 was determined by the order n° 18203/2009. Programs must include measures already set out in the different directives (urban wastewater treatment, integrated pollution prevention and control, nitrates from agriculture, etc.) and additional measures like voluntary agreements or best environmental practices guidelines.

The measures were categorized in according with the legal framework:

- Based measures (B-type measures) – these category present minimum requirements to fulfil the environmental objectives, in accordance with law.
- Supplementary measures (S-type measures) – aims to ensure greater protective or a water additional progress when necessary.
- Additional measures (A-type measures) – correspond to measures that are applied to water bodies that are probable to achieve the environmental objectives.
- Complementary measures (C-type measures) – has the objectives of the prevention and protection with the risk of flood, droughts and several accident rupture of hydraulic infrastructures.

The strategic objectives were created with helps the integrated analysis of various planning tools (national plans and program significant for the water resources). These objectives are represented in seven different thematic areas, which are: AT1 (water quality), AT2 (water quantity), AT3 (risk management and valuation of hydric domain); AT4 (regulatory and institutional framework); AT5 (economic and financial framework); AT6 (monitoring, investigation and knowledge) and AT7 (communication and governance).

The measures were framed too in 16 operational programs: ReduzirTop (reduction of topic contamination); ReduzirDif (reduction of diffuse pollution); Restaurar (hydromorphological requalification); Protagua (protection of the water bodies); Valener (energetic valorization); Monitorar (monitoring of the water bodies and control of emissions); Proteger (conditioning use in perimeter protection); Prevenir (prevention or reduction of the impact of accidental pollution, risk flood, drought and the rupture of hydraulic infrastructures); Valoragua (efficient use and cost recovery); Capacitar (training and administrative actions, economic and fiscal); Conservar (protection and valorization of water); Sensibilizar (elaboration and implementation of codes of practice and education projects); Reabilitar (projects of rehabilitation); Aquifero (artificial recharge of aquifers); Inovecer (projects of study, development and showing); Aferir (definition of new criteria of classification of water bodies, review of permits, establishment of standards);

In the RBMP hydrographic region 2, the watershed of the river Ave has 95 measures, divided as the table 1 below:

Table 1. Typology of measures for the river basin Ave.

Type of measures	Number of measures
Based	60
Supplementary	30
Additional	04
Complementary	01

3. MONITORING AND EVALUATION

Monitoring and evaluation is a significant component of development programs and projects. It ensures the most effective and efficient use of resources and assists in determining the success or failure of a program or a project (Khalifa, 2012).

The planning and management of water resources require adequate knowledge of the status of water bodies and the pressures to which they are subject. The monitoring must support of management of water resources and the sustainable development in watershed basin.

Monitoring may be defined as the process of repetitive observation for defined purposes such as establishing financial or materials flows to a prearranged schedule over space and time (Verschoor and Reijnders, 2000).

There is a broad consensus that monitoring programs should be integrated across disciplines ("multi-sectorial"), should be rigorous and standardized, should incorporate quality assurance principles, and should themselves be critically assessed at regular intervals (Lane, 1997).

New approaches to monitoring are linked more closely with research, by ensuring that they provide suitable data for environmental models, and with policy requirements, by providing information on patterns in environmental quality.

Monitoring is critical for environmental management, for developing the environmental strategy, managing the environmental program and for setting the targets and controlling whether the targets are met.

The monitoring program should be integrated across disciplines, incorporate policy and the legislation, standardized, incorporate quality assurance principles, and themselves be critically assessed at regular intervals.

Implementation of the ecosystem approach to water resource management requires development of general ecosystem goals, specific ecosystem objectives and indicators to guide decisions (Clark et al., 2010). According to the authors, the ecosystem goals are broad management goals that articulate the long-term vision for the ecosystem, usually indicating those problems that should be corrected and how aquatic resources should be utilized on a sustainable basis. It is important that the creating of monitoring programs should consider an ecosystem approach and consider the interaction of both human and nonhuman components of the ecosystem and necessitates a long-term view of the ecosystem. Clark et al. (2010), propose a systematic, sequential, eight steps, ecosystem-based process to ensure that monitoring programs will indeed provide information critical to making informed decisions regarding management of aquatic ecosystems.

Further challenges arise when policies are developed as a collaborative effort among multiple actors (Hermans et al., 2012). Considering that a major challenge in plan-based control is how to make sure that the actions in the plan are executed correctly and reliably (Bouguerra et al., 2008). It is important to develop methodologies that may accompany, monitor and assess the planned measures. A tool easy and that may help in the monitoring and evaluation is the development of a matrix.

4. PROPOSAL OF A MATRIX

The matrix method is primarily a planning device, which defines project inputs, outputs and the intermediate and higher objectives in measurable or objectively verifiable terms. Targets are

established which permit subsequent measurement or verification of achievement of the defined outputs and objective.

Studies have developed matrixes for evaluation and monitoring in various areas of knowledge. Sousa et al. (2011) developed a simplified matrix of environmental impacts. The matrix is used to determine the relevance of environmental risks through the classification of mining activities according to the likelihood that they may cause environmental impacts.

The program of measures are complex and diverse, thus their measures should be analyzed to a better management. The matrix developed in this paper helps in the evaluation and monitoring of the program of measures developed to river Ave. The matrix was developed as a tool that could be presented directly to the public.

For the development of matrix we used the technical report of RBMPs (RH2), which is valid until the year de 2015 (RBMP, 2012). We also used the Annex IV of this report, which deals specifically the program of measures. The annex IV presents the details of each measure established, as well as its status of execution and programming material and financial.

Was made a matrix, who shown a final analysis of the implementation of the measures. The analysis contemplates measures, the estimated time for its execution, the thematic area, its fulfilment on some requirements and its execution state.

To analyse the fulfilment of the measures evaluated, this was divided in four topics. These topics seek to frame the measures according to planning, investment, deployment and operation. That is, we analyse how the measures are being met at each step management. For each topic (planning, investment, implementation and operation), we adopted the following analyses: "as expected", "with a slight delay", "outside the intended", "not started" and "not applicable".

For analysis your execution state we adopt the same evaluations that had in the technical report of RBMP RH2: "in execution/executed", "approved", "in analysis", "not apply". The developed matrix is showed in the annex 1.

In a general analysis it is observed that most measures, specifically 78,95%, are yet in status "in analysis". While 14,74% of the measures are "in execution" or "executed" and only 6,32% of the measures were "approved". For these data we can see that more than half of the measures are in analysis. With that, maybe, is not possible to show improvement in water quality until the year 2015. Maybe some improvement is showed because of the measures in execution, but we believe not achieve the final aim until this date.

The based measures present the minimum requirements to fulfil the environmental objectives, in accordance with law. The most measures are of this category, totalling 60 measures. This type of measure should present most measures in execution or executed, or even approved. However, 81,7% of the based measures is still in analysis and only 13,3% of them were executed.

The figure 1 below shows the status of fulfilment of the measures established. The fulfilment is related to how the activities of planning, investment, implantation and operation are, in accordance with de Annex IV of the technical report of RBMP RH2.

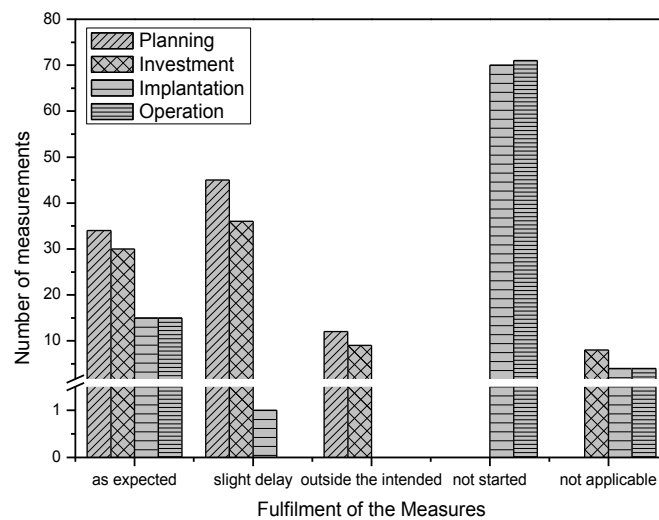


Figure 1. State of fulfilment of the measures in its different phases.

Through the Figure 1, we can see that the planning and investment fulfilment is with “slight delay” and “as expected”, in the implementation of the measures. Note that the deployment and operation are presented, mostly, as “not started”, while a small portion is “as expected” in the report. Thus it appears that most measures are still not approved because many of these proposals are still being analyzed. This fact may contribute too many of the measures will not meet the schedule, resulting in the delay of your goals.

Some measures have their deadlines established until 2027. The establishment of this term does not enter in accordance with the WFD and Water Law, which establish good ecological and chemical status of waters until 2015. Most measures are not yet approved (proposals under consideration). Many of the measures adopted or under consideration do not comply with the timetable.

The program of measures was established with the help of the method used in the diagnostic, in the technical report. This method worked with the analysis of Strengths, Weaknesses, opportunities and threat (SWOT), for each thematic area (RBMP, 2012). This analyse was an important tool for the definition of the program of measures. Others tools and analysis were also used, which made possible the development of the program of measures. Thus, we note that the program of measures established sought an analysis consistent with the needs of the river basin Ave.

However, some measures that have already been executed appear not to be evaluated in the technical report. And some measures that are still in execution, does not have any evaluation yet. The evaluation, even that the measure has already been executed, is important, because it creates subsidies for learning, whose reflections can be observed in the quality of management.

Other aspects, such as training to managers, technicians and administrative entities responsible for their implementation, help to improve the knowledge and consequently the operational measures and communication.

The great and maybe the greatest difficulty is the lack of information on water resources. There is insufficient data of the quality and quantity of surface and groundwater and mainly ecological quality. For this reason most of the measures consist in the development of studies and projects. It is important to note that the vast amount of information generated in an information system of water resources requires the use of a process of collection, processing, storage and availability. This will allow making them useful to decision-making.

The strengthening awareness and public participation in water resource management is another important factor that is also presented in the WFD. The preparation, review and updating of management plans, has three forms of participation: information, consultation and active involvement. These actions should also be designed in a perspective of adopting preventive policies, which is fundamental to the involvement of populations. Actions of this type may that

allow many situations of degradation are avoided by the adoption of new behaviors, resulting from the awareness and participation.

The Implementation of the RBMPs requires an integrated promotion, monitoring and evaluation, supported by indicators, to attribute greater objectivity and consistency to the planning process. Although the WFD does not explicitly require an environmental management system (EMS), the water framework directive master plan recognizes the benefits of incorporating the ISO 14001 standard and the fact that the WFD itself effectively embodies all of the features of the classic Plan-Do-Check-Act cycle (Earle and Blacklocke, 2007).

Given the complex and rapid evolution of the issues associated, the water resources management also implies the need to increase knowledge to find answers to news problems, through the use of new methodologies and technologies. Thus, it is possible to incorporate the knowledge gained from this matrix developed to contribute on development of a model that allows its monitoring and evaluation. This model should incorporate the integration of other areas of knowledge, business management, environmental, financial and others, to achieve better performance.

5. CONCLUSIONS

The matrix demonstrated to be a convenient tool for analysing and monitoring a dataset extensive and complex, as was the case of the program of measures analyzed in this paper. Other aspects can be addressed, such as the existence of the need for simplification of data for the valorization of certain criteria.

In relation the program of measures, most measures are not yet approved (proposals under analysis). Many of the measures adopted or under analysis do not comply with the timetable and therefore probably will not achieve good chemical and ecological status of water bodies until the year 2015. However, it is also proposed for some measures the years 2016 and 2027 to reach goals.

The matrix was a tool that allowed evaluating the status of the proposed measures, as well as a general evaluation. The final process of decision would be more simplified, since the available matrix meets the criteria and provides a way of evaluation. However, monitoring and evaluation of the plan requires an integrated monitoring. In past decades, monitoring programs were often designed with a focus on short-term human activities and immediate environmental concerns, but with rather little guidance towards providing information upon which to base long-term water-management decisions (Clark et al., 2010). This sense, the development of a model that helps in monitoring and evaluation of RBMPs long term is necessary.

With this paper, we created subsidies for the posterior development of a model that enable the creation of scenarios to manage the RBMP, from the river basin Ave. Thus, assist in making decisions regarding the management of water resources, describing its changes spatial and temporal implementation of the program of measures.

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ANNEX 1

The annex 1, shows the matrix developed for the RBMP watershed of river Ave. The analyzes, as previously mentioned, exhibit some classifications. These classifications (or topics of classification) seek to frame the measures according to planning, investment, deployment, operation and your execution state, as seen through the tables below.

Table 2. Execution state of the measure, used in the matrix.

Execution State of the measures	
A	in execution/executed
B	approved
C	in analysis
D	not apply

Table 3. Evaluation of the fulfilment of the measures, used in the matrix.

Fulfilment of the measures	
A	as expected
B	slight delay
C	outside the intended
D	not started
E	not applicable

Annex 1: Matrix developed for the program of measures of the river basin Ave.

Program of measures	Estimated time		Thematic area	Fulfilment				Execution state
	Start	End		Planning	Investment	Implantation	Operation	
Definition of classification criteres for the ecological potencial water bodies of rivers heavily modified and artificial water bodies.	2012	2012	AT1	B	*	D	D	C
Definition of processes and creation of instruments for monitoring the system of water resources use.	2012	2013	AT5	B	B	D	D	C
Program for energy valuation of rivers - VALENER - Implementation of small hydroelectric utilizations of Ruivães, of the Azenhas Espinheira, Poldras, Soberposta, Soutelo and of Sta. Cruz do Bispo.	2012	2012	AT5	C	**	D	D	C
Analysis of the impact of the rate of water resources in the improvement and management of water resources	2013	2015	AT5	A	A	B	D	C
Implementation of the recommendation ERSAR n. ° 2/2010 concerning the criteria for the formation of tariffs applicable to end users of public water supply and sanitation	2013	2013	AT5	A	A	D	D	C
Introduction of new technologies, particularly through the use of specific tools to support monitoring, loss minimization and cost reduction	2016	2027	AT5	A	A	D	D	C
Establish systems for monitoring the implementation of HRT specific to the agricultural sector	2013	2013	AT5	A	A	D	D	C
Definition of methodologies for assessing environmental costs and the scarcity associated with the use of irrigation water	2013	2013	AT5	B	C	D	D	C
Articulation of manuals of good practice with the PNUEA	2007	2013	AT1; AT2; AT4; AT5	A	A	A	A	A
Reduction of water losses in transmission and distribution systems of water, among others, the system suburbanos and sectors of agriculture and industry	2016	2021	AT2; AT5	A	A	D	D	C
Program restoration of the natural state of rivers - RESTORE (Rivers Este, Pele, Pelhe, Ave)	2012	2016	AT1	B	B	D	D	C
Collecting information along the body of water in accordance with the methods set by the WFD for checking the status of the water body	2012	2012	AT6	B	B	D	D	C
Detailed survey of pressures	2012	2012	AT6	C	C	D	D	C
Reconstitution of riparian gallery Vizela the river banks	2010	2010	AT1	A	A	A	A	A
Program restoration of Rivers State - restore - River Veiga and Trofa	2012	2015	AT1	B	B	D	D	C
Program restoration of the natural state of rivers - RESTORE (River Póvoa)	2013	2015	AT1	A	A	D	D	C
Development of beach profiles and implementing a review process in accordance with the periodicity established by Law, Decree-Law 135/2009, of June 3	2012	2014	AT1; AT3; AT6	B	B	D	D	C
Surveillance monitoring of implementation of codes of good practice in the agricultural sector and golf for control of diffuse pollution	2012	2015	AT1; AT4	B	B	D	D	C
Study review of coefficients scarcity to adopt in the calculation of rates of water resources	2012	2012	AT5	C	C	D	D	C
Advancing environmental infrastructure for wastewater treatment and effluent wine	2012	2015	AT1	A	A	D	D	B
Promotion of measures of agro-environmental character	2012	2015	AT1	A	A	D	D	B

Program of measures	Estimated time		Thematic area	Fulfilment				Execution state
	Start	End		Planning	Investment	Implantation	Operation	
Control of invasive species in selected habitats - Ave	2012	2027	AT1	B	B	D	D	C
Strengthening the monitoring program of inland surface waters	2012	2027	AT6	B	B	D	D	C
Operationalization of the monitoring networks of coastal and transitional waters	2012	2027	AT6	B	B	D	D	C
Monitoring of the implementation of the Programme of Action for Vulnerable Zone Esposende-Vila do Conde and evaluation of its effectiveness	2012	2015	AT1; AT4	B	B	D	D	C
Strategic areas of protection and groundwater recharge	2012	2013	AT1	B	E	D	D	C
Definition of codes of good practice guides and technical guidance	2012	2013	AT1	A	A	A	A	A
Reformulation of piezometric monitoring network and quality of groundwater bodies	2012	2012	AT1; AT2; AT6	C	B	D	D	C
Revaluation of quality thresholds for bodies of groundwater occur where enrichments of certain natural substances	2013	2014	AT1; AT6	A	A	D	D	C
Delineation and classification of protected areas for aquaculture	2012	2012	AT1; AT4	C	*	D	D	C
Protection of groundwater abstraction	2012	2012	AT1; AT2; AT4	C	E	D	D	C
Protection of surface water abstractions	2012	2012	AT1; AT2; AT4	C	C	D	D	C
Update the mapping of sensitive áreas	2012	2012	AT1; AT4; AT6	C	C	E	E	C
Definition of processes and creation of instruments for monitoring the scheme Exercise Activity Livestock (REAP).	2012	2013	AT1; AT4	B	E	E	E	C
Supervision and review of the conditions of the industries discharge	2012	2015	AT1	B	B	D	D	C
Prohibition of direct discharges of pollutants into groundwater	2013	2021	AT1	A	E	D	D	C
Definition of processes and creation of instruments for monitoring the Regime of Exercise Activity Industrial (REAI)	2012	2013	AT1; AT4	B	E	E	E	C
Implementation of an ecological flow regime for the dam Eral / Guilhofrei	2012	2015	AT2; AT3	A	*	D	D	B
Program of ecological restoration of rivers heavily modified in the downstream of AH	2012	2016	AT1; AT4	B	B	D	D	C
Program restoration of the natural state of rivers - restaurar (river Ave)	2014	2016	AT1	A	A	D	D	C
Definition and implementation of an ecological flow regime for the AH of the watershed Ave	2012	2015	AT1; AT2	B	*	D	D	C
Monitoring of ecological flow regime in the AH of river Ave	2012	2016	AT1; AT2; AT6	B	B	D	D	C
Implementation of the Management Plan of the Eel in the watershed Ave	2013	2015	AT1	A	A	D	D	C
Improved connectivity fluvial / estuarine	2012	2013	AT1	B	B	D	D	C
Constructions to control inflows improper drainage networks of waste water and to the river system - Ave	2016	2020	AT1	A	A	D	D	C

Program of measures	Estimated time		Thematic area	Fulfilment				Execution state
	Start	End		Planning	Investment	Implantation	Operation	
Improving the management of technical systems and / or rehabilitation of treatment plants	2012	2015	AT1; AT4	B	B	D	D	C
Implementation of programs for self-control and reinforcement the supervision of wastewater discharges of the treatment plants	2012	2015	AT1; AT4	B	B	D	D	C
Licensing of discharges from wastewater treatment facilities that are not yet licensed	2012	2015	AT1;AT4	B	B	D	D	C
Control and reduction of urban pollution topical - interventions in sanitation systems Waters of the Northwest in the watershed of Ave	2009	2015	AT1	A	A	A	A	A
Control and reduction of urban pollution topical - interventions in sanitation systems of the Barcelo's water in the watershed of Ave	2009	2015	AT1	A	A	A	A	A
Control and reduction of urban pollution topical - interventions in sanitation systems of the INDAQUA Vila do Conde in the watershed of Ave	2010	2014	AT1	A	A	A	A	A
Control and reduction of urban pollution topical - interventions in sanitation systems of the AGERE in the watershed of Ave	2009	2013	AT1	A	A	A	A	A
Construction / improvement the level of treatment of sewage plant wastewater of the Waters of the Northwest, under Directive treatment of urban waste water in the watershed of Ave	2010	2011	AT1	A	A	A	A	A
Studies inflows undue of urban drainage and hydrographic network and if necessary the control of the same	2012	2015	AT1	B	B	D	D	C
Operationalizing warning system against accidental pollution incidents, including contamination of bathing waters	2012	2015	AT3; AT4	B	B	D	D	C
Evaluation of potential sources of risk of accidental pollution and supervision the preparation of safety reports and emergency plans and their implementation	2012	2015	AT3; AT6	B	B	D	D	C
Review of POOC Caminha-Espinho	2011	2013	AT1; AT3; AT4; AT6; AT7	A	A	A	A	A
Reclassification of the type of water bodies AveWB2 and AveWB3	2012	2013	AT3; AT4; AT6	B	E	D	D	C
Electronic governance	2012	2013	AT4; AT7	C	C	D	D	C
Monitoring of compliance of the RBMP	2012	2015	AT4; AT6	B	B	D	D	C
Training, modernization and innovation institutional and administrative	2011	2012	AT4; AT6	C	C	D	D	C
National Information System and Monitoring of Coastal	2008	2012	AT4; AT6	A	A	A	A	A
Organization and updated information on public water resources - definition of the public domain water	2012	2015	AT3; AT4	C	C	D	D	C
Preparation and updating of manuals of good practice	2007	2013	AT1; AT4; AT6; AT7	A	A	A	A	A
Promoting technical publications on good practices for the uses and activities sustainable coastal	2012	2027	AT7	B	E	E	E	C
Program for river conservation and nature reserve - CONSERVAR - river Ave, river Homem	2012	2012	AT3	C	C	D	D	C
Rehabilitation of river Pisão and reconstitution of the riparian gallery of the river Sanguinhedo, both integrated into the body of water "Rio Sanguinhedo"	2009	2009	AT1; AT3	A	A	A	A	A

Program of measures	Estimated time		Thematic area	Fulfilment				Execution state
	Start	End		Planning	Investment	Implantation	Operation	
Definition of a five-year plan for dredging and subsequent monitoring - Ave	2012	2027	AT1; AT6	B	B	D	D	C
Evaluation of the tendency piezometric	2012	2015	AT2	B	B	D	D	C
Licensing for use of groundwater resources	2011	2015	AT2	A	E	A	A	A
Regularization, renaturation and ordering of river Este between Av Frei Bartolomeu dos Martires and Bridge Pedrinha	2012	2012	AT3	B	B	D	D	B
Study and characterization of water consumption of the industries most significant	2013	2013	AT5	A	A	A	A	C
Development of a guide of technical guidance for artificial recharge of aquifers	2012	2013	AT2; AT6	B	B	D	D	C
Control, including a requirement for authorization of artificial recharge on groundwater bodies, industries and farmers	2013	2021	AT2; AT6	A	E	D	D	C
Conduct awareness raising and information to main users / responsible for the water sector	2012	2015	AT2; AT7	B	B	D	D	C
Dynamisation of support services and advice to farmers	2012	2015	AT1; AT4; AT5; AT7	B	B	D	D	B
Environmental education and training	2012	2014	AT7	B	B	D	D	C
Preparation of documents and realization of training courses and technical support to main users / responsible for the water sector, including municipalities, industries and farmers	2012	2015	AT2; AT7	B	B	D	D	C
Monitoring the use of chemical and organic fertilizers available free of charge of an application "Assistant of Good Practice of Fertilization"	2012	2015	AT1; AT6	A	A	A	A	B
Evaluation of relations groundwater / surface water and dependent ecosystems	2012	2014	AT1; AT2; AT6	B	B	D	D	C
Evaluation study of environmental flows	2010	2010	AT6	A	A	A	A	A
Modernization of Laboratory Water of ARH North, I.P.	2012	2014	AT1; AT6	B	B	D	D	C
Baseline study for setting ecological flows.	2013	2014	AT6	A	A	D	D	C
Periodic bathymetric survey of the beds of ponds	2012	x	AT6	B	B	D	D	C
Classification of dams and implementation of emergency plans	2012	2013	AT3	B	E	D	D	C
Improved knowledge of the hydrogeological groundwater bodies	2012	2015	AT6	B	B	D	D	C
Reevaluation of the criteria of issuing TURH according to the characteristics and state of the receiver	2015	2015	AT1; AT2; AT5	A	A	D	D	C
Integrated Study of Water Quality of the watershed of Ave	2012	2013	AT1; AT6	B	B	D	D	C
Implementation of the recommendations resulting from the investigation of unknown causes at less than good status	2016	2021	AT1	A	A	D	D	C
Review of criteria for the classification of fishing waters	2012	2012	AT1	B	*	D	D	C
Compliance with Directive on Flood Risk	2012	2015	AT3	B	B	D	D	C

*cost to be determined by management entities.

