GW·MATE

THE WORLD BANK
global water partnership associate program

38801

Sustainable Groundwater Management
Lessons from Practice

Case Profile Collection Number 1

Thailand: Strengthening Capacity in Groundwater Resources Management

June 2002

Author: Stephen Foster
Task Manager: Louise Scura (World Bank -EAP)
Counterpart Organization: Department of Mineral Resources Groundwater Division (DMR-GWD)

The input from GW•MATE was part of broader World Bank efforts to facilitate the strengthening of national capacity for natural resources management. It focused upon developing the groundwater resources management function of the DMR-GWD, through preparation of a project with two interrelated components:

- *a long-term strategy to improve staffing and facilities, and to deliver a nationwide groundwater management plan (including better working relations with related organizations and establishment of regional offices)*
- *a pilot-level field groundwater resources management sub-project to research key technical unknowns and to explore mechanisms for full user and stakeholder involvement.*

Although the project has not yet received government approval, it has been announced that a new Groundwater Resources Department will be formed from the above divisions, with a structure similar to that proposed by GW•MATE and with clearer linkages to other natural resources and environmental departments. The information in this paper was received mainly in unpublished form from the DMR-GWD, and the ideas were developed jointly with their senior staff.

General Background

- Long-term population growth and economic development is placing ever-increasing demands on all natural resources in Thailand. The stress on water in the main development regions is especially heavy, and groundwater has become an important resource for industrial use and urban water-supply. Moreover, as a consequence of recent droughts, it has become more widely exploited for irrigated agriculture to insure dry-season cropping. In the Chao Phraya Basin the typical dry-season shortfall in supply from surface water is some 2440 million m^3, and to offset this groundwater is being heavily developed by more than 10,000 wells incapable of producing more than 1120 million m^3/a .

- Thus, Thailand now needs a soundly-based and effectively-implemented management system to ensure sustainable and efficient use of its valuable groundwater resources. In general terms it can be said that all of the major alluvial aquifers possess very large reserves of freshwater in storage, but their rates of active replenishment (while very significant) are still subject to a large degree of uncertainty.

Key Issues Identified

- The DMR-GWD already has significant experience of attempting to control and reduce groundwater abstraction through its on going work to mitigate some of the impacts of intensive aquifer development in the Bangkok Metropolitan area. This experience forms the starting point from which to broaden the scope of such work and to extend it geographically to other major aquifers in Thailand. It is noteworthy, however, that to date there is a lack of practical experience in certain key future concerns:

- formulating national and regional groundwater resource strategies
- regulating and guiding groundwater development for agricultural irrigation
- promoting groundwater quality protection, both at source and resource levels.

- Currently, each agency concerned with groundwater use compiles its own records of development and performance, and no single national agency is responsible for coordinating what is a common resource. Thus without considerable research, it is not possible to determine the status of development of a given aquifer.

- Shallow wells, even when used for agricultural irrigation, do not require licences, nor do public water-supply (and other) wells constructed by government agencies, and this situation needs to be corrected in view of the large numbers and/or large pumping rates involved. Moreover, groundwater pollution is occurring from a number of sources and urgently needs to be controlled.

Approach Recommended

The five principal components of groundwater management are listed below (Table 1).

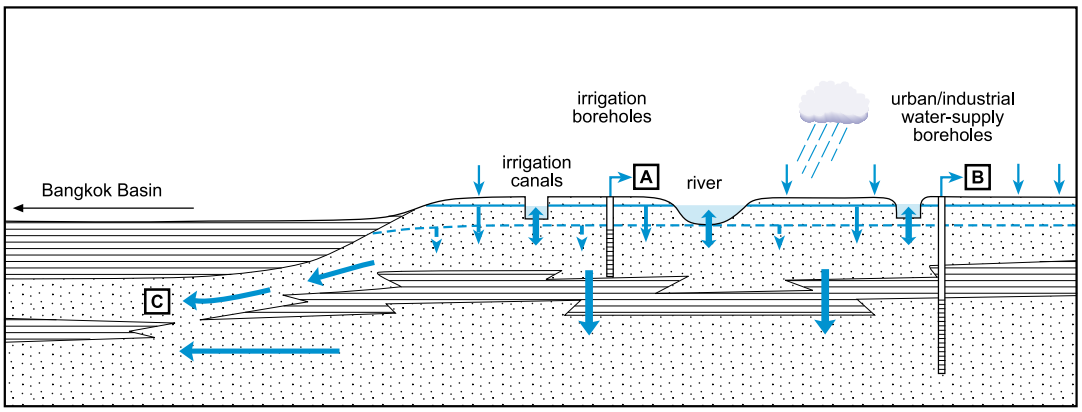
Table 1: Key government functions for groundwater resource management and their incorporation into project components

no.	PROJECT (SUB)COMPONENT Title	IMPLEMENTATION LEVEL National	Pilot
1	**Groundwater Resources Evaluation**		
	• Hydrogeological Surveys & Groundwater Monitoring	X	X
	• Aquifer Numerical Modeling		X
	• Research on Shallow Aquifer Behavior		X
	• Assessment of Conjunctive Use for Irrigation		X
2	**Groundwater Strategic Planning**		
	• Political & Public Awareness of Functions	X	X
	• Groundwater Management Master Plan	X	
	• Groundwater Utilization & Valuation	X	
	• Feasibility of Recharge Augmentation Measures	X	
	• Technical & Economic Appraisal of Impact Mitigation	X	
3	**Groundwater Abstraction Use & Regulation**		
	• Legal Modifications to Abstraction Licensing	X	
	• Stakeholder Engagement & Participation		X
	• Evaluation of Licence Charging, Trading & Policing	X	
4	**Groundwater Quality Assessment & Protection**		
	• Production of Land-Surface Zoning Maps	X	X
	• Groundwater Pollution Hazard Assessment		X
	• Promotion of Water Well Protection Zones		X
	• Groundwater Quality Monitoring Networks	X	X
5	**Groundwater Databasing & Information Provision**		
	• Updating & Linkage of Groundwater Databases	X	
	• Development of GIS for Information Provision	X	
	• Promotion of National Groundwater Data Centre	X	

- These components are in practice the key functions that government needs to perform or facilitate for comprehensive and effective management of major aquifer systems. It was thus proposed to make them the principal components of the proposed project. The areas for which capability strengthening are specifically required are also listed, and a distinction is made in respect of those which are best developed at pilot sub-project scale.

- The part of the Middle Chao Phraya Basin selected as a pilot field area for strengthening groundwater management practice is underlain by a typical multi-aquifer alluvial system (Figure 1). The uppermost phreatic aquifer has become heavily developed for drought and dry season irrigation of rice and other crops during the 1990s, while the deeper semi-confined aquifer is also under rapidly increasing development for urban and industrial water-supply. The area is also probably part of the recharge capture zone of the downstream heavily developed Bangkok aquifer.

Figure 1: Generalized groundwater flow regime of area selected for pilot groundwater management project in Middle Chao Phraya Basin – Thailand



- An adequate level of resource characterisation and quantification is needed to provide the scientific foundation for efficient and sustainable groundwater resource management. It has to be recognized, however, that the degree of natural hydrogeological uncertainty and the cost of hydrogeological field investigations are such as to make the precise initial evaluation of resources uneconomic. Careful monitoring of the aquifer response to existing or new pumping, and to already-existent pollution plumes, is the cost-effective way of confirming conceptual models, and calibrating numerical models, used as the basis for groundwater management.

- A particularly important need is to assess shallow aquifer recharge mechanisms and rates, together with evaluation of shallow-deep aquifer interactions, in typical alluvial aquifer situations. This is related to the field assessment of hydrogeological sustainability and socioeconomic benefits of existing informal conjunctive use of groundwater for supplementary agricultural irrigation.

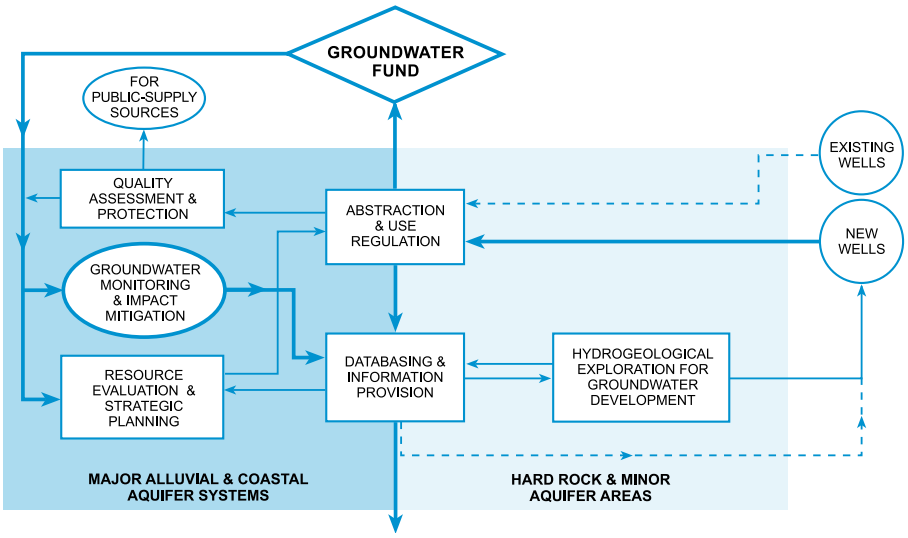
Transforming the DMR-GWD

- It is important at national level that the key government functions in groundwater resource management are well understood, and that a much clearer distinction is established and maintained between the groundwater regulator and the groundwater users. Moreover, the DMR-GWD as at present structured is primarily a groundwater development agency, with a licensing of water wells in a separate interlinked section. The organization requires restructuring (Figure 2) to focus on what now needs to be its primary task — improving groundwater management — whilst retaining limited groundwater exploration and drilling capacity to continue the search for minor aquifers in the more remote regions of the country.

- Because of the very large number of individual abstractors often involved, it can be said that 'groundwater resources management is as much about managing people as it is about managing water'. For this reason it is important that effort be put into mobilizing water-user (and broader stakeholder) participation in the definition and implementation of local groundwater management strategies and into bringing

all volumetrically-significant groundwater abstraction (including shallow irrigation wells) inside the regulatory process. These two critical steps will involve a large amount of primarily administrative action, and careful technical and political promotion at regional and provincial level.

Figure 2: Proposed groundwater management structure for a refocused national groundwater agency



- While the responsibility for groundwater resource quality protection currently falls upon the DMR-GWD, it is necessary to recognize that this function can only be carried out effectively in close collaboration with other government agencies, who have responsibility for controlling specific sources of potential pollution and for environmental quality monitoring. In these circumstances, the first priority for the DMR-GWD in its groundwater protection role must be to communicate to sister government agencies (and to land users and developers) concerns about the vulnerability of groundwater to given types of pollution in certain areas. This can be achieved through the publication of appropriate maps, together with plans indicating the capture (recharge) areas of important public water-supply sources.

- There is also a need to take certain databasing initiatives, such as establishment of a computerized linkage system (with joint numbering and agreed location) between well-based entries in the scientific hydrogeologic database and the abstraction regulation database, and also widening the data-capture up-grading and completion of the computerized regulation database.

- It is considered highly desirable to implement the concept of a 'national groundwater data centre' at the DMR-GWD Bangkok (in a physical as well as virtual sense), with improved conditions for direct public access to groundwater data/information and a provincial level technical enquiry service for water and environmental sector professionals.

Publication Arrangements

The GW•MATE Case Profile Collection is published by the World Bank, Washington D.C., USA. It is also available in electronic form on the World Bank water resources website (www.worldbank.org/gwmate) and the Global Water Partnership website (www.gwpforum.org).

Funding Support

GW•MATE (Groundwater Management Advisory Team) is a component of the Bank-Netherlands Water Partnership Program (BNWPP) using trust funds from the Dutch and British governments.