

# AFTER-LIFE PLAN



# iBathwater

**Advanced urban water management to  
efficiently ensure bathing water quality**

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iBATHWATER is a project co-funded by the  
LIFE Programme of the European Commission



**Ajuntament  
de Barcelona**

Barcelona  
Cicle de  
l'Aigua SA

**KWB**



Project ref. no. LIFE17 ENV/ES/000396	
Project title	Advanced urban management to efficiently ensure bathing water quality
Duration of the project	1 September 2018 – 30 September 2022
Action/Sub-action	E Project management
Dissemination level	PUBLIC
Document due date:	30/09/2022
Actual date of delivery	31/12/2022
Leader of this deliverable	EURECAT

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## 1 Project details

### Locations:

Barcelona (coastal water)

Berlin (continental river water)

Reference: LIFE17 ENV/ES/000396

Duration: 1/9/2018 - 30/9/2022

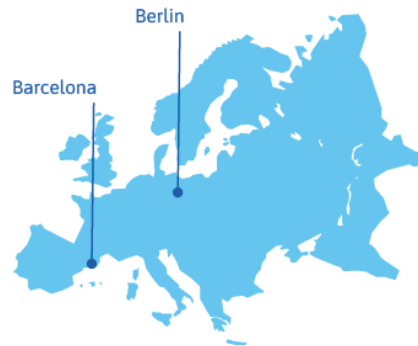
Budget: €2,274,164

(contribution from the European Union:  
€1,364,497 - 60%)

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## PARTICIPATING INSTITUTIONS AND ENTERPRISES

Coordination: Fundació Eurecat

### Associated entities:

Adasa Sistemas

Barcelona City Council

Barcelona Cicle de l'Aigua, S.A.

Kompetenzzentrum Wasser Berlin gGmbH

## 2 The raison d'être of LIFE iBATHWATER

The **function of the urban drainage system and sewage system** is to collect urban wastewater, rainwater, and surface runoff. When the system is a combined system, it transports this water via the same pipes. When the water reaches the treatment plants, it is treated to remove suspended solids and pollutant load, and then returned to the environment (rivers, lakes, and coastal areas). Sustainable management of this water helps to close the anthropic water cycle, guarantee public health, and reduce the pollution that reaches the environment.

During **episodes of intense or prolonged rainfall**, the volume of water may exceed the capacity of the sewage system or of the treatment plants; in these cases, the untreated water is directly discharged to the environment directly. These discharges have a negative effect on aquatic ecosystems and their physical-chemical and microbiological quality, as well as on bathing water and on public health, as beaches, rivers, and lakes are leisure spaces.



*During episodes of intense rainfall, the volume of water may exceed the capacity of the sewage system or of the treatment plants; in these cases, the water reaches the environment directly, without prior treatment*

**iBathwater is a full-scale demonstration project for a new integrated system to manage the sewage network and bathing water.** Application of this system is expected to reduce the impact on the natural environment of the discharged urban runoff and rainwater, thus improving the quality of bathing water during and after episodes of heavy rainfall. The proposed innovations have been applied in Barcelona and Berlin. These systems make possible to anticipate risks and provide the highest healthcare guarantees.



*Barcelona (left) - Annual volume of discharged untreated water: 6 Mm<sup>3</sup> / Berlin (right) - Annual volume of discharged untreated water: 4 Mm<sup>3</sup>*

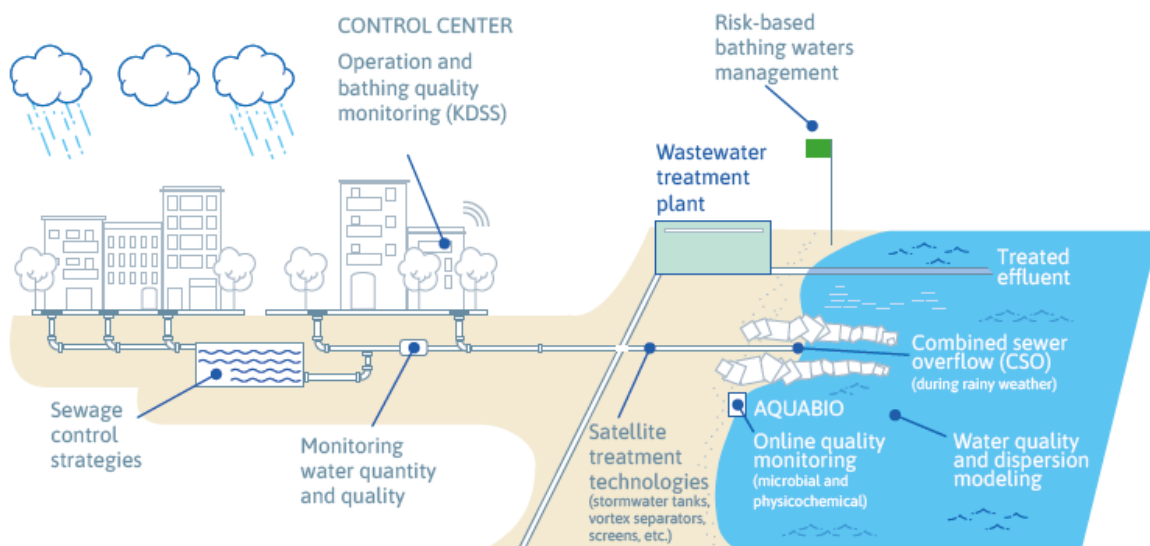
### 3 The objectives

The **main goals of the iBATHWATER** project are the following:

- Minimize the health risks to bathers associated with the quality of recreational waters.
- Reduce the number and volume of sewer overflows during episodes of rainfall.
- Reduce the quantity of land-based floating solids and litter discharged into the sea during episodes of intense rainfall.

To achieve these goals...

- a system has been developed to **take operational decisions**, both for bathing areas and for urban drainage infrastructure;
- real-time continuous monitoring was performed of **microbiological parameters using aquaBio technology**;
- the quality of the water in bathing and leisure areas was modelled based on the **new parameters introduced during monitoring** in real time and on a continuous basis (including the indicators specified in the European directive on bathing waters);
- and **data harmonization, interoperability, and open standards** were facilitated to encourage replicability and transferability to other cities and regions.



*iBATHWATER scheme, a full-scale demonstration project for a new integrated system to manage the sewage network and bathing water*

## 4 Contributions and results

AquaBio technology to minimize the health risks associated with the quality of recreational waters



*Port Olympic installation where the quality of water at Somorrostro beach is measured using the aquaBio device (Barcelona, left). Installation in the Flussbad, where the quality of the Spree Canal is measured (Berlin, right)*

### Milestones achieved with the aquaBio technology:

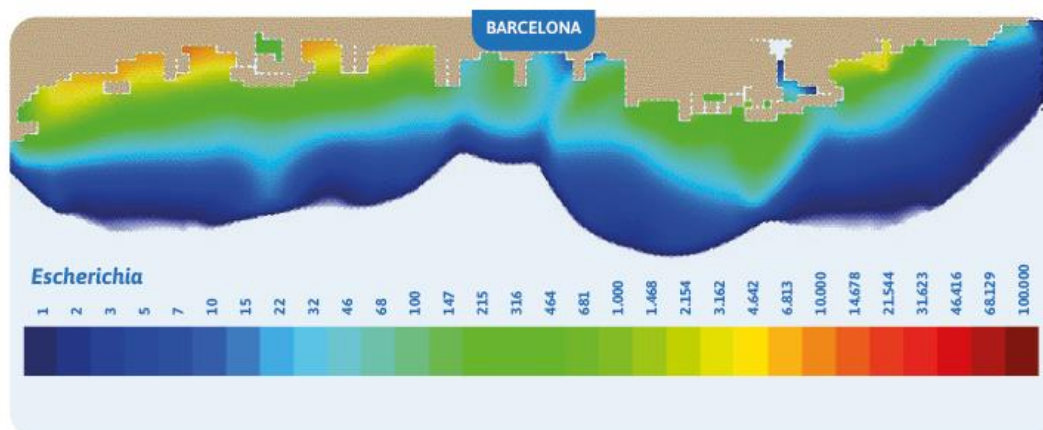
- Fine tuning of the technology for measuring intestinal enterococci and also for saltwater matrixes for *E. coli* and enterococci.
- Installation of 4 devices in Barcelona and 4 in Berlin, which have taken daily measurements of the microbial quality of bathing waters.
- Programming of a new operating mode, which is activated during episodes of rainfall that cause overflow of untreated rainwater. This mode makes it possible to carry out continuous real-time measurements and, therefore, to determine the exact moment when the bathing water regains sufficient quality, based on the limits indicated by the Bathing Waters Directive.
- Demonstration that the aquaBio technology reliably detects episodes of bathing water pollution with a minimum 60% reduction time compared to conventional monitoring of water quality.

**MOLIBATH, an urban-drainage management tool for improving monitoring of the quality of recreational waters**

### Milestones achieved with the Molibath tool:

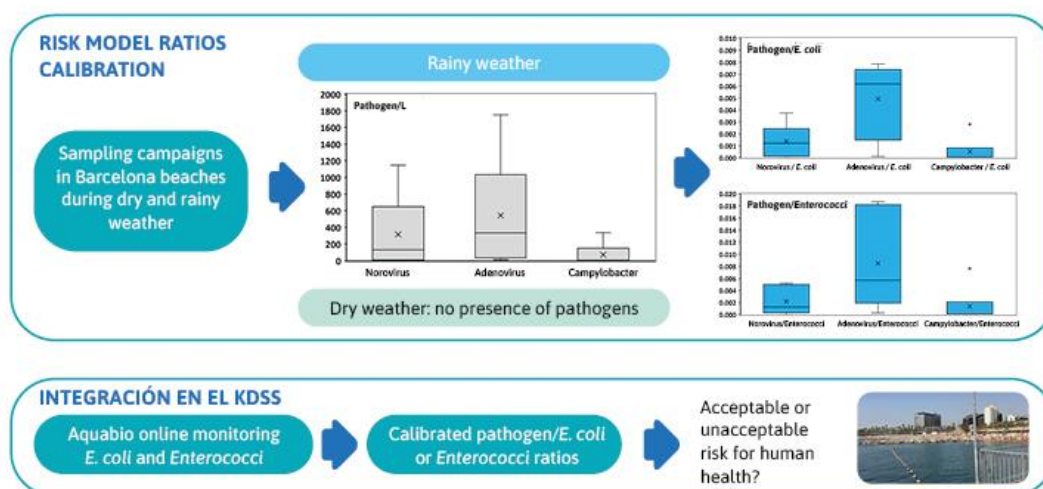
- Real-time continuous monitoring of bathing-water quality using the open-source models integrated in the Molibath platform
- Development of a tool that improves decision-making in management of bathing water quality, as it makes it possible to determine the specific moment when the quality falls below regulatory limits.
- The tool makes it possible to notify bathers that the bathing water quality is good even before laboratory analysis results become available.





*Result of the simulation of water quality using the Molibath tool*

Determination of the microbiological health risks for more optimal management of the quality of recreational waters



*Workflow carried out in the quantitative determination of microbiological risk in the iBATHWATER project*

### Milestones achieved in terms of microbiological risk for human health:

- Analysis of reference pathogens at different points of the beaches of Barcelona in dry and rainy weather. In dry weather (outside episodes of rain that caused overflow of the sewage system), no pathogens were detected, whereas in episodes of rain, three were detected (norovirus, adenovirus, and *Campylobacter*), based on which the risk model was developed.
- Calibration of the pathogen/*E. coli* and pathogen/enterococci ratios.
- Integration of the risk model in a decision-support system (KDSS) based on the calibrated ratios and on the measurements provided by the aquaBio device.



- Additional analysis of SARS-CoV-2. The virus was not detected at any point of the sampling campaigns on the beaches, but it was detected in the sewage system during two episodes of rainfall in April and August of 2022.

## Evaluation of the strategies for managing the sewage network to improve the quality of bathing waters (Berlin)

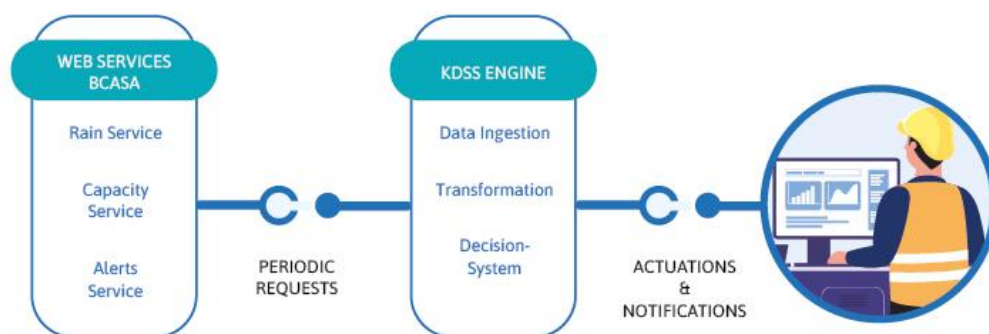
### Milestones achieved in sewage system management:

- Simulation of two different sewage-network management strategies in Berlin
- The first strategy, consists of enabling additional storage volume by means of a mobile dam, reduces the volume of wastewater discharged by between 30% and 80%.
- The second strategy consists of building a bypass canal; although this option makes it possible to reduce the total amount of water discharged, it has a much higher economic and environmental cost than the use of new technologies based on continuous monitoring of the water quality



*Conceptual illustration of the envisaged bathing site in Spree Kanal*

## Decision-support system (KDSS) to reduce the number and volume of sewer overflows during episodes of rainfall in Barcelona



1. Periodic collection of data from the different services (BCASA, ADASA) providing information on: rainfall data, water level in tanks, sewage-system levels in different areas, pathogen levels in water samples.
2. Analysis depending on the criteria and protocols defined based on the strategy to be used (anti-flooding or anti-CSD)..
3. Activation and notification of the strategy to be employed.

*Flow diagram of the Barcelona KDSS*

### Milestones achieved with the KDSS system:

- Reduction of the annual volume of overflows of untreated rainwater into the environment by 16-25%.

- Reduction of the pollutant load discharged into the environment during episodes of rain by 18-26%.
- Reduction of up to between 3 and 12.5 times the environmental and economic impact by using the iBATHWATER digital platform (KDSS) instead of building additional water tanks to achieve a reduction of 30%.

### Solid waste retention systems (Barcelona)



*Solid waste retention systems in combined sewer overflow points*

#### **Milestones achieved in the retention of floating waste:**

- Coverage of all the overflow points on the beach seafront of Barcelona with waste-retention systems (prior to the project, only 2 of the 4 overflow points were covered)
- Installation of 49.5 linear meters of waste-trapping systems (with a total coverage of 147 meters)
- Retention of more than 230 m<sup>3</sup> of waste during 2021
- Almost 50% of the waste collected on the beaches consisted of wet wipes
- The results highlight the need to promote new awareness-raising campaigns on the correct use of wet wipes

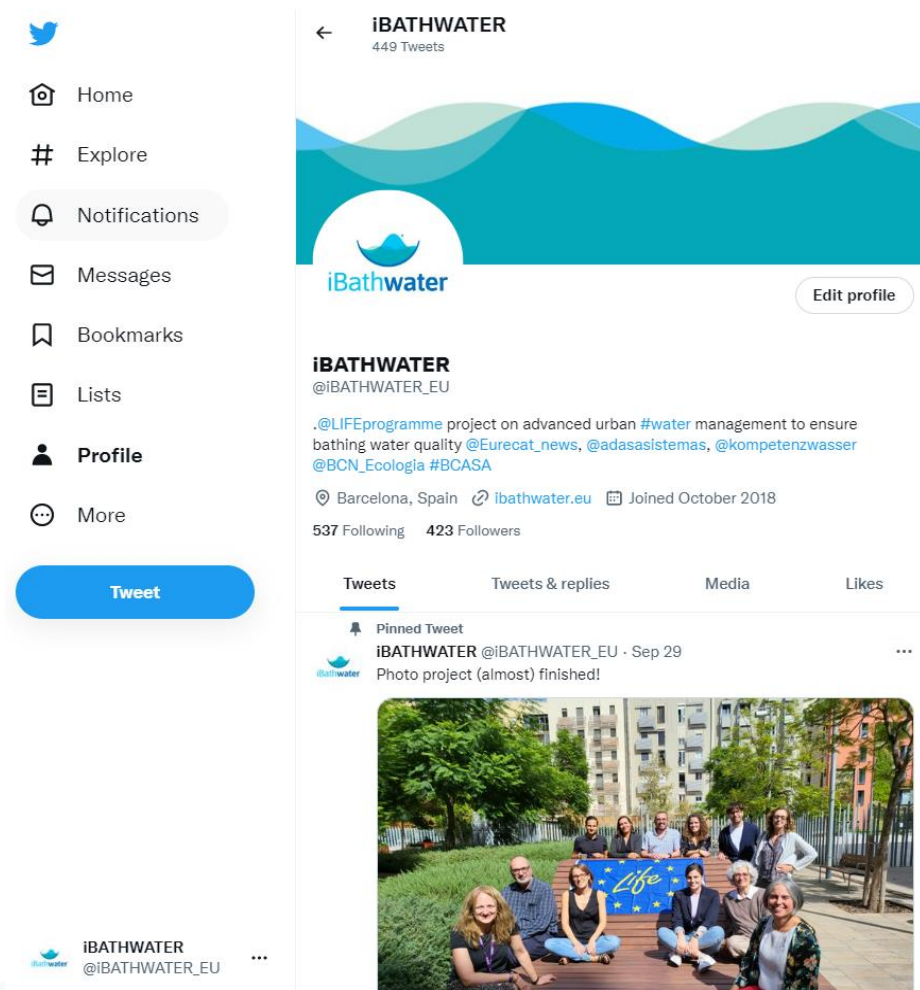
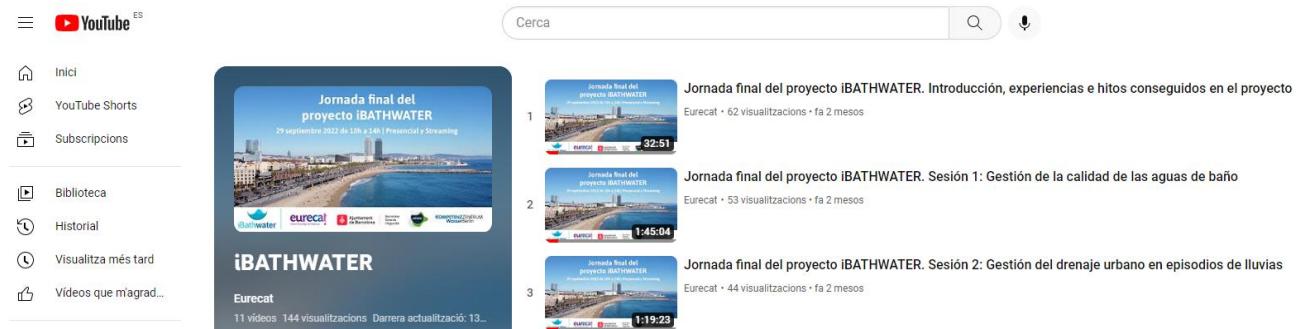
## 5 Communication during the project

### Communication tools

Website: [www.ibathwater.eu](http://www.ibathwater.eu)

Twitter account: @iBATHWATER\_EU

Youtube Channel: [iBATHWATER - YouTube](https://www.youtube.com/channel/UCBATHWATER)



## Communication materials

- Brochures
- Roll-ups
- Infoboards
- Layman's report
- 11 videos in iBATHWATER - YouTube with >450 views
- 2 publications:
  - Extended abstract for International Association for Hydro-Environment Engineering and Research (IAHR) World Congress, 2022
  - Retema, Enero/Febrero 2020
- Press impact at Spanish level: 4 in paper and 25 online, with an economic value of +42,614 € and an audience of +2.9M people
- Contribution to:

European Commission, Executive Agency for Small and Medium-sized Enterprises, Elelman, R., Wencki, K., Chen, A., et al., *The need for digital water in a green Europe : EU H2020 projects' contribution to the implementation and strengthening of EU environmental policy*, Publications Office, 2021, <https://data.europa.eu/doi/10.2826/661606>





## LES CIUTATS I ELS PAISATGES DE L'AIGUA

Barcelona i Berlín són les dues ciutats on es duen a terme les proves pilot del projecte iBATHWATER. Les seves administracions locals aposten per la innovació contínua en la gestió de l'aigua, a fi de millorar el coneixement i el respecte ciutadà per l'entorn natural.

Es tracta de territoris urbans amb unes característiques climàtiques, meteorològiques i biogeogràfiques molt diferents, per la qual cosa el cicle hidrí i els paisatges naturals de l'aigua també ho són. Això influeix en el model de planificació i gestió del cicle urbà de l'aigua que s'hi aplica.

Aquests trets diferencials entre ambdues ciutats permet avaluar la plataforma iBATHWATER i el comportament dels equips de mesura en dues condicions urbanes diferents –les aigües salobres d'un paisatge litoral mediterrani i les aigües dolces d'un paisatge fluvial centreeuropeu–, cosa que aporta un gran valor al projecte i les accions demostratives.



iBATHWATER és un projecte demostratiu a escala real d'un nou sistema integrat de gestió del cicle de l'aigua en entorns urbans (ciutats i medi receptor). Amb la seva aplicació es preveu reduir l'impacte sobre el medi natural dels abocaments d'aigües pluvials no tractades, millorant així la qualitat de les aigües de bany durant i després dels episodis de pluges intenses.



LIFE17 ENV/ES/000396  
El projecte iBATHWATER està finançat pel programa LIFE de la Unió Europea

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Gestió avançada de les aigües pluvials en entorns urbans per garantir de manera eficient la qualitat de les aigües de bany (litorals i fluvials).

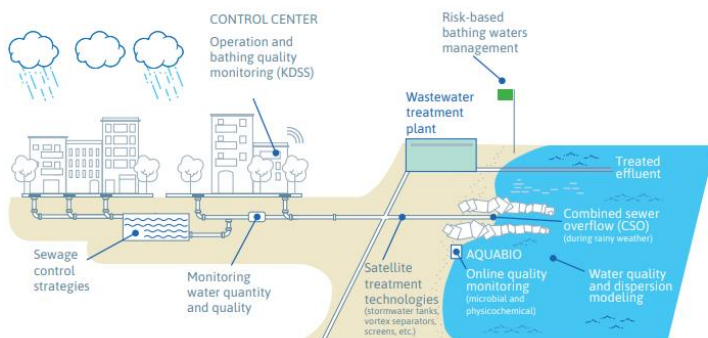


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## UNA PLATAFORMA OBERTA

iBATHWATER consisteix en una plataforma oberta, estàndard i interoperable que combina diverses eines de gestió i tecnologies per a la millora de la gestió integrada del drenatge urbà i les aigües de bany, per tal de reduir riscos sobre la salut dels banyistes durant i després dels episodis de pluges intenses.



## ELS OBJECTIUS DEL PROJECTE

- Desenvolupar un sistema d'ajuda a la presa de decisions operatives, tant per a les zones de bany com per a la infraestructura de drenatge urbà.
- Monitoritzar en continu i en temps real paràmetres microbiològics a les aigües de bany a través dels dispositius de mesura (tecnologia aquaBio).
- Modelitzar la qualitat de l'aigua de les zones de bany i de lleure a partir dels nous paràmetres introduïts en el seguiment en continu i en temps real, inclosos els indicadors especificats a la directiva europea d'aigües de bany.
- Proporcionar l'harmonització de dades, la interoperabilitat i els estàndards oberts per afavorir la replicabilitat en altres ciutats i territoris.

## ELS RESULTATS PREVISTOS

- Reduir l'impacte de la càrrega contaminant de les aigües pluvials urbanes no tractades abocades al medi natural: un 30% a Barcelona i un 20% a Berlín.
- Incrementar el percentatge de zones de bany i de lleure que es consideren "excel·lents".
- Millorar l'avaluació dels impactes ambientals "reals", mitjançant dispositius de monitorització en continu i en temps reals, i models de dispersió diferents per a aigües continentals i litorals.
- Realitzar una caracterització completa a curt termini de la qualitat i la quantitat d'aigua abocada durant els episodis de contaminació en temps de pluja.
- Optimitzar el procés de presa de decisions i governança de l'aigua de bany, reduint el temps de resposta durant els abocaments en temps de pluja.

### AQUABIO



Per assegurar i validar la qualitat de l'aigua de bany s'utilitza el dispositiu de mesura aquaBio, que monitoritza en continu la concentració d'*Escherichia coli*, coliformes totals i enterococs. L'equip comptarà amb l'acreditació europea ETV (European Environmental Technology Verification) per a tecnologies ambientals innovadores.

## Communication events

Dissemination events throughout iBATHWATER at a glance:

- (Co-)organization of **4 events**:
  - o 1 presential, 2 online and 1 hybrid
  - o Around 400 attendees in total
  - o Co-organization with Water Europe, Aqua Publica Europea, NEEMO, Cetaqua, Digital Water City project
  - o 3 at European level, 1 national (Spain)
  - o For policy makers, urban water managers, public authorities, researchers, and water and ICT industry
- Participation on **31 events**:
  - o 4 posters, 24 oral presentations and one booth with promotional material and 2 round tables
  - o 16 events presential and 15 online
  - o 3 international, 11 events at European level, 17 at national level (5 in Germany, 12 in Spain)
  - o More than 2,500 attendees
  - o For policy makers, urban water managers, public authorities, researchers, water and ICT industry, and general public
- Involvement in **16 networking activities**:
  - o 17 research projects
  - o 11 institutions including universities, research centers, public authorities at national level, urban water operators and associations

## LIFE Urban Wastewater treatment Platform “Making Water Fit for LIFE”



On 29th and 30th of January 2020, the members of the project iBATHWATER took part in the event LIFE Platform Meeting “*Making water fit for life*” about wastewater treatment. The event was organized by the European Programme LIFE, and its main aim was to bring together internationally renowned scientists, European institutions and companies related to wastewater treatment. By this way, new approaches towards future European regulations were shared and discussed.

The project partners took active part in the working groups in areas such as urban runoff and urban storm water overflows, and also in real time monitoring. In addition to this, the consortium contributed to disseminate the project with a visit to the stormwater retention

tank located in Parc de Joan Miró. The project partners explained the objectives, concept and the project progress to the attendees.

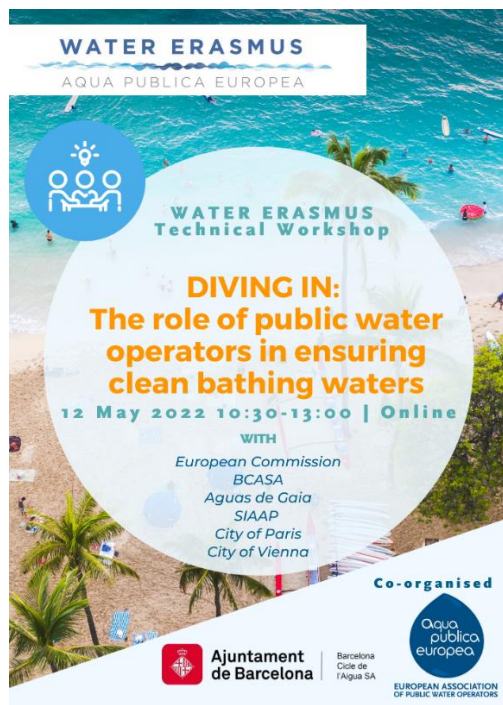
### Workshop on the digitalization of bathing water management

On 5th April 2022, KWB organized, jointly with Digital Water City and Water Europe, a webinar with more than 200 attendees with the following purposes:

- explore the benefits of digital innovations such as online sensors, machine learning, process-based models and mobile apps for managing microbial safety of bathing water sites;
- promote an open-source data-driven early-warning system, which is currently developed within digital-water.city and iBathwater projects; and
- draw concrete policy recommendations for the ongoing revision of the Bathing Water Directive (BWD).



### WATER ERASMUS Technical Workshop



On 12th May 2022, Aqua Publica Europea and Barcelona Cicle de l'Aigua, the public operator from Barcelona (Spain) organized the WATER ERASMUS Technical Workshop on Bathing Waters, to discuss the role of public water operators in ensuring clean coastal and inland waters for bathers.

In the broader context of ongoing review of the Bathing Water Directive by the European Commission, the WATER ERASMUS Technical Meeting started by reviewing the challenges and perspectives for safe bathing waters with institutional experts and moved on to a technical exchange among water operators who shared their technical and governance approaches to contribute to clean seas and rivers, in particular considering the impact of combined sewer overflows.

**iBATHWATER Final Event.** On 29th September 2022, the iBATHWATER consortium organized a hybrid event to explain the main outcomes of the project. The intention of the



event was to reach an audience at national level, and for this reason the language was Spanish. A total of 74 people attended the meeting, either online or presential. The day was divided in 2 sessions, one dedicated to bathing waters management and the other to the management of urban sewage systems. The first session counted on presentations, besides the ones about the project, of DG ENV explaining the current policies at European level related to bathing waters, and the World Health Organization giving a global overview. The second session had as key speaker the Spanish Ministry of Environment explaining the upcoming new Reglamento del Dominio Público Hidráulico. At the end, a round table was held with representatives from the academics (Universitat Rovira i Virgili), Barcelona City Council, Catalan Water Agency, AEOPAS and Aqua Publica Europea.





## 6 Activities AFTER LIFE

Concept	Barcelona	Berlin	Global
<b>AquaBio technology</b>	<p>Further data treatment</p> <p>Operation of aquaBio devices beyond project end</p> <p>Transfer of maintenance of devices to BCASA, incl. training of BCASA personnel</p>	<p>Operation of aquaBio at Flussbad site beyond project end</p> <p>Integration of quality data from Flussbad into the KDSS</p>	<p>Complete the ETV test execution for all 3 water matrixes</p> <p>Implementation of the marketing plan</p> <p>Incorporation of a vendor to promote aquaBio sales</p>
<b>MOLIBATH, urban-drainage management tool</b>	<p>Update the bacteria concentration of the sewer overflow effluent of the model, using the wastewater data generated during the project</p> <p>Adjust the bacteria decay parameters of the model taking into account data on quality generated during the project</p>		
<b>Determination of the microbiological health risks</b>	<p>Further pathogen measurements and human health risk validation in the framework of <u>IMPETUS</u> project</p>	<p>Pathogen measurements foreseen during bathing season 2023</p> <p>Developed risk-based KDSS will continue operating</p>	
<b>Sewage network management strategies</b>	<p>Further development and operation of the KDSS in the framework of IMPETUS project</p> <p>Operation of the Barcelona sewer system facilities with anti-CSO strategies.</p> <p>Operation of the KDSS in online mode</p>	<p>Development of an open-source platform SWIM:AI (demo-case)</p> <p>Integration of flowtime model into the KDSS for re-opening bathing site</p> <p>Roadmap for the implementation of the activated volume option</p>	
<b>Solid waste retention systems</b>	<p>Operation in Barcelona beyond project end</p>		

Concept	Barcelona	Berlin	Global
<b>Short-term pollution events impact analysis</b>	<p>Municipal budget has been allocated to continue with the research of the impact of short-term pollution events due to the overflows into the sea during rainy weather through new analytical campaigns</p> <p>Further data treatment will be performed by a Phd candidate enrolled in Polytechnical University of Catalonia</p>		
<b>Website and social media</b>			Maintenance of the project website and Twitter account up to a min. of 5 years after project end
<b>Publications</b>	<p>Preparation of a scientific publication on the results of short-term pollution events with overflows duration and volumes, water qualities, etc.</p> <p>Preparation of a technical article on the result of waste removal with the retention technologies.</p>	Preparation of a scientific publication on “Bayesian modeling for improved bathing water quality management”	
<b>Dissemination materials</b>	<p>Implementation of the educational resource (giant board game) “Bathers to rescue” developed as part of the project. In “Centre de la Platja” and “Fàbrica del Sol”, addressed to families and schools.</p> <p>Local funding is being sought to create more editions to provide the primary schools from Barcelona with this educational resource</p>		<p>Distribution of leaflets, Layman’s report, and other dissemination material</p> <p>Maintenance of information boards and rollups in all partner facilities and demo-sites</p>

Concept	Barcelona	Berlin	Global
<b>Dissemination events</b>	Dissemination day for the citizens of Barcelona with the presentation of the educational resource "Bathers to rescue", Focused for a familiar audience. Planned for March 8, 2023, Seas and Oceans Day. It will be accompanied by other visits linked to the iBATHWATER project.		Participation to ICT4WATER cluster, AIOTI and OGC Participation to international conferences, such as CONAMA, Pollutec Lyon, Aquatech Amsterdam, among others