



Progress of Water Environment Management and Future Challenges in KOREA

Soon-Ju Yu



National Institute of Environmental Research(NIER)



Content

- I. State of Water Quality in Korea**
- II. Changes of Organisation Arrangement related to Water Quality Management**
- III. Water Quality Management Policies**
- IV. Changes in Laws, Standards**
- V. Goals of Water Quality Management Policy in short/mid-term to follow April 2011**

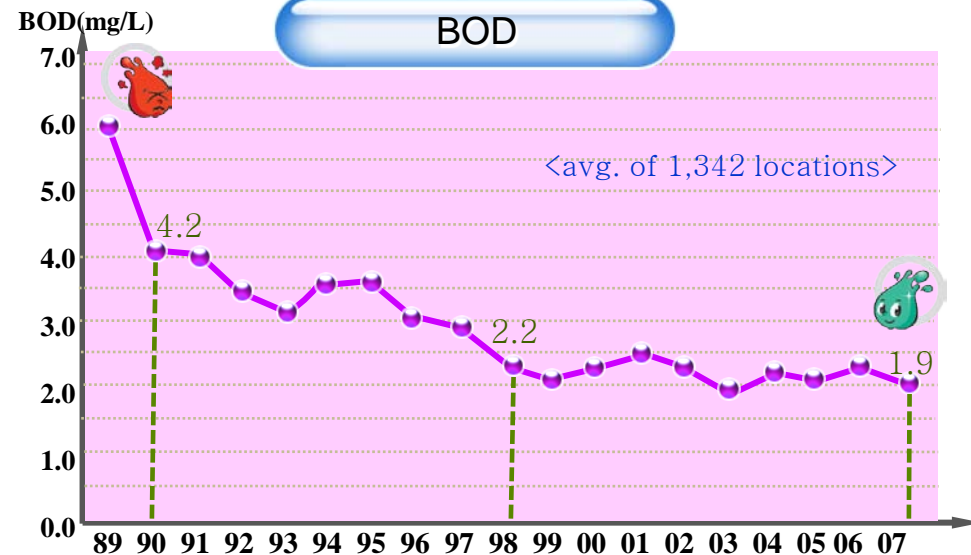
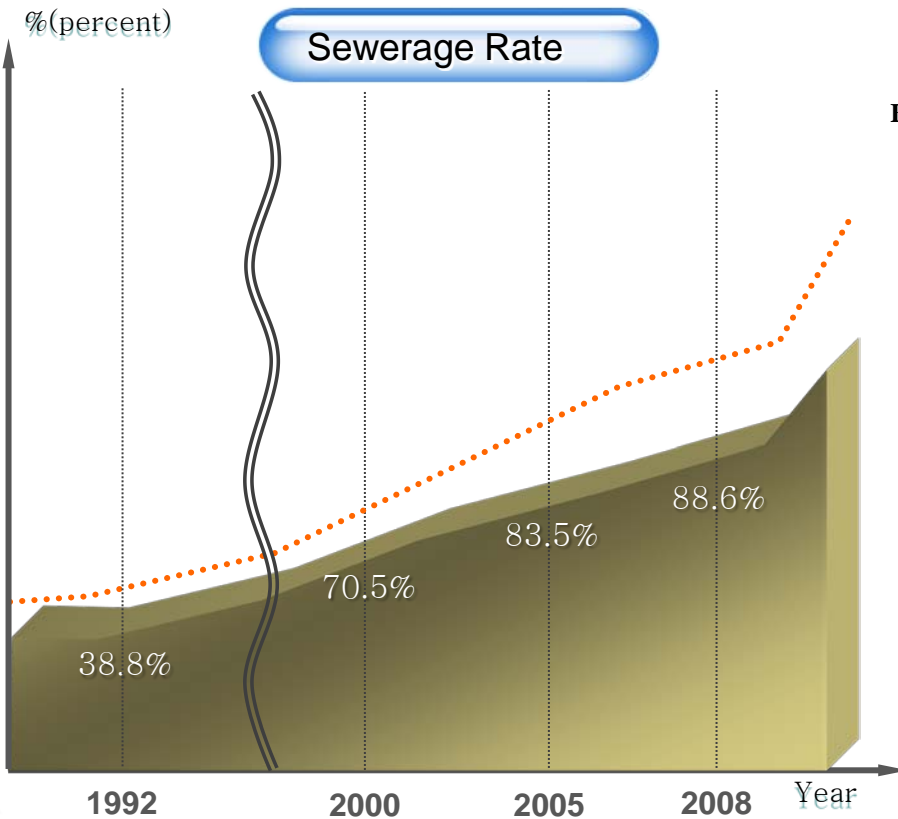


I . State of Water Quality in Korea



Water Quality in Korea

- The water quality of main river, 4 has improved through the comprehensive water measures since 1996.
- Main water supply sources of 4 major rivers are well managed to 1~2 mg/L BOD.

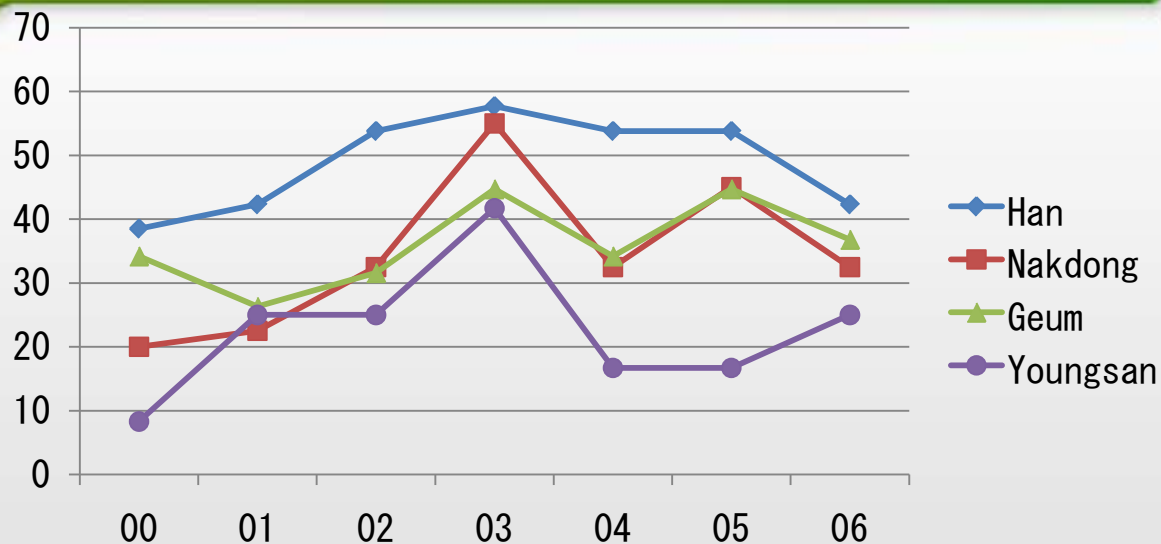


Water Quality in Korea

Improvement Rate of Aquatic Environmental Standard

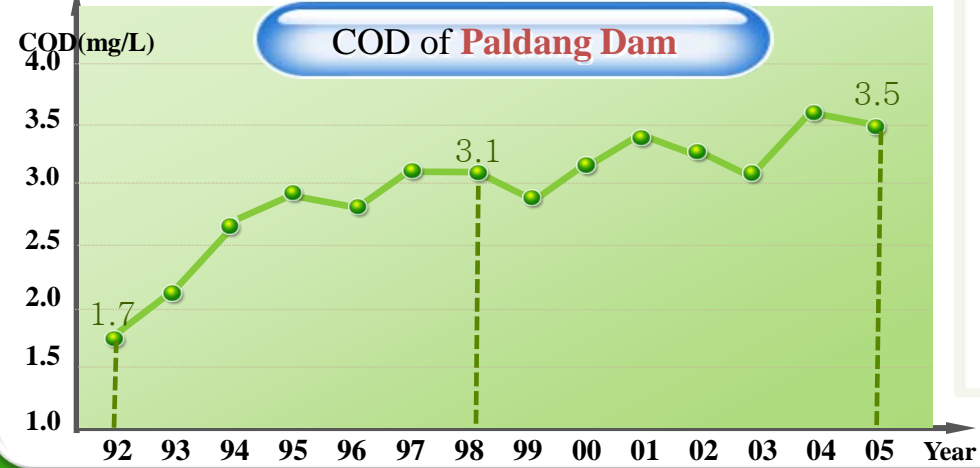
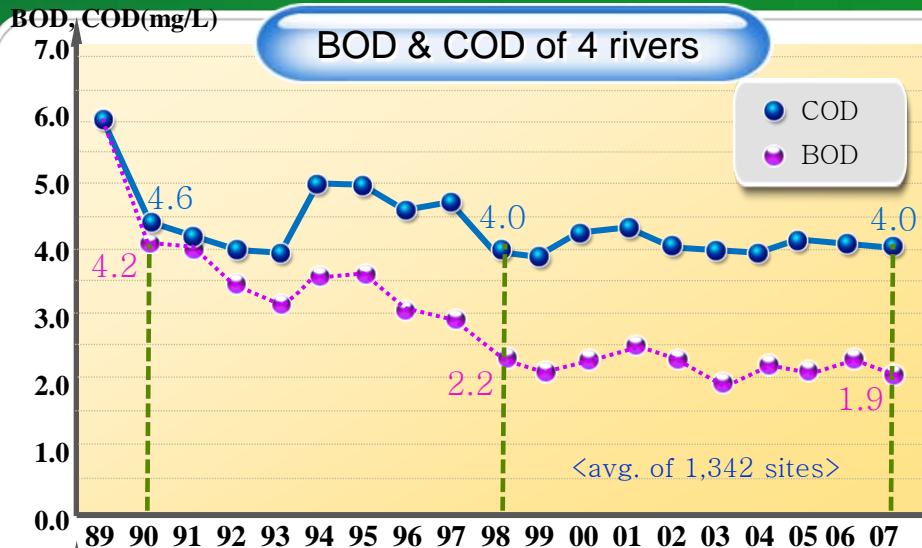
- All streams nationwide are classified into 194 sections.
- Improvement rate of the standard focusing on BOD levels was 35.6 % in 2006, which is an increase compared to the 27.6 % in 2000.

Improvement Rate (BOD) in major 4 river



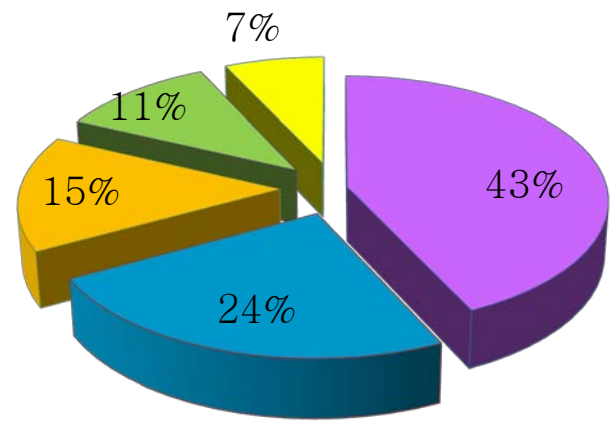
Water Quality Korea

- However **COD** are increased because of increased chemical uses and refractory pollutants influx from non-point source.



Sources of COD

(Year : 2007, ton/day)



- non-point
- livestock waste water
- others
- sewage
- Industrial waste water

Water Quality Korea

Online Water Quality Monitoring System(57 sites)

- 20 cases have been recorded since 2002. 7

Reason	The number of Early warning case
Total	20
the inflow of wastewater or water pollutants	4
Rain flows into non-point source pollutants	6
Development of algae caused by rising temperature	7
Unidentified	3

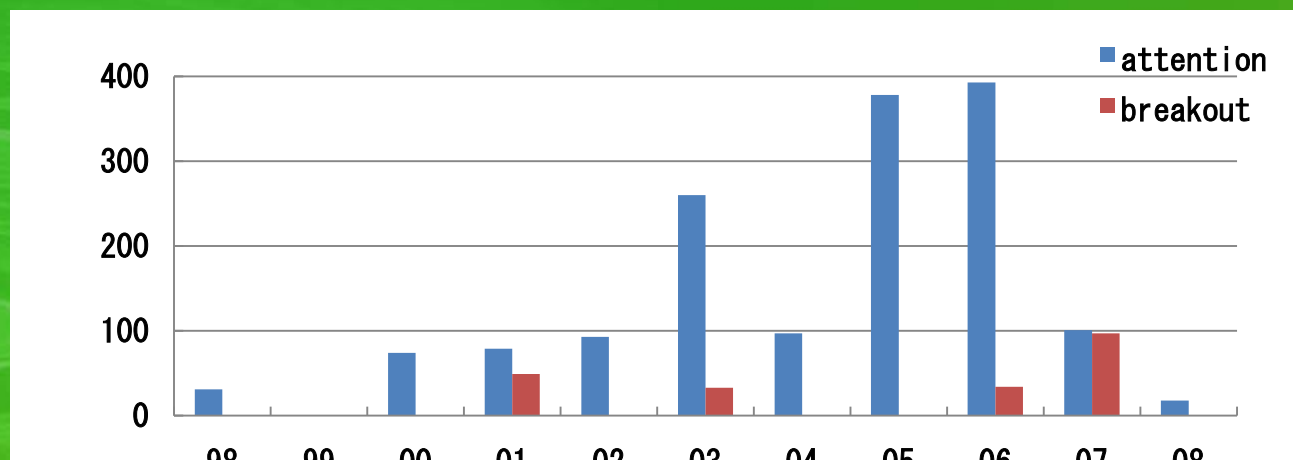


Water Quality Korea

Algal Bloom Forecasting System

- Respond to water quality deterioration by algal bloom and algal toxin in waterworks, Reservoir
- Reservoir : 4 ('98) → 16 ('06) → 17('07) → 20 ('08)

criteria	Attention	Warning	Break out
Chl-a (mg/m ³)	> 15	> 25	> 100
Microcystis (cell/mL)	> 500	> 5,000	> 1,000,000

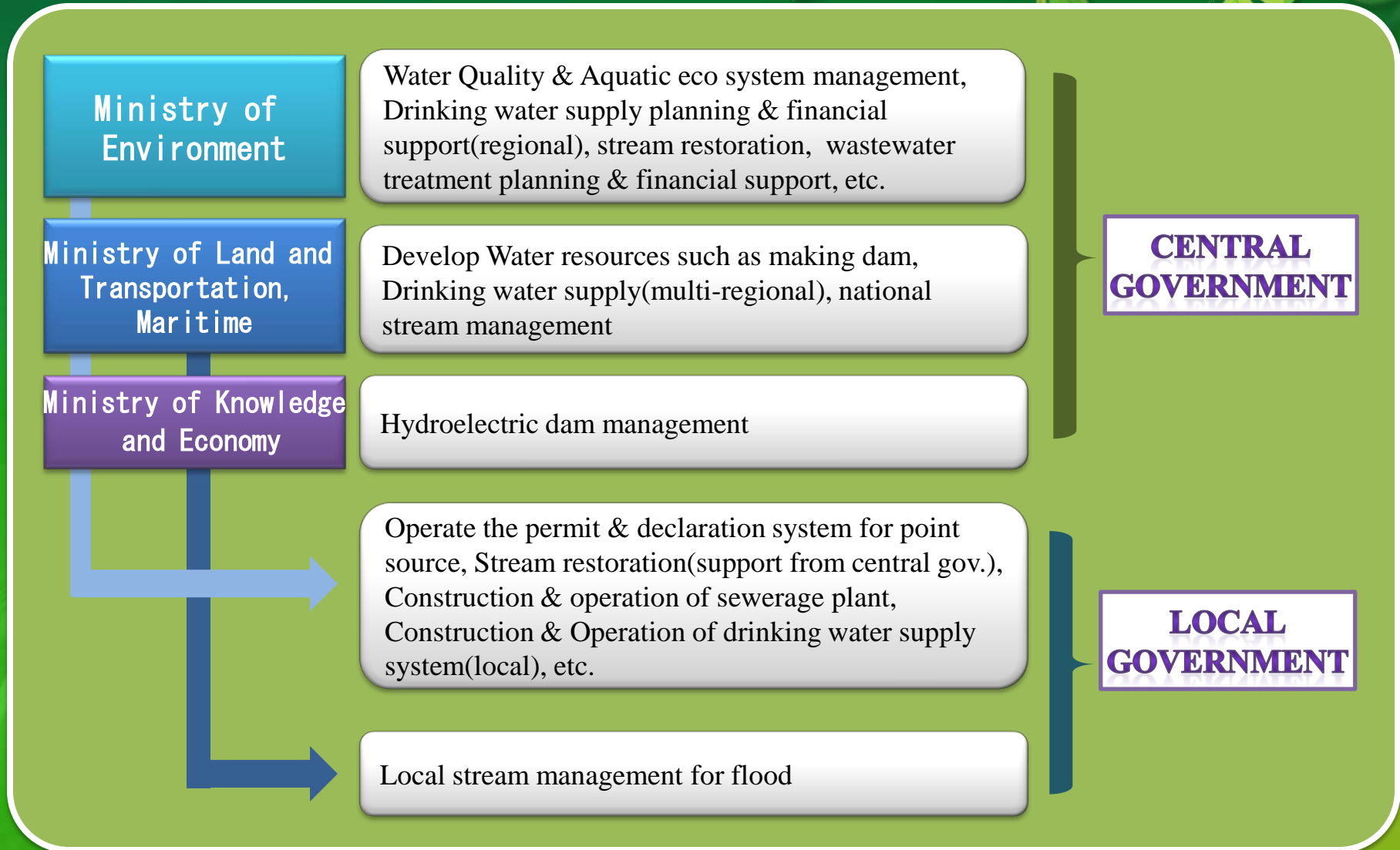




II. Changes of Organization Arrangement related to Water Quality Management

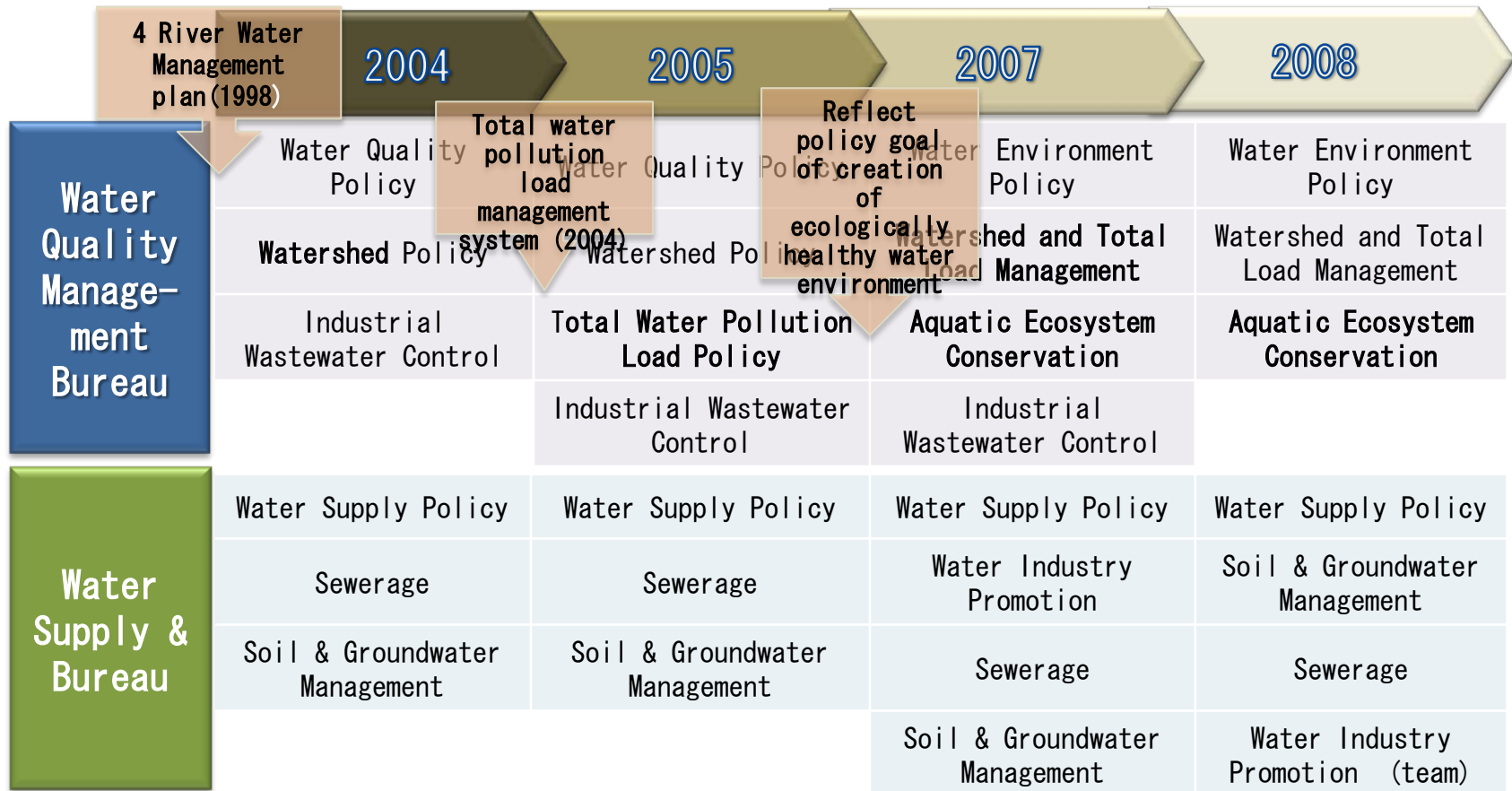


Water Management Structure



Changes of MOE Organization

Water Quality Management Division



Changes of NIER Organization

Water Quality Research Department

2004	2005	2009	2010
Wastewater Engineering	Water Quality	Water Environment Control	Water Pollution Load
Water Pollution Chemistry	Drinking Water	Drinking Water	Water Environment Engineering
Watershed Management	Soil and Groundwater	Soil and Groundwater	Water Quality Control
Water Microbiology	Water Pollution Cap System	Water Pollution Cap System	Water Supply and Sewerage Research
Drinking Water	Emission Sources Research		Soil & Groundwater Research
4 River Environmental Research Center	4 River Environmental Research Center	4 River Environmental Research Center	4 River Environmental Research Center

Water quality Control Research

predict long-, short-term water quality through modeling and monitoring for integrated water quality control



III. Water Quality Management Policies



Water Management Policies

1 Basin Management System(4 river basin)

2 Pollution Sources Management

3 4 Major Rivers Restoration Project

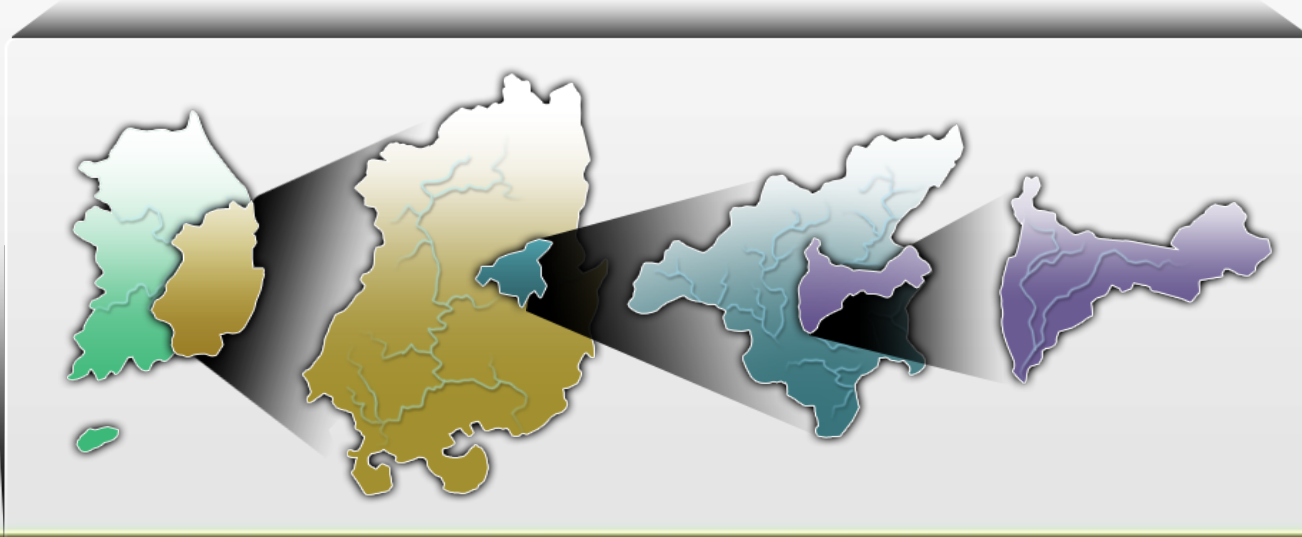
4 Non-point Source Pollution Management

Basin Management System

- Advanced basin management system of 4 main river
Han river(30/289), Nakdong river(33/266),
Geum river(22/141), Yeongsan & Seomjin river(32/144)
(watershed/sub watershed)

Basin Management System

..... Basin Watershed Sub watershed



Basin Management System (4 river basin)

Designation of Water Quality Protection Area

+ Riparian Buffer Zone System

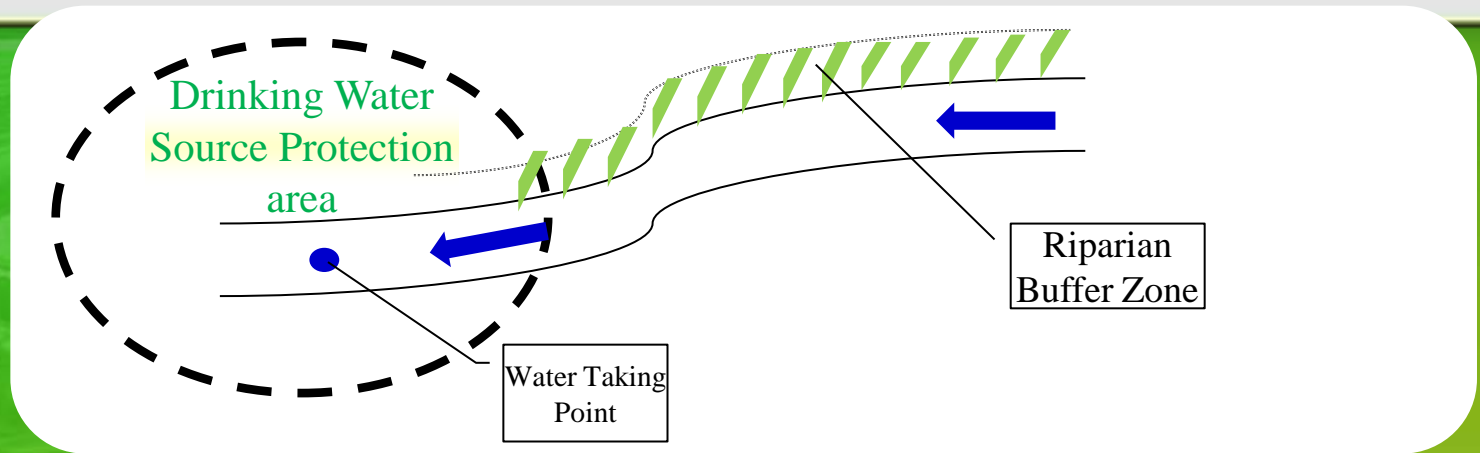
- Restricting the construction of restaurants, accommodations, and factories by designating a certain section of a river as a buffer zone for the purpose of securing a healthy aquatic ecosystem and clean water.
- Status of designated Riparian Buffer Zone, 1,200km² as of end of 2009.

+ Drinking Water Source Protection Area

- Restricting the development near the drinking water source area

+ Specific Water Quality Protection Area

- Restricting the comprehensive development projects near the large-scale drinking water source area (Paldang, Daecheong)



Basin Management System

1 Total Water Pollution Load Management System

- ✚ to compensate for the shortcoming of conventional concentration-based regulation and to encourage environment – friendly local development within the scope of achieving and maintaining the desired water quality.
- ✚ **Advanced watershed control** is designed to raise the efficiency of water quality management based on **scientific method**, increased responsibility of each economic entity, and the achievement of administrative goal (target water quality) within an appropriate time.
- ✚ Pollution sources are managed so as to keep total amount pollutant load “total maximum daily allowable load” to attain target water quality.
 - Primary target pollutant is BOD
 - TMDL management implemented in 3 major rivers (**Nakdong, Geum, Yeongsan**) since 2004, and will be implemented in **Han river** from June 2013 applied to **BOD**, and **T-P** will be added from 2011.

Pollution Sources Management

Regulatory Policy

- ✚ Strengthen the control of hazardous substances
 - Increasing the number of specified hazardous substances
No. of pollutants : 17(2005) → 25(current) → 35(2015)
※ 2010 : Acryl amid added
 - Set emission standards for 7 pollutants (2010)
1,4-dioxane, DEHP, Vinyl chloride, Acrylonitrile, Bromoform, Ni, Ba

Eco-toxicity Monitoring System

- To comprehensively manage the toxicity in wastewater
- **Receptor-oriented** water quality management system
 - Ecotoxicity refers to the degree of influence the **acute toxicity** of wastewater
 - Using Daphnia Magna is transformed into a **toxicity unit(TU)** to determine the ecotoxicity degree . TU takes the survival of 50% of Daphnia
 - Applied to 2,258 wastewater & sewerage treatment from 2011



4 Major Rivers Restoration Project

Environmentally Friendly Approaches

+ Background

- Climate change
 - Average temperature has constantly risen to as high as 6.4 degree
 - Frequency and range of floods and droughts is increasing
- Need to ensure water resources and water quality in future

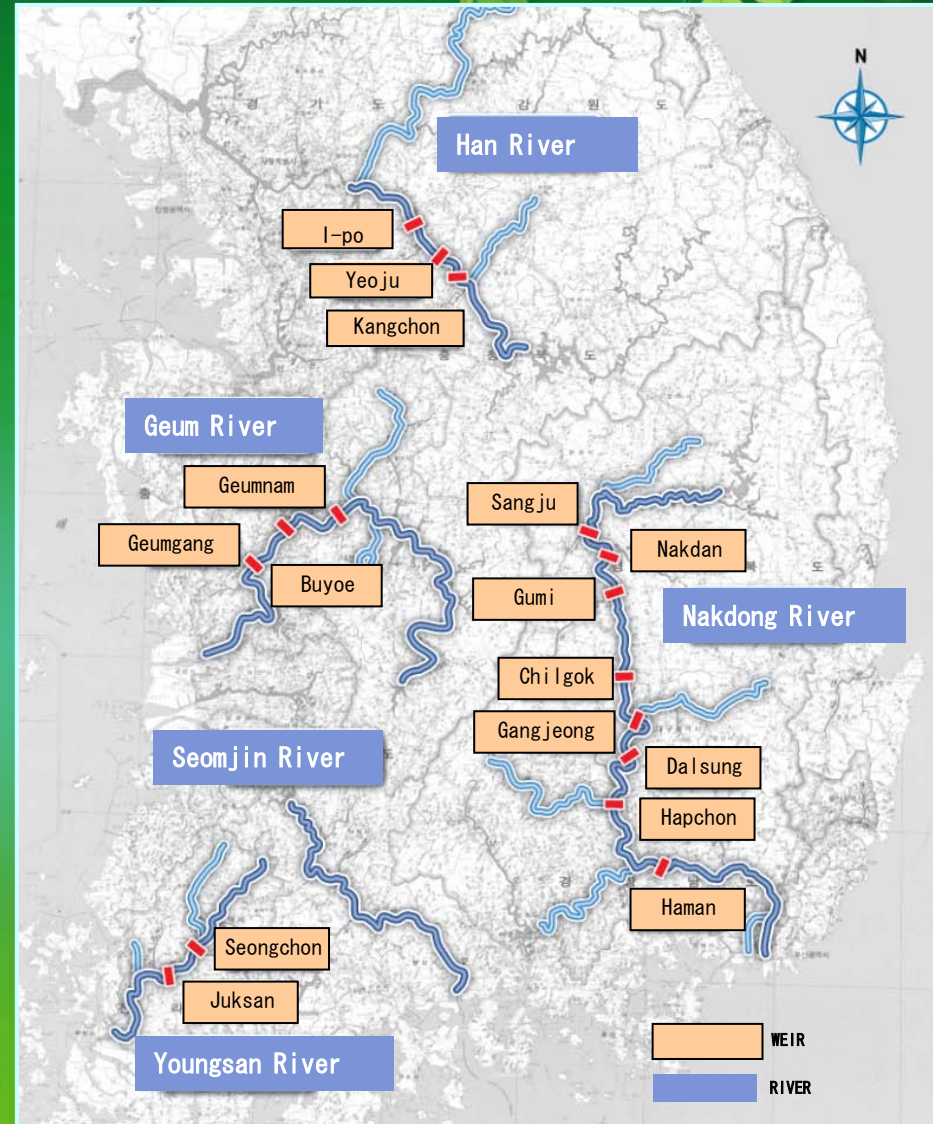
+ Urgent call

- Sustainable Water Management System
- Increasing Management Efficiency by integration of regional water supply systems
- Decreasing leakage from water supply pipes by maintenance investment
- Improving quality of tap water through expanding high-level treatment facilities

4 Major Rivers Restoration Project

OUTLINE OF PROJECT

- Project Period : 2009~2012
- Project Budget : 19.3 Billion USD
- Contents of Project
 - Building 16 weirs
 - Construct 2 new dams
 - Dredging 5.7 billion m³
 - Bike lanes 1,928km
 - Enlargement of Environmental infrastructure (1,100)



Major Rivers Restoration Project



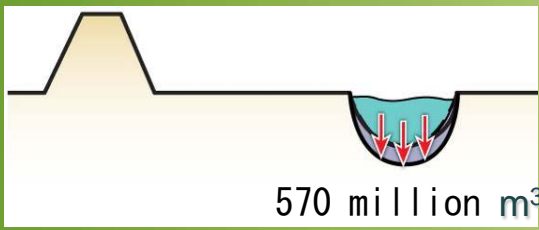
Securing Water – 1.3 billion m³

Building weirs(16) and dredging

Ipo Weir (The Han River)



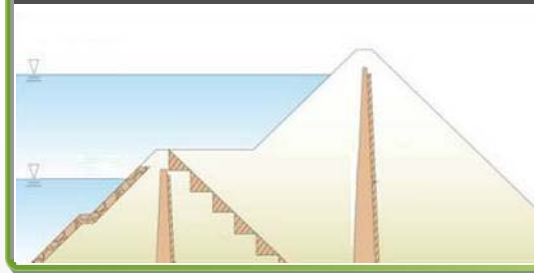
Dredging Riverbeds



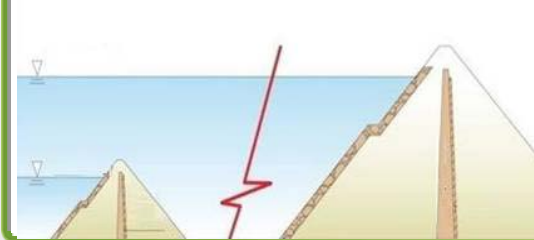
800 million m³

Embanking Agricultural Reservoirs (96)

Heightening the River Banks



Reinforcing the River Banks



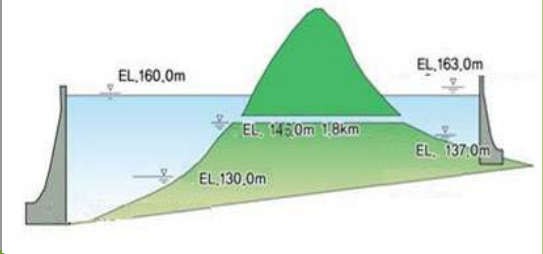
250 million m³

Constructing New Dams (2)

Yeongju Dam



Connecting Andong and Imha Dams

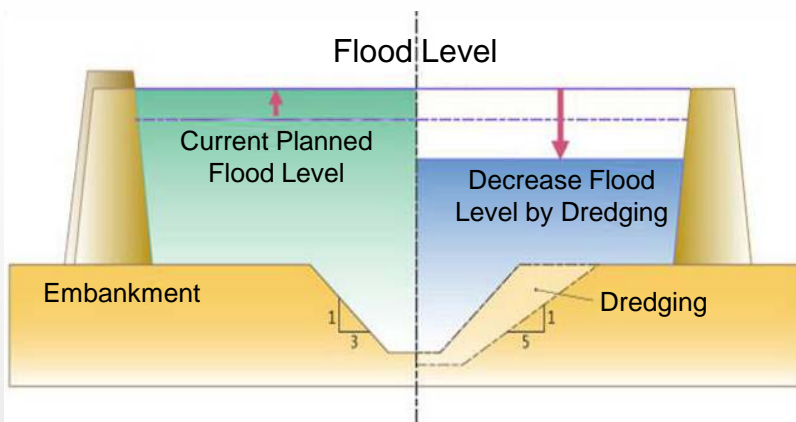


250 million m³

Major Rivers Restoration Project

2 Prevent Flood, Promote Regional Development

Control the Floods



- National flood control capacity
100 Year Flood → 200 Year Flood
- Embankment → Dredging

Regional Development



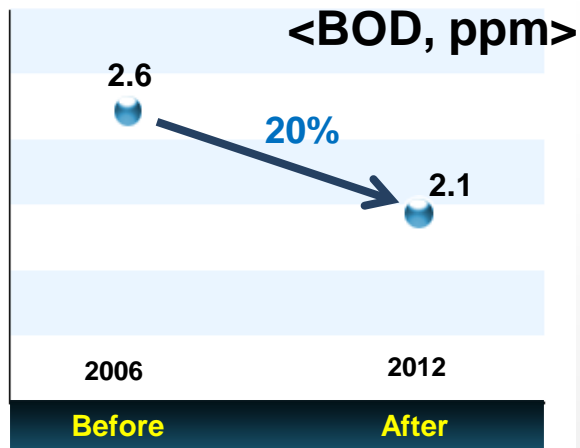
- Eco-tourism
- Waterfront Uses

- 500 stream and creeks that flow into the 4 rivers will be ecologically restored
- It will come to bring regional development through eco-tourism and waterfront uses

Major Rivers Restoration Project

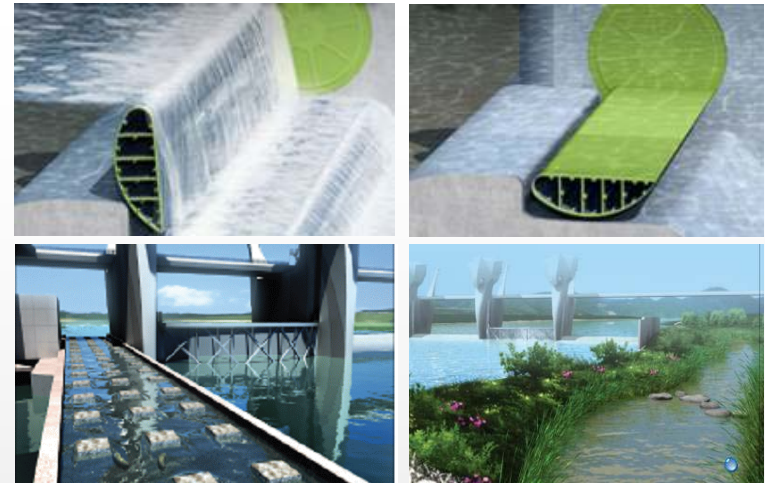
3 Improve Water Quality, Restore the Eco-system

Improving Water Quality



- ◆ Sewage treatment facility: 709
- ◆ Livestock manure treatment facility: 21
- ◆ Waste water treatment facility: 38
- ◆ Non-point pollution treatment facility: 21
- ◆ Stream restoration : 120

Movable Weirs & Natural Fish-way



- ◆ Prevent Accumulation (movable weir)
- ◆ Address flood and drought (movable weir)
- ◆ Protect fishery species (natural fish-way)

Major Rivers Restoration Project

3

Improve Water Quality, Restore the Eco-system

Restoring the Ecological Stream and Constructing Wetland



- Ecological stream(national) restoration(929 km, ₩3,000 billion)
- Create 84 wetlands
- ※ Han-river(17), Nakdong river(11), Geum river(8), Yeongsan-Seomjin river(48)
- Local & city stream restoration projects, streamlet revival projects, etc.

Non-point Source Pollution Management

✚ Mandatory installation of non-point pollution reduction facilities

- Development workplaces which should go through environmental impact assessment
- workplaces of industries whose site area is more than 10,000 m²

✚ Designation and Management of 'Non-Point Source Management Area'

- The areas highly vulnerable to non-point pollution sources are designated as 'non-point source control districts'
 - Soyang Lake, Doam Lake, Imha Lake, Gwangju metropolitan city

✚ Reduction of muddy water from highland field

Promoting the facilities to mitigate landslide and sediment discharge from highland field caused by torrential rains

✚ Pilot projects of 43 non-point source reduction facilities

The installation of reduction facility model and execution of the monitoring of various non-point sources for land-use type such as urban areas, roads, farmland, and parking lots



IV. Changes in Laws, Standards



Change in Water Environmental Act

Water Quality Management

1960s (6 Acts)	1970s ~ 1980s (6 Acts)	1990s ~ 2009 (6 Acts)	Enacted Revised
Environmental Pollution Prevention Act (Nov 5, 1963)	Environmental Conservation Act (Dec 31, 1977)	Water Quality and Ecosystem Conservation Act	'90. 8 '09. 5
		Act Relating to the Han River Water Quality Improvement and Community Support	'99. 2 '08. 12
		Act on Nakdong River Watershed Management and Community Support	'02. 1 '08. 12
		Act on Geum River Watershed Management and Community Support	'02. 1 '08. 12
		Act on Yeongsan & Sumjin River Watershed Management and Community Support	'02. 1 '08. 12
Sewerage Act (Aug 3, 1966)		Sewerage Act	'66. 8 '09. 1
Water Supply and Waterworks Installation Act (Dec 31, 1961)		Water Supply and Waterworks Installation Act	'61. 12 '07. 12
		Management of Drinking Water Act	'95. 1 '08. 3

Change of Water Quality Standard

- **National Standard for Water Quality Management in order to protect human health and achieve sound aquatic environment**
- **Water Quality and Aquatic Ecosystem**
 - Water quality chemical standards is limited to evaluate aquatic ecosystem due to a lot of chemicals
 - Consider the effect of pollution on aquatic ecosystem
 - 5 grades in the existing category are adjusted and increased into 7 grades 2007 to explain water quality state more detail
 - **Standard for human health protection (17)**
 - **Standard for the living environment (5) / 7th grade**
 - **Water quality biological feature of aquatic ecosystem, 4th grade**

Water Quality Standard(WQS)

- Rivers and Streams, Lakes (before 2007)
- Physico-chemical and organism-based environmental standard (5 grade)

classification	class	pH	BOD COD*	SS	DO	Total Coliform	TP *	TN *
Living Environment	I	6.5~8.5	≤ 1	≤ 25 ≤ 1 *	7.5 ≥	≤ 50	≤ 0.010	≤ 0.200
	II	6.5~8.5	≤ 3	≤ 25 ≤ 5 *	5 ≥	≤ 1,000	≤ 0.030	≤ 0.400
	III	6.5~8.5	≤ 6	≤ 25 ≤ 15 *	5 ≥	≤ 5,000	≤ 0.050	≤ 0.600
	IV	6.5~8.5	≤ 8	≤ 100 ≤ 15 *	2 ≥	–	≤ 0.100	≤ 1.0
	V	6.5~8.5	≤ 10	No floating matter such as garbage	2 ≥	–	≤ 0.150	≤ 1.5
Protection of human health (9)	Cd ≤ 0.01, As ≤ 0.05 CN ND, Hg ND, Organic phosphorus ND, Pb ≤ 0.1, Cr+6 0.05, PCB ND, ABS ≤ 0.5							

* Lake

Water Quality Standard

Standard for human health protection (17)

- 8 hazardous substances which can pose a direct/indirect threat to the public health were added and Cd, Pb were reinforced to twice

Pollutants	Standard Value (mg/L)
Cadmium (Cd)	≤ 0.005
Arsenic (As)	≤ 0.05
Cyanide (CN)	Not Detected (Limit of Detection 0.01)
Mercury (Hg)	ND (LOD 0.001)
Organic Phosphorus	ND (LOD 0.0005)
Polychlorinated Biphenyls (PCB)	ND (LOD 0.0005)
Lead (Pb)	≤ 0.05
Hexachromium (Cr6+)	≤ 0.05
Alkyl Benzene Sulfonate (ABS)	≤ 0.5
Carbon Tetrachloride (CCl ₄)	≤ 0.004
1,2-Dichloroethylene	≤ 0.03
Tetrachloroethylene (PCE)	≤ 0.04
Dichloromethane	≤ 0.02
Benzene	≤ 0.01
Chloroform	≤ 0.08
Di-Ethylhexyl Phthalate (DEHP)	≤ 0.008
Antimony (Sb)	≤ 0.02

Water Quality Standard

Standard for the living environment

- Animated character was able to understand easily the environmental standard
- COD, TP** were included to make up for water quality management after Jan. 2010









Stream and river		State (Character)	pH	BOD (mg/L)	COD (mg/L)	TP (mg/L)	SS (mg/L)	DO (mg/L)	Coliforms (No/100mL)	
									Total coli.	Fecal coli.
Very Good	Ia		6.5~8.5	≤1	≤2	≤0.02	≤25	≥7.5	≤50	≤10
Good	Ib		6.5~8.5	≤2	≤4	≤0.04	≤25	≥5.0	≤500	≤100
Fairly Good	II		6.5~8.5	≤3	≤5	≤0.1	≤25	≥5.0	≤1,000	≤200
Fair	III		6.5~8.5	≤5	≤7	≤0.2	≤25	≥5.0	≤5,000	≤1,000
Fairly Poor	IV		6.0~8.5	≤8	≤9	≤0.3	≤100	≥2.0	-	-
Poor	V		6.0~8.5	≤10	≤11	≤0.5	1)	≥2.0	-	-
Very Poor	VI		-	>10	>11	>0.5	-	<2.0	-	-

Lake		State	pH	COD (mg/L)	SS (mg/L)	DO (mg/L)	TP (mg/L)	TN (mg/L)	Chloro phyll-a (mg/m ³)	Coliforms (No/100mL)	
										Total coli.	Fecal coli.
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	≤5	≥5.0	≤0.05	≤0.6	≤20	≤5,000	≤1,000
Fairly Poor	IV		6.0~8.5	≤8	≤15	≥2.0	≤0.10	≤1.0	≤35	-	-
Poor	V		6.0~8.5	≤10	1)	≥2.0	≤0.15	≤1.5	≤70	-	-
Very Poor	VI		-	>10	-	<2.0	>0.15	>1.5	>70	-	-

1) No floating matter such as garbage

Water Quality Standard

- Water quality biological feature of aquatic ecosystem
 - Biological indicator species including benthos and fish according to each grade was establish to evaluate for water quality biological feature of aquatic ecosystem

Class	Biological Indicator Species				Habitats & Features
	Fish		Benthos		
Very Good ~ Good					<ul style="list-style-type: none"> Crystal clear water, and high flow velocity Rocks and pebbles at the bottom. Very little attached algae
	산천어 (<i>Onchorhynchus masou masou</i>)	금강모치 (<i>Rhynchocypris kumgangensis</i>)	통옆새우 (<i>Gammarus sobaegensis</i>)	가재 (<i>Cambaroides similis</i>)	
					
	머들치 (<i>Rhynchocypris oxycephalus</i>)	열목어 (<i>Brachymystax lenok tsilingensis</i>)	빨하루살이 (<i>Drunella aculea</i>)	민하루살이 (<i>Cinctocostella levanidovae</i>)	



V. Goals of Water Quality Management Policy in short/mid-term



New Threat : Climate Change

Intensified Flood



Last 10 years, Heavy rain fall(over 100mm) has increased by **1.7 times**

Annual Property loss : ₩2.7 trillion('02~'06)

Frequent Drought



Severe Drought during `2008~2009

Difficulty in supplying drinking water

Rising Temperature



Last 100 years, temp. of Korea rose by **1.5°C**

Climatic Damage : ₩17.7 trillion

Drinking water Shortage

Change of the Ecosystem

Water Quality Degradation

Property Loss

Goals of Water Quality Management

Water Environment Management Master Plan (2006~2015)

✦ Object and Vision

To create clean water environment where our children can swim with fish

- ecologically healthy water environment and secure water quality against harmful substances

✦ Core indicators

- Maintaining the nationwide quality of 85% of the water at high levels under the revised Water Quality Conservation Act
- Restoration of 25% of non-natural stream(21,800) into natural stream
- Creating 30% of the buffer zones purchased in the upper streams of water quality sources as Riverine Ecobelt
- ✦ The basic criteria for public health will be increased from 9 items to 30
 - The criteria for dealing with specific water quality hazards will be increased from 17 items to 35



Goals of Water Quality Management



Securing Fishable and Swimmable Rivers & Lakes

Perform
Basic
Research

Restore
Aqua-eco
System

Manage
Hazardous
Materials

Extend
Basic
Infra

Current Environmental Policy 2010

Vision

‘Achieve Green Korea’ where the environment, economy and society co-exist

Goals

- Improve people’s satisfaction for environmental services
- Contribute to enhancement of Korea’s profile through advancement of environmental policies
- Achieve a low carbon society through green lifestyle revolution

Policy Task

- **Restore the vitality of 4 major rivers**
- **Advance waterworks service**
- Conserve and make wise use of natural resources
- Provide advanced weather services
- Construct a society where resources are circulated
- Earn reputation as and environmentally-advanced country through a successful hosting of 2012 WCC in Jeju.
- Provide supports for improving environmental capabilities of developing countries
- Management hazardous substances for the public health
- Implement “carbon Diet 2030”
- Construct 5 Green Growth Model Regions

Summary

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- IV. Changes in Laws, Standards
- V. Goals of Water Quality Management Policy in short/mid-term

Websites

 **Ministry of Environment** : <http://eng.me.go.kr/main.do>

- Four Major River Restoration Project of Republic of Korea
- Water Environment Management Master Plan
- ECOREA

 **National Institute of Environmental Research**
<http://www.nier.go.kr/eric/portal/eng>



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In Focus more +

Integrated system to manage GHG and air pollutants built 2011.02.17

The National Institute of Environmental Research (NIER) announced it built GHG-CAPSS (Greenhouse Gas Clean Air Policy Support System) to support greenhouse gas reduction strategies of local governments and obtained a patent on it. GHG-CAPSS is an integrated system, connecting an air pollutants

News Release more +

- Distance measuring instrument for Bukhansan dullegil trail produced [2011.02.18]
- Campaign to improve paper cartons recycling to be launched [2011.02.18]
- Recycling of plastic bottles to be more facilitated and improved [2011.02.16]
- MOE improves management of wildlife ecological corridors around the nation [2011.02.11]

Vote for Jeju, new 7wonders of nature!

Jeju Island has been selected as one of the final candidates for the New7Wonders.

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Air Korea Real-Time Air Quality

Current Temperature

JEUJU 7.2°C

Multimedia more +


- Jae-dong's Very Special Adventure
- 4 Major Rivers Restoration Project, Life with

Environmental Information

- Policy Bulletin
- Statistics
- White Paper



Thank you for your
attention

 National Institute of Environmental Research

