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WEPA | Water Environment Partnership in Asia (WEPA) Fourth Phase Final Report





WEPA

Water Environment
Partnership in Asia (WEPA)

Fourth Phase Final Report

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Preface

Asia is one of the most important regions for the global economy. The region saw economic growth of about 5.5% from 2018 to 2019, along with major progress in industrialization and urbanization. The COVID-19 pandemic, which began in 2019, hampered the global economy, and according to World Bank, average GDP growth was -3.1% in 2020. By 2022, global growth had recovered to 3.1%. The Water Environment Partnership in Asia (WEPA) was initiated in 2004 by the Ministry of the Environment, Japan to strengthen water environment management in the Asian region and is made up of 13 partner countries. Out of these, eight countries —Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, and Viet Nam—are also ASEAN member countries. These countries experienced an average GDP growth of 5.4% in 2022, showing a higher recovery than the global economy.

The population of the WEPA partner countries accounted for 29% of the world's population in 2022, with many people living in urban areas. Economic development and an increase in the regional population have led to increased discharges of industrial and domestic wastewater, placing a heavy burden on the water environment in the region. Addressing this problem requires appropriate wastewater management.

The 2030 Agenda for Sustainable Development, including its 17 Sustainable Development Goals (SDGs), was adopted by the UN member states in 2015. SDG6 aims to improve water quality through wastewater treatment, implement integrated water resources management, and protect and restore water-related ecosystems. The progress report on SDG6 published by the United Nations in 2021 stated that approximately 35% of domestic wastewater was discharged without proper treatment in the East and Southeast Asia region. However, the report also indicated that the percentage of this untreated water varies widely among countries in the region, from less than 10% to over 75%. The deterioration of the water environment is affecting our water use and ecosystems, and considering the impacts of climate change on water resources in the future, the water environment management is one of the most urgent issues in many countries.

Once a water environment has been polluted, it takes a huge amount of time and money to restore it. Furthermore, water environment governance requires the involvement of government officials from all levels of government and multisector stakeholders. It is also essential to gain the cooperation of a diverse range of actors across society. Under such a complicated governance framework, central government officials play an important role as they have the primary responsibility for formulating and implementing water environment management policies. It is vital

to improve their capacity to establish a good water environment governance framework. For this reason, since the first phase, WEPA has been promoting knowledge sharing through a platform that includes a network of policymakers and a database on the water environment, in order to establish a governance framework and implement the necessary water environment management to conserve water resources in the partner countries.

Through WEPA Action Programs, which began in the third phase, we have further strengthened our support to the partner countries to address water environment issues in their respective countries. In the fourth phase, which began in 2019, the WEPA Action Program was implemented in Myanmar, Cambodia and Lao PDR, aiming to establish autonomous and appropriate water environment governance through the PDCA cycle. This involves understanding the current situation, identifying pollution sources, and formulating, implementing and evaluating policies. The aim is to ensure compliance with regulations that are essential for water environment management.

This year marks the end of the fourth phase of the WEPA project and is also the 20th anniversary of the establishment of WEPA. As we look back on our past activities, I hope that we can use our achievements, experiences and evaluations over the past 20 years, and ensure that WEPA continues to evolve, thereby further strengthening and improving water environment governance and management in the Asian region.

March 2024

Mitsumasa Okada

Chairperson of the WEPA Advisory Board

Message from the Ministry of the Environment, Japan

The Water Environment Partnership in Asia (WEPA) was launched in 2004 under an initiative of the Ministry of the Environment, Japan, as it was realized that developing better water environment governance was essential to solve water environment problems in the Asian region.

Each WEPA project phase is set for five years. During the first phase (FY2004-2008), WEPA established a human resource network of government officials involved in water environment management in the Asian region. In addition, we developed an information database on the water environment of the partner countries. In the second phase (FY2009-2013), through workshops and bilateral meetings, we encouraged information and knowledge-sharing to explore solutions to regional priorities such as “domestic wastewater management” and “climate change and water environment.” In the third phase (FY2014-2018), based on the information and knowledge-sharing platform, we implemented the WEPA Action Program (AP) scheme, to support partner countries to solve their water environment issues under collaboration. Following this, the fourth phase (FY2019-2023) started focusing on “compliance with regulations.” The objectives were to analyze governance framework for domestic and industrial wastewater and to provide support to establish soft infrastructures in each country.

The purpose of this report is to introduce the activities implemented by WEPA and present the results we have obtained in the fourth phase. The report is also an opportunity to reflect on WEPA’s activities over the past two decades, as 2024 marks the 20th anniversary of WEPA.

First, as a review of the past 20 years, we have included a summary of past activities, as well as policy revisions in the partner countries. Next, we give a

summary of the Action Programs completed in the third phase and investigated how the programs supported the partner countries to solve issues and develop the capacity of government officials. Following this, we present an outline and results of APs during the fourth phase in Cambodia (capacity building of administrative officers on understanding the pollution load in Tonle Sap Lake), Myanmar (development of national surface water quality standards), and Lao PDR (development of legal systems and guidelines for sewage treatment).

We conclude the report with issues on water environmental governance in partner countries, expectations and suggestions by FPs, and messages from WEPA Advisor Dr. Motoyuki Suzuki and WEPA Focal Points, Dr. Vicente B. Tuddao, Jr., Director, Department of Environment and Natural Resources, and Dr. Ratnayake Mudiyansele Sanjaya Kumara Ratnayake, Deputy Director General, Environment Protection Division, Central Environmental Authority, Sri Lanka, who have long been involved in WEPA.

Last but not least, we would like to express our gratitude to our partners for their great contribution to the publication of this report and their support over the last 20 years of WEPA activities from the first to the fourth phases.

It is our sincere hope that many more people will become interested in WEPA’s activities through this report.

March 2024

Seiji Tsutsui

Director, Environmental Management Division,
Environmental Management Bureau,
Ministry of the Environment, Japan

1

Water Environment Partnership in Asia (WEPA)

The Water Environment Partnership in Asia (WEPA) was launched to improve water environment in Asia by strengthening governance and public administration related to the water environment through sharing knowledge and experiences. The partnership aims to raise the well-being of people and conserve aquatic ecosystems.

WEPA FACTS

When did it start?

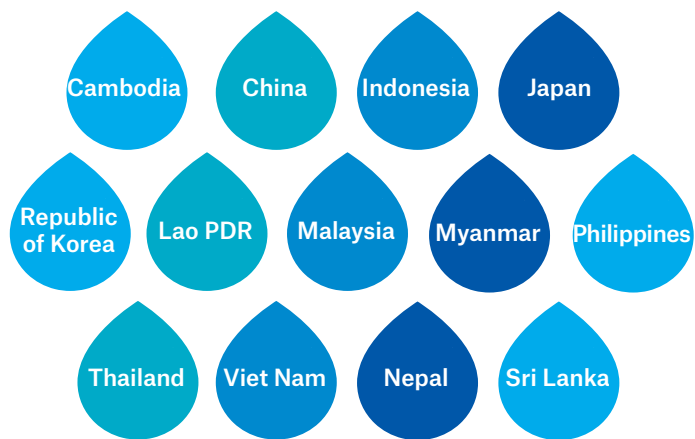
WEPA was proposed by the Ministry of the Environment, Japan, at the 3rd World Water Forum held in Kyoto, Shiga and Osaka in 2003, and was launched in 2004. WEPA follows a 5-year cycle, and the fourth phase started in April 2019.

- 2004 The First Phase
- 2009 The Second Phase
- 2014 The Third Phase
- 2019 The Fourth Phase

Who are the partner countries?

Currently, WEPA comprises 13 Asian countries. Eleven partners—Cambodia, China, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, and Viet Nam—joined in the first phase, and two partners—Nepal and Sri Lanka—joined in the second phase. Each partner country appoints a Focal Point who actively participates in and facilitates WEPA activities in the partner countries.

13 Asian Countries



How is it governed?

The plan of activities under WEPA is discussed and endorsed at the WEPA Annual Meeting. According to the plan, the WEPA Secretariat implements activities in close collaboration with partner countries.



What is the mission of WEPA?

Based on partnerships between policymakers and relevant stakeholders in Asia, especially through those of WEPA Focal Points, WEPA makes efforts to:

- enhance capacity for problem identification, policy planning and implementation, monitoring, as well as evaluation of central government officials, mainly via the WEPA Focal Points, through sharing knowledge and organizing dialogue on water environmental management in the partner countries
- identify critical water environmental issues and institutional issues for management thereof, support such efforts in resolving them, and share the lessons learnt from these activities with WEPA partner countries and related stakeholders
- enhance cooperation within WEPA partner countries and with international organizations and donor agencies to resolve existing water environmental issues and to improve water environmental governance



WEPA website and database

—an information platform for water environmental management

Developed in collaboration with the partner countries, the WEPA database stores information on the status of the water environment, related policies, and water management practices, as well as links to other resources in the partner countries. The WEPA website was developed during the first phase, and it was renewed in March 2023. Information from the former database can be found in the Archives on the new website. The website also stores the bulk of WEPA meeting presentation material and publications.



WEPA Action Programs

To promote concrete actions for improving water governance in each country, a new scheme to implement “WEPA Action Programs” was introduced in the third phase. The WEPA Action Program scheme sets out actions to resolve specific problems on water governance in partner countries, with support provided by WEPA. Practical lessons learnt from the programs are shared with other WEPA partner countries.

Over two phases, six action programs were implemented to address various water environment related issues in partner countries.



WEPA Outlook on Water Environmental Management in Asia

Considering the importance of a common understanding among stakeholders to solve water quality issues in the region, the “WEPA Outlook on Water Environmental Management” has periodically been published. The Outlook is prepared based on accumulated information and knowledge, using the human resources network developed under this initiative. It aims to provide the most up-to-date and useful information on the water environment and its management in Asia.

2

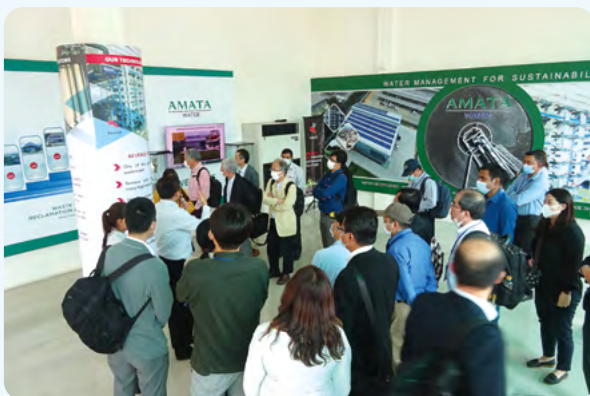
Summary of the Fourth Phase of WEPA

FY2019

Year	Month	Event
2019	Dec	Bilateral Meeting with Cambodia (Phnom Penh, Cambodia)
2020	Feb	15th Annual Meeting and International Workshop (Bangkok, Thailand)
Others		<ul style="list-style-type: none"> Implemented WEPA Action Program (AP) "Pollution Load Management in Citarum River, Indonesia" (Continued from the 3rd phase) Developing WEPA AP in Cambodia Conducted a survey on water environment governance updates

FY2020

Year	Month	Event
2021	Mar	16th Annual Meeting and International Workshop (Online)
Others		<ul style="list-style-type: none"> Implemented follow-up activities for the WEPA AP on Pollution Load Management in Indonesia Planned to implement WEPA AP in Cambodia (Continued) Developing WEPA AP in Myanmar



Site visit at the 15th Annual Meeting and International Workshop (February 2020)



Site visit at the 19th Annual Meeting and International Workshop (January 2024)

FY2021

Year	Month	Event
2022	Mar	9th World Water Forum (Dakar, Senegal) <ul style="list-style-type: none"> • Participated in Setting up an Action Group on Water Quality Improvement • Exhibited WEPA's Activity in Japan's booth
Others		<ul style="list-style-type: none"> • Conducted WEPA Action Program on Identifying Major Pollution Sources in Tonle Sap Lake in Cambodia • Conducted WEPA Action Program on Establishing Surface Water Quality Standards in Myanmar (Continued) • Conducted WEPA Action Program on Development of an Appropriate Domestic Wastewater Management System in Lao PDR • Published WEPA Outlook on Water Environmental Management in Asia 2021

FY2022

Year	Month	Event
2022	Apr	17th Annual Meeting (Kumamoto, Japan Online (Hybrid)) <hr/> 4th Asia-Pacific Water Summit in Kumamoto, Japan <ul style="list-style-type: none"> • Participated in Parallel Thematic Session No.5, entitled "Toward the realization of appropriate wastewater management to contribute to sustainable development"
2023	Feb	18th Annual Meeting and International Workshop (Siem Reap, Cambodia Online (Hybrid))
Others		<ul style="list-style-type: none"> • Conducted WEPA Action Program on Identifying Major Pollution Sources in Tonle Sap Lake in Cambodia (Continued) • Conducted WEPA Action Program on Development of an Appropriate Domestic Wastewater Management System in Lao PDR (Continued) • Conducted WEPA Action Program on Establishing Surface Water Quality Standards in Myanmar (Continued) • Conducted a survey on water environmental governance

FY2023

Year	Month	Event
2024	Jan	19th Annual Meeting and International Workshop (Hayama, Japan Online (Hybrid))
Others		<ul style="list-style-type: none"> • Conducted WEPA Action Program on Development of an Appropriate Domestic Wastewater Management System in Lao PDR (Continued) • Published WEPA 4th Fourthp Phase Final Report

3

Looking back at 20 years of WEPA

3.1. Overview

Asian countries continue to face serious water pollution problems, leading to degradation of the living environment, decrease in available water, and loss of aquatic ecosystem services. Recognizing the critical situation of water quality in Asia, the Water Environment Partnership in Asia (WEPA) was proposed by the Ministry of the Environment, Japan at the 3rd World Water Forum in 2003. Formed in 2004, WEPA aims to strengthen water environmental governance in Asia through the collection and dissemination of information, and the capacity development of relevant stakeholders, in partnership with 13 partner countries in the region, namely Cambodia, China, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Myanmar, Nepal, the Philippines, Sri Lanka, Thailand, and Viet Nam. Deterioration of water quality is one of the most pressing environmental problems threatening human health and sound economic development in WEPA countries. It remains a critical problem in many WEPA partner countries despite significant progress made by these countries.

WEPA as a partnership allows partner countries to discuss their experiences and identify potential solutions to improve the water environment. Over the last 20 years, the partner countries have significantly advanced the development of their own policies, environmental laws, and acts, and formulated guidelines, regulations, and directives. They have issued ambient water quality and effluent standards, and implemented measures to combat the growing threat of water pollution in critical areas, as well as working to avoid future pollution risks in other areas. However, institutions for monitoring, evaluating, and regulating ambient water quality and effluents among WEPA partner countries are in different stages of development and implementation. Evaluating environmental status quo and conducting Environmental Impact Assessment

(EIA) are basic and established practices in most WEPA countries, particularly in terms of industrial and development activities, and these are ways to avert any potential high environmental impact and pollution of water environment. Currently, there is a robust monitoring framework supported by information and communication technology, and many partner countries have adopted automatic monitoring stations, although not at full scale in all countries. These achievements are truly inspirational when compared to the state of water environment in those early days of WEPA.

Over the last 20 years, the environmental and developmental context has also changed significantly as Asia has taken center stage in terms of dynamic economic growth. The size of the economy in each partner country has expanded impressively, along with the capacity to deal with pollution, wastewater treatment, and to address the effects of environmental changes on water security. The Millennium Development Goals (MDGs) (2000-2015) and the Sustainable Development Goals (SDGs) (2015-2030) are two major initiatives at the global level during this period that have tremendously shaped the discourse of water management, including for WEPA. Establishment of WEPA itself happened just four years after the inception of the MDGs, which included a goal on environmental sustainability that aimed to address safe water supply and sanitation as a major target in MDG7. A similar target has become the main focus of SDG6, the goal for clean water and sanitation for all. The WEPA database was developed in collaboration with the partner countries during the first phase of WEPA (2004-2008) and it contains comprehensive information on related policies, technologies, NGO and CBO activities, as well as links to useful resources including the bulk of WEPA activities and publications. The WEPA database of the 13 partner countries has been a vital source of information on water environment that is critical for

assessing the status of both MDGs and SDGs. The database also opened a new window for sharing information among the stakeholders on water environment, and helped to build a strong human network, including policymakers, experts, and practitioners dealing with water environmental management in the Asian region.

Beyond the database, in the second phase (2009-2014), WEPA promoted information and knowledge-sharing in two key priority areas—domestic wastewater treatment, and impacts of climate change on the water environment—to find feasible solutions. WEPA started sharing regular updates on water environment management by organizing regular meetings such as the annual meeting, carrying out questionnaire surveys, and conducting expert interviews. WEPA initiated more focused discussion to foster deeper exchange of information and find solutions on the two priority areas. To bolster information exchange between partner countries with similar policy interests and challenges, workshops were organized covering discussions on policy, technologies, and practices as well as site visits on these priority areas. Through close communication between the partner countries, WEPA also responded by providing support on industrial wastewater management (particularly, enforcement and implementation of pollution control measures) which remains a common management issue among the partner countries. In the process, WEPA promoted its close collaboration with organizations and initiatives, by holding training sessions on water environmental governance in Japan, collaborating with the Network of Asian River Basin Organizations (NARBO) secretariat to share their activities during WEPA International Workshops and Annual Meetings, and also organized several events including side events at the World Water Forum, Asia-Pacific Water Summit, and the IWA-ASPIRE Conference and Exhibition in Tokyo. Furthermore, WEPA launched the publication of its flagship report “WEPA Environmental Outlooks” which provides the most up-to-date and useful information on the state of water environment, its management, progresses and initiatives, and challenges in the 13 partner countries in Asia, with a target audience of policymakers, experts, and others in the

water sector of the region. Outlook 2009 and 2012 were published during the second phase. In Outlook 2009, unclear demarcations of responsibility between different levels of government and insufficient capacity of staff responsible for water environmental management were identified as challenges. In addition, conducting regular water quality monitoring and implementing proper operation and management (O&M) of wastewater treatment facilities were major issues in some partner countries. Considering water quality and quantity issues simultaneously as well as raising awareness to promote law enforcement were challenges for many countries. In Outlook 2012, in addition to the issues mentioned in the previous outlook, organic pollution in rivers traversing through populated areas, eutrophication in closed water bodies, and issues related to domestic wastewater particularly “grey water” management were raised as problems in the partner countries.

In the third phase (2014-2019), WEPA continued the exchange of information and experiences through workshops, bilateral dialogues, and participation in important forums, as well as bringing out key publications. Additionally, the “WEPA Action Program” (AP) scheme was launched based on requests from WEPA partner countries to resolve specific problems in the water environment. The action programs were developed and implemented by WEPA partner countries and in the process, they shared knowledge, experience, and lessons with other partner countries. APs were designed by considering the needs, sustainability, relevance/lessons for all partner countries, and feasibility (completion and generation of output/impacts). The first AP was implemented in Viet Nam to determine the pollution load in wastewater generated from pig farms. Results from the study were utilized in the establishment of an effluent standard for livestock wastewater (QVCN622016/BTNMT). The second AP was implemented in Sri Lanka to develop and improve policies related to industrial settings and waste/wastewater disposal to prevent groundwater pollution. At the final workshop for the AP in Sri Lanka, findings were shared with all stakeholders, and the Central Environmental Authority used these findings in the development of wastewater discharge standards for these point sources. The

standards have been already published and disseminated to all stakeholders. Practical lessons learned and knowledge accumulated from the action programs are shared not only among partner countries but also with a wider audience through open access WEPA databases. WEPA has significantly strengthened interactions with other like-minded networks, international organizations, and donor agencies to explore opportunities to maximize the impacts of WEPA activities. During this phase, the WEPA Outlook was published in 2015 and 2018. Issues such as climate change, pollution source and loads, financial sustainability in wastewater and sludge management, and inclusiveness were mentioned in Outlook 2015. Subsequently, issues including water reuse and recovery of useful by-products, and selection of wastewater treatment technologies accounting for natural and socioeconomic conditions and development level, were considered in Outlook 2018.

During the fourth phase (2019-2024), regular programs continued, including the implementation of new APs in Cambodia, Lao PDR, and Myanmar, in addition to the program in Indonesia that was started in the third phase. The WEPA Outlook 2021 was also published. The AP in Indonesia was implemented at the end of the third phase to improve the water quality of the Citarum River and this program was completed in the fourth phase. The program provided opportunities to government officers in Indonesia to obtain key knowledge to bolster their respective actions for improving the water quality of the Citarum River, such as determining the load or quality and quantity of pollutants to allocate to each sector or industry. The AP in Myanmar was implemented to support the establishment of National Surface Water Quality Standards (NSWQS). The program ended in FY2022, and the final version of NSWQS went through the public review in October 2023, just one step before submitting the standards to the National Standard Council for their approval. The AP in Lao PDR started in FY2022 aiming to address domestic wastewater management. By utilizing baseline water quality data collected through field surveys, the program aimed to develop training materials for O&M of septic tanks and decentralized wastewater treatment systems. The Lao Ministry of

Natural Resources and Environment (MONRE) further plans to develop national guidelines based on the output from the AP. During the fourth phase, Outlook 2021 was published. The key challenges discussed in this latest outlook were selecting and customizing water management solutions or wastewater treatment technologies based on the local environmental contexts, socio-economic conditions, and data availability on water quality. It also looked at the need for technical innovation to improve wastewater treatment efficiency, and how to formulate policies based on scientific evidence, financial sustainability in wastewater and sludge management. Inclusiveness of diversified stakeholders in management, and compliance with laws and regulations were also mentioned in Outlook 2021. The WEPA database also got a new look with a focus on enhancing accessibility and navigation for users. The fourth phase was marked by the COVID-19 pandemic that grew into a global health crisis with cascading implications to economies, societies, and the water environment. Safe and accessible water was a life-saving commodity that was used for drinking, cooking, washing, and sanitation, among countless other uses required to fight the pandemic. The pandemic heightened the importance of a clean and healthy water environment, which is critical for public health.

Universal access to clean, safe, and adequate freshwater, improved sanitation and safe wastewater treatment is crucial for human well-being, minimizing any detrimental impacts on human health, and is required for healthy ecosystems. Asia has seen rapid population growth, urbanization, and industrialization along with changing lifestyles, including shifting diets toward highly water-intensive foods such as meat. The region has also been hit by the severe impacts of climate change which have serious implications for the water environment and for the achievement of the sustainable development agenda. How to develop appropriate infrastructure and improve water environment governance is still a major challenge. As a result, unabated discharge of untreated wastewater and pollutants and deterioration of water quality across the region is still a serious problem. WEPA will continue to strive to provide better management solutions and cross-learning among the partner

countries as well as in the wider community. Some key areas that could be relevant are: exploring the nexus of water-food-health-climate; promoting a circular approach to water quality and wastewater management; improving the monitoring and collection of reliable and timely data for decision-making including the use of hydrological simulations, digital tools for big data mining, and modern advances in sensors and information technologies; and carrying out scenario analysis for answering what-if questions for the decision-makers. Backed by the necessary infrastructure, tools and technologies, WEPA countries will be able to use scientific evidence-based knowledge in formulating effective water quality legislative frameworks to implement policies and regulations, to enhance human and institutional capacity, and to influence political will to enforce regulations and penalties.

3.2. Reviewing Action Programs in the third phase

The WEPA action program (AP) scheme is one of the key activities of WEPA. These action programs aim to conduct a stock take of emerging issues related to the water environment in partner countries and take collaborative/integrative actions to co-design and co-deliver sustainable solutions. These solutions will cover strategies on all technical, institutional, and governance fronts. APs were introduced in the third phase of WEPA to address issues and take actions in each partner country to improve water governance. Each program is developed by a partner country (beneficiary) that needs to address water environment issues, and WEPA provides supports to the beneficiary, considering the following aspects:

- Needs of the country
- Feasibility
- Sustainability of the actions
- Replicability in the other areas and countries

Each program is implemented by the beneficiary, supported by experts from the WEPA partner countries including Japan and the WEPA Secretariat. The WEPA Secretariat also supports the coordination between the beneficiary and experts as well as providing

funding for activities. Practical lessons learned through implementation and outputs are shared with other WEPA partner countries. In the third phase, three action programs were implemented: Viet Nam from 2014 to 2017, Sri Lanka from 2015 to 2019, and Indonesia from 2018 to 2020. This section presents summaries of these action programs. Action programs implemented in the fourth phase are briefly introduced in the following section.

Summary of WEPA Action Programs Implemented in the third phase

WEPA implemented the first action program (a) “Waste and Wastewater Management of Pig Farms” in Viet Nam, the second one (b) “Groundwater Monitoring for Industrial Effluent Management” in Sri Lanka, and the third one (c) “Pollution Load Management in the Citarum River” in Indonesia. Table 1 shows the objectives and outcomes of these three action programs. In (a), the program provided support to estimate the pollution load units from swine wastewater. This AP acted as a catalyst for the government in Viet Nam to establish effluent standards for livestock wastewater in 2016. In (b), the program worked on developing and improving policies and guidelines related to industrial sites and waste disposal to prevent groundwater pollution. The water quality of groundwater from 96 wells were measured over four seasons, and several wells located near industrial sites showed correlations between distance from the industry and the concentration of different contaminants. The results were used to develop wastewater discharge standards for on-land discharge in Sri Lanka. In (c), the program assisted in the development of guidelines on implementing Total Maximum Daily Loads (TMDL) to improve the water quality of the Citarum River. The Ministerial Decree on TMDL has been drafted by Indonesia but has not yet been enforced.

Table 1. Objectives and outcomes of action programs

Country	Title of Action Program	Objectives	Outcomes
(a) Viet Nam	Waste and Wastewater Management of Pig Farms	To determine pollution load units in pig wastewater in Viet Nam	Establishment of effluent standards for the livestock industry
(b) Sri Lanka	Improving Industrial Waste and Wastewater Management in Gampaha District	To develop/improve policy/guidelines related to industrial siting and waste/wastewater disposal to prevent groundwater pollution	Development of wastewater discharge standards for on-land discharge
(c) Indonesia	Application of Total Maximum Daily Loads (TMDLs) for Effluent Discharge Permit and Capacity Building for Local Officials to Implement the TMDLs	To improve the water quality of the Citarum River	Establishment of new regulations for TMDLs in Indonesia (planned)

Program review

The main objective of the third phase was “Actions for Issue oriented Solutions”. WEPA aimed to act to solve water environmental issues in partner countries. Although it is hard to quantify the contribution of WEPA AP, a list of outcomes from (a) – (c) are mentioned in Table 1. To understand how the programs

helped government officials in these three countries in policy formulation, we asked 10 questions to current and former Focal Points (FPs), as seen in Table 2. Questions 1-5 were mainly intended to gather opinions and perspectives about the effectiveness and significance of the APs implemented in their countries, whereas questions 6 – 10 were more general questions to get their feedback to improve APs in the future.

Table 2. Questions to FPs in Indonesia, Sri Lanka, and Viet Nam

Q1	Do you think the AP was helpful?	Q6	What do you suggest us so that WEPA becomes a more useful network?
Q2	Could you highlight how the program helped?	Q7	What subject/issue/problem would you expect WEPA to work on in the future?
Q3	More specifically, which part of the program would you think the program helped government officials?	Q8	In your country, what are water environmental issues that need to be addressed in next 5 years?
Q4	Do you have any suggestions to disseminate outcomes within your ministry?	Q9	Can you share any good practices addressing the water environmental issues mentioned in Q8? Please briefly explain how the problem has been addressed.
Q5	Would it be better if WEPA could have provided more support in other topics/areas during the project implementation?	Q10	In general, what are the difficulties for government officials in your country to form policies, implement them, and have people comply?

Key findings

How the action programs helped to address various issues related to water governance and management

All three countries responded that the AP was helpful to strengthen governance in their country and provided opportunities for capacity development of relevant staff members (Q1 and Q2). The program particularly helped to strengthen the following points: problem recognition and identification, getting ideas for necessary elements to be considered during policy formulation/planning, policy implementation, and policy revision for robust water environment management (Q3). Considering general public policy formulation in the Plan-Do-Check-Action (PDCA) cycle, the program supported: “Plan” (generating and sharing ideas for conserving the water environment through problem recognition and identification), “Do” (implementation of management plans/policies in the ground), and “Check/Action” (revising policies).

WEPA is a platform for creating various ideas through sharing practical knowledge to improve the water

environment in Asia. Being an information hub, it aims to disseminate and share knowledge through FPs in each country, which is also important to strengthen capacity in the relevant organizations. However, in some cases, converting this skill development to ensure practical usage on the ground is a challenge because there are frequent changes among the responsible government officials in the relevant ministries/institutions in the recipient countries. We asked FPs to suggest better ways to disseminate the knowledge gained from implementing APs and received the following suggestions: sharing the outputs/outcomes with colleagues at the internal bulletin board, preparing a policy brief/guidebook internally, organizing workshops and training sessions at the relevant ministries, creating a platform internally, setting up partnerships with local governments, and implementing a similar pilot project (Q4). Figure 1 summarizes the responses on this issue. Disseminating knowledge further after completing the program is an important topic in the future to achieve the objectives of WEPA.

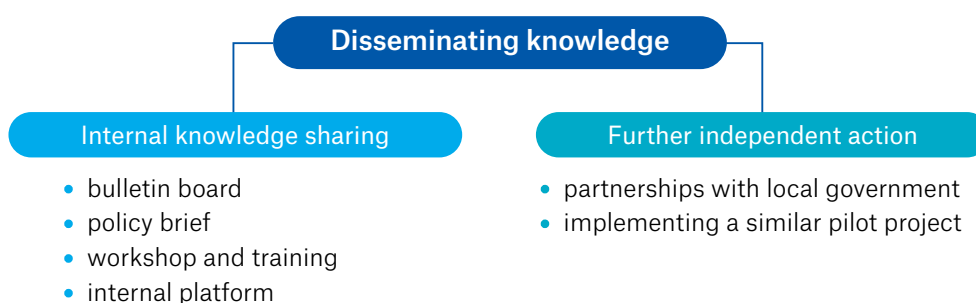


Figure 1. How to disseminate knowledge within the organization after completing AP

APs were planned and implemented based on the needs of recipients, and we asked FPs if they wanted further support during implementation (Q5 and Q6). They responded that the program would have been more helpful if the following activities such as “technology transfer and innovation” and “research and data analysis” training were included (Figure 2). Some specific suggestions on how to improve policy imple-

mentation of APs are: (i) gather more detailed information on how to customize the existing successful technologies to fit local conditions; (ii) decide the rationale behind selecting indicators to determine the status of water resources in the local context; and (iii) find ways to carry out performance analysis for any implemented technologies.

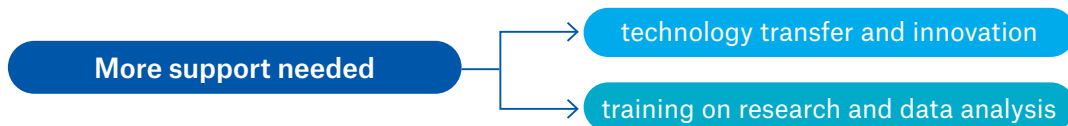


Figure 2. Components of AP that need more support

Future key issues for WEPA activities in line with challenges/difficulties for government officials in partner countries

We asked about what water environmental issues are likely to arise in partner countries over the next five years (Q7). Responses included: estimating pollution status at river basin scale for hotspots in respective countries; domestic wastewater treatment and management in urban areas; construction and management of WWTPs in rural areas with limited resources; advancing domestic wastewater treatment/management systems in combination with renovating and restoring lakes, ponds and canals in urban areas; best practices for water quality management for rivers and lakes; estimating pollution load capacity for some rivers; management of increasing pollutant loads to water bodies (unpermitted discharge and non-point source); roadmaps for clean drinking water guidelines; over-extraction of groundwater and associated risks like land subsidence; water sanitation and health

issues; plastic pollution; extreme weather conditions and hydrometeorological hazards like flooding, saltwater intrusion, and land subsidence. Figure 3 summarizes the responses. AP topics suggested by FPs would help to address problems that may arise in the near future. We also asked about subjects and issues that they would like WEPA to work on in the near future (Q8). FPs gave the following list of issues: advanced water treatment technologies; cost effective treatment technologies; better monitoring and reporting systems; sustainable agricultural and storm-water practices; water reclamation (reuse and recovery); nature-based solutions; industries with a high risk of causing environmental pollution (textile, garment, steel, and fisheries); formulation of regulations on emerging environmental contaminants like antibiotic resistance substance and microplastics; more effective stakeholder involvement in river basins for better water resource management; emerging issues of water securities in urban areas; and management plans for non-point source pollution.

Issues in the future	
Water environmental issues in next 5 years	<ul style="list-style-type: none"> • Increasing domestic WW in urban areas • Increasing pollutant loads (unpermitted discharge and non-point source) • Estimating load capacity for some rivers • Planning water quality management for rivers and lakes • Clean drinking water and sanitation • Over-extraction of groundwater • Plastic pollution • Flooding, saltwater intrusion, and land subsidence.
AP topic suggested	<ul style="list-style-type: none"> <li style="width: 50%;">• Advance WWT technologies <li style="width: 50%;">• Antibiotic resistance substance <li style="width: 50%;">• Monitoring system <li style="width: 50%;">• Stakeholder involvement in the basin <li style="width: 50%;">• Sustainable agriculture and storm-water practice <li style="width: 50%;">• Microplastic pollution <li style="width: 50%;">• Water reclamation (reuse) <li style="width: 50%;">• Issues in urban areas <li style="width: 50%;">• Industries causing degradation <li style="width: 50%;">• Non-point source pollution

Figure 3. Issues that may arise in next five years and AP topics suggested by FPs

Governments often face difficulties to put policies in practice. We asked FPs what are some of the difficulties facing government officials when working to implement policies (Q10). Responses included: unclear definition of terms in legislations; data scarcity; diligent monitoring of both point and non-point sources; assessing the load-carrying capacity of waterbodies;

lack of guiding principles and assessment frameworks for policy formulation; and enabling industries and stakeholders to participate in water environment management (Figure 4). When implementing APs in the future, it is important to make sure that any difficulties raised by FPs are well supported.

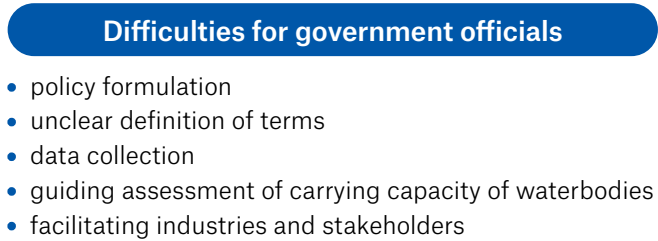


Figure 4. Difficulties for government officials in water environment governance

Good practices to address issues and improving water environment in Asia

As well as ascertaining problems and issues, we also asked about good practices in participating countries (Q9). In Viet Nam, the government issued a circular to control pollution from point sources by assessing capacities of receiving water bodies (No. 76/2017/TT-BTNMT). In Sri Lanka, the Surakimu Ganga (conserve river) program was implemented, whereby many projects to reduce plastic and solid wastes litters were initiated. It contributed to a significant reduction in the amount of solid waste in water bodies. In Indonesia, the government implemented stricter regulations and enforcement measures to control industrial wastewater discharges in addition to regular monitoring and inspection by environmental agencies, resulted in improving water quality in affected areas. The government also developed a plan to manage groundwater and regulate overexploitation by setting limits for groundwater extraction and promoting water conservation practices. It contributed to slowing down groundwater depletion and preventing saltwater intrusion in coastal regions.

WEPA is a regional network to improve the water environment in Asia, and 13 countries are currently involved. To encourage better networking, FPs

suggested to extend the network beyond the current partners, to implement joint research projects and build capacity, as well as upgrading the network to include higher rank officials and encourage more MOUs.

3.3. Changes in policies and institutions for water environment governance: Review of Surveys in FY2019 and FY2020, and cases of policy revisions in the Philippines and Republic of Korea

Water security is very important to achieve sustainable and comprehensive growth. Water security literally means a world where everyone has safe, affordable, and clean water to live a healthy and productive life. It also promotes environmental protection and social justice, and deals with the consequences of poor water management (ADB, 2016). In lieu of rapid social and environmental changes (land use land cover changes, urbanization, population growth, industrialization, and so on), it is important for environmental authorities to revise policies based on the social and environmental status for achieving long term sustainability in any region or country. WEPA's main mission is to improve water environment through better governance. Knowledge

sharing, capacity development, and technology transfer among partner countries are the main activities of this partnership. In the last 20 years, WEPA has initiated and hosted meetings and programs, which directly or indirectly helped to improve the water environment by strengthening governance in the partner countries. Moreover, the best way to see changes in governance, is to analyze its critical vehicle (i.e. changes in national or regional policies or ordinances) while considering new drivers and pressures with time to make it more robust for managing the water environment. This section strives to understand how water policy and governance have changed over the last 20 years in WEPA partner countries and which areas or gaps need further discussion and support. More precisely, the key objectives are: (i) To understand the progress/status of the water governance of the WEPA partner countries including monitoring the status of setting environmental and effluent standards as well as compliance, and enforcing related legal systems; (ii) A detailed analysis from two countries (Philippines and Republic of Korea) on revising policies; and (iii) To examine and identify feasible areas of support to further improve water governance in WEPA countries.

Semi-structured questionnaire surveys were conducted between WEPA focal points in each country in 2019 and 2020. We summarized the responses to these surveys and updated the information FPs provided at the annual meetings. Questions were prepared in accordance with the broad framework of the water environment governance:

- Legal framework
- Monitoring framework
- Enforcement framework
- Institutional framework

A detailed list of questions is shown in Appendix X. In addition, based on the preliminary questionnaire survey results, another set of questions were targeted at FPs in the Philippines and Republic of Korea to understand the rationale behind making such changes in the water policies in their countries.

Key findings:

Regulatory framework (Basic legislation on environmental protection and water quality standards)

First of all, we asked about the status of basic legislation on environmental protection. In this context, the environment consists of all elements such as water, air, biodiversity, and ecosystems. We then asked if amendments were made to these legislations after enactment. Finally, we considered whether there were existing water quality standards (surface, ground, and effluent) developed to support legislation in the partner countries. A summary of the results is presented in Table 3. It was found that 10 out of 13 WEPA countries had enacted basic environmental legislation before 2004 (the year WEPA was established), while three countries enacted it after 2004. Again, many WEPA countries (10 out of 13 countries) have amended legislation according to the state of the water environment (Figure 5).

Legislation, can only be enforced if a country sets up and implements water quality standards are. Almost all WEPA countries have established water quality standards for surface water, groundwater, and effluent, except Myanmar which has no standards for effluent water, and Nepal which has not set standards for groundwater. Myanmar has not formulated ambient water quality standards yet, but deliberations are now underway as mandated by the Environmental Conservation Law passed in 2012. The National Surface Water Quality Standards (NSWQS) are expected to be published soon. Nepal sets different water quality guidelines according to the objective (e.g., for recreation, and for protection of the aquatic ecosystem) or according to each sector.

Moreover, for managing effluents based on their source of origin such as from the industrial or domestic sector, different countries are making additional efforts. Currently, eight out of 13 countries (Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Republic of Korea, Thailand, and Viet Nam) have separate effluent standards for domestic as well as industrial effluent. Nepal has also set different effluent standards for specific industries.

Table 3. List of key legislation for environmental protection, their enactment and Umbrella Act/Regulations for water environment conservation in WEPA countries

State of ambient water quality standard in WEPA countries

Country	Basic legislation on environmental protection	Enactment/ Amendment of the basic law	Surface water quality standards	Groundwater quality standards	Effluent water quality standards
Cambodia	Law on Environmental Protection and Natural Resource Management	1990/1996/1998	○	○	○
China	Environmental Protection Law	1989/2014	○	○	○
Indonesia	Law Concerning Environmental Protection and Management	2001	○	○	○
Japan	Basic Environment Law	1967/1993/2012/2013/2016/2021	○	○	○
Lao PDR	Environmental Protection Law	1998/2017	○	○	○
Malaysia	Environmental Quality Act	1974/2012	○	○	○
Myanmar	Environmental Conservation Law	2012	△*	-	-
Nepal	Environmental Protection Act	2019	○	-	○
Philippines	The Philippine Environmental Code	1977/2004**	○	○	○
Republic of Korea	Framework Act on Environmental Policy	1978/1981/1983/1989/1991/2006/2012***	○	○	○
Sri Lanka	National Environmental Act No. 47	1980/2000/2022	○	○	○
Thailand	Environment and Conservation of National Environmental Quality Act	1992/2018	○	○	○
Viet Nam	Law on Environmental Protection	2014/2020	○	○	○

*: As of December 20, 2023, in the process of approval by the National Standards Council, **: The Philippine Environment Code of 1977 (PD 1152) for the protection of water environment was updated with the enactment of the Clean Water Act of 2004 (Republic Act No. 9275), ***: The Framework Act on Environmental Policy comprises a variety of media in the environment such as air, water, waste, and soil. These years are when revisions were made for water.

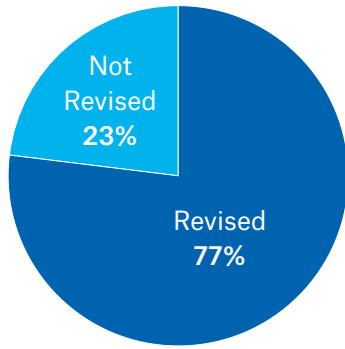


Figure 5. Number of countries where umbrella laws have been revised since being enacted

Monitoring framework and enforcement mechanism

Status of water quality monitoring framework

Out of 13 countries, 12 countries have water quality monitoring frameworks. Six countries established their water quality monitoring framework before 2004.

China established its water quality monitoring framework in 2017, while Myanmar still does not have a water quality monitoring framework. It is envisaged that Myanmar will establish a monitoring framework after the adoption of ambient water quality standards in the near future, as the country is in the middle of the administrating process.

WEPA countries have also strengthened their efforts to monitor water quality by increasing the number of water quality monitoring stations (Figure 6). As of 2020, China has the highest number of monitoring stations (11,888). Frequency of monitoring varies from twice in year in Indonesia to 24 times in a year in Sri Lanka.

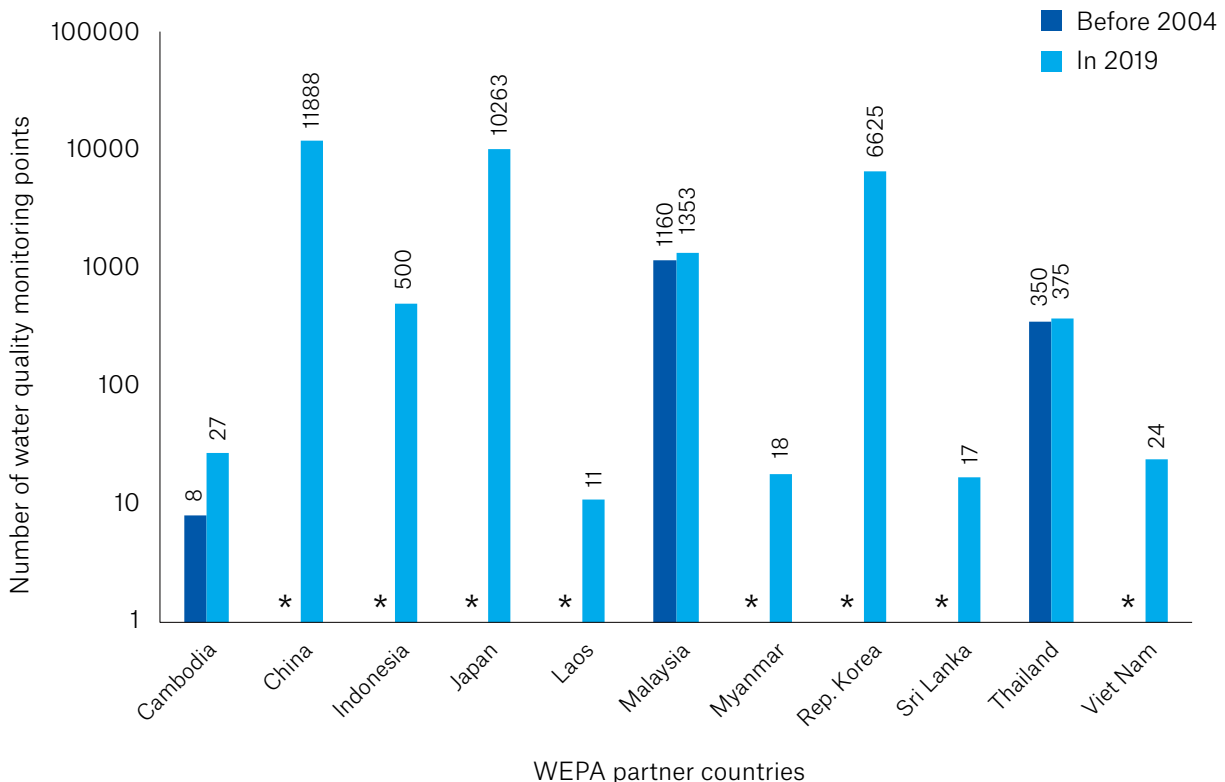


Figure 6. Number of water quality monitoring stations in selected WEPA countries (* denotes no data available)

Enforcement Framework

Here we present the summary of enforcement mechanisms by looking into effluent monitoring systems, reporting systems and frequency, implementing agencies, and provision of penalties as shown in Table 4. All WEPA partner countries have effluent quality monitoring standards. Out of these, nine member countries established an effluent quality-monitoring framework before 2004. Frequency of reporting the monitoring results varies from once per year in

Indonesia, Japan, Philippines, Thailand and Viet Nam to 3-4 times per year in Cambodia. In different WEPA countries, different agencies are given mandates to control the effluent quality. Most WEPA countries except Cambodia, China, Republic of Korea, and Thailand have introduced penalty provision for violations of effluent quality standards. Some partner countries have introduced mandatory effluent monitoring reports for industries, and frequency varies from annually/biannual to quarterly submission.

Table 4. Status of effluent quality monitoring framework and its enforcement mechanisms in WEPA countries

Country	Diligent monitoring	Implementation agency	Penalty provision	Reporting	Note
Cambodia	Regular monitoring*	Department of Pollution control, MoE	No	Quarterly	* MoE has been promoting online monitoring system and pushed polluters to install it for real time effluent data (quality and quantity); Industries (categorized by sub-decree) need to acquire discharge permits, and Department of Water Quality Management needs to monitor or take samples for lab analysis before providing the permit.; Inspection teams exist for regular monitoring of the industrial sector.
China	Regular monitoring*	Local ecological environment agency	No	Frequency differs depending on the situation	* Depending on local agency ** Depending on types of industry
Indonesia	Regular monitoring*	Local Environmental Agency, Provincial Environmental Agency and MOEF	Yes	Semiannually	* All industries are required to send wastewater samples to registered laboratories once a month or more frequently depending on their activities, with the analysis reports then submitted every six months to local authorities and the MOEF.
Japan	Regular monitoring	Local governments	Yes	Annually	
Lao PDR	Regular monitoring	Department of Natural Resources and Environment Inspection and Department of Water Resources, MONRE	Yes	Six month and Annually*	* MONRE inspection based on Environment Impact Assessment (EIA) and Environmental Management Monitoring Plan (EMMP) once a year. Local governments monitors based on Initial Environment Examination (IEE) twice a year and investment projects to monitoring is daily, weekly, or monthly and then submitting the report to the central and local governments

Country	Diligent monitoring	Implementation agency	Penalty provision	Reporting	Note
Malaysia	Regular monitoring*	Department of Environment	Yes	Monthly for industry	* "Competent person/owner/occupier" samples discharged effluent weekly, submits the monitoring records once a month, and conducts performance monitoring based on industrial effluent treatment system (IETS); DOE inspects effluent compliance 1-4 times a year
Myanmar	Regular monitoring*	Environmental Conservation Department	Yes**	–	* Local and regional offices of ECD are responsible for regular monitoring of effluent quality ** Issuing operation suspension
Nepal	Regular monitoring*	Department of Environment	Yes	–	* Annually but as per the workload of available environment inspector * provision of self-monitoring report by the industries
Philippines	Regular monitoring*	Environmental Management Bureau (DENR)	Yes	Quarterly	* Annually and/or upon receiving complaint
Republic of Korea	Regular monitoring*	Local governments	–	Annually	* By May: Industrial facilities analyze samples, and submit data with justifications; By July: Regional Environmental Agencies review and verify reports, and take/analyze samples; By December: National Institute of Environmental Research confirms the data and conducts metadata analysis; By following March: Ministry of Environment discloses data to the public
Sri Lanka	Regular monitoring*	Central Environmental Authority	Yes	**	* High polluting industries: once a year in general, but the frequency increases if the industry is a critical one; Medium & low polluting industries: once in 3 years or less ** Depending on the frequency of monitoring
Thailand	Regular monitoring*	Pollution Control Department	–	Monthly**	* Inspection by PCD once a year ** Mandatory provision to submit effluent quality monitoring report by the business operators every month
Viet Nam	Regular monitoring	Viet Nam Environmental Administration	Yes	*	Annually/biannual depends on type of company

Source: Presentations at the 18th WEPA Annual Meeting and WEPA Outlook 2021

Institutional framework

Having effective institutional arrangements is one of the key factors for achieving sound water environment governance. A summary for existing institutional frameworks (key agencies responsible for water environmental governance and their responsibilities) is shown in Table 5. This indicates that key ministries or agencies responsible for water governance in WEPA countries range from one agency (Republic of Korea, Lao PDR, Sri Lanka, Thailand, Viet Nam) to many agencies (remaining eight countries). The scope of responsibilities among these key ministries

also varies, and is mainly based on local environmental and socio-economic conditions. For example, Cambodia mandates its ministries to take care of environmental impact assessment, inventory development for pollution, development of sub-decrees to prevent and reduce pollution, executing management and conservation plans.

In this section, we reviewed the framework of the water environment management in the WEPA partner countries. In addition, the stories behind the change of water and environmental policies in the Philippines and Republic of Korea are presented at the end.

Table 5. List of key ministries responsible for water environment governance in WEPA countries

Country	List of key ministries/agencies	Responsibilities
Cambodia	Ministry of Environment; Ministry of Water Resources and Meteorology; Ministry of Public Work and Transport; Tonle Sap Authority	Environmental impact assessment (EIA); inventory development, developing sub-decrees to prevent and reduce pollutions; MRV (monitoring, reporting, and verification) of water pollution; executing management and conservation plans
China	Ministry of Ecology and Environment; Ministry of Agriculture and Rural Affairs; Ministry of Water Resources; Ministry of Natural Resources	Supervision and management of water environmental protection; Supervision and management of rural environment
Indonesia	Ministry of Environment and Forest; Ministry of Public Works and Housing; State Ministry of National Development and Planning	Water quality management, pollution control
Japan	Ministry of the Environment; Ministry of Land, Infrastructure, Transport and Tourism	Water quality management; Wastewater management
Republic of Korea	Ministry of Environment	Water quality management of public water, sewerage and wastewater
Lao PDR	Ministry of Natural Resources and Environment	Protection of natural resources (including water)
Malaysia	Ministry of Environment and Water; Ministry of Health	Water quantity and quality management

Country	List of key ministries/agencies	Responsibilities
Myanmar	Ministry of Natural Resources and Environmental Conservation; Ministry of Planning, Finance and Industry	Formulation of national water quality standards, water quality monitoring, enforcement; Regulate industrial water use and discharge
Nepal	Ministry of Forests and Environment; Ministry of Water Supply; Ministry of Energy, Water Resources and Irrigation; Water and Energy Commission Secretariat	Environmental protection; Water supply, sewerage management; Water quality monitoring; Water policy and program and vision formulation
Philippines	Department of Environment and Natural Resources; National Water Resources Board; Department of Public Works and Highways	Prevention and control of pollution; Coordinate/manage water resources; National sewerage and septage management
Sri Lanka	Ministry of Environment	Environment and natural resources management
Thailand	Ministry of Natural Resources and Environment	Management of water resources
Viet Nam	Ministry of Natural Resources and Environment	Management of water resources

Based on the facts and information presented above, it is evident that all WEPA countries are making every effort to renew and renovate their policies, institutions, and other instruments, and thereby upgrade their management strategies to deal with the complex and evolving issue of sustainable management of water environment. Since there is no “one solution fits all”,

different customized solutions are required based on the local hydro-meteorological, geographical, and socio-economic situation of each country. Therefore, it is vital to continue to work in more collaborative ways and codesign robust management plans for the future.

1. The Philippines

The Department of Environment and Natural Resources of the Republic of the Philippines amended its Department Administrative Order (DAO) 1990-34, and DAO 2016-08 was approved and went into effect in June 2016. Under the new order, Water Quality Guidelines (WQG) and three additional water quality parameters (Color, Fecal Coliform, and TSS) were added to protect surface water quality, the standard value of temperature was revised, and surfactant, oil & grease, and total coliform were dropped. The WQG is applicable to all water bodies such as freshwater, marine water, and groundwater, and it is used as a basis for taking action for improvement and to control

effluent discharge. Table A shows the water quality standards for class C water bodies (Fishery water for the propagation and growth of fish and other aquatic resources; Recreational Water Class II for boating, fishing, or similar activities; and agriculture, irrigation, and livestock watering). Modification of the WQG can be requested as long as there is clear and scientifically valid evidence to demonstrate that such modification is consistent with Republic Act 9275 (Philippine Clean Water Act of 2004), in which the State shall pursue a policy of economic growth in a manner consistent with the protection, preservation, and revival of the quality of fresh, brackish, and marine waters.

Table A. Comparative values between the revised Water Quality Guidelines (DAO – 1990 – 34) and the present (DAO – 2016 – 08) for Class C water bodies

PARAMETERS	UNIT	DAO – 1990 – 34	DAO – 2016 – 08
Color	PCU*	–	75
Temperature	°C	3**	25 – 31
pH	Range	6.5 – 8.5	6.5 – 9.0
DO	mg/L	5	5
BOD	mg/L	7 (10)***	7
Surfactant	mg/L	6.5	–
Oil & Grease	mg/L	2	–
Nitrate as N	mg/L	10	7
Phosphate as P	mg/L	0.02	0.5
Total Coliform	MPN/100ml	5000	–
Fecal Coliform	MPN/100ml	–	200
Chloride as Cl	mg/L	350	350
Total Suspended Solid	mg/L	–	80

*: PCU (Platinum -Color Unit) A measure of color using platinum cobalt standard for visual comparison. DAO-1990-34 indicates no abnormal discoloration from unnatural causes (Footnotes of Table I, DAO-1990-34 Water Quality Guidelines).

** : This is the temperature rise. A 3 °C rise is the allowable temperature increase over the average ambient temperature for each month. The rise shall be based on the average of the maximum daily temperature reading recorded at the site but upstream of the mixing zone over a period of one (1) month. In DAO-2016-08, the natural background temperature determined by EMB shall prevail if the temperature is lower or higher than the water quality guidelines: provided that, the maximum increase is only up to 10% and that it will not cause risk to human health and the environment (Footnote (b) of Table 3, DAO 2016-08 Water Quality Guidelines for primary parameters).

***: The numerical limits of BOD in table 1 of DAO-1990-34 is yearly average values. Values enclosed in parenthesis are maximum values.

The water quality management area (WQMA) has been designated by the Environmental Management Bureau (EMB) since 2006 to maintain the water quality within the criteria in WQG through

the stakeholder collaboration, and 10 areas were newly designated in 2016, in addition to the existing 20 areas. As of October 2023, 40 areas are designated as WQMA.

2. Republic of Korea

The Republic of Korea continues to update its water environment conserving policies such as monitoring framework and standards. Below are some major revisions to these policies:

1. Ambient surface water quality standards (WQS)—Korea makes occasional changes to the ambient water quality standards such as adding several new parameters in 2006 and 2012 (2006: Carbon tetrachloride, 1,2-dichloroethane, PCE, benzene, chloroform, dichloromethane, DEHP, antimony; 2012: Total organic carbon, chlorophyll-a, 1,4-dioxane, formaldehyde, hexachlorobenzene). The reason behind introducing TOC is that in major rivers, the concentration of BOD has been stable, while COD concentrations have gradually increased, probably due to the increase of unbiodegradable substances in water. However, experiments to estimate COD use toxic chemicals like silver and sulfuric acid. Studies have been carried out to seek an alternative to COD to measure the amount of organic matter in the water. Consideration has been given to analyzing organic matter in the water and thus TOC has been introduced as an alternative to COD. In addition, there has been investigation carried out into a number of other organic chemical substances across the country. Based on the results of this monitoring, these substances have been prioritized in terms of the toxicity and detection frequency of chemicals. These priority substances are candidate chemicals for water quality standards. According to the process of establishing WQS, the substances mentioned above have become part of the WQS in Korea.

2. Effluent standards—Extra effort has been made to revise industrial effluent standards several times by adding new elements/parameters (2006:1,2-Dichloroethane, Chloroform; 2008: 1,4-Dioxane, Bisphthalate, Vinyl chloride, Acrylonitrile, Bromoform; 2010: Nickel, Barium, Acrylamide; 2013: Naphthalene, Formaldehyde, Epichloroph-

drine, Toluene, Xylene; 2016: Pentachlorophenol, Styrene, Bis-adipate, Antimony). The reason why these substances were introduced as industrial effluent standards is exactly the same as for ambient WQS. After the candidate substances were chosen for investigation, the chemicals were monitored at the end of pipe from factories, as well as in ambient water near those pipes. Based on the results of this monitoring, the substances were prioritized, taking into consideration the toxicity and detection frequency of chemicals. These priority substances are candidate chemicals for effluent quality standards. According to the process of establishing industrial effluent standards, the substances mentioned above have become industrial effluent standards in Korea. Several years ago, two standards were introduced separately, which caused a problem. There were more industrial effluent standards than WQS, and so to fix this problem, some substances for industrial effluent standards were selected from the monitoring results on ambient water. In this way, two standards of chemical substances have been aligned with each other.

3. Introduction of ecotoxicity to the domestic effluent standards—The ecological toxicity testing method in Korea is designed to evaluate the potential harmful effects of pollutants on aquatic organisms and ecosystems using *Daphnia magna*. It is not possible to regulate all the toxic chemicals by establishing industrial effluent standards, but by introducing this ecotoxicity, toxic chemicals can be detected in water, which could affect *Daphnia magna* movement or life.

4

WEPA Action Programs

4.1. Overview

WEPA Action Programs (APs) were introduced in the third phase to support addressing water environment related issues in WEPA partner countries. APs have been implemented in six countries since they started, and practical information and lessons learned in the implementing countries have been shared with other WEPA partner countries at WEPA International

Workshops and Annual Meetings. This information is included in the WEPA database. During the third phase, APs were implemented in Viet Nam, Sri Lanka, and Indonesia, and a summary and review can be found in the previous section. During the fourth phase, APs were implemented in Myanmar, Cambodia, and Lao PDR as shown in Table 6. This section provides general information on WEPA AP and details of these three action programs.

Table 6. Overview of WEPA AP in the fourth phase

Country	Term	Title of AP	Objectives	Outputs/Outcomes
Cambodia	2020-2022	Capacity building of the officers at Sub-national level on identifying major pollution sources and estimating pollution in Tonle Sap Lake	Developing methodologies on estimating pollution loads from major sources, developing a guidebook for local environmental staffs, and facilitating formulation of draft strategies of water quality management of TSL through a co-design and co-production approach, and capacity building training programs.	<ul style="list-style-type: none"> • Guidebook for sub-national environmental officers on methodologies of identifying major pollution sources and potential policy actions in TSL • Capacity building workshop for local and national officers
Myanmar	2020-2022	Establishing surface water quality standards including rivers, lakes and marine water	Stipulating National Surface Water Quality Standards (NSWQS) and Enhancing capacity of ECD in water quality monitoring and assessment	<ul style="list-style-type: none"> • NSWQS needs to go through the National Standard Council (NSC) for final approval. (as of 15 January) • Offered training on water quality monitoring (63 people) and surface water classification (108 people)
Lao PDR	2021-2023	Development of An Appropriate Domestic Wastewater Management System in Lao PDR	Developing training materials for maintenance and operation of septic tanks and decentralized wastewater systems, and strengthening the capacity of relevant agency's officers for law enforcement	<ul style="list-style-type: none"> • Training materials for capacity building • Offered a capacity building training session

4.1.1. Program development

The AP is planned and developed by a partner country with assistance from the WEPA Secretariat, considering the following aspects:

- Needs of the country
- Feasibility
- Sustainability
- Replicability

The results and lessons learned from implementing AP are shared with other WEPA partner countries.

4.1.2. Implementing structure of WEPA Action Programs

- Implementing agency
 - The WEPA Focal Points or designated administrative agency at the local level
- Support team
 - Experts from WEPA partner countries
 - Experts from Japan including researchers, local government officials, and representatives from the private sector
 - WEPA Secretariat

- WEPA partner countries
 - In accordance with requests from the WEPA Secretariat, the partner countries will support the program by sharing relevant information, participating in meetings, and introducing experts.
 - The partner countries will provide advice at the WEPA annual meetings, considering their experiences and conditions. If the ongoing AP appears to be feasible in their own country, they will convey the information to relevant personnel.
- WEPA Secretariat
 - Liaising and coordinating with the country implementing the Action Program and the support team; and
 - Providing financial support for implementing activities



4.2. WEPA Action Program in Cambodia

4.2.1. Overview

Official Title of Action Program

Facilitating comprehensive water quality management plan in Tonle Sap Lake through capacity building of officers at sub national level in Cambodia

Term of the Action Program

2019-2022

Location of Action Program

Tonle Sap Lake (Cambodia)

WEPA Focal Person(s) responsible for program

Phin Rady

Director

Department of Water Quality Management

General Directorate of Environmental Protection

Ministry of Environment

Him Chandath

Deputy Director

Department of Air Quality, Noise and Vibration

Management

General Directorate of Environmental Protection

Ministry of Environment

4.2.2. Background and Objective

Tonle Sap Lake (TSL) is the beating heart of Cambodia with its wide-ranging and diverse ecosystems. It supports the livelihoods of more than one million people, and it is a major source of protein for Cambodian people, and a source of water for various users. However, anthropogenic pressure together with climate change impacts have led to the degradation of the lake's water environment. Manmade threats include the increasing discharge of untreated domestic and industrial wastewater, and pollution loads from chemical intensive agricultural practices etc.. In order to control the pollution in TSL, it is essential to have effective collaboration among key stakeholders surrounding the TSL (sub basins). Therefore, capacity development of sub-national level officials in the relevant agencies so that they can carry out pollution load inventory is critical to formulate priority policies and actions towards a sound water environment management. The WEPA Action Program was designed to support capacity building of officers at sub-national level to enable them to identify major pollution sources and estimate pollution in Tonle Sap Lake. The wider aim is to facilitate the development of a comprehensive water quality management plan for TSL planned by the Ministry of Environment under the umbrella of National Strategies on water quality management, which will be formulated in the very near future.

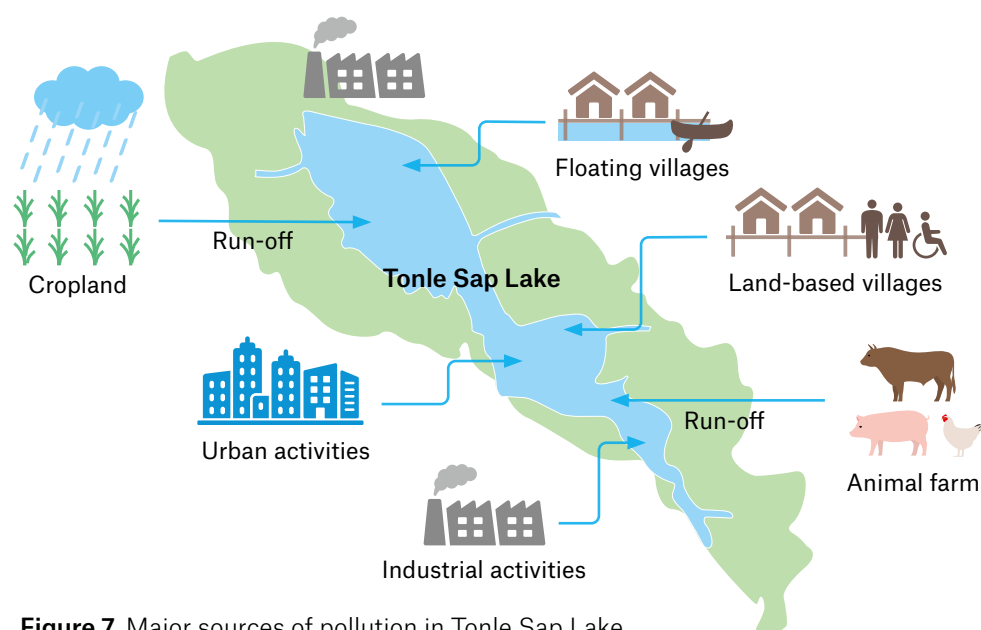


Figure 7. Major sources of pollution in Tonle Sap Lake

4.2.3. Description

WEPA action program activities in Cambodia consisted of identifying pollution sources and load by conducting pilot field surveys in the target area, developing a guidebook for national and sub-national level officials, and providing capacity development training to the relevant agencies on “Water Pollution Inventory Development in the Tonle Sap Lake Catchment”. A pilot survey was conducted in Chhnok Trou and Phat Sanday villages, located in the Tonle Sap catchment to identify major pollution sources, including from the domestic, industrial, farming, and livestock sectors. The pilot survey activities include a questionnaire survey, interviews, field visits, effluent

sample collections, and laboratory analysis. Based on the results of the pilot survey, a simplified methodological approach was developed to conduct a pollution load inventory from the major identified sectors with full consideration of the TSL. This has been turned into in a Guidebook on Water Pollution Loading Inventory in Tonle Sap Lake, which was officially adopted by the Ministry of Environment in February 2023 (available at https://wepa-db.net/wp-content/uploads/2023/08/Guidebook-on-Water-Pollution-Loading-Inventory-in-Tonle-Sap-Lake-V_English.pdf). Under the WEPA action program, two capacity building workshops were organized to transfer knowledge of the pollution load inventory to the key stakeholders.



Figure 8. WEPA Action Program activities in Cambodia

4.2.4. Outcomes

The outcomes of the WEPA Action Program are as follows:

- A local context-based methodological framework was developed for pollution load inventory in the major identified sectors.

- A Guidebook on Water Pollution Loading Inventory in Tonle Sap Lake was developed and adopted by the Ministry of Environment of Cambodia, which will facilitate the development of a comprehensive water quality management plan for TSL.

- WEPA action program provided capacity building training to the staff of MOE, inviting experts to explain how to design and conduct surveys to develop a pollution load inventory through active participation in field activities.
- National and subnational level officials were given capacity-building training using the adopted guidebook.

4.2.5. Policy recommendations

- In order to achieve sound water environment management in Tonle Sap Lake, it is essential to develop a pollution load inventory. This will provide the scientific basis to set short-term, medium-term and long-term targets for pollution load control and restoration goals.
- The guidebook can be used to establish a pollution load inventory at the sub-basin level.
- The capacity development program on the pollution load inventory in TSL catchment can be designed for the relevant department at the provincial level, and then used in all provinces located in the catchment.
- Inter-agency collaboration and integrated efforts are critical to develop a pollution load inventory for Tonle Sap Lake. Therefore, the guidebook should be disseminated to other relevant Ministries and agencies, as well as academic and research institutes.

4.3. WEPA Action Program in Myanmar

4.3.1. Overview

Official Title of Action Program

Establishing surface water quality standards including rivers, lakes and marine water

Term of the Action Program

July 2020 – February 2023

Location of Action Program

Myanmar

WEPA Focal Person(s) responsible for program

Tin Aung Win

Director, Environmental Quality Standard Division, Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation

4.3.2. Background and objective

Myanmar has been facing considerable challenges in managing the environment due to increasing domestic and international investments in industrial and urban/rural development sectors. In order to establish a legal and institutional framework to manage environmental issues, the Government of Myanmar enacted the Environmental Conservation Law (ECL) in 2012, established the Environmental Conservation Department (ECD) under the Ministry of Environmental Conservation and Forestry (MOECAF, from 2016 Ministry of Natural Resources and Environmental Conservation (MONREC)) in the same year, and issued the Environmental Conservation Rules in 2014. For the protection of human and ecosystem health, MOECAF notified the Environmental Impact Assessment (EIA) Procedure and the National Environment Quality (Emission) Guidelines (EQEG) in 2015. Although the environmental standards such as surface water quality standards, underground water quality standards, and effluent standards are supposed to be stipulated under the ECL, those standards have not been stipulated, except for guidelines values of effluents notified in the EQEG.

The lack of standards has made it difficult to properly evaluate the current status of the water environment and develop control measures against water quality degradation. While effluent quality data exists in the EQEG, evaluation of the surface water quality is not possible without standards. ECD made efforts to establish ambient water quality standards, with technical assistance from the Asian Development Bank (ADB) between 2015 and 2018, and assistance from an ADB resource person was provided between May and June of 2019 to finalize the EQS and advise ECD on their adoption. Consultations based on the ADB assistance results had been made for the proposed standards in the Environmental Quality

Standards Technical Development Sub-Committee chaired by the Director General of ECD and consisting of officials from relevant line ministries. However, further review was required to finalize the standards and lay a foundation for better water environmental governance. The JICA advisor for environmental management policy has been dispatched since January 2020 to enhance ECD capacity. Furthermore, ECD requested WEPA to support the proposed activities in the WEPA Action Program in Myanmar.

ECD received support from WEPA to get advice to develop surface water quality standards from the aspect of water qualities and laboratories' capacity in Myanmar through the WEPA Action Program from 2020 to 2023. The program includes development of NSWQSs and its related documents as well as meeting support with other relevant ministries. The development of NSWQS with international support is shown in Figure 9.



Figure 9. Development of NSWQA with international support

4.3.3. Description

As for the development of NSWQS, the formulation requires four steps—proposal stage, preparatory stage, committee stage, and approval stage. It should be noted that the enquiry stage is not necessary for nationwide standards development because there are relevant ministries, technical working group and National Standard Council (NSC). Currently, NSWQS development is in the Committee Draft (CD) stage in which the standard values, parameters and analytical methodologies are being drafted among Environmental Quality Standards Technical Development Sub-Committee members. Once the final draft standard is prepared and confirmed by the sub-committee members, it will be submitted to NSC for approval. Since it is not necessary to get approval

of Cabinet or Parliament after the approval stage, endorsement of NSC is a final step and the standards will be issued after that.

4.3.4. Outputs

As NSWQS will be published in the national language, the draft version of NSWQS has been prepared in both English and Myanmar versions. The draft NSWQS (English version) was prepared first by revising in accordance with the comments and suggestions from WEPA advisors. After that, the final draft version of NSWQS was translated. As of February 2023, the final draft version of NSWQS (both English version and Myanmar version) were distributed to the technical sub-committee members, and feedbacks from sub-committee members were

collected. NSWQS applies to 36 parameters, which fall under two categories—priority parameters (parameters for human health and parameters for environmental conservation) and monitoring parameters. EQSD had already reflected any editorial comments, especially in the translation of the NSWQS Myanmar version. The final technical sub-committee meeting was held on 15 February, 2023, where the technical sub-committee members provided their final comments and suggestions.

As for future steps, NSWQS will be revised again, and the finalized NSWQS will be submitted to NSC. NSC will distribute the final draft version of NSWQS to all the ministries, and post the draft on their website for public review. After receiving any comments, NSWQS will be revised and resubmitted to NSC as necessary. Once all comments are reflected, NSC will give approval, and the NSWQS will be disclosed to the public. The tables below set out the tentative standards.

Table 7. National Surface Water Quality Standards for Human Health

Parameter	Unit	Class I	Class II	Class III	Class IV	Class V
<i>Chemical Parameter</i>						
Boron	mg/L			2.4		
Cyanide	mg/L			0.07		
Fluoride	mg/L			1.5		
Nitrate nitrogen	mg/L			10		
Nitrite nitrogen	mg/L			1		
<i>Organics</i>						
Benzene	mg/L			0.01		
Phenol	mg/L			0.05		
Polychlorinated Biphenyls (PCB)	µg/L			0.5		
<i>Heavy Metals</i>						
Arsenic	mg/L			0.05		
Cadmium	mg/l			0.003		
Chromium (Hexavalent)	mg/L			0.05		
Lead	mg/L			0.01		
Mercury	mg/L			0.001		
Nickel	mg/L			0.07		
Selenium	mg/L			0.04		

* Standard values are expressed as annual average concentrations.

Source: Draft National Surface Water Quality Standards in Myanmar (as of February 2023)

Table 8. National Surface Water Quality Standards for Human Health for Environmental Conservation

Parameter	Unit	Class I	Class II	Class III	Class IV	Class V
<i>Physical Parameter</i>						
Total Suspended Solids	mg/L	25	50	75	100	150
<i>Chemical Parameter</i>						
BOD	mg/L	2	3	8	25	30
COD	mg/L	5	8	13	50	100
DO	mg/L	>6	>5	>4	>3	>2
pH	-	6.5-8.5	6.5-8.5	6-9	5-9	-
Ammonium nitrogen	mg/L	0.2	0.3	0.5	0.8	0.9
<i>Organics</i>						
Oil & Grease		No noticeably seen				
<i>Biological Parameter</i>						
Escherichia Coli (E. coli)	MPN/100mL (or) CFU/100mL	20	300	1000	1000	-
<i>Heavy Metals</i>						
Copper	mg/L	0.1	0.3	0.5	-	-

Table 9. Waterbody classification and water use of surface water

Water Class	Water use
Class I	(1) Conservation of the natural environment (2) Water supply Grade 1 (conventional treatment) (3) Water uses listed in Class II to V
Class II	(1) Water supply Grade 2 (pre-treatment and conventional treatment) (2) Fisheries Grade 1 (3) Bathing & swimming (4) Water uses listed in Class III to V
Class III	(1) Water supply Grade 3 (advanced treatment) (2) Fisheries Grade 2 (3) Industrial water Grade 1 (4) Agricultural water Grade 1 (5) Water uses listed in Class IV to V
Class IV	(1) Industrial water Grade 2 (2) Agricultural water Grade 2 (3) Water uses listed in Class V
Class V	(1) Navigation/Transportation (2) Environmental Conservation

Note: Water supply Grade 1: applicable for water supply with sedimentation, filtration and other comparable means
Water supply Grade 2: applicable for water supply with pre-treatment, sedimentation, filtration, and other comparable means
Water supply Grade 3: applicable for water supply with pre-treatment, and other advanced means
Fisheries Grade 1: applicable for fisheries of oligotrophic species
Fisheries Grade 2: applicable for fisheries of semi-eutrophic species
Industrial water Grade 1: applicable for industrial use with sedimentation and other comparable means
Industrial water Grade 2: applicable for industrial use with chemical additives and other advanced means
Agricultural water Grade 1: applicable for agricultural use with ordinary means
Agricultural water Grade 2: applicable for agricultural use with advanced means
Environmental conservation: maintained to the extent of not causing discomfort to citizens
Source: Draft National Surface Water Quality Standards in Myanmar (as of February 2023)

Table 10. National Surface Water Quality Standards

Parameter	Unit	Class I	Class II	Class III	Class IV	Class V
<i>Physical Parameter</i>						
Colour	TCU (or) mg Pt/L	15	25	50	100	150
Conductivity	dS/m	1	1.5	1.5	3	6
Total Dissolved Solids	mg/L	500	1000	1000	1500	2000
Turbidity	NTU	5	25	25	50	100
<i>Chemical Parameter</i>						
Chloride	mg/L	250	250	250	350	350
<i>Pesticides</i>						
Atrazine	µg/L			100		
Carbofuran	µg/L			7		
Chlorpyrifos	µg/L			30		
Fenitrothion	µg/L			3		
Glyphosate	µg/L			370		
Permethrin	µg/L			300		
Thiram	µg/L			6		

Source: Draft National Surface Water Quality Standards in Myanmar (as of February 2023)

4.4.4. Next steps

MONREC-ECD is preparing a National Environmental Master Plan (Draft, 2020), including air, water, and other environmental fields. Additionally, Myanmar has a National Environmental Policy (2019), and National Environmental Strategic Framework (draft). In order to implement policies and plans, the functions of EQSD-ECD are more regulatory in nature. Therefore, EQSD-ECD will conduct a National Water

Quality Management Initiative over the next few years, together with PCD-ECD, to fulfil its role as a primary environmental regulator and preventer of environmental pollution and degradation, and to be in line with emerging national and international focus and priorities. Accordingly, this Initiative will set up and roll out ambient water quality guidelines, monitoring systems across the nation, and management programs.

4.4. WEPA Action Program in Lao PDR

4.4.1. Overview

Official Title of Action Program

Development of an appropriate domestic wastewater management system in Lao PDR

Term of the Action Program

April 2022 – March 2024

Location of Action Program

Lao PDR

WEPA Focal Person(s) responsible for program

Sengkeo Tasaketh

Department of Natural Resources and Environment Inspection Ministry of Natural Resources and Environment

4.4.2. Background and Objective

The socio-economic landscape of Lao PDR has seen significant growth since joining ASEAN in 1997. This also results in rapid urbanization with the urban population rising from 15% in 1990 to 38% in 2022. However, this unsustainable growth has been exaggerated by inadequate governance and thus has put an unprecedented amount of pressure on natural resources, in particular water resources. The population in Lao have become highly vulnerable, in terms of water pollution, waste management, and associated health risks.

To address this emerging environmental crisis, the Government of Lao PDR has taken legislative steps and enacted its first environmental protection law in 1999 (revised in 2012), and established national environmental standards in 2009 (revised in 2017). Every five years, the National Socio-Economic Development Plan (NSED) sets targets for pollution control and waste management. Moreover, 29 decentralized wastewater treatment facilities were installed in nine provinces between 2009 to 2020, with 15 more currently under construction. However, data on their removal efficiency and performance is limited. On the

other hand, conventional septic tanks struggled to meet the new, stricter effluent standards, and fecal sludge management remained a challenge. Only five cities had sludge treatment facilities, and illegal disposal is an ongoing problem.

Additional challenges were the lack of design standards for septic tanks, insufficient monitoring systems, and weak enforcement mechanisms of policies/regulations. To address these, it was crucial to collect baseline water quality data, develop training materials for domestic wastewater management, particularly focusing on proper operation and maintenance (O&M) of existing and future septic tanks and decentralized wastewater treatment systems, as well as strengthening the capacity of relevant agencies.

Considering the aforementioned knowledge gaps and challenges, the WEPA Action Program (AP) was developed in response to a request from the Ministry of Natural Resources and Environment (MONRE) of Lao PDR, with the following objectives: (i) identify legal, institutional, financial, and technical hurdles for improving domestic wastewater management systems; (ii) investigate the quality of domestic wastewater in public canals and the performance of decentralized wastewater treatment facilities and sludge disposal in three cities (Vientiane, Luang Prabang, and Khammouan province); (iii) develop training materials for the operation and maintenance of septic tanks and decentralized wastewater treatment facilities, including de-sludging, transportation, and disposal; and (iv) enhance the capacity of relevant officers for the successful implement of the management plans.

Between 2022-2024, a number of activities (field survey, water quality analysis, stakeholder meetings) were carried out, to create a baseline dataset on the current situation of wastewater management, and to evaluate the performance of existing septic tanks and decentralized wastewater treatment systems. Training materials were also developed to help MONRE draft the technical guidelines on the operation and management of septic tanks and decentralized wastewater treatment systems.

4.4.3. Description

The following actions were taken in order to achieve the objectives:

(i) and (ii) Baseline study to understand the status quo of wastewater management:

- Literature review including scientific peer reviewed papers, government reports, technical reports, project reports, and other grey literature was conducted to understand up-to-date knowledge on legal, financial, and technical issues regarding wastewater management.
- Field surveys were carried out in three cities/ provinces to collect water samples and analyze different physico-chemical parameters and flow rates. and to identify the pollutants of key concern.
- Questionnaire survey, Key Informant interviews were also conducted to gain deep insight about the existing challenges and opportunities regarding wastewater management

(iii) Development of Training Materials:

- Training materials were developed for the maintenance and operation of septic tanks and decentralized wastewater treatment facilities . The materials reflected the key findings and identified challenges from the baseline investigation.
- Technical guidelines for proper O&M of septic tanks and decentralized wastewater treatment systems will be drafted by Lao MONRE, based on the above training materials.

(iv) Capacity Building:

- Annual workshops were held to share the results and information obtained from the WEPA Action Program among ASEAN experts and local authorities.
- Seminars and training sessions were organized for relevant agencies, local authorities and private companies to strengthen their technical capacities in water sector.

4.4.4. Detailed outputs

During the field survey, the key findings were as follows: (i) several wastewater facilities lacked regular monitoring and maintenance; (ii) several operators lacked technical knowledge; and (iii) the majority of facilities lacked a budget and budget plan for proper and sustainable operation and maintenance.

Several outputs have been achieved under this WEPA Action Program in Lao PDR so far, including:

(i) Baseline Report

In order to assess the current domestic wastewater treatment systems for future regulations and policies, the team conducted a comprehensive baseline study in Lao PDR. The legal, financial, and technical aspects of wastewater management data were compiled through literature reviews and actual field surveys. In addition, the study investigated potential drivers and barriers for implementing decentralized wastewater treatment at the community level and standard septic tanks in homes. To gain insight, various consultation meetings were held with various relevant departments (Figure 10), including the water supply department, ministries of public work and transport, as well as international organizations such as JICA and KOICA.



Kick-off Meeting for FY2023 at NREI, MONRE

Figure 10. A series of consultation meetings conducted with relevant governmental agencies and Johkaso in Luang Prabang

(ii) Field surveys, questionnaire, and interviews

A series of field surveys were conducted in three Laotian provinces—Vientiane Capital, Luang Prabang, and Khammuoane—in order to collect information on water quality and wastewater pollution. The team comprised technical officers from MONRE as well as faculty members and students from the Faculty of Natural Sciences, National University of Laos. The operators of the decentralized wastewater treatment facilities were given a questionnaire and then they were interviewed. The water quality was assessed on-site, and samples were taken for laboratory analysis. Water samples were collected and analyzed

for both dry and wet seasons to gain information about spatio-temporal variation in the water quality (Figure 11). The dry season survey was conducted from November 2022 to January 2023, and the wet season survey was done in July and August 2023. In-situ analysis of physical parameters such as temperature, pH, conductivity, and DO was supported with laboratory analysis of chemical parameters such as TSS, BOD, COD, and numerous nitrogen and phosphorous contents to understand the performance of decentralised wastewater treatment plant and water quality in the public canal.



Figure 11. Field survey and water sampling at decentralized wastewater treatment facilities in Vientiane Capital

(iii) Training materials

It was expected that these training materials would help in equipping stakeholders in Lao PDR with the necessary knowledge and skills for effective management of domestic wastewater and fecal sludge. First the materials make the reader aware of the current sanitation landscape, practices, and challenges in Lao PDR. Then they explain the characteristics of domestic wastewater and fecal sludge, including health risks, current policies, water quality regulations, and reporting requirements and the importance of onsite and decentralized wastewater treatment systems. Finally, the materials provide operational and maintenance (O&M) guidelines for these systems, including protocols for waste collection, transportation, and disposal, as well as inspection and reporting mechanisms. The final section of the training materials outline the roles and responsibilities of

various stakeholders, such as central and local governments, owners (residents or managers), and the private sector, in ensuring effective O&M. These comprehensive training materials are vital resources for improving wastewater management in Lao PDR, as they address the country's unique challenges and regulatory environment. Target trainees included public administrators responsible for domestic wastewater management and planning (e.g. Provincial Government (UDDA), Department of Natural Resources and Environment (DONRE), etc.).

(iv) Capacity Development

A Consultation Workshop including several presentations on wastewater treatment was held in FY2022 to disseminate the results of WEPA AP and share information about wastewater related projects in Lao PDR (Figure 12). The meeting, presided over by the

Director-General of MONRE's Department of Natural Resources and Environment Inspection, included over 32 in-person and online participants. Technical officers, experts, and representatives from various departments and organizations, including DNREI, WEPA Secretariat, JICA, and private companies, were in attendance.

The capacity development workshops are planned to be held in November 2023 and January 2024 with the completed training materials.



Figure 12. Consultation meetings on 3 February 2023 (left) and 21 November 2023 (right).

4.4.5. Next steps

MONRE is making preparations in collaboration with the WEPA Secretariat for two technical capacity training workshops, which are scheduled to take place around the middle of November 2023 and in January 2024.

Relevant governmental agencies and stakeholders (e.g. UDDA, DONRE, etc.) from three studied cities and provinces, as well as from other provinces, will be invited to participate in the meeting and the onsite training course, which will include both lectures and onsite visits to the sampled decentralized wastewater treatment systems and onsite sanitation systems, such as septic tanks. It is anticipated that the first draft of the training material will be distributed to participants in order to solicit their comments and feedback for further development.

The second training workshop is anticipated to take place in January 2024, during which the final version of the training material will be distributed. MONRE will also initiate the discussion and consultation process for an early draft of Technical Guidelines for proper O&M of septic tanks and decentralized wastewater treatment systems at the Final Workshop for this project, which will be held concurrently with the second training workshop.

Upon completion of WEPA AP, MONRE plans to develop national guidelines on O&M of septic tanks and decentralized wastewater treatment systems, utilizing the training materials developed in WEPA AP.

5

Feedback, expectations, and messages from WEPA Focal Points and Advisory Board

In FY2022, we conducted an online survey at the annual meeting to evaluate WEPA activities during the year, and the responses are presented in 5.1. In addition, to understand the general challenges and expectations faced by government officers involved in water resource governance, we requested WEPA FPs to respond to three questions in FY2023, and the results from nine countries are presented in 5.2.

5.1. FY2022 Survey Results

A. Evaluation of overall WEPA's Activities

In the survey, we first asked FPs to rate WEPA's activities in general. The results are shown in Figure 13, with 44% of the respondents (4 countries) rated activities as "very good" or "good," and another 44% rated them as "medium," thus confirming a mainly favorable evaluation by the partner countries. However, one country gave a low rating for WEPA's contribution to improving water environment governance. During the fourth phase, WEPA's main focus was industrial and domestic wastewater management. However, based on existing diverse issues related to water environment management in partner countries, they expect WEPA to work on diversified problems.

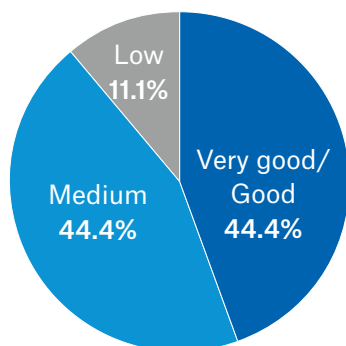


Figure 13. Rating of WEPA's activities during the fourth phase

B. Partner Country Suggestions for Future WEPA Activities

Furthermore, we asked for any suggestions with regards to WEPA activities to further improve water governance in WEPA partner countries going forward. One suggestion was to share knowledge and skills on strategies to comply with water governance and water environment conservation, and another pointed to the use of various state-of-the-art tools and technologies to achieve this aim. Other respondents expressed their hope that WEPA would continue its work in the future and requested more opportunities to build capacity. On the other hand, we also received a comment saying that there is often not enough time at annual meetings to discuss detailed pressing issues related to water governance and what support partners countries actually need. We would like to find ways to ensure that there is sufficient time allocated at meetings in the next phase so that more active discussions can take place. Some of the other comments for future topics included:

- Providing training and conducting research studies on specific wastewater management issues;
- Providing support to establish a monitoring framework for industrial and domestic wastewater;
- Conducting studies on specific topics such as pollutant removal technologies, and impacts of climate change on water quality and quantity;
- Indicating methods to apply polluter's pay principle to control major polluters such as convincing business operators; and
- Broadening the scope of engagement with appropriate personnel other than FPs in partner countries in line with WEPA activities and topics of meetings and workshops.

C. Water environment issues in WEPA partner countries

Lastly, we asked if partner countries would like to highlight any particular issue about their water envi-

ronment. WEPA partner countries had a variety of responses, including water quality governance and microplastics, which have been the focus of global attention in recent years. Other pressing issues are listed below:

- Trace contaminants in the aquatic environment
- Application of total maximum daily load (TMDL) in water resources management
- Wastewater treatment and management in centralized sewage treatment systems
- Wastewater treatment using nature-based solutions on islands and in rural areas
- Water pollution from industrial waste
- Sharing best practices on water environment projects and programs that can be implemented in each country
- Damage assessment related to water pollution

5.2. Feedback in FY2023 and expectation from WEPA Focal Points

WEPA is a partnership that envisions better and more sustainable water environment governance across Asia, with countries collaborating and sharing good practices. WEPA has maintained solid cooperation since its establishment in 2004. After 20 years of

various WEPA activities, we are looking to make further improvements. In order to complement the survey in FY2022, we created a questionnaire targeting partner countries, to discover what would make WEPA a better platform, and how to better understand the needs of policymakers in partner countries so that they could work on improving their respective water environments. To this end, we asked all partner countries three questions:

- Q1.** What are the challenges faced by policymakers in WEPA countries?
- Q2.** What are the benefits of being involved as WEPA partners and its activities?
- Q3.** What are your hopes and expectations for WEPA in the future?

The following section shows a summary of the responses provided by the WEPA focal points. For more detailed answers, please refer to the Annex.

First of all, to understand existing difficulties related to water governance, we asked WEPA partner countries to list the key challenges that policymakers are currently facing. We received a diverse range of responses and categorized them into three types: policy-related, capacity-related, and institutional issues as shown in Figure 14.

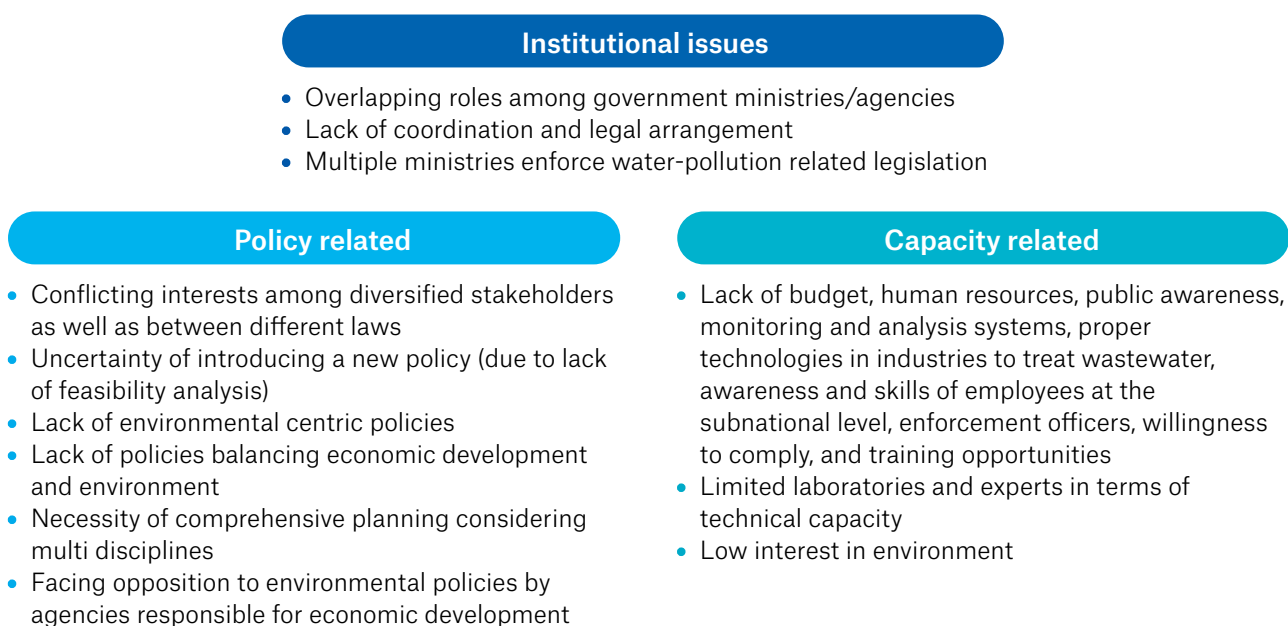


Figure 14. Challenges faced by policymakers in WEPA countries

Since the first phase, WEPA has evolved as a platform for sharing information related to water governance and networking among partner countries. In the third phase, the Action Program (AP) scheme was added as one of WEPA’s activities to strengthen the capacity of policymakers in partner countries. Eleven countries Cambodia, China, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, and Viet Nam, joined in the very first phase, and two countries—Nepal and Sri Lanka, joined in the second phase. These 13 partner countries gave similar examples of challenges for institutional issues and policy related issues, but had different capacity-related challenges. Some felt the need to develop technical capacity to carry out observation of the water environment, both by installing state of the art technologies, as well as by having more experts. Since capacity-related challenges affect various aspects of water resource management, WEPA implemented APs in those countries requiring technical capacity to develop necessary policies for water conservation. Many institutional and policy-related issues arise from the political setup of a particular country, and WEPA provides a platform to learn about cases in partner countries. In this way, countries with similar problems can learn from each other to find a solution. Going forward, WEPA can continue conducting APs to close capacity gaps and organize workshops to find mutual ways to deal with challenges, in addition to the current international workshop.

The second question asked countries what they thought were the benefits of being a WEPA partner and participating in WEPA activities. We implemented six APs during the third and fourth phases. Responses to this question varied among countries, but we were able to group them into two categories: capacity building and accumulating information as shown in Figure 15.

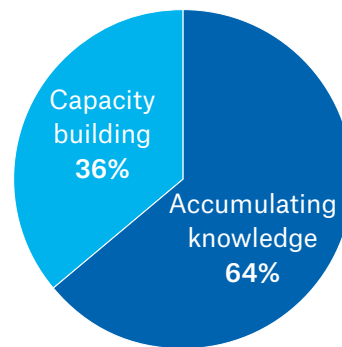


Figure 15. Benefits being involved in WEPA

The objectives of WEPA are to enhance capacity for public policymaking including problem identification and evaluation, to identify institutional issues and support local efforts in resolving them, and to enhance cooperation with partner countries, by using the platform for information-sharing and networking. From the responses to the question on benefits, it is evident that while the platform has achieved its objectives, it seems to be perceived by the partner countries more as a platform for information acquisition rather than for capacity building. APs have been implemented mainly due to collaboration between the recipient country and the WEPA Secretariat, and so far only six countries have gained any benefit from APs. It was pointed out that if the programs were implemented multilaterally and the results were disseminated among partner countries as initially planned, more partners would have benefitted from APs. Training to build capacity of government officials is often provided by international organizations and donor agencies; however, this is not enough in many cases and the government officials in WEPA partner countries would like increased capacity to improve the water environment. WEPA should consider modifying its current activities and providing more opportunities in the future for capacity development, if partner countries express a preference for more capacity building rather than information sharing.

Lastly, we asked what kind of activities FPs would like WEPA to consider and implement in the future. The question was slightly similar to that of question “C” in section 5.1, but we received more answers. Subsequently, we classified them into four different

groups: awareness-raising to wider groups of stakeholders; continuing similar efforts being carried out at present; (further) capacity development of management system considering additional elements; and expanding networking and making further efforts, as seen in Table 12. WEPA has engaged in capacity building for government officials in charge of water environment management since the first phase. FPs would like WEPA to continue its current activities and they also think that it should further broaden the umbrella for capacity building as the need arises, such as in cases of managing emerging contaminants, extreme weather conditions, and water-human interactions. Furthermore, the network should be expanded to handle the complex issue of conserving the water environment in Asia. In addition, it is critical to have the understanding and cooperation of the general public to ensure environmental conservation, FPs would like WEPA to be more proactive in raising public awareness in the next phase.

From the first to fourth phases, WEPA's capacity building has focused on problem identification and policy development, which are the major tasks of officials in central government. In addition to these topics, some FPs want support on data integration, management, modeling, and advanced methodologies for water quality analysis, which are topics that have not been covered in the four phases to date. Training workshops are often organized in current APs, but they are generally organized only in the country implementing the AP. Moreover, these short training courses/workshops do not generally extend an invitation to all FPs, and as such, there are very few opportunities that include all FPs. Considering this gap, and WEPA's objectives of mutual learning,

one suggestion would be to invite all relevant FPs to attend such trainings/workshops in future phases. In this way, partner countries could suggest ideas to overcome capacity shortages seen in some countries.

Some partner countries also suggested that WEPA should expand the current network of 13 countries to include more countries and also other sectors such as businesses, NGOs, and communities as these are important stakeholders in sustainable water resource management or achieving sustainable water environment. Moreover, other countries want to extend their efforts to cover a broader range of subjects, as there are many new and emerging challenges related to the water environment. In the current phase, WEPA focused on industrial and domestic wastewater management, but managing non-point source pollution, emerging pollutants, and issues related to climate change and extreme weather conditions are common problems in WEPA countries. Partner countries also want to transform and disseminate the results and information collected from APs into cost-effective solutions to improve the water environment. Some of the above requests may be difficult to handle by a small group; however, the Secretariat together with partner countries would be able to provide relevant suggestions.

Ideally, WEPA will continue its current efforts to support the needs of partner countries and enable them to collaborate when dealing with emerging issues. We hope our platform will be further strengthened in the future.

Table 12. FPs' future expectations for WEPA

Awareness raising	Extending network and efforts
<ul style="list-style-type: none"> ● Citizen's education ● Raising awareness at the subnational levels 	<ul style="list-style-type: none"> ● Opening for business sector, NG(P)O, and community ● Strengthening communication and information sharing among member countries, particularly in water ecological environmental management of technology ● Starting thematic information sharing ● Extending the network system ● Information sharing on non-point source pollution management ● Cost-benefit analysis of implementing policies ● Developing and adopting of cost-effective technologies, methodologies and protocols, regulation and enforcement ● Transforming results of AP into technologies and disseminate it in the member countries ● Further capitalizing information from member countries to show a picture of the region ● Highlighting climate change and economic development ● Changing platform to higher level and creating an interactive database for decision-making ● Providing support to researchers in water environment and associated issues ● Providing support to WEPA countries to develop necessary strategy, regulations, and institutional frameworks ● Providing technical equipments to promote water quality monitoring
Continuing current efforts	
<ul style="list-style-type: none"> ● Continuation of WEPA activities ● Sharing best practices for achieving sustainable water governance from Japan in depth through field visits or in other forms More flexible supports for AP ● More flexible support for AP ● Sharing information from APs to the member countries so that they can determine their institutional gaps and governance deficiencies to help them improve ● Regular updating and consolidating WEPA website and policy brief 	
Capacity development	
<ul style="list-style-type: none"> ● Supporting data information and Management system ● Providing capacity development for staff involved in WQ analysis and developing related guidelines and procedures ● Conducting short training sessions 	

Message from Dr. Vicente B. Tuddao, Jr., Director, Department of Environment and Natural Resources (DENR), Quezon City, Philippines (WEPA FP since the first phase)

Established in 2004, the Water Environment Partnership in Asia (WEPA) was organized under the leadership of the Ministry of Environment, Japan, and has grown into the current network of 13 nation-states in Asia sharing similar water environmental issues and concerns ranging from water pollution to weak institutional arrangement and ineffective water environmental governance. These problems have been affecting the quality of the water environment in Asia for decades, bringing with it health hazards to the region's population, and damaging ecological integrity. Conceived as a network with an established paradigm to share information and knowledge with partner countries, WEPA has evolved further by incorporating in situ problem identification and finding solutions in its agenda through the implementation of appropriate and specific action programs in selected partner countries, aimed at providing technological and/or institutional responses.

I have participated in WEPA activities since the first phase of its operation. I have witnessed four continuous phases as the partnership implements plans and priorities to be more agile in achieving its objectives in view of the emerging risk factors such as industrial development, population growth and climate change. The increasing volume of wastewater generated from industries and households and the disposal of untreated wastewater into the environment has persistently posed a challenge which requires institutional, technological, and governance solutions.

The evolution of WEPA towards the next phase of its operations should focus on further intensifying its role in strengthening institutional and policy development and water environment governance through an improved platform for information and knowledge/technology sharing, strategic building of capacities among governments towards better water environment governance, support for institutional and policy development, identification of technology gaps in wastewater treatment technologies, and engagement in a broader multi-stakeholders participation among WEPA partner-countries. It is only through the engagement of the players, stakeholders, and users of a clean water that practical and economical solutions to water environment issues can be achieved. It is crucial that updated information can be shared more broadly by maintaining and improving the database and the websites for faster and easier access by users.

I would like to commend WEPA for its continuing collaborative work with the WEPA Asian partner-countries. The economies of these Asian countries continue to grow amidst the increasing threat of climate change, and if this threat remains, the water environment will be at higher risk of degradation. We need to further solidify our efforts by strengthening our commitment and resolve in achieving WEPA objectives and responsibilities to improve the quality of our water environment for the present and future communities of nations in the region.

Message from Dr. Ratnayake Mudiyansele Sanjaya Kumara Ratnayake, Deputy Director General, Environment Protection Division, Central Environmental Authority, Sri Lanka (WEPA FP since the second phase)

Sri Lanka has been a partner country of WEPA since 2009 from the second phase and we participated in the 6th Annual Meeting and International Workshop. I would like to commend the activities conducted by WEPA and emphasize that the partnership is widely recognized and has continuously improved with suggestions and comments from participants in the region. WEPA programs in the initial stage were mostly focused on fresh water resources and management. While expanding its horizon, we also witnessed a change in the focus to other areas of interest such as domestic and industrial wastewater management. This timely topic was discussed at the 2012 WEPA dialogue on industrial & domestic wastewater management, hosted by the Central Environmental Authority, Sri Lanka, with the participation of stakeholder organizations in water environment governance.

In 2015 we had the opportunity of organizing the 10th WEPA International Workshop and annual meeting in Sri Lanka where international participants were able to experience water environment management from a Sri Lankan context. The WEPA Action Program 2017 granted to Sri Lanka included a collaborative study on "Improving Industrial Waste and Wastewater Management in Gampaha District, Colombo, Sri Lanka". The study was successfully implemented and identified critical water environment issues with respect to ground water. The outcomes of the program have been translated into good water governance, and the experience gained from these activities and collaborative work has enhanced a trustworthy cooperation which was also expanded to other Sri Lankan projects. The outputs of this action program were applied when we amended the regulations for industrial effluent discharge on land for agricultural applications.

While Sri Lanka strives to implement and improve its water governance practices, inadequate data on water environment management is a common problem faced by implementing agencies and policymakers. The WEPA website was able to fulfil this need and because information gathered from partner countries is continuously updated, the website is an extremely useful resource where all partner countries in the region can share data & information.

Considering the current environmental problems, and trying to find solutions, it is high time to focus on other areas such as ground water pollution, conservation of ground water resources and data on ground water quality, and pollution of water from microplastics. These are some topics that we can discuss and share information in future WEPA meetings. It would also be better if WEPA could enhance and expand its focus area to include capacity building programs for officers engaged in the water environment sector in partner countries. I very much hope that we can continue this globally important program to help protect and manage water environment management in Asian countries.

Message from Dr. Motoyuki Suzuki, Professor Emeritus, The University of Tokyo (Special Advisor of WEPA Advisory Board)

Looking Back on 20 Years of WEPA—The Rise of WEPA

In March 2003, the 3rd World Water Forum (WWF3) was held in Kyoto, Japan. Three years earlier, WWF2 had been held in The Hague, the Netherlands, with the participation of Dr. Hans van Ginkel, Rector of the United Nations University (UNU, Headquarters: Tokyo) and myself as Vice-Rector at that time, and we suggested that Kyoto, which was to host the forum three years later, should have a session to discuss water issues in the Southeast Asian region. After returning to Japan, we received a great deal of support from the Ministry of the Environment, Japan (MOEJ), and we called on Southeast Asian countries to join us in holding a session at WWF3.

This meeting became the impetus for a preparatory meeting for the establishment of Water Environment Partnership in Asia (WEPA) in Jakarta the following year, led by MOEJ, and they continued to support this initiative.

WEPA's focus is on water environment governance, particularly the establishment and management of water quality standards, as each country and administrative body responds to the issues, but it was meaningful to see how the participating countries deepened their mutual understanding of each other's governance systems, the environmental conditions of each region, the diversity of the relationship between water and society, and national characteristics with each passing session, as well as the prosperity of each country's long-standing culture.

The Institute for Global Environmental Strategies (IGES), which had just been established, took up the responsibility of managing the project, with the exception of a period of time, and I am sure that Ms. Yatsuka Kataoka, who was in charge in the early days,

and later Mr. Tetsuo Kuyama must have had many difficulties. However, at the same time, the overall value of the network that has been created over the past 20 years through the changing forms and changing attitudes of the people in charge of the network has become a great asset that cannot be easily created.

Some of WEPA's ideas and achievements were also introduced at WWF, and one of the most memorable opportunities for me was at WWF4 (Mexico City, 2006), where I gave a lecture titled "The Importance of Information for Water Environment Conservation" on WEPA activities at the start of the conference. The then Crown Prince of Japan attended the conference, and I was impressed by the interest shown by the Mongolian Minister of Environment and others in the WEPA exhibition booth.

What to expect from WEPA in the future

The activities of WEPA over the past 20 years have been more or less in line with the global trend of the time, with each partner country aiming to become a typical developed country, and to share among the partner countries methods of wastewater treatment (domestic and industrial) and water quality management of natural water (rivers, lakes, etc.) in residential environments, with the goal of economic growth and industrialization. The goal is to share the methods of wastewater treatment (domestic and industrial) and water quality management of natural water (rivers, lakes, etc.) in residential environments among partner countries.

The summer of 2023 experienced a heat wave. Natural disasters resulting from climate warming, which has become more pronounced in recent years, have appeared in diverse forms in various parts of the world, including large-scale forest fires, localized heavy rains,

and more frequent outbreaks of zoonoses and other infectious diseases presumably caused by changes in wildlife habitats, all of which are believed to have been brought about by outbursts of human activity.

From about 12,000 years ago, after the most recent ice age in the 200,000-year history of *Homo sapiens*, humans have been spreading across the globe during the Holocene, a geological period that began about 200,000 years ago. During most of this time, the increase in the global population was estimated to be about 0.05%/year, but after the Industrial Revolution began in around 1750, its impact has rapidly expanded, especially in the last 70 years since 1950, which has seen a population explosion and the expansion of economic activity at a different rate than before. It is estimated that the global population grew at a rate of 1.5%/year during this period (30 times faster than in the Holocene), tripling the earth's population in 70 years and increasing economic activity by about 13 times during that period. It is believed that the destruction of nature by mankind during that period has progressed so rapidly that it has far exceeded the scope of nature's ability to recover, including the ecosystems on the planet. The term "Anthropocene" has been under consideration in the field of geochronology for the period after 1950.

If we continue to develop and alter nature in accordance with the values we have held in the past, we will sooner or later greatly exceed the estimated tolerance limits for some functions of Earth activity, and we will deviate from the stable state on which the Earth depends today. Thus, we must be aware that we will repeat the experience of the great extinctions that the Earth experienced hundreds of millions of years ago.

The way to deal with this may be found in cultures that have been nurtured and developed in the nature-rich Asian region since ancient times.

People will have to work to rapidly restore the degraded natural environment around human activities, including forests, mountains, rivers, and other waterbodies. We will have to develop a new way of life in which the natural environment and human life, which has become so dense, share the same place. It will also be necessary to consider a shift from the past approach that has been hostile to nature and aimed at mechanization, industrialization, and urbanization, to a way of life that is based on the logic of nature.

In relation to water, it will be important to shift from a narrow perspective of optimizing water use in industrialized areas to a truly comprehensive and optimal concept that focuses on the function of water in the natural environment (green water). It is also important to return to the restructuring and development of sustainable systems by learning from natural circulation pathways, rather than relying on energy-intensive artificial systems in the nutrient cycling by water. To this end, it would be effective to seek the participation of a wide range of researchers from various countries and to promote discussions with the private sector and citizens in the local community.

Concepts such as "Nature-Based Solutions" and "Nature Positive" are now emerging. How to evaluate nature as a whole involves many difficult issues, but I hope that WEPA activities in the future will focus on how to position the water environment in Asia within the context of nature, to present new solutions to this problem, and to uplift the region to a world-leading mindset.



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(April 2019 – March 2024)

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List of Activities and Publications

Annual Meeting			
	Month	Year	City, Country
15th Annual Meeting	Feb	2020	Bangkok, Thailand
16th Annual Meeting	Mar	2021	Online
17th Annual Meeting	Apr	2022	Hybrid (Kumamoto, Japan and Online)
18th Annual Meeting	Feb	2023	Hybrid (Siem Reap, Cambodia and Online)
19th Annual Meeting	Jan	2024	Hybrid (Hayama, Japan and Online)

International Workshops			
	Month	Year	City, Country
WEPA Workshop on Industrial Wastewater Management	Feb	2020	Bangkok, Thailand
WEPA Workshop on Domestic Wastewater Management	Mar	2021	Online
WEPA Workshop on Industrial Wastewater Management	Feb	2023	Hybrid (Siem Reap, Cambodia and Online)
WEPA Workshop on Water Environmental Policy Revisions	Jan	2024	Hybrid (Hayama, Japan and Online)

Other WEPA Activities at International Events			
	Month	Year	City, Country
9th World Water Forum Thematic Session “Water Quality Improvement” and Exhibition at the Japan’s booth	Mar	2022	Dakar, Senegal
4th Asia-Pacific Water Summit in Kumamoto, Japan	Apr	2022	Kumamoto, Japan
3rd Asia Wastewater Management Partnership General Meeting	Aug	2023	Sapporo, Japan

Publication		
Title	Month	Year
Toward the Establishment of Sustainable Faecal Sludge Management (English)	Mar	2021
WEPA Outlook on Water Environmental Management in Asia 2021 (English)	Dec	2021
WEPA Outlook on Water Environmental Management in Asia 2021 (Japanese)	Dec	2024
WEPA Fourth Phase Final Report (English)	Mar	2024
WEPA Fourth Phase Final Report (Japanese)	Mar	2024



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