MEST / MLTM
21st Frontier Research Program

Sustainable Water Resources Research Project (2001-2011) in Korea

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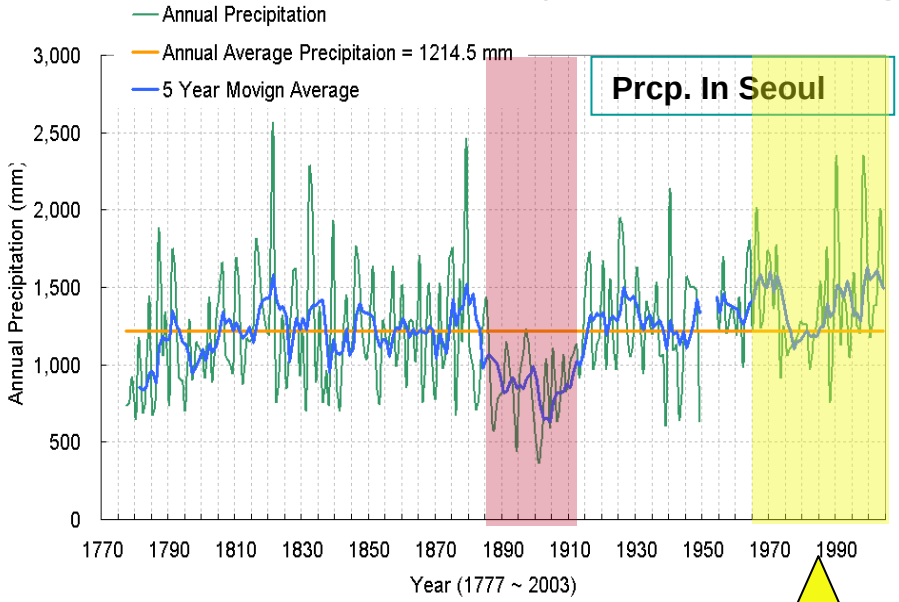
Sung Kim, Senior Research Fellow
Korea Institute of Construction Technology

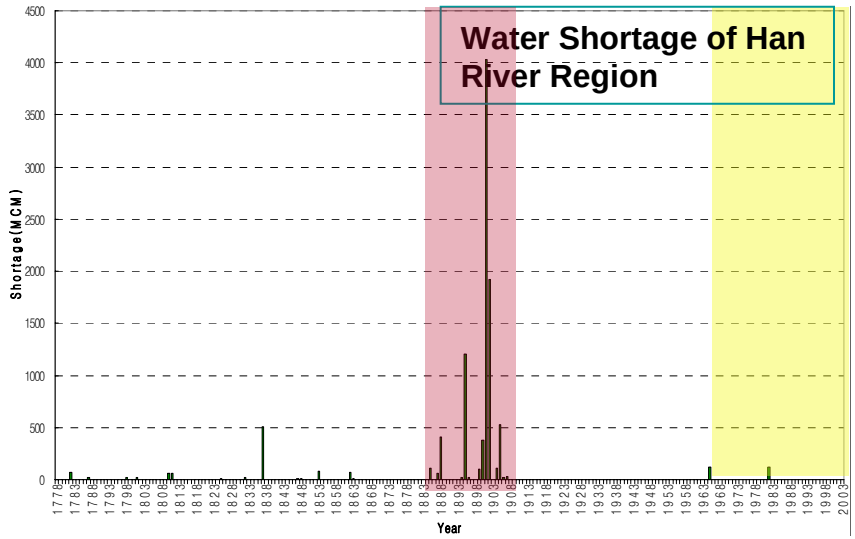
Contents

I. Challenges

Highly Vulnerable National Water Security:

- Han River basin water shortage is 791 mil m^3 in case of the worst yr since 1967 (National Water Resources Planning period), however 4 bil m^3 for the worst yr since 1900 (historical worst period).



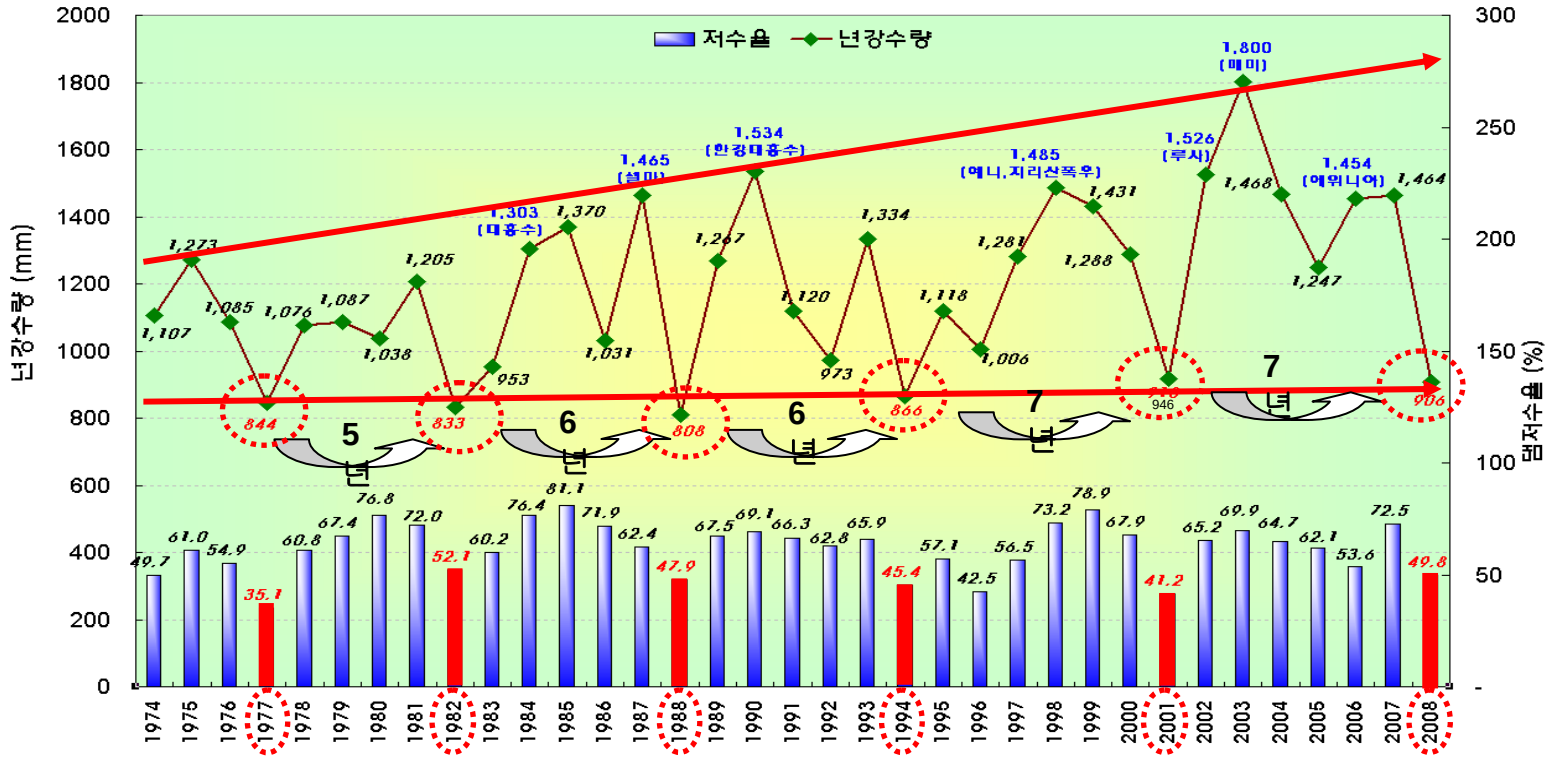


National Water Resources Planning (2006): 791 mil. m^3 (2011)

Maximum Drought since 1966

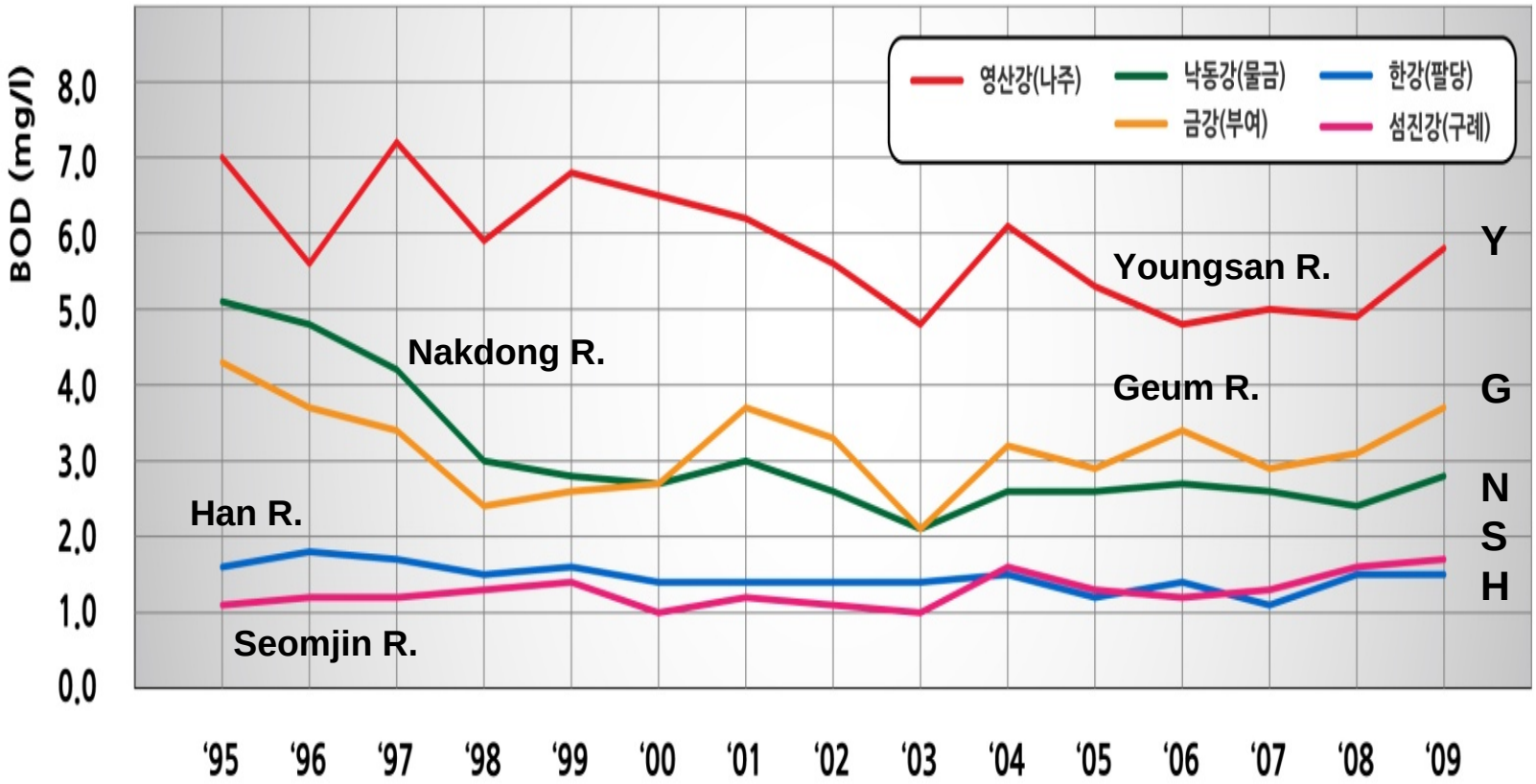
More than 4 bil. m^3 (2011)

Drought occurs every 5-7 yr period since 1970's and high extremes increases with time.



※ Because of high intensity of rainfalls, flood control spaces in multi-purpose dams have been increased.

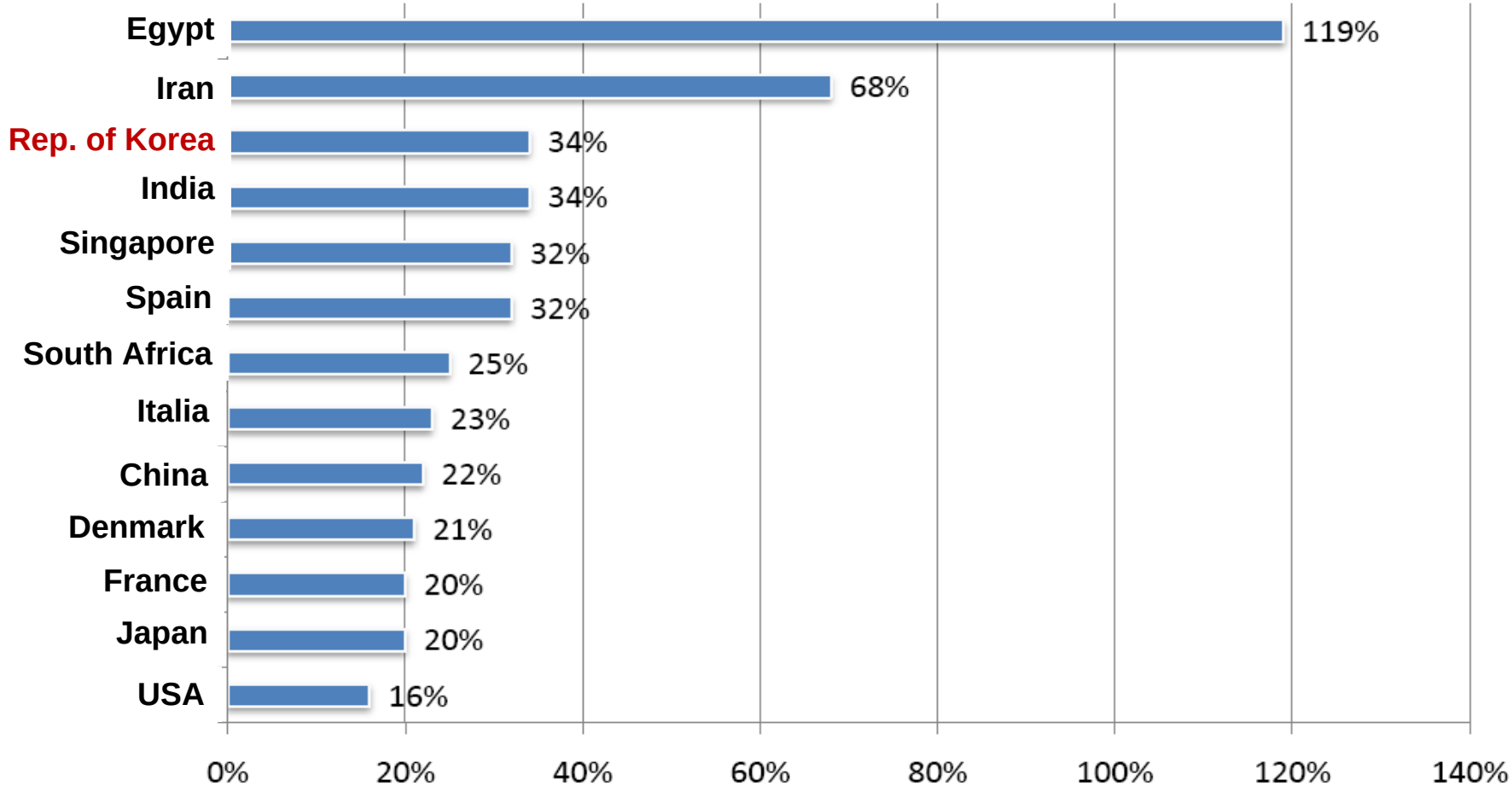
River water quality is improving in a long-term basis but not improving in a short-term basis



※ If COD is considered, river water quality has been deteriorated in a long and short term basis.

Source: National Water Resources Plan (MLTM, 2011)

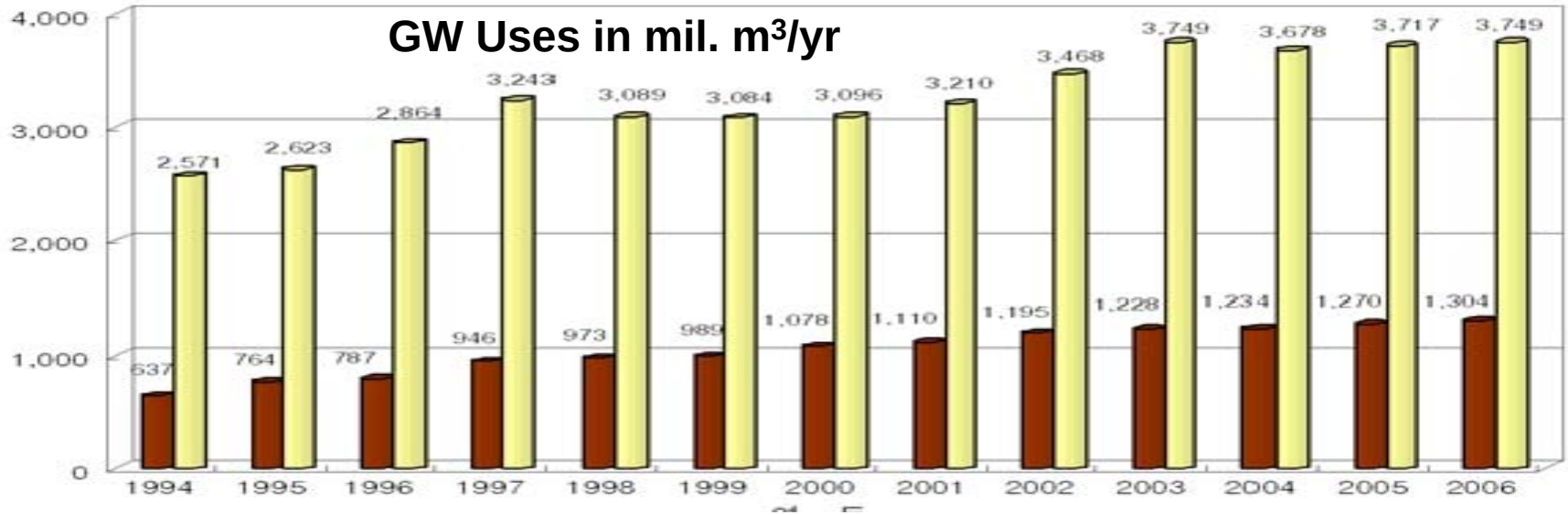
High Water Withdrawal (34% of Renewable Water Resources)



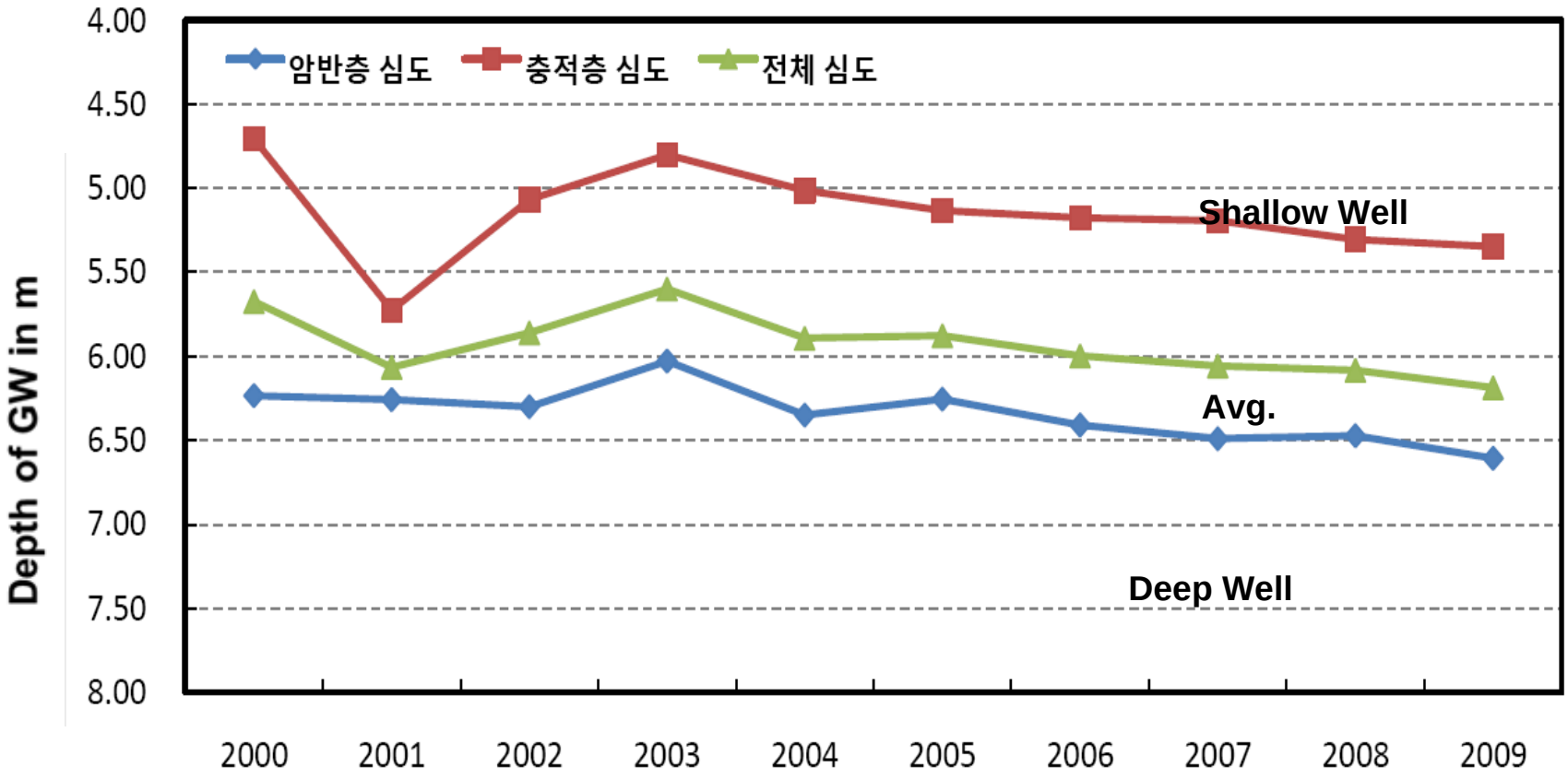
※ Because of high withdrawal rate, river WQ is worse than we expected even with major SOC (treatment plants etc.) investments.

GW uses increase (www.gims.go.kr)

- Number of wells with total volume of use is increasing
- 10% of total water use (3.7 bil m^3/yr)
- Over use (37mm/unit area/yr)
- 50% of observation wells show water level decreasing while 33% increasing



Groundwater level is decreasing nationwide
(Avg. 5.8cm/yr from 2000 to 2009)



※ Irrigation water shortage has been supplemented by groundwater supply. No severe drought damage has been occurred at least for the last 20yr period.

Korea needs sustainable Water Management

Vulnerable Water Security: Supply, Qual., GW

Sustainable WM: Surf/Grd, Quan/Qual

Problems are basin-wide, complex, deteriorating, and zero-sum game.

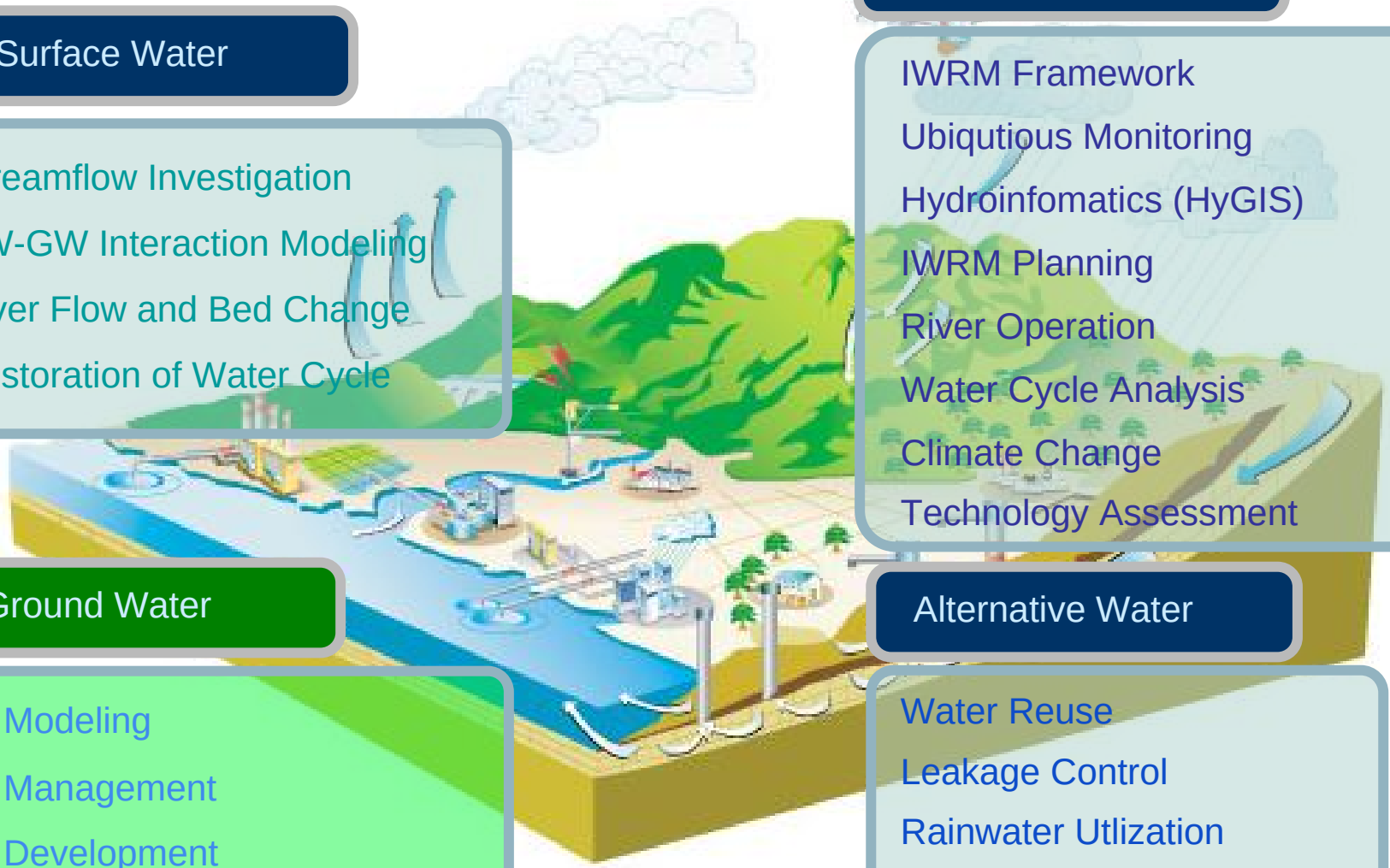
Needs Integrated River Basin Water Management

Sustainable WR Research Project

Period	2001. 8. 1 – 2011. 9. 31
Budget	147.5 B Won (Gov. 73%, Industries 27%)
Ministries	MEST 70%, MLTM 30%
Participants	77 orgs (Univ. 28, Res 11, Industry 13), 600 people/yr

- Joint Ministry Program: MEST & MLTM
- Mission: R&D and Implementation for IWRM tools in monitoring, planning and operation
- Area: Surface/Ground/Alternative Water Resources

SWRR Projects



Surface Water

- Streamflow Investigation
- SW-GW Interaction Modeling
- River Flow and Bed Change
- Restoration of Water Cycle

Integrated Water

- IWRM Framework
- Ubiqutious Monitoring
- Hydroinfomatics (HyGIS)
- IWRM Planning
- River Operation
- Water Cycle Analysis
- Climate Change
- Technology Assessment

Ground Water

- GW Modeling
- GW Management
- GW Development
- GW Dam

Alternative Water

- Water Reuse
- Leakage Control
- Rainwater Utlization
- Desalinization
- Agricultural Water Reuse

Strategies for SWRRP

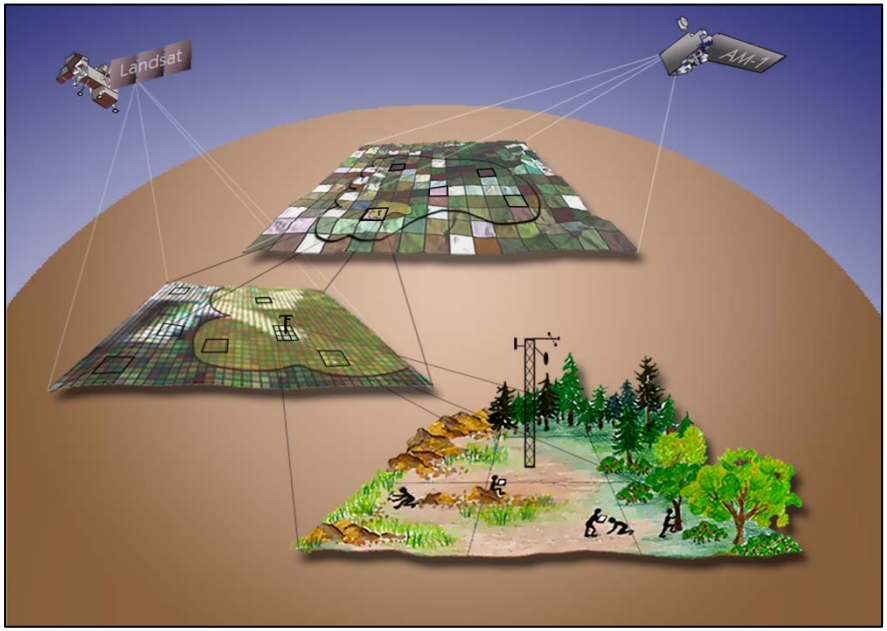
Fusion

Implementation

Capacity Building

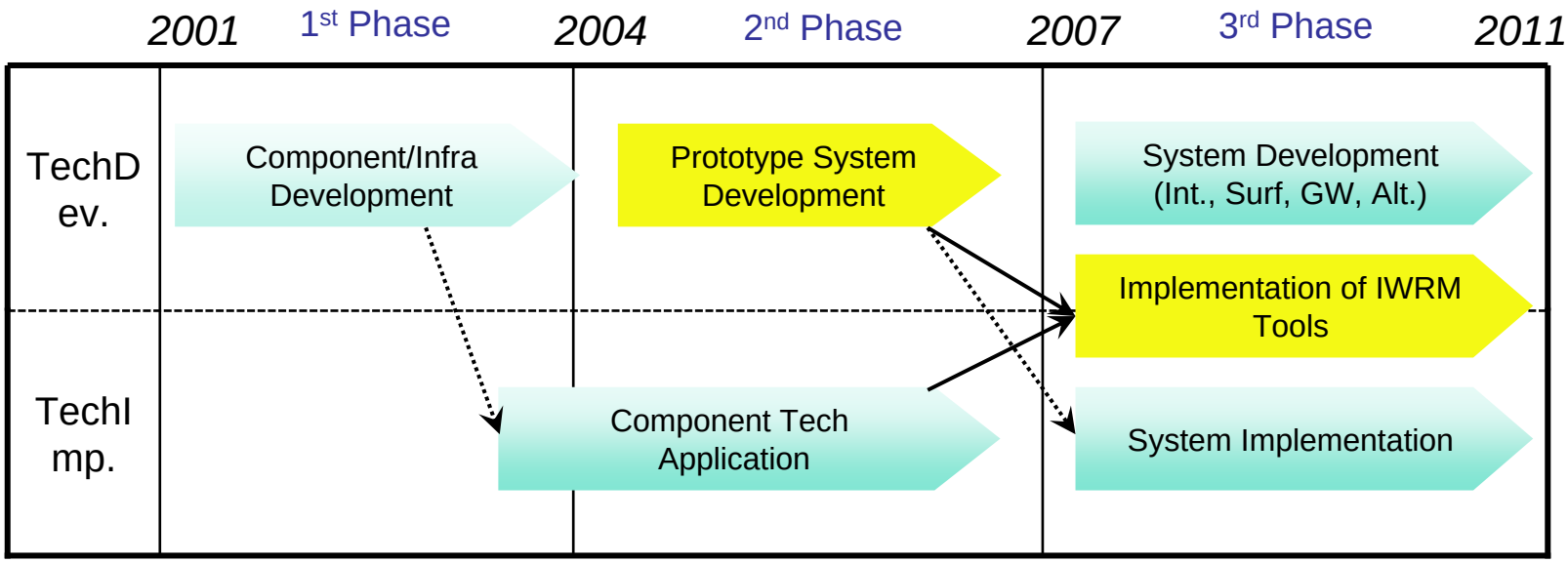
Research Strategy 1: Fusion

- **Research teams consist of scientists (hydrologist, meteorologist, geologist, chemist, biologist, etc.) and engineers (civil, agricultural, environmental, forest, electronic, computer etc.)**
- **Collaboration traditional water researchers (hydrologist, civil engineers, etc.) with IT experts.**



Research Strategy 2: Implementation

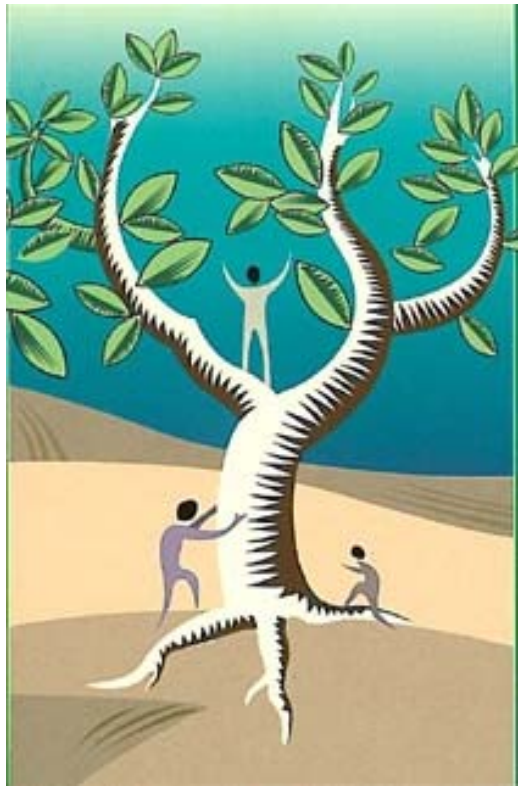
- **All of outcomes are implemented in practice within the research period.**
- **To facilitate implementation and technology transfer, R&D and implementation are conducted simultaneously.**



Research Strategy 3: Capacity Building

- **Water Engineers for IRBM**
- **Water Experts for International Activities**
- **Technology Transfer**

utsa.edu



english.education.gov.qa

II. Outcomes

Quantitative Research Outcomes

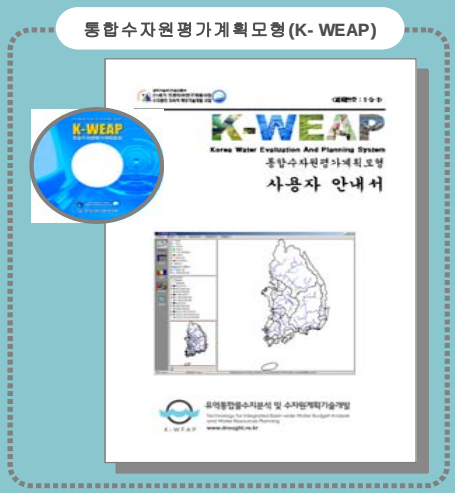
- Publications Total and SCI: 1048 and 354
- Patents Permitted and Applied: 89 and 222
- SWs Registered: 131
- Technology Transfers: 55 cases
- Technology Implementations: 104 cases
- Tech Book Publication: 105
- Home Page Clicks: 5.5 mil.

Develop and Implement IWRM Tools

- **19 SW for WR design, planning and operation**
- **River monitoring HW**
- **Water Saving, Reuse, Recycle, Desalination, Leakage control Technologies**

SW Tools for WR Planning & Operation (1)

K-WEAP



By DR Lee (KICT)

HyGIS

By KT Kim (KICT)

River Operation System

By IH Koh (K-Water)

SW Tools for WR Planning & Operation (2)

CAT

By HJ Kim (KICT)

HDAMS SWMM-GE

By KS Lee (SNU)

RAMS

By IW Seo (SNU)

HW Tools for River Monitoring

GPS-RF Float Pole

By W Kim (KICT)

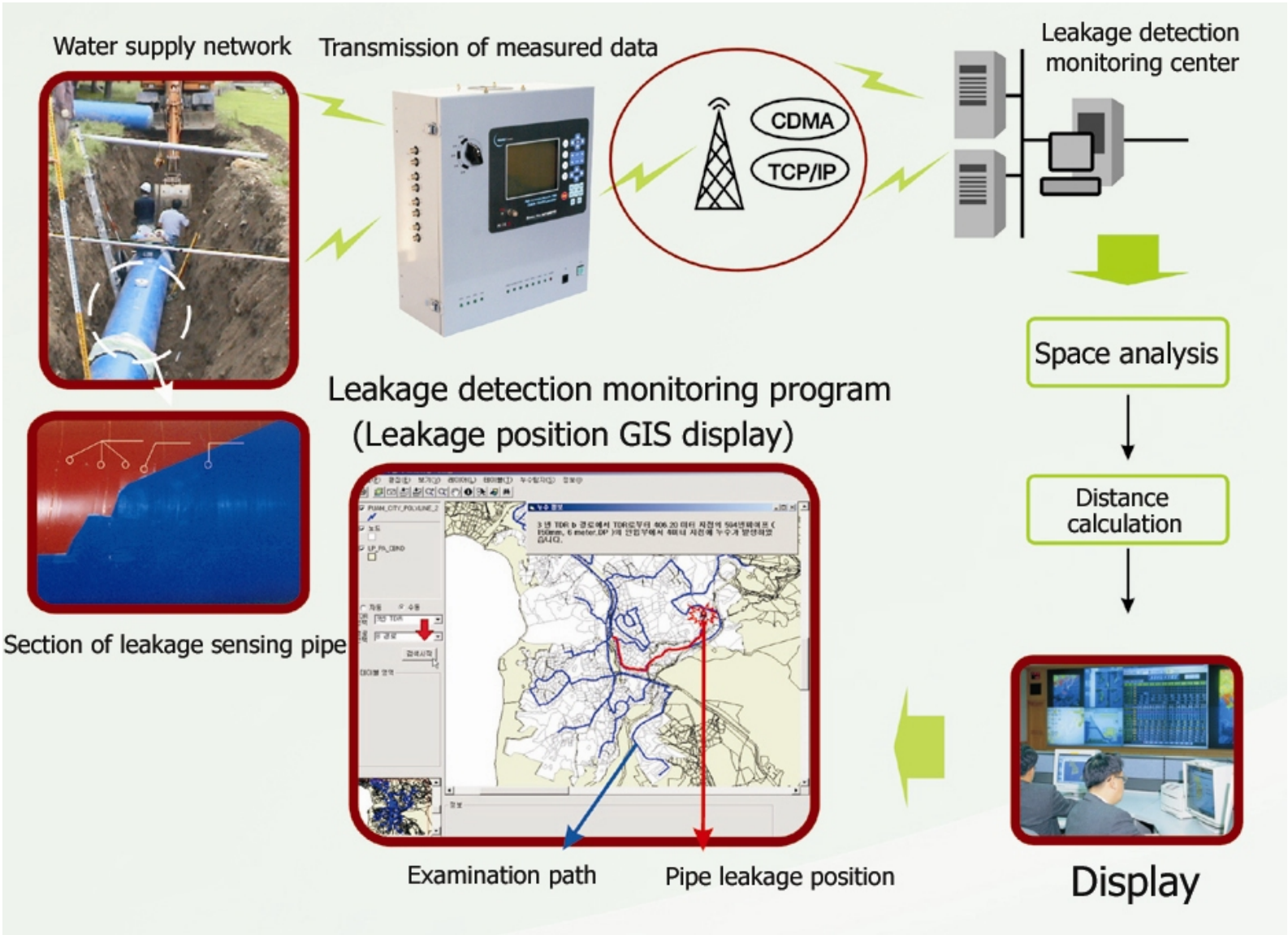
Image River Stage

By W Kim (KICT)

Monitoring Boat

By JK Lee (DPCS)

Development of Leakage Detection System by JY Ku (SU)



Waste Water Reuse System for Irrigation
By SW Park (SNU)

Environmental Assessment

Soil

Water Quality

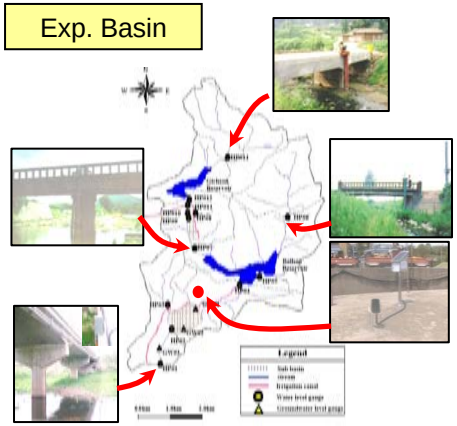
Ecology

Health

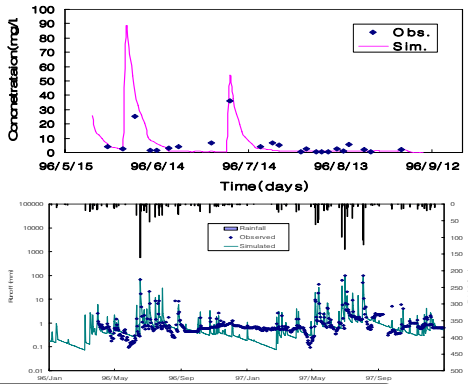
Risk Analysis

Safety Test

Exp. Basin



Quality



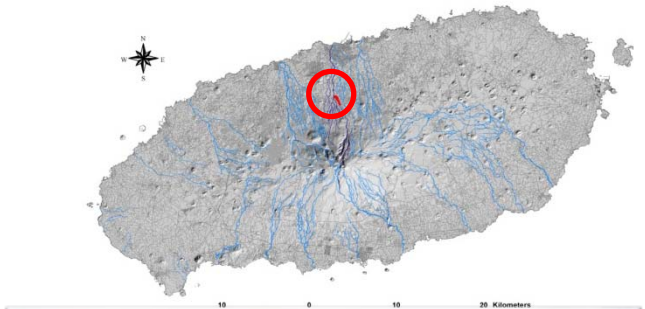
Pilot Project
(Suwon, 2006)

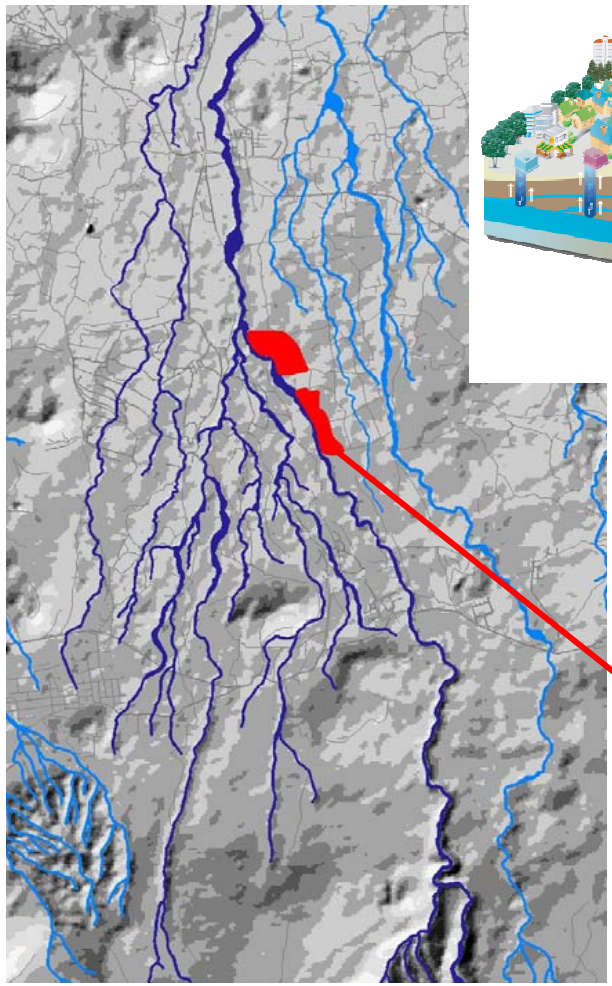
Monitoring/Modeling

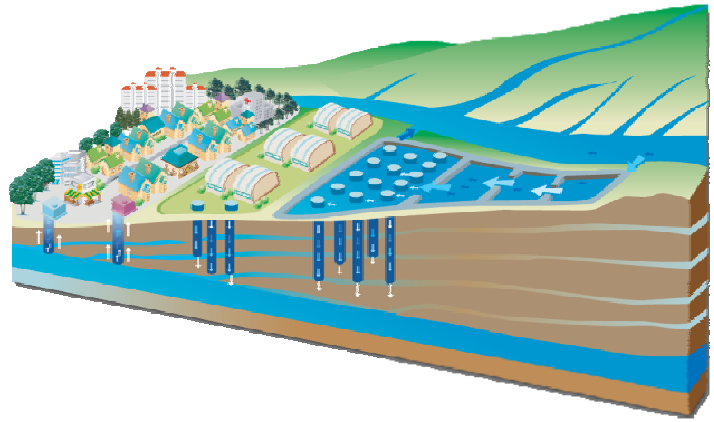
Develop Field Level Tech ➔ Establish Tech. Center ➔ Improving Tech.

Flood Mgmt & Artificial Recharge by YJ Kim (KIGAM)

- **Jeju Island Test Site**

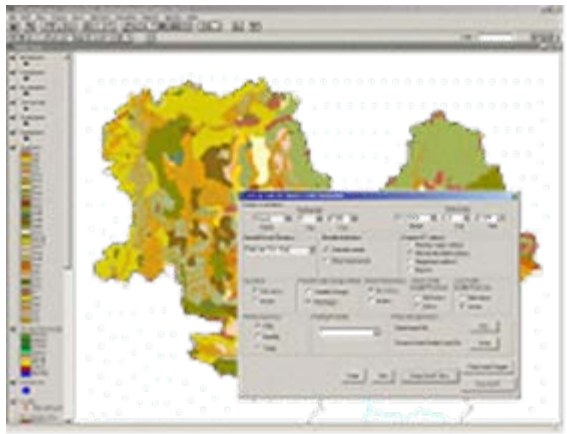






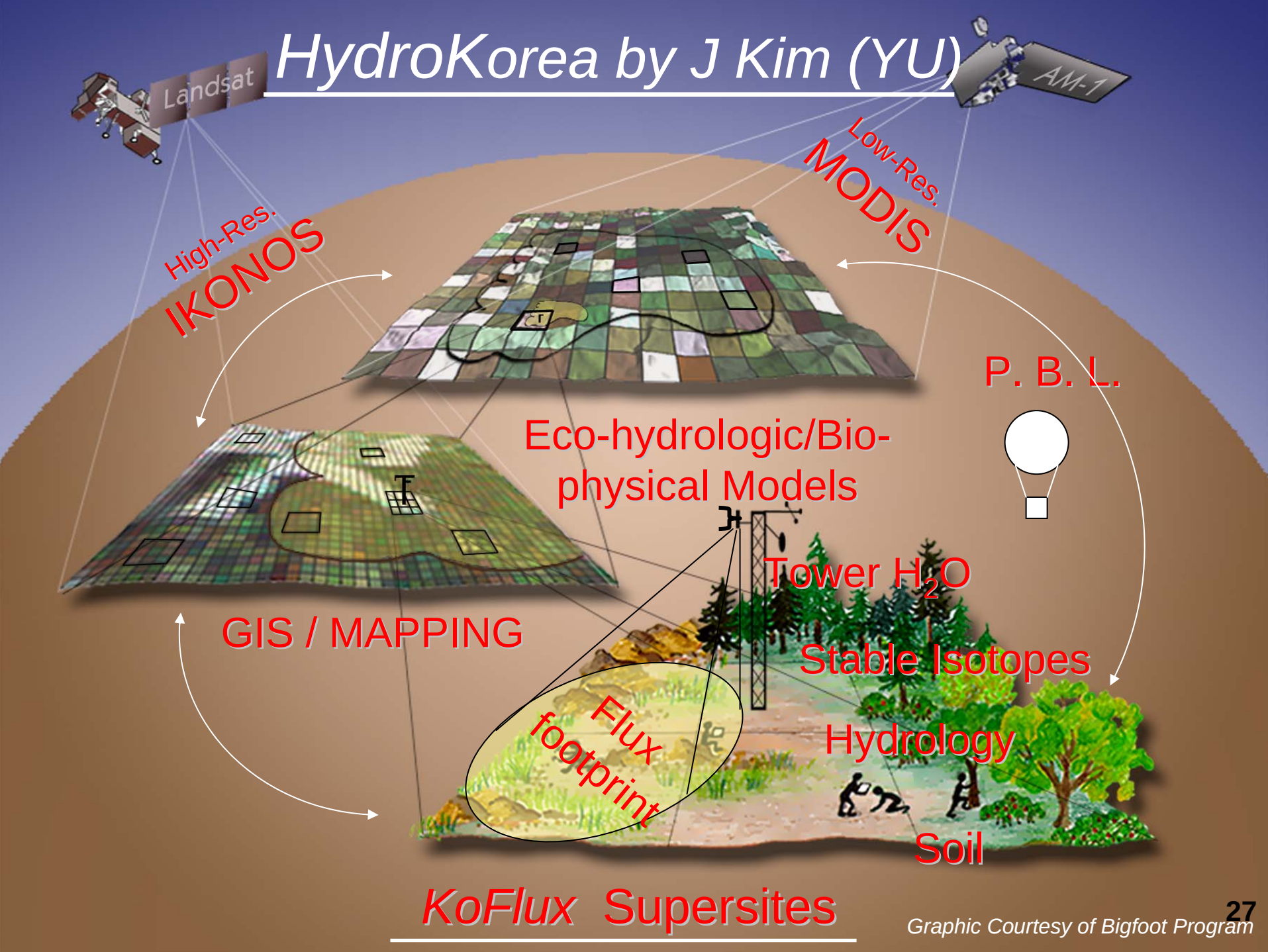
2010. July – Sep.
2.5 mil. m3 of flooded water artificially recharged

Surface Water-Groundwater Linking Model
by NW Kim (KICT)



A module for simulating paddy rice fields was added to SWAT , and linked to MODFLOW for simulating surface-ground water interaction with fully-coupled manner.

HydroKorea by J Kim (YU)



KoFlux Supersites

Graphic Courtesy of Bigfoot Program

Capacity Building

- **74 Ph.Ds, 347 MSs, 36 BSs graduates**
- **89% of graduates are working in water area**
- **74 times of tech workshop during 2007-2011**
- **Weekly Newsletter for 10,000 people**

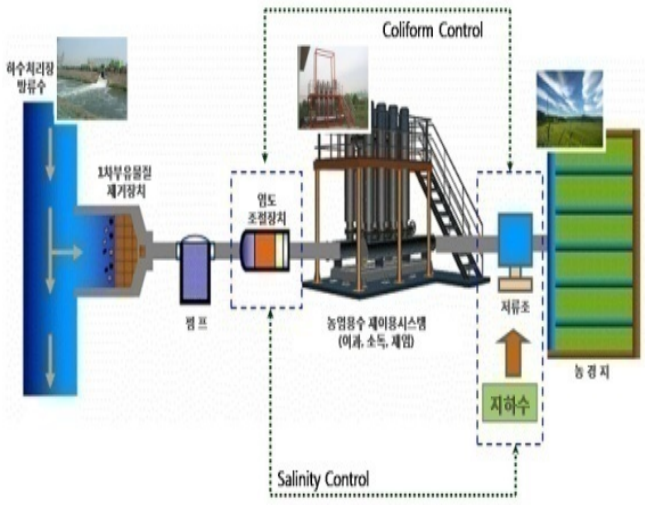
III. Assessment

Survey Results for Research Products

- **Intention to use: Yes (92%); No (3%); No reply (5%)**
- **Competitive power: Very High (20%); High (58%); Medium (20%); Low (2%)**

Technology Potential of Outcomes

- Equivalent to 3.7 bil m^3 of new water supplies
- Actual water development, savings or reuse by application: 106 mil m^3 (GW Recharge 40 mil; Waste water reuse 60 mil; Water savings by leakage control 1 mil)
- Tech potential estimated: 3.6 bil m^3



IV. Remarks

Summary and Conclusions

1. Water Management in Korea lacks in sustainability because of extremes of climate, climate change, over use and others.

2. Sustainable Water Resources Research Project (SWRRP) has been conducted successfully from 2001 to 2011.

3. SWRRP developed SW and HW tools for sustainable water management, and outcomes were assessed to have technology potential of 3.7 bil m^3 of new water supplies.

Discussions and Recommendations

1. For water resources research, a long-term, ten-year research program like SWRRP, could be effective for research, development and implementation within the project period.

2. In water resources research, a interdisciplinary project (ex. SWRRP) could be effective to link scientist with engineers and to develop practical outcomes.

3. Implementation activities could have been many folds than we achieved if institutional framework (ex. Water Management Law) were established.

Thank you for attention