Chungju Dam

FAITH**FUL**
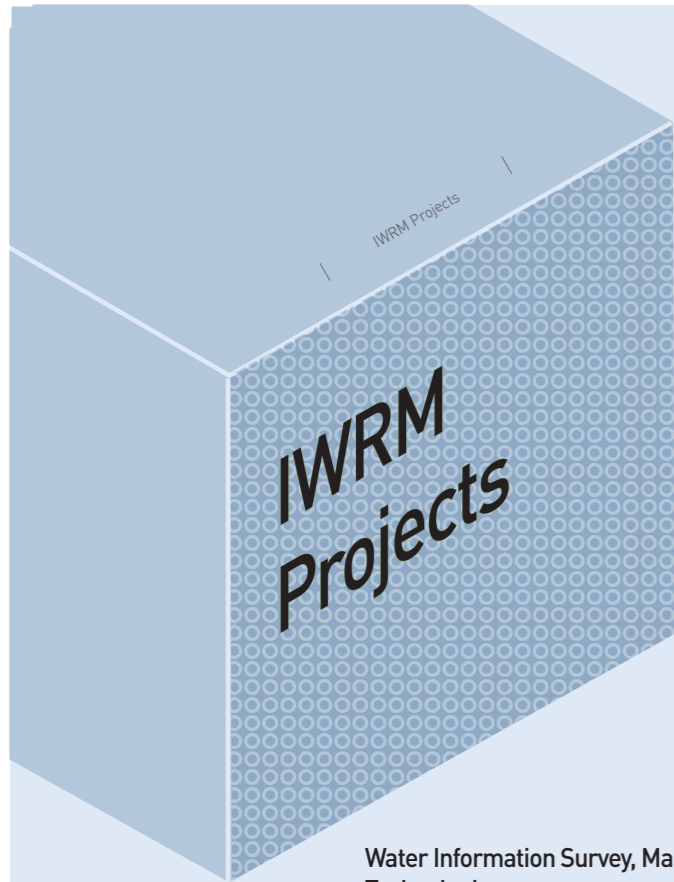# MANAGEMENT

IWRM (Integrated Water Resources Management) Project
To pursue and ensure the sustainable development of reliable water supply

K–water will always be there for the integrated water management of dams, weirs and rivers.
K–water's own competitiveness lies in the safe integration & management of water resources.
K–water will do its best to pursue & ensure the sustainable development of reliable water supply through its own IWRM practices.

IWRM projects

Sustainable development

Clean, reliable water supply

IWRM Projects

K-water has applied IWRM (integrated water resource management) practices across the whole process of water cycle, which would enable the efficient use and management of water resources, including rainfall and water flowing from basins and rivers.

Water Information Survey, Management and Analysis Technologies

Acquisition & analysis of real-time hydrological data
Survey & management of basin, river and groundwater data
Customized status survey & analysis of water resources

Hydrological survey and basin survey
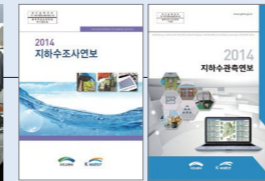
Survey & management of groundwater data

### Water Management Forecasting & Decision-Making Technologies

Real-time data analysis & decision-making
Rainfall forecasting
Flood control
Water supply
Water quality management
Power generation

Water Resources Operations Center

Hydraulic Infrastructure Maintenance & Safety Management Technologies

Integrated safety management system for hydraulic structures
Dam risk analysis & assessment
Improvement of flood control capacity
Improvement of aged dams' capacity
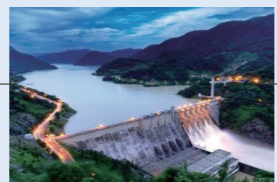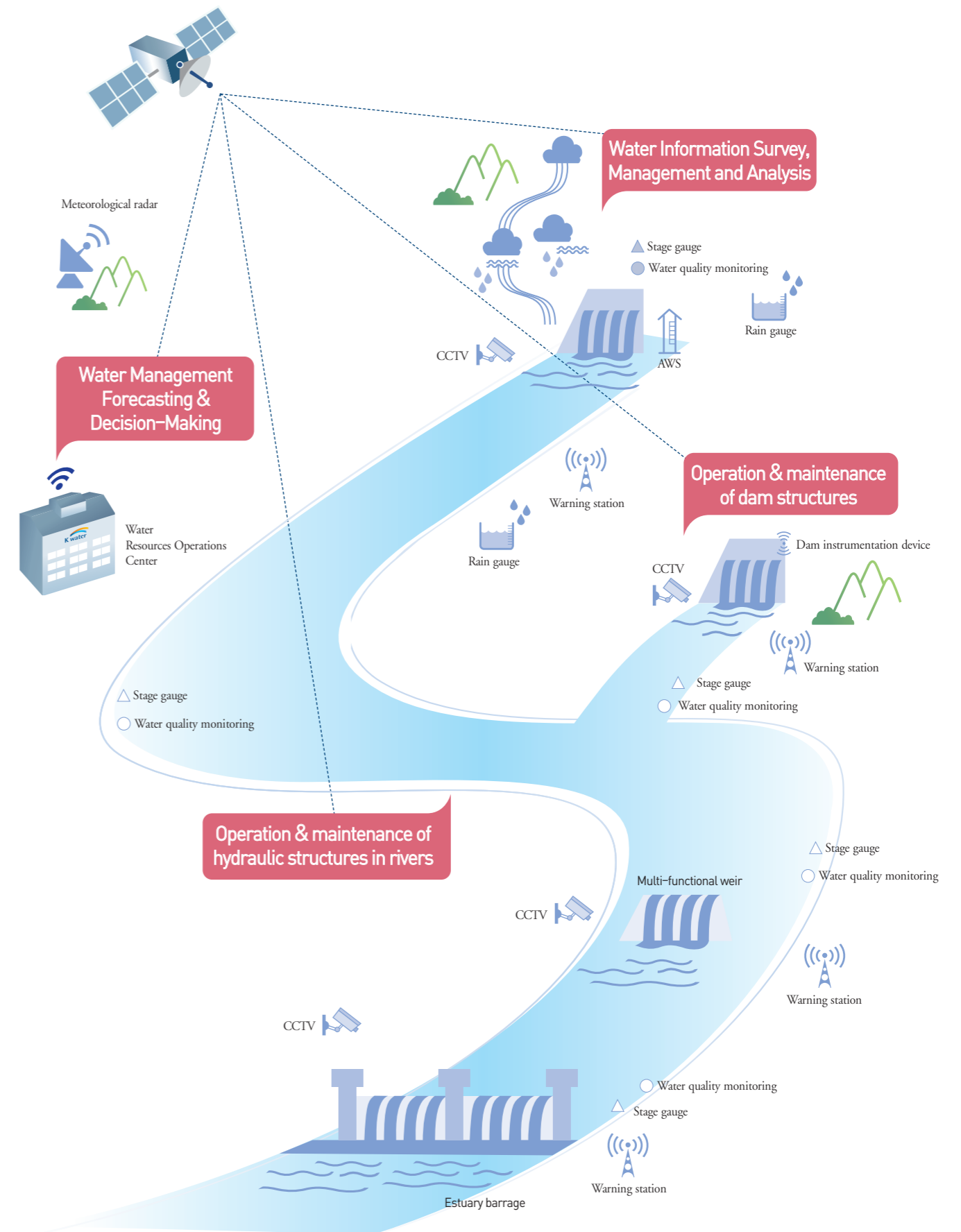
Operation & maintenance of dam structures

Operation & maintenance of hydraulic structures in rivers

Integrated Water Quality Management

Integrated water quality prediction system for target basins & rivers
Real-time monitoring of water pollution
Water ecology restoration technologies

Water quality management for target and rivers

Meteorological radar

Water Information Survey, Management and Analysis

Stage gauge
Water quality monitoring
Rain gauge
CCTV
AWS

Water Management Forecasting & Decision-Making

Water Resources Operations Center

Warning station
Rain gauge

Operation & maintenance of dam structures

CCTV
Dam instrumentation device
Warning station
Stage gauge
Water quality monitoring

Stage gauge
Water quality monitoring

Operation & maintenance of hydraulic structures in rivers

Stage gauge
Water quality monitoring
Multi-functional weir
CCTV
Warning station

CCTV
Water quality monitoring
Stage gauge
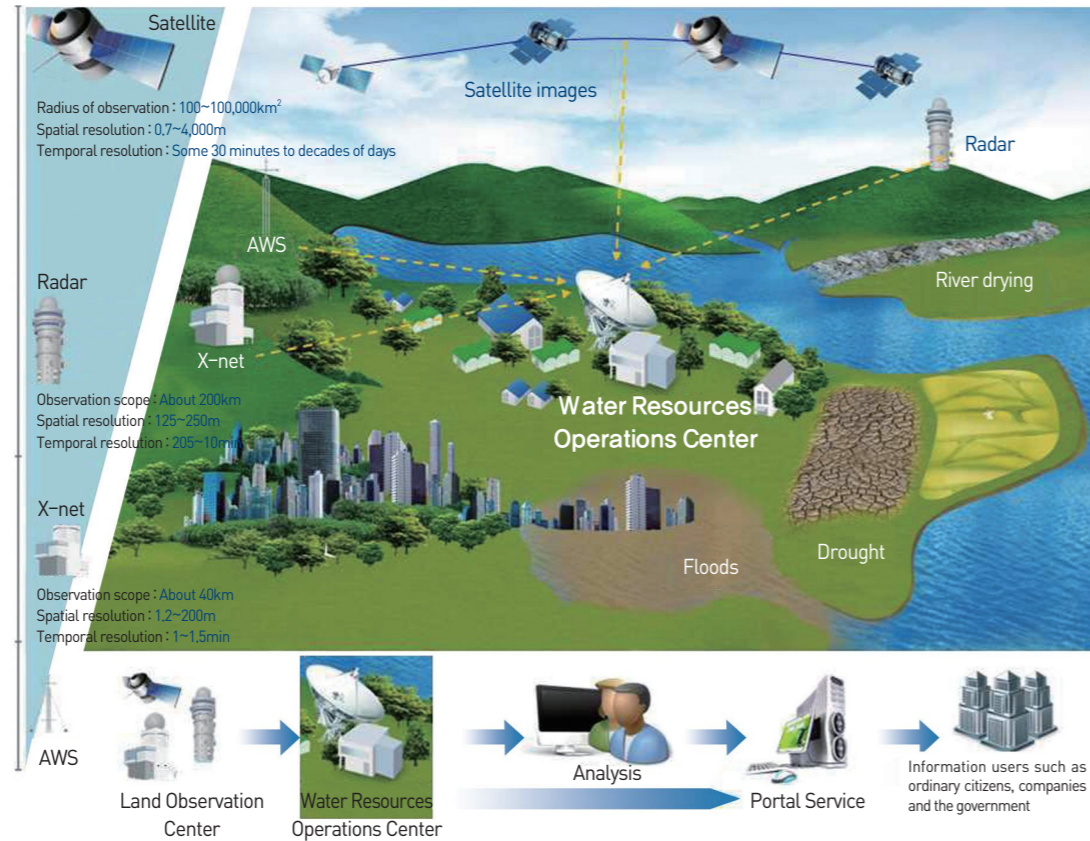Warning station
Estuary barrage

Water Information Survey, Management and Analysis Technologies

K-water is the only organization in Korea that is equipped with professional capabilities to perform various surveys & investigations on all areas of water resources, including hydrological survey, basin survey, groundwater survey, etc. All water-related information and data acquired on a real-time basis are accessible to all people via the ICT-based RHDAPS (Real-time Hydrological Data Acquisition & Processing System) or the national water-related portal systems. These data are also used to develop new policies on water resources or new water-related project opportunities.

Water Management Forecasting & Decision-Making Technologies

K-water has been continuously developing its own precipitation forecasting & decision-making technologies to ensure the efficient management of water resources even under unfavorable water management environment unique to Korea where regional & seasonal variations in precipitation are very substantial with the frequent occurrence of extreme weather events (e.g., flood accompanying a typhoon, abnormal drought). Also, K-water is capable of providing packaged, customized water management solutions from those technologies for different kinds of end users.

Big-data-based water resource information management system linked to satellite images and real-time measured data

Satellite
Radius of observation : 100~100,000km²
Spatial resolution : 0.7~4,000m
Temporal resolution : Some 30 minutes to decades of days

Satellite images

Radar

AWS

River drying

Radar
Observation scope : About 200km
Spatial resolution : 125~250m
Temporal resolution : 205~10

X-net

Water Resources Operations Center

X-net
Observation scope : About 40km
Spatial resolution : 1.2~200m
Temporal resolution : 1~1.5min

Floods

Drought

AWS

Land Observation Center

Water Resources Operations Center

Analysis

Portal Service

Information users such as ordinary citizens, companies and the government

RHDAPS (Real-time Hydrological Data Acquisition and Processing System)
A-1

RHDAPS is a customized portal system based on web-DB to acquire, transmit, store and process real-time hydrological data, and thereby produce & supply quality hydrological data.

Riverflow Measurement Technology(RMT)
A-2

RMTs, which include multi-depth flowmeters, microwave surface velocity meter and gyro ball, are used to acquire reliable basic water resources data, and thereby perform relevant surveys in a timely manner

M-WAS(Mobile Water Analysis System)
A-3

M-WASs are multi-purpose river survey vehicles used to conveniently accommodate and transport such river survey equipment or instruments as flowmeters, suspended load samplers, S-boats, etc.

HOPTC (Hydrological Observation Performance Test Center)
A-4

HOPTC is a proven performance test center with capabilities to perform overall performance tests on hydrological monitoring systems in terms of their performance, compatibility, applicability, reliability, etc.

WROC(Water Resources Operations Center) functioning as a hub for IWRM practices

K-HIT (K-water Hydro Intelligent Toolkit)
A-5

K-HIT is a decision support package converged with advanced ICTs and linked with individual water management technologies, which will ensure flood control & reliable water supply and monitoring of real-time data.

PFS (Precipitation Forecasting System)
A-6 A-7

PFS is a system to produce quantitative long- and short-term precipitation forecasting information optimized for specific physical environments and detailed geometry conditions based on a digital map dividing the Korean territory into 3km×3km grids

FAS (Flood Analysis System)
A-8 A-9

FAS is a system to support flood analysis and decision-making process based on real-time hydrological conditions and precipitation forecasts (COSFIM for multi-dam flood analysis, K-DRUM for distributed river basin rainfall-runoff analysis)

RWSS (Reservoir Water Supply System)
A-10

RWSS is a system to estimate optimal discharge for ensuring the linked operation of target dams and weirs considering expected flow into each of them and water demand within the same water system, and thereafter apply the optimal discharge estimates to a water budget analysis model and a water quality analysis model to estimate discharge availability at the event of water pollution and analyze the effects of water quality improvement.

GIOS (Generation Integrated Operation System)
A-11

GIOS is a system used for the real-time remote supervisory control of dam & weir generation, transmission and distribution systems and gates, and the production & provision of relevant data covering overall operation status and other statistical analysis data.
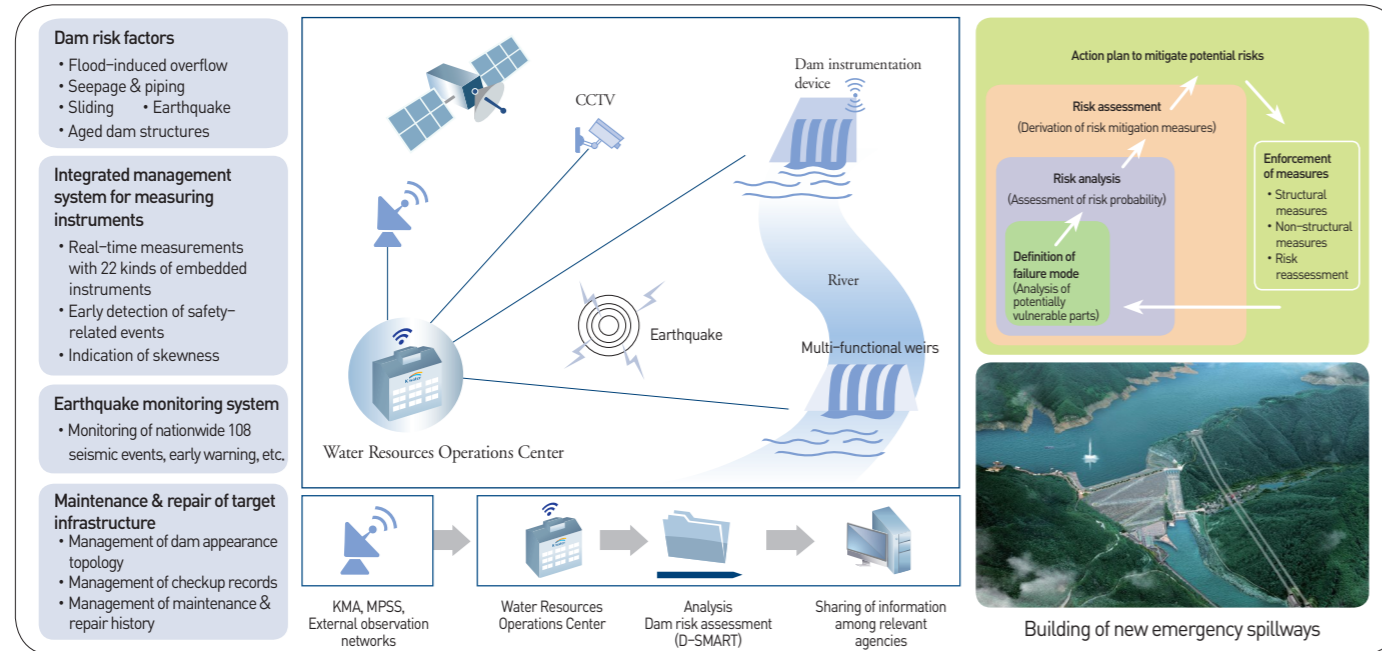
K-FAT (K-water Frequency Analysis Tool)
A-12

K-FAT is a tool with which it's possible to acquire & preprocess hydrological data online and make frequency analyses of flood and drought through estimating 14 types of probability distributions, perform a goodness-of-fit test and determining an optimal probability distribution.

Hydraulic Infrastructure Maintenance & Safety Management Technologies

As part of efforts to ensure the stability & safety of water resource management infrastructure against various risk factors (e.g., extreme storm events, earthquake, aged structures, etc.), K-water has been making efforts to improve its own flood control capacity, as through building new emergency spillways and connecting dams for their integrated operation. Also, K-water has applied prevention-oriented safety management practices by developing & building the ICT-based integrated safety management system which allows real-time measurements with various kinds of embedded instruments and real-time monitoring of seismic events, and adopting quality dam risk analysis & assessment methods.

Dam risk factors
- Flood-induced overflow
- Seepage & piping
- Sliding   • Earthquake
- Aged dam structures

Integrated management system for measuring instruments
- Real-time measurements with 22 kinds of embedded instruments
- Early detection of safety-related events
- Indication of skewness

Earthquake monitoring system
- Monitoring of nationwide 108 seismic events, early warning, etc.

Maintenance & repair of target infrastructure
- Management of dam appearance topology
- Management of checkup records
- Management of maintenance & repair history

CCTV

Dam instrumentation device

River

Earthquake

Multi-functional weirs

Water Resources Operations Center

Action plan to mitigate potential risks

Risk assessment
(Derivation of risk mitigation measures)

Risk analysis
(Assessment of risk probability)

Definition of failure mode
(Analysis of potentially vulnerable parts)

Enforcement of measures
- Structural measures
- Non-structural measures
- Risk reassessment

KMA, MPSS, External observation networks → Water Resources Operations Center → Analysis Dam risk assessment (D-SMART) → Sharing of information among relevant agencies

Building of new emergency spillways

ICT-based IWRSMS (Integrated Water Resource Safety Management System)

WRIS (Water resources Integration System) A-13

A system for the methodical management of real-time big-data on water resources (e.g., hydrological & meteorological data, water supply, etc.) and the integrated management of information required to operate & maintain dams and weirs.

IWRSMS (Integrated Water Resource Safety Management System) A-14

IWRSMS is a system with which it's possible to trigger an early warning in any emergency situation through monitoring and analyzing information about the maintenance records of relevant infrastructure assets (in terms of regular inspection, repair and reinforcement) and nation-wide seismic events and ensuring real-time measurement with dam instrumentation devices.

KEMS (Korea Earthquake Monitoring System) A-15

KEMS is a system with which it's possible to receive & analyze real-time information about seismic event through ensuring the integrated management of seismometers at hydraulic structures (dams and weirs) and spread & share information about any emergency situation in a timely manner.

D-SMART (Dam risk assessment tool) A-16

D-SMART is a dam safety management decision support system to assess risks through the hydrological, geotechnical probability analysis of various possible risk factors inherent in dams, and thereby improve their performance.

Large Geotechnical Centrifuge(LGC) A-17

LGC is the world's largest modeling equipment used to evaluate the design appropriateness & stability of large-scale structures, identify their flood- or earthquake-specific damage & failure mechanism, and evaluate the viability of any countermeasures

SMART-TM A-18

SMART-TM is a system into which the whole disaster management practices (including the acquisition & sharing of relevant information among water management organizations and remote control) are integrated with a standard information delivery platform optimized for the development of disaster management system.
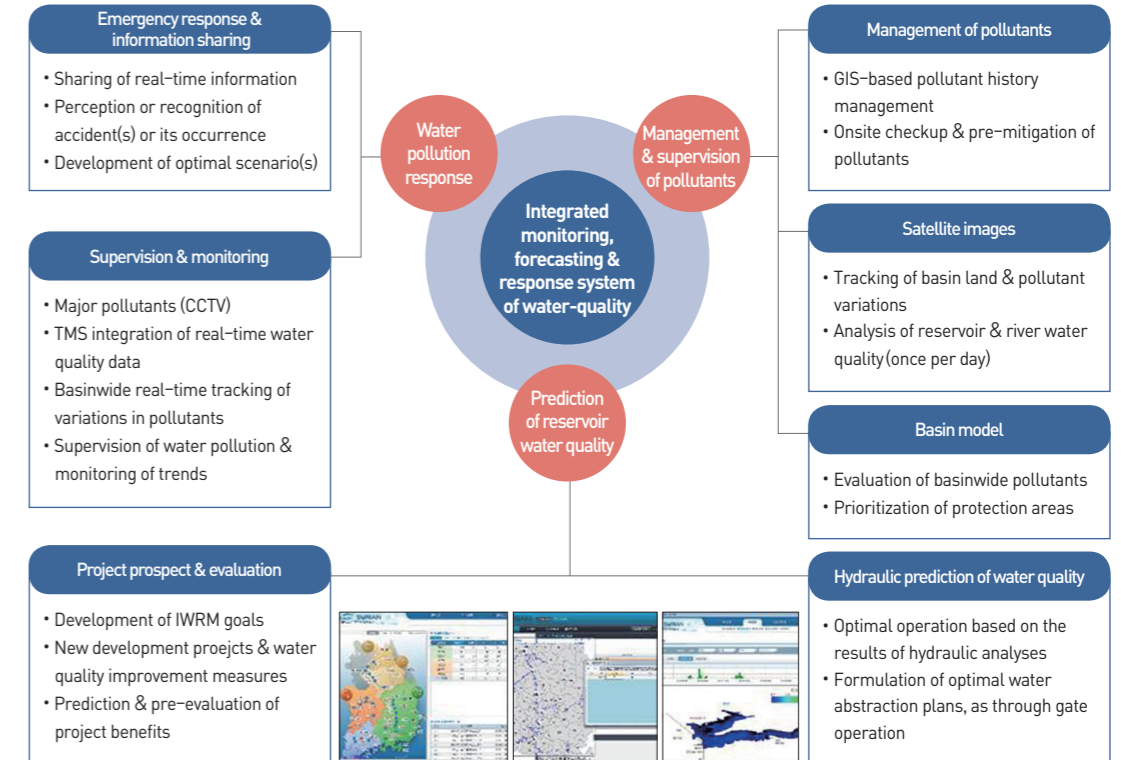
Water-Quality Management of Basins, Rivers and Reservoirs

K-water has developed and applied SURIAN(Supercomputer-based River Analysis Network), a real-time water-quality forecasting & monitoring system, which allows linkage among weather, basin, dam and river models to maintain a sound water ecosystem where human beings and nature can coexist harmoniously. With SURIAN, K-water has made lots of efforts to minimize the impacts of water-quality changes on the ecosystem and ensure the sustainable development of water resources & hydraulic infrastructure using various water ecosystem restoration technologies.

Emergency response & information sharing
- Sharing of real-time information
- Perception or recognition of accident(s) or its occurrence
- Development of optimal scenario(s)

Supervision & monitoring
- Major pollutants (CCTV)
- TMS integration of real-time water quality data
- Basinwide real-time tracking of variations in pollutants
- Supervision of water pollution & monitoring of trends

Project prospect & evaluation
- Development of IWRM goals
- New development proejcts & water quality improvement measures
- Prediction & pre-evaluation of project benefits

Water pollution response

Management & supervision of pollutants

Integrated monitoring, forecasting & response system of water-quality

Prediction of reservoir water quality

Management of pollutants
- GIS-based pollutant history management
- Onsite checkup & pre-mitigation of pollutants

Satellite images
- Tracking of basin land & pollutant variations
- Analysis of reservoir & river water quality (once per day)

Basin model
- Evaluation of basinwide pollutants
- Prioritization of protection areas

Hydraulic prediction of water quality
- Optimal operation based on the results of hydraulic analyses
- Formulation of optimal water abstraction plans, as through gate operation

SURIAN (Supercom-based River Analysis Network) A-19

SURIAN is a system that is used to supply highly accurate water quality prediction data through linking among meteorological elements and target basins & reservoirs, and thereby help make a timely decision about water pollution accidents.

K-water GATe Water Combine (to remove algal blooms) A-20

K-water GATe Water Combine is a system that is used to timely and directly remove algal blooms present in rivers and reservoirs through coagulating and floating them with physical and chemical methods.