

Chapter 1

Introduction

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The river basin water management is one of the most important global issues. Social demands to water management, such as flood control, water utilization, sediment transport control, navigation, landscape, biotic integrity and recreation, have been increasing yearly, and water management is expected to respond effectively to all of them.

Countries located at low latitude have high precipitation through the year. However, other regions have seasonally changing precipitation in general. On the other hand, there are many countries located in arid and semi-arid areas, and people living in the regions have difficulty obtaining water resources. In arid and semi-arid areas, infrastructure, such as reservoirs and water transfer, play a more important role than in the other areas.

Water utilization is closely linked to food production. In the world, agricultural water use accounts for 70% of the total water use. Aside from food production, secure employment is a socially expected role for the agricultural sector, especially in developing countries. Therefore, agriculture in the future is of foremost concern for water management. Allocation of water resources to the sectors — agriculture, industry, daily lives, and ecosystem — is an essential part of water management for social stability and sustainability.

Water circulation in an open system is seen in the agricultural sector where the amount of water decreases with evapotranspiration. On the other hand, a closed system in the industrial and domestic sectors where only water quality is lowered and the water amount does not decrease, net water consumption is decreased by reuse and/or recycling.

Meanwhile, it is possible to produce water by desalination. In developed countries, water can be made with an appropriate cost. But “making water” is not recommended, as it requires a large amount of environmental loading and

fossil-fuel consumption. Groundwater abstraction is increasing in recent years, and it has accelerated ground subsidence and the depletion of natural water resources.

Polluted freshwater does not work as water resources. Current wastewater treatment technologies can remove any pollutants from polluted water. However, the applicability of them depends on economics.

Even if there is no water pollution in arid and semi-arid areas, much evapotranspiration in the open system causes salt damage. Salt damage is already prevalent in many places in the world, thus, it is not unusual. As a result, some devices to use water efficiently in cultivated areas are needed.

Water exists not only for humans, but also for plants and animals. It is difficult to determine economic values of water for them, therefore it is not easy to involve them in water management.

Water transports substances, such as sediment. The variability of river discharge makes some important roles for sediment transport as well as living organisms. Keeping a steady state in river water flow is not well for them.

The object area of water management is basically a river basin. However, considering that water involved in products and substances, which are not concerned only with water use, the related area of water management may be expanded outside the basin and into the world.

At any rate, in arid and semi-arid areas with water shortage problems, a more appropriate allocation of water resources to all sectors has to be considered.

The Yellow River basin, located in the semi-arid and arid climate zones in northern China, is confronted with serious problems of water deficit as well as water pollution. The Yellow River basin has about a hundred million in population and 752,000 km² of catchment area. With regard to increasing human activities and climate changes, the usage of water with high efficiency is a key requirement to the development of the basin.

Due to increasing population, rising living standards, increasing pressure of expanding irrigation areas and developing industries in this basin, water resources allocation has been a major issue. This issue may seem domestic, but in reality, it is international, as it impacts other countries through trades of industrial products of food and human activities.

Development in the basin is limited by water shortage, salinity damage and pollution. There are many scenarios on the allocation of water resources. One extreme is industry-oriented while the other is agriculture-oriented. If China targets the former scenario, industries in other advanced countries would decline through trade competition. A high unemployment rate would occur, which would be followed by social instability (unless other sectors such as the service sector

absorbs the unemployed labor power). If China targets the latter, the income of its people would hardly increase, although social stability would be kept. This is an Achilles heel for the Chinese government. Even if the allocation of water resources among the sectors is determined, the allocation between upstream and downstream remains another issue.

This book discusses issues like these from the point of water resources and gives several ideas on the countermeasures to be taken. As the contents of this book is based on research results of a five-year project: “improving the sustainability in utilizing and controlling water in the Yellow River basin” sponsored by Japan Science and Technology Corporation (JST), all the content inside is newly obtained and full of new ideas and concepts.