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REGIONAL WATER BALANCE ASSESSMENT – CASE STUDY : YOUNGJONGDO ISLAND IN INCHEON, KOREA

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Korea repeatedly experiences floods and droughts that cause traumatic environmental conditions with huge economic impact. With an approach and solution such as Smart Water Grid these problems can be alleviated. Tapping into the retention ponds behind dams, rainfall harvest facilities in urban areas and any other structures installed to store rainfall water during flood events will mitigate the damage of flooding and provide a new source of national water resources. Similarly, purified waste water, ground water and desalinated sea water can also be feasible to use as alternative water resources.

In this study, the water balance assessment model is being developed as a Smart Water Grid research. In fact, large proportions of water resources in Korea rely on a river fresh water. Also in the Youngjongdo island, tap water from water purification plant which use original source from the Han river. However the water supply system in the island is quite dangerous since the water purification plant is located in Incheon city and the water comes to island through the sea and no other source is used in the island. Therefore, once the accident at main water pipe in the sea, no water is available in this island.

Information on water availability and water needs are crucial to identify hot spots of quantitative pressures on water resources. In this study, all available alternative water sources are calculated by the model developed through this study. Several physical and stochastic models on hydraulic and hydrological approaches are nominated to investigate physical characteristics of catchments.

Introduction

Korea repeatedly experiences floods and droughts that cause traumatic environmental conditions with huge economic impact. With an approach and solution such as Smart Water

Grid these problems can be alleviated. Korean water resources environment is rapidly changing because of the Climate Change. For example, Rainfall pattern changed and its term became more and more concentrated. So water resources environment of Korea becomes that the rainfall of central district is increasing and southland part is decreasing. Also, some areas have problems such as water shortage and water distribution. We faced some points that need to make reasonable correspondence considering Climate Change. Moreover, to secure additional headspring, mainly expand facilities were utilized, and didn't consider the Climate Change but just simply focused on the water supply system and unity water treatment system. Therefore, we need one integrated and effective water management with low-energy and high-efficiency. Smart Water Grid can make use of local IT skill with global level to solve this problem, and it can lead new generation with high green water industry which is come to the fore at water industry.

Then, it is necessary to make accurate assessment about water supply and demand of grid for water provision for essential market in right time and right amount. For the long term perspective, an assessment system will be developed, which can evaluate and solve water shortage of city including industrial water, agricultural water by automation technique.

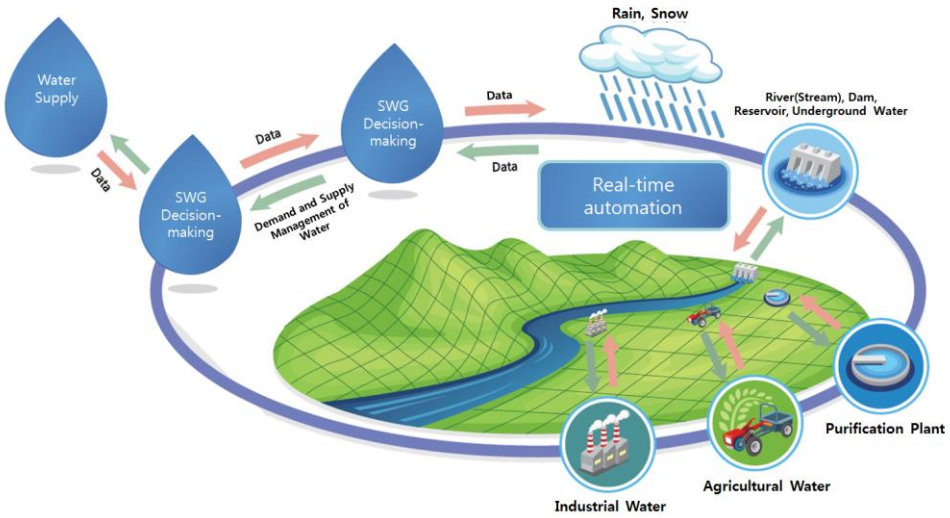

Figure 1 Concept of Water supply and demand evaluation system

Tapping into the retention ponds behind dams, rainfall harvest facilities in urban areas and any other structures installed to store rainfall water during flood events will mitigate the damage of flooding and provide a new source of national water resources. Similarly, purified waste water, ground water and desalinated sea water can also be feasible to use as alternative water resources.

Smart Water management

A smart water grid is a network that uses ICT to gather and act on information generated by suppliers, consumers and devices in an automated fashion to improve efficiency, reliability, economics and sustainability of production and distribution. Briefly, it uses sensors (meters), digital communications, and embedded digital processing to make the grid observable (able to

measure the states of all grid elements), controllable (able to affect the state of any grid element) and automated (able to adapt and self-heal). A smart grid's functionality [9] will (1) enable active participation by consumers, (2) accommodate all production, distribution and storage options, (3) enable new products, services and markets, (4) provide water quality for the digital economy, (5) optimize asset utilization and operate efficiently, (6) anticipate and respond to system disturbances, (7) operate resiliently against attack and natural disaster.

Target region for case study

In this study, the water balance assessment model is being developed as a Smart Water Grid research. In order to decide the target region for smart water balance assessment system, 3 different scales for major system and 1 overseas type have been defined as shown in the figure 2.

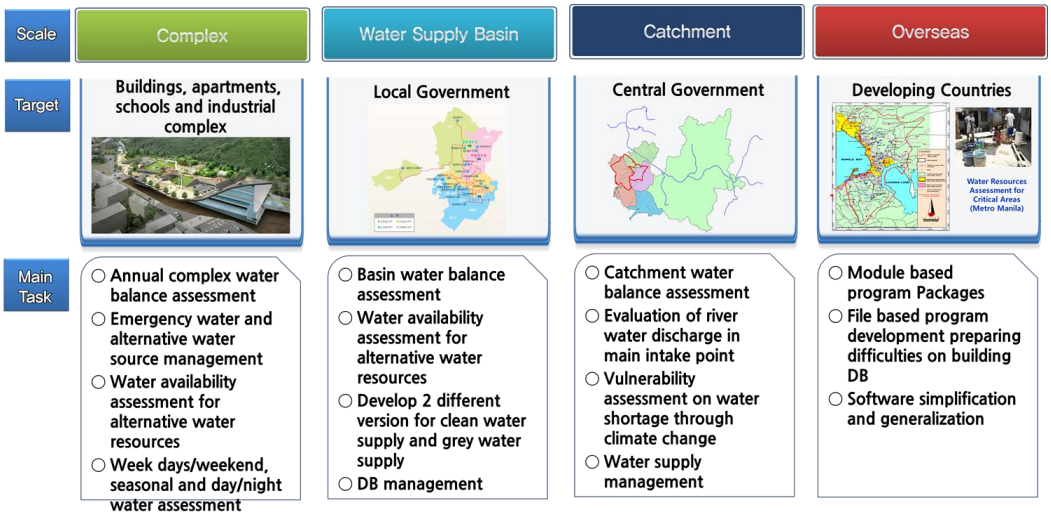

Figure 2 Targets for system development and main task for each scale

In fact, large proportions of water resources in Korea rely on river fresh water. Also in the Youngjongdo Island, tap water from water purification plant which use original source from the Han river. However the water supply system in the island is quite dangerous since the water purification plant is located in Incheon city and the water comes to island through the sea and no other source is used in the island. Therefore, once the accident at main water pipe in the sea, no water is available in this island as shown in the figure 3.

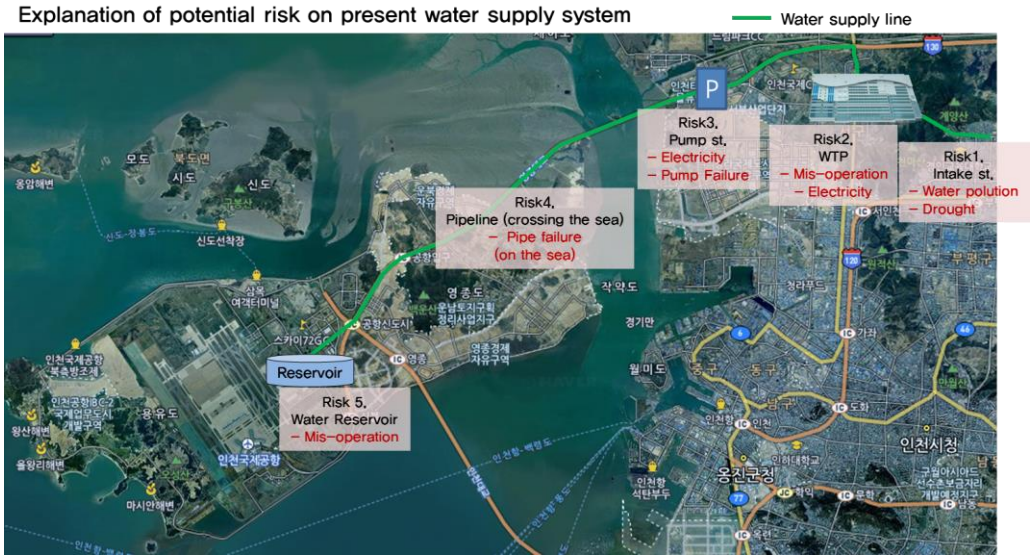

Figure 3 Potential risk on present water supply system of the Youngjongdo Island

Development of water balance assessment system

To replace the system with potential risks, new concept of smart water management for region with water stress has been created through the field work as well as active discussions on conceptual assumptions to improve. In this study, all available alternative water sources are discovered and calculated. Figure 4 shows the concept for smart water management in this complex and also shows how to overcome the potential risks.

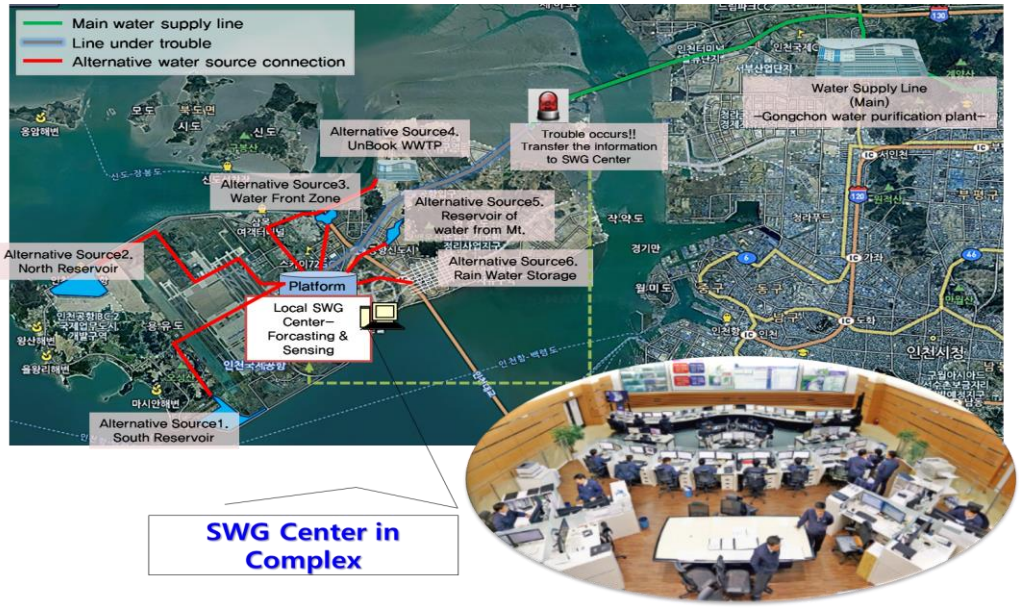

Figure 4 Concept of smart water balance assessment and multi-source connection

Several physical and stochastic models on hydraulic and hydrological approaches are nominated to investigate physical characteristics of catchments. 9 major modules are connected

in the system and each module also can be independent software to calculate the real situation as shown in the figure 5.

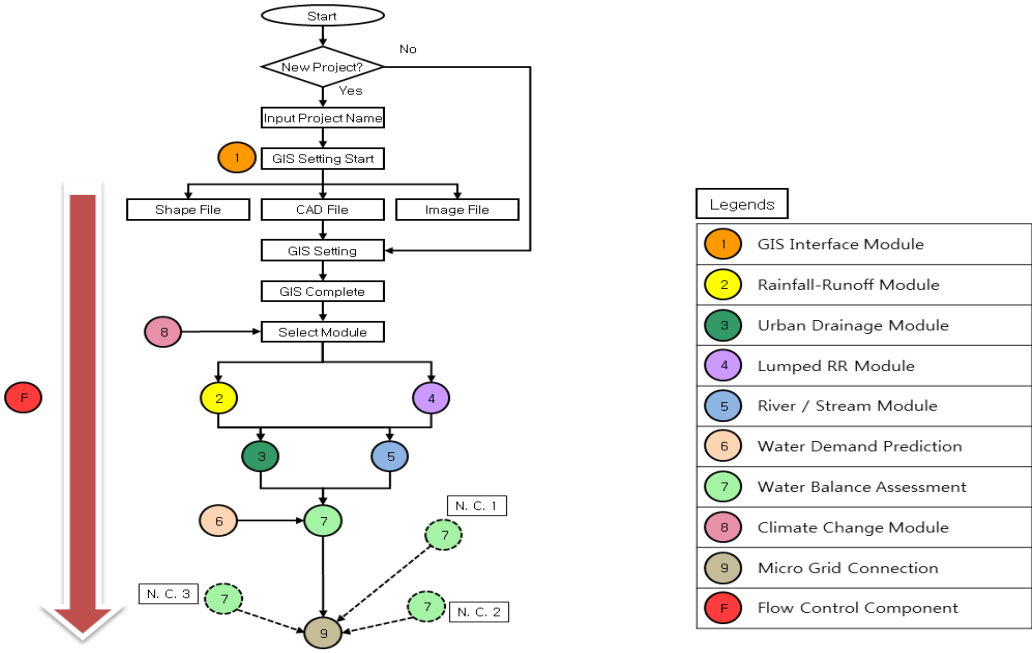

Figure 5 Major modules and their connectivity

Summary

This study discusses a novel water balance assessment model which is being developed as a part of smart water grid project in Korea. And following conclusions show the summary of the study.

1) The concept of water balance assessment is overcoming water shortage risk and enlarging the self-sufficiency rate of water through the connection of multi-sources such as desalinated sea water, treated waste water, ground water, harvested rain water and so on;
2) A complex type water balance assessment model has been developed within flow control and 9 different modules and;
3) The Youngjongdo Island has been chosen as 1st case study for the system since it has unique water supply system which providing purified water through the sea with several risks.

Smart water grids are a challenge to research and business. They may be seen as embedded activity towards the future water management.

Acknowledgement

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