CENTRE FOR HYDROGRAPHIC STUDIES (CEH)

2024 Activity Report

"Commencement of Work on Analyzing Floods Caused by the October DANA in Valencia"

At the **Centre for Hydrographic Studies (CEH)**, we have continued our regular activities this year, focusing on data related to natural phenomena, understanding water resources and the hydrological environment, developing regulations, standards, and technical specifications, and conducting research, technological development, and innovation in the field of inland waters.

We have also provided specialized technical assistance to the **Ministry for the Ecological Transition and the Demographic Challenge (MITECO),** through the **Directorate General for Water (DGA)** and the river basin authorities, as well as to the **Ministry of Foreign Affairs, European Union, and Cooperation** to support the programs of the **Water and Sanitation Cooperation Fund (FCAS).**

Undoubtedly, the most significant event of the year was the tragic floods that occurred in Valencia on October 29, 2024. We began analyzing this event immediately, providing the technical assistance required by the **Directorate General for Water and the Júcar River Basin Authority (CHJ).**

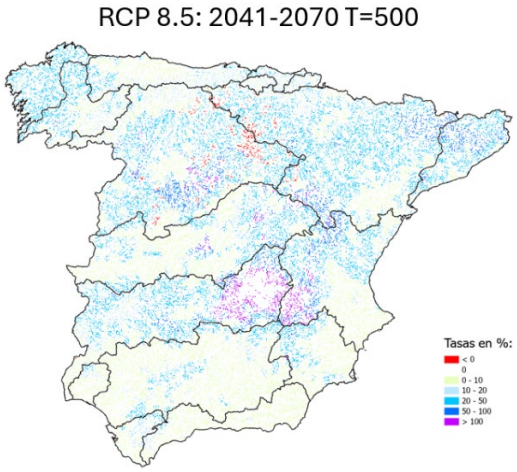
Data on Resources and Natural Phenomena

Updating the hydrological database of the Spanish river, reservoir, and canal control network (**HIDRO**) has been a cornerstone of our work, as has the preparation of the flow measurement yearbook for the 2021/22 hydrological year. These yearbooks, which are fully accessible on the CEDEX website, make all hydrological information collected by the official control network available to the public since its inception in the early 20th century.

Improving Knowledge of Natural Resources and the Hydrological Environment

Regarding the new national-scale evaluation of water resources for utilization, we have continued working on the review of the fourth cycle of river basin hydrological plans. Notable efforts include improving the treatment of the groundwater phase of the **SIMPA** hydrological model, with progress in calibrating the model in the river basin districts of Guadiana, Guadalquivir, Tinto-Odiel-Piedras, Guadalete-Barbate, Andalusian Mediterranean Basins, Segura, and Júcar.

As part of the technical update of the **Tajo-Segura transfer operation rule**, we have completed the work requested by the **Directorate General for Water (DGA)** to account for changes introduced in the new river basin hydrological plans, especially those related to the increase in ecological flows in the Tajo basin.



Map of annual maximum flow quantile change rates due to climate change, for a 500-year return period, in basins of less than 500 km² (impact period 2041-2070 and RCP 8.5).

Concerning the map of maximum daily rainfall in Spain, prepared by CEDEX in 1999, we have continued its update. Specifically, we have advanced in refining the sub-daily maximum rainfall database and based on it, in validating or modifying the regions established for maximum daily rainfall. We have also continued working on characterizing maximum rainfall generated by convective processes in the Levante and Southeast of the peninsula.

At the request of the **DGA**, we have prepared a methodological proposal for identifying new **Areas with Significant Potential Flood Risk (ARPSI)** due to increased risk from climate change. This proposal has been included in the documents for the review and update of the preliminary flood risk assessment for the 3rd cycle, prepared by the river basin authorities, and was presented at the technical coordination meeting for the implementation of the 2nd cycle **Flood Risk Management Plans** and the review of the 3rd cycle of the **Floods Directive**.

Additionally, due to the floods in Valencia on October 29, 2024, we have undertaken various support tasks for the **DGA** and the **Júcar River Basin Authority**, including the hydrological and hydraulic characterization of the event.

The interactive viewer of invasive exotic species in aquatic environments, developed at the **Hydraulic Studies Centre** and accessible from the **CEDEX** and **DGA** websites, has been expanded and updated. It now includes information on over 90 species and nearly 18,000 records of their presence. We presented these advances at the **13th International Conference on Biological Invasions** held in Lisbon in September. Furthermore, we have completed specific studies on rock snot (**Didymosphenia geminata**), the Asian clam (**Corbicula fluminea**), and the catfish (**Ameiurus melas**), and have begun studying the water fern (**Azolla spp.**).

Viewer of invasive exotic species.

Regulations and Technical Standards

In support of the **DGA**, we have developed various methodologies for implementing the new reuse regulation, including the preparation of risk management plans, health and environmental risk assessment systems, the application of the multi-barrier system, and the validation of treatment facilities. At the European level, we have continued participating in the review and debates for drafting the application guides for the regulation and the technical specifications on risk management prepared by the **European Commission**.

In the Ibero-American context, we have initiated technical collaboration with the **National Institute of Hydraulic Resources of Cuba**, through **Spanish Cooperation**, to support the drafting of the Cuban water reuse standard.

Visit of representatives from the National Institute of Hydraulic Resources (INDRHI) and the National Institute of Potable Water and Sewage (INAPA) of the Dominican Republic. June 25, 2024.

We have worked on developing methodologies and recommendations on aspects that remained pending in the first draft of the **Methodological Guide for the Preparation of Hydrological Studies of Floods for Dams**, delivered to the **DGA** in 2023. Currently, we have a new draft, only lacking the proposed methodologies to be applied in the coastal basins of the Levante and Southeast of the peninsula. The Guide aims to serve as a basis for conducting hydrological safety reviews of dams, as established by the **Technical Safety Standards for Dams and Reservoirs** approved in 2021.

In the European debate on the new **Urban Wastewater Treatment Directive**, which was approved at the end of the year, we have supported the **DGA**. We are conducting several studies to assess the implications of its implementation in Spain, focusing on estimating the costs of modifying the directive (small populations, increased requirements for nutrient removal, stormwater management, reduction of microcontaminants, nutrient recovery, and energy neutrality). We have also collaborated in preparing tools to perform the energy balance of wastewater treatment plants in Spain.

We have also participated in developing the official protocol for the **Assessment of Eutrophication Risk in Reservoirs and Large Lakes (RLE-EUT-2024)** for the **DGA**, which establishes a method to ensure compliance with the requirements for assessing trophic status and responds to the established regulations, complementing the monitoring programs of the **Water Framework Directive**.

Likewise, we have completed for the DGA the review and proposal of new limits for the change of ecological status class of the supporting physicochemical elements and their adaptation to the conditions of the

biological elements in rivers and lakes, using the physicochemical data from the NABIA database.

Together with the **Geotechnical Laboratory (LG)** and the **Central Laboratory for Structures and Materials (LCEYM)**, we have begun collaborating with the DGA to draft a **Dam Inspection Manual**. We have prepared an internal procedure for conducting reduced-scale physical model tests of hydraulic structures of dams in the **Hydraulics Laboratory**.

Research, Technological Development, and Innovation

In this section, we have completed the hydraulic studies for the project **Recovery of the Manzanares-Gavia-Bulera River Ecosystem. Green and Blue Infrastructure Metropolitan Forest of Madrid**, developed in collaboration with the **Centre for Studies on Applied Techniques (CETA)**, the **Madrid City Council**, and the **CONAMA Foundation**, funded by the **Biodiversity Foundation**.

As part of the collaboration with the DGA to study sediment transport in the lower course of the Ebro River, we conducted suspended sediment sampling campaigns during two controlled floods carried out by the **Ebro River Basin Authority** from the **Mequinenza Reservoir** in coordination with **Endesa**. These campaigns were conducted in collaboration with the **Polytechnic Universities of Madrid, Barcelona, and Valencia** as part of the European project **REST-COAST**.

To study the environmental conditions that determine the massive proliferation of phytoplankton in Mediterranean reservoirs using paleolimnological techniques and modeling, we conducted fieldwork at the **El Gergal Reservoir**, in collaboration with **EMASESA**, the company responsible for managing this reservoir, which supplies water to the population of Seville. We are working on constructing a hydrodynamic model that, coupled with an ecological model, will contribute to a better understanding of the biogeochemical processes occurring in these aquatic ecosystems, to determine which environmental variables are most influential in the potential formation of phytoplankton blooms. Monthly, in the **Water Quality Laboratory** of our Centre, we analyze the water entering the reservoir from different tributaries to model nutrient input along with the continuous recording of their flows.

At the **CEH**, we have continued supporting the DGA by participating as the **National Focal Center** in the **ICP-Waters Program (International Cooperative Programme on Assessment and Monitoring Effects of Air Pollution on Rivers and Lakes)**. We have participated in the development of the new Program Manual, which will be published next year, whose protocols serve as a reference for monitoring the effects of atmospheric pollution on surface waters in the application of national regulations and European directives. Additionally, we have continued coordinating the monitoring network program in Spain, which includes several stations located in the **Sierra de Guadarrama and Cabañeros National Parks**, with monthly analyses conducted in the **Water Quality Laboratory** of the Centre to detect the possible presence of pollutants in their waters. We also participated

in the **40th annual ICP-Waters meeting**, held in Prague (Czech Republic) from May 28 to 30.

Regarding the research project of the **National Plan DRY-Guadalmed: Advanced Tools for the Assessment of the Ecological Status of Mediterranean Temporary Rivers during their Dry Phase**—in which the CEH participates for the transfer and application of results—we presented the results of the application of a new hydromorphological protocol for the assessment of the ecological status of Mediterranean temporary rivers during the dry phase in different Mediterranean basins at the **Iberian Limnology Congress**, held in Vigo in June.

Manuel Toro Velasco, Head of the Water Environment Area, during the defense of his doctoral thesis.

Manuel Toro Velasco, head of the Water Environment Area, defended his doctoral thesis **Phenology of the Ice Cover of Mediterranean High Mountain Lagoons (Central System) in a Climate Change Context. Modulation by Climatic and Geomorphological Factors, and Effects on Winter Limnology**, obtaining the qualification of **outstanding with honors**.

Specialized Technical Assistance

As part of the technical assistance provided to the DGA, we have completed the studies of the spillways of the **Vega de Jabalón Dam (Guadiana)** and the bottom outlets of the **Canales and Tranco de Beas Dams (Guadalquivir)**, continued the study of the spillway of the **Fuensanta Dam (Segura)**, and initiated the studies of the spillways of the **Riaño (Duero)**, **Torre del Águila (Guadalquivir)**, **Regajo (Júcar)**, and **Mediano (Ebro)** dams.

Hydraulic study of the Regajo Dam.

Also for the DGA, we have continued the study of the **north zone interceptor project in the city of Murcia**, completing the hydraulic analysis of various alternatives, the results of which were presented at a meeting with the **Segura River Basin Authority**, the **Directorate General for Water**, and the **Murcia City Council**.

Additionally, we have continued working on the assignments from the **Guadalquivir River Basin Authority** to study the influence of the operation of the **Marmolejo Dam** on sedimentation in the reservoir and the floodability of **Andújar**.

On behalf of the **Tajo River Basin Authority**, we have begun work on studying sediment transport in the **Santa María, Chilla, and Alardos gorges**, on the right bank of the **Tiétar River**.

Regarding collaboration in the programs of the **Water and Sanitation Cooperation Fund (FCAS)**, carried out on behalf of the **Secretary of State for International Cooperation** of the **Ministry of Foreign Affairs, European Union and Cooperation**, in Bolivia, we have supervised the master plans for water supply, sanitation, and stormwater drainage in three towns, the project for a new treatment plant in another town, and improvement projects for two other treatment plants.

After completing the drafting of a guide on **Selection of Sites for the Location of Treatment Plants**, published in May by the **Spanish Agency for International Development Cooperation (AECID)**, we have continued developing guides on treatment plants in Panama and on sectoral planning for sanitation and treatment. Additionally, we have developed design and cost estimation tools for treatment systems. We are also collaborating on drafting a technical guide on integrated water resources planning and management. Furthermore, we have provided support in designing a quality control network in the Dominican Republic, with the drafting of a guidelines document.

Cover of the guide on Site Selection for Treatment Plants.

This year, we have also begun technical assistance work for the development of digital transformation projects in the **Directorate General for Water**, with an execution period of 48 months.

Training

We held the 41st Course on Wastewater Treatment and Operation of Treatment Plants, which took place from November 11 to 22.

As part of the **Conference of Ibero-American Water Directors (CODIA)**, and in support of the **FCAS**, we collaborated in organizing a regional workshop on **Safe Management of Wastewater Reuse**, held from June 3 to 5.

Visit of students from the Higher Education Cycle in Civil Works Projects of the Army Engineers Academy of Hoyo de Manzanares. February 13, 2024.

Four students from the **Complutense University of Madrid** and one from the **University of Alcalá de Henares** completed training internships at our centre, along with three others from the **Palomeras-Vallecas Secondary Education Institute** and one from **Benjamín de la Rúa**. We also hosted five students from the **4th ESO+Empresa Program**.

In December, a trainee joined the **Hydrology Area** for training and specialization in this field.

During 2024, a specialist in wastewater treatment from the **Mexican Institute of Water Technology** completed her stay at the centre, collaborating on reuse projects and the sectoral regulation debate platform launched by the **FCAS** and supported by the **CODIA**.

Dissemination and Technology Transfer

Inauguration of the 1st InterJIA Seminar. October 23 and 24.

On October 23 and 24, the **1st InterJIA Seminar** was held in collaboration with the **Spain Young Professional Network** of the **International Association for Hydro-environment Engineering and Research (IAHR)**.

In 2024, we received 22 institutional visits to learn about the activities carried out at the Centre and 37 cultural visits interested in the building's architecture.

Participation in Architecture Week in collaboration with the Official College of Architects of Madrid (COAM).

Institutional Collaboration

At the centre, we have continued our participation in the **Central Commission for the Operation of the Tajo-Segura Aqueduct**, of which we have been a part since its creation in 1978, and we have prepared the status and application reports of the operation rule, based on which decisions on the volumes to be transferred are made.

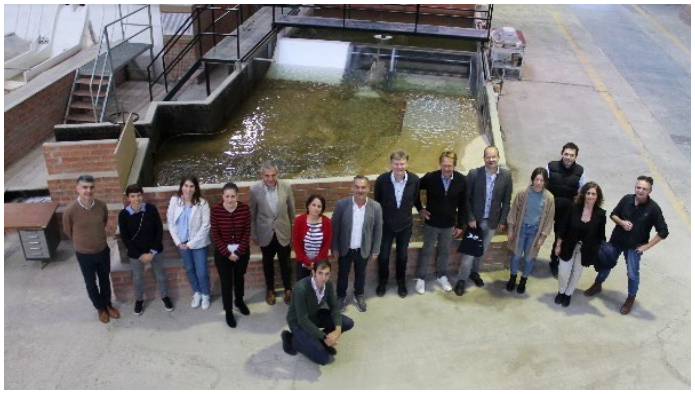
We have also participated in the **Commission on Large Dam Standards**, which, following the approval in 2021 of the **Technical Safety Standards for Dams and Reservoirs**, is focused on developing the **Technical Safety Standards for Ponds**.

We continue our participation in the **Hydrology Section** of the **Spanish Commission of Geodesy and Geophysics** and the **International Association of Hydrological Sciences (IAHS)** as national representatives.

Additionally, the **EurAqua** meetings, held online on June 4, November 25, and December 11, where the new structure of the organization was defined, also counted on our participation.

As part of an exchange program with other hydraulic experimentation centers launched this year in collaboration with the **IAHR**, we visited the hydraulic laboratories of **Artelia (France)**, **ETH (Switzerland)**, **LNEC (Portugal)**, and **EDF (France)**. In this context, we received a visit from a delegation of the **Federal Waterways Engineering and Research Institute (BAW)** from Germany, corresponding to a previous visit to their facilities in Karlsruhe.

Finally, we are pleased to announce that the **Hydraulic Studies Centre** has begun participating in the new **8th Cybersecurity Commission** of the **Spanish Association of Water Supply and Sanitation (AEAS)**.



Visit of members of the Federal Waterways Engineering and Research Institute (BAW) of Germany. October 16 and 17, 2024.