Global Water
Research Coalition

Overview of Activities

2023 | 2024

OUR MISSION

"To maintain a strong partnership between leading world water research organisations to strategically generate, exchange and communicate knowledge through research collaborations to support safe and sustainable water supply and sanitation for the protection of public health and the aquatic environment."

Global cooperation for the exchange and generation of water knowledge

In 2002 twelve leading research organisations established an international water research alliance: the Global Water Research Coalition (GWRC).

The Global Water Research Coalition (GWRC) is a non-profit organisation that serves as the collaborative mechanism for water research.

The GWRC maximises its value to member organisations through collaboration to address critical research needs across the water sector, the prompt dissemination of the latest leading edge research findings, the facilitation of knowledge sharing across all member organisations, and access to a global network of leading researchers.

The need for the GWRC to exist has never been greater given the major challenges confronting the water industry across the world. The impact of globalisation, increased population and pollution, impact of climate change, a pandemic and the ageing of the water and wastewater infrastructure are global in nature, and transcend both national and continental boundaries. It is only through global collaboration that the water industry will be able to address these challenges. Despite all we have achieved so far, there is a compelling need to gear up and improve our working processes regarding the implementation of the research strategies and the execution of our joint activities.

The GWRC offers its members and partners the opportunity to leverage resources through cooperative planning and implementation of research.

The current members of the GWRC are listed below.

- Canadian Water Network (Canada)
- KWR Water Research Institute (Netherlands)
- PUB (Singapore)
- SUEZ (France)
- STOWA - Foundation for Applied Water Research (Netherlands)
- TZW DVGW - German Water Centre (Germany)
- UK Water Industry Research (UK)
- VEOLIA (France)
- Water Research Australia (Australia)
- Water Research Commission (South Africa)
- The Water Research Foundation (US)
- Water Services Association of Australia (Australia)

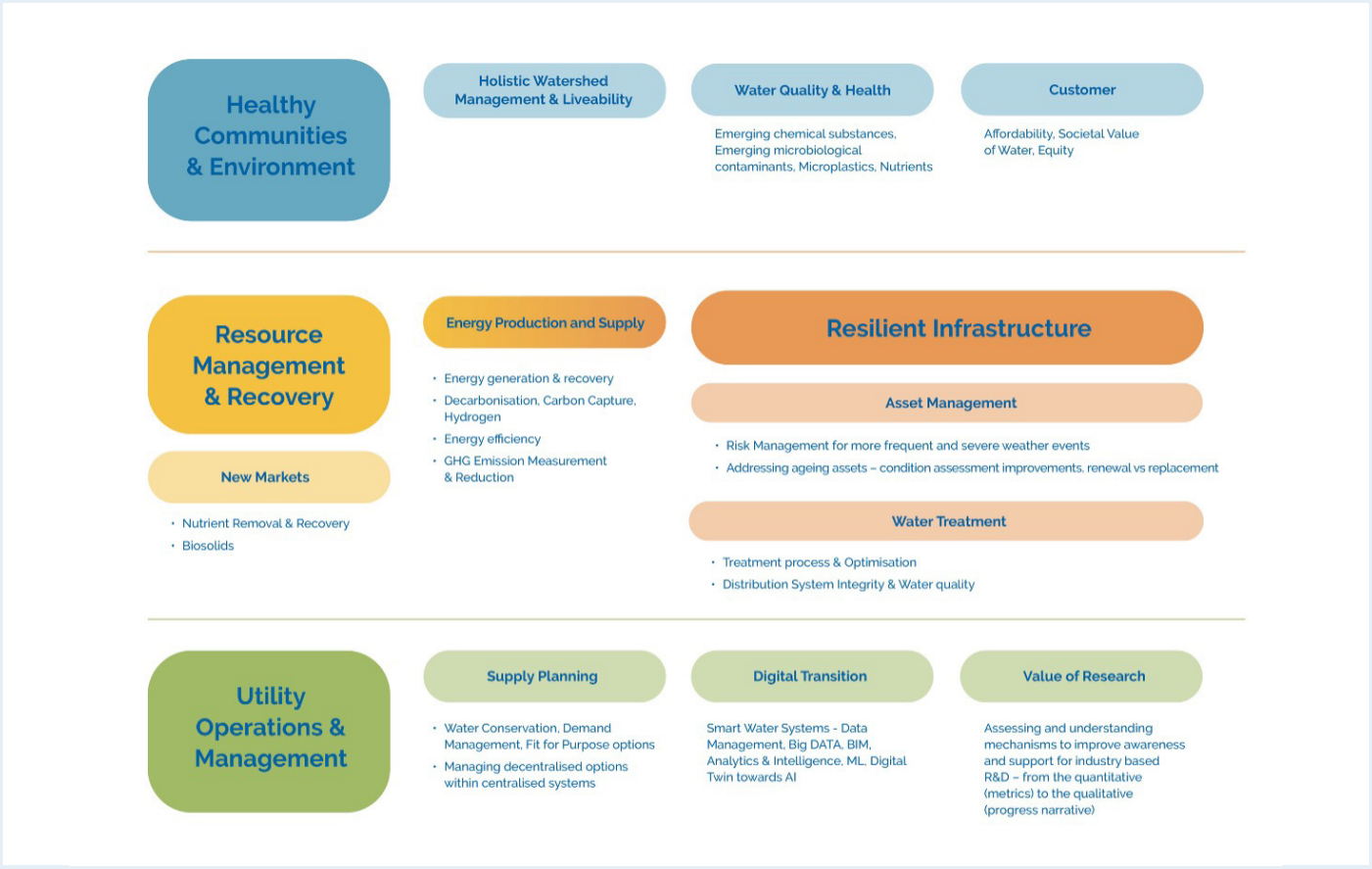
The US Environmental Protection Agency has been a formal partner of the GWRC since 2003. The Global Water Research Coalition is also affiliated with the International Water Association (IWA).

The research portfolio of the GWRC members spans the entire urban water cycle and covers all aspects of resource management.

GWRC Research Priorities

The joint research agenda of the GWRC addresses the urban water cycle and covers a number of research areas and in particular Water Quality and Health, Resource Management & Recovery, Resilient Infrastructure and the operational and management of utilities which includes the transition into the digital era.

The GWRC Research priorities matrix was updated in 2022 with the members and partners and is reviewed periodically.



GWRC Research Priorities

Following a strategic planning session with the GWRC board, three focus areas were selected to explore further for the coming years, namely Greenhouse Gas Emissions, Water Quality & Treatment (includes emerging contaminants) and Resilient Infrastructure. To deliver on these focus areas, the GWRC has established Working Groups comprised of member and partners representatives.

The working groups provide the ability to share and exchange on previous, current and developing research. This approach serves to reduce duplication and highlight opportunities for cross collaboration amongst GWRC members based on shared interests and needs. The objective is to determine knowledge gaps and develop research proposals. These proposals will be submitted for consideration by the board as a GWRC research project. The research proposals can cover a variety of formats (e.g., case studies, webinars/community of practice (CoP), research, white papers, workshops) and must articulate their relevance from a global point of view and relation to the purpose and objectives under the banner of the GWRC.

Overview of Ongoing and Finalised Projects and Activities

"Effect Based Monitoring in Water Safety Planning" *(Finalised)*

Effect-based monitoring (EBM) using in vitro bioassays and well plate-based in vivo assays has been recommended for water quality monitoring as it can capture the mixture effects of groups of chemicals that elicit the same mode of action. Applied as a complementary tool to targeted chemical analysis, EBM can provide valuable input for risk analysis and risk management through Water Safety Plans (WSP). This project was coordinated by the KWR Watercycle Research Institute and work package leaders were amongst others the GWRC members Veolia and Suez and Griffith University.

The main added value of this project was to combine substance based to effect-based monitoring tools to capture any adverse toxic pathways missing by substance-based targeting.

The key challenge of this demonstration project was to assess under innovative effect-based methods, the water quality profiles potentially triggered by residual organic micropollutants at different parts of the Drinking Water Treatment Plant (DWTP), from resource to tap and through the whole water cycle (water cycle DWTPs, WWTPs, conventional and alternative water treatment schemes and water reuse).

This project demonstrated an innovative water quality and safety assessment framework in a practical setting, to support water experts in the implementation of effect-based monitoring in integrative and cost-effective monitoring programmes to detect emerging water quality issues. User guidance was provided to operators and local authorities on the selection of bioassays, the interpretation of bioassay data, and the establishment of decision-making support for the operating practices on the upgrading/improvement of the supply chain. Furthermore, a selection of case studies was used to demonstrate the implementation of a combination of tools to assess the effectiveness of treatment stages, and the use of effect-based monitoring in Water Safety Plans. Ultimately, this leads towards a more efficient implementation of bioanalytical tools across the global water sector.

Project partners Veolia, Suez, Griffith University, Helmholtz Centre for Environmental Research – UFZ, GWRC and KWR have spent the past few years evaluating methods and tools for effect-based monitoring. They also studied how this technology can be incorporated into policy frameworks and carried out and analysed various case studies.

A key conclusion of this project is that effect-based monitoring is ready for practical application and can have several benefits. Well-integrated use of the technology can generate cost savings and contribute to water safety. This requires laboratories that can reproducibly apply the technology. Next to that, end users, governments and laboratories should jointly develop a reliable and reproducible approach for the application of bioassays, and integration in (legal) guidelines is needed for the use of bioassays and the assessment of the results of such measurements.

Our message is clear - we have compiled the evidence that effect-based methods are ready for implementation. Let's move forward with applying this knowledge and ensuring this information is integrated into policy-making.

All the associated project reports, fact sheets and relevant resources are available on the GWRC Website Reports & Resources of GWRC Project on "Effect-Based Monitoring in Water Safety Planning " (2019-2023) - Global Water Research Coalition (GWRC)

"High-Level Overview and Best Practice Guide" on how to undertake wastewater-based surveillance of SARS-CoV-2 and its variants for practitioners & operators" *(Finalised)*

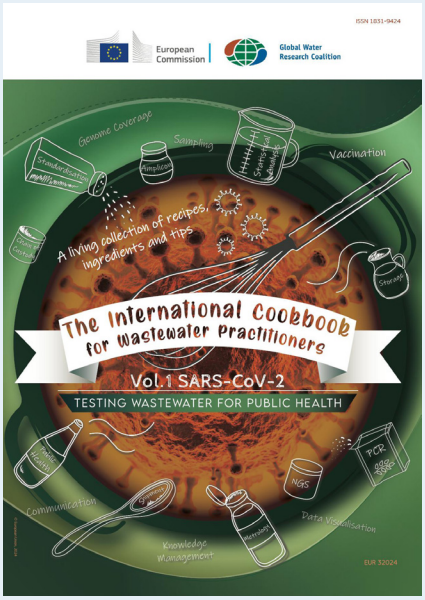
The fight against COVID-19 saw a remarkable partnership between the European Commission's Joint Research Centre and the Global Water Research Coalition (GWRC), with pivotal support from RIVM, VEOLIA, SUEZ, Water Futures and KWR. Together they spearheaded the evolution of Wastewater-Based Surveillance (WBS) that has reshaped public health monitoring. This joint leadership facilitated the pooling of expertise and resources, leading to the WBS „Cookbook" – a comprehensive guide filled with the best practices and innovative tools for tracking SARS-CoV-2 and preparing for future health threats.

The document has been structured into chapters, with nominated lead authors responsible for each chapter. To share the workload the authors and reviewers were drawn from across the world. To provide diverse perspectives, inputs have been drawn from health agencies, water utilities,technology providers, universities and research organisations.

The SARS-COV-2 WASTEWATER-BASED SURVEILLANCE COOKBOOK "High-Level Overview and Best Practice Guide"

on how to undertake wastewater-based surveillance of SARS-CoV-2 and its variants for practitioners & operators has been published and is available to be downloaded under the following link: publications.jrc.ec.europa.eu/repository/handle/JRC138489

The Cookbook has been drafted by a global team of authors, with one or more lead authors identified for each chapter. The chapters were then subjected to extensive peer review from the external review group. These authors and reviewers are acknowledged in the Cookbook.



This was a a fantastic collaborative endeavour and sincere gratitude goes out to Bernd Gawlik (DG Joint Research Centre, European Commission), Gertjan Medema (KWR) , Dan Deere (Water Futures) , Ismahane Remonnay (Veolia), Jean Francois Loret (SUEZ),Olivier Schlosser (SUEZ) and Ana Maria de Roda Husman (RIVM) and Monica Nolan who were all part of the core team that played a big part in bringing this Cookbook to fruition. Their contributions are a testament to the power of collaboration and shared vision in advancing the field of public health surveillance.

We hope that this guide will serve as a cornerstone for practitioners worldwide and for future challenges.

"A practical protocol to monitor and quantify nitrous oxide (N2O) emissions from full-scale wastewater treatment plants" *(New)*

A global collaborative project led by the University of Queensland (Australia) and coordinated via Water Research Australia has been launched in 2024 to tackle nitrous oxide emissions from wastewater treatment plants—one of the most critical challenges in achieving net-zero emissions for the water industry. Nitrous oxide, a potent greenhouse gas, accounts for over 80% of direct greenhouse gas emissions from wastewater treatment plants, making their reduction essential for utilities to meet their climate targets. However, accurate quantification remains challenging due to inconsistencies in equipment setup and data collection, posing a significant barrier to effectively comparing and reducing these emissions.

This project brings together international partners and interdisciplinary experts to develop a globally recognised and implementable methodology for monitoring and quantifying nitrous oxide emissions. This will enable water utilities worldwide to adopt good practices for accurately measuring their nitrous oxide emissions and lay the groundwork for building a comparable global database. The data collected can then be used to provide more accurate representations of nitrous oxide emissions from the wastewater sector, helping the industry take actionable steps toward reducing emissions in the future.

This international collaboration is a vital step toward ensuring that best practices are adopted worldwide, unlocking significant benefits for the water industry.

The Project Partners are: The Global Water Research Coalition and in particular the members including The Water Research Foundation (US), KWR Water Cycle Research Institute (Netherlands), the Water Services Association of Australia (Australia), the Canadian Water Network (Canada), PUB (Singapore), SUEZ (France), STOWA– Foundation for Applied Water Research (Netherlands), UK Water Industry Research (United Kingdom), VEOLIA (France), Water Research Australia (Australia) and the Water Research Commission (South Africa).

Editor Team: Prof. Liu Ye (The University of Queensland - Australia), Dr. Wenzel Gruber (Upwater - Switzerland), Dr. Haoran Duan (UNSW – Australia), Dr. Carlos Domingo-Felez (The University of Glasgow - UK).

"Developing a Global Risk-based Tool for Prioritizing Contaminants of Emerging Concern (CEC) for the Water Industry" *(New)*

Contaminants of emerging concern (CECs) pose a risk to the water industry due to their presence in sewage and drinking water sources, as well as their potential formation during treatment and their potential toxicity to humans and the environment. A defining feature of a CEC is a lack of knowledge on either occurrence, persistence, or toxicity (or all three), making it difficult for the water industry to accurately assess the risk they are managing as part of their operational responsibilities, and to meet their community's increased need for transparent communication in regards to their own risk perception.

CECs are a truly global issue for the water industry especially as they do not abide by national or geographic boundaries, and hence it is appropriate for the GWRC to take the lead in developing globally relevant scientific approaches and tools that support a common approach to CEC risk evaluation and prioritization efforts.

The GWRC project will, however, not start from scratch, but will be built on existing efforts as much as possible and translate these into meaningful, nationally specific, risk ratings. For example, many databases and tools have already been developed to assist water industry practitioners around the world to cope with the occurrence and complexity of the ever increasing number of new chemicals on the market (and their transformation products formed in the environment or during water treatment), by bridging the gap between the uncertainty about a particular chemical or compound and the actual (individual) risk it poses to the environment and public health.

The proposed new global tool will augment the efficacy of numerous existing international databases such as REACH and NORMAN databases and tools by enabling individual CECs to be considered in comparison to each other in a local setting so that clear priorities emerge. The tool will be based on a risk ranking tool developed by Water Research Australia and Griffith University.

Knowledge Exchange & Webinars (Highlights)

Numerous webinars were organised by the three GWRC Working Groups. The GWRC Working Group on Greenhouse Gas (GHG) Emissions Reduction has organised webinars on understanding, analysing, capturing nitrous oxide with presentations by members from the GWRC and the University of Queensland in particular. Other webinars included presentations on exploring the prioritisation and beneficial carbon impact of resource recovery opportunities.

The Resilient Infrastructure Working Group focused their efforts on "Early Prediction: Short- and Long-term Forecasting" including webinars on "Maximising Seasonal Forecasting in the Australian Water Sector, "Drought monitoring and Early Warning Centre in the Netherlands" , "Singapore's rainfall nowcasting journey" and even a Climate hazard awareness tool developed by a GWRC member.

PFAS Webinar Series - Unveiling the Science and Strategies

The Global Water Research Coalition (GWRC) organised a five part webinar series in collaboration with the U.S. Environmental Protection Agency on PFAS (per- and polyfluoroalkyl substances).

Per- and Poly-Fluoro Alkyl Substances (PFAS) are widely used, long lasting chemicals, components of which break down very slowly over time. Because of their widespread use and persistence in the environment, many PFAS are detected in people and animals all over the world and in the environment. PFAS are found in water, air, fish, and soil at locations across the globe and are present at low levels in a variety of food products. Scientific studies have shown that exposure to some PFAS in the environment may be linked to harmful health effects in humans and animals. There are thousands of PFAS chemicals, and they are found in many different consumer, commercial, and industrial products. This makes it challenging to study and assess the potential human health and environmental risks.

During this new international webinar series, global experts have provided their insights into the science and innovative approaches of how to monitor, treat, and remediate PFAS compounds. Additionally, the webinars highlighted the international regulatory and policy landscape dealing with PFAS in the water industry ranging from different waters to biosolids and biochar.

This informative series delved deep into the science and strategies surrounding PFAS, with each follow-on webinar tackling another crucial aspect.

This comprehensive series, delivered by renowned experts, was designed to educate and empower water professionals, policymakers, researchers, and anyone concerned about PFAS contamination.

The five series webinars covered:

Webinar 1: PFAS Sources & Occurrences in Water. (7 February 2024)

Webinar 2: Disposal and Destruction of PFAS in difficult to treat matrices and other water industry products such as biosolids, biochar sludges) (9 April 2024)

Webinar 3: Treatment Technologies and Processes for Removing PFAS from Public Water Systems (27 June 2024)

Webinar 4: Analytical Methods for PFAS (Drinking Water, Wastewater, and Environmental Samples (Non-targeted analytical methods for unknown and large groups of PFAS) & Challenges (12 September 2024)

The last webinar (Webinar 5) will be on public perception and communication challenges and is scheduled to take place in the first half of 2025..

All the recordings of this Webinar Series are available on the GWRC Website under the following link: PFAS Webinar Series - Unveiling the Science and Strategies - Global Water Research Coalition (GWRC)

Workshops

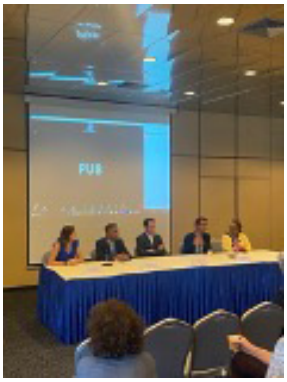
"The Role Water Reuse can play in enhancing Resiliency"

Water Reuse has been identified as a priority focus area for GWRC members and partners and a workshop was organised and attended by International experts and held in Singapore in September 2023 to share first-hand experience/lessons learned, identifying opportunities for cooperation, and developing a future research roadmap.

The city-state of Singapore has been playing a leading role in the field of sustainable water reuse, as Singapore lacks water despite of the abundant rainfall it receives. Now, about 40% of Singapore's water supply comes from its water reuse program.

The workshop gave the opportunity for GWRC members and partners to share their experiences and learnings to be equipped when integrating and developing water reuse practices into their own country's water management systems. The ultimate objective was to enhance collaboration and knowledge sharing and be open to discuss challenges, pitfalls and considerations to take into account when embarking in developing water recycling practices to enhance resiliency.

Highlights included presentations on the NEWater facility in Singapore (lessons learnt) , potable reuse via aquifer recharge case studies in Orange County (California, U.S), potable water reuse opportunities in Europe, Groundwater Replenishment in Western Australia, evolution of potable reuse in Europe, risk management, communication and customer acceptance and engagement.



Brainstorming Session at the Water Reuse Workshop in Singapore (September, 2023) hosted by PUB Singapore at the NEWater Visitor Centre

"Circular Economy and the race towards "Net Zero"

Water Research Australia and the Water Services Association of Australia (WSAA) together with RMIT University (Bundoora Campus, Victoria) hosted a Circular Economy Workshop in March 2024 in Melbourne, Australia.

Circular economy was identified as a key priority by the GWRC members and partners. This workshop was aimed at highlighting case studies and innovations in this space with a particular focus on „Biosolids Management"and „GHG Emission Management". The outcome of the workshop was to identify priorities, challenges and ideas for further knowledge exchange and potential pathways for collaboration. The presentations on GHG emissions and biosolids management gave a better understanding of the ongoing research for mitigating Scope 1 emissions and showcased how circular economy practices can drive progress towards net-zero emissions.

Regulatory, social and environmental pressures, along with a wide range of opportunities, are driving water utilities to rethink the nature of wastewater treatment. Recognising that what was once considered waste contains significant value, the sector is on its path to transforming into water resource recovery facilities (WRRFs). This transformation was particularly highlighted by SUEZ and STOWA in their presentations, showcasing what a wastewater treatment plant (WWTP) of the future could look like, where waste becomes resources and pollution evolves into waste valorisation.

The race to net zero emissions and the circular economy are deeply interconnected for the water industry. Achieving

net zero requires reducing energy consumption and emissions, while the circular economy emphasizes resource efficiency, waste reduction and resource recovery. Both approaches necessitate a paradigm shift in how we view and manage wastewater. Instead of seeing it as waste, we need to recognise its potential as a valuable resource.

International collaboration and research and development are crucial to this transformation. By sharing knowledge, technologies and best practices, we can accelerate progress towards our goals. Collaborative efforts can drive innovation, improve efficiencies by avoiding duplication and ensure that new solutions are scalable and adaptable across different contexts.

Overall, we are moving towards the WRRF model, exploring the various options to tackle emissions and embrace circular practices, ultimately working towards a Net Zero future. By embracing this paradigm shift and leveraging the benefits of international collaboration and R&D, the water sector can lead the way in creating sustainable, resilient and efficient systems that support both environmental and economic goals.

Per- and Poly-Fluoro Alkyl Substances (PFAS)

A GWRC Workshop on Per- and Poly-Fluoro Alkyl Substances (PFAS) took place on in October 2024 in the US hosted by Water Research Foundation (WRF). The overall goal of this workshop was to share knowledge and discuss upcoming challenges in meeting new regulations. Presentations covered funded WRF projects entitled Investigation of Alternative Management Strategies to Prevent PFAS from Entering Drinking Water Supplies and Wastewater, Enhanced Aeration and Scum Recovery for Physical Removal of PFAS from Wastewater , Microwave Regeneration of PFAS-Exhausted Granular Activated Carbons, State of the Science and Regulatory Acceptability for PFAS Residual Management Options and International presentations including PFAS groundwater pollution and drinking water treatment: What are affected water suppliers doing in Southern Germany, Comprehensive evaluation of treatment technologies for removing PFAS from Drinking Water, Investigating the Fate of PFAS in Biosolids Using an Innovative Pyrolysis Technology and PFAS Health Risks & Legislation in the Netherlands.

Whitepaper

“Quantifying and addressing the contribution of water and wastewater to the emerging risk of antimicrobial resistance”

Antimicrobial resistance (AMR) poses a critical global challenge, with environmental factors such as wastewater treatment plants (WWTPs) playing a significant role in AMR evolution and dissemination. While WWTPs are crucial for reducing antimicrobials and antibiotic-resistant bacteria, concerns remain regarding the amplification and release of problematic mobile genetic elements along with gene/bacterial combinations from WWTP. Studies indicate increased levels of antibiotic resistance genes (ARGs) downstream of WWTP discharges and in soils post-biosolids application, raising worries about human exposure risks via water, soil, and air. Evaluating these risks is complex due to the propensity for transfer of ARGs among bacterial hosts and potential for delayed adverse effects. Addressing AMR risks associated with WWTPs within a broader One Health framework is vital for informing the development of effective management strategies.

As a follow-on to WRF project 4813 “Critical Evaluation and Assessment of Health and Environmental Risks from Antibiotic Resistance in Reuse and Wastewater Applications, research investigators Kerry Hamilton, Amy Pruden, and Emily Garner with the support of the Global Water Research Coalition and the Water Research Foundation (WRF) have used the existing database (developed in WRF project 4813) to conduct a meta-analysis to develop a white paper informed by literature review and an internal focus group, titled “Contribution of wastewater treatment and disposal to the emerging risk of antimicrobial resistance.” This project is financed by the Water Research Foundation and STOWA -Foundation for Applied Water Research (Netherlands) with in kind support from all other members and partners.

The white paper is currently being finalised outlining the current understanding of the contributions to antibiotic resistance from wastewater, wastewater treatment, and the use of the products of wastewater treatment (e.g., recycled water and biosolids). This will include a literature review of the current understanding of the contribution of these products to the increased incidence of antibiotic resistance, placing those risks in the context of risks associated with other industries, such as agriculture and healthcare.

Key benefits of the white paper include quantifying the contributions of water and wastewater environments to the AMR burden of disease can help to prioritize risk mitigation resources. The white paper highlights the need to understand the context for water and wastewater-related sources as well as source attribution within a One Health approach by identifying key research gaps. This research informs future research and policy actions addressing environmental AMR sources and quantifying associated human health risks.

GWRC Board of Directors

Board meetings, workshops and topic discussions were organised for the Board of Directors in Amersfoort in the Netherlands (March 2023), Singapore (September 2023), Melbourne (March 2024) and Chicago (U.S.) in October 2024.

Board of Directors meeting in Singapore, September 2023 hosted by the PUB Singapore.

The Global Water Research Coalition's Board of Directors gather with MWRD President Kari K. Steele and Executive Director Brian Perkovich to kick off meetings at the Stickney Water Reclamation Plant in Chicago. The Board meetings were hosted by the Water Research Foundation.

Members of the Global Water Research Coalition (GWRC) held its Board of Directors meetings from the 1st and 2nd of October 2024 in Chicago at the Metropolitan Water Reclamation District of Greater Chicago's (MWRD's) Stickney Water Reclamation Plant (WRP) to discuss, share ideas and strategize about the many issues and trends facing the water industry. It was an honor to be welcomed by President and Commissioner Kari Steele and Executive Director Brian Perkovich who shared their current strategic priorities and future challenges.

In addition to the board meeting, members of the GWRC toured the Stickney WRP and listened to several presentations on the latest water research on several topics that addressed managing emerging contaminants in water. MWRD staff presented alongside researchers from universities, water utilities and leading engineering firms.

The Stickney WRP is one of the largest wastewater treatment facilities in the world serving over 2.3 million people and cleaning an average of 700 million gallons of wastewater per day and with a capacity to treat 1.4 billion gallons per day. The Stickney WRP serves residents in Chicago as well as 46 other communities within a 260-square-mile-area. The Stickney WRP consists of two plants; the original West Side Plant which was placed in service in 1930 and the Southwest Plant which was placed in service in 1939.

During the Board meetings members and partners presented their priorities and challenges for the years ahead. The exchanges of information between members and partners has developed into a very valuable part of the Board meetings. The presentations by the hosting organisations and their stakeholders give an additional dimension to the Board events.

An informative session took place during the Board meetings in In Amersfoort in the Netherlands in March 2023 where we heard from a young employee working at STOWA- Foundation for Applied Water Research (Netherlands) on the importance of knowledge exchange between young and experienced professionals and what to do to keep young professionals within the water sector".

The GWRC Board of Directors is made up of the representatives of the GWRC members.

Members of the Board (as per November 2024)

Nicola Crawhall	CEO, Canadian Water Network
Marielle van der Zouwen	Deputy Director, KWR (Netherlands) (Vice-Chair)
Gurdev Singh	Chief Engineering and Technology Officer, PUB (Singapore)
Mark van der Werf	Executive Director, STOWA (Netherlands)
Zdravka Doquang	Innovation Officer & Technical Performance Manager, SUEZ (France)
Josef Klinger	CEO, TZW (German Water Centre) (Germany)
Steve Kaye	Executive Director, UK Water Industry Research
Ismahane Remonnay	Head of R&I Partnerships & Megatrends, Veolia (France) or
Valerie Ingrand	Research Group Manager, Veolia (France)
Jennifer Molwantwa	CEO, Water Research Commission (South Africa)
Karen Rouse	CEO, Water Research Australia Limited (Australia)
Peter Grevatt	Executive Director, Water Research Foundation (US) (Chair)
Adam Lovell	Executive Director, Water Services Association of Australia
Stéphanie Rinck-Pfeiffer	Managing Director, GWRC (secretary/treasurer)

Suzanne van Drunick (National Program Director Safe and Sustainable Water Resources, US EPA) and Kala Vairavamoorthy (Executive Director, IWA) have an ex-officio position on the Board and are partners of the GWRC.

Global Water
Research Coalition

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