Updates of Water Environment Governance in Republic of Korea

Park Tae-Jin, Ph.D

Water Environmental Engineering Research Division

National Institute of Environmental Research

Ministry of Environment, Korea

30 January, 2024

The 19th Annual Meeting in Hayama, Japan

1. Goals of water environment

Legal structure

Environment Policy Framework Act

- The **primary law** governing environment in Korea
- Purpose: to **prevent environmental pollution**, to protect environment appropriately and to keep the environment sustainable, resulting in letting people enjoy the healthy and amiable environment.
- **The basis for regulations**

Water Environment Conservation Act

- Purpose: to **protect people from water pollution**, and to manange the quality of streams, rivers and lakes appropriately, resulting in the benefit from the water environment managed well.
- **Regulation of wastewater** from the effluent

1. Goals of water environment

The goals are set forth in the Environment Policy Framework Act (1978)

Environmental Quality Standards (EQS) are set as the goal for government to prevent environmental pollution, conserve environment appropriately, and allow people to enjoy a healthy and amiable environment.

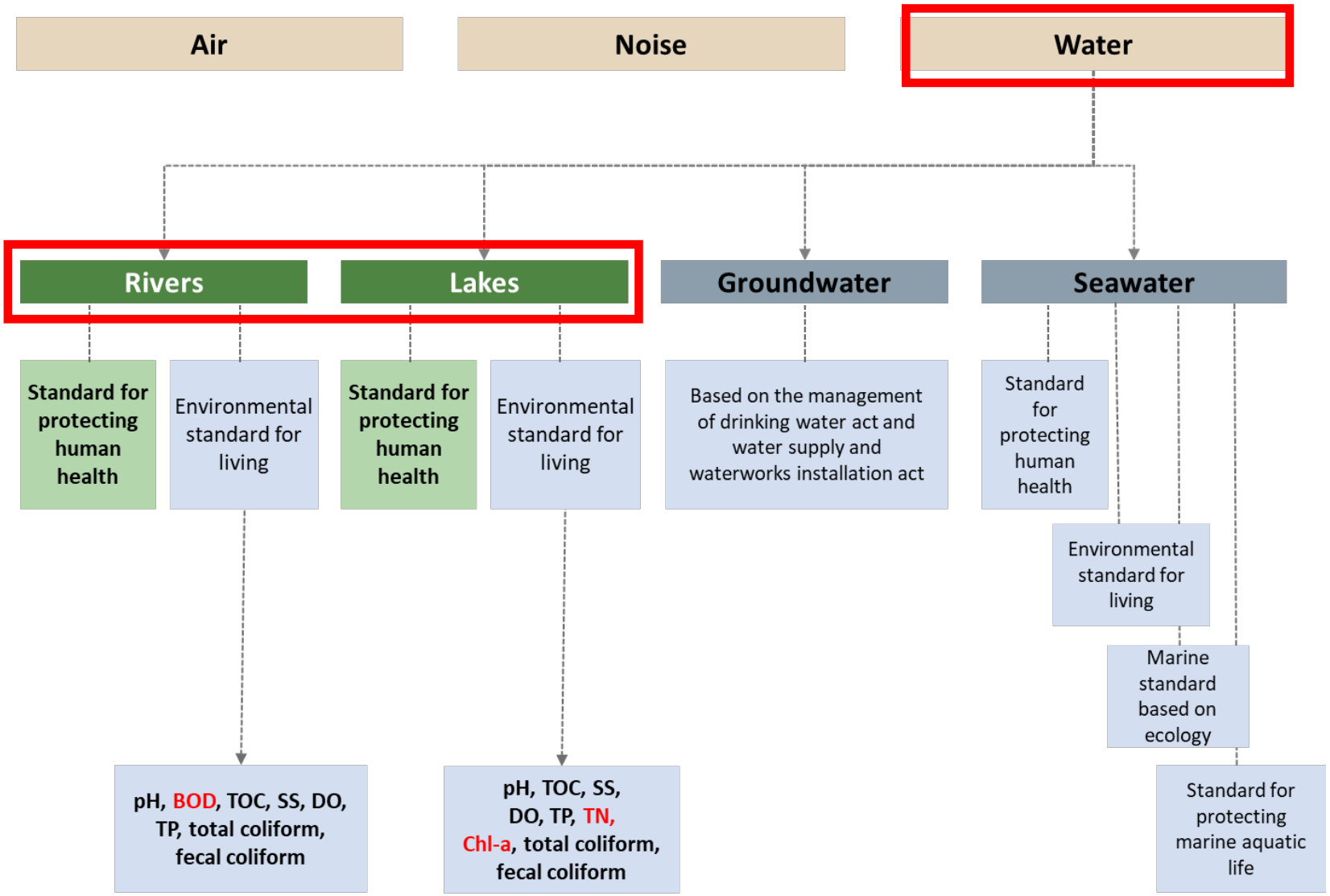
- **Environmental Quality Standard**
  - Water Quality Standards (WQS) for **protection of human health**
  - Water Quality Standards (WQS) for **living environment**

- **Discharge Permits are set forth in Water Environment Conservation Act since 1970**

Discharge Permits regulate wastewater from specified factories/establishments to achieve EQS and uniformly set in nationwide.

1. Goals of water environment

Environment Policy Framework Act



1. Goals of water environment

Water Quality Standard for protecting human health

Pollutants	Standard Value (mg/L)	Pollutants	Standard Value (mg/L)
Cadmium (Cd)	≤ 0.005	Carbon Tetrachloride (CCl_4)	≤0.004
Arsenic (As)	≤ 0.05	1,2-Dichloroethylene	≤0.03
Cyanide (CN)	ND (LOD 0.01)	Tetrachloroethylene (PCE)	≤0.04
Mercury (Hg)	ND (LOD 0.001)	Dichloromethane	≤0.02
Organic Phosphorus	ND (LOD 0.0005)	Benzene	≤0.01
Polychlorinated Biphenyls (PCB)	ND (LOD 0.0005)	Chloroform	≤0.08
Lead (Pb)	≤ 0.05	Di-Ethylhexyl Phthalate (DEHP)	≤0.008
Hexachromium (Cr^{6+})	≤ 0.05	Antimony (Sb)	≤0.02
Anionic Surfactant (MBAS)	≤ 0.5	1,4-Dioxane	≤0.05
Formaldehyde	≤ 0.5	Hexachlorobenzene (HCB)	≤0.00004

1. Goals of water environment

Water Quality Standard for Living Environment (River)

Grade		Status	Standard							
			pH	BOD (mg/L)	TOC (mg/L)	SS (mg/L)	DO (mg/L)	TP (mg/L)	Coliform MPN/100mL	
									Total Coliform	Fecal Coliform
Very Good	Ia		6.5~8.5	≦ 1	≦ 2	≦ 25	≧ 7.5	≦ 0.02	≦ 50	≦ 10
Good	Ib		6.5~8.5	≦ 2	≦ 3	≦ 25	≧ 5.0	≦ 0.04	≦ 500	≦ 100
Fairly Good	II		6.5~8.5	≦ 3	≦ 4	≦ 25	≧ 5.0	≦ 0.1	≦ 1,000	≦ 200
Fair	III		6.5~8.5	≦ 5	≦ 5	≦ 25	≧ 5.0	≦ 0.2	≦ 5,000	≦ 1,000
Fairly Poor	IV		6.0~8.5	≦ 8	≦ 5	≦ 100	≧ 2.0	≦ 0.3	-	-
Poor	V		6.0~8.5	≦10	≦ 8	-	≧ 2.0	≦ 0.5	-	-
Very Poor	VI		-	> 10	> 8	-	≧ 2.0	≦ 0.5	-	-

1. Goals of water environment

Water Quality Standard for Living Environment (Lake)

Grade		Status	Standard								
			pH	TOC (mg/L)	SS (mg/L)	DO (mg/L)	TP (mg/L)	TN (mg/L)	Chl-a (mg/m^3)	Coliform MPN/100mL	
										Total Coliform	Fecal Coliform
Very Good	Ia		6.5~8.5	≦ 2	≦ 1	≧ 7.5	≦ 0.01	≦ 0.2	≦5	≦50	≦ 10
Good	Ib		6.5~8.5	≦ 3	≦ 5	≧ 5.0	≦ 0.02	≦ 0.3	≦9	≦500	≦100
Fairly Good	II	 	6.5~8.5	≦ 4	≦ 5	≧ 5.0	≦ 0.03	≦ 0.4	≦14	≦ 1,000	≦ 200
Fair	III	 	6.5~8.5	≦ 5	≦15	≧ 5.0	≦ 0.05	≦ 0.6	≦20	≦ 5,000	≦ 1,000
Fairly Poor	IV		6.0~8.5	≦ 6	≦ 15	≧ 2.0	≦ 0.10	≦ 1.0	≦35	-	-
Poor	V		6.0~8.5	≦ 8	No floating waste-	≧ 2.0	≦ 0.15	≦ 1.5	≦70	-	-
Very Poor	VI		-	> 8	-	< 2.0	> 0.15	> 1.5	>70	-	-

1. Goals of water environment

Status of Water Quality in accordance with Grade

Grade		Status of Water Quality
Very Good	Ia	• The ecosystem is in a pristine state with abundant dissolved oxygen and absence of pollutants • Domestic water use is suitable after simple water treatment processes such as filtration and disinfection
Good	Ib	• The ecosystem is in close proximity to a clean state with a high level of dissolved oxygen and minimal presence of pollutants. • After common water treatment processes such as filtration, sedimentation, and disinfection, it can be used as domestic water for daily living."
Fairly Good	II	• The ecosystem is in a relatively good state with a high level of dissolved oxygen, although there are slight traces of pollutants. • After common water treatment processes such as filtration, sedimentation, and disinfection, it can be used as domestic water or recreational water for activities such as swimming."
Fair	III	• Due to typical pollutants leading to the consumption of dissolved oxygen, this general ecosystem can be subjected to advanced water treatment processes such as filtration, sedimentation, activated carbon input, and disinfection. • After high-level purification, the water can be utilized for domestic purposes or, following standard water treatment, used for industrial purposes."
Fairly Poor	IV	• Due to a significant amount of pollutants leading to the consumption of dissolved oxygen, this general ecosystem can be subjected to advanced water treatment processes such as filtration, sedimentation, activated carbon input, and disinfection. • After high-level purification, the water can be used for industrial purposes."
Poor	V	• The ecosystem, characterized by the depletion of dissolved oxygen due to a substantial amount of pollutants, does not cause discomfort in the daily lives of the public, such as during walks. • After specific water treatment processes like activated carbon input, reverse osmosis, and other advanced methods, the water can be used for industrial purposes."
Very Poor	VI	• In water heavily polluted with virtually no dissolved oxygen, it becomes challenging for fish to survive.

1. Goals of water environment

The framework of Setting Water Quality Standard

Check point

STEP 1

Selecting population for candidate pollutants

STEP 2

Prioritizing the pollutants through CRS & preliminary investigation

STEP 3

Nationwide monitoring of 4 major rivers

STEP 4

Human health risk assessment & Ecotoxicity

STEP 5

Cost-benefit analysis & comparison with drinking WQS

STEP 6

Audit

2. Assess the status of water environment

Environmental Agencies
River Environmental Research Centers
Local government *etc*

Nationwide Water Quality Monitoring

Instruction/ guidance, notice, technical advice for WQ monitoring

National Institute of Environmental Research

(Regulated pollutants) Compiling nationwide WQ data
Assessing the status of water quality in 4 river basins

(Unregulated pollutants) Monitoring and deriving WQS

Ministry of Environment

(Regulated pollutants) Development of improvement plan
(Unregulated pollutants) Legalizing unregulated pollutants as WQS

2. Assess the status of water environment

Assessing water quality from nationwide monitoring about regulated pollutants

○ **Purpose**

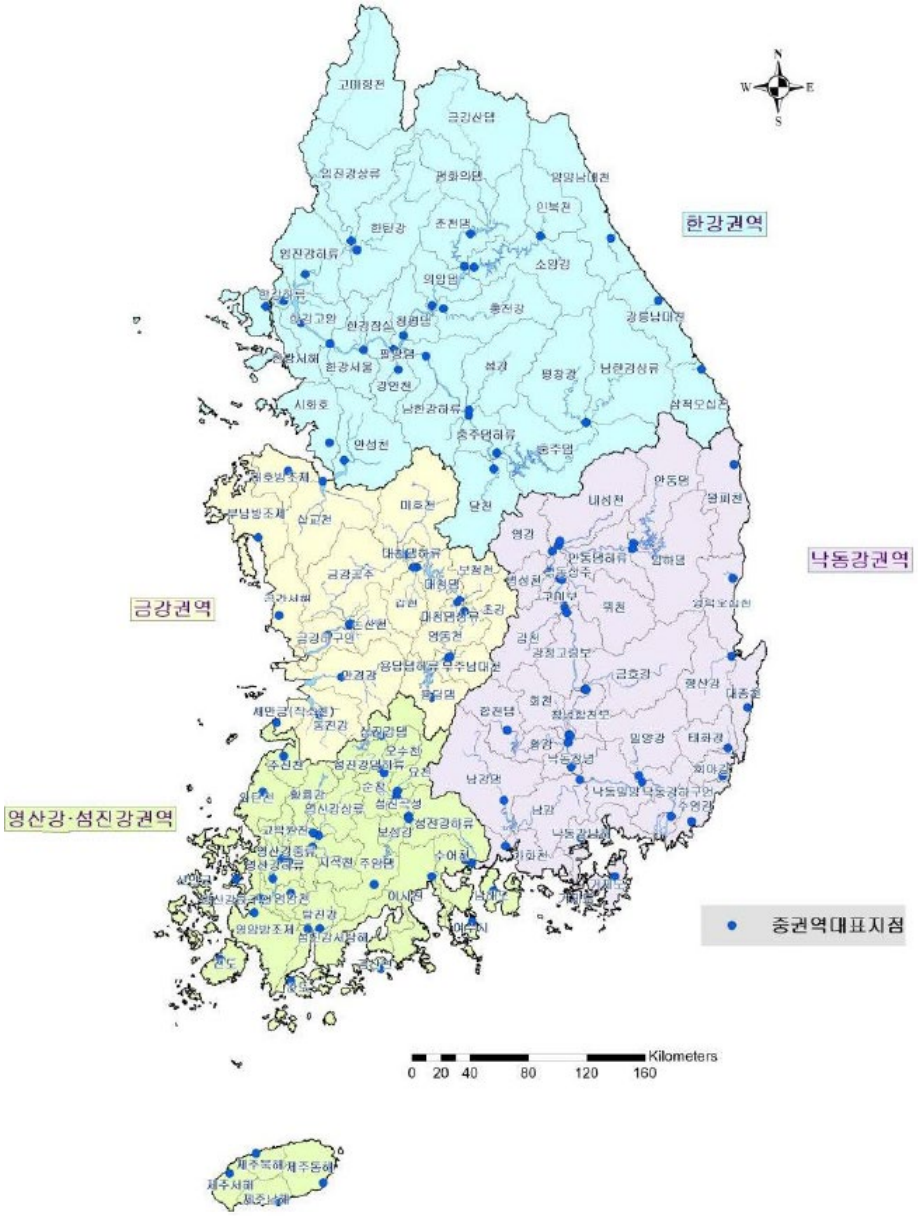
- **To evaluate the achievement of 'goal criteria' nationwide**
  - **Goal criteria**
    - **River : BOD, TP**
    - **Lake : TOC, TP**

○ **Sites**

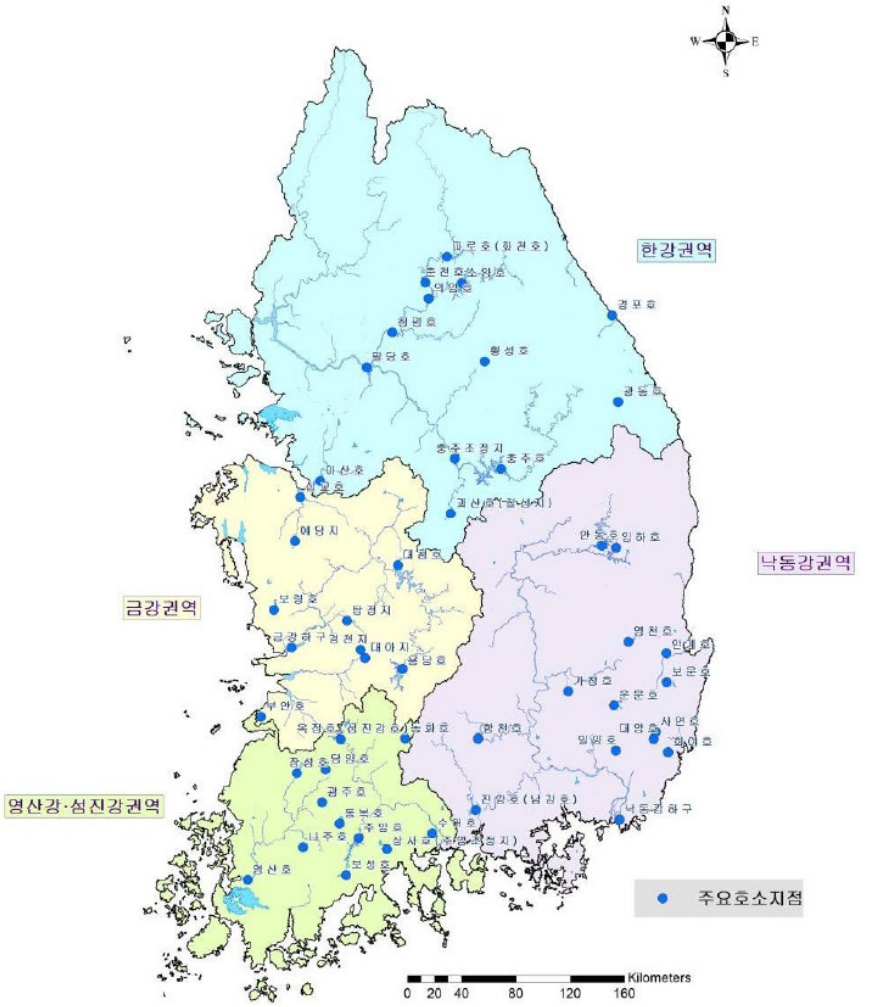
- **115 river and streams in middle basin**
- **49 main lakes**

Evaluation of nationwide water quality

2. Assess the status of water environment



115 river and streams in middle basin



49 main lakes

2. Assess the status of water environment

Achievement percentage of goal criteria in 2022

	Parameter	Total	Han River	Nakdong River	Geum River	Youngsan River
Rivers	BOD	81/115 **(70%)**	25/29 **(86%)**	24/32 **(75%)**	16/21 **(76%)**	16/33 **(48%)**
	TP	61/115 **(53%)**	15/29 **(52%)**	20/32 **(63%)**	18/21 **(86%)**	8/33 **(24%)**
Lakes	TOC	24/49 **(49%)**	9/13 **(69%)**	4/14 **(29%)**	8/10 **(80%)**	3/12 **(25%)**
	TP	9/49 **(18%)**	1/13 **(8%)**	4/14 **(29%)**	3/10 **(30%)**	1/12 **(8%)**

(Rivers) BOD 78%(`21) → 70%(`22), TP 51%(`21) → 53%(`22)

(Lakes) TOC 49%(`21) → 49%(`22), TP 18%(`21) → 18%(`22)

2. Assess the status of water environment

Monitoring unregulated micropollutants

STEP 1

Selecting population for candidate pollutants

STEP 2

Prioritizing the pollutants through CRS & preliminary investigation

STEP 3

Nationwide monitoring of 4 major rivers

STEP 4

Human health risk assessment & Ecotoxicity

STEP 5

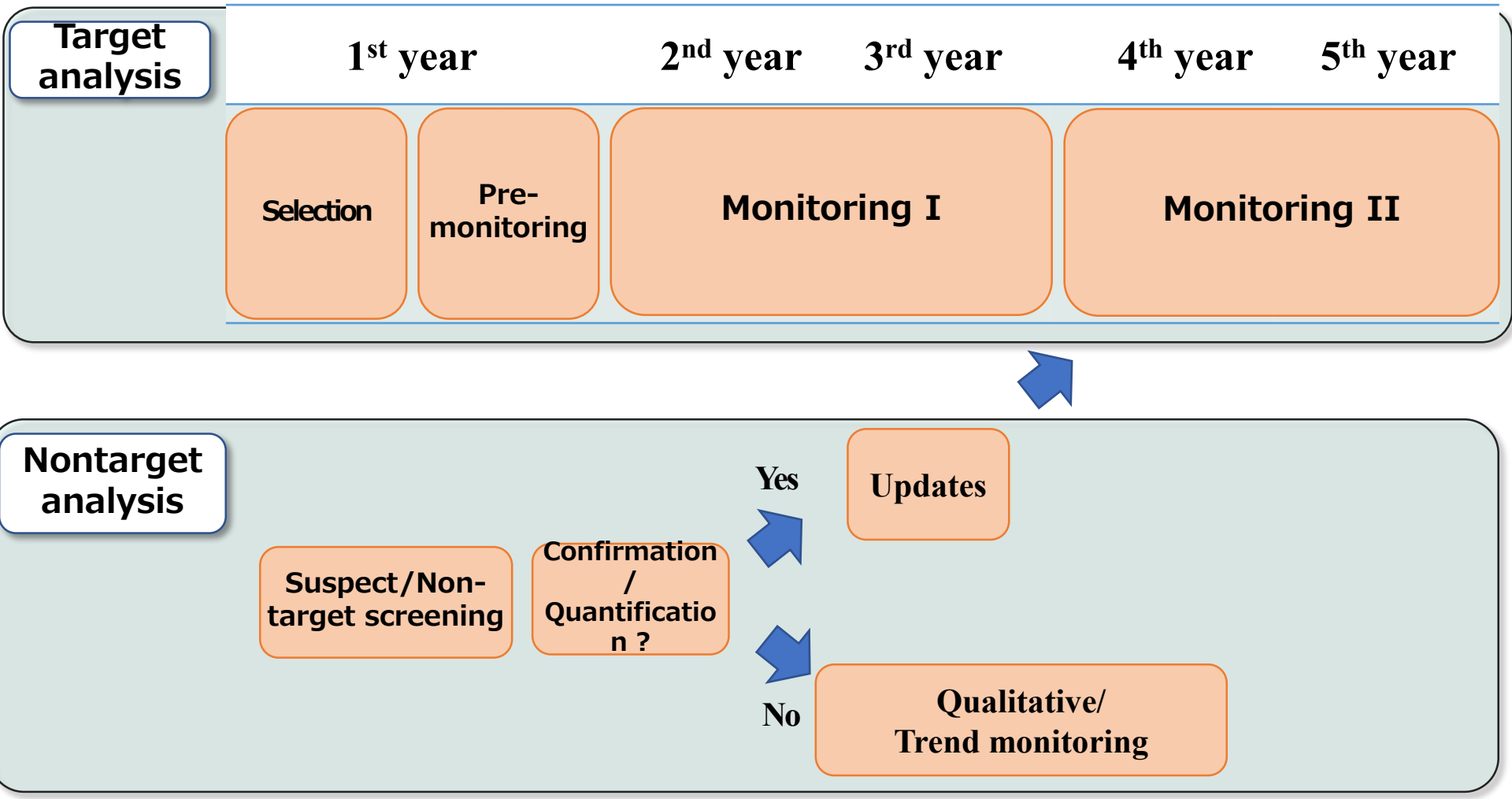
Cost-benefit analysis & comparison with drinking standards

STEP 6

Audit

2. Assess the status of water environment

Framework of monitoring system for unregulated micorpollutant



3. Identify pollution sources

(Regulated pollutants)

● **When some parameter exceeds WQS frequently, the area should be designated as 'special measures zone' to protect environment.**

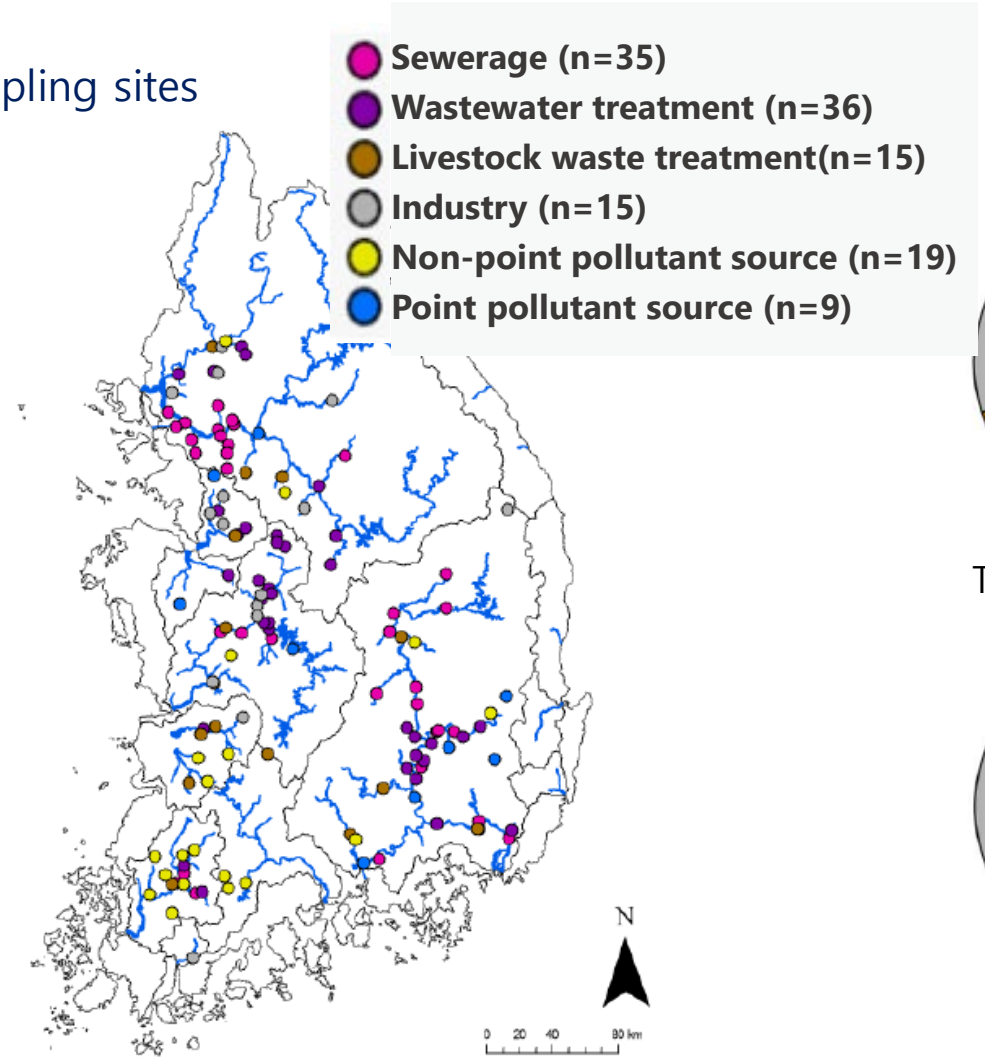
- Mitigation measures should be established.

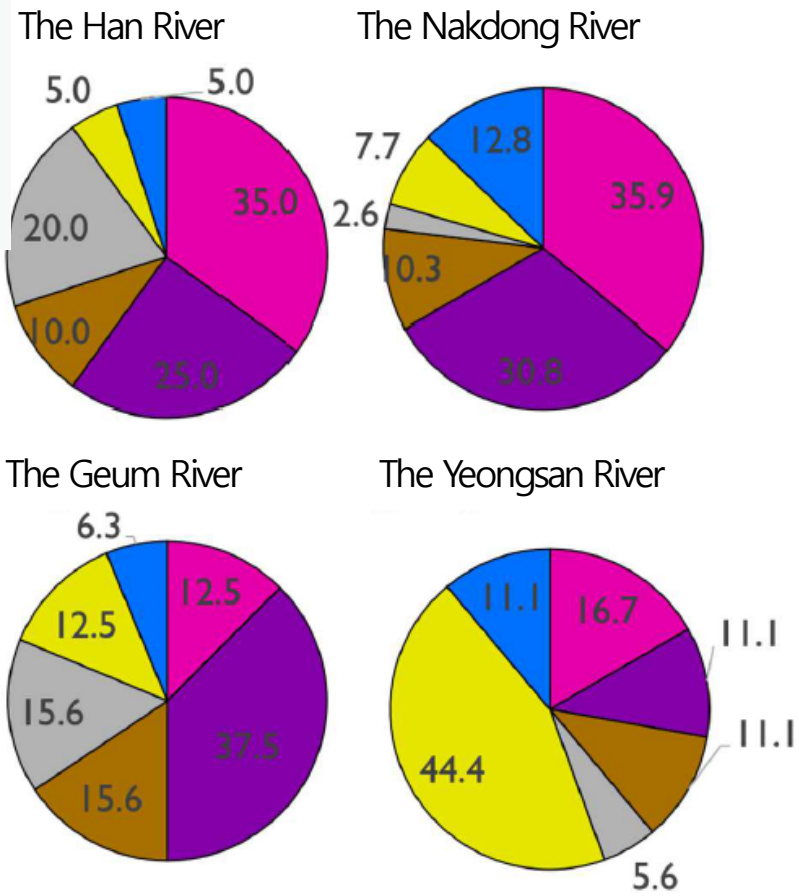
- Following the measures, action such as compilation of inventory of manufacturers and other point sources near the site should be taken.

3. Identify pollution sources

Monitoring unregulated micorpollutants

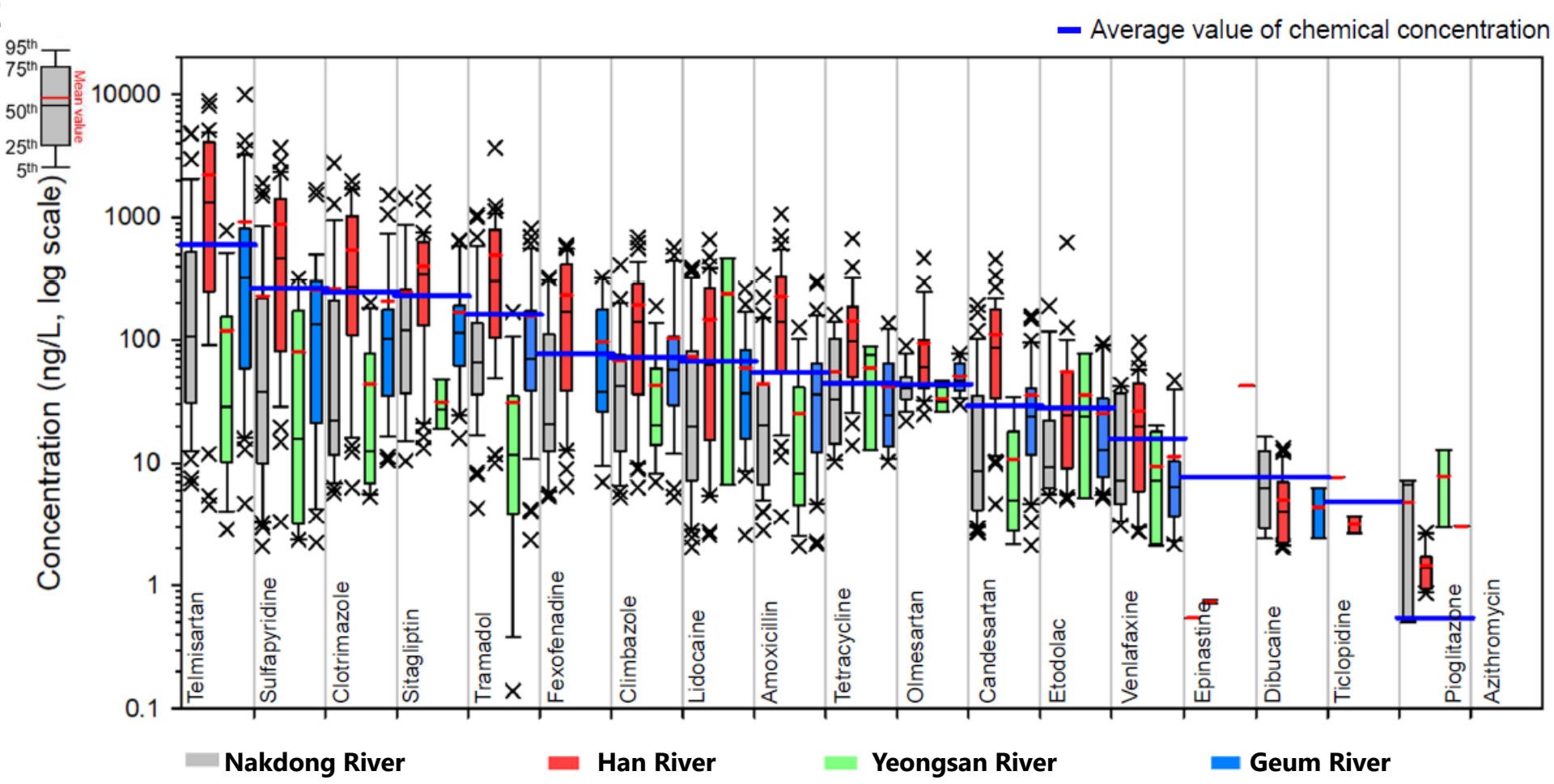
Sampling sites





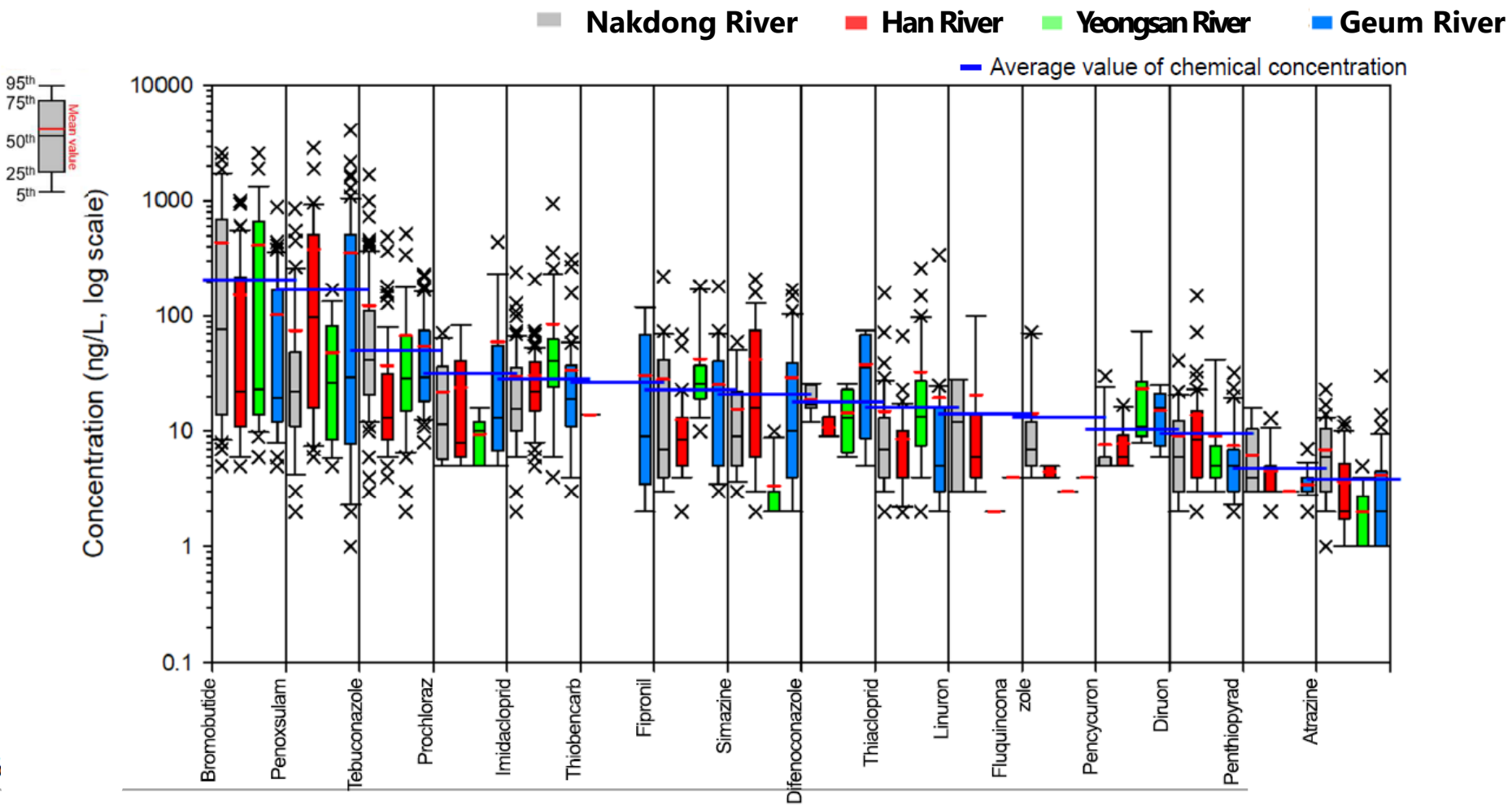
3. Identify pollution sources

Monitoring unregulated micropollutant (Pharmaceuticals)



3. Identify pollution sources

Monitoring unregulated micropollutant (Pesticides)



4. Implement measures to address issues

(Regulated pollutants)

- **The related laws should be reviewed.**
- **When the goal criteria is not achieved, plans for measures have to be established and if necessary, implemented.**

(Unregulated pollutants)

- **When hot issues related to chemicals in rivers come out, monitoring should be conducted to develop policy.**

  ex) PFAS, Microplastics *etc*

5. Evaluating outcomes and revising policies

(Regulated pollutants)

- **To address nutrients in water, the related laws were revised.**
  - **Effluent standard of sewage treatment plants was more strict. (2.0 mg/L→ 0.2 mg/L in facilities >500m^3/d)**
- **When the reason is found, follow-up measures such as TMDL have been implemented to keep WQS.**

(Unregulated pollutants)

- **WQS or discharge permit is reviewed and if necessary, revised.**

  ex) The revision of the law to introduce PFAS in discharge permit is currently under review.

6. Challenges and future plans

Challenges

- Not easy to increase the number of WQS due to dualized legal system
- Need to introduce WQS to protect aquatic life
- Need to use more parameters to evaluate water quality
- Since there are many divisions related to water quality management in MOE, it is hard to cooperate with each other, making it difficult to find some reasons why the water quality is better or deteriorated

6. Challenges and future plans

Future plans

- Increase the number of WQS to protect human health (HH) and aquatic life (AL) by 2025 (HH 20→30, AL 0 →8)

- Expand water quality monitoring centers nationwide by 2026 to investigate unregulated micropollutants

Waegan Water Quality Analysis Center

Maeri Water Quality Analysis Center

Thank you for your attention.