MELIA PROJECT

WATER POLICY IN SPAIN.

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1.- BACKGROUND

Hydraulic infrastructures are a key element for economic growth in a developing country that has extensive fields not yet cultivated and an economy that is mainly agricultural. This was the case of Spain in the last century; since getting new resources was relatively easy during this period, their use seemed unlimited while the concern for environmental problems and water quality merely existed.

The hydraulic policy was highly beneficial, since it allowed an improvement in the quality of life, the growth of a flourishing irrigation agriculture and the development of other economic sectors such as industry, and more recently, tourism. Nonetheless, the traditional water management model has shown signs of collapse for several years now, since after decades of strong public investment, Spain is still subject of severe and frequent conflicts related to water. It is also worth mentioning that the economic structure of the country, its political situation and the perception of the problems have significantly changed over the years.

We live in the transition of a model based on the construction of dams and water transfers to a new one more concerned for the management of the water demand. In this context, a new policy is developing that considers water as an economic, social and environmental heritage that we must conserve and protect. In other words, a policy that will make us feel proud of the heritage we leave for future generations.

This change occurs just in the middle of the process of adjustment to the Directive 2000/60/CE, known as the Water Framework Directive (from now on WFD), which implies a new conception of water management. The main goal of the WFD is to maintain and improve the aquatic environment of the European Union. The Directive forces the

Member States to reach a good ecological and chemical status of all water bodies (groundwater, surface, coastal and transitional) by 2015.

After reviewing crucial landscape issues to understand the singularity of the Spanish situation and the phases of the traditional water policy during the 19th and 20th century, this report intends to show the key themes of the new water policy. These are: adjustment to the new European regulation (WFD), agriculture and the modernization of irrigation, the urban water cycle (supply and sanitation), risk management (droughts and floods) and the new environmental line of this policy.

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2.- APPROACH TO THE SPANISH LANDSCAPE: A SEMIARID PHYSICAL ENVIRONMENT, TRADITIONALLY AGRICULTURAL AND CURRENTLY WITH GREAT PRESSURE ON THE COAST

In this section, we will review the Spanish landscape, especially those aspects considered important for water management.

2.1.- THE PHYSICAL FRAMEWORK

The main characteristic of the physical and biological part of the Spanish landscape is the variety of climates, geological substrates, fluvial regimes, fauna and flora species, soils, sceneries, etc. From the hydrological perspective, such environmental diversity implies the existence of very different hydrological environments, with strong aridity gradients, with islands of humidity in dry contexts, of strong runoff variability, with a hydrogeology with significant regional differences and high water distribution heterogeneity in Continental Spain and the Canarian and Balearic Archipelagos.

2.2.- POPULATION TRENDS. THE ROLE OF TOURISM.

2.2.1. TERRITORIAL IMBALANCES

The location trends of the Spanish population has clear signs: population stagnation in the inland (except metropolitan cities such as Madrid or the regional capitals) and demographic and territorial pressure on the coast (especially on the Mediterranean one) due to the growing economic dynamism derived from tourism, the new agriculture and the strategic situation of the coast. This demographic boost will

trigger an increase in the hydrological demand in the mid and long term, which will cause more concern since these regions are the most affected by the lack of available resources. Hence, due to demographic reasons, water deficit problems in the Mediterranean coast are expected to worsen in the future.

Although water consumption by tourism is not so significant, especially compared to the economic activity tourism generates, it produces intense local and seasonal effects in areas already with water deficits. The problem gets worse when we consider the need to build oversized infrastructures in comparison with the ones that would be needed to serve the permanent local population.

For all this, the availability of hydrological resources, in quantity and quality, can be a limiting factor for tourism development and the maintenance of the associated economic activity in these territories.

2.2.2. THE NEED OF SECURED RESERVE IN WATER SUPPLY

This aggravation of the scarcity problems in Spanish Mediterranean basins should be considered with caution, given the low impact, in absolute terms, that this urban component has on the overall water demand in the region.

It is essential to remark the importance of the secured reserve: the massive population concentrated in the large southern and Mediterranean areas requires, necessarily, a stable and secured water supply of good quality.

Furthermore, from a territorial perspective, it is worth mentioning the current situation of the small towns in the interior, which will tend to worsen in the future. Since these towns do not have the minimum population size necessary to take advantage of the economies of scale,

they will have problems to fund and efficiently manage the water supply and purification services. Hence, public intervention seems mandatory to improve the quality of life of these rural populations.

On the other hand, given the strategic character of tourism for the Spanish economy, it is imperative to provide tourist areas with a secured supply reserve. In addition, due to their greatest hydrological deficit, it will also be necessary to procure the maximum hydraulic saving through urban water reuse destined to the closer irrigation areas.

2.3.- THE IMPORTANCE OF IRRIGATED AGRICULTURE

Irrigation is a key element in the landscape structure and one of the territorial variables that configure the total demand of hydrological resources. It is the most important sector, considering both land occupancy and water use and consumption.

However, the decline of the agricultural activity and the boom of services seem unstoppable. Occupation in the agricultural sector has decreased to almost half in 10 years, from almost 2 millions in 1984 to a little more than 1 million in 1994. These tendencies are expected to continue in the next few years; in the year 2010, the population actively dedicated to agriculture will not surpass a half million employees. Furthermore, this national step back will be more intense in the rural interior and northern Spain.

Despite this general tendency, there is a relatively high dependence of a great part of the Spanish territory on the primary sector, heritage of the

traditional agricultural vocation of an important part of the productive structure of the country. Even though agriculture and fishing represent less than 5% of the national Gross Added Value, in some provinces it represents more than 15%.

Clearly, the current and future situation of irrigation agriculture is a key factor to determine the water requirements in the different Spanish regions.

2.4.- THE INSTITUTIONAL FRAMEWORK

2.4.1. SHARED RESPONSABILITIES IN THE REGIONAL GOVERNMENTS´ SCHEME

The organization of the territory as a result of the Regional Governments´ scheme is a significant element in the current configuration of the Spanish institutional framework. This organization has brought new legislative problems in regards to the competencies concerning water and topics such as sovereignty, territoriality, public organization, etc.

The legislative development and the adjustment, interpretation and progressive depuration of the legal body, have configured a complex reality in which the National and the Regional Governments have important competences and shared responsibilities regarding environmental issues and resources management, on which the Municipalities also have a saying.

All this has caused an important change in the political and administrative organization of the territory; change that has a great

influence on water issues and has brought problems that remain unresolved despite the numerous legislative efforts made.

2.4.2. BASIC ORGANIZATIONS OF THE HYDRAULIC ADMINISTRATION

The institutional element is a key factor in the water arena, and so, the administrative structures it is based on are decisive on this matter. Among all the related organizations, two of the most important ones are: the ¨Confederaciones Hidrográficas¨ (Basin Organizations), or the Hydraulic Administrations in the watersheds enclosed within a single autonomic region, and the Irrigation Communities. The first ones because they are the basic competent administrative organizations in this subject, and the second ones for being the receivers of the greater part of the consumptive use of water in Spain.

2.5.- EXISTING PROBLEMS: HYDROLOGICAL RESOURCES

2.5.1. THE NEED FOR COORDINATION OF THE MEASURING NETWORKS

The measurement of surface waters is responsibility of the Watershed Organizations. Currently, daily data is generated in more than 1,000 measuring stations located in rivers, reservoirs and channels, however, the last few years have witnessed a decrease in the number of working stations and lack of information maintenance and processing. The improvement of the existing network should be a priority for most Watershed Organizations.

Although it only covers about half of the national territory, the network SAIH (Automatic System of Hydrological Information) registers surface water data in a great number of points and communicates them to the Basin Organizations in real time.

Regarding groundwater, the network of water table measurements in the aquifers consists of 3,000 points which are usually controlled quarterly. The main observation to this network is that it has not been designed based on technical criteria, according to the objectives any national network should follow. To date, with few exceptions, control points are located in wells or drills built for supply or irrigation, mainly of private property. In the last few years, the Government has planned several actions with the intention of implementing new measuring networks that in the future will form the Official Control Network of Groundwater.

In general, it is necessary to highlight the importance of an adequate conservation of the measuring networks for the correct estimation of hydrological resources, since they are one of the components of the hydrological planning practice. The large number of existing networks and Organizations in charge of their management requires a coordinated effort and the establishment of unification and information exchange procedures.

2.5.2. THE HYDROLOGICAL RESOURCE

Annual average runoff in Spain is approximately 220 mm, that is, 111,000 hm^3/year or about one third of precipitation. This contribution includes the fluvial network, namely, direct surface runoff plus aquifers drainage (109,000 hm^3/year) and groundwater runoff to the sea (2,000 hm^3/year).

The main characteristics of water as a resource are:

⇒ **The marked spatial and temporal irregularity of the resource.** In Spain, the average annual runoff is unevenly distributed in the territory. The region of the Cantabrian coast hast the greater abundance of water, with values over 700 mm/year. The rest of the basins do not exceed 250 mm/year. The Segura basin has the least runoff, not even 50 mm/year, five times less than the one in Galicia and five times less than the national average.

In addition to this spatial irregularity, there is also a marked temporal variability in the contributions in some areas. In some watersheds as the Guadiana, the ratio between the maximum and minimum value can reach thirty. In other regions with less irregularity such as the Cantabrian coast or the Ebro basin, this relation is around three.

⇒ **The fraction of groundwater origin.** Aquifer recharge is of great theoretical and practical interest, since it delimits the maximum sustainable groundwater exploitation possibilities in the long term.

The estimate of aquifer recharge made in the new resources assessment is 29,000 hm^3/year or 26% of the total contribution, figure higher than the estimates made by the Basin Plans. This difference proves the need to study aquifer recharge in depth, especially since this knowledge would improve the understanding of the role of groundwater in the hydrological resources as a whole. Such role is extremely important in some of the main basins, especially in those with the greatest hydrological difficulties.

⇒ **The uneven territorial use of groundwater.** In the case of groundwater, approximately 5,500 hm^3 of water are currently exploited every year. 30% of this volume is used for urban and industrial supply, and 27% of the irrigation land. At the national level, the Jucar and Guadiana basins present the largest exploitation of groundwater resources. In average, extractions in the Guadiana basin are higher than the natural recharge, while in other watersheds, such as the Segura, Jucar, Catalonian inner basins and the islands, the relation between pumping and recharge is between 50 and 80%. On the other hand, some basins as the Duero, Ebro or Guadalquivir have important aquifers but present little use of groundwater resources.

The use of groundwater is associated with a decline in the aquifer levels and the river flows they usually drained into. In small aquifers, the effect can appear after a few months, while in the largest ones, the impact can take years to come into view.

In more than 20% of the hydrogeological units, located mainly in the south, in some areas of the Mediterranean Coast and La Mancha, the ratio between pumping and recharge is greater than one, meaning an unsustainable use of the aquifer.

⇒ **The Spanish hydrological singularity in the European context.** The contrast between our natural resources and the equivalent ones in other European countries show that Spain is the most arid Community Member, with a precipitation equivalent to 85% of the European Union average and one of the highest potential evapotranspiration of the continent, causing the least runoff of the Member States (approximately half of the European average).

⇒ **The difference between natural resources and available resources.** The seasonal irregularity of the resources in the natural regime prevents their full exploitation to satisfy the different water requirements, since available resources are much less than the natural or existing ones. In fact, just a little fraction, less than 10%, could be used if the natural regimen was not artificially altered.

2.5.3. THE LOCAL IMPORTANCE OF NON-CONVENTIONAL RESOURCES

In addition to the conventional resources, there are others that, due to the experimental character of the techniques used or for its *uniqueness*, are considered as non-conventional resources. Currently, the direct reuse of wastewater and the desalinization of marine and brackish waters are regarded as non-conventional resources.

Every year, approximately 200 hm^3 of water are saved through reuse, which are used mostly for irrigation. Its application takes place in the Mediterranean and South Atlantic coasts and in the archipelagos. Currently, water reuse is scarce mainly due to the negative response of potential users. This problem would lessen, at least in part, with the existence of specific regulation on required quality criteria for water that will be reused and its management issues.

In Spain, the desalinization of marine water occurs since the end of the 60s, and has generated water for the supply of Ceuta, Lanzarote, Fuerteventura and Gran Canaria. Currently, around 200 hm^3 are obtained every year through desalinization of marine and brackish waters, positioning Spain in the first place regarding desalinated volume

in Europe. This technology however, still has problems such as the elimination of brines, the high energy costs or the high repercussion of the investment amortization due to the short life of the facilities.

Currently, the use of non-conventional resources is approximately 1% of the available conventional resources. Even though they are essential for solving local problems, its participation in the solution of global water shortage problems in Spain is very little.

2.5.4. CLIMATE CHANGE

The climate scenarios foreseen for Spain by the Climate National Commission show a slight reduction of the average annual rainfall and an increase in the temperatures that will bring a decrease in the overall runoff.

The southeastern regions, the Guadiana basin, the Ebro valley and the archipelagos have been identified as the areas where the impact on the water resources would be higher, right where there are already the largest water problems.

A rise of 1ºC in temperature, together with a 5% decrease in rainfall would lead to a 20% decline in the volume of water contributed by the aforementioned regions. This decrease would be remarkably higher in a more extreme scenario, with a 15% decline in rainfall and an increase of 4ºC in temperature.

In sum, the arid and semiarid conditions of the Iberian Peninsula (generally associated with rainfall irregularity and the risk of droughts), the traditional irrigation agriculture and the demographic pressure on

the Mediterranean coastal landscape can be considered as the three key drivers of the Spanish territory, setting the geographic framework of this report.

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3.- BACKGROUND: PHASES OF THE TRADITIONAL MODEL. HYDRAULIC POLICY

In Spain, the term ¨hydraulic policy¨ has always meant agricultural policy, and, given the importance of the agricultural sector on the Spanish economy, it has also been understood as economic policy. This is one of the key ideas that characterize the traditional model of hydraulic policy, set off in the 19th century Regenerationism[1].

During the last two centuries, the need to ¨reform Spain¨ creating the conditions necessary for its economic development was concentrated in the hydraulic policy, with plans that allowed for irrigation agriculture, economic driver and key element of growth in rural areas.

In the last century, the transformations of the territory made by the Government, promoter of hydraulic works, were very important. The key phases of the process that set the basis of the agrarian economy are:

⇒ **Initial phase (1865-1936)**: with the Regenerationism, as a dominant thought in this period, and the first work plans, starts a process of transformation of spaces traditionally valued for its potentials but scarcely exploited (such as the inner valley of the Sevillian riverside of the Guadalquivir). The basis of technical knowledge, hydrological studies and institutional agreements is also set. It is worth mentioning that the Basin Organizations were created on 1926.

⇒ **Expansive phase (1939-1984)**: it includes the Dictatorship and the Spanish Transition. The first one was *dominated* by the autarky and its bet for agriculture; the desarrollism on the other hand,

[1] The Regenerationism was an Ideological movement that began in Spain at the end of the 19th century. It was motivated mainly by the feeling of decadence and the loss of the colonies. It defended the renovation of the Spanish political and social life.

prevailed in the second period. Extensive territories are exploited and irrigated under the *productivity* paradigm, demanding large hydraulic infrastructures. In 1939, the National Institute of Colonization is created, a key instrument when getting to know the territorial changes linked to water issues.

⇒ **Crisis symptoms of the model (1984-2000):** the end of the 20th century was marked by the incorporation of our country to the European Union (which caused significant changes in our global policy) and by a previous model that was all used up, causing a crisis as the one that caused changes in the United States hydraulic policy at the end of the 70s.

The main causes for which the traditional model turned into a crisis and that have driven us to look for new foundations are:

⇒ Quick and large increase of the water demand in the last decades in contrast with the limited available resources. This has caused negative impacts on the environment, basically, the deterioration of water quality and the degradation of the ecosystems that depend on it.

⇒ The increasing valuation awarded by the civil society to the conservation of natural resources, as shown by the appearance of new social agents among the community currently concerned for water issues. Until very recently, the traditional hydraulic policy community was mainly formed by politicians, managers, economists and engineers working for the Government, farmers with water rights, and building companies. All these actors worked together for a unique political and administrative organization and the implicit consensus regarding the goals to accomplish and the instruments to use. Just like it happened in other countries, in the 80s and 90s, such community experienced

a profound revolution, currently showing a more pluralist and multidisciplinary character.

⇒ The new possibilities offered by the modern techniques, including the increase in water availability (purification for reuse, desalinization, better irrigation techniques that help to save more water, etc).

⇒ The need to improve the instruments used for coordination and integration of all the interested sectors, especially in those areas of the national territory where shortage problems and resource limitation are more severe.

⇒ Appearance of territorial conflicts that derive in political confrontations when deciding new resource allocations.

⇒ The change in the economic perspectives existent in both the private exploitations which success and profitability depend largely on the use of water (mainly for irrigation), and the definition of economic objectives of public policies regarding hydraulic issues (to maximize national income, to avoid bottlenecks, etc.).

⇒ The international context, on which we can highlight three main reasons: the internationalization of the water policy, the globalization of markets and the restrictions derived from the economic convergence implemented by the EU.

These problems have caused changes in the water policy, a new management plan that will be reviewed in the following section.

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4.- FOUNDATIONS FOR A NEW WATER POLICY

We have mentioned how the traditional understanding of the term hydraulic policy is currently insufficient to include all the requirements and uncertainties of our society and to give adequate answers to all water problems. The search for a balance between economic growth and the limits and capacities of the natural environment, in a way that guarantees its conservation in the mid and long term, forces us to make a turn in the definition of the policy goals. The underlying idea of what has traditionally been understood as hydraulic policy implied a simplification of the term, since it always had one predominant objective and an almost exclusive one (maximum intensification of irrigation). To reach this goal we counted with merely one instrument (hydraulic infrastructures), while management aspects had an unimportant role.

Currently, the term **water policy** is more widely used. Having a multidisciplinary and integrating character, it is understood as the actions performed by the Public Administrations, at different levels and fields, that affect the development, allocation, preservation and management of hydrological resources. For this reason, the institutional character of many of its components will be reinforced, since the new policy will require a more global perspective when formulated and a greater attention from the Public Administrations.

The instrumental character of the hydraulic policy (many of its goals are determined by different sectorial policies not directly related to it: agricultural, energetic, etc.) and the loss of its local character (even being related to environmental problems that affect the entire planet) reinforce this new management philosophy.

All this has brought us the need to look for new foundations. The inspiring principle of any foundation is the desire to reach a rational use of water in terms of sustainability. Currently, water policy is considered

a complex concept that incorporates all actions related with, on one hand, the use of the resource, in its double facet of consumption good and production factor, considering its quantitative and qualitative aspects, and on the other hand, the management of the public hydraulic domain, but understanding it as an integrating part of the natural hydrological environment that we need to conserve, protect and improve. The search for mechanisms that contribute to this goal lays in the different approaches analyzed in this section.

4.1.- LEGISLATIVE FOUNDATIONS

The growing complexity of hydrological resources management has caused a development and proliferation of the regulation of such magnitude that Public Administrations have not been able to efficiently and coordinately answer the new requirements. The existing legislation therefore, has proven insufficient when trying to solve problems related to the water policy, in some cases due to the regulation itself and in others to the real dynamics of its application. So far, this situation has favored an inefficient management of the public hydraulic domain.

Right now, there is a search for the new instruments that will allow for the correction of the problems identified, such as: management of the aquatic environment and associated ecosystems, control of authorizations and concessions systems, economic-financial regime of hydrological resources, extreme situations management, adjustment of the Hydraulic Administration to the new challenges, etc.

The inclusion of the environment in the new plans implies the appearance of specific difficulties when dealing with management in terms of sustainability. For the first time there is a general awareness of the effects of human activities on the natural environment, which may cause irreversible and large scale changes, important obstacles for sustainability. Other complications include the problem of free access to these goods, an adequate economic valuation of natural resources and the correct introduction of future time in the valuation of the different alternatives, and the high degree of uncertainty in many of the aspects involved.

It is evident that the use of the hydrological environment by economic activities, or human activities in general, has at least some negative effect on the environment. This impact can be pollution or any environmental damage of a given magnitude and intensity.

Currently, the problem and challenge is to find that level of economic activity, production and economic growth that causes an environmental impact that benefits or is acceptable by the civil society.

Given the huge diversity that characterizes the Spanish territory regarding hydrological issues, environmental richness, economic profitability derived from the exploitation of water resources, etc., it is easily understood that the answer to all these problems is not immediate and that there are no general or uniform solutions for all the watersheds, not even for all the exploitation systems within one given basin.

Having these difficulties in mind, it is essential for the new policy to count with well-done Environmental Impact Assessments, which can be an important tool if used correctly. To maintain the current environment is the only mean society has to make sure their wealth will not reduce the options available for future generations.

These criteria not only do not contradict the inspiring principles of the current regulation on water issues, but it is one of the keystones of the new Spanish water policy. The change of location of the water policy, from Public Works to Environment, is one sign of the new times to come.

4.3.- ECONOMIC FOUNDATIONS

The current economy has analysis and valuation techniques that considerably exceed the conventional vision (reductionism) of economic problems, considering them from a wider perspective. Its *help* is twice valuable, since it helps to bring together the understanding of water as an economic and productive good, and as an environmental good that needs to be conserved and protected.

From this perspective and the experiences of the implementation of the current economic and financial water regime, we can say that this regime can be improved so the user can perceive and be aware of the real costs of his actions for the rest of the society. The expectations of having an ¨almost¨ free good and the subsidies for water use in some sectors are key factors for the existence of current problems, not providing enough incentives for water saving.

When talking about environmental goods and services, usually free, there is evidence that people are concerned about other issues than just

economic efficiency in a strict sense. Aspects such as a fair and equitable access to natural resources, together with the conviction that many of them are essential for our subsistence (even to provide quality of life) and that they can not be replaced lead to serious doubts regarding the usefulness of the classic instruments of optimization in terms of costs and benefits.

The complexity and multiplicity of aspects to be considered in the management of hydrological resources show the variety of economic instruments that can be used, which cover:

- ⇒ Use of economic incentives to improve the allocation of resources: taxes that are as equal as possible to the external costs generated by the environmental impact, an exact definition of the rights on the use of natural resources to favor the transfer of such rights and with it, the efficient allocation of a scarce resource.
- ⇒ Regulation through fixed rules, establishing standard values that are considered satisfactory in relation to the most significant parameters in water management.
- ⇒ Execution of projects with objectives that are specifically environmental (works to correct the impact on the environment, regeneration of valuable natural spaces, etc.).

4.4.- SOCIOPOLITICAL FOUNDATIONS

There are some foundations in the current legislative *framework* that are not ignored as important references in the new water policy. These judgments and valuations are part of the public conscious and have its roots in the costumes, cultures and myths of every town.

Any *aggression* or substantial innovation of these principles requires a sound justification and a gradual and cautious *application*. The feeling that water is a special good, with a strong social component and different from other goods, perception usually shared in regions where the resource has been historically scarce, and the scope given to its management are key aspects in the new water policy.

Public participation mechanisms permit that this variable is taken into account in the decision making process, ensuring an innovative social management of water.

4.5.- TECHNICAL BASIS

The traditional approach followed by the Spanish water administration was based in the incessant construction of hydraulic infrastructures for regulation and supply, with the intention of increasing the availability of the resources to satisfy the growing demands, that is, it responded exclusively to an offer policy.

Nonetheless, from a rational perspective, an analysis of this behavior shows that the most efficient economic and environmental solution is to promote a decrease in water consumption. A simultaneous combination of the offer and demand approaches, complementary schemes that can be used in a coordinated and joint way, are considered for the integrated management of both.

In addition to the progress made in the location, development and exploitation processes of new water sources (regulation, combined use of surface and ground waters, reuse, desalinization and transfers between basins), and the improvement of estimation procedures and

methodologies (databases and simulation and optimization models, among others), other measures are being studied for the management of the water demand (programs to reduce loses in infrastructures, to promote water saving, efficiency, management, etc.).

Facing the near future, not only the usual conventional sources (generally reservoirs) are taken into account but the non-conventional sources, which are opening new possibilities and will definitely expand, are also gaining importance.

It is worth highlighting the large potential of the direct reuse of purified wastewater and the desalinization of marine and brackish waters. Today, this second option acquires relevance to solve many different situations, especially given the current decline of costs due to technical progress of the desalinization plants and the foreseeable decrease of energy prices.

The integration of surface and ground waters in schemes of joint exploitation is other alternative currently in consideration, although there are certain limiting factors (natural, economic and related to the existing hydraulic infrastructures) that make it difficult to put into practice this option.

These new grounds, inspirers of the new water policy that gains legislative value with the Water Framework Directive, are materialized in the Spanish water policy through the Program A.G.U.A.

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5.- THE PROGRAM A.G.U.A.

The Program "Actions for the Management and Use of Water" (AGUA by its acronym in Spanish) is the instrument of the new orientation of the water policy in Spain. This policy, based on the principles of the WFD, is not a series of actions related to infrastructures but an authentic management program.

The Program is based on three tools:

- ⇒ Investment on actions. Some of the activities are completely new while others were already considered in the National Hydrologic Plan and have been subject of revision.
- ⇒ New legislation
- ⇒ Efficient management of the resources

AGUA will make possible for citizens to know more about the water policy and contribute with suggestions and proposals to the Ministry of Environment with the intention of improving the actions taken.

This program arose with the following goals: (i) to solve the deficiencies existent in water management in Spain (especially in the Mediterranean basins) regarding both the availability and quality of water; (ii) to overcome the lack of knowledge and the common images, still present in the general public, that may defend actions that are contrary to the European regulation; (iii) to spread water technologies that are more efficient and respectful with the environment.

Its implementation will take place in the period 2004-2008, through the achievement of the following targets:

- ⇒ To reform Basin Organizations, with the incorporation of the Regional Governments in the decision making process and the promotion of citizen participation.

⇒ To create Public Water Banks in each watershed, which will allow the reallocation of historical water use rights using new criteria such as equity, efficiency and sustainability.
⇒ To set up water prices according to the real extraction and treatment costs.
⇒ To improve water management and supply through the optimization and better distribution of infrastructures (for both urban supply and irrigation), purification-reuse and desalinization.

The implementation of the program will have a modular character, with actions to be developed independently and with flexibility in each basin, allowing for progressive results. Thanks to this, there is autonomy for the future development of each territory and the possibility of achieving a greater social and territorial consensus in regards to the water policy.

To answer the question of where it will be applied, AGUA will be developed in the entire country, although the first actions have taken place in the Mediterranean basins. More than one hundred specific actions are prepared for these watersheds, which have been defined in collaboration with the sectors interested in obtaining and using the water: farmers, consumers, business people…

In this sense, the program has developed actions not previously executed but that are compatible with the new water policy (and so open to European financing). It also includes new actions for management optimization, empowering social participation. Overall, 105 urgent actions have been proposed for the Mediterranean Arc.

We have seen how the program AGUA is the materialization of the new water policy in Spain. The following sections will explain the keystones of this policy.

6.- KEY ELEMENTS OF THE NEW WATER POLICY

Far from making a catalog of all the programs of actions taking place in Spain in relation to water, we want to explain the key elements of the new policy. These components respond to the new conceptions, are materialized in programs (many of them of transverse character) and include numerous transforming measures.

6.1.- ADJUSTMENT TO THE EUROPEAN REGULATION

6.1.1. THE WATER FRAMEWORK DIRECTIVE

The Program A.G.U.A. entails a redirection of the water policy in Spain, a new direction that occurs in the middle of the adjustment process to the Directive 2000/60/CE, the Water Framework Directive (WFD), that implies a new management model.

The WFD is the most important regulation on water policy in the European Union countries. It establishes criteria for water protection, to prevent its pollution, to promote its sustainable use, to protect the environment, to lessen the effect of droughts or floods, and to improve the status of aquatic ecosystems.

The main goal of the WFD is the maintenance and improvement of the aquatic environment in the European Union, and compels the Member States to reach a good ecological and chemical status of all water bodies (groundwater, surface, coastal and transitional), as well as to take into

consideration all the social and environmental costs of the use of the water in pre-established timelines.

The challenges of the WFD *focus* on changing the traditional water management methodology to a management that is committed to the environment. The understanding of the water policy goes from a strategy based on the offer (materialized in the large infrastructures) to one based on the optimization of the demand, with a complete recovery of costs so that public subsidies in the water price can be gradually reduced.

The WFD is based on the following key aspects:

- Maximum consideration to water quality and the impact of human activity.
- The qualitative status of the aquatic environment becomes a restriction for the development of activities and the allocation of the resource.
- Water saving enforcement and/or promotion policies.
- Prices that reflect financial costs, any damage caused to the environment and shortages.
- Instruments for controlling water use and guarding hydrological systems.
- Citizen participation.

The WFD principles the Spanish water policy should be based on are:

1. **Sustainability Principle** (no deterioration)

    - To prevent damages, to protect and improve the status of aquatic ecosystems (WFD, Art. 1, Pt a)

- Integrated management at the watershed level to improve the ecological status. Estuaries, deltas and coastal waters are included.

2. *Subsidiary* Principle
   - Decisions must be adopted as closest to the problem as possible.

3. Effectiveness Principle
   - To determine sufficiently detailed and justified previsions of costs and prices (WFD, Art. 9 and Annex III).
   - To apply combinations of measures with the best cost/effectiveness relationship.
   - To estimate and recover real costs, including the environmental and shortage ones.

4.Participation Principle
   - To ensure transparency in the information and decisions.
   - To facilitate active participation of all the actors.

The key points of the WFD would be:

⇒ We will only have safe and healthy water supply if our aquatic ecosystems are also safe and healthy.
⇒ The main goal of the water policy should be to improve the ecological status of aquatic ecosystems.
⇒ The ecological status is defined at four levels:
   - Physical-chemical condition (water quality)
   - Quantitative state (river flows and other water bodies)
   - Biological condition (fauna and flora diversity, river flows and banks)

- Morphodynamic processes (erosion, transport, sedimentation)

⇒ In 2015, all water bodies in the European Union should be in a ¨good ecological status¨.

The transposition of the WFD to the Spanish regulation was made through the Law 62/2003 on fiscal, administrative and social measures, accompanying law to the Government's General Budget for 2004. It is the modification of the adapted text of the Water Law.

Spanish authorities have confirmed their commitment to the compliance of the Directive, looking for a sustainable use of water through a management model that gives preference to the optimization of the resources before the construction of big and costly hydraulic infrastructures.

All the environmental objectives of this regulation should be accomplished by 2015, and their implementation represents a coordinated and joint challenge for all the Member States. Hence, international agreements have established a necessary common strategy to accomplish these goals.

The improvement in the exchange of information between States is one of the key actions. For this reason, a public access platform, WFD CIRCA, has been created with valuable information on the process, and regular meetings are organized to specify agreements such as the commitment for the sustainability of the Mediterranean, subscribed by Spain to defend the historic, cultural and climatic singularity of this zone in the elaboration of a common water policy.

The **timeline** would be:

⇒ 2000: Publication of the Directive

⇒ 2003:

- o Transposition of the Directive
- o Delimitation of the Public Hydraulic Domain (DPH)
- o Competent Authorities

⇒ 2004:

- o Characterization of the DPH
- o Registration of Protected Zones
- o Analysis of pressures and impacts
- o Economic analysis

⇒ 2006

- o Follow up program
- o Working schedule for the Hydrological Plan
- o Public Consultation

⇒ 2009

- o Publication of the Hydrological Plan
- o Program of Measures

⇒ 2010

- o Performance Repercussion of costs

⇒ 2012:

- o Performance Program of Measures

⇒ **2015:**

- o Good ecological and chemical status of water bodies

Revision every 6 years

6.1.2. REFORM OF THE BASIN ORGANIZATIONS

To fulfill the goals of the WFD, the new management policy of the Spanish Government has to implement a reform of the Basin Organizations. The objective is to change the traditional priorities and promotion measures of hydraulic works by the environmental

management of hydrological ecosystems, which will demand a new approach that is multidisciplinary, more transparent and open to the citizenship.

This reform is not only directed to a new water management model but it is also aimed at getting a greater implication of the Regional Governments in the management of hydrological resources. In fact, since the creation of these authorities, there have been strained negotiations between the National Government and the different Regional Governments so the latter ones can obtain more political competencies and greater economic resources for their regions. The territorial division of water according to the basins superimposes the land division according to the Regional Governments. In most cases, this has implied that the Regional Governments, although having a great part of the competencies for managing their regions, can not have at their disposal all the hydrological resources found in their territories, with the exception of the inner basins. For this reason, the reform of the Basin Organizations should consider a series of concrete measures that will allow to strengthen the cooperation, co-responsibility and integration of the Regional Governments in the policy of the Basin Organizations.

The reform is structured in the following phases:

Phase I: Modifications of the administrative structure of the Basin Organizations according to new criteria of a rational use of water – more efficiency, more social and territorial cohesion, more environmental protection and more transparency– and that favor the collaboration with the Regional Governments and the users.

Phase II: Modifications in the collegiate associations of participation of the Basin Organizations so Regional Governments and social institutions that do not necessarily represent water users are included. This reform

should be made exploring the different possibilities allowed by the current legislation. AQUI FALTA ALGO…. REVISAR

6.2.- AGRICULTURE: MODERNIZATION OF IRRIGATION

Eighty percent of Spanish hydrological resources are assigned to agriculture, where irrigation is a key piece: it contributes more than 50% of the final agricultural production and uses up to 13% of the useful agricultural land. One hectare of irrigated land produces approximately six times more than a non-irrigated one, generating a four times bigger income. Thus, it becomes essential to optimize its water requirements for its correct maintenance.

Currently, Spain has almost four million hectares of irrigated land. They take up 68% of the available water but its price only reflects between 10 and 20% of its real cost; their infrastructures therefore, require a costly maintenance.

Regarding the difficulties of the water supply for irrigation, there are problems in the water supply in part of the irrigated land which do not always receive the necessary amount to satisfy crop demands. The problems of a secured reserve have appeared especially in the last years. Despite the existing regulating infrastructure, long drought periods frequently cause failures in the water supply for irrigation. During the beginning of this decade, these failures had an important effect on Spanish irrigated lands, with a considerable reduction of water allocations and even the impossibility of irrigation in important areas.

In addition to the problems related to having a secured reserve, there might be difficulties with the delivery of the required amount. This can

be caused by an incorrect estimate of the irrigation needs, the introduction of new crops with higher hydrological needs than the ones originally planned in the project, or the reduction of working hours in the field with the subsequent decrease in working time.

Other difficulty related with the supply is the irrigation efficiency, closely linked to the conservation of the hydrological resources. In the case of irrigation, the efficiency not only refers to the canalization and distribution processes in which important water loses can be made due to filtration and spills, but also to the process of applying water to the crops in which an excess of water, besides obvious loses, can cause salinity problems if there are not sufficient or adequate drainages.

For all this, it is convenient to rehabilitate and modernize the irrigation schemes since loses in conduction and distribution depend on great part on the state and characteristics of the infrastructures. Amongst the more than 100,000 km of irrigation channels of the distribution network, an important proportion is just soil beds without coating. Approximately 30% of the network is more than 100 years old and a significant portion of the remaining is more than 20 years. The ageing and deterioration of these networks is one of the causes of the water loses in the channels and ditches, meaning less volume of water available for crops, even though these resources can usually be used downstream. All this highlights the rehabilitation and modernization needs of the networks in some areas of the Spanish irrigated areas.

For this reason, the Government implemented emergency measures as the National Plan on Irrigation with the following objectives:

- ⇒ To rationalize water consumption through efficient technology.
- ⇒ To improve the landscape from a social and an environmental perspective.
- ⇒ To increase productivity.

The first results already indicate an increase of localized irrigation. This efficient practice has overcome drip irrigation on 110,000 hectares. It is foreseen that the measures already taken will help to save approximately 3,000 cubic hectometers of water in less than two years.

These improvements imply the need for investment, capacity building and commitment of all the interested actors, that is, the Government and the farmers with water use rights.

The Modernization of the 2006-2007 Irrigation Plan, from the Ministries of Environment and Agriculture, Fishing and Food, entails a public investment of 1,873 million euros that will save 1,200hm^3 of water through 73 actions in 876,000 hectares of irrigated land.

The expected results of the Plan are:

- ⇒ To prevent the overexploitation of aquifers
- ⇒ To control spills and soil degradation
- ⇒ To recover wetlands
- ⇒ To fight desertification
- ⇒ To prevent migration through improving the quality of life of rural people

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6.3.1. URBAN SUPPLY

One characteristic of the water demand in the urban cycle is the great heterogeneity of its use, since it includes domestic (single uses), municipal, collective (public services such as hospitals and schools), industrial, commercial and farming uses; all which just hinders its knowledge.

Furthermore, the water demand, which is highly concentrated by regions, should have maximum priority, a secured supply reserve and quality levels superior to the rest of the uses.

The most obvious problems of the Spanish supplying systems refer to its reliability and vulnerability. Reliability, understood as a secured supply reserve, should be near 100%, meaning total security of water supply. Nonetheless, droughts in the last years have shown that supply systems in many areas are not reliable, frequently showing failures in the supply of potable water. With such failures affecting vast regions, the vulnerability of these systems has also become evident. A great part of the Spanish population (approximately ten million people) suffered from water supply shortages during the drought of the 90s. Populations such as Granada, Jaen, Seville, Malaga and Toledo, and the regions of Bahía de Cádiz and Costa del Sol suffered from severe supply restrictions, in some cases with shortages of up to 30% and daily cuts 9 to 10 hours long.

Besides this inadequacy of resources, derived from the irregularity of its presentation, there are also supply problems in regions with sufficient

resources but little regulation capacity, such as in the Cantabrian coast, where some populations recurrently suffer from water supply shortages during the summer months.

Given the previsions of the Basin Hydrological Plans, these situations can worsen in the next few years. Increases in the water demand of 15% and 36% in the mid and long term (10 and 20 years) have been foreseen. This rise, which in absolute terms may not be that important compared with other demands, bring up the problem of its geographic concentration, probably hindering the gathering of new resources, each time more distant and usually more compromised.

Considering the balance between the existing resources and the urban demand in Spain, there are still important deficiencies that are shown with greater severity during shortage periods, when the amount of resources remain lower than the average value for several years.

The need to increase the secured reserve of water supply, as close to 100% as possible requires measures that restore the equilibrium by either optimizing the supply network to minimize losses or by implementing non-conventional technologies such as desalinization.

❖ Optimization of the urban distribution networks

The development of our cities has involved a greater complexity of water supply facilities and networks. Treatment, pumping and storage facilities, as well as the extensive network existent in Spain, require constant maintenance and upgrading to accomplish the necessary quality requirements.

The current situation is also affected by the sustainability principles stated in the Aalborg Letter and the Hannover Declaration on

sustainable cities, and implemented at the local level through Agenda 21; principles to which Spain has committed to.

The infrastructure of the water supply network in an average Spanish city, such as Saragossa, headquarters of Expo Zaragoza 2008, allows for the distribution of more than 200 million liters potable water daily, and just for domestic use.

According to INE (Spanish National Statistics Institute) data, in 2004 an average of 59.5 liters of water per inhabitant and day were lost in the distribution network, approximately 17.9% of the total volume of water supplied by the network.

Regarding the implications, the system requires reliability and guarantee of both water quality and supply management. Effectiveness and economic optimization are also important criteria that should be considered in the supply provision.

As key pieces, the maintenance and improvement of the distribution network present difficulties for its preservation, such as the need for continuous operation, the diversity of materials used or the length of the network, as well as the inconveniences that may appear in the urban life in case of interference. Therefore, important investments are needed.

In a global demographic expansion context, the challenges of the urban supply management include anticipating future provision requirements in regards to the water extraction and the adequate maintenance of the network.

The objectives would be the following:

- ⇒ To improve control of the water generated and supplied
- ⇒ To adapt facilities

⇒ To reform and improve the water network
⇒ Consumption management
⇒ To incorporate technology into the process

❖ **Desalinization as an autonomous and guaranteed solution**

Given the constraints of the available hydrological resources, desalinization technologies and remote water pumping may alleviate the existing demand, especially in the insular regions where minimum precipitation values coincide with high tourist presence and high water requirement for agriculture.

Spain has thirty years of experience regarding desalinization technologies, but just very recently the Government has definitely bet for this system, which, together with the reuse of purified water and the modernization of irrigation is the counterpoint of the traditional hydraulic works (reservoirs, water transfers).

Among its advantages are:

⇒ High quality water.
⇒ The availability of resources can be guaranteed, even during drought periods
⇒ Progressive reduction of energy costs
⇒ Cost per square meter of desalinated water missing

Today, Spain has 700 desalinization plants with a production capacity of 800,000 cubic hectometers per day. The water generated is perfectly fit for human and productive (agriculture, industry and services sector) consumption.

The program A.G.U.A., implemented by the Spanish Ministry of Environment, has put into operation desalinization plants that generate

713 cubic hectometers (an investment of 1,945 million euros), considerably increasing the 2004 amount of 140 cubic hectometers per day.

The implications derived from the use of this technology include the previous analysis regarding the location of the desalinization plants (Environmental Impact Assessment) and the implementation of measures for the treatment or discard of the surplus of the plants without causing any impact on the environment.

Besides, in the last ten years, technological development has allowed to reduce energy consumption by half, as well as made possible that the return of water with greater salt concentration to the sea has no effect on the marine fauna and flora, through techniques of dilution and selection of long distance locations for the discharge.

In the last years, the desalinization cost has decreased to half of its previous value due to the increase in the energy efficiency of the plants, currently being about 0.45 euros per cubic meter.

The ¨Renewable energy program related to desalinization¨ has been developed to optimize energy management in the Mediterranean. Such program will allow the production of more renewable energy than the one consumed by the plants of the program A.G.U.A.

The challenge is to dismiss old myths on this technique and understand desalinization as a way to bring resources that should be complemented by consumption rationalization factors such as an optimum water management, recycling systems and water reuse. Desalinization allows:

⇒ To guarantee high quality water at all times, without the uncertainties derived from the rain regime or the increase in water consumption in upstream watersheds.

⇒ To substitute surface and groundwater, highly used in the coast (tourism and urbanization), by the resources generated through desalinization so the first ones can be used in the inner territories (agriculture or supply).

⇒ To take advantage of a technology in which Spanish organizations are world leaders.

6.3.2. SANITATION: PURIFICATION AND REUSE

Pollution from agricultural, industrial and domestic wastewaters breaks the natural purification capacity of the natural water cycle. Polluted waters put health in danger and lessen the quality of the available hydrological resources.

Urban expansion, with the consequent increase in water consumption, has also generated an equivalent rise in wastewater. Domestic wastewater and industrial and agricultural drainages are loaded with residues having an environmental impact that can and should be minimized through purification. Additionally, the resulting water could then be reused after the proper treatment.

Regarding the current situation, it has already been mentioned that the measures gathered in the Water Framework Directive, in force since 2004, intend to recover the quality of European waters (rivers, aquifers, lakes, watersheds, estuaries, coastal waters…) and thus protect the hydrological environment.

To accomplish these requirements, Spain has developed several initiatives such as the National Water Quality Plan or the River Restoration Plan, already in implementation. The goals of these actions

focus on maintaining a good status of all water bodies, continental, coastal or transitional.

Approximately 70 to 80% of the water allocated for domestic use end up as wastewater drained into the sanitation network or other types of drainages to finally reach natural water bodies. Water used by the industry for its operation and cleaning activities is drained into the drainage network and channels, ending up in rivers, lakes and the ocean.

On the other hand, the environmental impact of agricultural wastewater, loaded with pesticides and fertilizers used in agriculture, organic material and soil particles, can cause critical damages to the natural ecosystems.

One of the consequences is that States must fix stricter values and sampling frequencies for water quality control than what is stated in the WFD, which implies more investment in technology.

According to the European Directive on Wastewater 91/271/CEE, the Sanitation and Purification Plan 1995-2005 foresaw the purification of drainages from urban populations of more than 2,000 inhabitants equivalent before December 31st, 2005. This plan established a financial model to pay for the investment costs; however, regional deficiencies have not allowed a full compliance of the requirements of the Directive, which can bring significant sanctions for Spain. Furthermore, several European regulations on water quality, approved after 1995, call for an important complementary investment effort form the Public Administrations.

The challenges include the use of adequate technologies, new management and financial methods, and active participation from all administrative levels and social agents related to this subject. All this is

necessary to successfully fulfil all the quality objectives established by the WFD.

In 2006, the Ministry of Environment worked with all the Regional Governments to establish the basis for a new National Plan on Water Quality: Sanitation and Purification 2007-2015. The objectives are:

- To accomplish all the requirements established in the Directive 91/271/CEE.

⇒ To contribute to reach the environmental goals of the WFD by 2015.

6.4.- NATURAL RISKS MANAGEMENT

6.4.1. DROUGHT

Drought can be a natural disaster when there is no capacity for hydrological resources management. It can also cause severe damages if water management is not efficient. The World Meteorological Organization estimated that 28,000 million people have suffered the consequences of natural meteorological disasters since 1967; half of them affected by droughts.

❖ **Drought related concepts**

The meanings around the term ¨Drought¨ are multiple and confusing. We can define drought as a temporary anomaly in precipitation, capable

of causing damages and negative impacts to the society. There are two key points to be considered in this definition:

⇒ Temporary anomaly in precipitation, with the mainstream in the physical conditions..
⇒ Impacts, which depend on both the intensity of the precipitation anomaly and the vulnerability of the society to this event. This vulnerability is greatly dependent on the management of the resource.

To clarify these variables, we have to define the following concepts:

⇒ **Aridity**: structural and natural rainfall shortage situation of a given region. For example, the Mediterranean summers represent an arid period (using the appropriate indicators); therefore, the term drought could not be applied in this case.

⇒ **Meteorological Drought**: influences the precipitation anomalies. It has a temporal, cyclic and natural character. To study this type of drought, we count with indicators that are evaluated through a strictly meteorological and climatic analysis, not taking into account the possible impacts.

⇒ **Edaphic drought***:* soil humidity shortage, with a great impact on dry agriculture and farming. It originates in the meteorological drought, although since some rainy years present short periods of precipitation shortages during the spring (when vegetation growth in the Mediterranean is greater), this drought could be generated in years with no severe rainfall anomalies. On the contrary, sometimes the scarce rainfall of dry periods can be distributed in the key phases of vegetation growth and so, the edaphic drought and its impacts could not appear even in the case of a meteorological drought.

⇒ **Hydrological drought or water shortage**: it means the shortage of the resource itself, situation generated by the imbalance between the water offer and the demand. This condition depends on the management of the hydrological resource, which in case of optimization it would mean availability of water even in meteorological drought periods. On the contrary, an inefficient management with an excess of the demand (for irrigation for example) could place us in a hydrological drought or water shortage, even in periods of normal rainfall. This type of drought causes the greater number of impacts for society such as damages to agriculture or restrictions in urban supply, all which has a mass media effect and an associated political crisis.

❖ Drought recurrence in Spain

Spain has been particularly affected by the drought phenomena. During the period 1880-2000, more than half of the years have been classified as dry or very dry. In the decade of the 80s, seven years were considered as dry or very dry, and in the 90s five years received the same categorization. According to the agricultural organizations, during the period 1992-1995, the economic loses caused by drought events in the sector were higher than 9,000 million euros.

Even though droughts affect all regions in Spain, the territories where annual rainfall does not exceed 600 mm are the ones suffering the greatest consequences.

Drought episodes in Spain during the 19th and 20th century.		
	Dry years	Drought sequences
19th century	1836, 1853, 1882,	1820–30 1840–50 1861–80
20th century	1907, 1950, 1952, 1955, 1961, 1966, 1970, 1973, 1998	1909–14 1938–89 1944–45 1963–64 1978–84 1992–96
21st century		2005–07

Source: INM

According to the White Book of Water, the most severe droughts of the 20th century occurred during the following three periods:

- ⇒ October 1941 to September 1945
- ⇒ October 1979 to September 1983
- ⇒ October 1990 to September 1995 (the most acute one)

These three drought periods affected most of the Spanish territory and caused considerable decreases in precipitation, such as the case of the Guadalquivir basin that suffered a reduction in rainfall of more than 30%.

Runoff values declined considerably during the drought of the 90s, with reductions higher than 40% in most of the Spanish territory. These decreases represented more than 70% of the interannual average contribution *to* the Guadiana and Guadalquivir basins. The southern watersheds and the Tajo suffered a decline of approximately 60% and

50% respectively, while the Duero, Segura, North and Ebro basins experienced decreases between 20 and 40%. The variation in the rest of the watersheds was lower, and only the Catalonian Inner Basins showed positive data (an increase of 15%).

❖ Actions

The measures taken to improve water management and fight the drought periods focus on the new Drought Observatory, the Special Drought Plans, basic infrastructures to increase water availability and the regularization of agricultural insurances.

❖ National Drought Observatory

The National Drought Observatory (ONS by its Spanish initials) is an initiative of the Ministries of Environment and Agriculture, Fishing and Food. It intends to group all the Spanish Hydraulic Administrations with competences in water issues, to form a Center of knowledge, *anticipation*, mitigation and follow up of the effects of drought evens in the national territory.

The Observatory is *constituted* by:

- The eight *inter-regional* Basin Organizations that depend on the National Government.
- The seven *intra-regional* Hydraulic Administrations (Galician coast, Vasco country, Catalonian Inner Basins, Mediterranean-Andalusan Watershed, Balearic and Canary Islands).
- The autonomous cities of Ceuta and Melilla.
- The seventeen Regional Governments.
- Local corporations.

It is a real national observatory where all the interested actors with responsibilities in the subject can participate and offer the necessary information for an adequate management that permits the anticipation of drought effects and the mitigation of its consequences on the environment, the society and the economy. This initiative is framed with the new policy of *reinforcement* of the public control of the use and quality of water, and intends to *promote* citizen participation and co-responsibility to *fight squandering*, speculation, and water shortages and pollution.

The National Drought Observatory is a clear exponent of the participation policy, not only of the competent Hydraulic Administrations but also of all the citizens that want and demand transparency and quality of information. Because of this, the Observatory is created with the premise of being a center of reference for the follow up and analysis of drought in Spain, and not just a place to discuss mass media topics. Citizen participation is essential to attain this, either through the Commissions with the Users and Experts or through the environmental education campaigns promoted by the different Administrations.

❖ Special Drought Plans and Environmental Sustainability Reports

One of the key elements in the prevention of droughts are the Drought Plans, which should be developed by each Basin Organization in the near future and include drought thresholds and protocols of action.

According to Articles 10 and 21 of the Law 9/2006 of April 28th, the preliminary versions of these Plans for the North, Duero, Tajo, Guadiana, Guadalquivir, Segura, Jucar and Ebro Basins Organizations are currently in the consultation period.

❖ Agricultural Insurance

The Ministry of Agriculture, Fishing and Food established an agricultural insurance system to compensate for part of the agricultural damages caused by drought events. In addition, a combination of measures was taken to alleviate some of the damages not covered by the insurance.

Agricultural insurance in Spain is based on the particular agroclimatic conditions of the Peninsula: adequate climate for a diverse agricultural production, but with an extreme variability in its climatic factors.

Private and public agricultural insurance, as well as a combination of both, were developed in Spain during the 20th century. After several failures, a combined system, developed in 1978, received great *acceptance* since it considered the private (insurers and insured people) and the public interest.

The insurable production types are:

- Agricultural Production: All vegetable production cultivated in Spain can be insured.
- Farming Production: cattle, sheep, goat and horses can be insured.
- Aquicultural Production: Trout, silthead bream, seabass, turbot and mussels can be insured.
- Timber and Forest Production: Although insurable by Law 87/1978, they have not been included in the system yet.

Drought risks are covered by integral insurance (winter cereals, vineyard…), production insurance (olive trees, almonds…), beekeeping and pastures insurances.

The Government dedicated 229.67 million euros to support the Agriculture Insurance Plan 2005, of which 224.18 million euros were used to subsidize the insurance hired by farmers.

- **Measures to palliate the damages not covered by the agricultural insurances**:

The Spanish Government has already established some measures while others have been proposed to the European Union. The ones adopted by the Government intend that people who depend on agriculture do not have to leave it because of droughts: dedicating public support mainly to farmers and Priority Exploitations, acting in the promotion of Insurance as the most adequate instrument to manage the damages caused by climate, and having a special consideration for the most affected sectors such as extensive farming, which is particularly sensitive to the effects of droughts due to its dependence on pastures for animal feeding.

The measures proposed to the EU relate to agriculture, farming and rural development. For example, in all the Spanish territory, with the exception of the Cantabrian Coast, it was proposed to exclude the need to harvest pulses so farmers can receive economic help if harvesting was not possible due to droughts. Regarding rural development, one of the measures was to anticipate the compensation in 2005 in the regions affected by droughts.

6.4.2. FLOODINGS AND WATERCOURSES

Although precipitation in Spain is not abundant, rainfall can sometimes reach higher values than the annual average, such as in some regions of the Mediterranean coast. Consequently, the big difference between ordinary and extraordinary river flows makes floods a severe problem in Spain.

Originally, floods are a hydrological problem; however, they become a territorial problem with great socioeconomic consequences when they affect areas of human activity. Humans have traditionally located on alluvial terrains next to rivers, since they are plain and fertile, but this fact, together with an inefficient landscape planning, has just aggravated the flood problem, probably being its indirect cause.

Material damages caused by floods could be interpreted as the *cost* of the occupation of some territories with a reduced surface but important territorial value, since frequently the river corridor is a key driver for the establishment of cities, irrigation infrastructure, transportation network, etc.

Human intervention in floodplains has implied an artificial change of the plain's answer to floods due to constructions, crops (since they change natural rugosity), obstructions by transportation networks and other obstacles that can even deviate the flood to places that would otherwise have not suffered from flooding.

❖ Criteria for action

In the new policy, actions for the protection against floods are based on several basic criteria that ensure their efficiency in reducing damages.

Among this criteria, we can highlight the coordination between the different administrations and institutions involved; decentralization; the separation of material and human damages, developing programs oriented to differentiated objectives; realism, admitting that complete protection does not exist; respect for the environment; prevention, avoiding urban occupation of floodplains; and, finally, transparency, clearly explaining all risks taken and the goals of the measures.

The organization of the actions for defence are implemented by sectors, through reforestation programs, the implementation of alert and prevision systems such as the Automatic Systems of Hydrological Information (SAIH by its initials in Spanish); structural actions such as flood detention dams, artificial channels or longitudinal dikes, non-structural measures of landscape planning, actions on the transportation network with the double objective of saving human lives and reducing damages by service interruptions, and insurance programs oriented to the protection of agricultural goods.

❖ Adequate levels of protection

The level of protection intended for each region requires a balance between the cost of actions and the value of protected goods. In agricultural areas for example, a high level of protection is only allowed for extensive floodplain areas and high value crops, so the potential damages that are avoided are larger than the cost of the works plus the possible affection of the fluvial ecosystem.

The way to obtain more adequate levels of protection consists in the combination of structural and non-structural measures. Hence, urban areas under flood risk could be protected from ordinary floods with structural measures, leaving non-structural measures for supplementary protection against extraordinary floods.

❖ Structural and non-structural measures

Spain, just like many other countries, has been traditionally applying structural measures based on infrastructures (mainly flood detention dams and artificial channels). In fact, a significant part of the investments planned in the Basin Plans are intended to this type of actions.

Nonetheless, non-structural measures have also been applied in the last years. This type of measures do not act on the watercourse itself (as the structural measure does), altering its hydrological or hydraulic characteristics, but modifies the susceptibility of the floodplain to flood damages. These measures do not eliminate flood risks but can minimize its effects.

Some of the non-structural measures mostly used are the prevision and alert systems (SAIH), already implemented in great part of the Spanish territory, and landscape planning of floodplain areas. This last measure is still scarcely developed, as shown in the few references to it made in the Basin Plans. Risk maps are needed for its application, but they have only been prepared in the Valencia Region and the Vasco country.

It is essential to incorporate the concept of flood risk in the instruments of urban planning. For this, the General Plans of Urban Planning have to include the delimitation of the public domain in the urban areas, and where risk maps are available, the delimitation of the types of risks identified. This cartography must be elaborated by the local Administrations, with the technical and economic collaboration of the Regional and National Governments, and should be available for the competent Organisms of landscape and urban planning.

Finally, insurance is the ideal instrument for protection when the cost of defence exceeds the value of the protected area. It should be the base of protection in rural regions, in particular against damages to agriculture and farming.

6.5.- ENVIRONMENTAL KEY ELEMENTS: NATIONAL PLAN OF RIVER RESTORATION

It is a line of work from the environmental perspective, where water is not treated as a mere resource but as another element of the territory and the landscape. The best representative of this new policy is the National Plan of River Restoration (NPRR), which with a national context, intends to recover the structure and natural functioning of Spanish rivers and riversides.

This Plan was initiated because:

1º.- The goal of the WFD is to establish a framework for the protection of water bodies that prevents additional deterioration and protects and improves the status of aquatic and terrestrial ecosystems, and the wetlands directly dependent on them.

2º.- The program AGUA, based on the WFD principles, establishes the recovery of aquatic ecosystems and the associated terrestrial ones as keystones of the water policy.

3º.- In addition to the previous points, the growing social demand of river recovery has motivated the Ministry of Environment to develop a National Plan of River Restoration.

❖ **Goals**

⇒ Impulse to the current management of our rivers to reach a good ecological status, complying with the Water Framework Directive.
⇒ To promote the integration of policies, the ones regarding land use and management and the ones related to the use and management of fluvial ecosystems, with sustainability criteria.
⇒ To improve capacity building in the subjects related to the sustainable management of rivers and their restoration.
⇒ To provide information and experiences to improve the actions related to river restoration in Spain.
⇒ To promote citizen participation and involve social groups in the management of fluvial ecosystems.

❖ **Guide for the preparation of restoration projects.**

It is a key aspect to accomplish the goals of the Plan. The guide is currently going through an internal process of debate and waiting for the end of the debating phase in the working tables for its improvement and final publication. It will be the base of the restoration projects developed in the framework of the Plan.

❖ **Volunteering programs in rivers.**

An important aspect to achieve the objectives of the Plan is to promote public participation and implication. The first phase has been the elaboration of a Guide for the design and implementation of Environmental volunteering programs in rivers and riversides; the

second one is the promotion and logistical and financial support to volunteering actions in our rivers in the framework of this Guide of action.

❖ **Current actions related to the NPRR**

To sum up and reviewing the key elements of the new water policy and the programs related to them, we will highlight the actions of the National Plan of River Restoration.

⇒ **Water quality**
- *Spills Rapid Assessment.*
- *National Plan of Water Quality: Sanitation and Purification*
- *Control networks: adjustment to the WFD.*

⇒ **Water quantity**
- *Program ALBERCA and Registry of Water permits*

⇒ ***Protection and Conservation of the Hydraulic Public Domain (HPD)***
- *Program of Conservation and Improvement of the HPD*
- *Characterization of the riverside vegetation.*
- *National System of Floodplains cartography.*
- *Project LINDE.*
- ***Report of urban planning.***

⇒ ***Legislative changes***
- *National Water Council*

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