IWA LAKE AND RESERVOIR MANAGEMENT SPECIALIST GROUP

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OUR MISSION

The IWA Specialist Group on Lake and Reservoir Management brings together expertise from regions where lake and reservoir management knowledge is rapidly advancing and regions where this expertise is most needed. The group encourages knowledge transfer between academia, industry, and government agencies fostering interdisciplinary collaborations within the IWA community.

INTRODUCTION FROM OUR CO-CHAIRS

Since February 2026, we have had the privilege of serving as Co-Chairs of the IWA Lake and Reservoir Management Specialist Group. During this time, we have been focused on strengthening the foundation of the group through committee reorganization, reviewing our constitution, and planning upcoming webinars that will bring together expertise from around the world. It is therefore with great pleasure that we present the first LRM Specialist Group Newsletter of 2026.

This year has been marked by renewed energy and commitment from our committee members to advance integrated lake and reservoir management. Our vision is to bring together scientists, engineers, water utilities, regulators, policymakers, and practitioners to address the complex challenges facing lakes and reservoirs in a rapidly changing world. Through interdisciplinary collaboration, knowledge exchange, research, and innovation, we strive to promote science-based and practical solutions that protect source waters, support public health, strengthen ecosystem resilience, and improve water quality outcomes.

The importance of this work continues to grow as communities around the globe face increasing pressures from climate change, population growth, land-use change, emerging contaminants, and competing demands for water resources. Addressing these challenges requires collaboration across disciplines and jurisdictions, as well as a willingness to learn from one another's experiences.

This newsletter reflects that spirit of collaboration. It is the result of the efforts of a small but highly dedicated group of volunteers who have contributed their time and expertise to share knowledge, lessons learned, and emerging ideas. We are grateful for their contributions and hope this publication will encourage broader participation from our membership. We welcome article submissions, case studies, project highlights, event ideas, and suggestions for future activities.

One of our goals as Co-Chairs is to continue building an inclusive and vibrant community where members feel encouraged to contribute, collaborate, and lead. Whether through joining the committee, participating in webinars, sharing technical knowledge, contributing to this newsletter, or simply engaging in discussions with fellow members, there are many ways to get involved. We encourage each of you to participate in shaping the future of our Specialist Group. Together, we can strengthen our global network and advance the knowledge, tools, and practices needed to protect and manage lakes and reservoirs for generations to come. We hope you enjoy this newsletter and find inspiration in the outstanding work being carried out by colleagues around the world.

Nancy Martin **(Country: Canada)**



Nancy comes from a background in water quality management, with experience in both regulatory and utility settings. Based in Calgary, Canada, her work has focused on water quality assessment, watershed protection, water quality modelling, and evaluating the potential impacts of urban development on aquatic ecosystems. Throughout her career, she has seen the value of science-based decision-making in helping communities understand how future growth, environmental change, and management actions can influence the health of our lakes, reservoirs, and watersheds. She first became involved with IWA through the encouragement of a respected colleague who was actively engaged in one of the Association's Specialist Groups. That experience demonstrated the tremendous value of connecting with professionals from different regions, disciplines, and perspectives. She believes that some of the most innovative solutions emerge when people come together to share challenges, exchange ideas, and learn from one another's successes and lessons learned.

Kath Cinque **(Country: Australia)**



Kath has worked in the water industry for over 25 years. She provides specialist technical expertise and knowledge within Melbourne Water in regard to hydrodynamics, drinking water quality and public health. Kath develops and applies models to support decision-making across the planning, investigations and operational space. Her extensive experience in the 3D hydrodynamic modelling of Melbourne’s drinking water reservoirs has expanded and heightened her interest in lakes and reservoirs, specifically the enormous benefit they provide for drinking water quality and public health as well as the many and varied issues that they can encounter. She is passionate about sharing knowledge and creating strong and mutually beneficial networks.

Dam Reservoir and Lake Management in Japan: Institutional Framework, Monitoring, and Emerging Policies

Hiroshi Yajima **(Country: Japan)**

Estuary Research Center, Shimane University / Australian Rivers Institute, Griffith University
IWA Lake and Reservoir Management Specialist Group, Communications Team

Japan has approximately 2,700 completed dams with heights of 15 m or more (Japan Dam Foundation, 2026). Together with numerous natural lakes, these dams and reservoirs support multiple functions, including flood control, domestic and industrial water supply, irrigation, hydropower generation, and environmental conservation.

Japan's steep topography and monsoon climate contribute to rapid river flows and intense seasonal rainfall. At the same time, many dams and reservoirs are located relatively close to densely populated areas and support multiple, sometimes competing, water uses. As a result, reservoir managers must address a range of issues simultaneously, including eutrophication, water temperature, turbidity, sedimentation, and the effects of changing inflow and discharge patterns. These characteristics make integrated monitoring and adaptive management essential for the long-term protection and effective use of Japan's dam reservoirs and lakes (MLIT, 2018).

Multi-Layered Management Structure

Dam management in Japan is organised across multiple institutional levels. The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and the Japan Water Agency (JWA) manage major dams for flood control and water supply, while prefectural governments manage numerous dams for regional flood control and municipal water supply needs. Electric power companies also operate a large number of dams primarily for hydropower generation. In addition, agricultural dams are developed and administered under the policy and institutional framework of the Ministry of Agriculture, Forestry and Fisheries, primarily for irrigation. Depending on the project and facility, completed facilities may be managed directly by the national government or entrusted to prefectural or municipal governments or land improvement districts (MAFF, 2016).

Eleven lakes have been designated under the Act on Special Measures concerning Conservation of Lake Water Quality (enacted in 1984) as requiring comprehensive conservation measures. These designated lakes include Lake Kasumigaura, Lake Biwa, Lake Shinji, and Lake Nakaumi. For these lakes, prefectural governors formulate Lake Water Quality Conservation Plans in accordance with the national policy and with the involvement and approval of the relevant national authorities. Non-designated lakes are generally monitored and managed by prefectural or municipal governments (Ministry of the Environment, n.d.).

Dam Management Follow-up System

MLIT has established regional Dam Management Follow-up Committees to periodically evaluate the management of dams and related facilities. As a general rule, a Periodic Report is prepared for each dam approximately every five years, and the results are reviewed by committees comprising academic and technical experts. The reports comprehensively assess dam management and environmental conditions, including flood-control and water-supply operations, sedimentation, water quality, biological conditions, and social and economic conditions in the reservoir and watershed areas. This institutional mechanism supports systematic verification of dam management practices and promotes transparency and continuous improvement (MLIT, 2014, 2018).

Regulatory Framework and Standards

Japan's water quality management framework consists of environmental quality standards established under the Basic Environment Act, including water-body classifications and standards for parameters such as COD, total nitrogen (TN), and total phosphorus (TP) in lakes and reservoirs. In addition, an ecological conservation-oriented environmental quality standard for bottom-layer dissolved oxygen (DO) was added as a 'living environment' item in 2016 (Ministry of the Environment, 2016a, 2016b).

For dam reservoirs specifically, MLIT's Guidelines for Dam Reservoir Water Quality Improvement (2018) organise water quality improvement measures into three broad categories: watershed-source control measures, in-reservoir measures such as aeration and selective withdrawal, and measures for managing discharged water. Through evaluation and verification by the Follow-up Committees, water quality improvement measures are continuously reviewed and revised (MLIT, 2018).

In February 2025, Japan revised the framework for environmental quality standards for the conservation of the living environment. The revision allows more flexible application of water-body classifications, including seasonal classifications, and modifies certain aspects of COD assessment. Separately, PFOS and PFOA were added to Japan's drinking-water quality standards in 2025, with the new standard taking effect on 1 April 2026. These changes illustrate the continuing evolution of Japan's water quality management framework in response to advances in scientific knowledge and changing societal needs (Ministry of the Environment, 2025a, 2025b).

Monitoring Practice

At MLIT-managed dams, water quality monitoring is conducted systematically in accordance with relevant water quality monitoring guidelines, including measurements of water temperature, turbidity, DO, TN, TP, and chlorophyll-a (Chl-a), with plankton surveys also conducted as necessary (MLIT, 2015). Water levels, discharge, rainfall, and other hydrological parameters are continuously monitored using telemetry systems and other monitoring technologies. These data are used in periodic reports reviewed by the Follow-up Committees and support the operation and management of facilities such as selective withdrawal systems and aeration systems.

Emerging Policies: River Basin Disaster Resilience and Sustainability by All and the Hybrid Dam

Against the backdrop of increasing flood and drought risks associated with climate change, Japan's policy shift toward "river basin disaster resilience and sustainability by all" has been gaining momentum since around 2020. This approach extends beyond the management and improvement of dams and rivers by engaging stakeholders throughout the entire river basin to reduce flood risks through an integrated framework tailored to local basin characteristics. It combines a range of measures, including advance release from reservoirs, coordinated operation of multiple dams, the development and use of flood retention areas, and coordination with land-use planning and urban development (MLIT, n.d.).

In 2022, MLIT introduced the "Hybrid Dam" initiative. This initiative aims to enhance flood-control functions while promoting hydropower generation and contributing to regional development through advanced dam operation using weather forecasting technologies, as well as the construction and expansion of hydropower facilities. In fiscal year 2023, operational enhancement trials aimed at increasing hydropower output were conducted at 72 dams managed by MLIT and the Japan Water Agency. During the same fiscal year, case studies on the construction or expansion of hydropower facilities were conducted at three existing dams, including Obara Dam in Shimane Prefecture (MLIT, 2023).



Obara Dam (Shimane Prefecture, completed in 2012). A multi-purpose gravity dam (height: 90 m; crest length: 440.8 m) managed by MLIT. In FY2023, it was selected as one of three existing dams for a Hybrid Dam case study on the construction or expansion of hydropower facilities. Photo courtesy of the Izumo River Office, Chugoku Regional Development Bureau, MLIT, Japan.

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TECHNICAL CASE STUDY

Hybrid Eutrophication Control through the Integration of Physical Engineering Technologies and Natural Ecosystem Functions: Restoring Aquatic Ecosystems for Human Well-Being

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Background

The transition of water environment management in China is described below, with particular emphasis on the case of Lake Taihu. Since the latter half of the 1990s, one of the adverse consequences of China's rapid economic development, accompanied by annual GDP growth rates of approximately 10%, has been the progressive deterioration of aquatic environments, as measures to control industrial and domestic wastewater have failed to keep pace with the rapid expansion of economic activities. Consequently, eutrophication progressed in lakes throughout China during the 2000s, and cyanobacterial blooms (cyano-blooms), dominated by *Microcystis*, became increasingly prominent. In particular, in 2007, severe cyano-bloom development in Lake Taihu caused serious disruption to water use, including municipal water supply, in Wuxi, a major city located on the shore of the lake, thereby developing into a major social and environmental issue.

Countermeasures

Subsequently, substantial reductions in pollutant loading to aquatic environments were achieved through a series of measures targeting external pollutant sources. These measures included the widespread implementation of decentralised wastewater treatment facilities and the upgrading and improvement of urban wastewater treatment plants. In parallel, industrial and livestock-production facilities within the watershed were closed, relocated, or converted to other types of production. Regulations controlling both pollutant concentrations and total pollutant loads further contributed to substantial reductions in pollutant inputs to aquatic systems. As ecological approaches to water-quality management, measures have been implemented in bays and inner-lake areas receiving riverine inflows. These measures include the planting and restoration of *Phragmites australis* and other aquatic and riparian vegetation along riverbanks and lake shores and the conversion of suitable areas into constructed or restored wetlands for water purification. In Lake Erhai, an innovative approach has been adopted in which conventional agriculture associated with relatively high pollutant loading has been transformed into a water-quality-oriented agricultural system based on the cultivation of *Ottelia acuminata*, a regionally symbolic aquatic plant that also has agricultural and economic value. This approach integrates cyano-bloom control with local agricultural production and tourism, thereby linking aquatic environmental restoration with regional economic development and the enhancement of residents' well-being.

At the interprovincial and basin scales, substantial financial resources have been invested in water environment conservation, including large-scale water transfers from other river basins and planned dredging of lake sediments. In water bodies where cyano-blooms accumulate, various in-lake management measures have been implemented, including artificial floating islands, fountains, water-circulation enhancement facilities, and the collection and removal of cyanobacterial biomass using specialized collection vessels. Following collection, the biomass is subjected to coagulation-separation-drying processes and is subsequently reused, primarily as a fertiliser resource.

In present-day China, nitrogen loading has been substantially reduced as a result of watershed-scale measures to control external pollutant sources. In addition, in-lake management and restoration

measures have continued, and the scale of cyano-blooms has decreased in some water bodies. Nevertheless, cyano-blooms continue to occur annually in many lakes and rivers. Their persistence is considered to be associated, at least in part, with internal nutrient loading, particularly the release of phosphorus from bottom sediments into the overlying water. These circumstances have led to the recognition that measures focused solely on controlling watershed-derived external loads are insufficient for achieving long-term prevention of eutrophication and restoration of aquatic ecosystems.

Under China's national policy framework defined by the 15th Five-Year Plan for 2026–2030, the improvement of aquatic environmental health is being advanced through integrated approaches combining environmental monitoring and ecological restoration. In addition to satellite remote sensing, drones, and automated water-quality monitoring stations, the development of an intelligent monitoring architecture that integrates Space–Air–Ground–Water–Engineering systems has been designated as a policy priority. Within this emerging framework, aquatic ecosystem health is identified as a central objective of water-environment governance. Key directions include integrating decarbonization with aquatic ecosystem restoration and incorporating watershed ecological value into socioeconomic development. Accordingly, hybrid approaches combining innovative engineering infrastructure with green infrastructure and ecosystem-based approaches are increasingly recommended.

Against this background, this report introduces a hybrid water environment management system that integrates engineered facilities with the functions of natural ecosystems and is consistent with the emerging philosophy of water environment management in China. The proposed system aims to establish a framework for coexistence between human activities and cyano-blooms, moving beyond approaches that rely solely on the elimination or removal of cyanobacterial biomass. As a first step toward coexistence with *Microcystis*, it is essential to understand the natural ecological characteristics and physiological functions of *Microcystis*. Such understanding provides the scientific basis for developing a new generation of water environment management technologies that can regulate the ecological dominance of *Microcystis* while maintaining and restoring the functions and biodiversity of aquatic ecosystems.

Ecosystem Restoration Technology through Jet-Shock Physical Processing of *Microcystis* Bloom

A new coexistence-oriented system for managing cyano-blooms, consistent with the concept of Nature-based Solutions (NbS) and designed to activate diverse biological interactions within natural aquatic ecosystems, is introduced below. The proposed Jet-Shock physical processing technology represents a novel approach to restoring ecological balance (Iseri et al., 2026). Without the addition of chemicals, this technology applies purely physical forces to reduce the adaptive advantages of *Microcystis* associated with its sheath-based structural organisation and other biological characteristics listed in **Table 1**. The treatment is intended to reduce these ecological advantages to levels comparable to those of competing phytoplankton, particularly green algae and diatoms, within the same aquatic environment.

Table 1. Comparative growth-advantage mechanisms of *Microcystis* relative to other algal taxa: physiological, ecological, and environmental drivers.

Microcystis ecological growth advantages	Photo-synthesis	Obtain CO_2, HCO_3^-	Obtain nutrients	Nutrients stock	Initial density	Anti-predator defense	Anti-decomposer defense	Anti-digestion defense	Photo-inhibition reduce	Salinity stress reduce	Dryness stress reduce	Oxidative stress reduce	High-temp. stress reduce	Bacterial mutualism
Seed population					●		●				●			
Vertical migration	●**	●	●			●	●		●	●		●		
Horizontal migration			●			●	●							
Colony structure, EPS *			●	●		●	●	●	●	●	●	●		●
Sheath shield						●	●	●	●	●	●	●		●
High-temperature growth													●	
Toxicity						●		●						
Usable organic-phosphate			●	●										●
Usable bicarbonate		●												

* EPS: Extracellular Polymeric Substances, ** ●: Factors contributing to the growth advantage of *Microcystis*

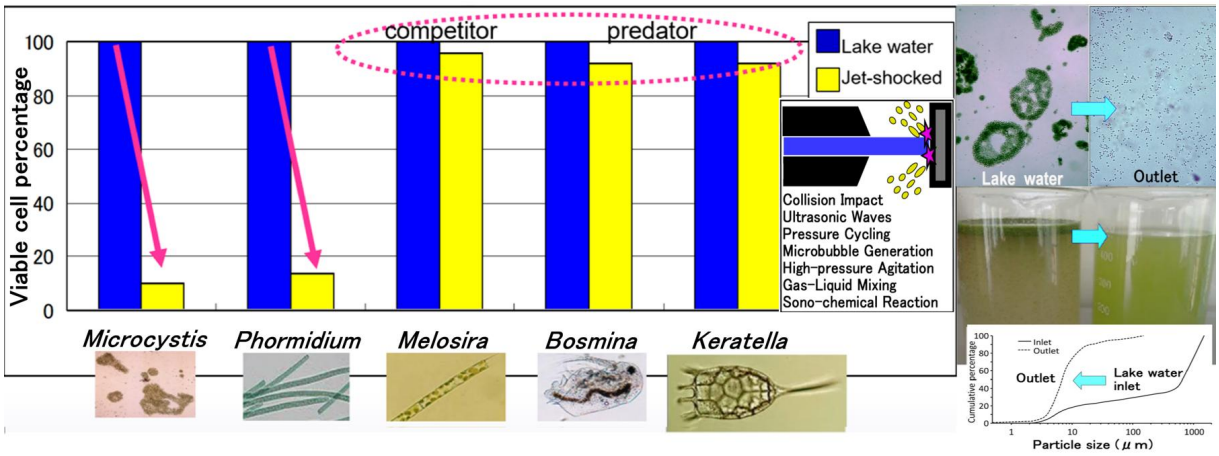


Fig. 1. Effects of Jet-Shock treatment on various plankton immediately after treatment.

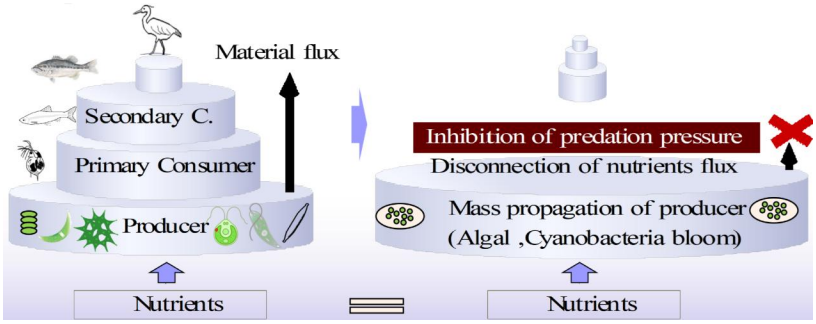


Fig. 2. Elimination of cyanobacterial blooms and biodiversity recovery through Jet-Shock treatment–driven restoration of aquatic ecosystem material flux.

By impairing the vertical migration of *Microcystis*, reducing its ability to acquire preferential access to light and nutrients, and weakening its protection against grazing, decomposition, and various environmental stresses, the technology is expected to diminish the competitive fitness of *Microcystis* and ultimately facilitate the development of a more diverse and coexistence-oriented aquatic ecosystem. Conventional harvesting and removal methods primarily reduce the standing biomass of cyano-blooms through physical removal. In contrast, the present approach is designed not only to reduce the biomass of *Microcystis*, but also to suppress its subsequent proliferation after treatment. Furthermore, following discharge of the processed biomass into the receiving water body, increases in competing phytoplankton such as green algae and diatoms, together with enhanced activities of grazers and decomposer communities, are expected to extend the suppressive effects on cyano-blooms over a broader spatial scale. A further distinctive feature of this technology is its selective ecological effect. The physical processing is designed to exert its principal effects on cyanobacteria, while causing little or comparatively limited impact on competing organisms such as diatoms and green algae and on consumers such as zooplankton (**Fig. 1**).

This differential response is particularly important for ecosystem restoration because it allows the biological communities that can compete with or consume *Microcystis* to remain functional following treatment. The most important ecological function of the technology is the promotion of grazing and decomposition processes through disruption of the *Microcystis* sheath structure. Once the protective sheath is disrupted, the processed *Microcystis* biomass becomes more accessible to grazers and decomposer organisms. This can reactivate the transfer and recycling of organic matter through food-web processes originating from the cyanobacterial biomass, thereby facilitating the recovery of trophic interactions and material cycling within the aquatic ecosystem (**Fig. 2**).

Through the reactivation of these ecological interactions, the system has the potential to transform a bloom-dominated and ecologically simplified water body into a healthier ecosystem characterised by greater biological diversity and more functional trophic interactions. In addition, the recovery of aquatic food-web functions may increase the production of higher-trophic-level organisms, including fish, shrimp, and bivalves, thereby contributing not only to aquatic ecosystem restoration but also to the recovery of aquatic biological resources and the revitalization of fisheries and related industries.

Field-scale mesocosms ranging from 1,250 to 225,000 m² were constructed in eutrophic water bodies in Japan and China to conduct ecological restoration demonstration experiments. In Japanese dam reservoirs, jet-shock dispersion treatment of cyanobacteria resulted in measurable water quality improvements within several months, accompanied by a shift from *Microcystis* dominated conditions to communities dominated by green algae and diatoms, as well as increases in benthic organisms such as shrimp species (**Table 2, Fig. 3**). Similarly, in Lake Taihu, China, the treatment promoted the recovery of aquatic biodiversity and led to reductions in pollutants and microcystin concentrations, demonstrating clear improvements in water environmental conditions. During the experimental period, dozens of fish deaths were observed in the untreated control zones, whereas mortality in the treated zones was limited to only a few individuals. Furthermore, in the treated zones, the initial emergence of *Microcystis* from sediment seed banks in the following year was also reduced (**Fig. 4**), indicating the potential for long-term cyano-bloom suppression through inhibition of seed-bank activation (Hao et al., 2025). Complementary indoor cultivation experiments using several grazers, including an ostracod species, *Macrobrachium* sp., and *Hyriopsis* sp. demonstrated that disruption of the *Microcystis* sheath and dispersion of cellular aggregates markedly enhanced grazing activity. As a result, *Microcystis* cell abundance decreased substantially within a few days, confirming the effectiveness of physical disaggregation in promoting ecological top-down control.

Table 2. Plankton abundance in jet-shock and control areas.

Type	Species	Jet-shock area (inds/mL)		Control (inds/mL)	
Bloom	*Microcystis* spp.	1,953	<<	140,400	Decrease
Phytoplankton	*Gloeocystis* spp.	323	>	278	Native species as Competitors Increase
	Oocystis sp.	403	>	336	
	Melosira granulata	710	>>	456	
	Fragilaria crotonensis	11,309	>	9,765	
Zooplankton	*Tintinnopsis cratera*	2.04	>>	1.07	Native species as Predators Increase
	Polyarthra spp.	0.94	>>	0.49	
	Bosmina longirostris	0.33	≈	0.39	
	Copepod nauplii	0.78	≈	0.72	

We observed *Caridina* sp. predation. Next year *Hypomesus nipponensis* increased.

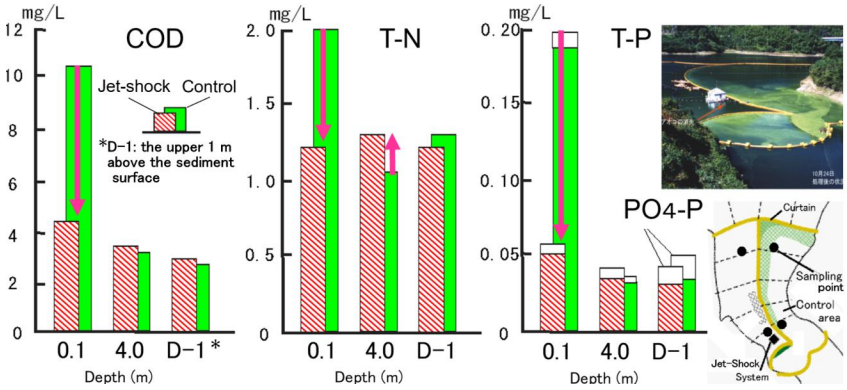


Fig. 3. Water-quality improvement effects in the reservoir mesocosm.

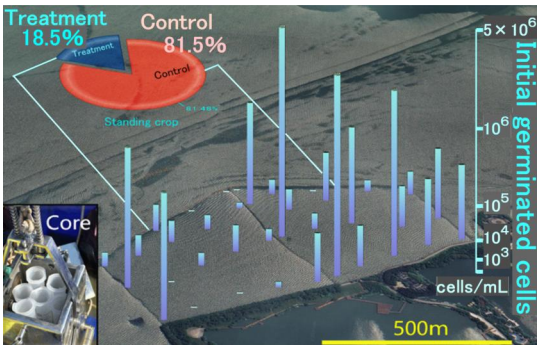


Fig. 4. Suppression of *Microcystis* germination in the Lake Taihu mesocosm.

Future Perspectives

Through Japan-China collaboration integrating human technologies and ecological knowledge, our research has led to the completion of a practical vessel in 2026 (**Fig. 5**). We plan to deploy this system in aquatic ecosystem restoration projects across East Asia, Oceania, Africa and Europe. Recent findings



Fig. 5. Completion of the practical Jet-Shock vessel through Japan–China collaboration.

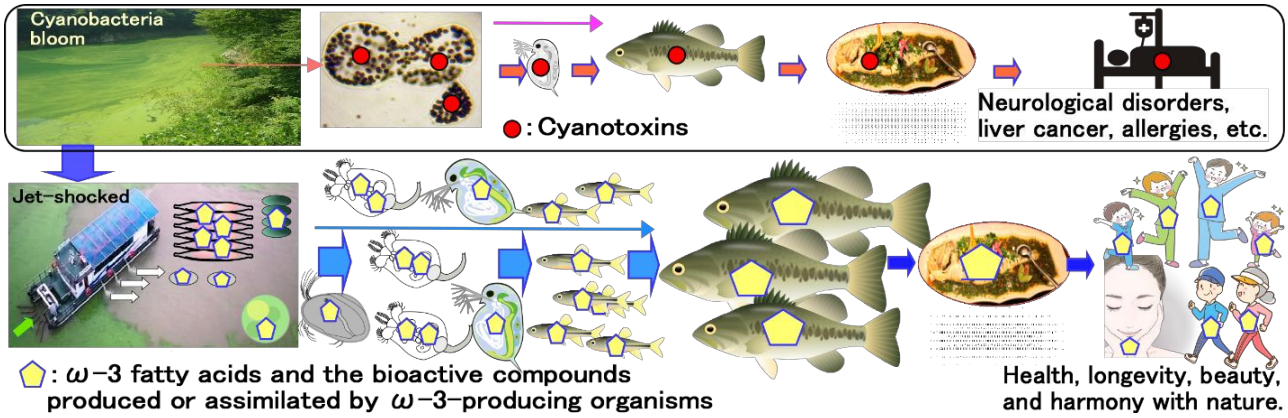


Fig. 6. Integration of Jet-Shock processing with ecosystem functions to promote human well-being.

have revealed that the physical disruption of *Microcystis* colonies, specifically the weakening of the sheath and extracellular polymeric substances (EPS), promotes the proliferation of protozoa and diatoms capable of producing or bioconcentrating ω-3 fatty acids. Notably, we discovered that the globally distributed diatom *Nitzschia* can penetrate *Microcystis* colonies via gliding motility when the sheath is sufficiently weakened and can subsequently proliferate within the sheath matrix (Hao et al., 2014, 2021). Furthermore, we found that bamboo substrates combined with blue LED illumination suppress *Microcystis* growth while selectively promoting *Nitzschia* dominance (Hao et al., 2022). Based on these insights, we have initiated joint Japan–China field trials to evaluate the creation of ω-3 producing ecosystems by integrating blue LED bamboo ecological reefs with the Jet-Shock method.

This approach begins with the controlled physical processing of overgrown *Microcystis* as a raw material, followed by the activation of ecosystem functions that enhance both the quality and quantity of fishery production. Ultimately, this system is expected to contribute to human health and well-being. The method represents a hybrid nature-based solution that integrates human technology with natural ecological functions. Moreover, by shifting from conventional cyano-bloom control to a human-technology-nature integrated Jet-Shock ecosystem activation approach, we aim to transform harmful cyano-blooms into **"ecosystem signals to services"**, driving a paradigm shift toward creating nature- and human-centred well-being (**Fig. 6**).

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EMERGING ISSUES

Climate Change and Water Quality Risks in Lakes and Reservoirs

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Lakes and reservoirs are important freshwater resources that also serve additional purposes, such as supporting fisheries and recreation and providing storage capacity to buffer communities from floods and droughts. Water stored in these systems may remain for long periods, ranging from months to decades, making them vulnerable to external inputs of nutrients, sediments, and other contaminants. As a result, lakes in many parts of the world are experiencing more frequent algal blooms and periods of low oxygen, which can degrade the quality of drinking water supplies, harm aquatic life, impede recreational activities, and increase the cost of treating raw water. In this article, we provide an overview of the myriad effects of climate change on these systems.

How Climate Change Affects Lakes

Almost all processes occurring within lakes, including water mixing, nutrient movement, organism growth, and contaminant behaviour, are affected by temperature. One of the most important changes involves stratification during warm weather, in which lakes separate into layers, with warmer, lighter water floating near the surface and colder, denser water sinking below. Prolonged warming can cause these layers to persist longer, isolating the deeper waters from the atmosphere and lowering their oxygen levels for longer durations. As oxygen levels decline, nutrients stored within sediments can be released back into the water. Additionally, seasonal mixing can redistribute trapped nitrogen and phosphorus compounds, as well as iron, manganese, and other substances within the lake. The release of nitrogen and phosphorus is of greater concern, as even small increases in their levels can promote algal growth. Climate change is also altering winter conditions, and in many regions, lakes are freezing later and thawing earlier than they once did. Shorter ice-cover periods can sustain biological activity for longer durations and alter seasonal mixing patterns. Although these effects vary geographically and temporally, the overall trend is shifting towards longer growing seasons and changing ecological conditions within lake ecosystems. Lastly, changes in rainfall patterns create additional pressures, with many regions reporting longer dry periods and more intense storm events. Droughts lower water levels and concentrate dissolved substances, while also causing shoreline sediments to dry and weather. When heavy rain occurs, large quantities of sediment, nutrients, pesticides, and other contaminants are rapidly washed into the receiving lakes, and a substantial proportion of a year's pollutant load may enter the system over a few days of runoff. This sudden influx can have a far greater effect on water quality than the gradual changes that occur throughout the rest of the year.

Chemical Threats

The chemical risks associated with climate change are often misunderstood, as the issue is not about the creation of new contaminants but about how climate change alters contaminant movement, accumulation, and transformation in lakes and reservoirs. Nutrients are often the first concern – phosphorus and nitrogen, either released from sediments or washed in during storms, can stimulate the growth of cyanobacteria, commonly known as blue-green algae. Some cyanobacterial species produce toxins that can affect people, livestock, pets, and wildlife, but even when toxin concentrations remain below health guidelines, blooms can create unpleasant tastes and odours, reduce recreational value, and require greater water treatment. We are increasingly becoming aware of new contaminants in

freshwater bodies. PFAS, often referred to as "forever chemicals", are highly persistent compounds that can enter lakes via runoff from contaminated soils, former industrial sites, and areas where firefighting foams were used. Heavy rainfall can also transport pesticides, pharmaceuticals, and other trace contaminants from surrounding catchments into lakes and reservoirs. Although their concentrations are low, concerns arise from the uncertainty about the long-term exposure and their combined effects. To complicate matters, climate change may be activating contaminants that were previously passive. For example, under low-oxygen conditions, naturally occurring microorganisms can convert inorganic mercury into methylmercury, a more toxic form. As small organisms that absorb these chemicals are consumed by larger organisms, contaminant concentrations can increase along the food chain, posing risks to wildlife and people who regularly consume fish and other aquatic organisms from these waters.

Microbiological Threats

Lakes and reservoirs receive microorganisms from multiple sources (e.g., wastewater discharges and agricultural runoff), yielding diverse microbial communities. Warming can lead to some microorganisms growing more rapidly, remaining active for longer periods, and persisting in areas where conditions were previously less favourable, causing a shift in which organisms dominate and how frequently they occur. For example, cyanobacteria are a natural part of many freshwater ecosystems, but warmer temperatures and elevated nutrient concentrations can selectively promote their proliferation, leading to dense blooms that reduce water clarity, degrade aquatic habitats, interfere with recreation, and increase treatment costs for drinking-water providers. Additionally, environmental variations influence the occurrence and abundance of potentially pathogenic microorganisms, such as *Vibrio*, *Aeromonas*, and *Legionella*, which can harbour antibiotic resistance genes, thereby conferring antibiotic resistance. Antimicrobial resistance is recognised globally as a growing public-health challenge, and freshwater bodies serve as reservoirs of antibiotic resistance genes. While warmer temperatures, higher nutrient levels, algal blooms, and periods of low oxygen influence the abundance, persistence, and transfer of antibiotic resistance genes in aquatic environments, several aspects of this phenomenon remain poorly understood and are the subject of active research.

Implications for Water Management

The greatest challenge for water managers is responding quickly to increased variability in water quality caused by heatwaves, algal blooms, storm events, or periods of low oxygen. These episodes develop quickly (often within days) and are also more difficult to predict using monitoring programmes designed around historical conditions. As a result, water authorities are placing greater emphasis on understanding biological processes, tracking emerging contaminants, and detecting changes before they become evident. Many of the resulting risks do not arise from entirely new contaminants or microorganisms but rather from changing environmental conditions that make existing contaminants, nutrients, and microbes more mobile, more abundant, or more difficult to control. The implication of these changes is that the future is likely to involve greater variability and less predictability.

MEMBER SPOTLIGHT



Madhukar Swayambhu (Country: India)

Q1. Please tell us about your professional journey and the key experiences that have shaped your career in the water sector.

Ans. My journey started in the year 2011, while working as a Vice President at India's second-largest network equipment manufacturing company "D-Link India Limited". For the next five years, I was doing academic research to understand the intricacies and interlinks of our environment, to visualise how ground water, soil, surface water, air and biodiversity were interlinked. Is contamination isolated in soil, water and air or is it a chain reaction? By 2016, we had a theoretical solution ready, to solve the crisis of lakes and ponds. The key difference in our approach vis-à-vis others was: we worked on the approach that waterbodies were "sick" not polluted. We don't need to "clean" them, but we need to "heal" them. Every waterbody is an "ecosystem services provider" not merely a pool or accumulation of water. From 2016 onwards, we (all three founders) left our IT jobs and started full-time in this new domain. While people laughed at us, we were out to do field experiments to perfect our technology. By 2019, we had done so much work that the Ministry of Jal Shakti, Government of India, recognised me amongst the first Water Heroes of the country. Starting our awards journey from there, this year we were named a Planet Hero by Earthday.org and IESA.

Q2. Looking back on your career, what accomplishment or project are you most proud of, and why?

Ans. While every award is an honour, every competition won is an achievement, every keynote speaking session or an invited guest lecture is an accomplishment, every membership of a global coalition is a triumph, every event we've been invited for to represent our country and present our perspective is an attainment, we still consider the biggest milestone we've achieved to be the impact we've been able to create, scientifically measured and documented.

We're proud to mention that since inception of our technology (NbS and EbA inventions), we've completed 80+ projects across Bharat (India) and over 10+ are ongoing as of today. These are spread over 30+ cities & towns, in 13 states of the country, restoring 100+ million litres of sewage back to usable water every day. We are saving and restoring over 370+ acres of waterbodies. Since 2022, every year we've been impacting the lives of 2+ million people, saving them from air pollution and associated diseases, water & vector-borne diseases by restoring the health of the waterbodies, wetlands and water channels. These projects also ensure recharging of over 100+ million litres of ground water every day of the year and conserving 50+ native species of biodiversity across all our projects.

Q3. What advice would you offer to the next generation of water professionals who are beginning their careers today?

Ans. For all the water professionals, my advice would be to understand the concept or the phenomenon of water first. People dealing with water don't even understand water very well. They take water as merely H_2O and take waterbodies as just a pool or accumulation point of water. Talking of the natural waterbodies, they are junctions of soil, water and air, between which constant exchanges take place, giving rise to the 'ecosystem services' that they provide to their vicinities. Just think about it, why would nature create the 1st land-locked waterbodies (lakes, ponds, rivers and rivulets), even though 73% of the planet is already covered by water? It is high time for humanity to understand and recognise them for their real purpose for which nature created them - as the 'ecosystem service provider'.

Q4. What do you see as the most significant challenges and opportunities facing lakes and reservoirs over the next decade, and how can our profession help address them?

Ans. A landmark global satellite study published in Science and tracking data from the United Nations Environment Programme (UNEP) provide the metrics that more than 53% of the world's largest lakes and reservoirs have significantly shrunk or dried up over the last three decades alone. A report published in The Guardian in May 2023, says "more than half of the world's lakes have shrunk in past 30 years only". According to UNEP, surface water bodies—including thousands of interconnected lakes—are shrinking or have disappeared entirely across 364 major basins worldwide. This directly impacts water security for nearly 2 billion people. Such data is scary, especially when the human population is rising. Thus, the most significant challenge is to first save our fresh water / sweet water natural infrastructure. We are losing them, not because of overuse, but because of our bad management.

Our profession, as water professionals / Waterpreneurs is to build the right awareness and make people (as in citizens, academia, civil societies, administration, political entities, media and all other sections of society) understand water and waterbodies better and change their behavioural pattern. All of them need to know that "a sick waterbody will only spread sickness all around, while a healthy waterbody spreads health". Don't save waterbodies, save yourself.

Q5. Over the course of your career, how have you seen lake and reservoir management evolve, and what role can the Lake and Reservoir Management Specialist Group play in advancing this field and supporting water professionals?

Ans. As the IWA Lake and Reservoir Management Specialist Group, we can have a four-pronged agenda. I call it the PEAR approach. Our key focus should be –

a) Policy advocacy: To make the policy-makers, policy-influencers and policy-implementers understand the waterbodies are 'ecosystem services providers' and should be recognized and dealt with in the same manner.

b) Educate: make the academia aware of the need to first complete the water cycle. The water cycle being taught in the schools is a half-truth, as if groundwater, lakes and ponds played no role in that cycle.

c) Awareness: Through events, symposiums and webinars, we need to make people realise that if every space mission in every celestial body is searching for the existence of water; the key reason is without water, there's no possibility of life. And the same is applicable to our home planet too.

d) Research: Either we should research ourselves, or we should fund research or arrange funding for research or support / publish research being done on water (both above and below surface), lakes, and ponds. And it shouldn't be restricted to only environmental science, it should be all possible streams from sociology to anthropology to climatology to archaeology to genealogy to microbiology to agronomy to speleology to even human psychology and many more. All are directly or indirectly affected by water.

About the member

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Ali Reza Shahvaran (Country: Canada)



Q1. Please tell us a little about yourself and your current role, studies, or area of interest in the water sector.

Ans. I first got into civil engineering because of my older brother, who is a structural engineer. My interest in water began in Iran, during my undergraduate studies, when I took courses in hydraulics and hydrology. Our department had an advanced open-channel hydraulics lab, and it was fascinating to watch scale models of hydraulic structures and see how water behaves under different flow regimes. That's when I decided to build my career in water. Today, I'm a first-year PhD student in Civil Engineering at the University of Toronto, working with Prof. Mohammed Basheer in the Water Resources and Hydrology Research Group. My research asks whether Canada's net-zero electricity plans still hold up once water is treated as a limited resource. Hydropower supplies more than half of Canada's electricity, yet most energy-system models assume the water will always be there. Before coming to Toronto, I completed an MSc in Earth Sciences (Water) at the University of Waterloo, where I used satellite imagery to monitor water quality in Lake Ontario, and then spent two years as a research assistant in Waterloo's Ecohydrology Research Group.

Q2. What has been one of the most rewarding experiences, achievements, or learning opportunities in your career so far?

Ans. One of the most rewarding parts of my PhD so far has been learning to operate remotely controlled drones and boats for aquatic monitoring. Our lab uses them to collect hydrologic and hydraulic data, such as flow velocity, discharge and bathymetry, so I trained for and earned my advanced drone pilot certificate from Transport Canada. It's really satisfying to have these hands-on operating skills. Another recent highlight was a water-focused startup competition, where I teamed up with students from the University of Toronto and McGill University. Water brought together people from engineering, business and geography, and our team made it to the semi-finals. Working closely with MBA and geography students, and seeing a water problem through their eyes, was a great experience.

Q3. How has your involvement with IWA or other professional networks contributed to your professional development and career growth?

Ans. I joined IWA earlier this year, and this invitation is a good example of how open the network is to early-career members. Before that, professional networks had already shaped my path in practical ways. As a master's student, presenting my research at international conferences gave me early feedback and the confidence to share my work with a wider audience, and a young professionals travel grant helped me connect with peers and mentors outside my own institution. Through IWA, I'm looking forward to learning from the people who actually manage lakes and reservoirs every day.

Q4. Looking ahead, what emerging challenge or opportunity in lake and reservoir management are you most excited to work on in the future?

Ans. What excites me most is the connection between water and energy. Lakes and reservoirs sit at the centre of the water-energy nexus: the same water that supplies cities, farms and ecosystems also generates hydropower, stores energy through pumped storage, and cools power plants. As countries work toward net-zero, they will lean more on reservoirs to balance wind and solar power, just as climate change makes inflows harder to predict. Yet water and energy are still often planned and managed separately. I'd like to help build a more holistic, systems view that links hydrology, water conveyance and reservoir operations with how energy is generated, stored and distributed. Managing the two together is

key to using our resources sustainably, protecting the health of our lakes and reservoirs, and advancing the Sustainable Development Goals on clean water, clean energy and climate action.

Q5. How can the Lake and Reservoir Management Specialist Group better support young professionals, and what activities or initiatives would you like to see in the future?

Ans. The initiative I'd most like to see is a mentorship programme that pairs young professionals with experienced members whose careers extend beyond academia, into industry, utilities or government. Many of us trained mainly in research settings and rarely see how lake and reservoir management decisions are actually made, or what careers in those sectors look like. A mentor with that kind of experience is something I would have really valued when I was starting out. The group could also offer regular chances for young professionals to present, such as a short webinar or lightning-talk series, and hands-on activities like a data challenge built around a real lake or reservoir problem. Finally, travel support or reduced fees for Specialist Group events would help more young professionals, especially those from lower-income countries, take part.

About the member

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Profiles: X | LinkedIn | Google Scholar | ResearchGate | ORCID | GitHub

EVENTS & OPPORTUNITIES

CONFERENCES

11th IWA Conference on Odours and Air Emissions

2–5 November 2026 | Malaysia
Focus: Odour management, air emissions, environmental impacts and control

Digital Water Summit 2026

24–26 November 2026 | Istanbul, Turkey
Focus: Digital transformation, digital technologies and smart water systems

23rd IWA International Conference on Diffuse Pollution & Eutrophication (DIPCON 2026)

24–27 November 2026 | Austria
Focus: Diffuse pollution, nutrients, eutrophication, emerging contaminants, agriculture, NBS and climate–biodiversity nexus

SCED 2026 – 2nd IWA International Conference on Sustainable Coastal and Estuarine Development

26–28 November 2026 | Chennai, India
Focus: Sustainable coastal and estuarine water management.

The 3rd IWA Conference on Sustainable Natural and Engineered Water Systems Management

13–15 December 2026 | Morocco
Focus: Water sustainability, climate resilience, reuse, circular economy, emerging contaminants, advanced treatment and resource recovery.

IWA Global Sanitation Summit

25–27 January 2027 | Cape Town, South Africa
Focus: The Future of Sanitation: Decentralised, Water-Efficient, Scalable.

IWA Global Utilities Summit 2027

6–8 April 2027 | Hong Kong
Focus: Utility leadership, resilience, finance, AI/digital transformation, climate adaptation, circular economy and future skills.

Young Water Professionals DACH Conference 2027 (YWPDACH27)

12–14 May 2027 | Dübendorf, Switzerland
Focus: Young-water-professional research, innovation, networking and professional development.

Watermatex 2027 – 12th IWA Symposium on Modelling and Integrated Assessment

16–20 May 2027 | Sète, France
Focus: Water and wastewater modelling, process modelling and decision support.

LET 2027 – 21st Leading Edge Conference on Water and Wastewater Technologies

24–28 May 2027 | Ghent, Belgium
Focus: Emerging and leading-edge water and wastewater technologies. (Call for papers currently open.)

23rd Health-Related Water Microbiology Conference (WaterMicro27)

30 May – 3 June 2027 | San José, Costa Rica
Focus: Water microbiology, pathogens, public health and water safety.

The 17th International Conference on Urban Drainage (ICUD 2027)

6–11 June 2027 | Ningbo, China
Focus: Urban drainage, stormwater, flood management and resilient urban water systems

7th IWA Resource Recovery Conference 2027

7–11 June 2027 | Santiago de Compostela, Spain
Focus: Circular value chains, resource recovery, wastewater-to-resource approaches. (Abstract submission deadline: 30 November 2026.)

8th IWA International Conference on Ecotechnologies for Wastewater Treatment

28 June – 2 July 2027 | Istanbul, Turkey
Focus: Ecotechnology innovations for urban and industrial wastewater treatment.

IWA LWWTP 2027 – 15th Specialised Conference on Design, Operation and Economics of Large Wastewater Treatment Plants

12–16 September 2027 | Vienna, Austria
Focus: WWTP design, operation, economics, energy efficiency, sludge, reuse and resource recovery.

11th IWA-ASPIRE Conference & Exhibition

25–30 October 2027 | Manila, Philippines
Focus: Water-sector innovation, resilience, sustainability and regional water challenges.

15th IWA International Conference on Water Reclamation & Reuse 2027

21–24 November 2027 | Sydney, Australia
Focus: Water reclamation, reuse, treatment technologies and water security.

IWA Conference on Water and Environment: Technology, Sustainability, and Heritage

21–23 March 2028 | Patras, Greece
Focus: Advances in water technologies, environmental sustainability, and the preservation of water heritage.

WEBINARS

Making Sense of Sensor Calibration Metadata

21 October 2026 | 60 min | Free
Hosted by the IWA Instrumentation, Control and Automation Specialist Group.

Digital and Smart Control of Wastewater Treatment Plants: China's Practice and the Road Ahead

22 October 2026 | 100 min | Free
Hosted by the IWA Digital Water Programme China Subgroup.

Water Disinfection: Are We Regulating the Right Disinfection By-Products?

27 October 2026 | 90 min | Free
Hosted by the IWA Disinfection Specialist Group.

Microplastic Pollution in Water Systems and their Management

30 October 2026 | 60 min | Free
Hosted by the IWA Specialist Groups on Environmental Engineering Education and on Diffuse Pollution and Eutrophication.

IWA Members Induction & Engagement - Session 2

14 December 2026 | 60 min | Free
General member orientation webinar.

SHORT COURSES

PFAS - Persistent Micropollutants in the Water Cycle

Starts 14 October 2026 | Delft University of Technology | online | 6 weeks.

Aerobic Granular Sludge Technology for Wastewater Treatment

Starts 21 October 2026 | Delft University of Technology | online | 7 weeks.

Water and Sanitation Sector Governance and Reforms Leadership Programme (1st Edition)

Starts 26 October 2026 | Lisbon International Centre for Water (LIS-Water) | in person | 3 days.

Drinking Water Treatment Principles

Starts 26 October 2026 | Cranfield University | in person | 2 days.

Wastewater Treatment Principles

Starts 28 October 2026 | Cranfield University | in person | 2 days.

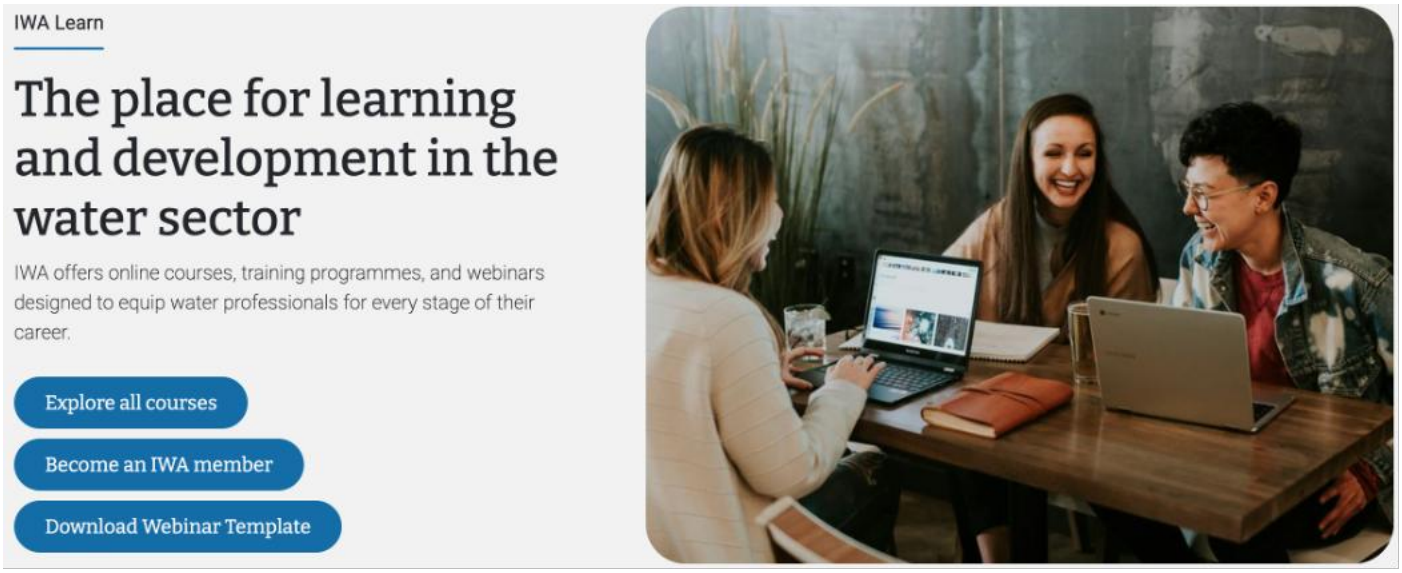
High-Rate Anaerobic Wastewater Treatment

Starts 24 March 2027 | Delft University of Technology | online | 6 weeks.

IWA LEARN
The place for learning & professional development in the water sector

Professionals in the water sector require continuous development to be able to keep abreast of the changing environmental circumstances. Whatever stage of your career you are at, IWA provides you with guidance and opportunities to build up the competences required to succeed. This includes a set of tools on how to develop your career, as well as opportunities for professional development, learning, training and networking.

To learn more, visit the IWA Learn platform: https://iwa-network.org/iwa-learn/



BECOME A MEMBER OF LAKE AND RESERVOIR MANAGEMENT SG

The IWA Specialist Group on Lake and Reservoir Management brings together expertise from regions where lake and reservoir management knowledge is rapidly advancing and regions where this expertise is most needed.

For IWA members, who already have a Connect Plus login, please go to Community https://www.iwaconnectplus.org/community/groups and click the “View Group” button for the group you are interested in, then simply click the “Join” button at the top right.

If you are not yet an IWA member, please register to join IWA by visiting https://www.iwaconnectplus.org/landing-page and then follow the link above to join the LRM SG group.

BECOME A COMMITTEE MEMBER OF LAKE AND RESERVOIR MANAGEMENT SG

Would you like to join the LRM Committee and help shape our activities? Stay tuned for the next call for nominations.

Connect to the world’s leading water professionals
Be part of our network today | www.iwa-connect.org
IWA
the international water association

WRITE TO LAKE AND RESERVOIR MANAGEMENT SG

The Newsletter is an opportunity to share information: points of view; policy developments; research; activities and events; worldwide. If you have an interesting project, comments, or are planning a conference or workshop, send it to us, including a contact person for more information. We also have a LinkedIn webpage (IWA Lake and Reservoir Management). This is another option to share information with LRM.

- **Martin**, Nancy Co-Chair

  Email: Nancy.Martin@calgary.ca

- **Cinque**, Kath Co-Chair

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Scan this QR code to visit our LinkedIn page. Please ensure you are logged in to LinkedIn on your device before scanning, or search for "IWA Lake and Reservoir Management" in the LinkedIn Groups search.

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