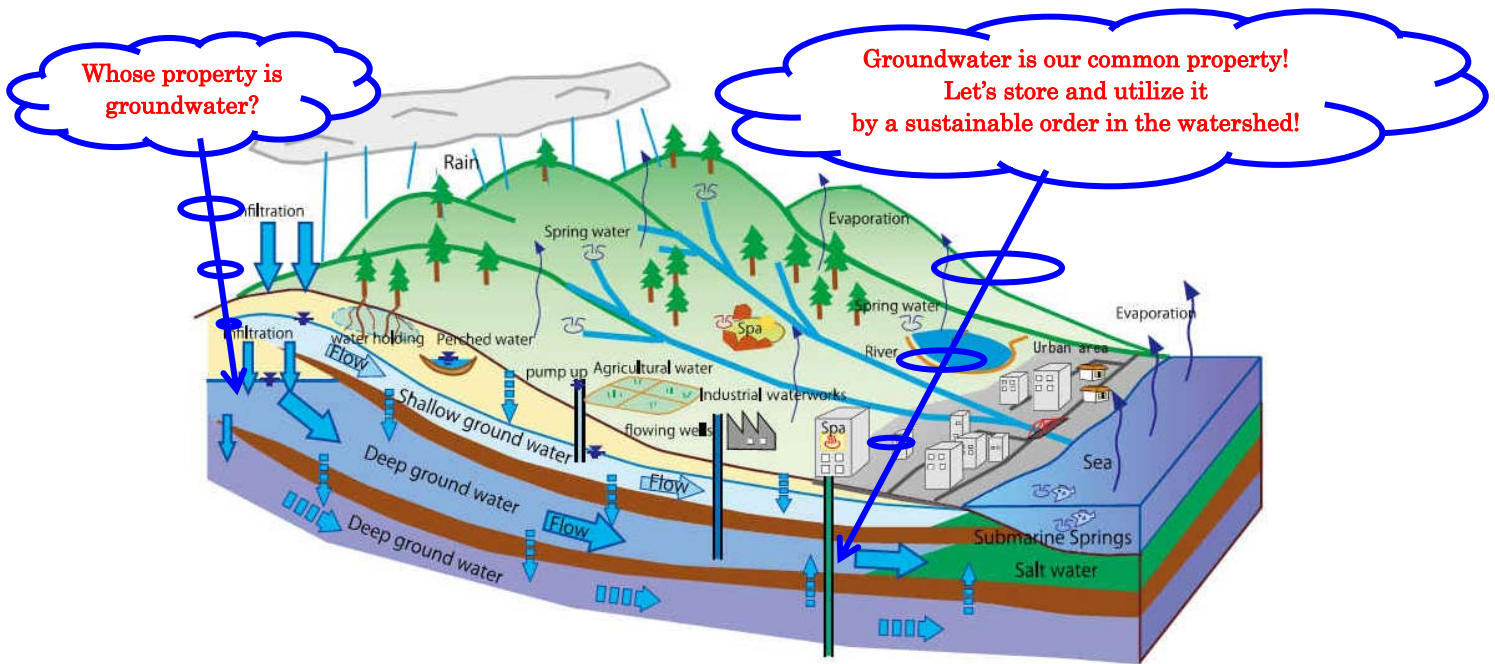


# Basic Concept on Sustainable Utilization of Groundwater in the Urban Area Towards Coexistence with Groundwater



## Introduction

Unless groundwater had been utilized effectively, cities in Japan might not have been developed as well as they were. This could also be said for the development of the four major ancient civilization in the world. However, during the process of modern industrialization, excessive discharge of groundwater has caused various types of geo-environmental problems including land subsidence. Therefore, new institutional controls in terms of rules and regulations have been sought. Recently, these geo-environmental problems have diminished. However, other new types of problems have been newly recognized. We should certainly continue to improve the methodology on a more effective and sustainable use of groundwater in accordance with the requirement of our society.

Here are the nine keywords on the groundwater policy.

- Coexistence
- Welcome donation
- Sound water cycle
- Common property
- Environmental problems
- Proper and wise utilization
- Water fostering
- Technology
- Geotechnical and Groundwater consultant firms

## Coexistence . . .

### Creation and utilization of the wisdom to coexist with groundwater

Various environmental problems might result from using and handling groundwater disorderly in the urban area. The causes of these are not in the utilization of groundwater itself, but the uncontrolled and inappropriate utilization of groundwater. It is essential to build up a mechanism of sustainable groundwater utilization, which is harmonized with regional characteristics, in the entire water basin.

## Welcome donation . . .

### What is the welcome donation of groundwater?

The functions of groundwater are as follows.

1. Stabilization of ground and water environment
2. Mitigation of climate change in the urban area
3. Preservation of biodiversity
4. Preservation and stabilization of geo-environment
5. Material storage under the ground

It is necessary to make the quality, quantity, temperature and pressure of groundwater sound to utilize groundwater as one of our resources.



*Ryusei Waterfall (Kamikawa Town, Hokkaido)*

## Sound water cycle . . .

### What is the distribution and existence of groundwater?

The total amount of natural water in the world is invariable. However, the amount of the natural water in a certain area shall change in accordance with the balance of the waters such as

1. inflow / outflow of the catchment area through rivers and the groundwater network,
2. rainfall and snowfall,
3. evaporation and transpiration,
4. virtual water through crops and foods.

A sound water cycle should be considered on the scale of the catchment basin and from a worldwide viewpoint, not from the administrative border and regional level.



*Lake Mashu (Teshikaga Town, Hokkaido)*

## Common property . . .

### Whose property is groundwater?

Groundwater circulates and flows as one of the forms of waters on the worldwide scale. Therefore, groundwater should be treated as a common property and we it should be effectively utilized, based on an agreement formulation by the stakeholders in a region / basement.

## Environmental problems associated with Groundwater utilization . . .

### What problems arise from disordered groundwater utilization in urbanization?

When groundwater is utilized, the following groundwater environment problems should be prevented:

1. Subsidence due to an excessive discharge
2. Groundwater salinity due to a movement of the salt-fresh water boundary
3. Negative effects on plants as a moisture content in soil
4. Water leakage into a building basement and uplift force
5. Wells and springs running dry
6. Risk of liquefaction during earthquakes
7. Freezing of the ground caused by a raise in the groundwater level
8. Groundwater flow obstruction caused by basement construction of buildings

## Proper and wise utilization . . .

### What is the proper and wise utilization of groundwater?

It is important to collect the information on the groundwater balance in terms of groundwater utilization (discharge) and recharge. The groundwater management index (groundwater level) should be monitored appropriately, and subsequent groundwater level should be determined in each aquifer. Groundwater monitoring and a control system should be discussed and adopted to manage groundwater appropriately.

## Water fostering . . .

### Coexistence of groundwater and mankind can be realized by water fostering

Water fostering is a concept in which recharging water into ground should be promoted in addition to groundwater preservation and management to maximize the benefits of groundwater. In this regard, the four points given below should be considered.

1. To live with the welcome donation of groundwater
2. To preserve groundwater as common property
3. To foster and recharge groundwater considering a sound water cycle
4. To improve the worth of groundwater for sustainable and wise utilization



*Rural landscape (Kitami City, Hokkaido)*

## Technology . . . Current status and the future challenge of groundwater

It is necessary to understand the current status of groundwater and to forecast its future condition based on its utilization. The present status of groundwater is briefly presented below.

1. Scale of the river basin, namely the large area of groundwater flow that includes both the recharge and discharge area
2. Long-term period scale, namely both seasonal variation and future trend
3. Public consensus formulation based on the natural condition and social environment

It is necessary to conduct a survey of groundwater, analyzing and forecasting, and develop a database to understand the current and future status of groundwater.

## Contribution of geotechnical and groundwater consultant firms . . .

### Creation of the wisdom to coexistence with groundwater

It is necessary to design and organize a sustainable groundwater utilization system, to carry forward the benefit of groundwater, a limited natural resource, to the next generation. We, the groundwater consultant firms, have been involved continuously in the technical development and the accumulation of activities of groundwater issues. It is our sincere wish that our efforts will be beneficial for the solution of the water problems of not only Japan but Asia and the rest of the world as well.



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