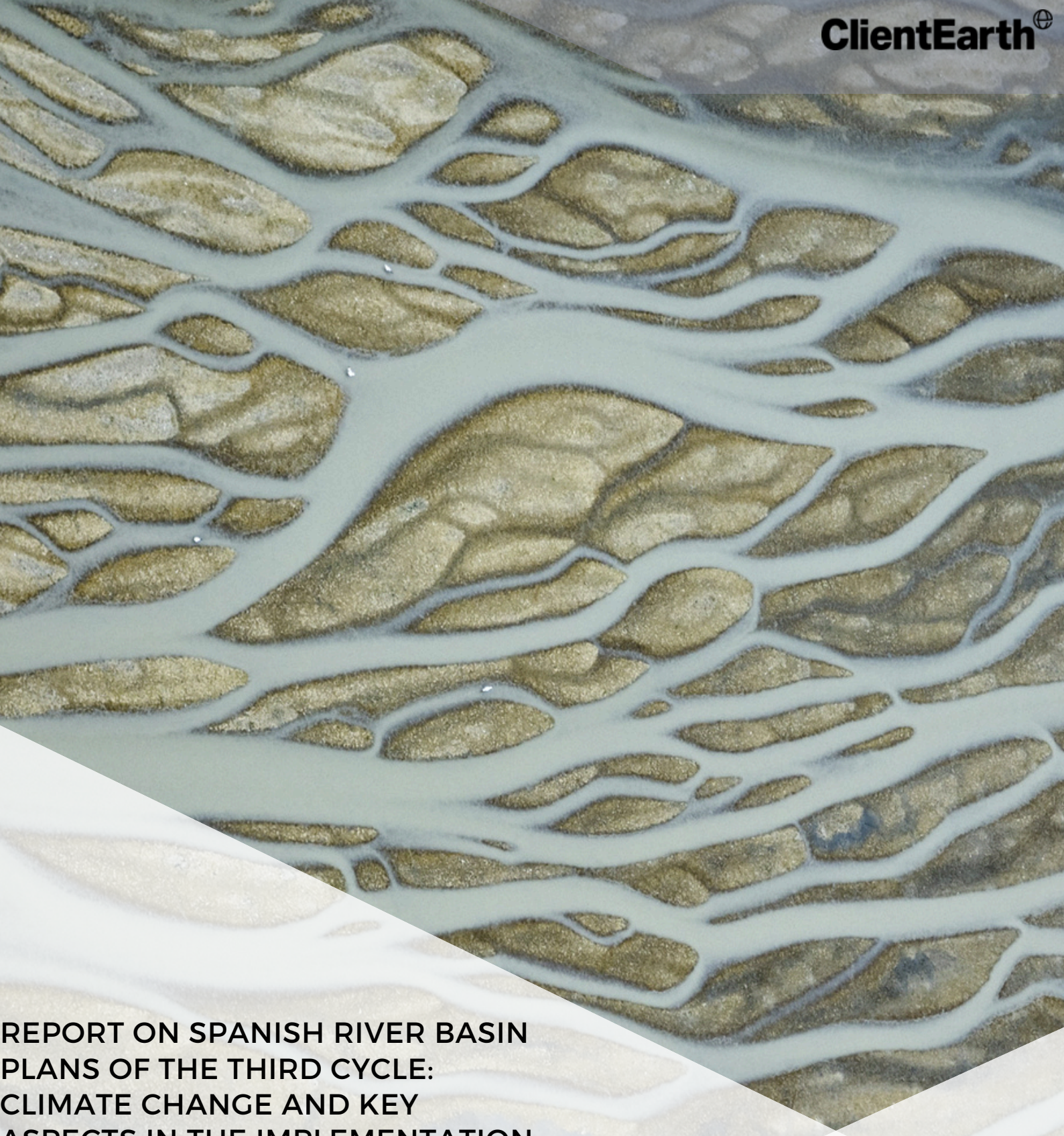

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REPORT ON SPANISH RIVER BASIN PLANS OF THE THIRD CYCLE: CLIMATE CHANGE AND KEY ASPECTS IN THE IMPLEMENTATION OF THE WATER FRAMEWORK DIRECTIVE

ECOLOGICAL FLOW REGIMES IN THIRD CYCLE RIVER BASIN MANAGEMENT PLANS

2024

ClientEarth

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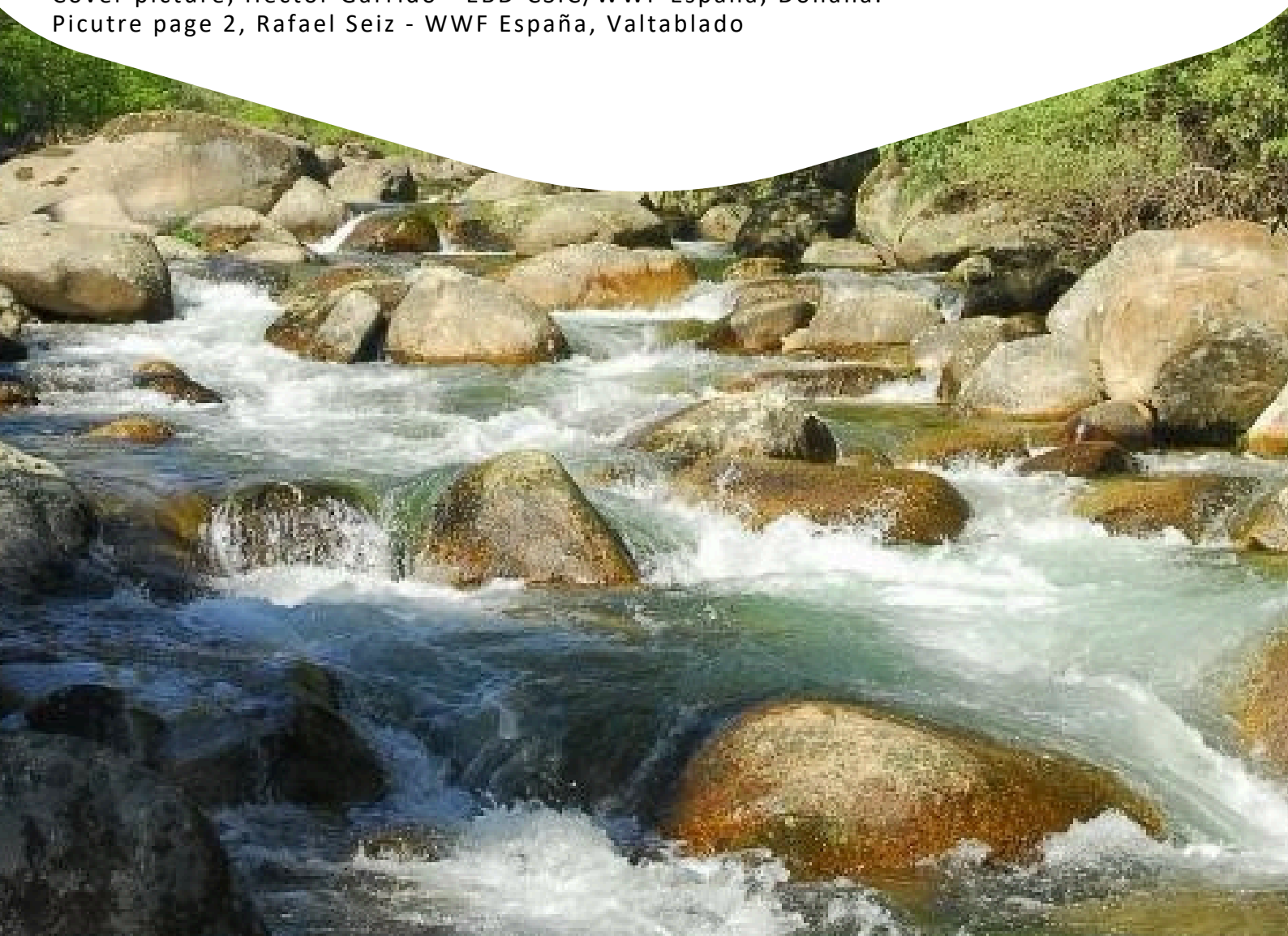

In this report, reports and documents prepared by the FNCA and WWF, which are cited in the bibliography, have been used extensively as references. In addition, various public participation documents (mainly allegations) from the following groups have been consulted: Fundación Nueva Cultura del Agua (FNCA), World Wildlife Fund (WWF), Asociación de municipios ribereños de los embales de Entrepeñas y Buendía, Cuenca azul, Ecologistas en Acción de la Región Murciana, Mesa Social del Agua de Andalucía, Red Ciudadana del Tajo, Xarxa per una Nova Cultura de l'Aigua al Xúquer, Xúquer Viu, Plataforma en defensa de los ríos Tajo y Alberche de Talavera de la Reina.

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This is the third part of the REPORT ON SPANISH THIRD CYCLE HYDROLOGICAL PLANS: CLIMATE CHANGE AND KEY ISSUES IN THE IMPLEMENTATION OF THE WATER FRAMEWORK DIRECTIVE that has four parts:

This report, analyses the latest Spanish river basin management plans in four large inter-community river basin districts (Ebro, Segura, Guadalquivir and Tajo) with information also from other districts, such as the Júcar.

Part 3- The regime of ecological flows in the hydrological plans of the third cycle: this chapter presents the definition, calculation, inclusion in the plans; degree of compliance and adaptive monitoring; repercussions on the state of ecosystems (fish indicators, solid flows and connection between surface and groundwater); protected areas, the Natura 2000 Network and coordination with other administrations; specific analysis of ecological flows in two case studies, the middle stretch of the Tagus River and the Ebro Delta.

-Executive summary of the full report (English)

-Report on Spanish river basin plans of the third cycle: climate change and key aspects in the implementation of the water framework directive. Full report in Spanish (including References and Bibliography)

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3. ECOLOGICAL FLOW REGIMES IN THIRD CYCLE RIVER BASIN MANAGEMENT PLANS

Ecological flows are a fundamental tool to preserve or restore the health of ecosystems faced with pressure caused by the use of water. The European Guide for implementation of ecological flows[1] (EC, 2016) clearly describes how those flows are related to the status of water bodies. The document establishes[2] that Member States must implement their own ecological flows while "*respecting the WFD obligations, the Habitats Directive and other European Directives and international commitments* (such as the Ramsar Convention). (...) *The fact that water management plays a fundamental role in determining physical habitats is well documented, which in turn determines the biotic composition and supports the production and sustainability of aquatic ecosystems. Within the context of the WFD, ecological flows are considered to be coherent water management to achieve the environmental objectives established in the WFD in natural surface water bodies, as mentioned in Section 1 of Article 4.*

Considering Section 1 of Article 4 of the WFD, the environmental objectives refer to:

- Non-deterioration of currently existing status.

- Achieving good statuses of natural surface water bodies.

- Fulfilment of the standards and objectives concerning protected areas, including those designated for the protection of habitats or species where maintenance or improvement of the status of water is an important factor for their protection, including relevant Natura 2000 sites designated under the Directives on birds and habitats[3].

As a general rule, in order to ensure non-deterioration of the status of water bodies, any significant alterations to water management must be actively prevented.

As made obvious in the Q-Clima project[4] (Martínez et al., 2018) on ecological flows in Spain and adaptation to climate change, the need to restore or maintain our river ecosystems entails ensuring they carry enough water in the way and structure necessary to guarantee natural biological and morphological processes. This need is even more important if we consider the foreseeable reduction in the contribution by rivers to such processes resulting from the forecasts made through climate change models.

The functions and objectives of ecological flow management were explained in the Q-Clima project, referring to the European Water Framework Directive (WFD) and transposition to Spanish law. The objective of establishing and implementing ecological flows is to sustainably maintain the functionality and structure of aquatic ecosystems and associated terrestrial

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[1] European Commission, Directorate-General for Environment, Ecological flows in the implementation of the Water Framework Directive. Guidance document No 31, Publications Office, 2016, https://data.europa.eu/doi/10.2779/775712.

[2] The following text has been translated from the EC Guidance document No 31, pages 2-3.

[3] Directives 2009/147/EC and 79/409/EEC.

[4] The Q-Clima project was carried out in two phases: Phase I which commenced in October 2017 and ended in June 2018 (Martínez et al., 2018), and Phase II (García et al. 2020) which commenced in October 2019 and ended in October 2020.

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ecosystems, thus contributing to achieving a good status or ecological potential in rivers or transitional waters, and avoiding any deterioration thereof. Spanish water legislation in particular indicates that at least fish life which would naturally inhabit or could inhabit the river, and its riverbank vegetation must be maintained. Ecological flows though, must also contribute to meeting the aforementioned goal that water-related habitats and species in protected areas (Natura 2000, Ramsar wetlands, etc.) are to maintain or reach a favourable status of conservation.

Implementation of ecological flows, as described in the aforementioned project, are understood as a restorative measure that seeks to make flow management of rivers as similar as possible to natural patterns in order to restore or maintain the ecological functions of river ecosystems that have been altered through human intervention (Meitzen et al., 2013). In fact, one of the most widely recognised tools to achieve good ecological status of river flows is precisely the management of the circulating flows from an ecological perspective (Arthington, 2012; Belmar et al. 2011; Poff et al. 2010). Ecological flows are not only a restorative measure with the objective of contributing to ensuring good ecological status in rivers subjected to water pressures such as surface water catchment and/or reservoirs, water abstractions, etc., but they are also a mitigating measure if such pressures are caused by major infrastructures or dams, which produce enormous alterations to the river ecosystem, and preventive measures can even be implemented in water bodies that are not regulated or which are not affected by water catchment or abstraction.

In view of all the foregoing, ecological flows are included in the basic measures or minimum requirements that must be established in river basin management plans (RBMPs) to "prevent deterioration", "to protect" and "to improve" the ecological status of rivers and river ecosystems.

Ecological flows in Spanish legislation, and how they are linked to the Water Framework Directive

Establishing ecological flow management has been mandatory since 2001 in Spanish water legislation. The definition thereof, its components, methodologies for determination and procedure for application, are all regulated in the amended text of the Waters Act (TRLA, Royal Legislative Decree 1/2001, Articles 42 c, 59.7, 98), Public Water Domain Regulation (RDPH, Royal Decree 9/2008)[5], Water Planning Regulation[6] (RPH, Royal Decree 907/2007, amended by Royal Decree 638/2016), and also the Water Planning Instruction[7] (IPH, ARM/2656/2008), the legal text implementing the provisions of the Regulation in order to standardise criteria and to establish the scientific/technical guidelines for determining ecological flow management.

The IPH functions, as a regulating code for water planning, establishes the general guidelines and methodology to be used to determine the ecological flow regimes. Nevertheless, some

[5] *The Public Water Domain Regulation was amended in 2016 to also regulate compliance aspects of ecological flows and the exceptions to full application thereof. This amendment was appealed against at the Supreme Court by environmental groups and was partially annulled in the sentence. See Gallego, M.S. 2018. Comment on the Sentence of the Supreme Court of October 3, 2018 (Contentious-Administrative Court, Section 5).*

[6] *https://www.boe.es/eli/es/rd/2007/07/06/907/con*

[7] *https://www.boe.es/eli/es/o/2008/09/10/arm2656*

Classification: Internal

studies, such as those by Fernández-Yuste et al. (2011) and Baeza et al. (2018), have brought to light that sometimes the applied ecological flows in practice taken using such guidelines and methodologies cannot be sufficiently effective to mitigate and restore the ecological status, or to reach a favourable status of conservation of the habitats and/or species[8].

In the Spanish legal system, ecological flows are a fundamental measure to achieve the environmental goals which must be established in the RBMPs for all surface water bodies pursuant to the Water Framework Directive (WFD). The WFD establishes the general goal of achieving good status of all water bodies, and to do so it requires that environmental goals and the necessary measures to achieve them must be established for each water body. Such measures include those that are set forth regarding "water management regimes" including the "quantity and dynamics of water flow", i.e. an ecological flow regime in accordance with the ecological status indicators of surface water bodies (Annex V.1.1.1 WFD; La Calle, 2020). The environmental goals in protected areas must be accomplished without the possibility of extensions or exceptions (Article 4.1.c WFD). Article 11 of the WFD requires each river basin district to establish a programme of measures in order to achieve the objectives defined in Article 4, with the obligation of such measures being effectively applied or operational by December 22, 2012 (Articles 13.6 and 11.7 WFD).

The amended text of the Waters Act (Article 42.1.b.c) makes reference to the purpose of ecological flows for "conservation and restoration of the natural environment" as well as for maintaining "at least fish life which would naturally inhabit or could inhabit the river, and its riverbank vegetation". In similar terms, the Water Management Planning Regulation (2007), the Water Management Planning Instruction (2008) and the Public Water Domain Regulation reiterate that objective and underscore that the ecological flows regime will be established such that it permits sustainably maintaining the functionality and structure of aquatic ecosystems and associated terrestrial ecosystems, thereby contributing to reaching a good status or ecological potential of rivers. In order to achieve those objectives, they must provide suitable habitat conditions to meet the needs of the different aquatic and associated terrestrial ecosystems, and provide a time frame pattern of the flows that permits maintaining the biological integrity of the ecosystem (Section 3.4.1.1, IPH).

It is important to point out the legal nature of prior general "restriction" of ecological flows with preference over other uses, except that of supply for populations under special circumstances (Article 59.7, TRLA; Article 49 ter.2, RDPH; Article 17.4, RPH). In turn, Spanish legislation establishes that setting or determining ecological flows is one of the mandatory contents in RBMPs[9].

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[8] Q-Clima, Propuesta integrada de mejora del régimen de caudales ecológicos (Acciones A4-A5-A6). June 2018.

[9] In terms of jurisprudence, we recall the sentences by the Supreme Court regarding the lawsuits lodged against the Tagus River Basin Management Plan in the second planning cycle. Those sentences of March 11, 2019, annul a number of articles of the Plan as they do not provide for implementation of an ecological flows regime in accordance with the provisions established in legislation. More specifically, the sentence refers to the "breach of the obligations by the Administration to establish a complete, binding ecological

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Despite the close relation with status of water bodies and the aforementioned principle of prevention, attention is drawn to the fact that on many occasions the Spanish water management administration has opted to reduce ecological flows to the minimum taking into account the interests of certain other users of water, and consequently they are actually no longer ecological flows as such on many occasions as they do not comply with all their functions. In general terms, the implementation process of ecological flow regimes in Spain has many shortcomings and there is much room for improvement.

The main shortcomings associated with the ecological flows detected by the European Commission in the second cycle river RBMPs largely remain unsolved in the reviewed third planning cycle documents. The Commission issued the following, and other recommendations for Spain:

- to improve the control programme **to guarantee comprehensive, consistent monitoring** of water bodies, appropriately covering all the relevant quality indicators, since there are still major shortcomings and there has been a reduction in the number of control points compared to the previous river basin plans.
- to conclude preparation of the **fish evaluation methods** in all water bodies, and for all the relevant indicators in coastal waters and transitional waters.
- to clarify how the measures contribute to eliminating the shortcomings that prevent achieving **good status**, and any complementary measures must be identified and applied whenever necessary.
- **to increase the use of flowmeters** with a view to guaranteeing that all catchments are measured and recorded, and that any awarded permits are in line with the available resources. Users must be required to regularly inform the river basin management authorities about the real catchment volumes. This information must be used to improve management and quantitative planning, particularly in water management districts with significant catchment pressure and with a high WEI+.

The cases of the middle section of the River Tagus (Tajo in Spanish, Tejo in Portuguese) and the Ebro Delta must be the subject of special mention in this report, where ecological flows play a crucial role, and are discussed separately. Furthermore, owing to its specific features it was deemed appropriate to include the River Júcar district in this section on ecological flows.

3.1. DEFINITION, CALCULATION AND INCLUSION OF ECOLOGICAL FLOWS VALUES IN RIVER BASIN MANAGEMENT PLANS

There are 5 components of the ecological flows regime according to the IPH: **minimum flows, temporary or seasonal distribution, maximum flows, flood flows and change rate generating flows**, which are defined as follows:

a) **Minimum flows** which must be exceeded at all times in order to maintain the spatial diversity of the habitat and its connectivity, thereby ensuring the habitat control

flows regime in the Tagus River Basin Management Plan (...) under the legally established conditions" (Sentences by the Supreme Court of March 11, 2019; appeal 4351/2016 of March 14, 2019; appeal 4430/2016 of March 14, 2019; appeal 4482/2016 of March 21, 2019; appeal 4398/2016 of April 2, 2019; appeal 4400/2016). See, Gallego, M.S. 2019.

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mechanisms over the biological communities and fostering the maintaining of autochthonous communities.

b) **Maximum flows** which must not be exceeded in ordinary infrastructure management in order to limit the circulating flow and thus protect the most vulnerable autochthonous species to those flows, particularly in heavily regulated sections.
c) **Temporary distribution** (or seasonality) of the aforementioned minimum and maximum flows in order to establish seasonable variability of the flow regime that is compatible with the requirements of the different lifecycle stages of the main species of autochthonous flora and fauna species in the water body.
d) **Flooding regime flows** (or generating flows), in order to control the presence and abundance of different species, to maintain the physical-chemical conditions of the water and the sediment, to improve the conditions and availability of the habitat through geomorphological dynamics and to enhance the water processes that control the connection of transitional waters with rivers, the sea and associated aquifers.
e) **Change rates**, in order to avoid the negative effects of sudden changes in the flows (hydro-peaking typical of hydroelectric facilities), which can drag aquatic organisms during the ascent curve and isolation in the descent stage of the flows. Likewise, these flows must contribute to maintaining favourable conditions for regeneration of water and river bank plant species.

At least the minimum ecological flows must be defined with their seasonal modulation, since they are all susceptible to water alterations due to abstraction. The remaining components must be defined in those places where there are facilities to alter them, mainly reservoirs of a certain size that are capable of causing flood regimes, or producing hydro-peaking and reversing the water management regime (summer irrigation reservoirs that use the river as a canal).

We would like to highlight the importance of generating flows: **flooding** regimes are extremely significant for river ecosystems and their functionality. There is consensus among the technical-scientific community that maintaining flooding regimes can be a key component that is largely missing from achieving the good status of water bodies, and therefore the goals of the Water Framework Directive (WFD). Nevertheless, a high degree of reservoir regulation has meant that hydro-peaking has practically disappeared in a large number of Spanish rivers, and as will be seen the generating flows still show shortcomings regarding the definition thereof in the third planning cycle (they are not defined for all the water bodies they should be defined for, or the process is not clear) nor are they actually implemented.

We need to clarify that the RBMPs contain information about ecological flows, but mandatory effective fulfilment is included in the regulatory provisions (Regulations) of the plans published in the Official State Journal. Not all the ecological flows established in the plans are always defined or “set” in their Regulations, and therefore legal fulfilment is somewhat limited.

One item to highlight in Spain is that after conducting the relevant surveys and studies, and applying the ecological flow calculation methodologies, the values are subjected to a process of **concertation with stakeholder sectors**, who are mostly users of the water. This process is in response to compatibilities with other uses rather than being based on technical grounds, and can breach the legal obligation of ecological flows being a prior restriction to allocating demand for other uses. In practice, the result is usually a review leading to a reduction in ecological flows.

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3.1.1. EBRO RIVER BASIN DISTRICT

638 river water bodies, excluding reservoirs, and 16 transitional water bodies have been defined in the Ebro river basin district. In the second cycle RBMP, the minimum ecological flow was only defined for 69 of them. Definition of the minimum flow was increased to all the river and transitional water bodies in the third cycle RBMP, i.e., *in 686 water bodies and a continuity proposal of the 12,459 km of rivers which are water bodies*[10].

In order to extend the minimum ecological flows to all the water bodies, some reference points with water bodies for which minimum flows were already defined are created, 51 stations with habitat monitoring are added, 32 dams whose ecological flows have been determined to ensure coherence with the ecological flows defined at points with habitats located downstream from the dams. There are 68 points at which the flow has been extrapolated by adjusting the water data based on the nearest points where habitat has been monitored. There is a total of 228 reference points, of which 104 include habitat monitoring. In application of this database, a model is applied in which linear interpolation is performed between the ecological flow at the reference points according to their watersheds[11], although some misgivings have been voiced by experts in the field during the public participation process[12].

The Plan Report qualifies the establishing of ecological flows as "a major development", which it considers "an environmental commitment of the first order, and perhaps, the most important content of this third cycle RBMP (...), of capital importance regarding this commitment that could lead to a radical paradigm change in water management of the Ebro river basin district (...)". Despite this enthusiastic response, there are still some serious shortcomings in this third cycle, as seen regarding the pressures caused by water usage and which will be seen in the following sections. As described above, ensuring the minimum flow all year is not enough to maintain the good status of a river ecosystem; the other items are also required: maximum flows, flooding regime flows and change rates.

Those flows are initially defined in the study[13]: *During this planning period, and in accordance with the provisions of section 5.2 of the Report,* ***surveys are conducted to assess the establishment of maximum flows, change rates and generating flows*** *at the priority points along the river basin located downstream of the main reservoirs. Nevertheless, without the conclusions from the aforementioned surveys, and as an initial experimental proposal to make evaluations on the basis of monitoring, the following subsections put forward some maximum flows, change rates and flooding regimes for 11 priority points in the basin located downstream from some of the main reservoirs in the basin.* Currently (2023), as an example following two planning cycles, the "Confederación Hidrográfica del Ebro" (Ebro River Basin Management Confederation or CHE) is starting with a survey under the title of: *Surveys to determine the maximum flows, flooding regimes and change rates in the Ebro River Basin District*, conducted by the Water Management Planning Office. Surveys of this type are very positive, but the

[10] *2022-2027 Ebro River Basin District Management Plan – Report (page 208).*
[11] *2022-2027 Ebro River Basin District Management Plan – Annex 5 (page 26).*
[12] *In the Remarks on the draft Ebro River Basin District Management Plan by Fundación Nueva Cultura del Agua (FNCA), page 5.*
[13] *2022-2027 Ebro River Basin District Management Plan – Annex 5 (page 88).*

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lateness in conducting them is proof that establishing ecological flows has not been a priority in water management planning.

As for the **maximum flows**, the RBMP proposes values calculated on the basis of habitat modelling and establishing water speed limits of 1 m/s in the dry season (associated with fry) and 2 m/s during the wet season (associated with juvenile fish). These criteria were used to calculate the maximum flows of 64 water bodies. On the other hand, they are only established in the regulations for 11 water bodies, claiming that "*in the cases in which the obtained maximum flows could substantially condition management of exploitation systems, it was decided not to include them, awaiting adaptive monitoring of the ecological flows providing more solid empirical values"*[14]*.* Furthermore, the seasonality mentioned in the calculation method was not applied. The criteria employed appears to be highly arbitrary and application is minimal and only when it does not involve real management changes. We are still waiting for further studies and monitoring regarding those maximum flows.

The **generating flows** are calculated using different methods for the 644 water bodies in which the minimum flow had been calculated, but they are likewise only applied in 11 water bodies. The criteria employed to calculate them is an analysis by mobile average over 30 days in a sequence of at least 20 years of daily flows. In this case, which years are taken is not even stated, nor why the average mobile is used compared to other methods based on return periods of 1.5 or 2 years. The mobile average statistical method flattens out the hydrograph, creating the average of the last 30 days at each point. This means that the generating flow value is lower than certain occasional water level rises that could be recorded. Moreover, if the period used in the analysis is after the reservoirs were built and after flow regulation, the result does not show the intended natural performance to be reproduced.

Implementation of occasional controlled flooding of 1,000-1500 m^3/s in the lowest section of the River Ebro, to restore the flow regime and especially to reduce macrophyte invasion is brought to our attention, whose effectiveness is seriously questionable, as discussed in further detail in section 3.7.1 of this report.

Finally, **change rates**. This value is also calculated for the 644 water bodies with an analysis of a hydrographic sequence spanning 20 years, but it is only applied to the same 11 water bodies for which the generating flow is established. The plan states that the validity of the change rates has not been proved: "*Based on the change rate values in the MARM (2013) study in PHDE 2014, and in view of a lack of studies proving their validity, a number of change rates for 11 priority points in the Ebro river basin is proposed (Table 05.03)"* [15]*.* On the other hand, the same value for raising and lowering the flood regime is established, although it is known that the natural regime is asymmetric insofar as the water level reduction is more gradual than the swell. Once again, the calculation method is not justified, the results are not verified and implementation is minimal.

In turn, the ecological flows are consulted and agreed by users and stakeholders through a **concertation** process, after they have been calculated using the relevant methods. The Ebro

[14] *2022-2027 Ebro River Basin District Management Plan – Annex 5 (page 24).*
[15] *2022-2027 Ebro River Basin District Management Plan – Annex 5 (page 25).*

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RBMP highlights this, and section 5.3 on this subject is included in it: "*(...) It must be clarified that the concertation process in the preparation of the third cycle RBMP was particularly rigorous owing to the importance of this process to define the ecological flows of all river and transitional water bodies (...) huge importance was given to the concertation process through proactive integration throughout the entire public consultation process of the River Basin Management Plan. Many meetings were held for this purpose, and during the process to reply to the contributions to the two public consultations following publication of the proposals (the EpTI and the Plan), all the submitted contributions were thoroughly evaluated transparently and individually. (...) integrating all the items is not possible because positions are a long way apart.* It then goes on to discuss the milestones, meetings and workshops relating to the concertation process, which were actually included in the public participation process for the preparation of the RBMP.

The concertation process is in itself questionable (the ecological flows should not be subject to modifications due to economic or usage interests); and what is notable in this RBMP, and rather more concerning, is a table[16] showing the changes made in response to the allegations received: according to the plan, "*all the submitted proposals were analysed, and as a result several modifications to the ecological flows proposal were made".* Most of the changes regarding the ecological flows are in response to initiatives by companies with interests in hydroelectricity, such as Hidroholding, Acciona, Endesa or Iberdrola. The first of the said changes for example, following an allegation by Hidroholding, is that: "*There be an exception so that the section diverted by the La Zaida Hydroelectric Power Station on the River Ebro achieves its concessional flow rate instead of the ecological flow during the validity of the concessional period due to the small section affected by operations".* The ecological flow is therefore explicitly adapted to a concession, and there is no technical justification for the length of the section, etc. Other changes apply to regulate the ecological flows to the new habitat studies that have been commissioned by the company itself (Acciona), in a clear case of conflicting interests.

3.1.2. TAGUS RIVER BASIN DISTRICT

Despite being legally mandatory, in the Tagus River Basin District the ecological flows have not been applied in a large majority of water bodies in the two previous planning cycles (mentioned in further detail in section 3.6.2 of this report). Only after several sentences by the Supreme Court (in cases filed by groups of citizens in the Tagus basin) bringing attention to the illegality of this situation, did the third cycle plan propose a broader regime of ecological flows, even so with serious shortcomings, failing to meet the instructions established in the said sentences (e.g., application of the ecological flows in the River Tagus is still being delayed). Consequently, with regard to the water bodies in the district, in general the current RBMP mentioned in its report that: "*In fulfilment of the Supreme Court sentences STS 309/2019, STS 336/2019, STS 340/2019, STS 387/2019 and STS 444/2019, and in line with the commitment of Article 9.5 of the second cycle regulations, a minimum ecological flows regime has been proposed for 503 surface water bodies in the Tagus river basin. In the 15 largest regulation reservoirs able to cause flooding, a regime of generating flows has been proposed, and in the 17 reservoirs most able to*

[16] *2022-2027 Ebro River Basin District Management Plan – Report (page 217).*

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alter the flow regime released by the river, change rates and a maximum flow regime have been proposed".[17].

In regard to those 15 reservoirs for which **generating flows** have been defined (2 of which are in the Tagus axis), no clear criteria justifying selection thereof have been found, nor what the aforementioned "most able to abate flooding" is nor how it has been quantified. Generating flows must be defined in infrastructures capable of eliminating flooding by having a capacity above the associated flooding regime over a given return period, for example 10 years, which is not specified in the plan. Likewise, the number of rivers with defined **change rates** requires greater explanation with regard to the number of hydroelectric power plants in the basin. There are no defined change rates for the lower section of the River Tagus (over 300 kilometres from the Castrejón reservoir where most of the hydroelectric activity takes place), and therefore it is assumed that it is a succession of dammed sections for hydroelectric operation, which is entirely denatured.

As for the **minimum flows**, despite progress in having defined them for all water bodies, there are still shortcomings. According to the report, "*To establish the minimum ecological flow value for each of the 511 water bodies, multiple criteria were taken into account",* which include the status of the water bodies, the presence of protected areas or protected species or autochthonous species of ichthyofauna, and their conservation status, etc. It also mentions that, *"The strategic flows of the second cycle have been maintained, since they were agreed, at 9 water bodies"*[18]. Nevertheless, no references in the rest of the Tagus RBMP documents have been found that would permit verifying that items such as the **water requirements of protected areas and their species**, particularly fish, have been taken into account (see section 3.4.2 of this report).

Experts who have collaborated in the public participation process[19] have expressed that a very simple solution has been implemented to extend the minimum flows to all the water bodies[20], a purely hydrological solution, and that no work was commissioned to obtain further information, nor have any contributions been made to improve knowledge, nor have the consequences that the minimum flows have had on the status of the water bodies in the previous plan been analysed. As for change rates, maximum flows and flooding regime flows, they forecast that they are not going to resolve the adverse environmental effects caused by excessively high flows or very extreme change rates stemming from electricity production operations, and therefore those ecological flows are highly unlikely to fulfil their function.

In effect, the plan documents only brush over the subject of those flows, and no information about how they were defined or the calculations has been found, or any progress in the study of them since the previous cycle. In the second cycle of the Tagus RBMP Regulations, it is stated that "*for informative purposes only, the results of some prior studies on the minimum and maximum flows, change rates and generating flows*" were presented, *and therefore they will*

[17] *2022-2027 Tagus River Basin District Management Plan – Report (page 250).*
[18] *2022-2027 Tagus River Basin District Management Plan – Report (page 132).*
[19] *Citizen's Network for a New Water Culture in the River Tagus and its Tributaries (2022).*
[20] *Appendix 5 of the regulations of the Tagus RBMP. Quarterly minimum flows in normal situations and prolonged drought.*

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not be required for the timeline of this Plan (...)"[21]. Studies on the generating flows and change rates for the 309 river water bodies were conducted at the time though.

Regarding the proposal in the allegations by different organisations and collective groups to "*raise the minimum ecological flow in different water bodies*", the Tagus Water Management Confederation replied that "*the minimum ecological flows proposed in the RBMP were established in accordance with the methodology set forth in the IPH. In several of the described water bodies, the proposal stems from the provisions established in the first planning cycle, which in turn were subject to their concertation process*[22]*.* Consequently, there is no review and/or adaptation of the ecological flows in other water bodies, even though they are insufficient or if a **concertation** process was established over a decade ago, which took into account the interests of hydroelectric operators or other users as a priority over environmental interests or needs. Modifications to the flow rates have been made, in that they have been lowered, with objectives such as "*avoiding increasing the forecast deficits*" in irrigation or "*mitigating the loss of hydroelectric production*"[23], thus contradicting the criterion of "*always prioritising environmental criteria*"[24].

It must be stated at this point that the Spanish Tagus basin district is a very special case, since the circulating flows along the middle section of the main river in the basin, i.e. the River Tagus, are very low and are conditioned by **water transfer for other uses (mainly irrigation) of the external River Segura basin** (which is not even stated as pressure due to abstraction of the corresponding water bodies, see section 1.2.4, of this report). The situation of the ecological flows in the River Tagus is discussed in more detail in a specific study in section 3.6 of this report. There is a major anomaly in this RBMP regarding the River Tagus ecological flows: the minimums have been increased to a certain extent, but **staggered implementation** is planned over three periods until the minimum ecological flow regime is reached in January 2027. This is clearly not in line with environmental objectives, but the need for the River Segura basin to adapt to the reduction in Tagus-Segura water transfer as a result of an increase to the minimum ecological flows, which although higher than the circulating flows in the Tagus, are still clearly insufficient. Deferred application of some ecological flows in the third cycle which should have been applied at least since the first planning cycle (2009) are once again contrary to the Spanish Waters Legislation approved to transpose the WFD, insofar as **they not only fail to prioritise ecological flows over other uses**, in this case irrigation in the Segura basin, but they also fail to prioritise all uses in the basin from where the water is transferred, including environmental uses, over any water transfer to other water basins from the Tagus, supposedly "surplus" or "in excess".

3.1.3. SEGURA RIVER BASIN DISTRICT

The Segura River Basin Management Plan establishes minimum flows for the 77 river category water bodies (strategic and non-strategic), of which a zero ecological flow is established in 16 of them as they are ephemeral rivers. As for the rest, the values are very low, for example in some sections of the River Mula, the River Chicamo and the River Taibilla, just to name some. Maximum flows have been defined for 11 water bodies downstream of regulation dams, but in

[21] *2015-2021 Tagus River Basin District Management Plan – Regulation, Article 10.2.*
[22] *2022-2027 Tagus River Basin District Management Plan – Annex 12. Appendix 1 (page 240).*
[23] *2022-2027 Tagus River Basin District Management Plan – Annex 12. Appendix 3 (page 10).*
[24] *2022-2027 Tagus River Basin District Management Plan – Report (page 173).*

Classification: Internal

many cases the values are not stated, including a note: "*No limitation on maximum flows is established, since the flow that would affect the habitat is much higher than the usual average daily circulating flows*". It is hard to understand this statement if it refers to rivers downstream of regulation reservoirs which could discharge water for irrigation at any time, etc. As for the flooding regime flows, they are only established for seven water bodies downstream from the reservoirs, whereas in the case of change rates, they are established for 5 water bodies located downstream of the La Fuensanta, Anchuricas, Cenajo, Talave and Camarillas reservoirs, since they are the "*most important in the district*" according to the RBMP documents. There is no justification here either concerning which infrastructures set the requirement to define those items.

The minimum flows have not been updated since the previous planning cycles, 2009-2015 (strategic masses) and 2015-2021 (non-strategic masses): *"no modifications at all are considered for the ecological flow regimes defined in the 2021/27 planning cycle, with the exception of the minimum ecological for prolonged drought periods of the water body ES0702080115 Channelling of the River Segura between Contraparada and Reguerón, which flows at between 0.5 m^3/s and 1 m^3/s"*[25]. The Report also refers to the concertation process of the flows, for example to achieve compatibility with hydroelectric uses. The water requirements associated with maintaining and preserving lakes and wetlands are identified.

The generating flows have only been defined for 7 water bodies, which are actually only 4 regulation infrastructures (there are water bodies downstream of 3 of them), and "*The generating flow is only defined for water bodies located between two regulation reservoirs, and will only be carried out when the one downstream has enough capacity to absorb the rise from the generating flow, which will be made to coincide with an episode of ordinary flooding in situations where there is no danger for the population*". Limiting the definition of generating flows to this situation cannot be justified through current legislation. The number of water bodies where maximum flows and change rate times is not properly justified either, when it is apparently obvious that there are more regulation reservoirs and/or hydroelectric power plants that are capable of altering those items on the hydrograph. In fact, Annex 05 of the Ecological Flows states that "*In view of the previous planning cycles, all the water bodies where it was considered appropriate to establish a regime of generating flows due to them being located downstream of reservoirs that regulate water flows or subdue flooding, were identified, leading to a total of 20*[26]".

In section 6.2.1 of Annex 05 discussing seasonal analysis, one of the criteria employed is as follows[27]:

• *The short sequence (1980/81-2011/12) of natural regime resources was used, which is what was used to assign and reserve resources.*

The **hydrological reference sequences** chosen to define these natural contributions are those from the most recent years, to reflect the effects of climate change and to ensure coherence with the calculations for assigning uses, as stated in the Plan itself. However, flows affected by

[25] *2022-2027 Segura River Basin District Management Plan – Report (page 132).*
[26] *2022-2027 Segura River Basin District Management Plan – Annex 05 (page 89).*
[27] *2022-2027 Segura River Basin District Management Plan – Annex 05 (page 23).*

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human impact cannot be considered natural flows, which also entails transferring pressure from water reductions to an aquatic ecosystem that is already subjected to very high water pressure. Using the short sequences can mean that classification of the rivers deviates towards more arid types than would be normal, which affects how the ecological flows are defined with regards to periods of cessation, which in these cases would not be natural, or would be longer than natural periods.

3.1.4. JÚCAR RIVER BASIN DISTRICT

A total of 989 contributions were received during the public participation stage regarding the Júcar River Basin District, of which 178 refer to subjects related to ecological flows. In the case of the River Júcar, the **minimum ecological flows** extend to all the river water bodies (337), which accounts for a certain degree of progress compared to the previous plan: the percentages of water bodies with defined minimum flows increase from 61% in the second cycle to 99% in the third.

Once again, the **hydrological reference sequences** chosen to define the natural water supplies are taken from the most recent years in order to "reflect the effects of climate change", as stated in the Plan, which is a grave mistake, because flows affected by human impact, such as climate change, cannot be considered natural. When hydrological methods are applied, as is the case, using such sequences altered by climate change leads to even lower ecological flow estimates, which erroneously transfers the pressure caused by climate change to the demand side (which has not yet adapted to the resources actually available) to the aquatic ecosystem side, which is already under considerable pressure due to excessive abstraction and other human impacts.

As for the rest of the ecological flow items, they are shown in Annex 05 of the Júcar Water Management Plan in the tables for 19 water bodies with defined **maximum flows** and 38 hydroelectric power stations with maximum flows established for hydroelectric uses. Change rates have been established for 22 sections of the river, for the hydroelectric power stations (schedule change rates) and for 19 reservoirs in the water management district. Generating flows have been defined for 31 gauging points, of which only 7 have been proposed for effective implementation in the 2022-2027 River Júcar Water Management Plan[28]. According to the Report: "*maximum flows have been established for the main regulation infrastructures in the district, differentiating between two periods in the year, dry and wet, in order to temper the reversal of the ecological flows regime*". *Furthermore, generating flows in some of the infrastructures in the region have been defined, whereas in regard to the change rates, they have been established for the main regulation and hydroelectric infrastructures* (…)[29]. The question therefore arises as to why they have been effectively applied in such a low number. How many reservoirs are there in the basin? How many of them can be regulated to eliminate natural flood peaks? That information is not specified in the text. Figure 23 of the Report[30] shows "*the 28 most important reservoirs in the water management district".*

Regarding the water requirements of the wetlands in the Júcar Water Management District, the groundwater requirements in those water bodies (20 of the 76 lake type wetlands in the District

[28] *2022-2027 Júcar River Basin District Management Plan – Annex 05 (page 131).*
[29] *2022-2027 Júcar River Basin District Management Plan – Report (page 49).*
[30] *2022-2027 Júcar River Basin District Management Plan – Annex 05 (page 135).*

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Register of Protected Areas) that are hydro-geologically connected to the wetlands have been reviewed. Furthermore, the water requirement established in the 2016-2021 RBMP of 210 hm^3/year[31] has been maintained for L'Albufera lake.

3.1.5. GUADALQUIVIR RIVER BASIN DISTRICT

The problems that arise when implementing ecological flows with priority over the rest of uses are emphasised in the Guadalquivir Basin Water Management Plan documents. They[32] also outline some improvements to resolve the possible conflicts concerning this subject, such as:

- The tender for "Study and Analysis of Ecological Flows in the Guadalquivir River Basin" to compile and analyse the existing information, which includes new field work employing ecohydrology methodology and hydrological recalibration, flow monitoring, and studies via remote sensing to determine the hydroperiod of lake type water bodies in a natural regime, and defining protected areas therein.
- Study and monitoring of ecological flows to contribute to effective implementation thereof.
- Adaptation project by the dam discharge bodies to modulate the ecological flows regime.
- Monitoring of the effects of ecological flow regimes on water bodies in the district.

Likewise, the Guadalquivir Basin District Water Management Plan clearly states that: "*(...) in view of the new technical and scientific information now available*", the defined **minimum and maximum components will need to be evaluated again and redefined[33]**, and **the rest of the components will need to be estimated**.

The main reason that the Guadalquivir Water Management Confederation puts forward for not having reached its objectives regarding the ecological flows regime refer to the regulation of natural flows in order to meet the demands of all uses. The Confederation justifies the needs of the water regulation infrastructures due to the: *"(...) relatively low rainfall compared to the national average, insufficient to meet the water requirements of the socio-economic activities in the district, making it necessary to carry out very tight regulation of water uses"*[34].

Minimum flows are established for all river type water bodies in ordinary conditions, as shown in Table 1 of Appendix 1 of Annex 4 of the Guadalquivir River Basin Management Plan documents. Moreover, the Regulations[35] add minimum flows for a number of infrastructures and control points where monitoring is considered to be a priority both in ordinary conditions and during prolonged periods of drought.

As for the rest of the ecological flow items, **maximum flows** have been defined for all the river type surface water bodies and 14 reservoirs. Despite the Regulation not containing a specific article on maximum flows, it is mentioned in Article 11. "*Other items of the ecological flows regime*" in Section 1 states the following: *"The maximum flows meet the requirements of the*

[31] *2022-2027 Júcar River Basin District Management Plan – Report (page 51).*
[32] *2022-2027 Guadalquivir River Basin District Management Plan – Report (page 67).*
[33] *2022-2027 Guadalquivir River Basin District Management Plan – Report (page 153).*
[34] *2022-2027 Guadalquivir River Basin District Management Plan – Report (page 66).*
[35] *2022-2027 Guadalquivir River Basin District Management Plan – Chapter II. Article 10.*

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ecological flows regime when they do not exceed the values established in Appendix 6 (Table 6.1.2)."

Generating flows or change rates have not been defined in the Guadalquivir Basin Water Management Regulations. Section 2 of Article 11 (*Other items of the ecological flows regime*) states: "*In order to implement effective measures, throughout this planning cycle, a study was conducted to identify the water bodies in which the change rate or generating flow frequency could be the cause of the bad status.*"

3.2. DEGREE OF FULFILMENT AND ADAPTIVE MONITORING

Fulfilment of the ecological flows is generally evaluated in the **Annual Monitoring Reports** for each RBMP. They include a chapter on "Fulfilment of Ecological Flows" in which, in principle, the percentage of water bodies where there is control over the ecological flows is stated, along with the number of breaches that take place. It must be emphasised that the network of gauging stations used to evaluate fulfilment is generally small, and consequently there is a degree of uncertainty regarding many of the water bodies, and numerous groups highlight particularly serious breaches of minimum flows in the public participation process.

In the previous RBMPs, ecological flow fulfilment criteria were established, such as not dropping below 80% of the minimum values established during a given period of time, etc. Nevertheless, **Sentence 1460/2018 passed by Section Five of the Contentious Administrative Courtroom of the Supreme Court** (Gallego, 2018), eliminated the consideration of **possible tolerance margins that would allow for breaches of the instantaneous minimum or maximum flows or change rates** in the ecological flows regime, and emphasises that the values defined in the corresponding RBMPs are the minimum values to be met, and they must not be reduced[36].

We need to bear in mind the huge pressure on water resources in many territories in Spain, as we have seen in previous sections. This represents a risk that the entire ecological flows implementation process will be rendered ineffective, and that in practice such flows will not be fulfilled, particularly as the quantity of water decreases and demand increases, since the plans do not foresee a parallel reduction in any effective way. For there to be successful implementation of ecological flows, with a real determination to improve the status of ecosystems, not only must fulfilment of ecological flows be controlled, but the **causes of any breaches must be investigated and the necessary measures to curb them must be established**. It is of utmost importance to bear in mind that the values established in the RBMPs are not static. They will need to be reviewed to ensure that they are meeting the purposes for which they were initially designed through the use of water-related ecosystem status indicators, and if this is not the case, other values will need to be applied and evolution monitored further still.

In addition to the strict calculation of fulfilment of the flow values, monitoring should serve to evaluate if the ecological flows are effectively performing their function: the function of maintaining the good status of rivers. "*Maintaining the state of conservation of water-dependant habitats and protected species in accordance with the Birds and Habitats Directives could require different flow conditions beyond those required to achieve the good status of rivers*

[36] *See Gallego, M.S. 2018. Comment on the Sentence of the Supreme Court of October 3, 2018 (Contentious-Administrative Court, Section 5).*

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or maintaining them in very good status. Those specific requirements must be identified and taken into account in the application of the different stages of the WFD"[37]. **The status of water body conservation** must be checked, and where applicable the ecological flows must be modified, which we have described previously as adaptive monitoring.

Adaptive monitoring of ecological flows would be fundamental, although it is practically non-existent in current water management plans. If a system is implemented for this purpose but fails to achieve the goals, it is only logical to change or adapt the system. This is indeed the case, as the ecological flows in Spanish river basins fail to meet the goals for which they were designed more often than not, and as a result, our river ecosystems have deteriorated. There is consensus among the scientific, technical and social community on the lack of suitable, more abundant flows, and that this is the root cause of many of the problems of the status of Spanish water bodies. The question is not considered nor is it yet the subject of study in this third planning cycle: work driven by the General Water Management Directorate on monitoring the effects of the ecological flows established in the plans is underway and included in the programme of measures in the plans. The aim is to identify the real effect that flows have on river environments and on the aquatic and riverside ecosystems that they support, providing better knowledge on the existing relationship between water and the different biological and morphological attributes[38]. We do not have the results of this study yet, although we expect them to serve as the basis for reflection and change, and subsequently, practical implementation in the RBMPs.

3.2.1. EBRO RIVER BASIN DISTRICT

In the second cycle RBMP, **gauge monitoring was conducted on 52 of the 69 water bodies** for which a minimum ecological flow had been established. Over the years spanning that cycle, between 3 and 6 of the 52 water bodies that were monitored **recorded breaches**. In view of that data, the Ebro Water Management Confederation only cited the water bodies and claims that a detailed analysis is still pending[39]. When selecting the new water bodies for which the minimum flow is calculated with an analysis of the habitat, one of the factors to take into account is that the section has serviceable gauging stations "*as far as possible"*[40], although in any event, the number of such stations is not specified. Priority has also been given to the more important sections, those that are included in the Natura 2000 network, and any other kind of protected area, which are home to endangered species or which are in a good state of conservation and are representative of the river's natural conditions. Nevertheless, no special conditions have been established for those areas. In fact, when selecting the water bodies to which drought flows can be applied (lower flows), of which the ones in the Natura 2000 network would initially be excluded, some of the Natura 2000 sites would be included as they "*are of little importance*"[41]. The number of water bodies in which a minimum flow under prolonged drought conditions is increased from 5 to 284[42].

[37] *Executive summary of the European Guidelines on Ecological Flows. Page 6.*
[38] *Summary of the drafts of the inter-community river basin district management plans (review for the third cycle: 2022-2027). General Water Management Directorate June 2021. (Page 31).*
[39] *2020-2021 Monitoring Report – Ebro River Basin District Management Plan (page 44).*
[40] *2022-2027 Ebro River Basin District Management Plan – ANNEX 5 (page 7).*
[41] *2022-2027 Ebro River Basin District Management Plan – ANNEX 5 (page 17).*
[42] *2022-2027 Ebro River Basin District Management Plan – REPORT (page 329).*

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3.2.2. TAGUS RIVER BASIN DISTRICT

Regarding **fulfilment of the ecological flows**, according to the most recent monitoring report on the Tagus River Basin Management Plan dated June 2022[43], there are controls for fulfilment of the ecological flows in "*17 of the 19 water bodies for which minimum flows were established*". The degree of definition for the others is 0. In the period spanning 2016/17 to 2020/21 which the report covers, there is only 1 water body where the minimum flow was not met in 2016/17, and 0 in the other years (with 4 points in two of the years when it occasionally dropped below the established minimum, but remained above 80%). It is emphasised here that the threshold defined in the RBMP Regulations establishes breaches at 80% of the minimum flow, which was repealed in the third cycle (Sentence 1460/2018 of the Fifth Section of the Contentious-Administrative Courtroom of the Supreme Court eliminated considering possible tolerances for breaches of the ecological flow regimes and stated that the values defined in the relevant RBMPs cannot be reduced).

Nevertheless, it must be pointed out that the Confederation eliminated monitoring of the minimum flows in "strategic" water bodies from its website in May 2023. A few days previously, breach of the minimum flows established in the RBMP was publicly reported by the Tagus Professorship[44] and Madrid-based organisations[45]. With the information taken from the Confederation's website, it was proved that there had been breaches of the ecological flows in several of the water bodies, some lasting even for months. The Tagus Professorship had already reported breaches of the ecological flows on the River Tagus on several occasions as it passes through Aranjuez, Toledo and/or Talavera de la Reina, through information provided by SAIH (Automatic Water Information Systems)[46]. In short, if those controls actually do exist, the fact that they are not public only serves to increase scepticism on the degree of established fulfilment.

Consequently, the information today on fulfilment or otherwise of the minimum ecological flows in the river basin is very limited, and non-existent in the case of the other items such as maximum flows, flooding regimes or change rates.

Within the specifics of the Tagus River Basin Management Plan and in view of the Tagus-Segura water transfer system (discussed in further detail in section 3.6 of this report), attention is brought to the staggered increase of the minimum ecological flows until 2027 until the minimum is reached for 19 water bodies on the River Tagus. Furthermore, the approved plan includes another important change owing to the inclusion of a ninth additional provision in the Royal Decree approving the RBMPs, which is a "**Special Water Body Monitoring Programme and Sustainability of the Operations within the Scope of the Tagus-Segura Aqueduct**", which conditions final implementation of the minimum ecological flows in the aforementioned 19

[43] *2015-2021 Tagus River Basin Management Plan Monitoring Report. June 2022. Page 24.*

[44] *https://catedradeltajo.es/la-catedra-del-tajo-uclm-soliss-responde-se-estan-cumpliendo-los-caudales-minimos-establecidos-en-el-nuevo-plan-hidrologico-del-tajo/*

[45] *https://www.ecologistasenaccion.org/293072/reclaman-el-cumplimiento-de-los-caudales-ecologicos-en-los-rios-madrilenos/*

[46] *https://catedradeltajo.es/la-catedra-uclm-soliss-responde-existe-algun-motivo-justificado-para-que-los-caudales-en-el-tramo-medio-del-rio-tajo-bajen-del-minimo-legal/*

Classification: Internal

water bodies on the middle section of the River Tagus to achieving the environmental goals for those water bodies. It establishes the following:

"1. (...) The "Special Monitoring Programme" has the ultimate goal of conducting detailed monitoring of the water bodies and fulfilment of environmental objectives, and also to analyse the impact of the ecological flows established in the Spanish RBMP *for the Tagus River Basin District on the basins to which water is channelled via the Tagus-Segura water transfer system, taking into account the effect of the mitigation measures defined in the plans for those basins."*

Among other matters, this plan shall include monitoring of the circulating flows along the River Tagus between Bolarque dam and Valdecañas reservoir, the evolution of the ecological and chemical status of the surface water bodies on the section between both reservoirs, and monitoring and evolution of a number of measures in the Tagus and Segura river basins. In the event of meeting the environmental objectives, applying the staggered steps envisaged in the RBMP as of January 1, 2026 will not be necessary for the minimum flows in force since approval of the plan.

The fact is that over the last decades water has been transferred to irrigation land in the Segura basin as "excess" or "surplus" from the River Tagus, which in fact would be the ecological flows that should have flowed along the river if the minimums had been established and applied in fulfilment of current legality. It is highly likely that this retraction of flows, rather than failing to apply suitable ecological flows, has had a very significant impact on conservation of the aquatic ecosystems (and associated terrestrial ecosystems, e.g.: riverside forests) and that, to a large extent, it is responsible for the bad status of water bodies in the mid section of the River Tagus. Additional provision nine in the Tagus River Basin Management Plan to link "*activation of those incremental steps to the achievement of the good status of water bodies between the Bolarque dam and the Valdecañas reservoir*" suggests that **the only time that adaptive monitoring will be implemented in the district is to reduce the levels of the minimum ecological flows**, which different groups have claimed are still insufficient, despite the increases, with the sole objective of meeting the agricultural demands of the other river basin, without actually considering the status of conservation and recovery of the River Tagus' aquatic ecosystems. Evaluating the ecological status of those water bodies, as discussed in section 3.3 of this report, should take the ichthyofauna and the hydromorphologic quality into close account, which are the ones that are related to hydromorphologic stresses, such as changes to flow regimes. The biological indicators that have traditionally been used in these evaluations have proven to be insufficient to reflect the status of river ecosystems beyond water quality.

3.2.3. SEGURA RIVER BASIN DISTRICT

There are **tolerated breaches** of the ecological flows in this water management district, which have no apparent justification, in addition to very limited control, as recognised in the plan: *"of the 77 water bodies (the total of those in the district where ecological flows are to be established) (...) only 15 have a permanent gauging station. Bearing in mind that in 16 of them, the ecological flows have been established at zero (ephemeral rivers) (...) there are 46 remaining bodies, which have an established flow but where the circulating flows regime is not permanently monitored,*

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which denotes a major lack of phoronomic control which must be rectified during this planning cycle through the measures which have been programmed in the plan[47].

As for **fulfilment**, in the 2021 calendar year monitoring report on the Segura River Basin Management Plan, table 28 details fulfilment of the ecological flows in the 2020/21 hydrological year, where there was failure to meet commitments in a total of 11 of the 25 water bodies with control stations, out of a total of 75 water bodies in which flows had been established in the second planning cycle.

In the section on ecological flows, the Report analyses the causes for the breaches in a few of the bodies where monitoring takes place. On several occasions, downstream from the reservoirs, it is said that the breaches could be resolved through a programme of discharges from the Cenajo reservoir (for example), as evenly distributed as possible over time. This is a breach that could therefore be minimised by implementing management measures. In other cases, the Report acknowledges that **the environmental regime is not met due to retractions by users**[48]. An analysis of fulfilment of the daily change rate in the River Segura water body was carried out "*from the Anchuricas reservoir a its confluence with the River Zumeta, due to the downgrading in status from very good to good in the third planning cycle, concluding that it is necessary to improve discharge management in order to meet the hydroelectric demands in compliance with the change rates and thus to ensure the communities of benthal invertebrates affected by flow variations are improved*"[49]. This is a very clear example that the economic interests of beneficiaries are prioritised, in this case the electricity company Iberdrola, which manages the Miller dam, over the obligation of appropriate ecological flows to avoid dragging away the biological communities, thereby meaning that the body is no longer in Very Good Status, which it should be due to its location as a headwater.

The monitoring reports prepared by the River Segura Water Management Confederation referring to the second planning cycle (2015/21) acknowledged certain shortcomings in the implementation and monitoring of ecological flows. In order to overcome those problems with the updated version of the RBMP, some specific measures were put forward[50]:

- *Extension and improvement of the gauging network.*
- *Permeabilization of the infrastructures transversal to the riverbed.*
- *Review and closure of unauthorised diversions that draw from water resources.*
- *General review and completion of the different items of the ecological flows regime in order to ensure their coherence with achieving good status or maximum ecological potential in the water bodies where they are defined, particularly in those that have been heavily modified due to channelling.*
- *Analysis of the repercussions of fulfilment of the ecological flows on the areas included in the Protected Areas Register and the habitats and species associated with water in such areas, considering the possible existence of additional conservation requirements.*
- *More specifically, the revised minimum ecological flows in periods of prolonged drought in the River Segura from Contraparada to Reguerón.*

[47] *2022-2027 Segura River Basin District Management Plan – Report (page 84).*
[48] *2022-2027 Segura River Basin District Management Plan – Report (page 181).*
[49] *2022-2027 Segura River Basin District Management Plan – Report (page 182).*
[50] *2022-2027 Segura River Basin District Management Plan – Report (page 86).*

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- *Revision and improvement of the definition of the rest of the ecological flow items, specifically the maximum flows, generating flows and change rates.*
- *Definition and improvement of knowledge and adaptive monitoring through specific studies to enhance knowledge on adaptation to climate change and its effects on the current ecological flows regime.*

All of this is positive, but at the same time, as in the case of the other water management districts we have analysed, they give priority to Spanish hydrological planning from the first WFD cycle: at this stage of the third planning cycle, they are still undertaking studies, which should have been done in the previous two decades when the planning process according to the WFD actually started. The Report also considers the possibility of conducting economic, technical and environmental studies for restoration of the River Taibilla, through the addition of a flow to supply the Taibilla Canals Community (MCT) from the Fuensanta reservoir[51].

As for **adaptive monitoring**, the only mention of this subject is at the start of Annex 05 on ecological flows, where it discusses necessary phases[52]: "*the general process to implement the ecological flows regime consists of three phases: (…)"*

c) Concerted implementation process of all the items of the ecological flows regime and adaptive monitoring.

This is where the stated intentions in the RBMP end regarding this type of monitoring. Nevertheless, in the previous sections we have seen the enormous pressure on the water bodies from abstraction that takes place in this river basin, and consequently, the general state of deterioration of the water bodies, which requires application and monitoring of the necessary ecological flows as a measure to mitigate that situation.

3.2.4. JÚCAR RIVER BASIN DISTRICT

It could be said that this is the water management district where the best efforts have been made to monitor fulfilment. Even so, there is no monitoring of the **generating flows**, and regarding fulfilment of ecological flows, the Jucar Water Management District points out that "*in order to carry out effective implementation and monitoring, improving the measuring systems is necessary*", although the measures in this plan amount to 4.49 million Euros financed by different public administration departments and private entities[53] which are not specified. For example, there are systems such as the Marina Alta and Vinalopó-Alicantí, where there are no control stations.

It is important to highlight that in all cases, the new gauging stations are to be built to environmental standards, with longitudinal fluvial continuity for the ichthyofauna, for example, ensuring minimal impact.

In section 3.4. Implementation, control and monitoring of the minimum flows regime, Annex 05[54] describes the criteria used previously to define fulfilment or breach of the ecological flows,

[51] *2022-2027 Segura River Basin District Management Plan – Report (page 173).*
[52] *2022-2027 Segura River Basin District Management Plan – Annex 05 (page 17).*
[53] *2022-2027 Júcar River Basin District Management Plan – Report (page 50).*
[54] *2022-2027 Júcar River Basin District Management Plan – Annex 05 (page 139).*

Classification: Internal

and it then refers to the Sentence 1460/2018 of the fifth Section of the Contentious-Administrative Courtroom of the Supreme Court: *The sentence eliminates the consideration of possible tolerances of the instantaneous minimum flows, maximum flows and change rates in the ecological flows regime, and points out that the values defined in the relevant* RBMP *are* ***absolute values****.*

Nevertheless, it then goes on to explain that instead of breaches, they could be called "failures", and establishes once again some "**flexibility criteria**" to consider that a failure in the ecological flows occurs during the hydrological year when:

a) *The ecological flows regime is not met over a percentage of time equal to or over 2% (this is equivalent to 7 days a year at the most if measured on a daily basis, or 175 hours per year if it is measured in hours).*
b) *The ecological flows regime is not met over a percentage of time equal to or over 4% (this is equivalent to 15 days a year at the most if measured on a daily basis, or 350 hours per year if it is measured in hours), and the deviation with respect to the flow item is under 20%.*

Bearing in mind that some flows, particularly the minimums, are already very restrictive and far removed from natural conditions, then those periods of time could account for major pressure on the most vulnerable biological communities. It is incomprehensible in view of the Supreme Court sentence on this subject, why fulfilment of the **absolute values** of the RBMP is not established.

According to the River Júcar River Basin Management Plan documents, in the 2016-2021 planning cycle different monitoring reports were prepared to assess the degree of fulfilment of the plan in the basin, which allow identifying the control points where the biggest difficulties in meeting the established ecological flows regime were observed. Until now, the most recent RBMP monitoring report available, dated 2021 (*Pending presentation to the Water Management District Water Council*), states that the **minimum and maximum ecological flows and change rates at 61 control points** have been monitored for fulfilment. Monitoring of fulfilment of the **generating flows**, which in the 2015-21 planning cycle were defined but not set forth in the Regulation, has been non-existent to date. The "*Evaluation of fulfilment of the ecological flows regime for the 2020/21 hydrological year at the 61 control stations envisaged in the 16/21 Water Management Plan*" shows 18 river type water bodies for which breaches were reported regarding the minimum flow, 2 for the maximum flow and 6 for the change rate. The minimum water requirements of groundwater in 19 lake category water bodies are also evaluated, although control only covers one of them, namely the L'Albufera lake in Valencia, for which only one breach was reported in the second cycle in 2017/18.

Some cases of **adaptive monitoring** are recorded regarding the ecological flows: the RBMP report mentions that "*the knowledge acquired in the participation processes and the field work carried out by the Water Planning Office, meant it was necessary to conduct an additional study to improve characterisation of the hydrological and hydrogeological functioning in some of the river sections, and the degree of impact of uses on hydrology.* This analysis has served to adapt

Classification: Internal

the minimum flows, mainly on sections of the Sénia, Mijares, Palancia, Guadazaón and Serpis rivers[55].

3.2.5. GUADALQUIVIR RIVER BASIN DISTRICT

In this river basin district, the minimum ecological flows defined for some of the unregulated water bodies **have not been fulfilled** for several years, in most cases due to pressure in the form of direct and indirect, legal and illegal abstraction, whose impact is worsened by the effects of climate change.

In the section of the Programme on monitoring, **measures** are mentioned that will improve the **control** of water bodies, such as increasing the number of gauging stations or control networks, but it does not state if they will be for the specific measurement of ecological flows.

In the Guadalquivir second cycle RBMP monitoring report, more specifically for the 2019/2020 hydrological year, the methodology to assess fulfilment is specified, and it is stated that there were no breaches of minimum flows downstream of the different infrastructures in the year 2019/2020. No reference is made to the minimum flows in river type water bodies, as, according to the RBMP Regulations, monitoring is to be performed in the main river axes of the basin, and therefore fulfilment is checked at 7 **gauging stations** on the River Guadalquivir, one station on the Guadiana Menor, one station on the Guadalimar, one station on the Guadalbullón, one station on the Guadajoz, 4 stations on the Genil, one station on the Corbones and one station on the Guadiamar. Of the 7 control points, the minimum flows were breached at Aznalcázar (Guadiamar) and Corbones[56].

According to the most recent monitoring report of 2020/2021, there are 61 minimum flow control points "*downstream of the main infrastructures*", and at gauging points on rivers (these points can control more than one water body[57]). 14 water bodies with an established maximum flow are mentioned, although there is no apparent monitoring for this. As for **breaches of the minimum flows**, there are some high numbers in the first two years (33 in 2017/18 and 14 in 2018/19), 0 in 2019/20 and 5 in the most recent year (2020/21). The third cycle documents do not specify any of those breaches nor any improvement measures, even having indicated that "*the characteristics and status of the dam do not permit correct measurement of the ecological flows*".

Remote detection studies to monitor the hydrological status of the different wetlands categorised as lake type water bodies have been conducted in the Guadalquivir River Basin Management District, in order to establish the water requirements and to meet the requirements for a good ecological status, as established in the WFD[58].

[55] *2022-2027 Júcar River Basin District Management Plan – Report (page 171).*
[56] *2015-2021 Guadalquivir River Basin District Management Plan – 2019-2020 Monitoring Report. Annex 1.*
[57] *2015-2021 Guadalquivir River Basin District Management Plan – Report (page 156).*
[58] *2015-2021 Guadalquivir River Basin District Management Plan – Report (page 158).*

Classification: Internal

3.3. THE IMPACTS OF THE ECOLOGICAL FLOWS ON THE STATUS OF THE ECOSYSTEMS: FISH INDICATORS, SOLID FLOWS AND CONNECTION BETWEEN SURFACE WATER AND GROUNDWATER

The crucial importance that the flows regime has on the functionality and health status of river ecosystems has been previously stated, even though it is not currently a direct indicator to check whether water bodies reach good status. This section aims to see how planning deals with how ecological flows and the status of water bodies and associated ecosystems are related. The considerations on the fish indicators in the plans have been reviewed (through the EFI+) index, on solid flows or sediments, and on how it is related to groundwater.

In this case, the subject of the **indicators** that are used to assess the status of the water bodies is the key matter. Within the WFD implementation process, the status or ecological potential of water bodies is assessed through physico-chemical, biological and hydromorphologic indicators. The latter includes hydrological impact, but it must be emphasised that the hydromorphologic indicators today have less specific weight than the others in the assessment, and do not tell if a water body is in good status or not (they are only used to differentiate between the good and very good statuses). Today, ecological flows are not mentioned regarding this process, but they should lead to a good status of the indicators, particularly fish and hydromorphology.

Guidance Document 31 "Ecological flows in application of the Water Framework Directive", as mentioned in the introduction, precisely recommends Member States to urgently implement the specifically sensitive metrics: "*classification of the ecological status must be based on sensitive methods to all existing pressures, in particular hydrological pressures. Classification of water bodies subjected to significant hydrological pressures only using biological methods which are not sufficiently sensitive to hydrological alterations can lead to an* ***overestimation of the ecological status*** *that would not be in line with the WFD. If those methods are no longer available, Member States should define and implement them, providing metrics that are more specifically sensitive to hydrological pressure (...)"*[59].

In general terms in Spain, this assessment of the status has been based on macroinvertebrate, diatoms, macrophyte, local river habitat and riverside forests indicators and indexes, which, although they are very interesting and have been through a process of intercalibration[60], they do have certain limitations. As for the subject matter in question, they only very partially show the impacts of alteration to liquid and solid flows. The ichthyofauna most sensitive to flow alterations have not been assessed in a systematic or generalised manner to date, nor have other very relevant hydromorphologic aspects. The integrated EFI+ index is the result of combining the new European Fish Index (EFI+) and the specific indirect indicators for fish fauna. This index was designed to be able to compare results at European level, but in the third cycle RBMP documents in Spain they have only been found in the Ebro, Duero and Júcar plans (with certain shortcomings that will be discussed as follows). The approved Tagus and Segura plans also mention the fish indicator, but say that in the end it was not used. Therefore, after two

[59] *Translated from EC Guidance document No 31, page 4.*

[60] *Intercalibration is a process that validates the different indicators and cut-off value between status classes through European scientific-technical work groups. See Guidance Document No. 14 - Guidance on the Intercalibration Process 2004-2006.*

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complete planning cycles, there is still no suitable generalised fish indicator for Spanish river basins.

In the Duero river basin for example, emphasis is placed on the huge efforts made to submit results after sampling fish in 273 water bodies and calculating nearly 400 EFI+[61]. Nevertheless, this is included in the calculations of the hydromorphology protocol and the results are confusing, and in any event, they are not applicable to assessing the status of water bodies. At least in the Duero basin over 60% of the results with uncertainty regarding the indicator calculations are certified[62], thereby assigning a low level of confidence and no results are submitted.

Another subject matter that is also missing in this third cycle is the **sediments** or solid flows, despite the fact that they are very important for river ecosystems. In principle, Article 19 of Law 7/2021 of May 20, on climate change and energy transition, specifies the following in Article 19.6:

> *6) To include the impacts from sediment retention in reservoirs in planning, and the solutions for mobilisation thereof, having two objectives, the first being to maintain the regulation capacity of the reservoirs and also to recover the transport of sediment to the coastal systems to stem regression of beaches and subsidence of deltas.*

The definition that the River Basin Management Planning Instruction provides for flooding regime flows includes the objective of maintaining the physico-chemical conditions of the water and sediment. Despite this, none of the studied RBMPs make any specific reference to the study of mobilisation of such through flooding regime flows, nor the results thereof.

The relation with **groundwater** is also very important for the flows of Mediterranean rivers, as they are largely fed from aquifers during the dry season. In the summary prepared by the General Water Management Directorate on the drafts of the RBMPs, evidence is shown on the impact of piezometric decrease caused by abstractions, mainly in the Guadiana, Guadalquivir, Segura and Júcar districts, which threatens fulfilment of the ecological flows[63] and achieving the environmental objectives of groundwater and associated connected protected surface water bodies. This aspect has not been studied in much detail in the plans and their Regulations.

In the assessment of the quantitative status of groundwater bodies, in principle **the relation with surface water intervenes**[64]:

2. *Surface water bodies associated with groundwater tests which assess if the surface water body is in bad status, or if the ecosystems associated with it does not reach a good status of conservation, is due to abstractions from the associated groundwater. The first thing to take into*

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[61] *2022-2027 Duero River Basin District Management Plan – Annex 8.2 (page 25).*
[62] *2022-2027 Duero River Basin District Management Plan – Annex 8.2 (page 26).*
[63] Summary of the drafts of the inter-community river basin district management plans (review for the third cycle: 2022-2027). *General Water Management Directorate June 2021. Page 32.*
[64] *2022-2027 Tagus River Basin District Water Management Plan – Report (page 189). This assessment is common to the rest of the water management districts.*

Classification: Internal

account with surface water bodies in bad status, is to check if the ecological flow is met (...) and, if that is the case, then estimating if it is the result of a high level of abstraction in the area (...).

3. Groundwater dependent ecosystems test. This test assesses if groundwater abstraction is a significant cause preventing the dependent ecosystems from reaching a good status of conservation. This test assesses the ecosystems that are not associated with any surface water body, as they are assessed in the previous test.

Nevertheless, in the plans that have been studied no references to those tests have been found when assessing the flows situation of surface water bodies, nor the establishing of specific measures anywhere a good status is not achieved.

According to Guidance Document 31 "Ecological flows in the implementation of the Water Framework Directive": the assessment of the hydrological regime is a specific requirement of the WFD when assigning a high ecological status.

- *Classification of a water body subject to significant hydrological pressures using only biological methods that are not appropriately sensitive to hydrological alteration may result in an overestimation of the ecological status that would not be in line with the WFD. In case such methods are not available yet, Member States should urgently develop them, providing metrics more specifically sensitive to hydrological pressures taking into account the relation between hydrology, morphology and the biological impacts. Evidence of severe hydrological alteration should trigger appropriate monitoring (operational or investigative) and action to significantly mitigate the impact.*

Significant hydrological pressures have not been taken into account in the assessment of the status of water bodies so far, nor in general any indicators sensitive to them, as would be the case of ichthyofauna. The hydromorphologic quality Protocol is starting to be applied in rivers (see section 2.2 of this report), which does include hydrological alteration indicators that should serve to provide a response to these indicators throughout this cycle. For now, those hydromorphologic indicators still have a lower specific weight in the strict process of assessing status, but they should be taken into account in planning.

3.3.1. EBRO RIVER BASIN DISTRICT

At the end of the second planning cycle in 2020, it was estimated that 79.7% (502) of the natural river water bodies were in good ecological and chemical status. Out of the modified river water bodies which are not reservoirs, none of them (out of 6) were classified as having good ecological potential. Out of the reservoir water bodies, it was established that 48.4% (31) were in good status, and 100% (2) of the artificial water bodies were in a state of good ecological potential. As for the groundwater bodies, 62.9% (66) were considered to be in good status[65].

The majority **good status** of the rivers in this analysis contrasts with at least one of the other environmental assessment indicators, such as the percentage of water bodies affected by significant pressures, which in 2020 was 53.8%, although the 2018 reports were used as the

[65] *Monitoring report on River Basin Management Plans and Water Resources – 2021. Appendix 1.14 – EBRO (page 11-12).*

Classification: Internal

baseline documents for the third planning cycle, in which the value was much lower at 34%[66]. Along the same lines as the pressures caused by uses, the WEI reports higher values in most of the river basin, as we have already seen in other sections (1.3.1). As mentioned previously throughout this report, the status indicators that are used in current assessments could be disguising other major problems such as **hydrological alteration** or **morphological deterioration** caused by a lack of liquid and solid flows. The uneven length of water bodies also needs to be taken into account, and the fact that the figures are likely to be much worse in terms of river distance in kilometres, since the pressures are concentrated in the areas with more human activity, where the water bodies are also longer (see **Error! Reference source not found.**)

The RBMP does not study the effects of the minimum ecological flows defined for aquatic ecosystems, with the exception of the coastal area at the river mouth. This study is biased and does not cover the Ebro's area of influence, since it at least extends from Cabo de Salou to the Columbrete islands covering the entire continental shelf beyond 40 nautical miles from the coast. Biological, hydromorphologic and physico-chemical indicators are analysed in the rivers. The biological indicators include aquatic diatom and macrophyte flora, benthic invertebrate fauna and **fish fauna** using the EFI+ indicator (European Fish Index), but the latter does not apply to all the basins. Having regard to this subject, the RBMP states: "*There is no national fish indicator today that is applicable to all river types. By means of its Guidebook (MITECO, 2020d), the General Waters Directorate proposes working with the EFI+ fish fauna indicator (European Fish Index), integrated with EC-HMF metrics related to the habitat known as "Indirect habitat indicators" (IideH)".* The Ebro Water Management Confederation has adopted this indicator and has assessed 137 water bodies in the district.[67]

The plan does not cover **sediment** management in the river basin either, other than a few pilot tests on sediment mobilisation. The problem of clogging of reservoirs is minimised by saying that a reduction in the amount of accumulated sediment has been observed, and that this means that the period in which complete silting up of reservoirs will be reached is significantly increasing. In the case of Mequinenza, they calculate that it will still take 876 years[68]. Likewise, in the scheme of important subjects, dealing with clogging in Riba Roja has been ruled out since it is not sufficiently significant or transversal[69]. Similarly, the size of the problem of failing to manage sediment in the river basin and its possible environmental and socio-economic problems is ignored. Nevertheless, there are some well-known examples, such as the regression taking place in the Ebro Delta, which is discussed in more detail in section 3.7 of this report.

Attention is also brought to the transitional waters (river and lake alike) and coastal waters located in the Ebro Delta, one of the most important natural spaces in the Ebro district: of the existing 16 water bodies, 12 are in bad status. Finally, regarding the water bodies with less strict objectives (14), the issue is largely headed off by saying that not enough tools are available to say if deterioration is temporary and that it could be determined at a later date via longer data

[66] Monitoring report on River Basin Management Plans and Water Resources – 2021. Appendix 1.14 – EBRO (page 16).
[67] 2022-2027 Ebro River Basin District Management Plan – Annex 09 (page 22).
[68] 2022-2027 Ebro River Basin District Management Plan – REPORT (page 165).
[69] 2022-2027 Ebro River Basin District Management Plan Report, section 2.1. Identification of important problems (Page 34).

Classification: Internal

sequences[70]. The third cycle RBMP undertakes to achieve good status of all water bodies. However, in view of these data and the fact that the minimum ecological flows have not been reviewed, nor is it planned to substantially modify management of the rivers, it is unlikely that this objective will be met.

3.3.2. TAGUS RIVER BASIN DISTRICT

According to the list of allegations in Appendix 1 to the RBMP, 107 allegations referring to ecological flows were submitted for public consultation. The reply by the Tagus Water Management Confederation regarding ecological flows is that "*it is a measure that contributes to achieving the environmental objectives. But it is neither the only measure, nor does increasing it guarantee fulfilment of the objectives. In this sense, we believe that the proposed ecological flows regime is rational, it focuses on achieving the objectives, to which a number of additional measures are included in the water bodies where risks have been identified, whether or not they are directly related to the Natura2000 protected areas"*[71].

According to Annex 09 on "Assessment of the status of water bodies", sampling of the biological quality of EFI+ fish integrated in 2020 has begun in 30 water bodies[72]. So far however, it has been decided to assign them a low level of confidence and **not to use the metrics in the status assessment**, since a clear procedure for integrating the results has not been established for this phase, despite having preliminary data.

Article 21 of the Water Management Plan Regulations states that: "*any new exploitations of groundwater will be conditioned to them not affecting catchments associated with current exploitation, nor the ecological flow regime in nearby flows, nor the water requirements of wetlands or other habitats that are dependent on groundwater, and therefore applicants may be required to furnish a hydro-geological survey to justify the inclusion of pumping and gauging tests."*

Annex 9 shows the results of the aforementioned tests only for **groundwater bodies** in which there is a risk of not achieving the environmental objectives, and in the case of the Tagus river basin there are 6. According to table 21 of the aforementioned Annex, all the surveyed groundwater bodies pass the **no effect** test, regardless of complying with or **breaching the minimum ecological flows**, according to the Aquatool simulation. In other words, that breaching the minimum ecological flows is apparently not a restrictive factor regarding its effect on the surface water body associated with groundwater abstraction.

One of the problems coinciding in several of the submitted allegations is that the flows in the water bodies of the River Tagus, the main river in the basin, is that practically **none of them achieve good status**, and according to the Plan, the ecological status in two of them has worsened since the second cycle (River Tagus from Arroyo del Álamo to Embocador Weir, and River Tagus from Estremera Reservoir to Arroyo del Álamo. Those two water bodies are located between Bolarque reservoir and the headwaters of the Tagus, and Aranjuez, as stated earlier in

[70] *Monitoring report on River Basin Management Plans and Water Resources – 2021. Appendix 1.14 – EBRO (page 13).*
[71] *2022-2027 Tagus River Basin District Management Plan – Annex 12. Appendix 1 (page 161).*
[72] *2022-2027 Tagus River Basin District Management Plan – Annex 9 (page 17).*

Classification: Internal

the section on WEI (see 1.3.4) is one of the sections along the river with the highest exploitation in the entire basin, due to the Tagus-Segura water transfers. We do need to underscore that if the limits established in the regulations had not been modified for other less-demanding specific limits in some of these water bodies, eight of them would have deteriorated on the River Tagus: four would have worsened between Bolarque and Aranjuez and another four between Aranjuez and the Valdecañas reservoir. This will be discussed in further detail in the case study on the mid Tagus ecological flows.

It remains to be seen if the increase of the minimum ecological flows envisaged in this RBMP is sufficient. Some experts in different groups warn that it is a very small step forward, and it is not expected to be applied effectively on the main river in the basin, i.e. the River Tagus, until 2027, as already mentioned.

3.3.3. SEGURA RIVER BASIN DISTRICT

In the section of the report[73] on the "*Main causes of deterioration to the surface water bodies"*, reference is made to the "*discontinuity of ecological flows*" as one of the main **causes of deterioration** of the natural river water bodies. The intensive use of water resources in the district is emphasised in Annex 05 of the Segura Water Management Plan[74] in section 10 thereof. "*Repercussions of the ecological flows regime on water usage*" in which the many permits that have been granted are emphasised, the extension of the deadline for termination thereof and the incompatibility with fulfilment of the ecological objectives, particularly of minimum flows. The proposed solution however does not prioritise environmental status, but rather deals with the subject on a case by case basis in an attempt to reach a generally acceptable, viable solution which would breach current legislation by negotiating on flows instead of considering them as a restrictive priority over and above any other uses.

In the systems and places where the Plan does foresee maintaining the uses of water, it should at least mention the status of the water bodies, what the ecological flows are, if they are being met and if they are effectively serving to keep the ecosystems in a good status; and also how maintaining or increasing demand or uses is expected to affect the flows regime.

The current RBMP has established status/potential limits for water bodies through specific metrics for the biological and hydromorphologic indicators, duly adapted to river sections that have been modified by channelling[75]. These biological indicators are for macroinvertebrates, macrophytes or diatoms, but no references to **fish** indicators have been found, which, as mentioned previously, is the best indicator in relation to ecological flows.

References to ichthyofauna have been found in the annual reports on the status of water bodies[76] in which it is confirmed that little use is made of fish indexes to assess the status. According to the 2020 ecological status report (the last report published on the website), "*calculation of the EFI+ index is only carried out every 3 years during operational monitoring in accordance with Royal Decree 817/2015*", and therefore the results at the control points are

[73] *2022-2027 Segura River Basin District Management Plan – Report (page 236).*
[74] *2022-2027 Segura River Basin District Management Plan – Annex 5 (page 99).*
[75] *2022-2027 Segura River Basin District Management Plan – Report (page 130).*
[76] *https://www.chsegura.es/es/cuenca/redes-de-control/calidad-en-aguas-superficiales/informes/*

Classification: Internal

highly influenced by the catches on a single day. According to the same report, the EFI+ was calculated at 54 control points in 2020, of which 32 reported a high confidence level by using EFI+ and indirect indicators for fish fauna. By including the results of the integrated EFI+ status, the number of water bodies rated as being in good or very good status falls by 32%. Despite all this work, it concludes that the **ecological statuses are expressed without the EFI+**, at least until further studies or more experience ensure the integration of such data[77].

As for the solid flows, the Segura plan refers to reducing the contribution of river sediment and alteration of the coastal dynamics, for example at the Babilonia beach in Guardamar del Segura, but it does not directly relate those solid flows to the ecological flows, nor are any improvement measures or any proposals discussed concerning this.

The diagnosis of the status of groundwater bodies (in the Segura Water Management District, 60% of the groundwater bodies are in bad status) depends on the fulfilment of the quantitative status, i.e. the water level in the aquifer. Once again though, no references have been found on the relation between the piezometric levels and the circulating flows in the rivers, nor fulfilment or breach of the ecological flows in surface water bodies which are connected to the groundwater in this plan.

3.3.4. JÚCAR RIVER BASIN DISTRICT

Monitoring of flows (water management regime) in river class water bodies is included constantly, but there is no specific mention of ecological flows. Tables 58 and 59 of the Júcar Water Management Plan quote **fish indicators** (EFI+) in operational control and monitoring, but neither this or any other ecological flow indicators are related to the status of the water bodies. Section 8.3.1 "*Status of surface water bodies*" refers to the "Guide for assessment of the status of surface water and groundwater" (MITERD, 2021), which, among other items, includes the EFI+ ichthyofauna indicator. This document states that the Júcar Water Management District used the IBI-Júcar index, but that the EFI+ index was used in the third planning cycle, supported by the IBI-Júcar to improve the level of confidence.

On reading this document (table 65), we deduce that there has been a worsening of 10% of the surface water bodies in the Management District, although there is no discussion on this subject.

The methodology to assess the ecological status is established in Annex 12 "Evaluation of water bodies", including the ranges for salmonids and cyprinids defined in the EFI+ for natural rivers. When reviewing the results on the application of the said index though, the number of water bodies where those studies were conducted is not mentioned. Only the tables in Annex 12 of Appendix 3 of the document show the status assessment using the EFI+ indicator with the colour ranges red-yellow-green in over 150 water bodies.

No conclusions regarding this matter, nor the results of the ecological flows or their possible changes due to not failing to achieve good status were found.

As per the aforementioned Article 19 (Climate change considerations in water planning and management) of Law 7/2021 on Climate Change and Energy Transition, "*planning for the impact*

[77] *Ecological Status Control Network Report. Final report. 2020 Campaign. CHS. Page 58*

Classification: Internal

*stemming from **sediment** retention in reservoirs and the solutions to mobilise them must be included*". The Júcar RBMP documents only refer to sediments in coastal waters related to effluent, but not to the mobilisation of sediments in river flows that the Law mentions.

3.3.5. GUADALQUIVIR RIVER BASIN DISTRICT

The biological indicators referring to assessment of the status of water bodies are IBMWP (invertebrates), IPS (diatoms), IBMR (macrophytes) and hydromorphologic, IHF for river habitat and QBR for riverbank forest. There is no evidence of considering the **ichthyofauna** or other hydromorphologic indicators in this third planning cycle, except for the proposal to measure the development of a biotic integrity index based on ichthyofauna to determine the ecological status of the rivers in the Guadalquivir river basin, and the design of a fish monitoring network[78]. In the assessment on the status of surface water bodies, a novel aspect is mentioned involving the use of the results of habitat and hydromorphologic indicators.

To assess the **groundwater bodies**, the procedure is based on quantitative and chemical testing. Annex 7 on Assessment of water body status does not mention ecological flows. Assessment of the status carried out when preparing this RBMP has brought to light the fact that within the Guadalquivir river management district, 32 **groundwater bodies** do not achieve good quantitative status, whereas 24 (28%) do not achieve good chemical status. The problem is aggravated further on noting that there was no significant improvement during the second planning cycle, which proves the need to implement more specific, effective measures[79]. Measures are proposed to control and monitor abstractions, and also to review water rights, and since it is one of the aspects on which the European Commission has been insisting since the first planning cycle, to increase the use of flow meters. According to the Guadalquivir river basin management plan documents, the solution to this problem "*is highly conditioned by synergy actions that are included in other analysed subjects: adjusting allocation to real demand and available resources, applying ecological flows, hydromorphologic improvement measures, or recovery of environmental costs, among others*"[80]. Therefore, a clear relation is made between water abstraction from groundwater bodies and the application of ecological flows.

Regarding water bodies, of the 455 bodies in the district (rivers, lakes, transitional and coastal), 282 are in good status, 172 fail to achieve good status and there is a newly created water body whose status could not be assessed, ES050MSPF012100037, known as Balsa del Cadimo. This means that 38% of the water bodies do not achieve the environmental objectives, without even considering the fish indicator in this case. As can be seen in Figure 6 of this report, and as is usually the case in the rest of the basins, the water bodies that are in bad status are those spanning the longest distances located in the areas with most use.

The Guadalquivir RBMP documents mention the **solid flows** as a fundamental part of interaction between circulating flows and river beds. This suggests that they have not yet been defined, as is the case of the generating flows and change rates, but to date this has not been addressed in the Management Plan Regulations.

[78] *2022-2027 Guadalquivir River Basin District Management Plan – Report (page 179).*
[79] *2022-2027 Guadalquivir River Basin District Management Plan – Report (page 70).*
[80] *2022-2027 Guadalquivir River Basin District Management Plan – Report (page 75).*

Classification: Internal

3.4. PROTECTED AREAS, NATURA 2000 NETWORK AND COORDINATION WITH OTHER ADMINISTRATIONS

Insofar as **protected areas** are concerned, the European Commission's report on Spanish RBMPs recommended in the first planning cycle "*Conducting a comprehensive study in conjunction with the relevant authorities for nature to determine the quantitative and qualitative needs of the habitats and protected species, converting such in specific objectives for each protected zone to be included in the water management plan. Likewise, the water management plans must include appropriate monitoring and measures".* Regarding assessment of application in the second cycle, the following is stated: "*Regarding protected areas defined as such in Directives on habitats and birds, some specific objectives have been set for a small number of water basin districts, although the needs are not known in some cases. In most of the districts, the WFD objectives are sufficient to achieve the objectives of the Directive as a relevant baseline, or the needs are unknown. Therefore, there is no proof that a comprehensive study has been conducted to define additional objectives or to implement control and appropriate measures. This recommendation has been partially applied*[81]*".* In the reviewed third cycle plans, there has been no response to the assessment of these needs or specific objectives in the protected areas.

The only specific discussion regarding the water bodies in protected areas such as Natura 2000 is that in the case of prolonged drought, the minimum ecological flows are not reduced, as is the case in the rest of the water bodies where lower values in situations of drought are expected to be applied.

3.4.1. EBRO RIVER BASIN DISTRICT

The RBMP says that "*One of the main advances in the third planning cycle is the integration of the Habitats Directive objectives (92/43/EEC) and Birds (2009/147/EC) in the planning process".* A total of 266 surface water bodies have been identified in the Ebro water management district, associated with 122 Natura 2000 sites in which establishing additional environmental objectives to reach a good status of conservation in the habitats and associated aquatic species would be necessary[82]. Nevertheless, when defining the specific measures for those areas, it says that "*The environmental objectives that enable the habitats and species to achieve a good status of conservation must be defined in the Natura 2000 area management plans, which fall under the competence of the Regional Authorities*". It also argues that a case by case study should be carried out to identify if the bad status of the water bodies is related to the flows, and if a modification to the flows would improve their status. Finally, it concludes by saying that "*The objectives taken from the reviewed plans are not applicable as an additional environmental objective to the water bodies related to the habitats and identified species. They are objectives that are already included in the WFD objectives*". Therefore, the specific environmental measures and objectives for the Natura 2000 sites are not included in this plan.

3.4.2. TAGUS RIVER BASIN DISTRICT

There is nothing in the item in Annex 05 of the document "Ecological Flows" that clarifies if special consideration is given to the water bodies included in the Natura 2000 areas.

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[81] *c*

[82] *2022-2027 Ebro River Basin District Management Plan – Annex 00 (page 86).*

Classification: Internal

The Tagus plan Report refers to coordination between the administration departments mentioned by the European Commission in its recommendations by means of transversal bodies such as the Water Council or the Competent Authority Committee, although it acknowledges the lack of effectiveness and the need to integrate different legislations[83]. They refer to the DSEAR plan (MITERD, on waste water treatment), but do not put forward any concrete information on ecological flows and protected areas.

Article 10 of the Regulation specifies that "*when a prolonged period of drought occurs, as defined in the Special Drought Plan of the Tagus Water Management District, the minimum ecological flows could be reduced*". As specified in the Water Planning Instruction (IPH), in the event of prolonged droughts, a more relaxed regime of flows can be applied, providing that they meet the conditions established in the Water Management Planning Regulations on temporary deterioration of the status of water bodies, and pursuant to the relevant Plan of action in situations of alert and subsequent drought. Nevertheless, this exception will not apply to the Natura 2000 sites or the List of Wetlands of International Importance (Ramsar). In the case of the Tagus river basin, this means that approximately 83% of the surface water bodies cannot be included in the aforementioned exception[84].

In the Natura 2000 data sheets[85] the water bodies associated with each protected area are detailed. A large number of them fail to achieve good status, and some of them are rated as bad such as the El Salor (ES030MSPF1024020), Rosarito (S030MSPF0704020) and Navalcán (S030MSPF0729020) reservoirs. We must point out that in this case most of the water bodies in the mid section of the Tagus (see Figure 13 of this report), from the Bolarque reservoir to the Azután reservoir are in the Natura 2000 network. The management plans of the different Natura 2000 sites mention the need to meet suitable ecological flows, including a generating flow, but the additional water requirements for conservation of species and habitats are not mentioned. In the data sheets of Annex 10 for each water body in the Tagus RBMP, states the following in reference to the protected areas, always adding the same paragraph:

"In addition to those required for the water bodies to achieve good ecological status, the quality requirements to be met by water bodies so that the associated habitats and species achieve a good status of conservation, are not currently defined in the Natura network management plans."

Consequently, the RBMP refers the responsibility for defining the additional water requirements to the management of the Natura 2000 network management Plans, which are currently refer back to the "suitable ecological flows". In the region of Castilla-La Mancha, for example, which is the region where most of the Spanish River Tagus basin is located, it is very vague about the needs of many of the water bodies within the Network.

In the Region of Madrid, the management plan ZEC ES3110006 "*Floodplains, inclines and moorland in the Southeast of Madrid*" (which includes the entire section of the River Tagus in Madrid territory) points out that "*the competent administration will establish the necessary flow regimes to guarantee good status, and maintenance of its ecology, pursuant to the provisions*

[83] *2022-2027 Tagus River Basin District Management Plan – Report (page 81).*
[84] *2022-2027 Tagus River Basin District Management Plan – Annex 5. (Page 27).*
[85] *2022-2027 Tagus River Basin District Management Plan – Annex 4, Appendix 3.5.*

Classification: Internal

established in current legislation, in order improve the conservation status of the Habitats of Community Interest, the Natura 2000 network species and the bird species identified in Annex I and migratory birds pursuant to Directive 2009/147/EC linked to river ecosystems", thereby returning the responsibility to the RBMPs.

The result is that this planning cycle does not take the water requirements of the species and habitats of the Natura 2000 areas into account when defining flow regimes. Furthermore, after two cycles without having applied ecological flows in the mid Tagus section, in the third cycle application of the ecological flows differs in time, and although they are lower than experts consider necessary, they do represent a change to this anomalous situation compared to the ecological flows of the main river in the basin (see in further detail in section 3.6 of this report).

The wetland areas data sheets include a box to complete with their water requirements, but all of them state that "*no additional requirements have been established to reach the environmental objectives of this protected area*".

The Report on the RBMP presents a list of plans and programmes relating to state and regional level actions, including the Conservation of Wetlands or the Natura 2000 Network Master Plan of Castilla-La Mancha (one of the autonomous regions where most of the river basin is located), but it only refers to ecological flows insofar as it makes reference to the drought plan and special regimes in situations of prolonged droughts.

3.4.3. SEGURA RIVER BASIN DISTRICT

At no point in the applied methodologies have the calculations for the necessary ecological flows been made based on the species and habitats, nor their conservation objectives. Neither has any work been done, nor attempts to do so, regarding the water planning work in the management plans for those areas. There are rivers in the Segura river basin today that are important river habitats for protected areas such as the Natura 2000 protected areas, which are regulated by reservoirs for which the water requirements are not known.

As for the protected habitats such as those in the Natura 2000 network, apart from occasional references to the special requirements of rivers in the protected areas, there is no information in the RBMP on the ecological flow values or the actual measures for implementation thereof.

For example, Annex III of Annex 8 "*List of relevant aspects, directives and measures considered in the management plans of the Natura 2000 Network protected spaces related to water bodies, and the recovery/conservation plans*" says the following in the section on the Use and Management Master Plan of the Sierra de Cazorla, Segura and Las Villas National Parks[86]:

3. *When establishing the ecological flows of the surface water bodies and other river sections in the area, or when reviewing those currently established in the water management plan, the following items shall be taken into account:*

a) ***the ecological requirements of the aquatic species in the area,*** *and in particular, those whose conservation is prioritised.*

[86] *2022-2027 Segura River Basin District Management Plan – Annex III of Annex VIII (page 18).*

Classification: Internal

*b) **the ecological requirements of the habitats associated with water in the area,** and in particular, those whose conservation is prioritised.*

c) the current context of global change.

Apart from the above references, **no other specific mention is made in relation to these objectives**. Annex 05 on Ecological Flows, only mentions the special importance of protected areas in the section on lakes and wetlands, but at no point has it been taken into account in the applied methodologies; nor have the calculations for the necessary ecological flows been made based on the **species and habitats**, nor their conservation objectives. No work been done either, nor attempts to do so, regarding the water planning work in the management plans for those areas. As mentioned earlier, there are rivers in the Segura river basin that are important river habitats for protected areas such as the Natura 2000 protected areas, and we do not know what their water requirements are, nor are any improvements planned in regard to this subject in the RBMP.

3.4.4. JÚCAR RIVER BASIN DISTRICT

Section 11 on "*Plans and programmes related to the Júcar river basin water management plan*", discusses relations with the Special Drought Plan (PES), the Flood Risk Management Plan (PGRI) and specific Studies on adaptation to climate change, although no direct reference is made to the necessary coordination between the River Basin Authority and the Regions on the subject of water bodies in Protected Areas.

Annex 05 of the RBMP "*Ecological Flows Regime*" **prioritises** the (objectives) referring to **protected areas**, and discusses the species and habitats protected under European, national and/or regional regulations. "*To the extent that the Natura 2000 protected areas and those on the Ramsar List of Wetlands of International Importance could be considerably affected by the ecological flows regime, **such flows must be appropriate to maintain or recover a conservation status that is favourable for the habitat or species**, meeting the ecological demands and ensuring the ecological functions on which they depend in the long-term (...) the objective of the ecological flows regime shall be to safeguard and maintain the ecological functionality of such species (reproduction, breeding, feeding and resting grounds) and their habitats, in accordance with the requirements and directives established in respective regulations[87]".*

Figures 98, 99 and 100 of the plan Report show the SCI, SAC and SPA where additional requirements of the associated water bodies shall be assessed with the aim of establishing a methodology in conjunction with the competent administration on protected areas, and the cause of bad conservation status of the habitats or species will be assessed.

In the Report section on "*Additional environment objectives in the Natura 2000 management plans"*[88] on the one hand, the RBMP mentions that "*The Regional Authorities, as the competent body, are working on the preparation of the said management plans that should permit changing from SCI to SAC. According to these approved plans, the River Basin Plan will define the additional objectives that are established when they are related to the water environment*". On the other

[87] *2022-2027 Júcar River Basin District Management Plan – Annex 05 (page 14).*
[88] *2022-2027 Júcar River Basin District Management Plan – Report (Page 298).*

Classification: Internal

hand, *"this Plan has analysed the management plans for the protected areas of habitats and species that were approved by the Regional Authorities with the aim of identifying additional objectives. With just a few exceptions, such additional objectives are not defined in the management plans*.

A table is shown as follows with the concrete quality or quantity objectives for associated water bodies in some management plans, which include as quantity objectives: modification of the water management regime for one SAC "*Hoces del río Júcar*"; modification of the water management regime (*analysis using different indicators: RB Index, HPU and others*) for SAC ES4230013 - "*Hoces del Cabriel, Guadazaón and Ojos de Moya*" and modification of the water management regime (using the RB index) at the SAC ES4230016 - "*Río Júcar sobre Alarcón*".

Despite this accounting for progress over other plans, we need to bear in mind the rest of the SAC or other protected areas for which these measures are not known or the environmental requirements have not been applied. Annex 05 describing the Ecological Flows Regime does not provide any details on the priority of protected areas and the need to conserve habitats and species, and only glosses over the subject in general terms.

Furthermore, in one of the only three cases mentioned above is the additional objective of quantity specifically mentioned, although the RBMP acknowledges that it is not met due to water usage[89]:

"*The only water body where the additional environmental objective is not reached is the one located upstream from Alarcón reservoir (18-06B)*" (River Júcar: River San Martín - Alarcón Reservoir). *The hourly variability proposed in the water management plan for the protected area is equivalent to the one the river would have in a natural regime, with this being incompatible with current uses. The hourly variability of the flow regime in this section is conditioned by hydroelectric usage located upstream from the Alarcón reservoir. Nevertheless, in order to reduce the impact on the aquatic ecosystems that this could have, the 2022-2027 Júcar Water Management Plan has increased the minimum flow in the section and has established monthly minimum flow variations (monthly variation factors) more in line with the natural regime. The objective is to keep a water body to buffer the hourly variations and to serve as shelter for the aquatic species living in the river ecosystem.*

Once again, we refer to current legislation in Spain that establishes ecological flows as a priority over any other use, except for water supply in certain circumstances.

3.4.5. GUADALQUIVIR RIVER BASIN DISTRICT

Apart from the section on natural groundwater reserves in Annex 5 on "*Protected Areas*" where several old studies by the General Water Directorate (DGA) or by the Spanish Geological and Mining Institute (IGME) are quoted regarding groundwater and the Natura 2000 Network with the objective of conserving ecological flows, the reviewed documents do not mention any close relation of protected areas with meeting ecological flows.

[89] *2022-2027 Júcar River Basin District Management Plan – Report (Page 299).*

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According to the plan Report "*one of the main advances in the third planning cycle is the integration of the Habitats and Species Directive objectives in the planning process*"[90]. In the cases where the habitat and species have been rated as in a bad conservation status, this is due to pressure on water resources, where additional objectives must be established, which are not defined in the Natura 2000 Network management plans, and therefore they need to be coordinated with the water authority and the competent administration of protected areas.

In the section on plans and programmes related to the RBMP Report, the related plans and programmes at state level are listed (special drought Plan (PES), flood risk management plan (PGRI) and the national adaptation to climate change plan (PNACC)), but there is no reference at all to ecological flows in the PES regarding special regimes in prolonged drought periods, as observed in other districts, nor is the need to adopt the aforementioned additional measures in the Natura 2000 Network protected areas mentioned.

3.5. GENERAL ASSESSMENT OF ECOLOGICAL FLOWS

Despite having completed two planning cycles and with the process of the third cycle now having been underway for several months, and in spite of having all the legal tools, the subject of ecological flows in the analysed river basins, and in general in Spain, could be summarised as a failure.

The European guidance on implementing ecological flows [91] (EC, 2016) clearly states that "***the water management regime plays a crucial role in determining physical habitats****, which in turn determines the biotic composition and helps in the production and sustainability of aquatic ecosystems*". The need to implement sufficiently suitable flows in sections with hydrological alteration is even more important if we consider the foreseeable reduction in the contribution by rivers resulting from the forecasts made through climate change models.

Spanish water legislation is very complete and explicit with regard to this subject and indicates that at least fish which would naturally inhabit or that could inhabit a river, and riverside vegetation must be maintained. Ecological flows though, must also contribute to meeting the aforementioned goal that water-related habitats and species in protected areas (Natura 2000, Ramsar wetlands, etc.) are to maintain or reach a favourable status of conservation. In the **Spanish legal system**, ecological flows are a fundamental measure to achieve the environmental goals which must be established in the RBMPs for all surface water bodies pursuant to the Water Framework Directive (WFD). It is important to point out the legal nature of **prior general restrictions** of ecological flows with respect to other uses, except that of supply populations under special circumstances.

Despite the above, Spanish water administrations have often given *de facto* priority to meeting demands over and above the environmental objectives, and have reduced ecological flows to **minimums with insufficient seasonal modulation**, which in many cases are no longer actual ecological flows since they do not meet all their functions. In general terms, the implementation

[90] *2022-2027 Guadalquivir River Basin District Management Plan. Report. (Page 250).*

[91] *European Commission, Directorate-General for Environment, Ecological flows in the implementation of the Water Framework Directive. Guidance document No 31, Publications Office, 2016, https://data.europa.eu/doi/10.2779/775712.*

Classification: Internal

process of ecological flow regimes in Spain has many shortcomings and there is much room for improvement. The main shortcomings associated with the ecological flows detected by the European Commission in the second cycle RBMPs largely remain unsolved in the reviewed third cycle planning documents, such as the subject of monitoring fulfilment or implementing and using a fish index.

As for **definition** of this item in the observed RBMPs, progress in terms of **minimum flows** has been made, which at last are established for almost all river water bodies in this third cycle (after over 12 years of planning, and legally mandatory since 2001). **Technical studies** are available to the river basin authorities, which may have certain shortcomings and on occasions they are criticised by environmental organisations and groups for responding to pressure from user sectors, but thankfully, in this third cycle, they are the basis for having defined flows in most of the water bodies.

This progress is somewhat lukewarm though regarding **generating flows and change rates**, which are both mandatory items that undoubtedly affect the ecological status of rivers, as is the case of **maximum flows** in most cases. Furthermore, seasonal modulation of these flows is carried out on a quarterly basis, leading to four values per year. Calculating the vales is sometimes thrown into doubt by experts, such as the case of the Ebro river basin, where flow values have been extrapolated from other rivers that have been studied to determine the minimums, instead of using the established methodologies. As mentioned previously, in order to define other components, such as the flooding regime flows, references are made to the need to conduct studies during this cycle, which is also the case in the Ebro and Guadalquivir basins (even the minimum flows in the latter case). Generating flows or change rates have still not been defined for the Guadalquivir river basin. The anomalous case of the **River Tagus** must be emphasised, where minimum flows (instead of ecological flows) have been defined in the previous planning cycles, whereas in this third planning cycle the values have been increased, but applying them in a staggered way has been planned, so that only by 2027 will the minimum ecological flows be reached in the Tagus. This is all due to maintaining water transfer to the Segura basin, prioritising new uses over ecological flows. Where **generating flows** have been defined, they are incomplete, and they remain to be calculated for some regulation reservoirs without this being justified because of their flood abatement capacity or any other technical criteria. In all cases, special consideration of **protected areas** is still found wanting, such as the areas included in the Natura 2000 Network, to which many of our rivers belong, and where the water requirements of habitats and species should be taken into account when calculating the ecological flows regimes. In general terms though, **the most recent hydrological sequences** are taken as the reference to show the effects of climate change, as has been explicitly the case in the Segura and Júcar river basins. That is something that cannot be considered natural, and it exerts additional pressure on ecosystems that are already stretched to the breaking point due to the reductions in the quantities of water.

The ecological flows are consulted and agreed by users and stakeholders through a **concertation** process, after they have been calculated using the relevant methods. The process in it itself is questionable, and in practice it usually leads to downsizing of the ecological flows in all the studied basins because they are adapted to existing permits, which are not related to technical

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justifications nor does such comply with the legal obligation of ecological flows being a prior restriction to assigning demand and uses.

As for **fulfilment** of ecological flows, it must be emphasised that the network of gauging stations used to evaluate them is generally small, and consequently there is a degree of uncertainty regarding many of the water bodies, and numerous groups highlight particularly serious breaches of minimum flows in the public participation process. The information on the other items such as maximum flows, flooding regimes or change rates is almost non-existent. In the Segura river basin for example, "*a significant lack of gauging control*" is mentioned "*which must be reversed in this planning cycle (...)*". These are improvements that could have been implemented in the last two decades when the planning process in accordance with the WFD began, which is yet another example of the **reversal of water management planning priorities**, which are not related to verifying fulfilment of ecological flows and environmental objectives. We need to bear the huge pressure on water resources in mind, as we have seen in previous sections, which in many territories means there is a serious risk of failing to meet flows, meaning that the entire process of implementing ecological flows is in practice a failure.

Monitoring should serve to assess if ecological flows are effectively serving the function for which they were designed: maintenance or recovery of the good status of rivers, and if this is not the case, to modify the ecological flows in what has previously been discussed under the term of **adaptive monitoring**. This has not been found in any of the analysed plans, with the exception of the case mentioned regarding the River Tagus Water Management Plan to link "*activation of those incremental steps* (of the minimum flow) *to the achievement of the good status of water bodies between the Bolarque dam and the Valdecañas reservoir*" which suggests that **the only time that adaptive monitoring will be implemented in the district is to reduce the levels of the minimum ecological flows**, which different groups have claimed are insufficient, despite the increases, with the sole objective of meeting the agricultural demands of the other river basin.

Many of the water bodies where insufficient minimum flows have been reported by groups in the public participation process **do not meet good status**, and have high exploitation indexes. There are no plans to increase the flows in these cases, which would be a basic measure to achieve the environmental objectives established in the WFD.

Furthermore, there is a difficulty involved when identifying the effects that the implemented ecological flows have on the status of water bodies, owing to the systematic use of indicators such as macroinvertebrates, diatoms or physico-chemical indicators, which are not sufficiently sensitive to the hydromorphologic conditions. The ichthyofauna indicators (Integrated EFI+ index) are being developed and fish data is being compiled, but except in the Ebro and Júcar rivers (but not in all water bodies), they are not considered in the assessment of the status of the water bodies in the studied management districts. Therefore, after two complete planning cycles, **there is still no suitable generalised fish indicator** for Spanish river basins.

Nevertheless, the European Guide on ecological flows recommends the member States to urgently implement the specifically sensitive metrics: *Classification of water bodies subjected to significant hydrological pressures only using biological methods which are not sufficiently sensitive to hydrological alterations leads to an* ***overestimation of the ecological status****.* Other

Classification: Internal

very relevant hydromorphologic aspects are starting to be assessed, but in any event they have less specific weight in the assessment and are not useful to establish whether or not a water bodies is in good status (they only distinguish between the good and very good statuses).

Sediment transport, which is closely related to the flows regime, and in particular flooding regime flows, is largely absent from the RBMPs despite its importance in forming the habitats of river ecosystems, and glaring problems such as regression of the River Ebro Delta. Some sediment mobilisation pilot tests have been carried out in this river basin, all of which are still in the study phase.

The relation with **groundwater** is not tackled properly either when studying the problem of circulating flows. Nevertheless, it is known that in many Mediterranean climate rivers, the base flows from aquifers are fundamental during the dry season. When assessing the quantitative status of groundwater bodies: "*surface water bodies associated with groundwater testing which assesses if the surface water body is in bad status, or that the ecosystems associated with it do not achieve a good status of conservation*" should be carried out, and another test on the "*groundwater dependent ecosystems*. *This test assesses if groundwater abstraction is a significant cause preventing the dependent ecosystems from reaching a good status of conservation".* There is no evidence that this information, where it has been defined (in some plans it is incomplete) is actually used when implementing and assessing ecological flows.

Insofar as **protected areas** are concerned, in the first planning cycle the European Commission report on Spanish RBMPs had already recommended "*Conducting a comprehensive study in conjunction with the relevant authorities for nature to determine the quantitative and qualitative needs of the habitats and protected species, converting such in specific objectives for each protected zone to be included in the water management plan".* There are some sites in the Natura 2000 Network where management plans have been approved stating the obligation of an ecological flows regime being established by the competent authority in order to achieve or maintain the good status of water bodies and to conserve the priority habitats, the Natura Network species and migratory species. Many of the water bodies that do not achieve good status, as is the case of most of the water bodies in the mid section of the River Tagus, are also river habitats included in the Natura 2000 Network. Nevertheless, **none of the studied plans have taken the needs of those species and habitats into account when defining their ecological flows**. This is a clear example of a lack of coordination between administration departments in Spain, in this case the water authorities (river basin administrations, in general Water Management Confederations) and environment administrations (Regional Authorities). Apart from the sections mentioning "Related Plans and Programmes" in the regional plans, and including water associated habitats and species, the RBMPs do not provide any specifics on how they are going to take those areas into account in practice.

In short, some positive progress has been made in terms of ecological flows in this third planning cycle, but at the same time it is obvious that the **priorities of Spanish water management planning** has focussed more on demand rather than on environmental objectives since the beginning of the first cycle: at this stage of the third planning cycle, studies are still being considered to define maximum flows, flooding regime flows and change rates, improving the

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control network, etc., all of which could have been done in the last two decades when the planning process pursuant to the WFD began.

The exploitation and pressure from consumption indexes on the system are such that there is very little margin, the amount of water being allowed to flow is low in the best of cases, and even though the minimum flows have been defined and are met, the river has the minimum quantity of water in its flow every quarter, without the natural variations. In addition to the lack of floods and contribution of sediments, there is the situation of **generalised deterioration of the morphology of our rivers**. Hydromorphology is a river ecosystem control factor. Approximately half of our water bodies do not achieve good status, but when hydromorphologic indicators intervene in the assessment, or a strict consideration of the ichthyofauna indicators, implemented in a realistic way, we believe this number will soar negatively.

One of the questions that civil and environmental organisations have brought to light concerning participation processes is the pressing need to implement **joint management of the river basin**, with a holistic approach, in which the different sector policies respond to a **territorial model** rather than taking independent paths that are often incompatible with each other. The subject of ecological flows, or water in general, is paradigmatic of how objectives can be opposed: uses against the good status of water bodies; irrigation, hydroelectricity, etc., against ecological flows; farming against quality fresh water. Most of the problems that affect water bodies go beyond water management planning and depend on other sector policies: real, effective coordination between administration departments with a long-term outlook and for the common good of all is indispensable.

Lacking a complete definition of all the flow regime components (maximums, generating, change rates) along with the meagre flow regimes in many cases, unjustified breaches and the lack of an assessment on whether the implemented flows permit guaranteeing the good status of water bodies is a frustrating scenario.

3.6. SPECIFIC ANALYSIS OF THE MINIMUM ECOLOGICAL FLOWS IN THE RIVER TAGUS (MID SECTION)

3.6.1. INTRODUCTION

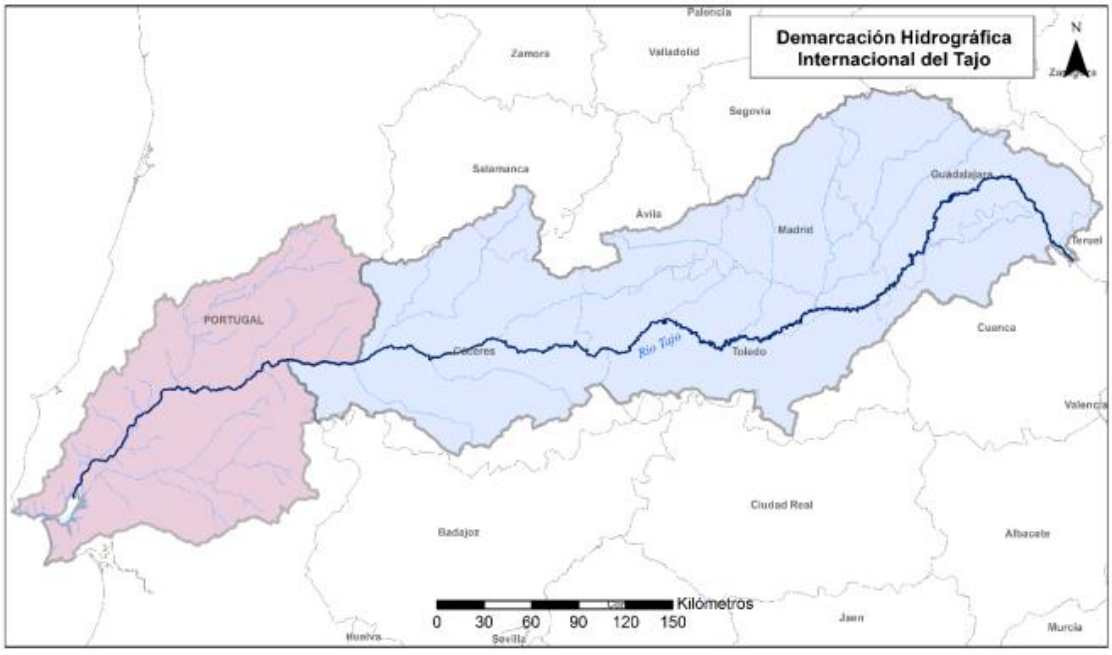
The International River Tagus Water Management District is the most densely populated in the peninsula, with 11 million inhabitants (8 million in Spain and 3.2 million in Portugal). It covers an area of 80.629 km^2, of which 70% is in Spain, and 30% in Portugal. The Tagus, which flows out to the ocean in Lisbon is the longest river in the peninsula, crossing from its centre to the Atlantic Ocean.

Classification: Internal

Figure 8. River Tagus in the Iberian Peninsula and part of the Tagus river basin in Spain.

Source: own source based on the sources cited in the image.

Figure 9. International Tagus river basin district



Source: Report. River Tagus RBMP (2022-2027)

In the Spanish part of the basin the district spans five autonomous regions, of which Castilla-La Mancha is the second in terms of population and the one that covers most territory. Madrid, despite only covering 14% of the territory, accounts for more than 80% of the total population in the river basin, with almost 8 million inhabitants. The fact that the metropolitan area of Madrid, one of the largest in Europe, is fully located in this river basin (in the upper part), is one of the peculiarities of the Tagus river basin, both regarding the need to guarantee water supply

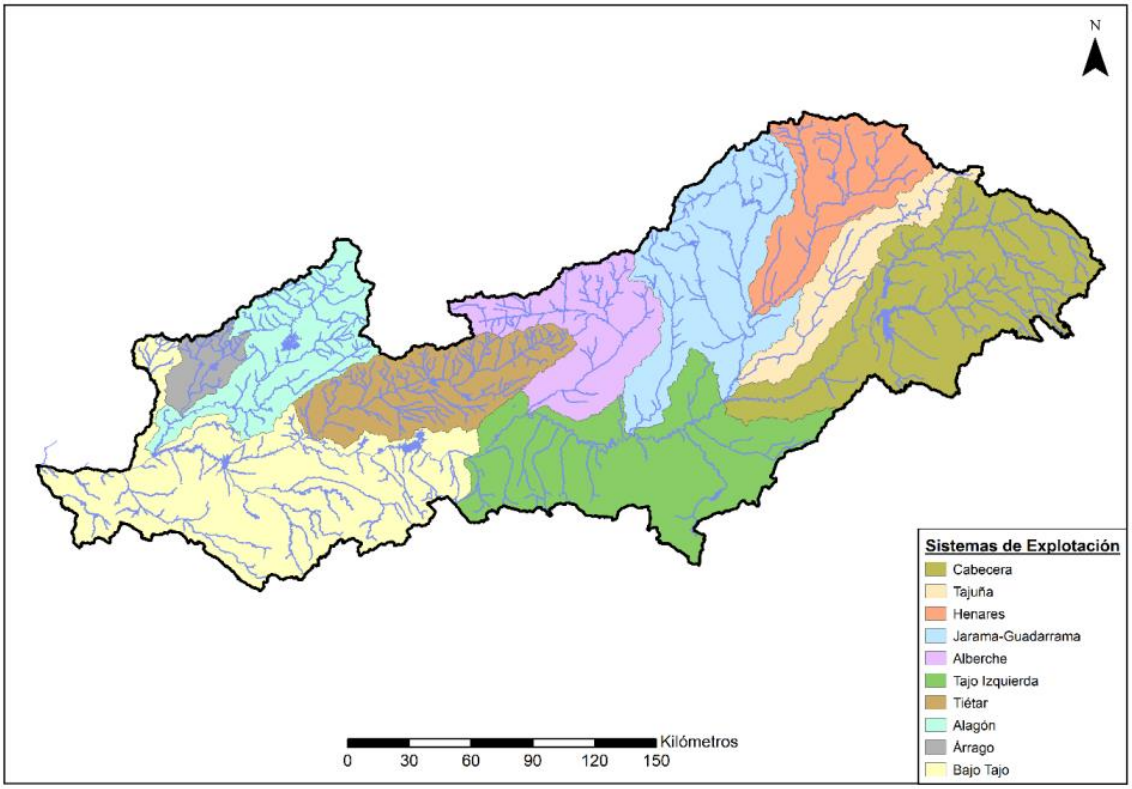
Classification: Internal

and the large amount of residual effluent from the metropolitan area which flows into the River Tagus through tributaries such as the Jarama and Guadarrama rivers.

In order to characterise the uses and pressures of the river Tagus and its basin, and the relation with the ecological flows in the river, comprising the main river or axis of the basin, we therefore need to take into account that the Spanish part of the water management district is divided into two big, very different zones, for management purposes. The mid section of the River Tagus analysed in this case study is located in the first part of the basin, or the upper Tagus basin, consisting of the headwaters and the exploitation systems on the Jarama-Guadarrama, Tajuña, Henares, Alberche and left Tagus rivers. The River Tagus and its tributaries withstand enormous pressure in the upper region of the basin, through drawdown and effluent from the supply to Madrid, and also a major water transfer system, the largest one in the peninsula, from Cabecera del Tagus to the River Segura, mainly for irrigation (and to a lesser degree for supply, thus alleviating pressure on the flows in the River Segura for irrigation).

The lower part of the basin comprises the Tagus on lower ground and another three exploitation systems grouped around the Tiétar, Alagón and Árrago rivers, mostly located in the Autonomous Region of Extremadura, but also in Castilla & León. The most important hydroelectric section in the river basin is located in this part of the Tagus, covering almost 300 kilometres of the river's length, from Talavera de la Reina to Portugal, featuring a chain of reservoirs (Azután, Valdecañas, Torrejón, Alcántara and Cedillo) for hydroelectric production, with a joint capacity of 5,145 hm^3 and flooded area of 21,330.

Figure 10. Exploitation systems in the Tagus river basin



Source: Report. River Tagus RBMP (2022-2027)

Classification: Internal

The lower Tagus region hydroelectric reservoirs accumulate half of the storage capacity of the basin's reservoirs (11.000 hm^3 per year), whereas another 25% of the capacity is located at the headwater (Entrepeñas, Buendía and Bolarque reservoirs), where it is subject to severe external pressure (Tagus-Segura water transfer system). With the remaining 25% of storage capacity, the main consumption demands in the Tagus basin are to be met, including the supply of Madrid (Gallego, 2013[92]). According to the Tagus Water Management Confederation, this leads to a general imbalance between the resource generating areas in the basin and the areas that demand the resources, which is reflected in deterioration of the main river in the basin, namely the Tagus, and the problems that have arisen over recent years through the necessary implementation of ecological flows in the mid section between Bolarque reservoir (connected to the Entrepeñas and Buendía reservoirs in the Tagus' headwaters), and the Azután reservoir in Talavera de la Reina (which, after a short section of river, is followed by the Valdecañas reservoir).

3.6.2. CONSIDERING THE TAGUS AS A "SURPLUS WATER" RIVER AND CLIMATE CHANGE

As mentioned previously, the Spanish part of the Tagus river basin is subject to the highest pressure to supply the population in the country, as it flows through Madrid city and its metropolitan area, where there were almost 7 million inhabitants in 2023. This huge concentration of inhabitants in the upper part of the Tagus basin, including its headwaters, means that it is an area with less farming pressure than other Spanish river basins (around 70% in this case), but it is subject to significant pressure from the need to guarantee the supply in the rivers and reservoirs surrounding Madrid (urban demand accounts for 27% of the abstraction uses). In turn, the huge volume of urban effluent produced in the metropolitan area of Madrid and the concentrations of pollutants (including emerging pollutants) that are not removed through ordinary treatment, end up in the mid section of the River Tagus.

There are significant amounts, as can be seen in the figures for the Tagus' tributaries Jarama and Guadarrama, as examples. With regard to authorised effluent, in 2021 there were 18.67 m^3/s of effluent in the Jarama, with a mean flow of 26.18 m^3/s. In other words, 71.32% of the flow in the River Jarama is waste water. This means that 79.60% of the flow in the Tagus where the Jarama and Tagus merge is effluent[93]. In the case of the River Guadarrama, the figure is lower, although it is still considerable: once again, according to the effluent census by the Tagus Water Management Confederation (2021), the annual effluent in the Guadarrama basin amounted to 83,505,502 m^3 (83.5 hm^3). Of that effluent 78,838,387 m^3 (78.8 hm^3), 94.41 % is produced in the Region of Madrid. The rest, i.e. 4,667,115 m^3 (4.7 hm^3), is in the province of Toledo. The mean volumes gauged at Bargas in the Guadarrama for the period between the hydrological years 2010/11 and 2018/19 amount to 119 hm^3, with a minimum of 84.70 m^3 and a maximum of 182.18 hm^3. The amount of effluent accounts for a mean of 70% of the circulating flow in the

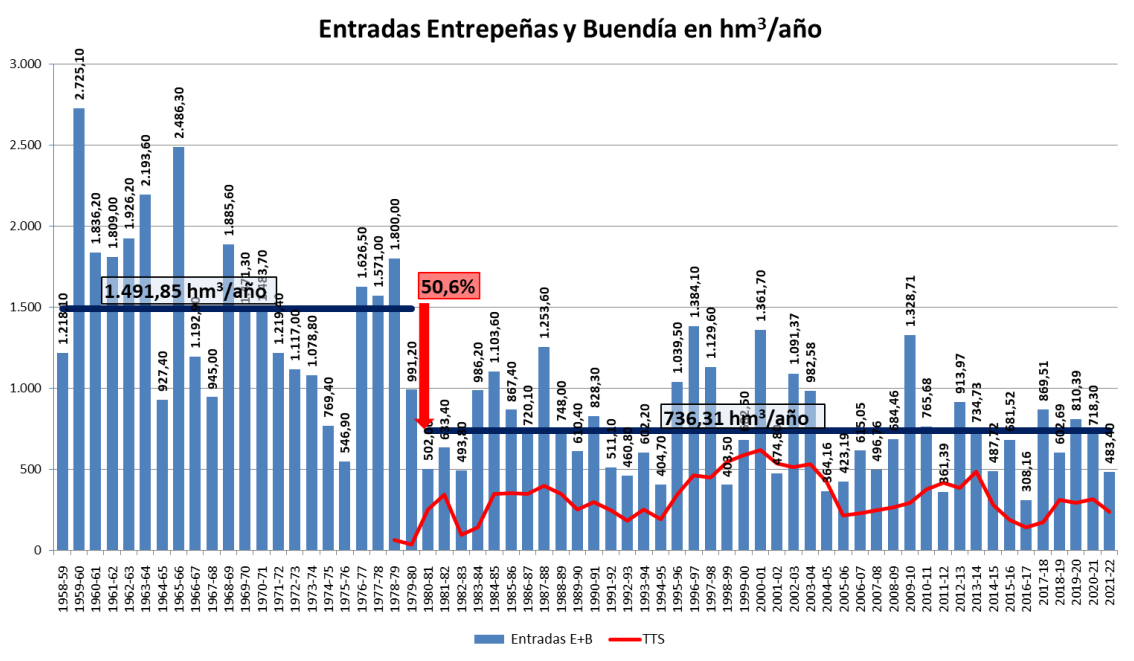
[92] *Chapter from the book "El Tajo. Historia de un río ignorado (Hernández-Mora et al., 2013).*
[93] *Own source by the Tagus Professorship at UCLM-Soliss based on data produced by the Tagus Water Management Confederation – Authorised effluent census and gauging yearbook 2019.*

Classification: Internal

river, which increased in years such as 2018/19 (with a gauged volume of 84.7 hm^3 in Bargas), to 98.6% of the circulating flow before the confluence with the Tagus[94].

In addition to this huge pressure on the river basin due to its geographical layout and the location of Madrid, the headwater and mid section flows of the river are subjected to enormous pressure (external) from irrigation in the Segura basin (and to a lesser extent, due to supply) through the Tagus-Segura water transfer system, which on average diverts between 45.6% and 60% of the water to the other river basin from the Tagus headwaters, although there are years when transfer has exceeded 100% of the supplies received by the reservoirs, as can be seen in the following graph.

Figure 11. Volume of water entering the Entrepeñas and Buendía reservoirs (starting point of the Tagus-Segura transfer system) and transferred water.



Source: Sánchez Pérez (2018)

The years when the amount of transferred water exceeds 100% of the water that enters the reservoirs (red line above the blue strip), are usually the years when the previous year has been wet, over the mean. This prevents appropriate management of the Tagus headwater reservoirs, which are of a hyper-annual nature and need several years to fill. Consequently, the Entrepeñas and Buendía reservoirs, which have a joint capacity of 2500 cubic hectometres, have not filled to more than 50% of their capacity for decades, due to the combined effects of less water contribution, and the management of the Tagus-Segura water transfer system, and the figures usually oscillate between 15% and 30%.

Therefore, Spanish planning transfers the effects of "unsustainability" of the huge amount of irrigation in the Segura river basin (see section 1.3.2 **Error! Reference source not found.** of this

[94] *Taken from the ANALYSIS OF THE CONSERVATION STATUS OF THE GUADARRAMA RIVER BASIN. CONSEQUENCES IN THE TOWN OF BATRES. Beatriz Larraz Iribas (Head), Miguel Ángel Sánchez Pérez, Raúl Urquiaga Cela, Consuelo Alonso García. Tagus Professorship UCLM-Soliss. 2023*

Classification: Internal

report) to the upper part of the Tagus basin, and the mid section of the main river, which consequently suffers from severe over-exploitation, with a WEI index of 71% in 2014 (see section 1.3.4 **Error! Reference source not found.**of this report).

In the 70's last century, the General Tagus-Segura Joint Draft Project estimated that the Tagus headwaters had a surplus of 600 hm^3/year which could be transferred to the Segura irrigation land in the Levant region via a new aqueduct. This calculation was based on considering mean annual contributions of 1400 hm^3/year in the Entrepeñas and Buendía reservoirs. Nevertheless, after the start of the water transfer system in the 80's, supplies have been much lower than forecast, 736 hm^3/year mean, i.e. 50.6% less. The mean amount transferred annually since then is 335 hm^3/year, thus drastically limiting the amount of water that is allowed to flow to the Tagus from its headwaters to around 290 hm^3/year, which causes severe hydrological alteration in the mid section of the river. The minimum flow of 6m^3/s in the River Tagus as it flows through Aranjuez which was established in the water transfer regulations (without any technical or ecological justification) has been the only reference for decades, and it has also been applied linearly in the wetter months of the year, thus contributing to the severe hydrological alteration of a river whose mean annual flow in a natural regime in Aranjuez would be 33 m^3/s.

The Tagus-Segura water transfer regulations and the national RBMP, have always pointed out that only "surplus" water can be transferred from the Tagus river basin, i.e. water that is not required for other uses, including environmental uses. Nevertheless, ecological flows in the River Tagus that could be used as a conditioning factor for water transfer have never been established, and determining and applying a suitable regime of ecological flows in the mid section of the Tagus has been arbitrarily delayed in time by Spanish water management planning, which led to several sentences by the Supreme Court in 2019, declaring the illegality of this situation, and ordering such to be established and applied.

In practice, the Tagus-Segura water transfer system is a strong political conditioning factor, including regional conflict, when establishing demand and the environmental requirements of the River Tagus. The amount of transferred water depends on the Law and water transfer regulations [95], but the demands of the river basin from where water is transferred are legally overriding pursuant to the aforementioned regulations and national RBMP. The Tagus basin RBMP is responsible for establishing those demands, including environmental demands, or better said, the prior restriction to respect the ecological flows.

In the Segura river basin on the other hand, some resources from the River Tagus are counted (see section 1.1.2 **Error! Reference source not found.**of this report) whose amounts cannot be guaranteed or previously determined, owing to the legal requirements that such amounts are

[95] *Law 21/2013, of December 9, on environmental assessment (LEA), in force since December 10 2013, contains provisions on the Tagus-Segura Water Transfer System: the fifteenth additional provision establishes the "Operating Rules for the Tagus-Segura Water Transfer System". These rules are modified, pursuant to the provisions of the LEA, by Royal Decree 773/2014 f September 12, which approves different regulatory rules for water transfer via the Tagus-Segura aqueduct. Later on, Royal Decree 638/2021 of July 21, includes an amendment proposed by CEDEX (Public Works Studies and Experimentation Centre) which changed the wording of Article 1 on the Tagus-Segura Water Transfer System Exploitation Regulations of Royal Decree 773/2014.*

Classification: Internal

surplus amounts, after covering all the uses and demands of the Tagus river basin, including environmental requirements.

According to some experts[96], ensuring an ecological flows regime in the Tagus basin would entail a certain reduction of the amount of water that can be transferred to the Segura basin, but in any event the main cause of reducing transfers from the Tagus to the Segura will not be due to applying the ecological flows, but rather climate change. This is not a future threat, it is a crude reality. Climate change has already seriously affected the natural water supply to the Tagus headwaters, which have reduced by 50% compared to the historical mean. This reduction will worsen in the future according to different studies and publications (San Martín et al., 2018, San Martín et al. 2020). For example, according to the research conducted by Pellicer Martínez and Martínez Paz (2018), considering the Tagus-Segura water transfer operating regulations, but without considering the establishment of ecological flows in the Tagus, "*The mean value in the 2020-2090 period within the most favourable climate change scenario (RCP 4.5), the annual transferable amounts of water from the Tagus to the Segura basin will fall to an average of 106 hm³ per year (...), with consecutive periods of three and four years during which there would be no transfer of water".* This situation would be even worse in the least favourable climate scenario (RCP 8.5), and most likely considering the current emissions pathway, since the mean transferable amount of water would be reduced to 77 hm³ per year, with the periods without any transfers being more frequent and lasting longer.

On the other hand, as pointed out by San Martín et al. (2020), the forecasts based on climate change models show reductions of up to 71% of the autumn flows in the Tagus basin (Guerreiro et at., 2017). 75% of the overall flow was contributed in autumn and summer between 1980 and 2011 (River Tagus Water Management Confederation, 2015d). Therefore, if the impacts of climate change are mostly during those seasons, with reductions in run-off water of such amounts, this will lead to serious environmental and socio-economic consequences. In fact, Lobanova et al. (2017) uphold that if management of the Tagus headwaters continue to ignore the environmental requirements of Entrepeñas and Buendía downstream, this will increase the possibility of the water system collapsing (i.e. suddenly, sudden and completely) in view of the changes caused by climate change. Therefore, the river basin is becoming more and more vulnerable to climate change. On the other hand, attempting to meet the environmental demands would improve the basin's ability to adapt and its resilience, since a gradual programme could be applied to avoid the aforementioned collapse.

The obsolete concept of "transferable surplus" established 50 years ago in the Tagus-Segura water transfer legislation (De Lucas, 2019), and the failure to adapt it to reality, distorts the current Tagus river basin water management planning process, particularly in the upper part of the basin[97]. Likewise, the term "surplus" is somewhat surprising when the WEI shows severe

[96] *FNCA (2023). On the Tagus-Segura water transfer system regarding ecological flows in the River Tagus and the receiving river basins. Fundación Nueva Cultura del Agua. https://bit.ly/FNCA-TTS*

[97] *For example, as mentioned in section* ***Error! Reference source not found.*** *on modernisation of irrigation land in that report, any water savings that reduce supply downstream on the River Tagus could be considered a surplus and be allocated to the transfer system, diverting water to an external river basin from the headwaters. In other words, this water will not only not be recovered for the river, but it will not flow along the River Tagus from its headwaters, and the returns for this use in the basin will also be lost.*

Classification: Internal

water stress in the section of the river between Bolarque and Aranjuez, due to transfers for irrigation in the Segura basin via the transfer system. It could be said that there is over-exploitation of the Tagus' headwaters and mid section, which is clearly incompatible with considering there to be "surplus" water. In view of this situation, the necessary, sufficient and suitable ecological flows in terms of quantity and seasonality need to be urgently applied, without any further delays to mitigate the serious hydrological alteration.

3.6.3. ECOLOGICAL FLOWS IN WATER MANAGEMENT PLANNING OF THE RIVER TAGUS: THE ANOMALOUS SITUATION IN THE MID SECTION

Of all the items comprising the ecological flows regime to be established for the 309 river type water bodies in the Spanish part of the Tagus district, the first and second cycle RBMPs reduced them (in the Regulations) to just the minimum ecological flows, and only for 16 water bodies, i.e. 5% of the river type water bodies, despite the fact that the specific studies to determine the minimum ecological flows, seasonal distribution, flooding regime flows and change rates had been carried out in the first cycle (2009-2015), for all the water bodies in the Tagus river basin, and the maximum flows for 23 water bodies. Nevertheless, the first and second cycle Tagus RBMPs established that those ecological flows were merely "indicative" and would not be enforceable within the timeline of both plans (2009-2015 and 2015-2021). The minimum ecological flows were only enforceable in 16 water bodies.

This anomalous situation was made worse in three strategic water bodies in the mid section of the main river in the basin, namely the River Tagus, because only a minimum circulating flow was established rather than an ecological flow, without any seasonality, the same flow for every month of the year (6 m^3/s for the Tagus in Aranjuez and 10 m^3/s in Toledo and Talavera de la Reina). These flows were lower than the minimum ecological flows that had previously been proposed in the river basin planning documents[98] (10.86 m^3/s in Aranjuez, 14.10 m^3/s in Toledo and 15.92 m^3/s in Talavera de la Reina) including quarterly distribution.

Consequently, the Tagus was the only main river in Spain without an ecological flows regime. Therefore, different riverside social groups and towns[99] in the Tagus river basin filed cases with the Supreme Court against the first and second Tagus RBMP planning cycles. In 5 sentences passed in 2019[100], the Supreme Court annulled the provisions on ecological flows and environmental objectives of the said Plan for breaching current legislation, and ruled that the water administration must establish the ecological flows and all applicable items for all the water bodies in the basin, including the River Tagus (Gallego, 2019).

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[98] *Scheme of Important Subjects (ETI) in the Spanish part of the Tagus Water Management District of November 2010.*

[99] *Platform for Defence of the Rivers Tagus and Alberche in Talavera de la Reina, , Action Group for the Environment, Toledo Platform for Defence of the River Tagus, Mantiel Town Hall (Guadalajara) and the Association of Riverside Towns of the Entrepeñas and Buendía Reservoirs.*

[100] *Supreme Court Sentence 309/2019, Supreme Court Sentence 336/2019, Supreme Court Sentence 340/2019, Supreme Court Sentence 387/2019 and Supreme Court Sentence 444/2019; declaring annulment of articles 9.1, 3, 5, 6 and 7, in relation to appendixes 4.1, 4.2 and 4.3 of the River Tagus RBMP Regulations.*

Classification: Internal

The third cycle RBMP in the Spanish part of the Tagus water management district (2022-2027) has led to a change to the establishment of ecological flows compared to the two previous plans. Minimum ecological flows are established for all the water bodies. Nevertheless, in 19 water bodies on the Tagus axis (between the Bolarque dam and the Valdecañas reservoir), application of the minimum flows is carried out gradually over three periods until the minimum ecological flows regime is reached in January 2027 (see following table). In addition, the rest of the ecological flow items (maximum flows, flood flows and change rates) are not defined for all water bodies, despite this being mandatory[101].

Table 44. Water bodies with a staggered, quarterly minimum flows regime

-----	Quarterly minimum flows in NORMAL situations. Values in (m^3/s)						
	Code	**Name**	**Period**	**Oct-Dec**	**Jan-Mar**	**Apr-Jun**	**Jul-Sept**
1	ES030MSPF0109020	Bolarque reservoir	Until 31/12/2025	6.60	7.20	7.00	6.40
			1/1/2026 - 31/12/2026	7.30	8.80	8.10	6.90
			From 1/1/2027	7.70	10.10	8.90	7.10
2	ES030MSPF0108020	Zorita reservoir	Until 31/12/2025	6.60	7.20	7.10	6.40
			1/1/2026 - 31/12/2026	7.30	8.80	8.20	6.90
			From 1/1/2027	7.70	10.10	9.00	7.10
3	ES030MSPF0107021	River Tagus from Zorita Reservoir to Almoguera Reservoir	Until 31/12/2025	6.70	7.30	7.10	6.50
			1/1/2026 - 31/12/2026	7.40	8.90	8.20	7.00
			From 1/1/2027	7.80	10.20	9.00	7.20
4	ES030MSPF0106020	Almoguera Reservoir	Until 31/12/2025	6.70	7.40	7.20	6.50
			1/1/2026 - 31/12/2026	7.40	9.00	8.30	7.00
			From 1/1/2027	7.80	10.30	9.10	7.20
5	ES030MSPF0105021	River Tagus from Almoguera Reservoir to Estremera Reservoir	Until 31/12/2025	6.70	7.40	7.20	6.50
			1/1/2026 - 31/12/2026	7.40	9.00	8.30	7.00
			From 1/1/2027	7.80	10.30	9.10	7.20
6	ES030MSPF0104020	Estremera Reservoir	Until 31/12/2025	6.80	7.40	7.20	6.50
			1/1/2026 - 31/12/2026	7.50	9.00	8.30	7.00
			From 1/1/2027	7.90	10.30	9.10	7.20
7	ES030MSPF0103021	River Tagus from Estremera Reservoir to Arroyo del Álamo	Until 31/12/2025	6.80	7.50	7.20	6.50
			1/1/2026 - 31/12/2026	7.50	9.10	8.30	7.00
			From 1/1/2027	7.90	10.40	9.10	7.20
8	ES030MSPF0102021	River Tagus from Arroyo del Álamo to Embocador Weir	Until 31/12/2025	6.80	7.50	7.20	6.50
			1/1/2026 - 31/12/2026	7.50	9.10	8.30	7.00
			From 1/1/2027	7.90	10.40	9.10	7.20
9	ES030MSPF0101021	River Tagus in Aranjuez	Until 31/12/2025	6.80	7.50	7.20	6.50
			1/1/2026 - 31/12/2026	7.50	9.10	8.30	7.00
			From 1/1/2027	7.90	10.40	9.10	7.20
10	ES030MSPF0608321	River Tagus from River Jarama to the merge with Arroyo de Guatén	Until 31/12/2025	12.10	13.80	13.10	10.50
			1/1/2026 - 31/12/2026	13.90	18.40	15.90	11.00
			From 1/1/2027	15.00	22.00	18.00	13.00
11	ES030MSPF0608221	River Tagus from the merge with Arroyo de Guatén to Toledo	Until 31/12/2025	12.10	13.80	13.10	10.50
			1/1/2026 - 31/12/2026	13.90	18.40	15.90	11.00
			From 1/1/2027	15.00	22.00	18.00	13.00
12	ES030MSPF0607021	River Tagus in Toledo to River Guadarrama	Until 31/12/2025	12.10	14.40	13.10	10.50
			1/1/2026 - 31/12/2026	13.90	19.20	15.90	11.00
			From 1/1/2027	15.00	23.00	18.00	13.00
13	ES030MSPF0606021	River Tagus from River Guadarrama to Castrejón Reservoir	Until 31/12/2025	12.10	14.40	13.10	10.50
			1/1/2026 - 31/12/2026	13.90	19.20	15.90	11.00

[101] *Among the reservoirs along this section, flood (generating) flows, change rates and maximum flows are only planned for two of them: Almoguera (which also includes the Estremera reservoir a short distance downstream) and Castrejón. As mentioned previously, no change rates for the lower Tagus section have been defined, and therefore it is assumed that it is a section of dammed water for hydroelectric use which are entirely denaturalised.*

Classification: Internal

----	Quarterly minimum flows in NORMAL situations. Values in (m^3/s)						
	Code	Name	Period	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sept
			From 1/1/2027	15.00	23.00	18.00	13.00
14	ES030MSPF0605020	Castrejón Reservoir	Until 31/12/2025	12.10	14.40	13.10	10.50
			1/1/2026 - 31/12/2026	13.90	19.20	15.90	11.00
			From 1/1/2027	15.00	23.00	18.00	13.00
15	ES030MSPF0604021	River Tagus downstream from Castrejón Reservoir	Until 31/12/2025	11.10	14.40	13.10	9.60
			1/1/2026 - 31/12/2026	11.10	17.00	13.30	9.60
			From 1/1/2027	11.10	17.00	13.30	9.60
16	ES030MSPF0603021	River Tagus at the merge with River Alberche	Until 31/12/2025	12.10	14.40	13.10	10.50
			1/1/2026 - 31/12/2026	13.90	19.20	15.90	11.00
			From 1/1/2027	15.00	23.00	18.00	13.00
17	ES030MSPF0602021	River Tagus from River Alberche to the end of Azután Reservoir	Until 31/12/2025	12.50	14.80	13.50	10.50
			1/1/2026 - 31/12/2026	16.40	19.90	16.70	11.00
			From 1/1/2027	16.00	24.00	19.00	13.00
18	ES030MSPF0601020	Azután Reservoir	Until 31/12/2025	13.30	15.40	13.50	10.50
			1/1/2026 - 31/12/2026	15.60	20.70	16.70	11.00
			From 1/1/2027	17.00	25.00	19.00	13.00
19	ES030MSPF1005021	River Tagus from Azután Reservoir to Valdecañas Reservoir	Until 31/12/2025	13.30	15.40	13.50	10.50
			1/1/2026 - 31/12/2026	15.60	20.70	16.70	11.00
			From 1/1/2027	17.00	25.00	19.00	13.00

Source: River Tagus RBMP (2023). Regulations

In the first and second steps, minimum flows under the minimum ecological flow that would apply in the third step are established. No technical criteria have been used nor are they defined in any of the 2023 Tagus RBMP documents, nor is there any justification of the lower values of the minimum ecological flow in the first two steps. On the other hand, it is important to point that that staggered or gradual implementation of the minimum ecological flows is established in all water bodies on the Tagus axis until Valdecañas Reservoir, not only in the section between Bolarque and Aranjuez, thereby assuming that the supply along the entire Tagus axis to Valdecañas must come from the Tagus headwater reservoirs (Entrepeñas and Buendía). Despite the fact that Article 4 on Water Releases of Reference in the Water Transfer System of the Operating Rules (Royal Decree 773/2014[102]) states that they are calculated for uses up to Aranjuez, the reality of daily management is applied here though, as cited in De Lucas' PhD thesis (2019).

In its 2019 sentences, the Supreme Court ruled that the ecological flows in the Tagus river basin must have been applied and were "enforceable" at least from the second planning cycle. Nevertheless, this gradual implementation established in the third cycle of the Tagus RBMP would mean that the minimum ecological flow established for the River Tagus water bodies (spanning almost 400 km of river) will not be met until the end of the third cycle in 2027. In the meantime, the flow will not meet the scientific--technical environmental criteria, meeting instead the Tagus-Segura water transfer demands, despite the legal priority of the ecological flows in the basin from where water is transferred, which means that they will not have been established or applied in three cycles spanning nearly 20 years. Implementing minimum ecological flows gradually is therefore a breach of the Supreme Court's ruling, and is a new management anomaly that is not justified in any way.

[102] *Royal Decree 773/2014 f September 12, which approves different regulatory rules for water transfer via the Tagus-Segura aqueduct. Official State Journal 223 of 13/09/2014. Reference: BOE-A-2014-9336.*

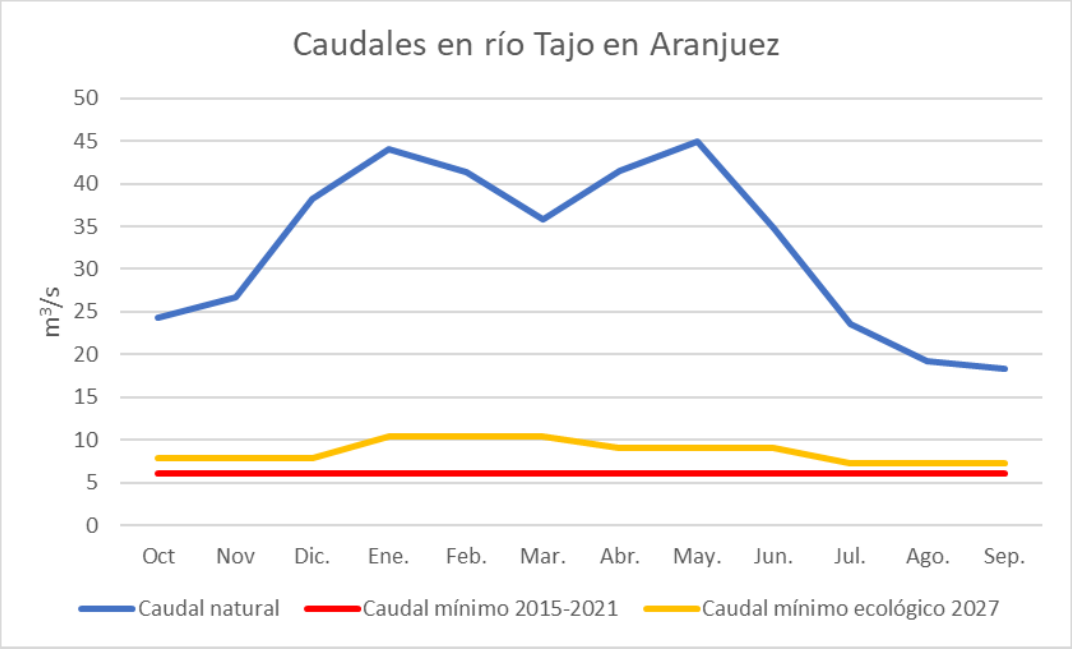
Classification: Internal

On the subject of the calculation methodology, despite the documents on ecological flows stating that the most demanding species is to be considered and the Potential Suitable Habitat (PSH) between 80% and 50% of the maximum, in general terms, the PSH in the water bodies on the Tagus axis have been established at just 50% (in fact, the PSH can be reduced to 30% in water bodies declared as heavily modified), without taking into account the demands of the Natura 2000 Network protected areas, for example. In fact, in the section of the River Tagus from Almoguera Reservoir to Estremera Reservoir, upstream from Aranjuez, the minimum flow established until December 2025 is 6.50m^3/s, which is lower than PSH50% (7.283 m^3/s), and is rather striking since it takes a value under Percentile 5. In theory the number cannot be lower than this (6.895 m^3/s).

The water bodies comprising the mid section of the Tagus are not currently in good status, and the measures envisaged in the approved RBMP are apparently insufficient to achieve good status by 2027, which is the current objective. Despite the increase, these new minimum ecological flows will not be bringing any significant improvements to a river that has lost its fluvial dynamics, floodplains, sediment transport, riverside in good status and ability to clean and dilute itself. The circulating flows in the River Tagus throughout practically the entire year are the established minimums, and therefore the flow remains practically constant, and the absence of any hydromorphologic function of the river means that achieving good ecological status will be very hard, as per the provisions established in the WFD (see section 3.3 of this report).

The following graph, comparing the flows that the River Tagus would carry in a natural regime and the minimums established in the River Tagus Water Management Plan, is very striking.

Figure 12. Comparison of flows in the River Tagus in Aranjuez.



Source: Own source based on information extracted from the 2016 and 2023 River Tagus RBMPs.

Classification: Internal

3.6.4. BREACH OF THE GOOD STATUS AND DETERIORATION OF WATER BODIES IN THE MID SECTION OF THE RIVER TAGUS

Achieving and maintaining the good status of surface water bodies is one of the environmental objectives established in the WFD and in Spanish water legislation (Article 4 of the WFD and Article 92 bis of Royal Legislative Decree 1/2001, Amended Text of the Waters Act). The environmental objectives should have been reached by 2015, although a number of extensions were granted until 31st December 2027, according to the exemption of Article 4.4 of the WFD for water bodies where, without any deterioration in their status, the necessary improvements required a longer period, had a disproportionate cost or the natural conditions would not allow such.

In the third planning cycle of the Tagus Water Management District, 160 surface water bodies (47% of the 343 river type water bodies, including natural and heavily modified bodies) failed to achieve good status (Tagus RBMP, Annex 9, Page 103). Among the water bodies that are in worse than good status, there are 13 of the 19 water bodies located in the section between the Bolarque and Valdecañas reservoirs on the River Tagus (11 river type and 2 reservoirs) for which gradual implementation of the minimum flows have been established in this planning cycle on three sections from 2023 to 2027 (see *Table*).

In spite of the poor quality, the following image shows how practically none of the water bodies in the River Tagus achieve good status as established in the third planning cycle of the WFD (only the headwater in the Alto Tajo Natural Park). This failure is due to the status or ecological potential of these rivers (many of them classed as heavily modified water bodies), since their chemical status is established as good[103]. We also need to consider, as mentioned in section 3.3.2 of this report, that this assessment does not include the fish indicator, which is more closely related to the flows regime, nor any hydromorphologic health indicator at the same level as the rest (they are assigned less specific weight). The use of fish community indicators, or others associated with the hydromorphologic status, has been highlighted by the European Commission as a shortcoming in the Spanish plans in their assessment of the second management cycle plans.

[103] *River Tagus RBMP (2022-2027) Annex 9 Assessment of water body status (page 100).*

Classification: Internal

Figure 13. Surface water body status in the Tagus Water Management District.

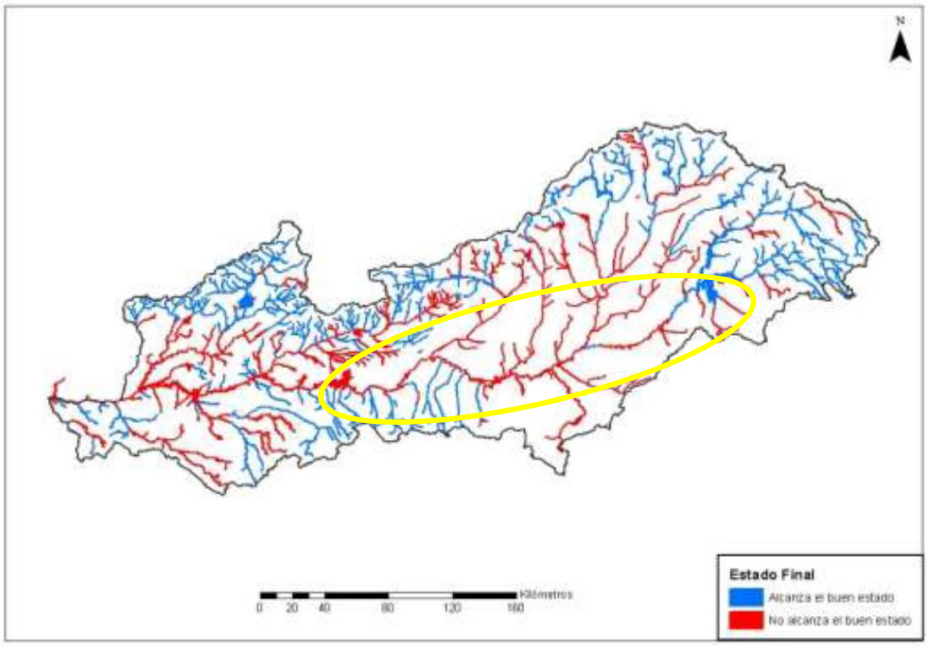


Figura 42. Estado final de las masas de agua superficiales de la cuenca del Tajo

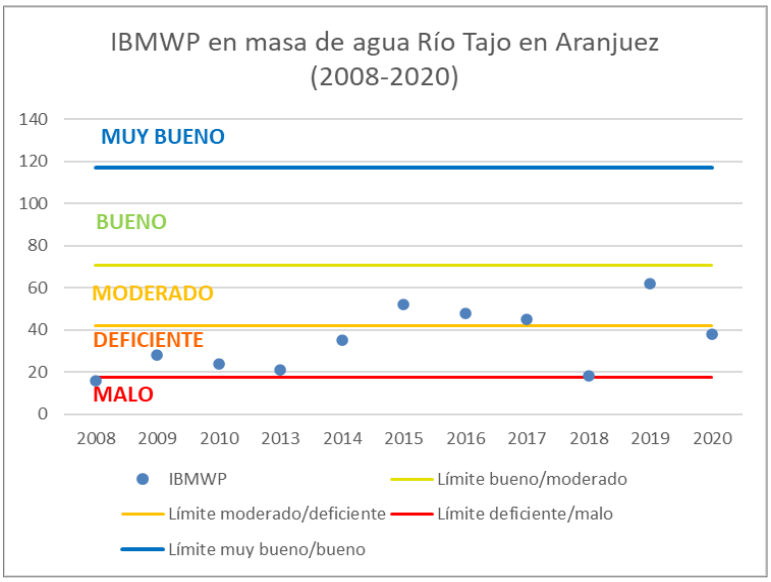
Source: Tagus RBMP[104]. The yellow colour has been added to approximately identify the section of the River Tagus referred to in this section.

In addition to the water bodies identified in the Plan, there are two others that should have been classed as "Failing to achieve good" final status regarding the analytical results by the Tagus Water Management Confederation for the evolution of the status/ecological potential of the surface water bodies (Tagus Water Management Confederation, 2022) if laxer specific limits had not been applied to them as heavily modified waters defined by channelling or hydroelectric pressure. They are the water bodies ES030MSPF0105021 River Tagus from Almoguera reservoir to Estremera reservoir and ES030MSPF0101021 River Tagus in Aranjuez. Figure and Figure show the evolution of the biological indicators that are used to classify water status in both bodies. It can be seen in Figure how the IBMWP indicator has not reached a value indicating good status in any of the samples taken from the River Tagus as it passes through Aranjuez, whereas in Figure it can be seen that the indicator shows failing to achieve good or good status at its lower limits of the River Tagus from Almoguera to Estremera depending on the year. In short, if the same criteria had been applied to these two water bodies as to the adjacent bodies, their status would be failing to achieve good.

[104] *River Tagus RBMP (2022-2027) Annex 9 Assessment of water body status (page 104).*

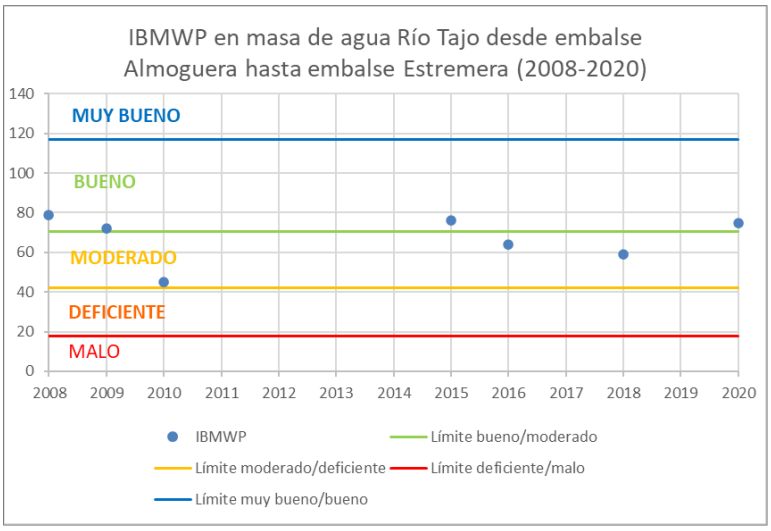
Classification: Internal

Figure 14. IBMWP biological quality index in the River Tagus water body in Aranjuez between 2008 and 2020.



Source: Own source from the Tagus Water Management Confederation data (2022).

Figure 15. IBMWP biological quality index in the River Tagus water body from Almoguera reservoir to Estremera reservoir between 2008 and 2020.



Source: Own source from the Tagus Water Management Confederation data (2022).

Bear in mind that those biological indicator values condition the entire status of the water body, since if any of them do not reach good status, the final classification will be failing to achieve good.

Hence, we deduce that if **those specific limits for which there are no methodological details in the 2023 Tagus RBMP**, all the river water bodies into which the River Tagus is divided between Bolarque reservoir and Valdecañas reservoir would be rated as failing to achieve good status. Of the 13 river water bodies, 9 of them would be moderate status, 3 poor status and 1 bad status

Classification: Internal

if the specific limits had not been applied differently to those established in the regulations (Royal Decree 817/2015)[105].

As a conclusion, 15 of the 19 water bodies located in the section between the Bolarque and Valdecañas reservoirs on the River Tagus would fail to achieve good status (13 rivers and 2 reservoirs), for which gradual minimum flows have been established in three steps from 2023 to 2027 (see following table).

Table 45. Degree of fulfilment of the water body status objectives on the River Tagus between the Bolarque and Valdecañas reservoirs.

Water body code	Water body name	Ecological status/potential	Chemical status	Final status/potential
ES030MSPF0107021	River Tagus from Zorita Reservoir to Almoguera Reservoir.	**Deficient**	Good	Failing to achieve good
ES030MSPF0105021	River Tagus from Almoguera Reservoir to Estremera Reservoir	**Moderate**	Good	**Failing to achieve good**
ES030MSPF0103021	River Tagus from Estremera Reservoir to Arroyo del Álamo.	Moderate	Good	Failing to achieve good
ES030MSPF0102021	River Tagus from Arroyo del Álamo to Embocador Weir	Moderate	Good	Failing to achieve good
ES030MSPF0101021	River Tagus in Aranjuez	**Moderate**	Good	**Failing to achieve good**
ES030MSPF0608321	River Tagus from River Jarama to merge with Arroyo de Guatén. (3rd cycle)	**Deficient**	Good	Failing to achieve good
ES030MSPF0608221	River Tagus from the merge with Arroyo de Guatén to Toledo. (3rd cycle)	**Deficient**	Good	Failing to achieve good
ES030MSPF0607021	River Tagus in Toledo to River Guadarrama	**Bad**	Good	Failing to achieve good
ES030MSPF0606021	River Tagus from River Guadarrama to Castrejón Reservoir.	Moderate	Good	Failing to achieve good
ES030MSPF0605020	Castrejón Reservoir.	Moderate	Good	Failing to achieve good
ES030MSPF0604021	River Tagus downstream from Castrejón Reservoir.	Moderate	Good	Failing to achieve good
ES030MSPF0603021	River Tagus at the merge with River Alberche.	Moderate	Good	Failing to achieve good
ES030MSPF0602021	River Tagus from River Alberche to end of Azután Reservoir.	Moderate	Good	Failing to achieve good

[105] *Royal Decree 817/2015, of 11th September, establishing the monitoring and assessment criteria for surface water and the environmental quality regulations. Official State Journal, No. 312 of 29th December 2021. Reference BOE-A-2021-21664.*

Classification: Internal

Water body code	Water body name	Ecological status/potential	Chemical status	Final status/potential
ES030MSPF0601020	Azután Reservoir.	Moderate	Good	Failing to achieve good
ES030MSPF1005021	River Tagus from Azután Reservoir to Valdecañas Reservoir	Moderate	Good	Failing to achieve good

Source: Own source from the Tagus Water Management Confederation data.

Furthermore, the principle of non-deterioration of water bodies is a fundamental part of the Water Framework Directive, whose main objective is to establish a framework to protect surface waters and to prevent any further deterioration, and to protect and improve the status of aquatic ecosystems (Article 1 of the WFD). In order to achieve this, "*Member States shall implement the necessary measures to prevent deterioration of the status of all bodies of surface water*" (Article 4.1.a of the WFD), through programmes of measures specified in RBMPs. In other words, the Member States have the obligation of preventing deterioration of water bodies, and also to establish the necessary measures in their RBMPs to achieve such.

Nevertheless, according to the third planning cycle Tagus RBMP documents, there was a deterioration in the ecological status/potential or the chemical status between the second and third cycles in **8 of the water bodies on the Tagus axis** between Bolarque reservoir and Valdecañas reservoir (61.5% of the 13 river bodies). None of those water bodies achieve good final status. The following table shows those water bodies.

Table 46. Deterioration of surface water bodies on the River Tagus axis between the second and third planning cycles.

Water body code	Water body name	Deterioration
ES030MSPF0107021	River Tagus from Zorita Reservoir to Almoguera Reservoir.	Ecological potential
ES030MSPF0105021	River Tagus from Almoguera Reservoir to Estremera Reservoir*	Ecological potential and final status
ES030MSPF0103021	River Tagus from Estremera Reservoir to Arroyo del Álamo	Ecological potential and final status
ES030MSPF0102021	River Tagus from Arroyo del Álamo to Embocador Weir	Ecological potential and final status
ES030MSPF0608321	River Tagus from River Jarama to merge with Arroyo de Guatén	Ecological potential
ES030MSPF0608221	River Tagus from the merge with Arroyo de Guatén to Toledo	Ecological potential
ES030MSPF0607021	River Tagus in Toledo to River Guadarrama	Ecological potential
ES030MSPF1005021	River Tagus from Azután Reservoir to Valdecañas Reservoir	Ecological potential and final status

*Deterioration according to the analysis conducted in the Annex.
Source: 2023-2027 River Tagus RBMP (Annex 9). Own preparation.

All those water bodies have undergone deterioration in terms of status, and the rest of the water bodies from Bolarque to Valdecañas, and they have been exempted from applying the ecological flow from the first planning cycle of the Tagus, and in the third cycle, gradual minimum flows have been established from when the RBMP came into force until 2027. This situation of

Classification: Internal

deterioration of those water bodies means that it is indispensable to establish a regime of ecological flows, which has not been done to date.

3.6.5. NATURA 2000 NETWORK PROTECTED SITES IN THE MID SECTION OF THE RIVER TAGUS. ECOLOGICAL FLOWS FOR CONSERVATION THEREOF.

Reaching good ecological status is not the only objective that a suitable flow regime can contribute to. On the river sections of greater interest that fall within the Natura 2000 Network (RN2000), the flow regime is one of the system's variables. It has a strong influence on the conservation status of natural values in those sections, both in terms of species and habitats.

There are 9 Natura 2000 Network sites directly associated with the River Tagus in the mid section from Bolarque reservoir to Azután. The current RBMP does not consider any special treatment for those sections in terms of ecological flows, apart from the generic consideration of not reducing the flows in periods of drought.

The Report by the European Commission to the European Parliament and the Council on application of the WFD (2000/60/EC) and the Directive on floods (2007/60/EC)[106], is a fundamental item to be considered by the Spanish Government when implementing the third cycle management plans. The report states that the Spanish Government must "*ensure that the quantitative and qualitative needs of the protected habitats and species must be specified, and that they translate as specific objectives for each protected area, likewise identifying the monitoring mechanisms and relevant measures*".

On the other hand, the Report by the Mission and the Recommendations approved by the European Parliament Petitions Committee on 13th July 2016[107], following the inspection visit to Spain, established in point 8 "*that the low levels established for the minimum flow in the Tagus* RBMP *in Almoguera, Aranjuez, Toledo and Talavera de la Reina, along with a non-existent seasonal variation flow, contribute to a significant alteration of the water flow regimes in areas related to the Natura 2000 Network. It is believed that this factor produces an ongoing alteration of the habitat for fish and other species in the areas of interest for the community, and seriously affects their conservation, while not contributing to their recovery".*

In this case, the Autonomous Region of Castilla-La Mancha is one of the responsible authorities, along with the Region of Madrid[108], for conservation of the Natura 2000 Network sites and the associated ecosystems in the mid section of the River Tagus. Castilla-La Mancha has submitted a proposal that "*specifies the quantitative and qualitative needs of the protected habitats and species, and that they have been set forth as specific objectives for each protected area*". Those studies should comprise the regulatory framework according to which the minimum ecological flows in the mid section of the River Tagus are established. As far as we are aware, this is the

[106] *Brussels, 26.2.2019 COM (2019) 95 final.*
[107] *European Parliament (2016) 14*
[108] *SAC ES3110006 Floodplains, hillsides and wetlands of the southeast of Madrid and SPA ES0000119 Carrizales y Sotos de Aranjuez*

Classification: Internal

only protected area management document that includes specific flow values through its own study.

The Natura 2000 Network Master Plan in Castilla-La Mancha[109] defines the "*Water resources and water supplies for the conservation of Natura 2000 spaces in the mid section of the River Tagus*" in Annex VIa[110]. Nevertheless, this Master Plan has not been officially approved, and until it is, the established water requirements are not valid. As mentioned in section 3.4.2 of this report, this is important because the river basin authority, namely the Tagus Water Management Confederation, refers to the absence of requirements established in the Natura 2000 Network Master Plan, and avoids implementing the ecological flows in the water bodies falling within the Network.

According to the said Annex, the Natura 2000 Network sites in Castilla-La Mancha associated with the River Tagus axis from Bolarque to Azután are as follows, along with the associated water bodies (some of the names have changed since the previous planning cycle):

Table 17. Natura 2000 Network areas associated with water bodies in the mid section of the Tagus axis in Castilla-La Mancha.

Water body	Length (km)	Natura 2000 site in Castilla-La Mancha
0108020 Zorita	-	ZEC/ZEPA ES4240018 Sierra de Altomira
0107021 River Tagus from Zorita Reservoir to Almoguera reservoir	5.9	
0106020 Almoguera	-	
0103021 River Tagus from Estremera Reservoir to Arroyo del Álamo	57.96	ZEC ES4250009 Yesares del valle del Tajo
0102021 River Tagus from Real Acequia del Tagus to Arroyo de Embocador	29.82	
0608021 Tagus from Jarama to Toledo	64	ZEPA ES0000438 Carrizales y sotos del Jarama y Tajo
0605020 Castrejón	-	ZEC/ZEPA ES0000169 River Tagus in Castrejón, islas de Malpica de Tajo y Azután
0604021 River Tagus downstream from Castrejón Reservoir	32.77	
0603021 River Tagus at the merge with River Alberche*	45.07	ZEC/ZEPA ES0000169 River Tagus in Castrejón, islas de Malpica de Tajo y Azután ZEC/ZEPA ES4250013 Rivers to the left bank of the Tagus and Berrocales del Tajo; ZEC ES42500003 Barrancas de Talavera

[109] *Natura 2000 Network Master Plan in Castilla-La Mancha, prepared by the General Directorate of the Natural Environment and Biodiversity of the Sustainable Development Council of the Castilla-La Mancha Regional Authorities. Resolution of 23/1072019 of the General Directorate of the Natural Environment and Biodiversity, referring the subject to hearing procedures of interested parties for approval of the Castilla-La Mancha Natura 2000 Network Master Plan.*

[110] *Draft document (in the process of public participation).*

Classification: Internal

Water body	Length (km)	Natura 2000 site in Castilla-La Mancha
0601020 Azután Reservoir	-	ZEC/ZEPA ES0000169 River Tagus in Castrejón, islas de Malpica de Tajo y Azután ZEC/ZEPA ES4250013 Rivers to the left bank of the Tagus and Berrocales del Tajo;

* This is the water body upstream on the River Tagus at Talavera, River Tagus from River Alberche to end of Azután Reservoir, for which the minimum flows were previously shown.
Source: Annex Via to the Natural 2000 Network Master Plan[111].

As for hygrophyllic habitats and aquatic species of community interest "*(...) most of them are in an unfavourable state of conservation, mainly as a result of the serious alteration and deterioration of rivers caused by high water demands (due to the high population density in the region), water pollution, large volumes of water transferred via the Tagus-Segura Aqueduct, occupation of the public water domain and falls in the natural water contribution in recent decades (estimated at -47% at the Tagus headwaters since 1980; Tagus Water Management Plan 2009-2015), in addition to the future effects of climate change. (...) In all the Natura 2000 Network areas the fish communities have been heavily altered, with severe fragmentation and populational regression, being gradually replaced by non-native species. The river does not work as a corridor, nor does it maintain its ecological functionality that is necessary to ensure long-term conservation of native fish species. (...) The riparian forests along the mid section of the Tagus (habitats of community interest assigned codes 92A0 and 92D0) in the Natura 2000 area in Castilla-La Mancha have significant deficiencies in terms of structure and typical species, and unfavourable future perspectives (...). Current management of the river is therefore incompatible with favourable conservation of the aquatic species and habitats in the Natura 2000 areas in the mid section of the River Tagus. The water regime in recent decades has been insufficient for basic functions."*

The Annex then describes the regime of "*necessary minimum water contributions and seasonal variability to considerably improve the level of conservation of the species and habitats of community interest within the Natura 2000 areas in the mid section of the River Tagus. These contributions were established by Baeza (2015), on the basis of flow studies shown in Annex 5 of the 2009-15 River Tagus* RBMP *report, taking into account proven scientific criteria at different points in the River Tagus basin (Baeza & García de Jalón, 1997, Baeza & García de Jalón, 1999).*

An excerpt from Table 4 for the water body upstream from Talavera on the River Tagus is then given as an example. As is the case of the rest of the water bodies, the minimum values are slightly higher than those established in the third cycle RBMP for the River Tagus.

[111] *Natura 2000 Network Master Plan in Castilla-La Mancha, Annex VIa Water contributions for conservation of Natura Network areas - Mid section of the River Tagus (page 4).*

Classification: Internal

Table 48. Minimum water contributions defined in the Natura 2000 Network Master Plan in Castilla-La Mancha for a water body, along with the values established in the Tagus RBMP.

Water body	WATER CONTRIBUTIONS FOR CONSERVATION OF THE NATURA 2000 NETWORK ON THE MID SECTION OF THE RIVER TAGUS (m^3/s)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
ZEC/ZEPA ES0000169 RIVER TAGUS IN CASTREJÓN, ISLAS DE MALPICA DE TAJO Y AZUTÁN ZEC/ZEPA ES4250013 RIVERS TO THE LEFT BANK OF THE TAGUS AND BERROCALES DEL TAJO ZEC ES4250003 BARRANCAS DE TALAVERA												
0603021 River Tagus at the confluence with the River Alberche	43.27	49.33	57.2	56.77	52.52	48.96	51.43	51.94	40.92	31.16	28.41	29.49
Minimum flows (Tagus Water Management Plan)	15			23			18			13		

Source: own preparation based on the Natura 2000 Network Master Plan in Castilla-La Mancha[112] and the Tagus RBMP[113].

According to the Master Plan, "*This regime of contributions (Table 4) is considered a priority conservation measure because of its technical validity and in view of its principle of prudence, which must be taken into account when establishing the ecological flows for the respective water bodies".*

On the other hand, the Management Plan for ZEC ES3110006 Vegas Cuestas y Páramos del Sureste de Madrid and ZEPA ES0000119 Carrizales y Sotos de Aranjuez, highlight the following as the main **pressures and threats** for the area**:** *"Water modifications caused by humans on water bodies can cause a significant alteration to the habitats associated with them. In the case of rivers, the main water changes can lead to an alteration of the natural flows regime (...). The aforementioned water changes can affect the habitats of a large number of Natural 2000 Network species: European otter, fish, amphibians and aquatic reptiles (...). In the case of birds, functional alteration of water in general, and modification of the circulating flow in water courses, (...), can make the presence of certain species closely linked to river ecosystems unfeasible, as is the case of the kingfisher (Alcedo atthis)"* (section 4.4 page) 392).

In all of the cases **there is a relation between the flows regime, as the physical conditioning factor of their habitats, and the status of populations**, which can be directly established, as is the case of fish, or indirectly. The latter refers to the case of predators, for example, who find their prey in the river, and are affected by changes to flow regimes insofar as flows affect the populations of the prey that they feed on. All these groups, and more so in the case of aquatic groups, are also affected by water quality, and are particularly susceptible to pollution. The effects of pollution are worse when the circulating flows are lower.

There are six cyprinid species in these rivers, *Achondrostoma arcasii* (bermejuela), *Luciobarbus Bocagei* (barbel), *Luciobarbus comizo* (Iberian barbel), P*seudochondrostoma polylepis* (Iberian nase), *Squalius alburnoides* and *Squalius pyrenaicus*, as well as the *Cobitis palúdica,* which is not

[112] *Table 4. Necessary water contributions to help reach a favourable level of conservation of the species and habitats of community interest associated with water in the Natura 2000 area in Castilla-La Mancha, established in the mid section of the River Tagus. Natura 2000 Network Master Plan in Castilla-La Mancha, prepared by the General Directorate of the Natural Environment and Biodiversity of the Sustainable Development Council of the Castilla-La Mancha Regional Authorities. Annex Via - Water contributions for conservation of Natura Network areas - Mid section of the River Tagus (page 8).*
[112] *River Tagus RBMP (2022-2027) Annex 5 Ecological flows, Appendix 1 (page 5).*

Classification: Internal

a particularly diverse community, but it is very relevant due to its endemic presence. Cyprinids native to our rivers are found within the most endangered group of animals of our fauna. There are many different reasons for this, but Ichthyologists have no doubt that modifications to flow regimes are one of the causes (Doadrio, 2001; Elvira et al., 2003). The measure required to solve this problem consists of ensuring an ecological flow regime, according to the general consensus within the scientific community, providing that this meets the function of restoring favourable conditions for the development of fish populations. Proposing a minimum ecological flow regime would fail to meet its objectives if it is unable to achieve the following:

- Provide a sufficient habitat and shelter for fish.
- Establish a sufficiently deep water body in the river to enable fauna movement.
- Maintain the ecosystems associated with the water that interact with the river.
- Enable elimination of invasive species by maintaining the natural river conditions.
- Contribute to diluting river pollution.

This functionality established by a correct flows regime is critical in this mid section of the River Tagus, since there are fish species included in Annex II of the Habitats Directive in the Natura Network areas, and therefore they are protected by law. It is also home to community habitats that are heavily dependent on circulating flows, and therefore their protection and conservation will depend on any water management decisions that are made.

3.6.6. CONCLUSIONS

The water bodies in the mid section of the River Tagus from Bolarque reservoir (where the Tagus-Segura aqueduct is located) **fail to achieve good status**, and the forecasts established in the current RBMP and regulations suggest the situation is unlikely to be sufficiently reversed to return the river to a good ecological status, favourable for river habitats and species. This is particularly true in the section between the Bolarque and Valdecañas reservoirs where there is a very meagre circulating flow. The increase in minimum ecological flows in the third planning cycle is insufficient. Moreover, there is an exception regarding **gradual implementation of intermediate values until the minimum value is reached** by 2027.

Ecological flows must be established so that they are able to contribute to the water bodies achieving a good ecological status, if they are not already rated as such, and to maintain the good status if they are already rated as such. Having regard to this subject, it is underscored that the minimum flows that were established in the previous planning cycle for the water bodies on the River Tagus between Bolarque and Valdecañas **have not contributed to achieving good ecological status** of those water bodies, since they all fail to achieve good status. Unfortunately, the status of the river in this section has not only failed to improve, but **it has worsened** in 8 of the 13 river type water bodies, thus contravening the principle of non-deterioration established in the WFD (Article 1.a WFD). This situation of deterioration of those water bodies means that establishing a regime of ecological flows is indispensable, which has not been done to date.

Insofar as the objective that ecological flows must meet the requirement of **providing suitable habitat conditions** to cater to the needs of the different biological communities is concerned, the new minimum ecological flows, which have been postponed until 1st January 2027, will create a larger area for the potential suitable habitat than is currently available. Any increase in flow before that moment arrives will be a necessary improvement, although it is true that this will be insufficient according to the terms outlined in this report.

Classification: Internal

On the subject of ecological flows contributing to reaching the good status objectives, the ecological flows regime must include a timeline pattern of the flows which allows the existence of slight changes at the most to the structure and composition of aquatic ecosystems and the associated habitats, while maintaining the biological integrity of the ecosystem. It is very important to ensure that the minimum ecological flows undergo **seasonal variation** as similar as possible to the natural flow, at least with different behaviour throughout the seasons, as this favours colonisation processes, dynamism and status of the vegetation, thus contributing to the water supply in the riverside area that will help to maintain the existing life and the extension and colonisation of such in a larger area. In this sense, since there is currently no seasonal variation because the minimum flows are constant throughout the year, any improvement will be progress, although the variability of the flows established in the new Plan are still a far cry from natural variability.

In conclusion, **it is absolutely necessary to ensure that the minimum flows in the mid section of the River Tagus remain as similar as possible to its natural regime**, since one of the reasons for the disappearance of several species is the lack of flow variations. Some fish species migrate and this process is facilitated by flows closer to natural flows, and therefore hindered by heavily altered flows. There is a direct relation between altered flow regimes and different populational parameters of several Iberian fish species, with a reduction in their populations having been observed, and in some cases they are not detected at all. Likewise, there is a close relation between maintaining and conserving the habitats of community interest and the regime of circulating flows, particularly with flooding regimes. If there are no seasonal floods associated with flow variability and there is no connection between the riverbed and the riverside, important functions to maintain them are lost, such as nutrients, plant propagules to renew the existing community, washing away of dead or diseased wood or replenishing the floodplain aquifers that feed the strips of plants on the banks.

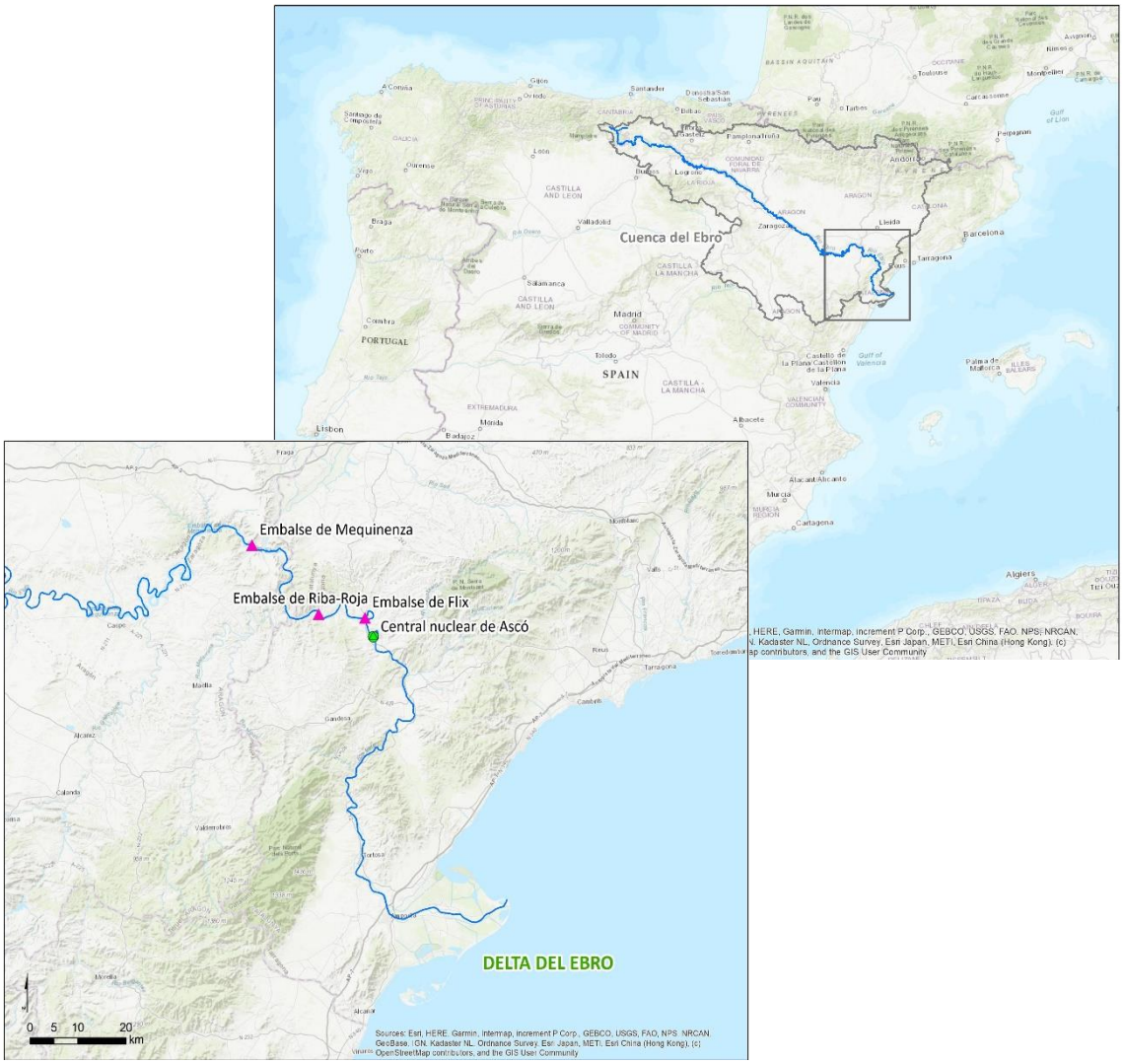
The flows established in the mid section of the River Tagus (in steps 1 and 2, and the minimum ecological flow in step 3) **do not guarantee fulfilment of the obligation to prevent further deterioration or to improve the status to achieve good ecological status** by 22/12/2027, regarding the indicators which depend on such flows to improve their status. An unsuitable design of the flows regime such as the one established in the Tagus RBMP in the third planning cycle will have negative effects on several items of the river, both regarding its structure and its functioning, and consequently, those effects could lead to a deterioration in the indicator scores used to measure the physical and biological status of the water bodies, and therefore its ecological and final status.

3.7. ECOLOGICAL FLOWS IN THE RIVER EBRO (DELTA)

The Ebro Delta is a very singular part of the country's geography. It is a large wetland created by historical accumulation of sediments deposited by the River Ebro. A large part of the delta is a Natura 2000 Network area known as the Delta de l'Ebre SCI (Site of Community Importance), and is home to many fauna and flora species, and also a farming system where the main crop is rice.

Classification: Internal

Figure 16. Location of the Ebro Delta



Source: own source based on the sources cited in the image.

Regulation of the Ebro by part of the reservoir system (Mequinenza, Riba-Roja and Flix) has led to a halt in the growth of the delta and to the start of a regression process, whereas climate change is a very real threat for some of the land. The status of the delta is entirely dependent on the flows carried by the River Ebro, and the supply of sediment to it, which are matters that we shall analyse in further detail as follows.

3.7.1. MATTERS RELATING TO ECOLOGICAL FLOWS.

Let us recall that in the RBMP proposed by the Ebro River Basin District (2021-2027) the ecological flows regime is defined in accordance with the provisions established in the Water Planning Instruction (IPH), as "*that allows maintaining the functionality and structure of aquatic systems and associated terrestrial ecosystems in a sustainable manner, thus contributing to the good ecological status or potential of rivers or transitional waters*". It also adds that, "*To achieve those objectives, the ecological flows regime must provide suitable habitat conditions to meet the needs of the different biological communities of the aquatic ecosystems and the associated terrestrial ecosystems through maintaining the necessary ecological and geomorphological processes to enable them to complete their biological cycles. Moreover, they must include a*

Classification: Internal

timeline pattern of the flows which allows the existence of slight changes at the most to the structure and composition of aquatic ecosystems and the associated habitats, and maintaining the biological integrity of the ecosystem".

This RBMP maintains the ecological flows defined in the two previous planning cycles for the final section of the River Ebro (between Mequinenza and the river mouth).

Table 49. Minimum ecological flows proposal for each month in m^3/s for the water bodies between the Mequinenza reservoir and the river mouth.

Code	Water body description	Oct	Nov	Dec	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
ES091MSPF70_001 (7)	Mequinenza Reservoir	80	80	91	95	150	150	91	81	80	80	80
ES091MSPF74	Flix Reservoir	10	10	10	10	10	10	10	10	10	10	10
ES091MSPF460_001	River Ebro from the discharge point at Flix hydroelectric station to Ascó	80	80	91	95	150	150	91	81	80	80	80
ES091MSPF461_001	River Ebro from Ascó to Xerta weir (including the Sec river basin)	80	80	91	95	150	150	91	81	80	80	80
ES091MSPF463_001(4)	River Ebro from Xerta weir to Gauging Station 27 in Tortosa	80	80	91	95	150	150	91	81	80	80	80
ES091MSPF891(4.5)	River Ebro from Tortosa to the river mouth (transitional waters)	80	100	100	120	150	155	100	100	100	100	100

Source: Own preparation based on APPENDIX 05.01 of the Ebro RBMP.

(4) Water bodies ES091MSPF463_001 and ES091MSPF891: This flow is increased with two occasional controlled flood regimes of 1000 - 1500 m^3/s to restore the flows regime and particularly to reduce invasion by macrophytes.

(5) Water body ES091MSPF891: The ecological flows in the delta as a whole consist of minimum flows that are set for the Tortosa gauging station, the controlled flood generating flows to restore the natural flow regime, the circulating flows contributing to the delta via the right and left lateral channels of the Ebro with an environmental nature, without prejudice to the pre-eminence of the permit rights granted to those channels, and natural discharge of groundwater:

(7) Water body ES091MSPF70_001: This minimum ecological flows regime will not be applicable if the end of the reservoir located downstream reaches the dam located upstream.

The described methodology used to determine the ecological flows of the water bodies is a combination of water management methods (analysis of historical records) and the suitability of the habitat. In the case of heavily impacted water bodies, such as the final section of the River Ebro, the criteria employed is to guarantee 30% of the potential suitable habitat (PSH) calculated for the studied fish species (*Barbus haasi*, *Salmo trutta, Barbus bocagei* and *Parachondrostoma miegii*).

3.7.1.1. INCONSISTENCY BETWEEN WATER BODIES, IMPOSSIBILITY TO GUARANTEE THE ECOLOGICAL FLOW

Regarding the last two water bodies of the Ebro River before the river mouth (ES091MSPF463_001 and ES091MSPF891) there are no flow diversions or contributions. On the other hand, there are two diversions between water bodies ES091MSPF461_001 and ES091MSPF463_001 delimited by the Xerta weir, from where between 15 and 45 m^3/s of water is diverted via two channels (Roset, 2004). This contradicts the ecological flows regime established for these water bodies.

Classification: Internal

The circulating flow in the Ebro cannot be the same before and after the Xerta weir in the months that water is diverted for agricultural uses. Therefore, if the minimum flow is only controlled upstream from the weir, it is not guaranteed downstream from it. The minimum flow must be guaranteed both upstream and downstream even in the case of diverting water flows.

In the case of the last water body, classed as transitional waters, the established ecological flow is said to take into account not only the River Ebro's flow in this section, but also the waters supplied by the right and left channels, and water from two discharge pulses released from Flix reservoir over the year, and the groundwater supply to the Ebro Delta[114]. This definition leads to several problematic situations.

- There is no system to quantify the amount of natural groundwater supplied to the Ebro Delta, nor any regulations that can guarantee a minimum flow.
- There is no water quantification system to quantify the amount of water which returns to the river or runs into the sea once it has passed the paddy field irrigation system and drains into the Ebro Delta. Part of this water will evaporate in the paddy fields and channels, and another part will be consumed by the plants in the fields and the drains. The water used for agriculture in the Ebro river basin is not considered as part of the ecological flow of the water body at any time.
- The water diverted to the "mini water transfer system" to Tarragona is not taken into account either, which consists of a concession of nearly 100 hm^3/year.
- The amount supplied by the two 8h releases and a maximum flow of 1200 m^3/s amounts to a total of 21.6 hm^3/year. This is an insignificant amount considering the calculated annual volume, and moreover it fails to meet its objectives, as discussed in the following section.

In conclusion, the ecological flows established for the last two water bodies in the River Ebro cannot be guaranteed or controlled. The minimum flow that can be guaranteed to reach the river mouth of the Ebro is released from the Flix Reservoir, less the amount that is diverted at Xerta weir and via the water transfer system to Tarragona.

3.7.1.2. MINIMUM FLOW AND REDUCTION OF PERCENTILES

Establishing a minimum flow does not guarantee the good ecological status of a river. Water management regimes need to take more factors into account that just the minimum flow to ensure good ecological status, such as water quality, riverside forests, the naturalness of the river, etc.

Since the Mequinenza, Riba-Roja and Flix dams were built (1948-1975), the daily circulating flow in the final section of the River Ebro has diminished drastically. Figure 1 shows how the annual percentiles have undergone a very considerable reduction. Percentiles 5, 10 and 20 are practically equal to the minimum flow, whereas percentiles 40 and 80 are reduced by over half. This shows that artificial controlled flooding is not sufficient to meet the objective of restoring the flow regime to its natural regime, as discussed previously. On the other hand, it is also

[114] *2022-2027 Ebro River Basin District Management Plan – ANNEX 5. APPENDIX 05.01 (page 69).*

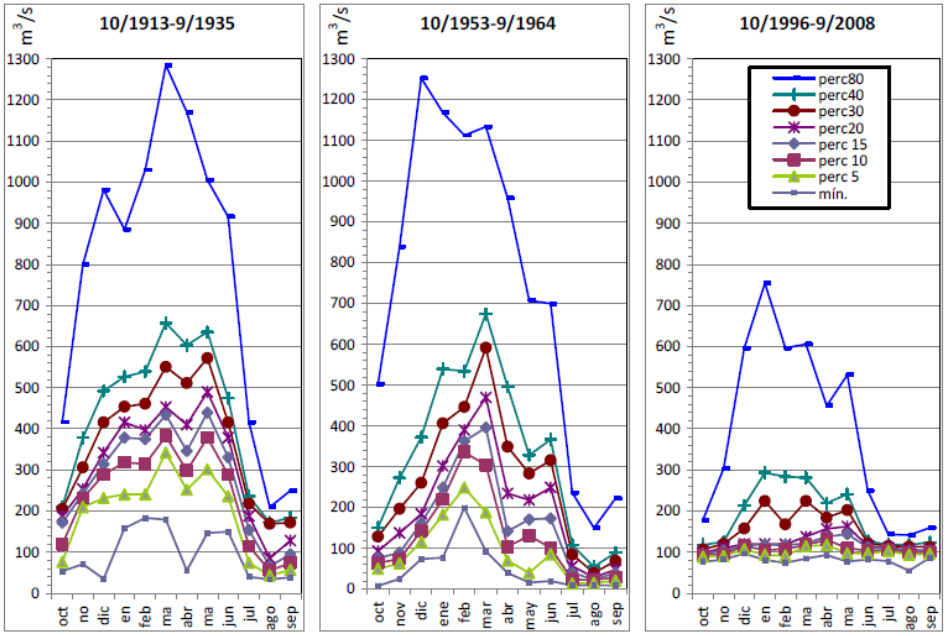
Classification: Internal

obvious that the trend in the last 50 years has been to reduce the flow in the river to the minimum established by law, which is the value that the Ebro Water Management Confederation (CHE) has arbitrarily established, and which will be discussed in the following section.

It is crucial to differentiate between the minimum flow that the ecosystem in the lower section of the Ebro can occasionally withstand and the predominant flow throughout the year. The CHE argues the validity of their proposed minimum flow or ecological flow, referring to occasional historical minimums. But that value (with modulations) is later used as the acceptable minimum flow for the whole year.

The RBMP also stipulates that a minimum annual flow reserved for environmental needs will be maintained, amounting to around 3000 hm^3/year. This is a very low amount that has never been recorded in the historical sequence, and is not a real measure.

Figure 1. Monthly percentiles in Tortosa for three periods with different water uses and regulations: predominantly agricultural use (1913-1935), intensified agricultural use (1953-1964) and post-reservoir period with hydro-electric uses and greater regulation (1996-2008).



Source: CHE (2012).

3.7.1.3. MAXIMUM FLOWS, GENERATING FLOWS AND CHANGE RATES

The following table shows the values established for these items in the water bodies we are discussing.

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Table 50. Established values for ecological flow items other than minimum flows in the 3rd cycle RBMP for the Ebro river basin district.

Body code	Body name	Qmax (m^3/s)	Qgen (m^3/s)	Times/year	Change Rate (m^3/s)	Duration (h)	Season-ality	Hydro-gram volume (hm^3)
ES091MSPF113	River Grío from source to mouth in River Jalón (*)	10	1,277	2	0.35	8	Spring-Autumn	0.02
ES091MSPF443	River Jalón from River Perejiles to River Ribota	15	5,000	2	5.00	8	Spring-Autumn	0.13
ES091MSPF55	Ardisa Reservoir	200	68,695	2	20.00	8	Spring-Autumn	1.14
ES091MSPF62	La Sotonera Reservoir	18	15,000	2	5.00	8	Spring-Autumn	0.27
ES091MSPF47	El Grado Reservoir	200	77,264	2	25.00	8	Spring-Autumn	1.36
ES091MSPF37	Yesa Reservoir	200	88,416	2	25.00	8	Spring-Autumn	1.43
ES091MSPF85	Santolea Reservoir	20	6,185	2	2.00	8	Spring-Autumn	0.11
ES091MSPF560	River Linares from its source to Gauging Station No. 43 at San Pedro Manrique (**)	5	1,000	2	0.25	8	Spring-Autumn	0.01
ES091MSPF86	Itoiz Reservoir	80	30,000	2	20.00	8	Spring-Autumn	0.70
ES091MSPF63	Rialb Reservoir	80	30,000	2	20.00	8	Spring-Autumn	0.70
ES091MSPF74	Flix Reservoir	1900	1200.000	2	400.00	8	Spring-Autumn	21.60

(*) These values will be assigned to the management of Mularroya Reservoir when it starts operating.
(**) These values will be assigned to the management of San Pedro Manrique Reservoir when it starts operating.
Source: Own preparation based on APPENDIX 05.01 of the Ebro RBMP.

3.7.1.4. GENERATING FLOWS THAT FAIL TO MEET THEIR OBJECTIVE

In the water bodies between Flix weir and the mouth of the River Ebro, the annual controlled flood releases are counted as part of the minimum ecological flow. These discharges are to "*restore the natural conditions of the flow regimes, and in particular to reduce macrophyte invasion*". The IPH (Water Planning Instruction) also establishes that "*controlled floods are to be designed to supply the necessary sediment to maintain the characteristic geomorphology (river islands, cuspate foreland, deltas, etc.) and to positively contribute to coastal dynamics, and the frequent maintaining of sediment fines and accumulated organic matter*".

The Ebro's flow regime, particularly in the final section, is controlled by reservoirs and is completely denaturised. Approximately 60% of the river basin's run-off water is retained in nearly 200 dams. In the study by Batalla *et al*., (2004) the impact of the reservoirs was analysed at 38 gauging stations on 22 rivers in the Ebro basin. The results show a very substantial fall in the magnitude and frequency of flooding: 30% mean and up to 60% of the flood magnitude with

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return periods of 2 years, and 70% for the 10 year return period. This loss in variability and floods has many consequences for the river and coastal ecosystem: hydromorphologic changes to the river, reduced transport of sediments, reduction of nutrient exchange, changes to the marine and river forces balance at the coast (Delta), proliferation of macrophytes in the lower section, more favourable conditions for invasive species, loss of river connectivity, and a very long etcetera.

Two floods (spring and summer) lasting for 8 hours with a total water supply of 21.6 hm^3 per year is a drop in the ocean with regards to solving the aforementioned problems. More specifically, water pulses to control the proliferation of macrophytes is not particularly useful, since it is limited to stunning them followed by them recovering just a few days later, or they are simply bent over and create a protective layer on the river bed, without pulling up the roots (Batalla & Vericat, 2009; Tena *et al*., 2017). On the other hand, we have seen that artificial flooding is much less effective in terms of transporting the sediment that the Delta requires to maintain its morphology. In Rovira *et al*. (2015) it was calculated that artificial flooding only supplies 1.1% of the annual transport sediment, compared to 50% transported by natural flooding. This is mainly due to the short duration of programmed flooding (8 hours in this plan, or 20 hours in previous years) compared to natural flooding which usually lasts for two weeks.

The best way to fight proliferation of macrophytes in the lower section of the River Ebro, which currently cover 80% of the river in some parts (Tena et al., 2017) would be to maintain high flows throughout a large part of the year, as this would supply sediment and nutrients to the river's ecosystem. The water would be cloudier, which in turn would reduce the amount of light reaching the river bed, thus preventing growth of macrophytes (Shivers et al., 2018), and it would enhance phytoplankton, which depend on the dissolved nutrients and compete with macrophytes for light (Ibáñez et al., 2012).

3.7.1.5. FLAWS IN THE ECOLOGICAL FLOWS CALCULATIONS

The ecological flow for the final section of the River Ebro established in the third cycle RBMP (2021-2027) is the same as in the previous plan of the second planning cycle (2015-2021). It is based on the studies defined in the document "*Ecological flows regime at the mouth of the River Ebro*" by the River Ebro Water Management Planning Office. This document comprises several studies that calculated the ecological flow value for that section of the river. In addition to the results, the applied methodologies are also described in detail.

3.7.1.6. HYDROLOGICAL METHODS: BREACH OF THE WATER PLANNING INSTRUCTION (IPH)

The Water Planning Instruction establishes that "*the proposed methodologies require a representative hydrological sequence covering at least 20 years under a natural regime that shows a balanced alternation between dry and wet years*". These data do not exist, since the entire available sequence is for periods with different degrees of impact due to water usage and the construction of reservoirs.

In the MARM (Ministry for the Environment, Rural and Marine Affairs) study (2010), natural flows were simulated based on the 1986/87-2005/06 sequence (blue in the following figure) using the SIMPA model and following IPH criteria. The results of the study reported a basic mean

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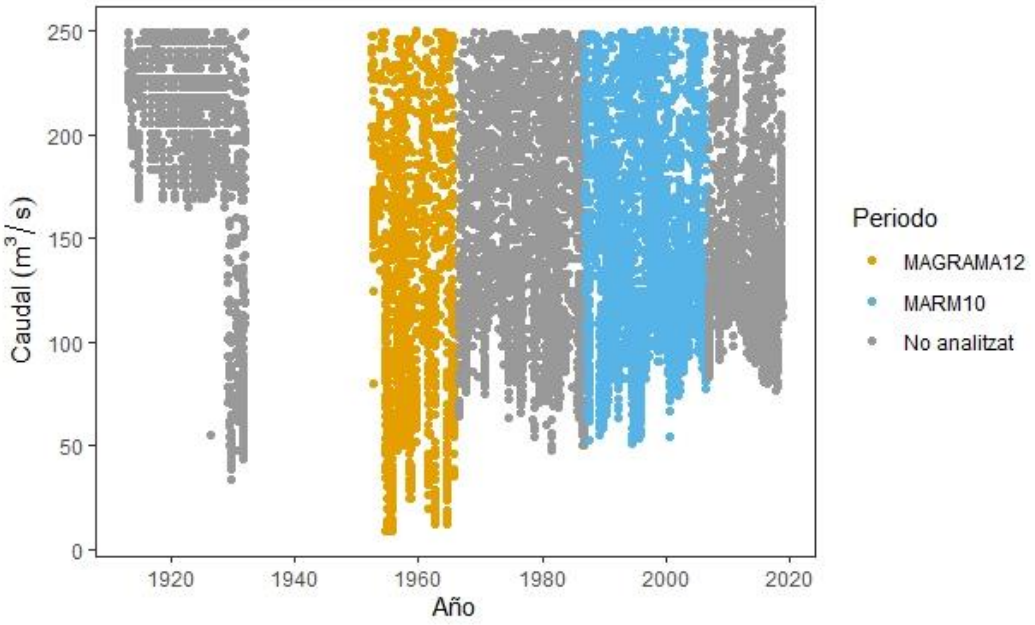
maintenance flow (QBMmean) of 174 m^3/s and QBMmedian of 164 m^3/s. Two years later though, the values were recalculated for the 1951/52-1965/66 sequence (orange in the graph) with real data measured at the Tortosa gauging station (MAGRAMA, 2012). This time the results were much lower, reporting a QBMmean of 74m^3/s and a QBMmedian of 49 m^3/s. In view of the said results, the CHE determined that "*the conclusion can be drawn that the hydrological methods report an interval of values oscillating between 50 and 75 m^3/s*."

Figure 2. Historical daily hydrograph for flows under 250 m^3/s.



Source: own source based on the cited documents.

Therefore, the CHE ignores the two conditions imposed by the planning instruction by using sequences of less than 20 years and a regime that has not only been altered by water usage, but also by the construction of the Mequinenza and Ribarroja reservoirs. Moreover, as can be seen in the figure, the chosen period is the one that has the lowest minimums in the sequence, with values under 50 m^3/s. We believe that this was a deliberate choice to achieve the lowest possible minimum flows through hydrological methods.

3.7.1.7. HABITAT SUITABILITY METHODS: BIASED RESULTS

The Water Planning Instruction states that "*the main argument to determine the ecological flows regime comprises the suitable habitat methods*". Habitat suitability is calculated as the Potential Suitable Habitat (PSH) for just 3 cyprinid species in the entire river basin. This entails considerable limitations, as to determine the good status of a habitat, a more holistic approach would be required (e.g. Parsons, 2004) taking into account not only fish species, but also macroinvertebrate communities, phytoplankton, macrophytes, etc. In the case of the final section of the River Ebro for example, there is an obvious problem of proliferation of macrophytes, and the presence of black fly larvae associated with them, which are a nuisance for the towns and villages bordering the river. Financial and human resources are assigned to deal with this problem every year, which is caused by the bad ecological status of the river.

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The results of the compiled studies are highly disparate, showing results for 30% of the PSH from 2m^3/s for the barbel (MIAM, 2010) - to an entirely outlandish figure of up to 130 m^3/s for the twaite shad (*Alosa fallax*) (ACA, 2008), an endangered species which should be monitored and protected. This threshold of 30% of the PSH is established for the hydrologically modified water bodies, as is the case we are dealing with, compared to 50% of the PSH established for the rest of the basin. Other results by the CHE report values under 7 m^3/s for 30% of the PSH for the twait shad. These values, so far removed from reality, suggest malpractice in the calculations of the minimum flows.

If those results are accepted as valid and the studies by the Catalonian Water Agency (ACA) are discarded, which report much higher flows, the CHE determines that "*the ecological flow in the lower Ebro is not a limiting factor until very low values are reached, and therefore the minimum flow of 100 m3/s can be reduced to a much lower flow (even lower than 50 m3/s) without such having a significant effect on the fish species*". Therefore, taking into account the indications in the Water Management Instruction on the prevalence of suitable habitat methods, the CHE is released from any ecological pressure when determining minimum flows.

This is extremely concerning since, as discussed previously, the objective of establishing ecological flows is precisely to ensure the good status of aquatic habitats and to meet the needs of the biological communities inhabiting them. The CHE uses these arguments to establish the ecological flow without duly considering the ecological status of the river. In exchange, a suitable hydrological method is used although it is based on flow data that have been modified by human activity and are regulated by the CHE itself.

3.7.1.8. MONTHLY MODULATION FACTOR

The calculated minimum ecological flow is not applied uniformly throughout the year. Having the alleged intention of restoring the river's natural flow conditions, a modulation factor described as follows is applied for each month of the year: $\sqrt[3]{(Q_i/Q_{min})}$; where Q_i is the mean flow for the month, and Q_{min} is the mean flow of the month with the minimum flow. The choice of employing this factor is not justified or properly explained in any of the documents. If the factor uses the mean flow of the regulated river, it does not guarantee in any way whatsoever that the regime is natural, but rather that the established regulation becomes the norm. The River Ebro should have two flood periods, one in spring and another in autumn, coinciding with the rainy periods in the Iberian Peninsula. The established ecological flows however, only consider one flood between January and March. This increase in the minimum flow is carried out before the thaw to ensure that the reservoirs are ready to retain as much water as possible for the summer period. When the water in the reservoirs has been consumed during the summer, the autumn rain is used to refill them and does not flow downstream. The natural regime is entirely altered leading to the serious consequences that this has on the river and coastal ecosystems, since the natural flood periods coincide with the breeding cycles of many of the ecosystem's key species.

3.7.2. NO SEDIMENT MANAGEMENT

References have been made to generating flows in the previous sections that are supposed to transport sediment. We have already mentioned that those flows are insufficient and are much

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less effective than natural flooding. Apart from that, the big problem for solid flows in the River Ebro is the reservoirs and the complete lack of sediment management. In exchange, after the public participation process and period of allegations concerning this RBMP, the subject of sediment management stuck in the reservoirs was not considered to be a sufficiently important subject matter for discussion.

(...) *There are other subjects that have been put forward in the EpTI public information process, which although they are considered to be of importance, they do not comprise an important subject since they lack any sufficient dimension or consequentiality, or they are dealt with in one or more of the existing subject matters. These include:*

- *The negative effects of sediment at the end of the Ribarroja reservoir in the municipal district of Mequinenza* (...)[115].

Sediment retention leads to a problem further downstream, but also upstream and in the reservoirs themselves. Reservoirs in the Spanish state have been clogging up ever since they were built in the 1960's. This means that their capacity has decreased and the actual water reserves are not in line with the theoretical capacity of the reservoirs. This is a State problem that affects the entire population. On the other hand, the loss of natural areas such as wetlands should also be of interest for the entire population. The benefits that these ecosystems provide are largely ignored, but at the same time they are absolutely fundamental for our survival. Failing to manage sediment in reservoirs by the companies that manage and exploit them, leads to a huge cost for the public treasury to mitigate the negative effects thereof.

The Riba-Roja and Mequinenza reservoirs have bottom sluice gates that allow sediment to pass through. The sluice gates must be opened periodically by law in order to ensure operation, since they are a reservoir safety system to prevent overflows and bursting. Nevertheless, those bottom sluice gates have never been opened at either of the two reservoirs. The "*Associació pels Sediments*" recently filed a lawsuit with the Tarragona Environment Public Prosecution against the company that was awarded the management concession of the reservoirs, for an alleged environmental crime in the management of the reservoirs[116]. A lawsuit was also filed in 2022, which was disallowed. Sediment retention in reservoirs is a subject of vital importance for the River Ebro and its delta. If there is no sediment supply to the delta, it will fall to below sea level in a few years due to the effects of climate change. This subject will be discussed in further detail later on.

Furthermore, the fact that the river does not contain sediment in suspension means that flooding, natural or artificial, washes the river bed, dragging the fine sediment with it and leaving only river gravel. This severely modifies the river habitat, since as there is no sand or silt, as should be the case in the final section of a large river such as the Ebro, it is more similar in terms of substrate and shelter to the headwaters.

[115] *2022-2027 Ebro River Basin District Management Plan Report, section 2.1. Identification of important problems (Page 34).*

[116] *https://www.imaginaradio.cat/lassociacio-sediments-ratifica-davant-fiscalia-la-seva-denuncia-per-la-gestio-dels-embassaments-de-lebre/*

Classification: Internal

3.7.3. INFLUENCE OF THE RIVER EBRO ON THE MARINE ECOSYSTEM

From the point of view of the marine ecosystem, the Ebro's influence goes way beyond the coastal region considered in the RBMP. It at least extends from Cabo de Salou to the Columbretes Islands and spans the entire continental shelf to over 40 nautical miles from the coast. Appendix 05.07 bases its analysis of the effects of the flows from the River Ebro at the river mouth on "*the need for coordination between the Marine Strategy of a marine district and the River Basin Management Plans of the districts sharing the same coastal area. A connection among some descriptors of the Marine Strategy has been put forward to assess the status of marine water and the status or behaviour of the water bodies in the Ebro River Basin District.*

The objective of the Appendix is to respond to the environmental objective defined in the marine strategies to "*ensure that the marine ecosystems that depend on the river plumes associated with river mouths are taken into account when establishing the ecological flows in* RBMP*s*". With the above in mind, it was decided to analyse the aforementioned connection with the D3 descriptor in this report, in regard to the commercially exploited fish species in the Marine District, more specifically, sardines and anchovies. The papers by Lloret et al. (2004) and Salat et al. (2011) explicitly prove the significant role of river supplies by the Ebro to maintaining anchovy populations, since their reproduction and fry period is spring-summer. The supply of nutrients from the river during that period of the year is essential, as it is the only source that is able to contribute to superficial productivity in the area. We believe that in view of the obvious loss of biodiversity due to climate change and overfishing, analysing the impact of the Ebro's flows on descriptor D1, on Biodiversity, and D4 on trophic networks would have been desirable, since they are both closely associated with the resilience of the marine ecosystem to those forces. In this aspect, the work conducted in the last decade has provided significant results. Pennino et al. (2002) for example, identified the continental shelf area of the Ebro delta as a very important ecological area because of its climate shelter characteristics in view of the forecast environmental changes. Those characteristics are clearly associated with the unique environmental conditions in the Ebro's area of influence. That area has also been identified as an area of great benthic and demersal biodiversity (Coll et al., 2010; Delahoz et al., 2018) and of great importance for endangered species (Coll et al., 2015). Additional works show the essential ecological role of anchovies and sardines in those ecosystems (see Coll and Bellido, 2019).

3.7.4. BREACH OF THE WFD AND WATER PLANNING INSTRUCTION

As stated in the general introduction to this section, the European guidance on ecological flows [117], in accordance with the Water Framework Directive (WFD), considers that in order to define the said documents, the principle of non-deterioration of water bodies must be taken into account, achieving good ecological status and meeting the specific requirements of protected areas, both those designated for the protection of habitats and the species included in the Natura 2000 network, where the flow is an important factor for protection.

On the other hand, both European legislation (WFD) and Spanish legislation (PHN, IPH) establish the need to take flow requirements into account to ensure transitional waters are maintained

[117] *European Commission, Directorate-General for Environment, Ecological flows in the implementation of the Water Framework Directive. Guidance document No 31, Publications Office, 2016, https://data.europa.eu/doi/10.2779/775712*

Classification: Internal

in good ecological status (estuaries, coastal lagoons, deltas and marine areas influenced by rivers). Moreover, the IPH establishes that "*to the extent that protected areas in the Natura 2000 Network and Ramsar Convention wetlands could be notably affected by ecological flow regimes, they must maintain a favourable status of conservation for the habitats and species or restore such status, in line with ecological demands and the ecological functions on which they depend*".

The River Ebro Delta is included in the Ramsar Convention and in the Natura 2000 Network. It is one of the most important wetlands with some of the widest biodiversity in the western Mediterranean region, and it is also one of the key natural sites for migratory birds between Africa and Europe. Even so, the status of heavily modified water body is applied to it and much laxer requirements apply to it insofar as environmental objectives are concerned: they only need to reach good ecological potential and regarding the suitable habitat to calculate the minimum flow, only 30% of the PSH needs to be achieved, compared to 50% of the PSH for the rest of the water bodies, whereas in protected areas, to maintain or recover good conservation status, ecological flows that provide a higher percentage of potential suitable habitat are to be established, at least 80%-100% of the PSH. This double standard is contradictory, since it assumes that the site is worth protecting, yet it applies the Water Planning Instruction criteria meaning the heavily altered water body parameters are applied without any special attention.

The Ebro Delta water bodies are those located in the final section of the Ebro, including lagoons and bays. Out of the total of 16, 13 are classed as heavily modified, with the implications that have just been mentioned. Based on the analysis described in Appendix 09.02 of Annex 9[118] we are able to see that after two planning cycles there has been a significant overall worsening in the status of the water bodies associated with the Ebro Delta. Of the 20 water bodies[119] that impact this site, only three failed to reach good status in 2016. There are currently 12 that fail to reach good status, whereas there is no data for another water body (Table). In short, we are able to conclude that the natural area of highest environmental relevance in the Ebro river basin fails to achieve good status, and after the previous planning cycles a negative trend has been observed. Further, there are no specific measures in the Programme for these water bodies, meaning that the objectives of reaching good ecological status or good ecological potential are highly unlikely to be achieved by 2027.

[118] *2022-2027 Ebro River Basin District Management Plan – Annex 09 (page 451).*

[119] *Water body ES091MSPF463_001 is also included since it feeds the Delta irrigation channels, which in turn feed Bahías de Fangar and Alfacs (bodies ES091MSPF892 and ES091MSPF893) and the rest of the transitional waters.*

Classification: Internal

Table 51. Status of the water bodies affecting the Ebro Delta

	Type	Total SWB	Exemption (4.4) (fail to achieve good status)	
River	Natural	1	1	100%
Transitional waters	Heavily modified	13	10+ 1 ND	92.3%
	Natural	3	1	
Coastal waters	Natural	3	1	33.3%

ND: No data.

Source: own source based on the cited documents.

The Plan does not include any ecological flows for the Natura 2000 Network water bodies, such as the lagoons and bays of Alfacs and Fangar. The flow in these water bodies exclusively depends on the supply through irrigation of the delta between April and September when the rice crops are irrigated. Owing to the fact that this is run-off water from farmland, it contains high amounts of pollution from farming processes. Protected species such as the *Pinna nobilis* have their natural habitats in the two bays and depend on the supply of freshwater from the irrigation run-off. In order to improve the ecological status of these water bodies, determining and applying a suitable ecological flow is fundamental, and as far as such is possible this should be unrelated to irrigation run-off water.

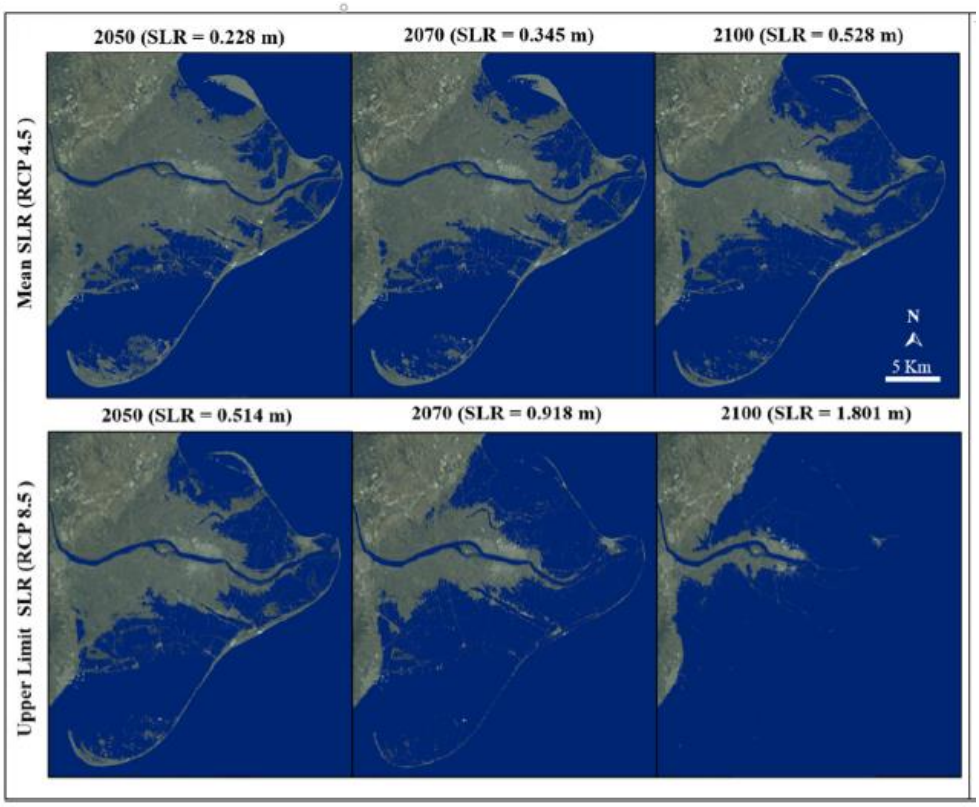
Sediment transport in rivers is the main mechanism for the transfer of sediment between the land and the ocean, accounting for 95% of it (Syvitski et al., 2003). It also has major implications for the functioning of river and coastal ecosystems, and the evolution of deltas and coasts (Morton, 2003; McLaughlin et al., 2003). For example, sediment in suspension is of vital importance for water quality, fish habitats and the transport of nutrients (e.g.: Golterman *et al.*, 1983; Gregory and Levings, 1996). This transport of sediments depends on two factors: the availability of sediment and the possibility of transporting it. An optimum flow is required to move sediment, and connectivity of the river and the possibility of crossing transversal barriers such as dams. Therefore, water flow and sediment management are crucial factors which are of vital importance to achieve the good status of water bodies and the associated ecosystems, thereby complying with the directives of the WFD. The River Ebro is a heavily regulated river with around 200 dams that retain approximately 60% of the annual run-off water (Batalla et al., 2004) and 99% of the sediment in the river basin (Batalla et al., 2004; Rovira et al. 2015). This has a direct impact on the rivers in the basin and also the river delta.

The Delta is considered one of the ecosystems that is most strongly affected by climate change in the Iberian Peninsula (MAA, 2006). The events over the last few years (Storm Gloria, regression of over 100 m of the coast at the river mouth, constant rupture of the Trabucador sandbar, salinisation of the coastal paddy fields, etc.) prove that the situation in the Ebro Delta is worsening. Moreover, according to the models by Genua-Olmedo et al., (2022), in view of the scenarios forecast for rises in sea level and the current zero supply of sediment, between 44% and 75% of the surface area of the Ebro Delta will be flooded (see Figure 3). Survival of the Ebro Delta is only possible with long-lasting high flows from the river that are capable of transporting the sediment retained in Mequinenza and Ribarroja reservoirs, initially, and the sediment retained in the other reservoirs afterwards.

Classification: Internal

This unfavourable evolution of the ecological status of the Ebro Delta water bodies, the problems arising through the lack of sediment supply, and the worsening effects of climate change predictions were not taken into account when the new RBMP was drafted, since it maintains the same minimum ecological flows as in the previous plans, which have proven to be insufficient to maintain a favourable conservation status, or restore it (Ibáñez, at al., 2020). Therefore, the third cycle RBMP is expected to breach the Water Framework Directive and the Ministry's Planning Instruction.

Figure 3. Forecast flooding of the Ebro Delta for the mean scenarios (RCP 4.5) and extreme (RCP 8.5) in view of sea level rise (SLR).



Source: Genua-Olmedo et al., 2022.

3.7.5. CONCLUSIONS

In the light of the enormous range of results regarding ecological flow studies, the Ebro Water Management Confederation chooses the **ones with the lowest flow rates that least take biological conditioning factors into account** (fish habitats), and take the provisional value that was established in 1999 as the arbitrarily valid flow. In fact, their conclusion is not only that the necessary ecological flow should be 100 m^3/s, but that 50 m^3/s would be sufficient, whilst also stating that "*the lower section of the River Ebro could have higher flows thanks to the Lower Ebro exploitation system with the Mequinenza-Ribarroja-Flix reservoirs*"[120]. These biased results and the way they are presented show the priority in planning to favour hydroelectric power uses that the reservoirs are used for, over any ecological requirements of the River Ebro and its Delta. Furthermore, it leaves the door open to further reduce the minimum flow. Subsequent

[120] *2010-2015 Ebro River Basin District Management Plan- ANNEX V. APPENDIX 9. (Page 40).*

Classification: Internal

management, based on those **minimum values, completely regulates the flow with zero transport of sediment**, which entirely denatures the river, altering the substrate of the river bed and water quality, destabilising natural cycles and with practically no flooding regimes. The minimum ecological flow is established as a daily flow and not an occasional minimum, as can be seen in the aforementioned percentiles. Implementation of flood flows, and change rates appear to be more related to completing documents and complying with the Water Planning Instruction than working towards actually improving the ecological status of the rivers. It is done arbitrarily, without any solid basis for calculations and only in 11 water bodies.

All of this has real consequences that are contrary to the principle of non-deterioration of water body status pursuant to the WFD. This negative evolution that has been taking place in the Ebro Delta at an alarming rate in recent years proves that the criteria employed in the previous plans did not meet European and State regulations on the conservation of protected ecosystems. The very motivation behind the Water Planning Instruction concerning ecological flows is completely ignored when the flow is calculated. Climate change foretells catastrophic scenarios if urgent measures in the Ebro Delta are not implemented, but those scenarios are not taken into account in the RBMP either. Fauna and ecological status monitoring in the rivers is not used to review whether or not the ecological flows are meeting their objectives. The trend, on the other hand, is to justify the management by establishing values for the different components of the ecological flows that would not lead to any changes to the established regime.

Classification: Internal