Strategy and Vision

[Written by WaterEurope]
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EXECUTIVE SUMMARY

The ZeroPollution4Water (ZP4W) Cluster, an initiative under the EU's Horizon Europe program, supported by the European Research Executive Agency (REA), focuses on addressing water-related challenges, particularly in contaminant identification and mitigation. This document outlines the cluster's structure, objectives, and strategies, including its expansion plans. The cluster's expansion strategy aims to address a wider range of global water challenges by gradually including new projects that focus on emerging contaminants in various water sources. The document also provides information on current research topics in drinking and groundwater, serving as a guide for both existing members and potential new projects.

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1 Introduction

The European Union policy framework has secured public safety and health objectives through the well-developed EU water legislation. Key directives, including Drinking Water Directive (DWD) [1], Groundwater Directive (GWD) [2], and the Water Framework Directive (WFD) [3] (via River basin management approach and RBMP- river basin management plans) are striving to align with the Green Deal and Climate Adaptation initiative. Despite these efforts, Member States have noted persistent challenges, with 35% of groundwater bodies facing diffuse pollution and 15% exceeding quality standards for substances like pesticides and herbicides. Factors such as climate change and growing water demand pose additional threats to groundwater quality. Natural and human-made disasters, coupled with rising water temperatures, could exacerbate issues leading to the quality deterioration of drinking water sources. The problems include enhanced eutrophication leading to algal and cyanobacterial outbreaks, as well as pathogen development or the spread of invasive species. Concerns are also emerging in the treatment and distribution of drinking water, encompassing disinfection operations, infrastructure aging, biofilm growth, and the potential harmful effects of by-products and metabolites.

To address these challenges and other climate change effects on water bodies, the EU has invested in research and innovation (R&I) framework programs (FP), such as Horizon 2020 and Horizon Europe to build more connected and efficient European innovation ecosystems, support the green and digital transitions and target global challenges. These funds support collaborative projects focused on preventing freshwater pollution, enhancing water quality, and ensuring its safe use for both - humans and ecosystems, among others. The approach involves the entire drinking water production cycle, with an emphasis on safeguarding water sources through the protection of groundwater resources from contamination.

In May 2021 the EC adopted the EU Action Plan Towards Zero Pollution for Air, Water and Soil [4], a key deliverable of the European Green Deal. This plan sets key 2030 targets, to speed up actions in reducing pollution at source. Among six targets there is a significant focus on improving water quality by reducing waste, plastic litter at sea (by 50%), and microplastics released into the environment (by 30%).

The broader objective of the EU Action Plan Towards Zero Pollution for Air, Water, and Soil is to bolster the EU's leadership in green, digital, and economic realms while fostering a healthier and socially equitable Europe and planet. It emphasizes integrating pollution prevention in all relevant EU policies, enhancing the implementation of existing EU legislation, and identifying potential gaps in the regulatory framework.

Recently, the Horizon Europe 2022 work program for Cluster 6 through the calls for proposals HORIZON-CL6-2022-ZERO POLLUTION-01-01 and 01-04, has granted funds to seven new projects that revolve around two main themes:

- Preventing groundwater contamination and protecting its quality against harmful impacts of global and climate change (HORIZON-CL6-2022-ZERO POLLUTION-01-01, three projects have been selected) and

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• Securing drinking water quality by protecting water sources against pollution, providing innovative monitoring and treatment solutions, and ensuring safe distribution (HORIZON-CL6-2022-ZEROPOLLUTION-01-04, four projects have been selected).

Referring to the expected outcomes outlined in the call topics, these seven projects (also referred to in the text as sister projects) will be clustered under the "ZeroPollution4Water Cluster", to work towards the achievement of the synergic and impactful outcome. The founding sister projects of the Cluster are as follows:

1. SafeCREW - Cordis: https://cordis.europa.eu/project/id/101081980
2. ToDrinQ – Cordis: https://cordis.europa.eu/project/id/101082035
3. UPWATER - Cordis: https://cordis.europa.eu/project/id/101081807
4. MAR2PROTECT -Cordis: https://cordis.europa.eu/project/id/101082048
5. NINFA -Cordis: https://cordis.europa.eu/project/id/101081865
6. H2OforAll -Cordis: https://cordis.europa.eu/project/id/101081963
7. intoDBP -Cordis: https://cordis.europa.eu/project/id/101081728

1.1 Objectives

The **primary objectives** of the ZeroPollution4Water (ZP4W) Cluster, currently revolving **around drinking water and groundwater quality**, are to:

- **Objective 1 (O1): Enhance our understanding** of new contamination sources, pathways, and impacts on water systems. This includes preparing for new challenges through forward-looking research.
- **Objective 2 (O2): Develop and deploy advanced strategies** for preventing contamination and mitigating its effects, ensuring the safety of our water sources from global and climate change impacts.
- **Objective 3 (O3): Implement robust risk management** techniques, incorporating early warning systems and decision-support tools for water safety.
- **Objective 4 (O4): Innovate in water quality monitoring and treatment**, introducing cost-effective sensors, analytical methods, and treatment technologies (e.g.: nature-based, advanced disinfection) to ensure source protection and water quality.
- **Objective 5 (O5): Support policymaking** with a solid scientific and technological foundation, offering guidance and recommendations for water quality management and further implementation of the European Green Deal.

The clustering initiative will enhance both the quantitative (hard and soft technology) and qualitative (human impact monitoring and policy making) **comprehension of newer contaminants in water sources**, moving us closer to realizing a Water-Smart Society.

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The cluster aims not only to **achieve essential scientific and technological goals** but also to **offer data-driven advice for policy formulations**, thereby collectively contributing to clean water management both: within EU policy, and in the context of the European Green Deal.

The ZP4W Cluster is set to enable **seamless collaboration**, amplifying the effects of its sister projects that will lead to achieving the following goals:

- **Goal 1 (G1)**: The creation of **shared policy briefs or recommendations**, which are informed by the evidence gathered from case studies or success stories within the cluster's projects.
- **Goal 2 (G2)**: The **recognition and advancement of research and innovation (R&I) accomplishments**, along with the evaluation of future necessities.
- **Goal 3 (G3):** A cohesive strategy for **communication management**, extending the reach to and engagement with a broader audience of stakeholders.

2 Clustering Strategy

The cluster adopts a comprehensive strategy, initially focusing on the **advancement of a knowledge base via research and innovation (R&I)**. This initiative aims to deepen the scientific understanding **of diffuse pollutants, their origins, pathways, and cumulative effects on water systems**. It encompasses anticipatory measures to identify forthcoming challenges and devise pre-emptive strategies for water management.

In terms of policy impact, the strategy is designed to contribute to **shaping the EU policymaking** through insights derived from the Cluster´s sister projects. Utilizing the Projects for Policy (P4P) methodology [5], which is a European Commission initiative, the strategy endeavors to integrate R&I outcomes into the policy-making process. The coordination by Water Europe (WE), supported by the European Research Executive Agency (REA) and relevant policy directorates (e.g., DG ENV, CLIMA), aims to craft a policy agenda aligned with essential policies (such as DWD, GWD) and cluster activities. This initiative leverages the sister project's case studies to highlight success stories and best practices, thereby facilitating the implementation of EU policies within the ambit of the Zero Pollution and European Green Deal objectives.

The operational blueprint of the Cluster delineates between internal and external action planning, engaging Cluster participants, external stakeholders, and the general public. It includes a provision for the annual **evaluation of new, relevant projects for potential integration into the Cluster** (criteria for admission presented in the following section).

To **enhance the Cluster's visibility and maximize the reach of its outcomes**, participants will engage in various public events tailored to specific audiences. These events, including public webinars, workshops, and online gatherings under the banners of Water Project Europe, are designed to showcase the collective efforts and achievements of

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sister projects. These sessions aim to highlight the dynamics, impacts, and objectives through a virtual showcase, with themes and narratives primarily determined by project representatives.

2.1 Working Group rationale

Following the meeting of the ZP4W Cluster on 5th June 2023, the cluster members agreed on the establishment of six Working Groups.

The WGs within the ZeroPollution4Water Cluster serve as mechanisms for collaboration, knowledge exchange, policy influence, and market uptake. They provide a structured framework for achieving greater impact, fostering innovation, and contributing to sustainable water management practices. Each WG operates through the execution of Action Plans—a yearly roadmap delineating specific objectives and timelines, crafted and periodically updated by the WGs themselves to ensure adherence and address any delays. It is noteworthy to mention that every WG formulates its unique rationale for existence within the Cluster, which can be succinctly summarized as follows:

1. **Internal collaboration and synergy**: The Cluster intends to facilitate collaboration and synergy among the sister and future projects within the ZeroPollution4Water Cluster. By bringing together the expertise, knowledge, and experiences of these projects, the WGs will create a platform for sharing best practices, exchanging insights, and identifying shared challenges and solutions. The WGs facilitate the capitalization of research and innovation achievements from the running sister and the new projects of the Cluster.

2. **Cooperation with other projects and Initiatives:** The Cluster recognizes the value of cooperation within and beyond the EU Research and Innovation Framework Program (FP). The WGs aim to develop cooperative actions with other ongoing and future projects, including those not funded by the EU R&I FP. This collaboration extends to initiatives like Water4All, Biodiversa+, DUT, Processes4Planet, EU Missions, and other relevant initiatives, Clusters, and alliances. By leveraging these initiatives, the Cluster through its WGs can broaden its scope, access additional expertise, and achieve greater impact.

3. **Policy Shaping and Implementation:** The Cluster, with the support of EC services, seeks to build a critical mass of knowledge and expertise, and enable the production of common policy briefs and recommendations based on evidence from case studies and success stories on effective water management to respond to the needs of the implementation of the EU zero pollution strategy. The experience gained from the Cluster's sister projects is expected to contribute to the EU policy agenda through the Project for Policy (P4P) methodology. This initiative aims to use research and innovation project results to shape policymaking. The ZeroPollution4Water Cluster, with the support of the EC REA and relevant EC DGs and other EC Executive agencies (EAs), will tackle relevant policies such as the Drinking Water Directive (DWD) and Groundwater Directive (GRW), aligning with the Zero Pollution and European Green Deal objectives.

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4. **Capitalization of Results and Communication**: The Cluster facilitates the capitalization of research and innovation achievements from the running sister and the new projects. Additionally, the WGs coordinate integrated communication management, ensuring effective outreach to relevant stakeholders and wider interaction.

5. **Sharing Good Practices and Recommendations**: The ZeroPollution4Water Cluster, through the WGs, focuses on developing and sharing good practices and recommendations related to drinking and groundwater management. By addressing cross-cutting topics, the Cluster contributes to knowledge dissemination to foster the adoption of sustainable and effective water management practices.

6. **Market Uptake and Exploitation of Solutions**: The Cluster also develops coordinated support actions for the market uptake and exploitation of solutions developed within the Cluster projects. This emphasis on market-oriented approaches helps bridge the gap between research and practical implementation, facilitating the broader adoption and impact of innovative water solutions. This will be done through coordinated initiatives that intend to foster the matchmaking between demand and offer of solutions, exploiting events or platforms such as the WE Marketplace.

After outlining the rationale, the following WGs have been formed, each with its respective objectives as follows:

The Management and Coordination Working Group (WG1) of the ZP4W Cluster orchestrates the strategic and operational framework, ensuring activities align with the Cluster's goals and objectives. WG1 oversees project progression, impact evaluation, and continuous improvement while maintaining output quality across collaborations (with the EC, particularly with the representatives of the REA) and initiatives. It also establishes criteria for incorporating new projects that align with the EU Zero Pollution Action Plan, enhancing the Cluster's contribution to water pollution reduction (see section 3). Through strategic oversight and effective coordination, WG1 is crucial in advancing the Cluster toward its vision of a pollution-free water environment.

The Policy Advisory Working Group (WG2) of the ZP4W Cluster has the responsibility of identifying and developing policy recommendations, papers, or other policy-related documents. These recommendations are based on the activities and outcomes of the various projects within the Cluster. Following the Project4policy principle, this group aims to enhance cooperation among sister projects to identify important opportunities, challenges, and policy solutions in the water sector, aligning with the research fields of these projects and the EU's political agenda. Furthermore, the WG will leverage dissemination and communication channels to raise awareness of these opportunities, challenges, and policy options among European Institutions, policymakers, and stakeholders.

The Communication Working Group (WG3) of the ZP4W Cluster engages in collaborative efforts to amplify the reach of the outcomes emerging from the sister projects of the Cluster. It develops and systematically updates communication materials (i.e. Cluster brochure, roll-up, etc.) as well as documents creating Cluster´s identity (i.e. presentation template, banner, etc.). WG3 promotes widespread recognition of the Cluster, its aims, activities, and accomplishments among relevant stakeholders and the general public by

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organizing a series of joint communication activities. Also, the Working Group disseminates results generated by the sister projects via the Cluster´s webpage, and social media channels, and organizes Cluster events. WG3 will encourage result adoption and expand stakeholder networks by supporting the organization of webinars and meetings dedicated to Cluster members and external stakeholders. Additionally, it increases impact by communicating on the organized webinars, workshops, and meetings on related topics from various projects, fostering a cohesive exchange of knowledge.

The Technology and Innovation Working Group (WG4) of the Cluster seeks to identify, develop, and facilitate the implementation of technology-based solutions for monitoring, managing, and reducing water pollution in drinking water across various sources, treatment processes, and distribution networks, encompassing groundwater, surface water, and wastewater. This group aims to enhance collaboration among sister projects, assess emerging technological and market potential, share best practices (based on case studies of the sister projects), and establish a roadmap for innovation and technology development for smart drinking water quality (IT-based) management (e.g.: monitoring, risk assessment, modeling, prediction, and control). This roadmap includes guidelines and a framework for technology transfer and scaling up of successful innovations. The WG also promotes collaboration and knowledge sharing among experts, researchers, technology providers, and industry stakeholders to encourage the adoption and commercialization of innovative solutions, in cooperation with the “From R&I to Impact” WG (WG6).

In the TECHNOLOGY SECTION, the WG focuses on gathering and sharing technologies and processes developed by sister projects. An open repository for proposed tools may be created and shared among partners. The overarching goal is to approach water management, monitoring, and treatment processes holistically, considering the relationship between source water quality and by-products formed during drinking water production across diverse countries and practices. Specifically, this WG aims to identify crucial **technological solutions (TS) in the following areas**:

- **TS1:** Monitoring technologies and processes (real-time soft sensors, satellites, laboratory analytical methods, processes, etc.).
- **TS2:** Treatment technologies (novel water treatment processes, innovative disinfection technologies both in the treatment and distribution process, etc.)
- **TS3:** Decision support and management tools (Digital twins, AI, modeling, sensor placement strategies, forecasting models, holistic models between source and distribution, smart algorithms for what-if scenarios, and decision-making support systems for water governance, optimal control, etc.)
- **TS4:** Early warning and detection tools (data acquisition platforms, real-time monitoring and data analysis algorithms, detection algorithms e.g., contamination detection and localization, etc.)

The Data Management and Sharing Working Group (WG5) of the Cluster is charged with the crucial task of identifying existing deficiencies in data management and sharing and devising strategies to elevate these practices. With a particular emphasis on establishing standardization across the sectors of drinking water systems and the management of surface and groundwater, WG5 will foster collaboration among sister projects within the Cluster. In alignment with the EC’s guidelines, WG5 is committed to advocating for open-source data practices. It focuses on ensuring that data is not only accessible but also

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meticulously documented, facilitating the use of this shared information across various applications within the water sector.

The Research and Innovation to Impact Working Group (WG6) of the Cluster focuses on two main goals: (1) facilitating the transition of R&I to the market uptake in the water sector, and (2) promoting three types of solutions: cutting-edge competitive technologies, governance models, and best practices. WG6 selects and evaluates case studies from sister projects based on their potential to achieve pollution targets within the water sectors (drinking and groundwater), considering their readiness for market deployment (ranked by their technology readiness level (TRL)). The group will also evaluate the economic and regulatory challenges, using the PESTEL model (Political, Economic, Sociological, Technological, Legal, and Environmental) to navigate the legislative and competitive landscape.

Furthermore, WG6 seeks collaborative synergies with other WGs to explore business models, funding mechanisms, and digital tools that support the deployment of zeropollution solutions. Engaging with stakeholders like water utilities, policymakers, and industry players is vital for actionable recommendations. Additionally, WG6 will address the R&I gaps, identify needs, propose actions for funding, and influence new Horizon Europe Work programs for 2025-2027 and beyond (e.g., the 10th Framework Programme succeeding Horizon Europe).

2.2 Leadership and dissemination

Each Working Group is responsible for appointing its leadership team, consisting of a leader and one or two co-leaders. In the event of leadership changes or updates, it's imperative to inform the cluster's coordinators. Additionally, the WGs have the autonomy to schedule their regular meetings, with a recommended frequency of at least every three months. The Communication Working Group will oversee the dissemination of information on cluster-related activities such as announcing publications, policy briefs, and event information on social platforms and keeping the cluster members aware and up to with relevant events organized by different WGs. Given the cluster's evolving dynamics, project coordinators must maintain and regularly update the contact list, ensuring seamless information exchange and preventing any communication gaps. Post-event management, which includes gathering materials such as presentations and recordings should be uploaded by the organizers in Sharepoint. A guideline document shared by the WG3, explains in detail the steps to be followed when organizing any event within and outside the cluster.

3 Cluster Expansion & Criteria for Joining

Given that water-related challenges encompass many more issues worldwide, an expansion of the cluster will foster a wider perspective and support the sustainability of the efforts made thus far. Water reclamation is another pressing issue that would be fit to address under this cluster as an example. The cluster expansion has also come as a need from the EC due to the various other calls that have been funded under the zero-pollution for water Calls for Proposals. Therefore, the clustering activity needs to ensure a smooth and gradual inclusion of projects, preventing overwhelming simultaneous implementations.

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Since the cluster intends to obtain an overview of pollutants across all water sources, the gaps that can't be fulfilled by the current sister projects will give rise to the eligibility criteria for projects to join. The seven sister projects of the ZP4W Cluster focus on obtaining 1) a better understanding of water contamination and 2) an improvement of the water quality, for drinking water and groundwater bodies (See ANNEX for more information)

The project that has the ambition to become a ZP4W Cluster member project must concentrate on identifying and mitigating emerging contaminants in water sources, addressing **one or more specific themes**:

- Type of water source (need not necessarily focus only on DW and GW but alternative sources like marine water and freshwater)
- Focus on emerging pollutants (e.g. microplastics in surface water, pathogens in reclaimed wastewater, PFAS)
- Technological innovation (such as treatment chain design and optimization, novel treatment technologies, nature-based solutions)
- Impact on drinking water quality (all projects must assess the effect of their research outcomes on drinking water quality)
- Identification and characterization of pollutants (hard sensor devices, analytical method, grab sample techniques)
- Contaminant monitoring techniques, solutions, and approaches
- Soft sensors for mapping, decision support and prediction, model-driven, and data-driven (Digital twin, machine learning models, flow and diffuse pollutant modeling, AI neural networks)
- Demonstration of technology (through case studies and pilot sites)
- Risk assessment and life cycle analysis of recommended solutions
- Type of funding (EU-(co)funded project/partnership, Interreg, Horizon, LIFE grant, FWO grants)
- In line with EC's Open science communication [6]

It is important to underline, that the **applicant will identify in its application** the following (see section 1.1): to which objective, goal, and working group it can contribute and how and which technological/non-technological solution the proponent can bring to the cluster.

3.1 Joining Protocol for the ZeroPollution4Water Cluster

The ZeroPollution4Water (ZP4W) Cluster welcomes new projects that meet the defined selection criteria and align with the overarching goals of achieving zero pollution and a water-smart society across Europe. Interested projects can be found on the ZP4W Cluster website.

The joining process follows these key phases:

1. Application (January 2 - March 31, 2025): Interested projects must complete the ZP4W Cluster application form, providing comprehensive details about their research focus, methodologies, expected outcomes, and relevance to the cluster themes. Applicants must also declare their intent to actively contribute to cluster activities and support its aims.

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2. Evaluation (April 2025): All applications undergo a thorough evaluation by the ZP4W Cluster committee made up of WG1 members and some cluster members. This panel assesses the project's suitability based on the selection criteria, potential contributions, and overall fit within the cluster's scope and strategy.

3. Decision and Onboarding (May – June 2025):

    a. In May, successful applicants will be notified and invited to join the cluster officially. An onboarding process will be facilitated to integrate the new project seamlessly into the existing structure and operations.

    b. Working Group Assignment will take place in June-July 2025: The selected projects will be invited to the Water Innovation Europe 2025 event for a formal introduction to the other sister projects. Each new member project will be assigned to one or more relevant working groups within the cluster. These groups focus on specific themes or aspects of water management, such as data management, research innovation, market uptake, or policy impact.

4. Contribution Planning (July - September 2025):

    a. In collaboration with the WG leads and the cluster management WG (WG1), new projects will outline their intended contributions to the group's activities. This may include sharing research findings, participating in joint initiatives, contributing to policy recommendations, or supporting dissemination and stakeholder engagement efforts.
    b. Resource Allocation: Depending on the project's budget and available resources, new members may allocate financial or personnel support to assist with cluster-wide activities, such as organizing events, producing publications, or developing communication materials.
    c. Representation and Participation: New projects will be expected to actively participate in cluster meetings, working group discussions, and collaborative initiatives. They may also have opportunities to represent the cluster at external events, conferences, or stakeholder engagements.

5. Reporting and Evaluation: Regular reporting on progress, achievements, and challenges will be required from all working groups. This information will contribute to the cluster's overall monitoring and evaluation processes, ensuring continuous improvement and alignment with its strategic objectives.

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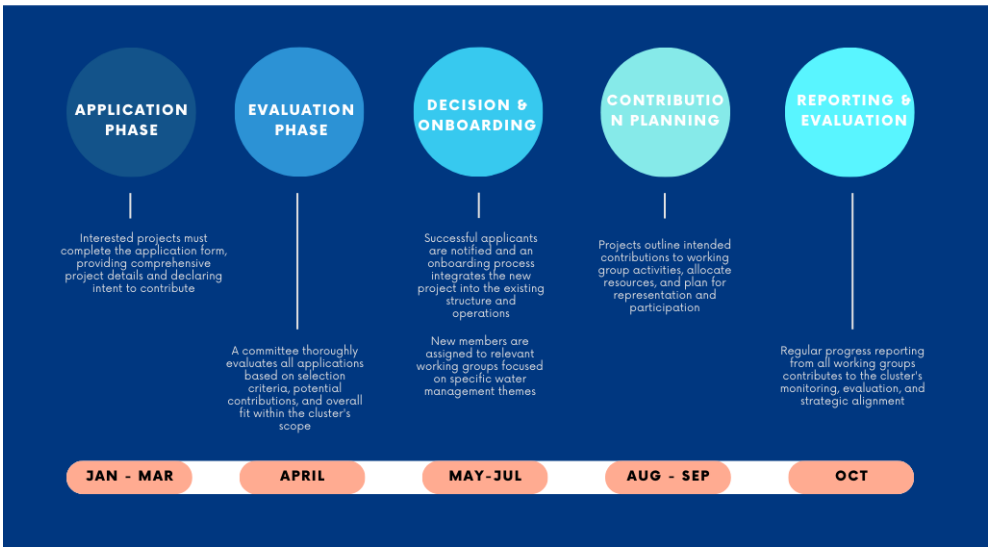
ZP4W CLUSTER JOINING PROTOCOL



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ANNEX: Current focus topics

For projects, focusing on drinking water or groundwater sources and considering joining the cluster, it's important to be aware of the following topics already being addressed by current sister projects:

I. Working topics related to Drinking water

1. Contaminant identification
   - Improve knowledgebase on emerging contaminants (e.g. disinfection by-products (DBPs))
   - Improve water sampling techniques: integration of grab sample and online analyzers.
   - Improve monitoring technologies for DBPs, pharmaceuticals, pesticides, and heavy metals: both sensor-based devices and analytical techniques.
   - Improve monitoring of biostability of water during distribution: pathogen contamination at the tap or source?
   - Develop rapid analysis tools for contaminant identification in mixtures
   - Accelerate the development of computational tools such as artificial intelligence (AI), that forecast changes in water sources and contaminant spread in the distribution network
2. Exposure characteristics
   - Collect data based on case studies to access the exposure scenarios: distribution-system-specific and source-specific
   - Research on disinfection and non-disinfection system integrity
   - Study novel treatment technologies to minimize exposure at the treatment step
   - Conduct research on data modeling distribution networks through collaboration with water suppliers
3. Human impact
   - Development of tools to assess human health risks under exposure to DBPs
   - Research methods to increase societal awareness of alternative water sources for drinking water production
   - Research on risk communication associated with contaminants in drinking water

II. Working topics related to Groundwater

1. Contaminant identification
   - Improve knowledgebase of emerging contaminants (e.g. pharmaceuticals and pesticides)
   - Improve water sampling techniques: e.g. time-integrated sampling with the passive sampling device.
   - Development of contaminant transformation quantification tools: Compound Specific Isotopic Analysis
2. Exposure characteristics
   - Improve knowledge base of contaminant source
   - Study novel nature-based treatment technologies to mitigate pollution
   - Study the effect of climate change on GW contamination
   - Develop models to minimize exposure through source-specific scenarios

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- Study innovative methods to improve aquifer protection for minimal exposure scenarios: AI-based techniques for decision making

3. Human impact
   - Develop methods to minimize exposure release at the source: e.g. through taxation.
   - Research on societal engagement in GW contaminant prevention

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Table 1: Sister projects and their focus areas

Project name	Focus area		Contaminants												Water matrix studied						Monitoring tools (Digital/analytical)	Treatment technologies	Risk assessment	Case studies
	Drinking water	Groundwater	Pathogens	Pharmaceuticals	Heavy metals	Microplastic	DBP	DOM	NOM	OMP	Nitrates	Isotope	Salt intrusion	Diffuse pollutants	Surface water	Aquifer	Tap water	Reclaimed water	Agriculture	Industrial				
SafeCREW	X						X		X						X						Online THM sensor, soft sensors for identification of DBP	NOM removal technologies, in-vitro toxicity assessment	X	3
ToDrinQ	X		X				X			X					x						AI-based soft sensors, decision tools, and digital platforms with real-time water quality information	Drinking water quality (membrane technology)	X	5
UPWATER		X	X									X									Analytical method for pollutant quantification, Passive sampling (viral, ceramic passive samplers, diffusive gradient in thin films), hydrogeological modeling, tools in a local context considering soil properties, leaching potential, and compound toxicity	Mitigating infiltration of pollutants (Novel bio-based solutions)	X	3
MAR2Protect		X											X	X		X					AI-based tool (REACH tool) for prediction of GC/CC on GW quality, Real-time bio and optical sensors	Micropollutant removal and biodegradation, FERT-ROOT technology to decrease diffuse pollution from agriculture	X	7

NINFA		X	X	X	X	X					X				X			X	X		Hard sensors for early warning detection, modeling groundwater flow	Nutrient recovery, water reuse, and aquifer recharge (Ultrafiltration,photo-Fenton, inoculated biochar, woodchip bioreactor)	X	8
H2OforAll	X						X		X						X		X				DBP analytical tools, Hard sensors combining spectroscopy with auxiliary sensors to monitor water quality, Modelling tool	Drinking water production (adsorption by aerogels, advanced oxidation processes), Disinfection techniques (UV /UV+chlorination)	X	1
intoDBP	X						X	X								X	X				Sensors (fluorescence/UV-VIS absorbance, Bioreporters), Analytical tools (HRMS fingerprinting), Open simulation tool for forecasting DBP formation from daily to seasonal scales	Drinking water quality (optimal pre-oxidation, formation of chloramine)	X	4

DBP: Disinfection by-product, DOM: Dissolved organic matter, NOM: Natural organic matter, OMP: Organic micropollutants