GOBIERNO DE ESPAÑA
MINISTERIO DE AGRICULTURA, ALIMENTACIÓN Y MEDIO AMBIENTE
CONFEDERACIÓN HIDROGRÁFICA DEL TAJO

AGÊNCIA PORTUGUESA DO AMBIENTE

Preparatory Action on development of prevention activities to halt desertification in Europe

Desertification 2012-2013

Report No 2

(2nd Quarterly report)

(01/05/2014- 30/09/2014)

PROTAGUS

PILOT PROJECT ON WATER BALANCES IN THE TAGUS RIVER BASIN

1. General Information

- Name of beneficiary of grant agreement: **EVREN, S.A.**
- Official legal form: **Evaluación de Recursos Naturales, S.A.**
- Official registration **No: A-46449112**
- Official address: **Conde Altea 1, 46005 Valencia**
- Name and title of the Project Coordinator: **Ana Nieto, Administrator**
- Name of partners in the pilot initiative:
    1. **Confederación Hidrográfica del Tajo (Tagus River Basin Authority). Miguel Antolín**
    2. **Agência Portuguesa do Ambiente (Portuguese Agency of the Environment – APAMBIENTE-). Manuela Matos**
- Name of observers to the pilot initiative:
    3. **United Nations Office to Support the International Decade for Action "Water for life" 2005-2015**
    4. **Sub-Directorate on Planning and Sustainable Use of Water (Spanish Ministry of Agriculture, Food and Environment)**
    5. **Júcar River Basin Authority**
- Title of the pilot initiative: **Pilot Project on Water Balances in the Tagus River Basin (PROTAGUS)**
- Grant agreement number: **07.0329/2013/671306/SUB/ENV.C.1**
- Start date and end date of the *reporting period*: 01/05/2014- 30/09/2014
- Target countries: **Tagus International River Basin, Spain and Portugal.**

2. Activities undertaken and problems encountered

This chapter provides an overview of activities carried out in the reporting period, including a brief description and an assessment of their status. The activities correspond those listed in the application and hence in the grant agreement. Furthermore, problems encountered or foreseen that have or will impact each activity (and maybe a related deliverable) are listed in this chapter, along with the proposed solution. It consists of two tables, namely Table 1 and Table 2 as presented below.

Table 1. Status of the planned Activities, period: 01/05/2014- 30/09/2014*, PROTAGUS*

Title	Brief description of activity undertaken within the reporting period	Partners/Stakeholders involved	Status[1] (C, P, NS)
Task 1) Establishment of the context and background	a. Identification of main water related issues in the Tagus River Basin. b. Assessment of desertification/water scarcity aspects. c. Summary of climate change scenarios and previsions. d. Assessment of specific measures in the Draft River Basin Management Plan and water economic aspects, taking into account also the possible preliminary works of 2015 RBMPs.	EVREN Tagus RBA APAMBIENTE	C
Task 2) Data gathering process	a. Assessment of available data for the basin (Spanish and Portuguese side). b. Identification of data gaps. c. Establishment of approach for determining scales (selection of management scale, criteria for data available at different scales). d. Fill-in of gaps through statistical analysis and other model simulations.	EVREN Tagus RBA APAMBIENTE	P[2]
Task 3) Build-up of water accounts	a. Improvement of data repository. b. Share of knowledge on water balances and SEEAW with CHT and Portuguese officials. c. Development/completion of tables. d. Reinforce and develop previous experience: share results with the Júcar River Basin Authority (where these actions have already been implemented), transmit possible improvements for their tables, exchange of ideas to improve exercise.	EVREN Tagus RBA APAMBIENTE	P[3]

[1] C=Completed, P=In Progress, NS=not started (for results already achieved reference may be made to previous reports).
[2] See **Annex 1** for a detailed status of Task 2.
[3] See **Annex 2** for a detailed status of Task 3.

	e. Assessment of socio-economic aspects. f. Propose targets and make recommendations on: water savings potentials, water reuse, "green measures", etc. where possible.		
Task 4) Training, dissemination and meetings	a. Participation in coordination meetings and workshops (coordinated by the EC). b. Use of existing platforms and tools to disseminate results (e-bulletins, webs, international events). c. Organisation of events: 1 technical meeting with the Tagus RB and Portuguese officials, 1 scientific dialogue, 1 participative workshop (with interested stakeholders from the basin).	EVREN Tagus RBA APAMBIENTE	P

Table 2. Problems encountered or foreseen and suggested solution, period: 01/05/2014-30/09/2014*, PROTAGUS*

Problem <u>encountered</u> or foreseen:	The first problem encountered with the pilot initiative has been the one related to the role of APAMBIENTE. Due to the internal reorganisation of the entity (and within the Tagus River Authority or ARH do Tejo), and to the limited human resources available at the entity to provide data or participate in meetings, the Portuguese partner has suggested to drop off from the project.
Activity and/or Deliverable affected:	Task 2) Data gathering process
Planned/suggested solution:	The first solution has been to propose the Portuguese colleagues to act more as observers and supervisors of the work to develop, as EVREN offered to do all the data gathering from available public sources. In addition, the President of the Spanish Tagus RBA, the COM and MAGRAMA have been in contact with the APAMBIENTE to try to solve this problem and facilitate a dialogue that would find a solution.

Problem encountered or <u>foreseen</u>:	Data robustness depending on source and no recorded data for all parameters needed to develop water accounts.
Activity and/or Deliverable affected:	Task 2) Data gathering process
Planned/suggested solution:	EVREN has dealt with these problems in a previous developed project (i.e. HALT-JÚCAR-DES), and was able to successfully implement the action. The proposed solution is to manage the most reliable data (in agreement with the Tagus River Basin Authorities). In addition, and when needed, the team will take into account aggregated data or models (e.g. simulation model for natural regime).

Problem encountered or <u>foreseen</u>:	Selecting the appropriate scale and matching of the political-administrative and natural boundaries of the RBD.
Activity and/or Deliverable affected:	Task 3) Build-up of water accounts

Planned/suggested solution:	EVREN has dealt with these problems in a previous developed project (i.e. HALT-JÚCAR-DES), and was able to successfully implement the action. The proposed solution is to use the "Water Management System" (management unit, union of sub-catchments) in the Spanish area of the basin and look for a similar solution in the Portuguese basin area. In addition, adjustments and estimations will be made in agreement with the Tagus River Basin Authorities indications. The methodology will be described in detailed when developing the water accounts.

Problem encountered or foreseen:	Unbalanced water assets final state regarding the heterogeneity of hydrological data.
Activity and/or Deliverable affected:	Task 3) Build-up of water accounts
Planned/suggested solution:	Differences between distributed modelized variables (precipitation 'P', evapotranspiration 'ET') and gauge data, may cause mismatching inputs and outputs of water balances. The SIMPA model used to estimate rainfall, evapotranspiration and its derivates, underestimates runoff on upper river catchments areas. Consequently, once stated every return and abstraction, a coefficient could be applied to the model data in order to close balancing accounts.

Problem encountered or foreseen:	Unavailable river network evaporation assessment
Activity and/or Deliverable affected:	Task 3) Build-up of water accounts
Planned/suggested solution:	Evaporimeters from dams are used to interpolate evaporation rates in the whole Tagus Basin Inverse Distance Weighted technique is the method defined to calculate the evaporation rates between evaporimeters location. Evaporation raster is then applied to the significant river network surface , thus obtaining the total evaporated volume.

Problem encountered or foreseen:	Estimation of river's initial state and other surface and volume related variables.
Activity and/or Deliverable affected:	Task 3) Build-up of water accounts
Planned/suggested solution:	Despite the high level of uncertainty involved, surface and volume of water bodies is estimated after having adopted representative width and river levels by sampling several locations for each ecotype category of water bodies described in the RBMP . Identically, gauges where flow levels are available are used to define the average water surface elevation of waterways.

Problem encountered or foreseen:	Discontinuity of EHRIN snow-water resources monitoring program data
Activity and/or Deliverable affected:	Task 3) Build-up of water accounts
Planned/suggested solution:	The great extension of nival basins, recommends considering the inclusion of snow resources analysis. Snow contribution data to runnof is not available in EHRIN until 2009-10 year. An approximate ratio of now contribution of 6-7% of total precipitation is adopted from the ASTER model description.

Problem encountered or foreseen:	Unpublished scientific data regarding groundwater-river interaction
Activity and/or Deliverable affected:	Task 3) Build-up of water accounts
Planned/suggested solution:	Groundwater discharge volumes to rivers and reverse flow to groundwater have been specified in a specific interactions IGME report called 'Activity 4, scientific assistance for groundwater protection and sustainability , which identifies gaining/losing behaviour of river reaches. This working document provided by River Basin Authority (CHT), includes detailed quantitative information of each groundwater management unit.

Problem encountered or foreseen:	Abstraction and returns of urban supply are not disaggregated between activities.
Activity and/or Deliverable affected:	2.2.b Production of tables for 2000-2010
Planned/suggested solution:	Therefore, it may be difficult to distinguish connected/unconnected industrial water supply origins, thus affecting returns. The RBMP define an economic analysis method for socio-economic processing of National Statistics Institute (INE) data in order to disaggregate each activity figures.

Problem encountered or foreseen:	High distortion in Jarama, Guadarrama and Henares subbasin regimes is caused by Complexity of Madrid's water supply system.
Activity and/or Deliverable affected:	2.2.b Production of tables for 2000-2010
Planned/suggested solution:	The unbalanced water asset accounts of these subbasins hide complex interactions. The water supplier in Madrid region (Canal de Isabel II) continue to extend its influence over near water management systems (WMS) as Alberche, thus increasing transferences, storages and magnitude of shared flows between systems. Regarding this complexity, any disaggregation of 'Canal de Isabel II' supplier allocations may facilitate the closure of water accounts.

Problem encountered or foreseen:	Only average values of urban supply are provided
Activity and/or Deliverable affected:	2.2.b Production of tables for 2000-2010
Planned/suggested solution:	Analysis of annual population and industrial production rates are required to define the evolution of water consumption throughout the period (2000-2010). INE provides municipal scale information that could be processed at water management system scale.

3. Deliverables

This chapter provides a comprehensive overview of the specific outputs of the project in the reporting period in terms of deliverables (reports, databases, models, conferences, meetings, leaflets, newsletters, etc.). The progress in terms of deliverables is presented in the form of Table 3, below. The table provides an overview of all project deliverables (even those not started yet), specifying which ones have been completed and which ones are in progress, and the activities undertaken in relation to those deliverables. It highlights potential problems that may have occurred or other constraints, to enable timely corrective actions. The Deliverables correspond to the ones listed in the application and hence in the grant agreement.

Table 3. Deliverables, period: 01/05/2014- 30/09/2014*, PROTAGUS*

Deliverable	Name of Deliverable	Status[4] (C, P, NS)	Brief description of the activities implemented in relation to the Deliverable	Problems, Constraints, Comments
1	2nd Quarterly Report **(SQR)**	*C*	This report will include similar information as FQR, but will focus on the processes used to gather data and build the water balances. It will be developed after completing **Task 2 and 3**.	*No major problems were encountered.*
2	Recommendations & Assessment Report **(RAR)**	*NS*	The report will focus on proposed measures for water management optimization and facing desertification. **It will be made as annex of the final report.**	-
3	Working Meetings Minutes	*P*	This deliverable should be a combination of the minutes of all coordination and working team meetings and other relevant events. As well as relevant documents (representing the results of **Task 4**). Included in this **2nd Quarterly Report as Annex 3.**	*No major problems were encountered.*
4	International sessions for results and measures dissemination	*NS*	This deliverable will represent the compilation of dissemination activities in international events (representing results of **Task 4**)	-
5	Report on WEB-site section	*NS*	This will be made as an annex of the final report (representing the results of **Task 4**)	-
6	Final Report **(FR)**	*NS*	This report will compile the results of the project and conclusions of meetings and discussions.	-

[4] C=Completed, P=In Progress, NS=not started (for results already achieved reference may be made to previous reports).

4. Meetings

This chapter provides an overview of the meetings that took place in the reporting period, including a brief description of their purpose. It consists of one table, namely Table 4 as presented below.

Table 4 Meetings, 01/05/2014- 30/09/2014*, PROTAGUS*

Meeting name	Purpose of the meeting	Partners/Stakeholders involved	Location	Dates
Coordination meeting	Discuss existing problem with the Portuguese partner	COM, EVREN	Brussels	20/05/2014
1st National meeting SCAE International sessions	Provide a meeting in which all pilot initiatives are presented and views are exchanged with the COM	All pilot initiatives, COM, MAGRAMA	Madrid	11/06/2014
Mid-term meeting PROTAGUS	Assessment available data and Problem encountered. Agree with partners the roles and future steps and activities	EVREN, CHT	Madrid	11/06/2014
Internal working team	Update to the new technical team and coordination	EVREN	Valencia	01/07/2014
II Mid-term meeting PROTAGUS	Assessment available data and Problem encountered.	EVREN, CHT	Madrid	30/09/2014

5. Other issues

Due to the problem with the APA, we have not signed the internal grant agreement yet.

6. Updated Work Plan

This chapter provides an updated outlook of the work plan regarding the whole period of implementation.

Table 5. Work plan, 01/05/2014- 30/09/2014*, PROTAGUS*

PLANNED DURATION OF THE ACTION												
TIMETABLE FOR EACH STAGE OF THE ACTION SHOWING MAIN DATES AND EXPECTED RESULTS FOR EACH STAGE												
Duration: 12 months,	**2014**											
Activity / Task	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**
Task 1: Establishment of background and context												
Analysis of the current situation, identification of stakeholders, projects planning, establishment of schedule and objectives, first contacts, etc.												
Task 2: Data gathering process												
Data gathering and analysis, identification of gaps, scales and approach assessment												
Task 3: Build-up of Water Accounts and Recommendations & Assessment Report (RAR)												
Build-up of water accounts, water balances, water savings proposal, SQR & RAR drafting												
Task 4: Training, Dissemination, Deliverables and Meetings	**KOM**		IWM		IWM	IS	IWM		**MTM**		IS	**FM**
Meetings*	**CM**				**CM**	**MTM**			**CM**			
Main Reports** (summary notes, brochure, minutes and web-site report not reflected)				**FQR**				**SQR**			**RAR**	**FR**

KOM: Kick-Off Meeting & MTM: Mid Term Meeting
FM: Final Meeting.
IWM: Internal working team meeting (including technicians from EVREN, and experts from the collaborating entities). 3-4 meetings have been envisioned; two in the first months to establish the background, the objectives and define schedules and works distribution, and one or two towards the end to complete works and reports.
CM: Coordination Meetings (number to be confirmed by DG ENV, but 3 have been considered. It is expected that experts from EVREN, and representatives from the two collaborators - Tagus RBAs- will participate in these meetings).
IS: International sessions. Possible international events in which dissemination of the project could take place.

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FQR: First quarterly report
SQR: Second quarterly report
RAR: Recommendations Assessment Report
FR: Final report

7. Annexes

1	Detailed works on Task 2. Data harvesting
2	Detailed works on Task 3. Methodology report
3	Meeting documents

Annex 1. Detailed works on Task 2. Data harvesting

Annex 1 Data harvesting

With the start of the project we began to investigate the sources of information necessary to accomplish the objectives of filling the SEEA-Water tables.

Firstly, we searched for public sources of data in repositories from Spain, Portugal and Europe.

Furthermore, we requested our partners the data for which we suspect they could have a better or more complete version than the public available sources (in annex 6 there is a copy of the communication request). Up to date, we have not received any data (we expect these will come soon).

The harvesting was done in two main phases. We made an initial search of information systems in February 2014. After this initial search, we tried again on May 2014 focusing on the lack of information. After these two phases we still have gaps of information mainly in the Portuguese area of the Tagus basin. The Portuguese government is doing organisational changes and information that was previously available is no longer in current portals.

SPAIN

- *CONFEDERACIÓN HIDROGRÁFICA DEL TAJO (CHT)*

We have requested data not easily available to the public. Mainly raw data that the CHT has used to develop the River Basin Management Plan, including the Decission Support Systems Model of Aquatool software, which database includes complete and RBMP updated information about the RBD: topology, infrastructure, main abstraction and return elements, including their spatial origin of resources and destination which is useful regarding the SEEAW table configuration. However, as certain data is averaged for the planification period, some trend analysis and extrapolation is needed.

- *CEDEX*

From the Annual gauge station report site we collected information of flows in rivers and channels, and capacity in reservoirs. Although continuity of series is remarkably good, several reservoir and gauge series need to be filled.

- *MINISTRY OF AGRICULTURE, FOOD AND ENVIRONMENT*

From the Integrated Information System of Water (Sistema Integrado de Información del Agua - SIA) of the Ministry of Agriculture, Food and Environment (Ministerio de Agricultura, Alimentación y Medio Ambiente - MAGRAMA) we extracted information on hydrological data (SIMPA model of CEDEX) with monthly rasters of 1km of cell size of the variables *Potential Evapotranspiration, Actual Evapotranspiration, Precipitation, Temperature, Soil Humidity, Surface Runoff, Infiltration, Groundwater Runoff and Total Runoff*.

Furthermore, we extracted water related data, and administrative delimitations including geographical coverages for:

- Regions
- Basin districts
- Urban areas
- Sub-basins
- Waste water treatment plants
- Delimitation of lakes
- Groundwater bodies
- Surface water bodies
- Dams
- Rivers
- Water Management Systems (WMS) (Sistemas de Explotación)

In this website, there are several additional datasets and coverages but we do not intend to use them for the time being.

➢ *ERHIN*

From the public data released, there is no option to use nival resources information to adopt appropriate accounts of flows from snow to the other resources, due to the lack of reports until 2010. Nonetheless, there are some documents that describe the approximate amount of water released from nival basins between 6 and 7% of total rainfall for the Spanish Tagus RBD.

➢ *INE*

In the Statistical National Institute (Instituto Nacional de Estadística - INE) web site, we found the socio-economical data. The main problem is the different used scale between this information (by municipalities or region) and the areas in which we need to aggregate the water balances (WMS). In the case of municipal information, information is rather simple to sum up. The problem comes when the intersections of the regions with the WMS are very different. In these cases, we will overlap the information extracting an estimation of the relevant quantities.

PORTUGAL

➢ *AGÊNCIA PORTUGUESA DO AMBIENTE*

APAmbiente has several sites of Environmental Information, but they are still in development, or do not provide useful information. Others sites referred inside of APAmbiente do not provide the actual information, only citing the indicator but not offering the data.

➢ *Sistema Nacional de Informaçao de Recusos Hídricos*

In the Sistema Nacional de Informaçao de Recusos Hídricos we accessed the hydrologic information in the Portuguese side of the Tagus basin. Some series are interrupted at 2008, and others at 2012/13 due to budgetary cuts. Some of them restart on 2014, but not all.

The information in this web site is time series of daily and monthly data of the following variables (not all stations have all the variables, and not all stations have completed temporal series, or daily or monthly information): Temperature, Precipitation, Wind velocity, Air humidity, Solar radiation, Cloudy level, Evapotranspiration, Gauge stations (flow and level in reservoirs), Piezometer level, Water quality (surface and groundwater).

➢ *Instituto Nacional de Estadística*

We collected economical and social data from the INE. This information includes demographical, agriculture, forestry, water uses, water treatment, etc., at various scales, usually at municipal scale. These data are usually aggregated temporally and spatially. We will need to disaggregate them to process and filling in data tables.

SOME ADDITIONAL CONSULTED WEBSITES THAT ARE NOT USEFUL

The following web sites have been consulted but have not provided useful information:

- Portal de Metadatos. No results obtained to queries.
- Portal Indicadores de Desenvolvimento Sustentável. The page shows the list of indicators but no data related to them.
- Visor de informacion Ambiental. It has no information related to water accounts.
- Portal da Água. It redirects the user to other National and Regional information systems. In the Regionals systems there is only information of the Azores archipelago.

EUROPE

➢ *European Environment Agency and WISE*

Urban Waste Water Treatment, from the EEA's waterbase, includes the official data sent by Member States and we understand are the most curated data we can obtain. It is easier to obtain some data from the collected repositories from the EC than from the Member States, and the Urban Waste Water Treatment data section is an example, as for instance for Non-point source pollutants (e.g. nitrates in agriculture).

➢ *Eurostat*

We do not intend to use Eurostat as main data repository. We will just use it in case of the necessity of contrasting information from the Spanish INE or Portuguese INE.

➢ Other Sources

We plan to consult other sources (as technical studies or university research reports) when we will be checking the validity of results. We do not want to start tasks being already

influenced by other elaborated research studies. We are sure at this point, that we will have to consult, for instance, Urban Runoff studies of pollutants.

- SOME FORESEEN PROBLEMS

From the previous edition of this annex, there have been some improvements on this aspect. For some variables, we expected not to find information unless it will come from models or studies: disaggregated abstractions and returns from the Aquatool model were able to support further analysis; groundwater flows were finally considered from the estimated values of the IGME aquifers inventory.

Interactions between river and aquifers represent the most challenging objective. Hardly could the flow between these elements be considered only from the net balance of SIMPA discharge and runoff, but without further sources from hydrogeological survey, its value represents the most reliable approach to its behaviour (at basin scale).

Outflows to the sea and some outflows to other territories -maybe in the same RBD- are highly dependent on the location of the station (some could be estimated by some upstream gauge station if no additional significant human intervention or major changes in aquifer-river interaction are registered within the reach).

Uncertainties comprise other unregistered flows: abstractions for own use both from surface or groundwater (only abstraction from the largest wells are metered); flows between economic units (especially when the same company has the whole abstraction, supply, sewerage, waste water reuse and discharge).

To date, the main source of uncertainty is the Portuguese lack of positive response about missing data. Several communications have been sent looking forward to hearing from the responsible organisms without sucess.

Annex 2. Detailed works on Task 3. Methodology report

Annex 2 Methodology report

Once reasonably completed the first stage of data harvesting, starts the main task of building the water accounts. Divided into the same chapters of the SEEAW manual, procedure comprises the consecution of the following subtasks, necessary to accomplish the objectives of filling the SEEA-Water tables.

a. Improvement of data repository.
b. Development of methodology for operating data and its treatment regarding the resources involved and the origin/destination of their fluxes.
c. Closure of balances analysis and its uncertainty.
d. Coherence between water, economical and hybrid accounts.
e. Assessment of socio-economic aspects.
f. Propose targets and make recommendations on: water savings potentials, water reuse, “green measures”, etc. where possible.

The main objective of the first two subtasks is developed through the following methodological summaries, whose content extends the data transferences, the hypothesis considered and each study variable calculations:

1. Hydrological variables
   - 1.1 Obtainment of SIMPA distributed hydrological model water cycle components.
   - 1.2 Reservoir evaporation
   - 1.3 Rivers evaporation
   - 1.4 Snow contribution to input resources
   - 1.5 Water bodies output to the sea
   - 1.6 Flux between storages
   - 1.7 Initial state estimation
   - 1.8 Other losses
2. Abstractions and returns
   - 2.1 Abstractions and returns of irrigated agriculture
   - 2.2 Extractions and returns of water supply
   - 2.3 Abstractions and returns of industry and refrigeration
   - 2.4 Other abstractions and returns
3. Transferences

At the end of each summary, a water table accounts example is included in order to facilitate the understanding of method's results.

1. Hydrological variables

1.1 Variable analysis with hydrological distributed model 'SIMPA'

SIMPA is the reference hydrological tool used to simulate water cycle and assess water resources at basin scale in Spain. Defined as a distributed model it is thought to operate at monthly time scale. On its water resources assessment module, it considers a schematic water cycle that distinguishes the main components of the water cycle.

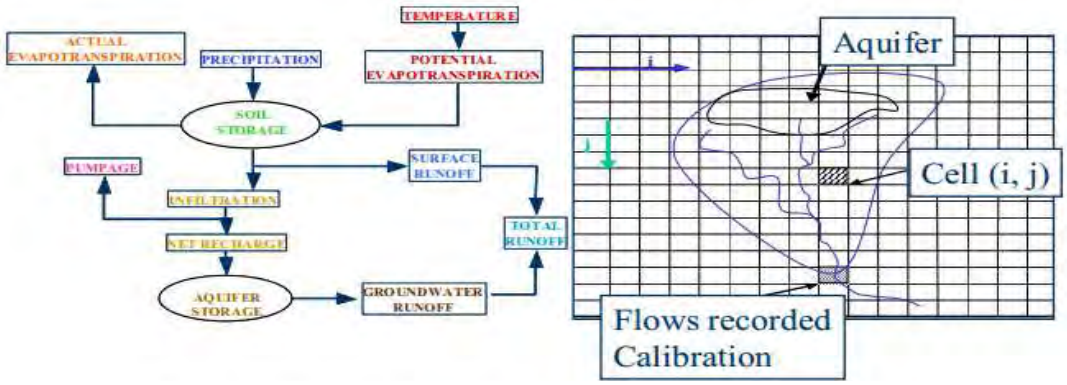


Figure 1 – Variables and flows simulated in the monthly model.

The interannual water balance model applies a unique water balance equation to the rainfall and the potential evapotranspiration in order to estimate actual evapotranspiration and runoff for the mean annual period. The annual water balance model applies the same simplified balance equation in a yearly step.

Modules are structured in a similar way:

1. Rainfall, temperature and water abstractions are evaluated by means of an inverse distance interpolation technique. The interpolation is applied to the data or to residuals after an estimation of mean patterns in the considered time step.

2. Potential evapotranspiration is estimated by means of experimental methodologies as Thornthwaite's or Hargreaves' and monthly regression coefficients can be applied to adapt it to other physically based methodologies. Actual evapotranspiration and runoff are estimated in the interannual and annual modules using Turc-Pike or Budyko equations.

   The monthly continuous model allows the estimation of the actual evapotranspiration, recharge, groundwater discharge, surface runoff and total runoff, and soil and aquifer water storage using Témez equations.

The last variables are involved in the construction of tables of the 6th chapter: water assets accounts. In fact they are used to define the initial estate, inputs and outputs as follows:

1. Rainfall is considered monthly for all the period between January of 2000 and December of 2010. In order to facilitate the data and GIS treatment, the zonal spatial analysis let us determine average values of SIMPA precipitation rasters for each month and subbasin.

   These values are assigned to the land, reservoirs and water bodies surfaces, thus obtaining the total amount of water received as input in Hm3. From the general land surface volume of precipitation, the other reservoir, rivers and snow values are subtracted.

2. Actual evapotranspiration defines the total amount of water lost from vegetated surfaces. Consequently, it cannot be applied to water surfaces as rivers and reservoirs, what in fact leads us to evaluate that evaporation by other separate formulas for the mentioned rivers and reservoirs. In any case, the values evapotranspirated from soil are noticeably larger.

3. Runoff variables imply the introduction of interaction between resources of the VI.1 table. That is the case of runoff, groundwater discharge and infiltration. Runoff determines the flow from the soil to the rivers, groundwater discharge the one from groundwater to rivers. Thirdly, infiltration proceeds to transfer flows from soil to groundwater. Identically, the flow from groundwater to rivers introduced as input in the column of river resources (1313) is inversely introduced as output in the column of groundwater (132).

4. Lastly, the initial state of soil water content is extracted from SIMPA values of this variable at the start of the considered period of study.

The raster maps have been processed at Water Management System scale in order to appropriately represent subbasins differences:

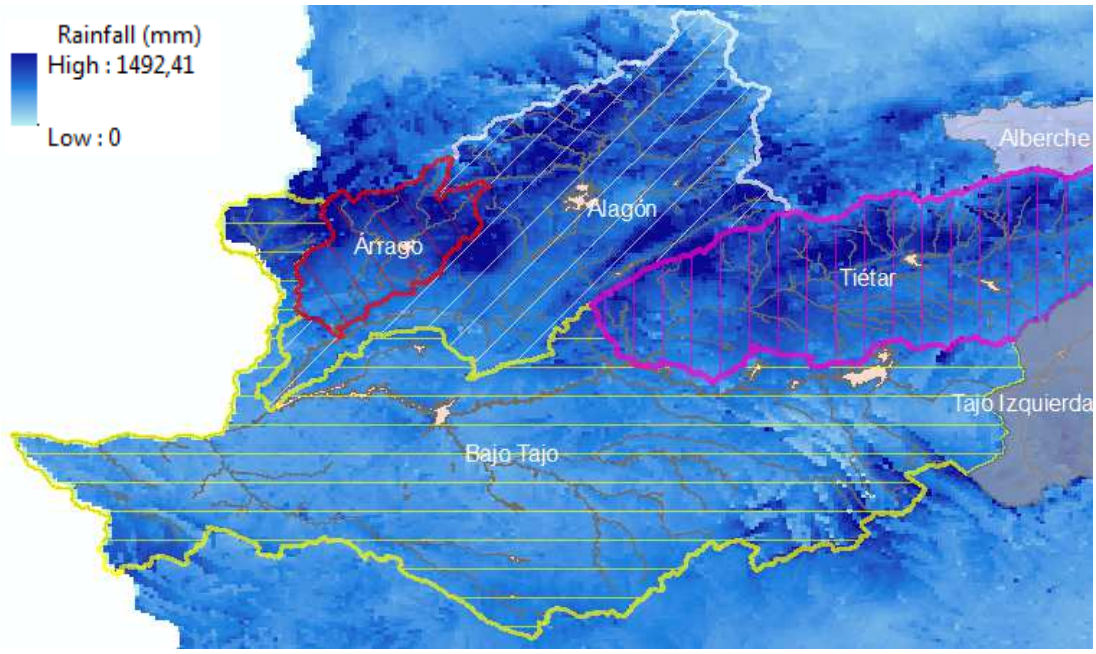


Figure 2 – SIMPA's raster processing of rainfall in subbasins.

An example of the VI.1 tables is shown below, where the cells have been filled in regarding the procedure mentioned before.

Basin		Tabla VI.1 Water asset accounts						
Total	Tajo Español		Element					
hm^3		Variable	1311 Reservoir	1313 Rivers	1314 Snow,	132 Groundwater	133 Soil	Total
Opening Stock	1 Initial state	StateInitial					2 678.52	2 678.52
Increase in Stock	2 Returns							
	3 Precipitation	Precipitation	630.58	74.21			31 979.61	32 684.39
	4a Upstream input							
	4b Other resources input			8 769.93		1 843.47		10 613.41
		FromArtificialReservoirs						
		FromRivers						
		FromGW		2 031.28				2 031.28
		FromSoilWater		6 738.66		1 843.47		8 582.13
Decrease in Stock	5 Abstractions							
	6 Evapotranspiration	Evapotranspiration					24 727.82	-24 727.82
	7a Output Downstream							
	7b Output To the Sea	ToSeaTotal						
	7c Output other resources					2 031.28	8 582.13	-10 613.41
		ToArtificialReservoirs						
		ToRivers				2 031.28	6 738.66	-8 769.93
		ToGW					1 843.47	-1 843.47
	8 Other Loses	OtherLosses						
Final state	Final state	Total	630.58	8 844.14		-187.80	1 348.18	10 635.10

Table 1 – Filling in example with SIMPA output.

1.2 Reservoir evaporation

There are significant losses of water resources through evaporation from reservoirs due to the extensive water sheets generated by large reservoirs, especially those of supply in the upper basin catchments or the ones focused on hydropower along the lower reaches of Tagus river.

The difficulties encountered with the availability of evaporimeters information involved the use of average evaporation figures included in water balances of 6th Annex of the River Basin Management Plan (see an example of these tables in Abstractions paragraph).

Unfortunately, the vast water sheet extension of some reservoirs as Buendía, or Entrepeñas implies that average values overestimates reality, as very rarely high levels have been reached in these reservoirs.

Evaporación	
Entrepeñas	40,49
Buendía	88,09
Bolarque	4,75
Zorita	0,58
Almoguera	2,20
Estremera	0,26
Valdajos	0,27
Embocador	0,07

Table 2 – Average evaporation volumes.

An example of the VI.1 tables is shown below, where the cells have been filled in regarding the procedure mentioned before.

WMS		Tabla VI.1 Water asset accounts						
Total	Spanish Tagus		Element					
hm^3		Variable	1311 Reservoir	1312 Lakes	1313 Rivers	132 Groundwater	133 Soil	Total
Opening Stock	1 Initial state	StateInitial						
Increase in Stock	2 Returns							
	3 Precipitation	Precipitation						
	4a Upstream input							
	4b Other resources input							
Decrease in Stock	5 Abstractions							
	6 Evapotranspiration	Evapotranspiration	433.71					-433.71
	7a Output Downstream							
	7b Output To the Sea	ToSeaTotal						
	7c Output other resources							
	8 Other Loses	OtherLosses						
Final state	Final state	Total	-433.71					-433.71

Table 3 – Filling in example of evaporation from reservoirs.

1.3 River evaporation

Although the total surface of all water bodies is not as massive as reservoir water sheets, the vast area of the Tagus river basin implies great river length that should not be neglected. Regarding that, losses of water bodies may be proportionate to the magnitude of river dimensions, width and depth in detail. Thus, a reliable classification of rivers is needed in order to sample the width and depth at the location of each type.

Having adopted the river classification of water bodies from the river basin management plan (RBMP) according to the WFD ecotypes characterization of water bodies, a simplified river network is obtained. There is length information available

for the 185 rivers considered under this criterion, so that sampling their width, the area is easily determined.

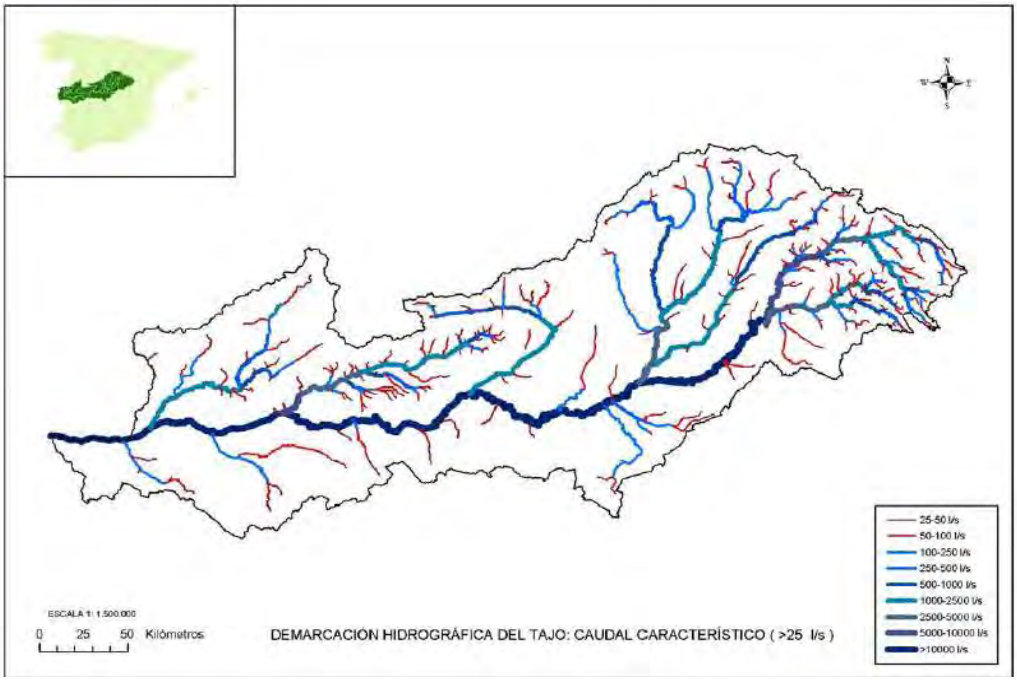


Figure 3 – River's hierarchy

Finally, an example of the VI.1 tables where the cells have been filled is shown below.

	Tajo Español	Element						
hm^3		Variable	1311 Reservoir	1312 Lakes	1313 Rivers	132 Groundwater	133 Soil	Total
Opening Stock	1 Initial state	StateInitial						
Increase in Stock	2 Returns							
	3 Precipitation	Precipitation						
	4a Upstream input							
	4b Other resources input							
Decrease in Stock	5 Abstractions							
	6 Evapotranspiration	Evapotranspiration			67.23			-67.23
	7a Output Downstream							
	7b Output To the Sea	ToSeaTotal						
	7c Output other resources							
	8 Other Loses	OtherLosses						
Final state	Final state	Total			-67.23			-67.23

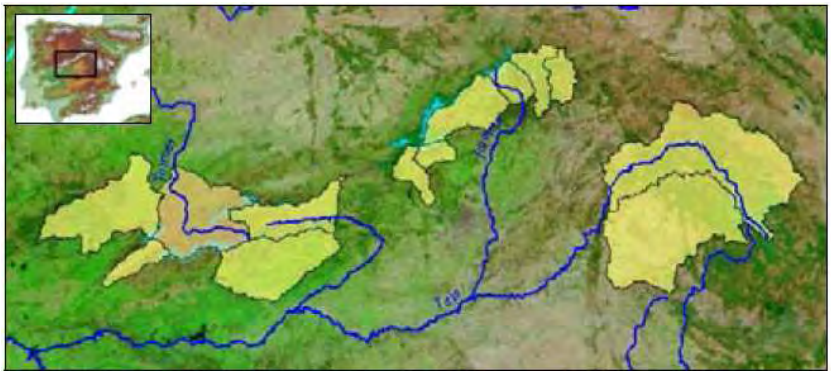
Table 4 – Filling in example of evaporation from rivers.

1.4 Snow contribution to water resources

The estimation of snow contribution in the Tagus basin is necessary due to the extensive nival basin domains (14939.5 km2, average altitude of 1102 meters above sea level). It is hardly influenced by altitude as well as by rainfall during winter.

For this reason, not only the highest ranges of Central Mountains (Tietar,Alberche,Jarama), but also the tabular reliefs of Iberian Mountains (Tagus catchments, with their vast extension over 1500m above sea level) comprise several areas where snow is determinant. It is especially during alternative cold-warm winter

spells when flash flooding from rainfall melts snow and notably varies the water storage location within the basin.



	Basin	Gauge station	Area (km2)	Altitude (m)
1	Alagón	E36 E. Gabriel y Galán	1.848,2	846
2	Jerte	E40 E. Jerte-Plasencia	370,0	1.071
3	Tiétar	E33 E. de Rosarito	1.743,2	759
4	Alberche	E17 E. de El Burguillo	1.052,7	1.355
5	Guadarrama	Ar19 Picotejo	355,9	1.044
6	Manzanares	E15 E. El Real	247,1	1.236
7	Lozoya	E14 E. de El Atazar	925,0	1.356
8	Jarama	E13 E. de El Vado	378,0	1.424
9	Sorbe	E11 E. Beleña	475,6	1.374
10	Bornova	E09 E. Alcorlo	362,3	1.228
11	Alto Tajo	E01 E. Entrepeñas	3.825,6	1.218
12	Guadiela	E03 E. Buendía	3.355,8	1.011
	TOTAL		14.939,5	

Figure 4, table 5 - Tagus river basin's nival catchments.

The ERHIN model reports include publication: 'El Programa ERHIN, datos sobre la nieve y los glaciares en las cordilleras españolas', where snow contribution is defined around 6 or 7 % of total rainfall for the Tagus river basin during the studied period.

Then, the procedure involves estimating specific rainfall in the Tagus nival basins, in order to include that 6-7% percent of snow in the corresponding 1314 snow-ice column of the water assets table.

Every of these basins have a reservoir gauge station to measure the volumes from snow, meaning that snow contribution column in the water assets accounts goes to the reservoir output row of the snow. Any other catchments without this control are not considered, while the implementation of SAIH programs tends to solve these gaps.

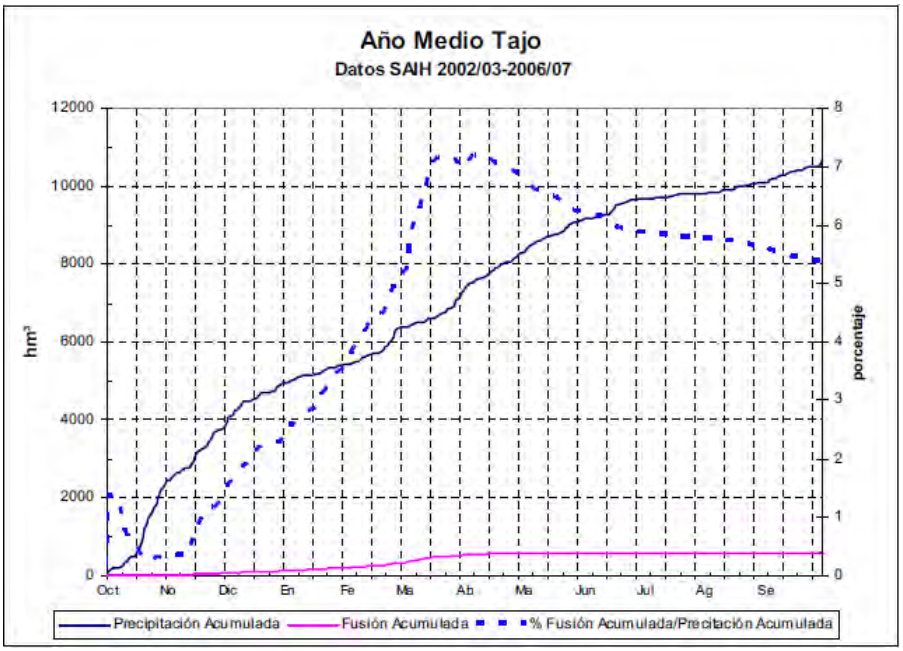


Figure 5 – Snow rainfall and contribution to reservoirs.

Differences between the 6-7% of rainfall computed as snow and the registered volume entered in reservoirs could be computed to rivers, groundwater or soil output, giving destination to the remaining uncertainties.

Stma. Explotacion		Tabla VI.1 Water asset accounts							
Total	Tajo Español		Element						
hm^3		Variable	1311 Reservoir	1312 Lakes	1313 Rivers	1314 Snow, ice, gl	132 Groundw	133 Soil	Total
Opening Stock	1 Initial state	StateInitial							
Increase in Stock	2 Returns								
	3 Precipitation	Precipitation				537.12			537.12
	4a Upstream input								
	4b Other resources input								
Decrease in Stock	5 Abstractions								
	6 Evapotranspiration	Evapotranspiration							
	7a Output Downstream								
	7b Output To the Sea	ToSeaTotal							
	7c Output other resources								
		ToArtificialReservoirs				519.24			-519.24
		ToRivers							
		ToGW							
	8 Other Loses	OtherLosses							
Final state	Final state	Total							537.12

Table 6 - Filling in example of snow inputs and outputs.

1.5 Output to the sea

(Pending the deliverance of data from Portugal agencies)

1.6 Fluxes between storages

The method used to compute water resources in the SEEAW manual implies registering water flows between resources. The objective is clearly reflected in VI.11 tables where each type of water resources have as input the volume originated from other's output and vice versa.

A clear example of these interactions is the case of reservoir inputs that come from the river's output within the system, thereby filling both 4b cell in 1311 Reservoirs and 7c cell in 1313 Rivers at the same time.

Stma. Explotacion		Tabla VI.1 Water asset accounts							
Total	Tajo Español		Element						
hm^3		Variable	1311 Reservoir	1312 Lakes	1313 Rivers	1314 Snow, ice, gl	132 Groundw	133 Soil	Total
Opening Stock	1 Initial state	StateInitial							
Increase in Stock	2 Returns								
	3 Precipitation	Precipitation							
	4a Upstream input								
	4b Other resources input		25 810.05						25 810.05
		FromArtificialReservoirs	25 810.05						25 810.05
		FromRivers							
		FromGW							
		FromSoilWater							
Decrease in Stock	5 Abstractions								
	6 Evapotranspiration	Evapotranspiration							
	7a Output Downstream								
	7b Output To the Sea	ToSeaTotal							
	7c Output other resources				25 810.05				-25 810.05
		ToArtificialReservoirs			25 810.05				-25 810.05
		ToRivers							
		ToGW							
	8 Other Loses	OtherLosses							
Final state	Final state	Total	25 810.05		-25 810.05				

Table 7 – Filling in example of fluxes between wáter storages.

Conversely, the output from reservoirs may not fit the river flows, as gauges in reservoirs determined global outputs that include supply or irrigation inlets among various diversions.

Hence the procurement of river inputs entails the disaggregation of reservoir's output registers by identifying the abstractions operated from the dam.

Aquatool decision support system provides precise information about each element location, thus allowing appropriate identification of abstractions required for the process of output disaggregation. An example of the detail of Aquatool model is shown below.

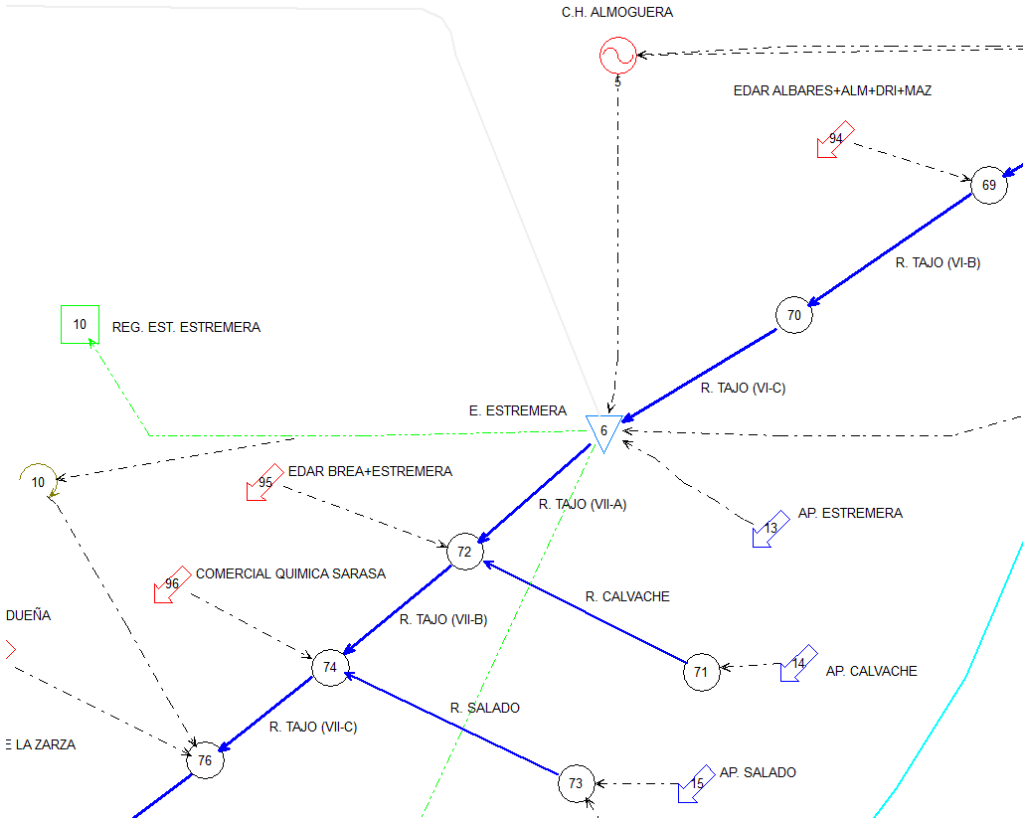


Figure 6 – Aquatool (Decision Support System Model) topology

1.7 Initial state estimation of storages

Initial state definition from the SEEAW water accounts refers to the existing volume at the start of the considered period of study. Then, it is necessary to obtain values of reservoirs, rivers and groundwater and soil water in order to complete the water assets accounts (snow column is not completed due to the inexistence of glaciers).

Reservoirs

Firstly, once the starting period date has been fixed, reservoir initial state could be extracted from the yearbook corresponding to the reservoir gauges series. All data from reservoirs is obtained from CEDEX (Centre for hydrological studies and experimentation).

Not every gauge has data series available for the reference period of this study, so only the ones that allow complete series analysis have been included.

The data is provided in a monthly basis, and the calendar year is the required model for the posting periods in accordance with the common socioeconomic accounting period. Only the value from the first day of January has been taken into account as representative of the initial state.

The list of active gauges used in the initial state has been the following:

Code ROEA	Reservoir gauge name	WMS
3006	Entrepeñas	Alto Tajo
3007	Bolarque	Alto Tajo
3008	Zorita	Alto Tajo
3009	Almoguera	Alto Tajo
3043	Buendía	Alto Tajo
3201	Molino de Chincha	Alto Tajo
3079	La Tajera	Tajuña
3065	Palmaces	Henares
3066	Atance	Henares
3068	Beleña	Henares
3287	Alcorlo	Henares
3050	El Vado	Madrid
3069	Santillana	Madrid
3154	Rio Sequillo	Madrid
3155	Puentes Viejas	Madrid
3156	Atazar	Madrid
3157	El Vellón	Madrid
3181	Valmayor	Madrid
3189	Navacerrada	Madrid
3190	La Jarosa	Madrid
3191	Navalmedio	Madrid
3196	Pinilla	Madrid
3263	El Pardo	Madrid

Code ROEA	Reservoir gauge name	WMS
3111	Burguillo	Alberche
3112	Cazalegas	Alberche
3113	Picadas	Alberche
3114	Charco del Cura	Alberche
3115	San Juan	Alberche
3227	La Aceña	Alberche
3073	Finisterre	Tajo-Izqda
3074	El Castro	Tajo-Izqda
3151	Castrejón	Tajo-Izqda
3166	El torcón	Tajo-Izqda
3252	Guajaraz	Tajo-Izqda
3127	Rosarito	Tietar
3128	Torrejón-Tietar	Tietar
3199	Navalcán	Tietar
3141	Guijo de Granadilla	Alagón
3142	Gabriel y Galán	Alagón
3143	Valdeobispo	Alagón
3145	Jerte-Plasencia	Alagón
3148	Borbollón	Arrago
3160	Rva. Gata	Arrago
3016	Torrejón-Tajo	Bajo tajo
3019	Alcántara	Bajo tajo
3152	Valdecañas	Bajo tajo
3203	Azután	Bajo tajo
3208	Salor	Bajo tajo

Table 8 – Name of reservoir gauges.

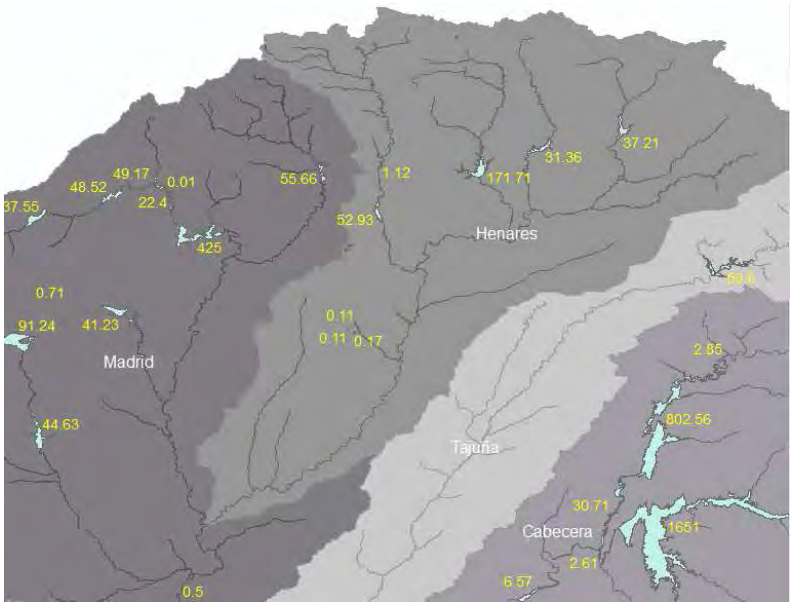
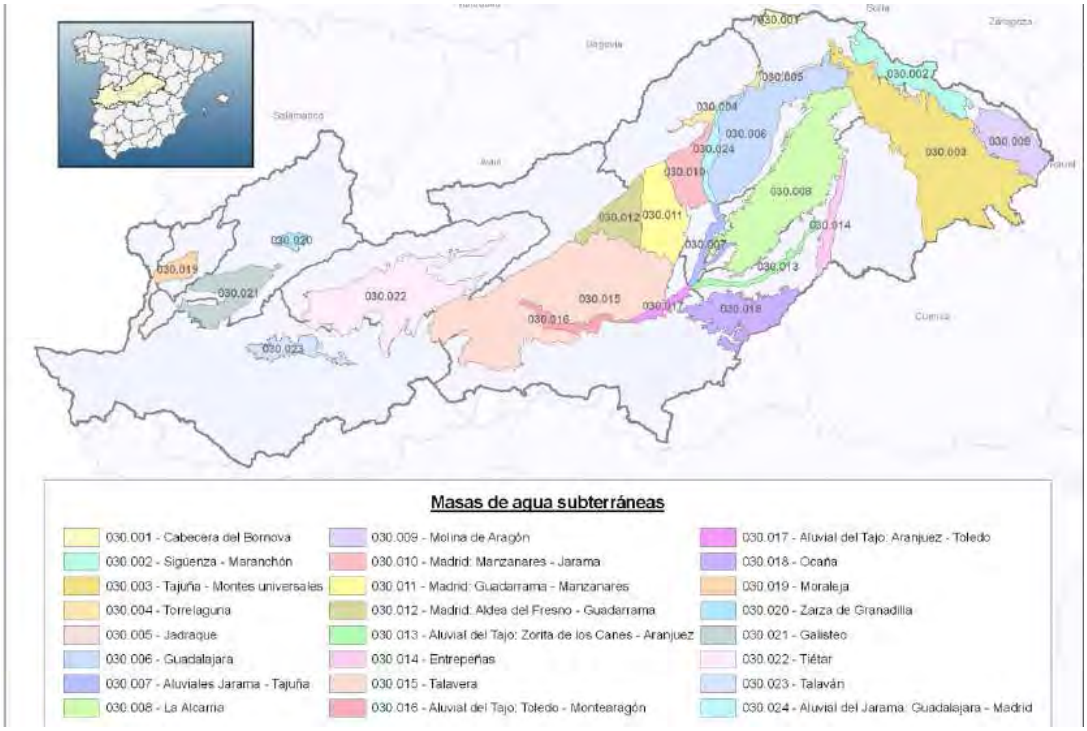


Figure 7 – Reservoir's capacity in upper Tagus basin

Groundwater

In the case of groundwater, obtaining some data from hydrogeological survey or detailed aquifer studies is compulsory. Without individual further characterization of each groundwater field is not possible to translate the available piezometric levels

from the IGME network. For this reason, the initial state reflected in tables is the mean value for the sum of every hydrogeological macrosystems. Therefore, the final state will define the variation of groundwater volumes caused by the balance of demands and recharges.



Aquifers of Tagus Basin		
Code	Hydrogeological unit	Renewable resources volume (Hm3)
System No.14	Terciary detritic of Madrid-Toledo-Cáceres	
Madrid-Toledo subunit	"	324
Tietar Subunit	"	200
System No.15	Limestone moors of La Alcarria	145
System No.16	Terciary detritic of Alagón	60
System No.17	Mesozoic border of Guadarrama	15

Figure 8, table 9 - RBMP hydrogeological units and quantitative information of microsystems.

The current hydrogeological unit division is included within the old macro systems classification. In this way, the values reflected above must be included in the whole Tagus basin tables, as there is no possibility to provide detailed information for the WMS water account balances.

Soil water

Soil water initial state is obtained from the results of the equivalent SIMPA variable: initial humidity of soil. This variable is part of the complete water balance simulated by SIMPA model, and is easily calculated from monthly provided raster results.

The main aspect to bear in mind is that the output represents the monthly average, so that the value placed in the water account tables won't be the exact soil water initial state but rather the average of January soil water content.

Obviously, this hypothesis involves certain amount of uncertainty that must be assumed until other modern sources of soil information as SMOS will be available for the use on this kind of simplified soil studies.

2. Abstractions and returns

2.1 Abstractions and returns

The reference document used to fill in this chapter has been the recently approved River Basin Management Plan (RBMP) of Tagus River (2009-15 Edition). It was made publicly available in April 2014.

The study and analysis of abstraction units and their counterpart return units, requires a complete repository of the volume allocated and its destination.

For this purpose, the main source of information about use and supply is the 6th annex of the plan called 'Use and water allocations' and the corresponding auxiliary document: 'Balances'. An example of the water balances within one of the management systems is shown below:

2.1.9 Sistema de explotación Árrago SC-2005

ENTRADAS	(hm³/año)	SALIDAS	(hm³/año)
Aportaciones en Régimen Natural		**Demandas**	
Borbollón	102,87	Abastecimiento Aguas arriba de Borbollón	0,20
Tralgas	22,08	Abastecimiento Aguas arriba de Rivera de Gata	0,20
Rivera de Gata	94,67	Mancomunidad Rivera de Gata	1,62
Árrago	83,83	Abastecimiento Bajo Árrago	0,31
Entradas Fluviales		Industria no conectada a redes en Sistema Árrago	0,02
—	—	Regadíos privados Bajo Árrago	0,82
Entradas por conducciones		Regadío público Árrago Sectores I-A y I-B	13,93
—	—	Regadío público Árrago Sector II-A	10,89
Retornos		Regadío público Árrago Sector III-A	19,58
EDAR Gata 2 y Torre de Don Miguel	0,08	Regadío público Árrago Sector II-B	21,39
EDAR Gata 1	0,14	Regadío público Árrago Sector III-B	15,87
EDAR Gata y Villasbuenas	0,08	Usos ganaderos en Sistema Árrago	0,85
EDAR Gata 3 y Perales	0,12	**Salidas Fluviales**	
EDAR Moraleja	1,21	Confluencia del río Árrago con el Alagón	226,30
EDAR Cilleros	0,08	**Salidas por conducciones**	
Retorno regadíos privados Bajo Árrago	0,08	—	—
Retorno regadío público Árrago Sectores I-A y I-B	2,78	**Evaporación**	
Retorno regadío público Árrago Sector II-A	2,17	Borbollón	7,42
Retorno regadío público Árrago Sector III-A	3,91	Rivera de Gata	2,45
Retorno regadío público Árrago Sector II-B	4,27	**Incremento de almacenamiento en embalses**	
Retorno regadío público Árrago Sector III-B	3,17	Borbollón	0,29
Disminución de almacenamiento en embalses		**TOTAL SALIDAS**	**322,14**
Rivera de Gata	0,58		
TOTAL ENTRADAS	**322,14**		

Table 10 – WMS balances in RBMP, Annex 6, for the Árrago subsystem.

There are some aspects that cause some distortion in these balances, mainly the differences between approved allocations and the real allocated volumes. More specified registries of yearly allocated volumes are the 'Commission on Dam Water Releases' reports.

Irrigation abstractions and returns

Focused on volumes released for irrigation, their numbers appropriately represent the real water use demand due to the major impact of irrigation in total. These reports have been delivered by the Tagus river Basin authority. An example of real water allocations is included in the following table for each water management system.

Año Hidrológico	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
CABECERA											
Usos Trasvase	620	536.5	543.13	513	422.5	217.55	227.55	246.65	296	293	378
Usos Tajo	357.2	335	325.4	329	367.9	250.9	242.1	253.8	253.8	279.9	332.2
Canales de Aranjuez			97.91	112.3				47.28	80.91	88.76	99.41
Castrejón M.D.			14.408	9.944		9.46	8.83	5.374	1.12	3.073	5.428
Castrejón M.I.			39.224	39.559		34.81	36.91	39.67	42.58	31.889	43.38
Azután				5.241		4.05	3.94	3.87	5.28	3.774	4.49
Valdecañas			15.8	15.72		14.46	6.96	8.377	12.215	7.597	8.028
Alcolea de Tajo			5.814	6.81		12.31	9.47	13.148	17.812	13.638	14.989
HENARES											
Abastecimiento Mancomunidad de Aguas del Bornova				1.156	1.1		1.094	1.098	1.095	1.095	0.927
Riegos Bornova	17.5	14.866	19.156	17.542	18.836	15.157	14.809	13.2	18	14.348	15.838
Riegos Henares	48.3	45.74	46.9	42.191	52.6	30.4	31.8	37.83	36.406	39.256	45.798
Mancomunidad del Sorbe (abastecimiento del Henares)	53.24	47.63	43.2	51.487	44.6	39.4	43.3	42.3	42.13	41.15	41.199
Mancomunidad del Sorbe (abastecimiento a Madrid)	19.26		20.5	6.014		9.51	32.3	14.6	29.1	24.23	22.2
JARAMA											
Real Acequia del Jarama						191.2	165	164.92	190.13	157.39	191.52
Abastecimiento a Madrid sistema CYII	558.6	573.657	603.791	597.735	622.1	557.5	540.1	541.6	550.3	541.1	537.4
TAJUÑA	64.3	17.7	19.9	25.4	27.9	20.8	12.3	12.1	13.4	8.7	44
ALBERCHE											
Madrid	21.8	119	76.06	13.84	120.318	167.42	124.169	223.152	109.16	120.4	55.7
Talavera	9.9	16.4	19.7	8.774	19.71	14.182	7.908	8.241	8.241	8.6	6.25
Riegos Bajo Alberche	86.7	80.6	79.835	81.029	75.693	1.963	59.8	59.879	68.333	68.9	70.23
Riegos y otros usos Alberche											
Riegos por toma directa y pérdidas	14	14	27.7								
Toledo-La Sagra	11.4	18.23	15.73	15.78	19.363	21.265	18.778	20.501	21.701	22.8	21.7
TIÉTAR											
Zona regable Rosarito	90	106.4	92.973	91.7	70.09	74.51	78.319	73.46	92.21	100.97	122.683

ALAGÓN											
Zona regable Alagón	424	419	407	438.9	427.4	389.4	364.75	381.73	457.38	410.24	425.799
ÁRRAGO											
Zona regable Árrago	91.5	80	86.6	84.93	57.8	80.5	72.17	90.658	66.719	74.879	76.51

Table 11 – Real water allocation reports summary from 'Commission od Dam Water Releases' reports.

Returns from irrigation follow the IPH08 procedure to be determined. Through this method, returns depend on the magnitude of gross provision for irrigation.

Gross allocation for irrigation (m^3/ha/año)	Return (%)
G.ALLOC. <5 000	0
5 000 < G.ALLOC. < 6 000	5
6 000 < G.ALLOC. < 7 000	10
7 000 < G.ALLOC. < 8 000	15
8 000 < G.ALLOC.	20

Table 12 – Returns as function of gross

Further details are included in the methodology auxiliary document of the Annex 3 'Uses and demands' of the RBMP.

Urban abstractions and returns

Urban abstractions are well detailed within RBMP in terms of granted allocation. Unfortunately only the basin authority monitorizes diverted volumes, because small villages do not carefully control their intakes, while big suppliers as 'Canal de Isabel II' Madrid metropolitan area supplier are reluctant to declare. In any case both atomized local supply entities or larger ones, real consumption reports are not widespread.

Urban allocations are not so dependent on reserves unless droughts periods force additional saving measures. Therefore, average abstraction volumes included both in the WMS balances and Aquatool model appropriately exemplify urban demand.

However, the increasing urban pressure in Madrid undermines other use's allocation, thus forcing River Basin authority (CHT) to redefine sharing policies. For this reason, an analysis of tendency is required to estimate urban allocation tendency, especially in upper Tagus subbasins.

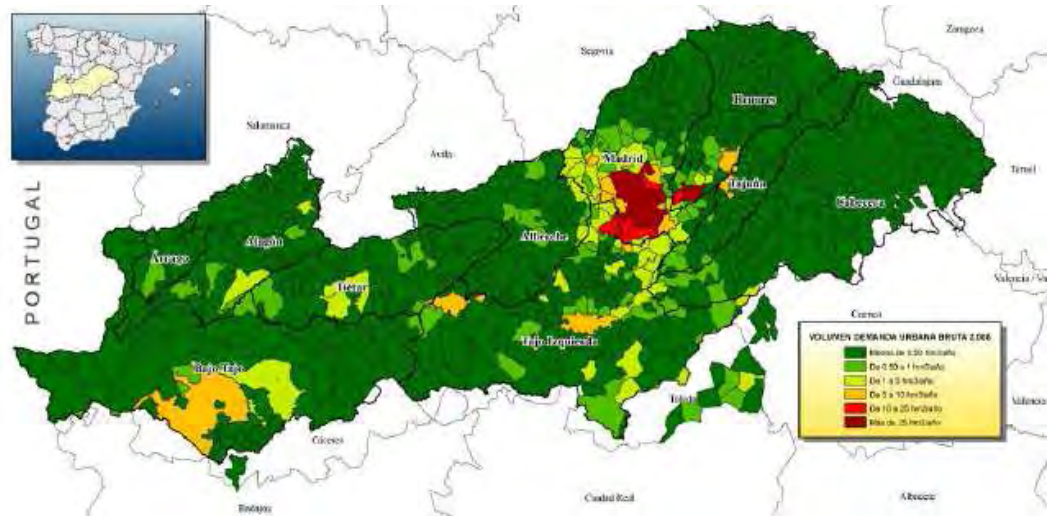


Figure 9 – Urban conurbation in Madrid and its pressures over water resources (urban demands).

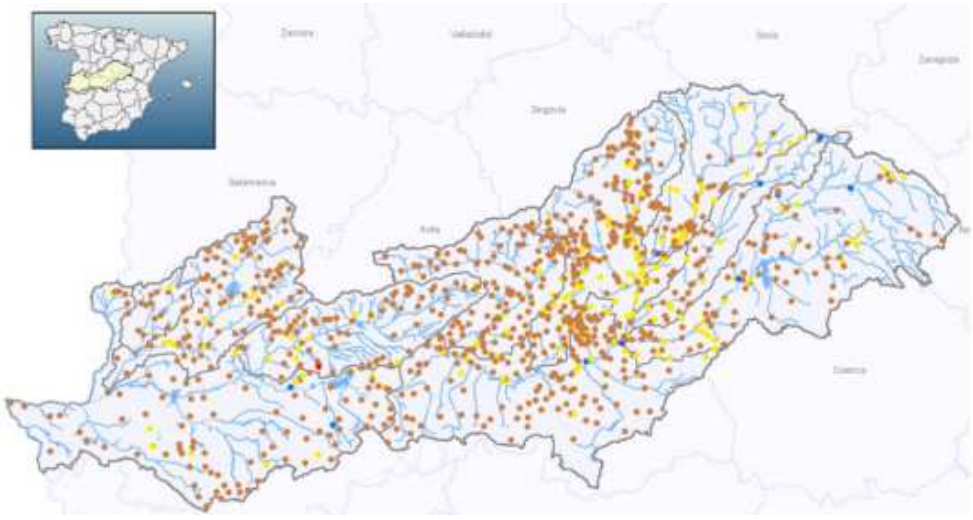


Figure 10 – Urban conurbation in Madrid and its pressures over water resources (urban returns).

The tendency analysis is developed from INE (National Statistics Institute of Spain) population data processed in GIS software. By this way, the obtained tendency coefficients (at subbasin scale) could be applied to the previously gathered data of urban allocations. Urban abstractions are well detailed within RBMP in terms of granted allocation.

Regarding urban returns, the Planning Manual for Hydrological Management 'IPH08' indicates return rates around 80% for urban supply. Figures from the plan adopt this value as specified in the methodology auxiliary document of the Annex 3 'Uses and demands' of the RBMP. Finally, urban losses are commonly diffuse losses that tend to feed groundwater instead of generating further returns. The ratio of urban losses could be considered around 20-25%.

Industrial abstractions and returns

Industrial abstractions compute the group of abstractions not connected to any water supply network. These abstractions correspond to large industrial demands or old granted rights which have surface water intakes. An example of these type of demands is in the Henares river subbasin.

The aggregation of the vast majority of industrial uses within the urban supply complicates the use and supply water accounts in chapter III of the SEEAW manual. This inconvenience forces us to find other procedure to distinguish types of economic activity included.

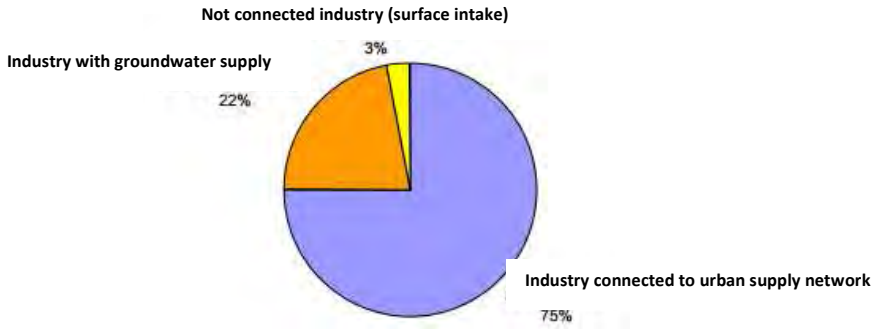


Figure 11 – Industrial activity according to supply system types.

There are some other industries, mainly those related with agriculture, that due to their rural location hold groundwater concessions, although the total amount of groundwater abstraction keeps low (compared to other Spanish basins). Both types of industrial uses are well detailed within the Annex 3 'Water uses and demands' of the RBMP from where data has been gathered.

Refrigeration abstractions and returns

Tagus river basin hosts several refrigerated power stations. Two of them are nuclear power (the third, Zorita, is already under dismantling stage), and their consumption which highly depends on the type of reactor and power, is generally well guaranteed by reservoirs or sufficiently mighty reaches. Their consumption volumes are detailed in the Annex 3, as well as the Ateca thermoelectric, which is the most demanding power infrastructure in the basin.

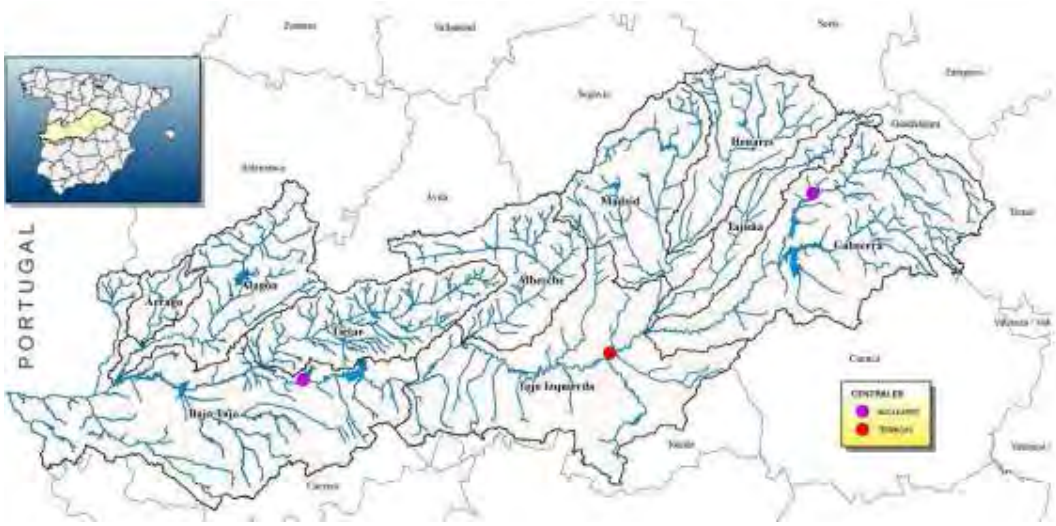


Figure 12 – Power plants location: thermal and nuclear plants.

Hydropower

This paragraph is included just to mention the absence of abstractions from this activity, neither in annual nor in month scale water assets accounts due to the hourly and weekly operating routines of hydropower dams. Conversely, their flows have been included in water accounts tables both in abstractions and returns with the same value, thus providing a more complete perception of this preeminent industrial activity.

3. Transferences

There is one aspect on which Tagus River basin is different from other major Spanish River basins that has a vast impact on water accounts: ATS (Acronym of Tagus-Segura Aqueduct). This infrastructure provides water resources to the Segura basin, thus causing a significant decrease in Upper Tagus water resources balance.

For the purpose of this water assets accounts, the volume diversion must be included in the 4a and 7a section, as well as other minor transference to Algodor-Guadiana community. As these transferences are completely operated through separate infrastructure, the intake and discharge have been computed from and to reservoirs.

Annex 3. Meeting documents

3.1. Madrid Med-term meeting documents

3.2. 1st National meeting documents

3.1. Madrid II Med-term meeting documents

PILOT PROJECT ON WATER BALANCES IN THE TAGUS RIVER BASIN

"PROTAGUS"

Convocatoria "Mid-term meeting"

11 de junio de 2014, 16.00-19.00 h

Confederación Hidrográfica del Tajo

Av. de Portugal 81, 28071 Madrid

https://maps.google.es/maps?f=q&source=s_q&hl=es&geocode=&q=avenida+de+portugal+81,28011+madrid

Invitados:

- Coordinador: EVREN
- Partners: CHT, ARH Tejo.

Orden del día:

a) Temas administrativos

b) Estado de los trabajo

c) Análisis de datos disponibles. Problemas y soluciones

d) Organización de tareas

e) Ruegos y preguntas

PILOT PROJECT ON WATER BALANCES IN THE TAGUS RIVER BASIN

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Asistentes:

- EVREN:
  - Vicente Ramírez Perea
  - Ana Nieto Arias
- Confederación Hidrográfica del Tajo CHT:
  - Jefe de Área de la Oficina de Planificación: David Peracho

Orden del día:

a) Temas administrativos

Respecto a los socios del proyecto cabe destacar:

- La Oficina del Agua de Naciones Unidas no puede figurar como socio debido a la complejidad administrativa. Por ello figurará como "observador" aportando principalmente su experiencia en la metodología a usar (SEEA-Water).

- La Agencia Portuguesa Do Ambiente comunicó anteriormente su imposibilidad de participar en el proyecto y la solicitud de exclusión del mismo. Tras las gestiones oportunas realizadas por el Presidente de la Confederación Hidrográfica del Tajo y de la Comisión Europea se consigue que permanezcan como socios del proyecto.

b) Estado de los trabajos

Hasta la fecha los trabajos han consistido principalmente en:

- Establecimiento del contexto y antecedentes.
  - Identificación de los principales temas de la cuenca
  - Especificaciones del sistema SEEA-W
- Recopilación y análisis de datos de fuentes públicas:
  - Estatales: MAGRAMA, CHT, INE, CEDEX,
  - Autonómicas
  - Portuguesas: APA, SNIR, INE
  - Europeas: EUROSTAT, EEA
- Solicitud de datos a los organismos de cuenca.
- Preparación de la estructura de la base de datos a utilizar.
- Participación en la Primera Reunión Nacional del Sistema de Cuentas medioambientales – económicas del agua

c) Análisis de datos disponibles: Problemas y soluciones

El jefe de área de la CHT proporciona a EVREN los datos necesarios para la realización del proyecto, principalmente para la elaboración de las tablas de los capítulos V y VI del SEEA-W.

Se analizaron los datos entregados y se buscaron posibles soluciones para conseguir aquellos no disponibles.

Se trataron los temas surgidos de la reunión que había tenido lugar esa misma mañana en el MAGRAMA, “Primera Reunión Nacional del Sistema de Cuentas medioambientales – económicas del agua.”

d) Organización de tareas

Los pasos a seguir por la empresa EVREN serán:

- Análisis de los datos recibidos.
- Adaptación a base de datos SEEA-Water.
- Elaboración de balances a partir de base de datos SEEA-Water.

- Análisis de resultados y comparación con resultados del Plan Hidrológico

e) Ruegos y preguntas

Se informa de la solicitud de datos a la Agencia Portuguesa Do Ambiente.

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
ENVIRONMENT
Directorate C - Quality of Life, Water & Air
ENV.C.1 - Water

GOBIERNO DE ESPAÑA
MINISTERIO DE AGRICULTURA, ALIMENTACIÓN Y MEDIO AMBIENTE

PRIMERA REUNIÓN NACIONAL DEL SISTEMA DE CUENTAS MEDIOAMBIENTALES – ECONÓMICAS DEL AGUA

AGENDA
11 DE JUNIO DE 2014

HORARIO	ITEMS	ORADOR
09:45 – 10:00	**Bienvenida e Introducción** Rueda de presentaciones	MAGRAMA
10:00 – 10:15	**Introducción al programa "Halting Desertification in Europe"** Interés de la Comisión Europea por las Cuentas del Agua	DG ENV C.1
10:15 – 10:30	**Perspectiva de las Cuentas Nacionales del Agua** Compromiso español	MAGRAMA
10:30 – 10:45	**SCAE: Estrategias de implementación** Presente y Futuro del SCAE-Agua	INE
10:45 – 11:00	**¿Qué es el SCAE-Agua?** SCAE-Agua. Tablas e Indicadores	GEODIM
11:00 – 11:30	**Comentarios y Discusión**	
11:30 – 11:45	*Café*	
11:45 – 12:00	**Experiencias previas y próximos objetivos: GuaSEEAW**	GEODIM
12:00 – 13:30	**Otros proyectos pilotos del programa 2013:** i. Pilot project on water balances in the Tagus River Basin ii. Accounting System for the Segura River and Transfers iii. Water accounting in a multi-catchment district iv. Duero River Basin: Water resources, water accounts and target sustainability indices v. System of Water Accounting in the Guadalquivir River Basin. vi. Pilot Arno Water accounts	 EVREN UPCT INTECSA UPM Universidad de Córdoba ISPRA/SEMIDE
13:30 – 14:30	**Comentarios y Discusión**	

Las transparencias se realizarán en ingles para facilitar la comprensión a la Comisión Europea, mientras que la presentación oral será en castellano.

PILOT PROJECT ON WATER BALANCES IN THE TAGUS RIVER BASIN

"PROTAGUS"

Convocatoria "II Mid-term meeting"

30 de septiembre de 2014, 12.00-14.00 h

Confederación Hidrográfica del Tajo

Av. de Portugal 81, 28071 Madrid

https://maps.google.es/maps?f=q&source=s_q&hl=es&geocode=&q=avenida+de+portugal+81,28011+madrid

Invitados:

- Coordinador: EVREN
- CHT.

Orden del día:

a) Segunda fase: Análisis de datos disponibles. Problemas y soluciones

b) Organización de tareas

c) Ruegos y preguntas

PILOT PROJECT ON WATER BALANCES IN THE TAGUS RIVER BASIN

"PROTAGUS"

Convocatoria "Mid-term meeting"

30 de septiembre de 2014, 12.00-14.00 h

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Asistentes:

- EVREN:
  - Ana Nieto Arias
- Confederación Hidrográfica del Tajo CHT:
  - Jefe de Área de la Oficina de Planificación: David Peracho

Orden del día:

a) Segunda Fase: Análisis de datos disponibles: Problemas y soluciones

El jefe de área de la CHT proporciona a EVREN los datos solicitados para continuar con la elaboración de las tablas del SEEA-W.

Los datos tratados fueron:

1. Respecto a aguas subterráneas: Actividad 4: identificación y caracterización de la interrelación que se presenta entre aguas subterráneas, cursos fluviales, descargas por manantiales, zonas húmedas y otros ecosistemas naturales de especial interés hídrico. Esta actividad se engloba dentro de la encomienda de gestión del IGME para la realización de trabajos científico-técnicos de apoyo a la sostenibilidad y protección de las aguas subterráneas. He encontrado estos documentos de casi todas las demarcaciones pero no lo encuentro para el Tajo.

La necesitamos para calcular el volumen de reservas en los acuíferos y hacer estimaciones sobre las relaciones río-acuífero.

2. Datos de evaporímetros que haya distribuidos por la cuenca, aunque sean pocos. Para calcular la evaporación de los embalses y los ríos.
3. Informes del Erhin que imagino que vosotros tendréis algo más que lo que hay colgado en la web del MAGRAMA.
4. Curvas de gasto de los embalses
5. Niveles de los ríos (marcos de control en el SAIH o en estaciones de aforo)
6. ¿hay datos de extracciones (demandas) pero que no sean teóricos, sino realmente suministrado?

   Se analizaron los datos entregados y se buscaron posibles soluciones para conseguir aquellos no disponibles.

b) Organización de tareas

   Los pasos a seguir por la empresa EVREN serán:

   - Análisis de los datos recibidos.
   - Terminar las tablas de los capítulos V y VI del SEEA-Water.
   - Análisis de resultados y comparación con resultados del Plan Hidrológico

c) Ruegos y preguntas

   Se informa de la solicitud de datos a la Agencia Portuguesa Do Ambiente.