IGES Institute for Global Environmental Strategies

A research on

Sustainable Water Management Policy (SWMP)

Background

Asia saw high population concentrations and high economic activity in the last century, which brought an unprecedented increase of water use and severe water pollution. For example, groundwater, a resource readily available and of stable quality, has experienced severe depletion and degradation in the course of the large-scale urbanization in some mega cities in the region, and such threats against groundwater could hinder sustainable development of the cities. Given this situation, sustainable use and integrated management of water resources is a critical policy issue will affect the future sustainability of the region.

Aim

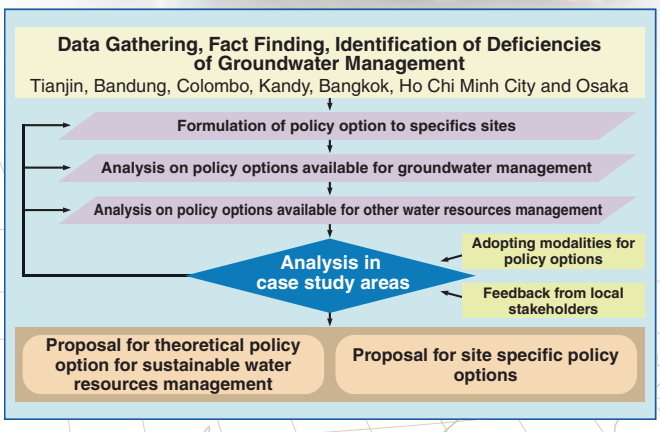
The research on Sustainable Water Management Policy (SWMP) aims to propose policy options for sustainable water management in Asian cities, based on empirical studies.

Research framework and scope

- Three-year project (2004 April – 2007 March)
- Case study cities include: Tianjin (China); Bandung (Indonesia); Colombo and Kandy (Sri Lanka); Bangkok (Thailand); Ho Chi Minh City (Viet Nam); and Osaka and other representative cities (Japan)
- The first stage of the study focused on groundwater management, targeting problems such as excessive groundwater abstraction, land subsidence as a possible result of excessive abstraction, and contamination of aquifers.
- From April 2006, the study included the management of other water resources, such as surface water and reclaimed water, aiming to propose integrated policy options for sustainable water resources management.

Research Scheme

(Groundwater Management)



Geographical Coverage of the Research

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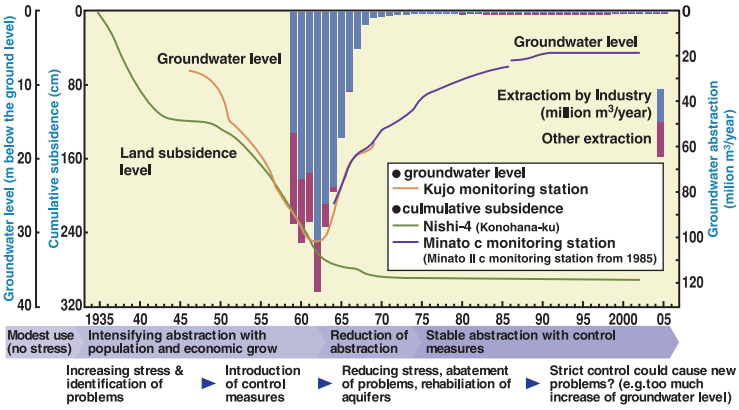
Policy responses to groundwater problems

A case study indicates that appropriate policy measures need to be taken in a timely manner, depending on the state of the groundwater usage and the associated problems.

Path of groundwater use in relation to policy measures

Osaka's past experience shows that water usage in the city followed a path related to the management measures that were adopted. With the introduction of proper measures, the water table, which had dropped due to overexploitation, was found to have recovered. However, land subsidence that stems from overexploitation is irreversible, and coping with the overexploitation at an early stage is therefore essential.

An example of Osaka city, Japan



(Source: Committee On Comprehensive Countermeasures Against Land Subsidence In Osaka. 1993)

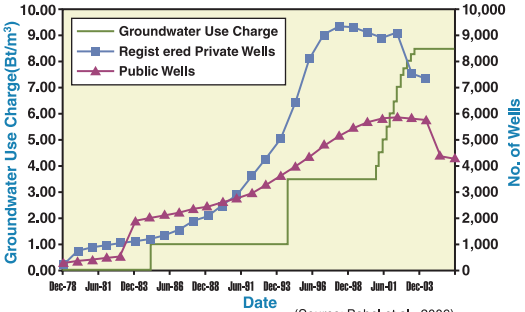
Policy measures for controlling groundwater abstraction

Several policy measures have been adopted in the case study cities, particularly aimed at reducing the rate of groundwater abstraction.

	Main components of groundwater management			
	Regulation(s) governing groundwater usage	Provisions of alternative water resources	Economic incentives/disincentives to reduce groundwater usage	Support for water-saving activities
Bangkok	National law (to regulate all sectors in principle)	Surface water (by public water supply scheme)	User charge and groundwater preservation charge	No specific measures
Bandung	Local regulations (to regulate all sectors in principle)	Expansion to include surface water usage being considered	User tax	No specific measures
Tianjin	Local level (to regulate all sectors except agricultural use)	Surface water transfer from other basins	User charge	Water conservation policy for industries
Osaka	National laws (industrial and commercial-scale uses in control areas)	Surface water to industrial sector (by new water supply scheme for industries)	No user charge, but wastewater treatment charge applies	Financial support for the introduction of water-saving technologies

Can economic instruments work?

A reverse trend of groundwater abstraction has been achieved in Bangkok by the introduction of a charging scheme, along with other measures, such as the expansion of the water supply network within the city.



(Source: Babel et al., 2006)

Challenges

There are a variety of severe challenges ahead that must be surmounted to achieve the goal of sustainable groundwater management.

- **Continuous urbanisation**
  Intensified and extended negative impacts of overexploitation without any control
- **Ex de facto responses**
  Extended negative impacts of the overexploitation problems
- **Less integration of groundwater management in urban planning**
  Less recharging areas
- **Less integration of other realms of water management**
  Hindering rational use of water resources
- **Unequal treatment to specific sectors e.g., agricultural sector**
  Less effective control measures
- **Insufficient responses to groundwater quality problems**
  Increase of health and environmental risks
- **Limited human capacity and social awareness about groundwater problems**
  Weak implementation of policy measures
- **Limited data and information**
  Barriers for timely and optimised management

The threat to groundwater in Asia

Groundwater has been overexploited in some cities, causing significant problems, such as land subsidence. The resource is also under the threat of aquifer contamination.

Background information to the case study cities

While the socio-economic conditions of the case study cities vary, the dependency on groundwater is generally high,with some cities, such as Ho Chi Minh City, extracting groundwater beyond its capacity.

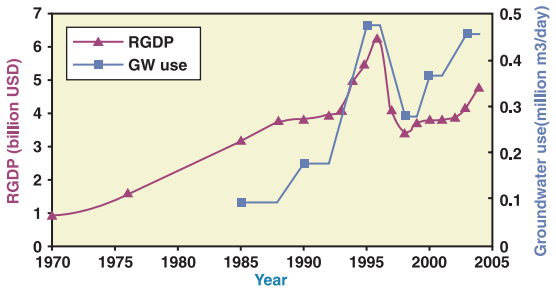
Unit		Tianjin	Bandung	Colombo	Kandy	Bangkok	Ho Chi Minh
RGDP*1 (GDP)	USD/capita	3,212 (1,100)	1,172 (940)	1,552 (957)	N.A*4 (957)	5,879 (2,190)	1,060 (480)
Population density	Persons/km^2	926	2,443	2,730	3,944	3,692	2,530
GW*2 Availability (Abstraction)	Million m^3 / y (%)	827 (90.4)	1,159 (14.7)	588 (27.2)	176 (16.5)	2,844 (28.1)	183 (186.9*5)
Per capita water use (Contribution of GW)	L/capita/day (%)	432 (53.0)	87 (58.6)	244 (41.8)	102 (38.2)	520 (24.6)	228 (54.8)
Industry use*3	%	15	80	>10	>5	65	57

*1 Regional GDP *2 Ground water
*3 Share of groundwater for industrial sector
*4 Not available
*5 Abstracted volume exceeds available groundwater

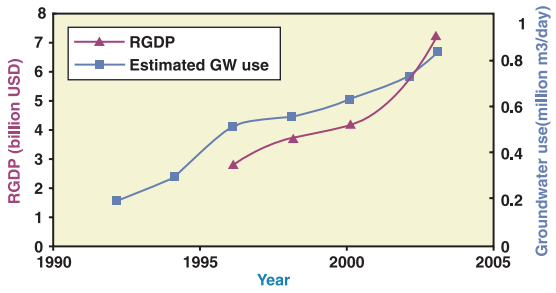
Groundwater use and economic development

Groundwater plays an important role in the economic development in Asian cities. Close linkage between groundwater usage and economic development is identified in Bandung and Ho Chi Minh City.

Groundwater use and RGDP in Bandung



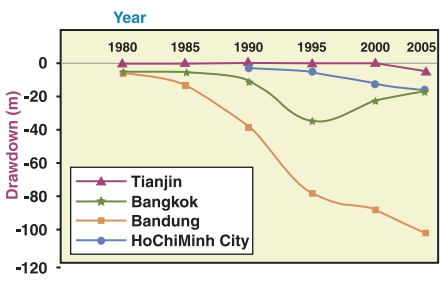
Groundwater use and RGDP in Ho Chi Minh City



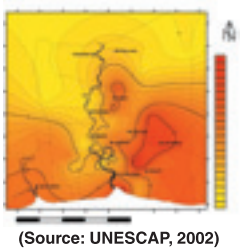
Associated problems

Water table drawdown due to excessive abstraction of groundwater, and consequent land subsidence, as well as the presence of various aquifer pollutants have been observed in the case study cities.

Chronological water table drawdown in four cities



Accumulated land subsidence in the Bangkok area



(Source: UNESCAP, 2002)

Aquifer contamination observed in Asian cities

Pollutants	Cities
Coliform	Tianjin, Bandung, Colombo, Kandy, Ho Chi Minh City
Nitrate	Bandung, Colombo, Bangkok, Ho Chi Minh City
Salinity	Tianjin, Colombo, Bangkok, Ho Chi Minh City

Recommendations for sustainable groundwater management in Asian cities

The project formulated 14 recommendations, based on the SWMP study, in order to achieve sustainable groundwater management in the Asian cities. The recommendations particularly highlighted the emerging issues regarding groundwater management, issues that must be addressed with the utmost urgency.

Groundwater management in Asian cities should be dynamic and proactive, considering not only the diversity of hydro-geological conditions but also the constantly-changing policy environment resulting from the ongoing urbanization and industrial development in Asia. The recommendations proposed are generic in nature, and the real application of the recommendations necessitates the special consideration of unique local conditions.

GENERAL

Diversity and continuous change of local settings

Optimal combination of different policy measures, and regular review and adjustment of existing policy measures are crucial for sustainable management.

Decrease of recharging capacity in the course of urbanisation

Groundwater conservation should be made an integral part of urban planning.

Poor planning to address the interdependency of water sources and integrated management

Groundwater management should be designed within the framework of a holistic urban water management policy.

Ambiguity of groundwater abstraction rights as a barrier of effective management

Groundwater abstraction rights should be assigned to the government sector in statutory form.

FOR RESPECTIVE BENEFICIAL USES

Industrial Sector

Less attention to water saving as a demand-side control measure

Available government resources should be allocated more to water reuse and recycling in industry.

Groundwater usage and wastewater treatment charges, and other economic disincentives can effectively control the demand for groundwater.

Lack of mechanisms to address the emerging quality problems particularly from the industrial sector

Governments should pay prior attention to groundwater pollution by Volatile Organic Compounds (VOCs) and take the necessary preventative measures.

Domestic and Commercial Sectors

Weak provision of stringent countermeasures under a critical situation

Groundwater abstraction by heavy users should be minimised first in places facing excessive groundwater abstraction associated with negative impacts on society.

Unmanaged sources of groundwater contamination and the subsequent increase of environmental health risks

Proper guidance on on-site wastewater treatment should be improved.

Agricultural Sector

Inadequate regulatory provisions for the control of groundwater use in the agricultural sector

Groundwater use by the agricultural sector should be controlled to prevent possible environmental impact due to intensive exploitation.

Nitrate contamination as a commonly observed problem

Fertiliser inputs should be capped to reduce the nitrate contamination of groundwater.

FOR OVERCOMING BARRIERS TO IMPLEMENTATION

Inadequate and unreliable scientific information as one of the obstacles of decision-making, implementation and monitoring

Scientific research and monitoring should be promoted by governments and research institutes to obtain reliable information for groundwater policy-making.

Confusion of responsibility, less coordination, and/or weakness of leading organisation of groundwater management

An agency should be established and reinforced to direct the coordination and facilitation of groundwater policy-making and implementation.

Less awareness, less understanding among stakeholders due to the lack of information dissemination and communication

Dialogues among relevant stakeholders should be incorporated in the policy-making and review process as a tool for promoting efforts in groundwater conservation.