IDENTIFYING AND MOBILISING STAKEHOLDERS

STRENGTHS. WEAKNESSES, OPPORTUNITIES, THREATS (SWOT) ANALYSES

Water-Supply 1: Public Water Supply Urban Area (Dhaka-WASA)
Water-Supply 2 –Domestic Shallow Boreholes, Urban/Periurban Areas (DPHE & Private Domestic Boreholes
Water-Supply 3: Industrial And Commercial Water Supply, Both Aquifers
Wastewater And Solid Waste Disposal: Urban And Periurban Areas
Present Management And Regulatory Control of Water Supply & Wastewater Disposal

PROBLEMS, CONSEQUENCES, TARGETS AND REQUIREMENTS (PCTR) ANALYSES

Groundwater supply management
Wastewater and solid waste disposal management

OBJECTIVES, POLICIES, RANGE OF MEASURES MATRIX

Water supply
Wastewater and solid waste disposal

Examples from Bishkek and Narayanganj

Understanding development settings

The identification of key stakeholders in both Bishkek and Narayanganj was much facilitated by a clear understanding of each city's groundwater development setting and urban water infrastructure. These were derived from the Urban Groundwater Profile exercise were quite different in each city and it is instructive to contrast them:

Groundwater development setting of Narayanganj:

Groundwater provides more than 90% of drinking water supplies in the study area and there is a similar high dependence for industrial and commercial needs. Large-scale groundwater abstraction for public supply and industrial use is mainly from the lower aquifer, and located mainly within the urban area of Narayanganj. Broadly similar designs are employed for public supply and private industrial/commercial use wells alike, so the deeper aquifer horizons are not reserved for potable use. The piped water supply does not extend beyond central Narayanganj, and the per capita supply from the water utility to the urban part of the project area is estimated to average less than 45 l/p/d. Actual per capita usage is therefore almost certain to be widely supplemented with private supplies from either the shallow or (less frequently) the deep aquifer.

While the groundwater productivity in the shallow aquifer is considered too low for large abstractions, it is tapped by numerous narrow diameter boreholes equipped with hand pumps for drinking water and domestic supply purposes. These are locally known as No.6 pumps. The operation of all such bore holes is the responsibility of local user(s) who could comprise just one family or a whole community. The total volume abstracted is unknown but there seems little doubt that the upper aquifer is the primary source of potable supply for the rural and periurban population of the project area as well as a supplement for urban households.

The resultant supply network is therefore diffuse, with piped water-supply coverage within much of urban Narayanganj but numerous handpump-equipped shallow boreholes in rural and periurban districts. A large number of private and industrial wells exist. There is a register but no published estimates exist of abstraction from the lower/main aquifer, and it is very likely that there exist many more unlicensed industrial wells.

There is no modern waste water and sewerage disposal system in the study area and dispersed on-site sanitation is widespread in urban, periurban and rural areas alike. Opportunistic use is made of the storm drainage system in central Narayanganj, mainly for sullage but illegal foul-water connections are said to be common. There is no wastewater treatment plant in the study area. Inadequate drainage results in frequent waterlogging of many parts of the town and this has become a problem.

Groundwater development setting, Bishkek:

There is a very extensive piped water infrastructure (pressurised hot water as well as drinking water mains, plus piped sewerage), but widespread on-site sanitation is practised in single/two-story residential areas. Significant amenity irrigation of communal parts of residential areas occurs, using both canalised surface water and pumped groundwater. A highly productive but very localised periurban valley-fill well field located 8 km south of the urban area provides about two-thirds of the city's water demand, the balance coming from boreholes of various depths distributed throughout the city. These urban wells are screened extensively in the middle aquifer (typically >120 m intake depth), but the lower part of the upper aquifer (40 m-120 m) is also widely tapped.

The majority of abstraction boreholes are operated by the municipal water supply agency, who may provide water for both domestic and industrial processes, and there are also three separate reticulated systems for domestic water. One supplies cold water (domestic potable use), one supplies hot water taps (domestic non-potable use) and one supplies hot water for radiators (non-potable district heating use), the last of which appears to be a closed (non-consumptive) system which is operated only during the winter. All come under the description 'public water supply'. The private urban water use categories are less important both in number and volume of water pumped; a small number of factories have private wells, for potable or non-sensitive water supplies and there are also small numbers of private domestic and public municipal irrigation wells. Owner-operated supplies for commercial premises, hospitals and large state administrative buildings appear to be insignificant.

The wastewater disposal system comprises a piped sewerage element, to which industrial, commercial, apartment and public buildings together with some low-rise residential housing are connected, and a dispersed on-site sanitation element in many low-rise residential areas. The relative importance and geographical extent of the latter is not well documented, but may be significant. A wastewater treatment plant receiving domestic and industrial sewered effluent is located on the northern fringes of the city.

City stakeholder features:

Thus in Narayanganj:

- Industrial users are important and influential stakeholders, meriting extra effort in consultation;
- There is overlap between rural and urban water supply agencies, especially in the periurban area;
- Users of the shallow aquifer, which still serves as a resource as well as a receptor will be difficult to represent.
- Apart from the water utility (debatable status), no primary stakeholder groups were identified;

The participation matrix in Narayanganj, indicated:

- The pivotal role of the urban water utility WASA and the rural water supply agency DPHE in partnering change,
- The essentially passive role of the Trade associations, who strive principally to safeguard their members' interests, and
- The potentially negative role of organisations like RAJUK and the Dept of Environment who need to partner implementation of planning or regulatory measures but see little benefit and potential opposition in a control programme.

While in Bishkek:

- State sector agencies remain the predominant stakeholder group members;
- Apart from the utility (debatable status) only secondary stakeholders could be engaged;
- A post-independence depression in industrial activity offers opportunities for context-sensitive planning intervention to support a sound basic infrastructure;

Even though the upper aquifer is not widely used for potable supply, likely high vertical permeabilities, especially in the southern half of the city will favour rapid vertical movement of pollutants towards much deeper aquifers remote from the land surface.

Stakeholder Mobilisation

Stakeholders are likely to have very different and possibly conflicting interests in the urban subsurface, stemming from its simultaneous use for the provision of water supply, the elimination of wastewater and the location of engineering infrastucture and buildings (Foster et al, *op cit*). Once identified, stakeholders were engaged through the medium of a periodic bilingual newsletter (Russian/English, Bangla/English). The aim of this device was

(i) To help establish dialogue

(ii) To set out the key issues and keep stakeholders informed of progress.

In both case-study cities, a one-day workshop was held near the end of the series of newsletters. The final issue recorded the results of the dialogue during the seminar sessions at the workshop. Thus while the technical reports (Morris *et al,* 2000 and O'Dochartaigh *et al,* 2000) document the project teams' conduct of Stage 2 (Situation Analysis) of the groundwater management strategy, the newsletters are the project's record of tackling Stage 3 (Strategy Definition) of the process. The newsletters trace the course of problem analysis and identification of management targets leading to the development of policy options. Together, the Groundwater Resources Protection/Planning Map (GRPM), and the policy options tables comprise the two parts of a draft Action Plan in each city
About half a dozen bilingual newsletters were issued over an 18-month period leading up to a stakeholder workshop in each city. The newsletters were kept short and focused, each edition communicating one aspect of the policy consultation process in a logical sequence leading through:

- Problem recognition;
- Identification of future threats and consequences;
- Setting of remedial/preventive objectives and targets.
- Policy formulation.

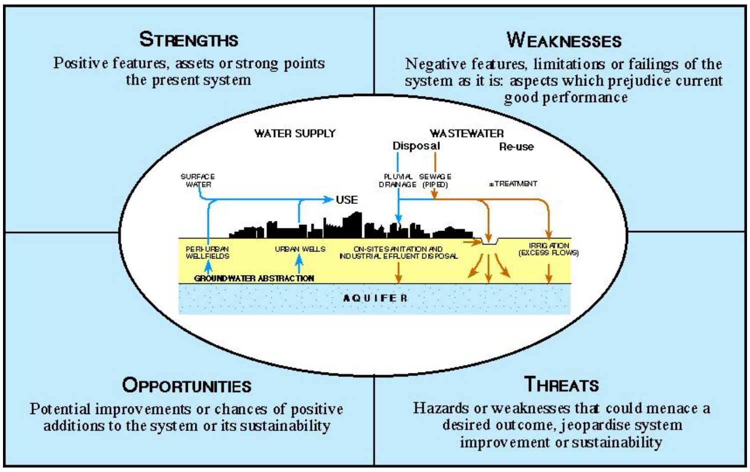
This process of 'unpacking' urban water infrastructure problems and issues gave stakeholders the opportunity to appreciate the diversity of subsurface use and the standpoint of other user groups. The simple analytical tools used are shown for the Narayanaganj case study in Figure 2.

Figure 1 Developing policy background to inform stakeholder consultation process

Thus different editions:

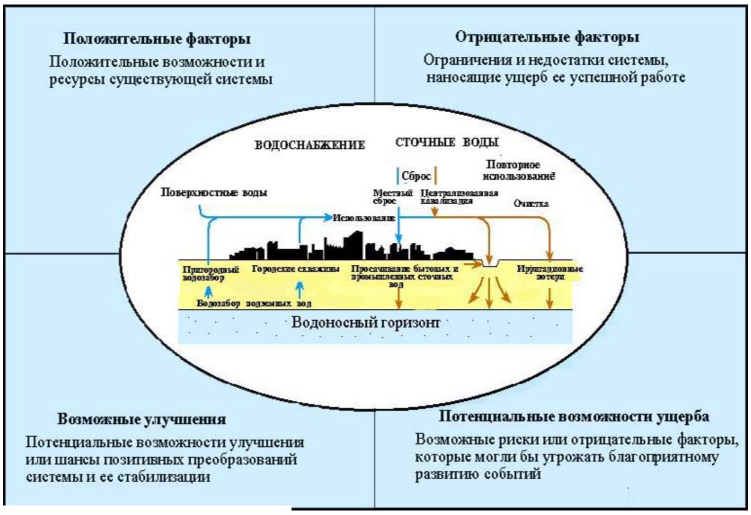
- Communicated a synopsis of results from the first part of the project, including the 'hot-spot' (potentially contaminating industries on vulnerable aquifer) map;
- Presented Strengths-Weaknesses-Opportunities-Threats (**SWOT**) analyses of different facets of the city water infrastructure (public and private water supply, wastewater and solid waste disposal, management and regulatory control, planning). This analysis method was employed as it lends itself to brevity in presentation and is likely to be already familiar to some stakeholders from its wide use as a commercial business/market analysis tool (see Figure 3 and an extract in Table 1);
- Provided Problems-Consequences-Targets-Requirements (**PCTR**) tables for water supply and wastewater/solid waste management. This analysis was intended to bring together public and private uses in such a way as to show the commonality of issues, the resolution of most of which would at some point require either the active participation (or at least the absence of opposition) of private sector users and powerful state industry interests e.g. energy in Bishkek;
- Suggested a range of policy options based on broad strategic objectives (maintaining groundwater supply, safeguarding water quality, sanitary elimination of urban wastewater/solid waste). These were ranked in terms of degree of intervention needed to put the policy into effect (Weak to Moderate to Strong), with an implied link to relative efficacy (Table 2
- Reported the results of the stakeholder workshop, at which each stage of the policy consultation process was revisited and reopened for modification by consensus and where the policy options were debated, revised and/or added to.

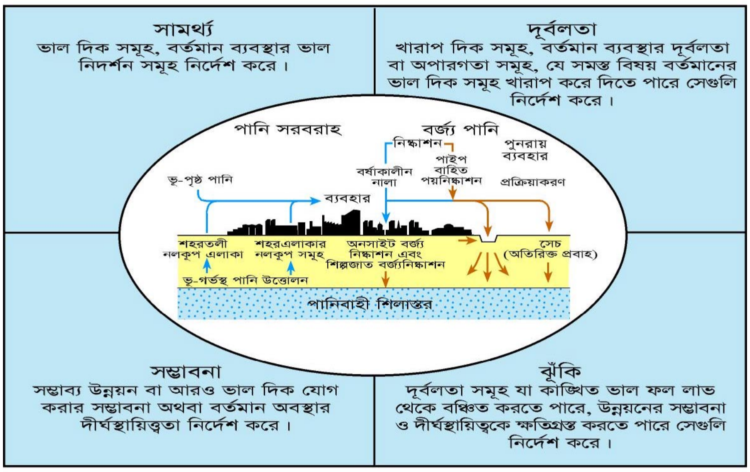
Newsletter sets from both cities are provided for reference.



English version

Russian example from Bishkek





Bangla example from Narayanganj

Figure 2 Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis for groundwater-dependent city (see also tables in newsletters)

Table 1 Example from Bishkek of SWOT analysis of one sector of city's water infrastructure

WATER-SUPPLY INFRASTRUCTURE-PERIURBAN (ORTO ALYSH) WELLFIELD	
STRENGTHS	**WEAKNESSES**
1. Located up groundwater gradient outside city and at topographically higher elevation. 2. High productivity in small area due to very high permeability, high specific yield and river-aquifer leakage. 3. Small interference effects between wells due to high permeability. Permits small, compact wellfield which simplifies distribution and treatment infrastructure 4. Wellhead protection/santary control area under control of utility. 5. Wellfield catchment areas still predominantly rural with few roads. 6. Aquifer baseline water quality likely to be high: significant quality derogation tolerable.	1. No control over catchment outside wellhead protection/sanitary control zones, despite existence of control directives. 2. Wellfield is susceptible to various pollution threats: aquifer is high vulnerability zone, adjacent to area of extreme vulnerability (losing reach of Ala Archa river). 3. Well catchments likely to include significant river leakage element; this could act as short-cut for pollutants in surface water to penetrate down to borehole intake levels. 4. Wellfield composite catchment not commonly known; time of travel zones not defined. 5. No coordination of either quantity or quality surveillance monitoring of piedmont recharge zone
OPPORTUNITIES	**THREATS**
1. Area of wellfield is compact and therefore easy to define for regulatory protection purposes. 2. Wellfield joint catchment would be relatively easy to define by existing groundwater modelling techniques. 3. Scope for progressively stricter control measures using time-of-travel zones defined by standard modelling techniques. 4. Proximity to National Park area could make regulation of potentially polluting activities easier for public to accept. 5. Stakeholder/public understanding of water supply protection issues could be improved by easier access to key urban water trends e.g. by means of a public information Website	1. Risk of microbial pollution from on-site sanitation of summer house co-operatives, either via river leakage or direct to aquifer: moderate probability hazard which could, however, be managed by treatment (raw water disinfection). 2. Susceptible to pollution incidents eg spillage from traffic accidents: low probability hazard but with potentially serious consequences. 3. Major pollution incident affecting wellfield would threaten 70% of city's water supply, only part of which could be offset by use of reserve wells in city. 4. Adjacent sensitive central government facilities may increase risk of terrorist attacks on infrastructure due to proximity. 5. Hazard of water quality deterioration due to use of agrochemicals for livestock pest control and in cultivated area, and increasing density of domestic properties in catchment 6. Risk of flood/mudflow damage to wellfield installations due to proximity of wellfield to axis of narrow valley.

Table 2 Example from Bishkek of policy options developed by stakeholder consultation for aquifer Action Plan (water supply matrix)

Objectives	Urban water management policies	Examples of policy measures to achieve targets Degree of intervention Weak → Moderate	→ Strong *Policies in left-hand column plus:*
Maintain groundwater supplies	1. Monitor groundwater levels and use results to manage urban aquifer	Install/operate a water level monitoring system to identify trends in water level of all utilised aquifers	Use results in directing/controlling abstraction patterns e.g. to conserve OrtoAlysh for potable supply and promote use of urban wells for district heating water supply and industrial non-potable use
	2. Increase understanding of aquifer resource so as to develop it in a sustainable way	Estimate water balance and, if results merit concern, develop digital groundwater flow model Use model and monitoring data to assess aquifer sensitivity to changes in recharge and abstraction pattern/magnitude	Undertake comprehensive 'Master Plan'-type water resource study, actively employing digital groundwater flow model as aquifer management tool e.g. to manage aquifer upstream of key wellfields
	3. Manage future competition for scarce aquifer resource	Enforce well spacing criteria to minimise interference effects between neighbouring deep wells on all new wells License drilling companies to regulate rate of well construction and enforce minimum construction standards	Extend well-spacing criteria to existing wells to maintain wellfield target levels
	4. Use demand management to relieve pressure to find new supplies	Initiate water economy measures such as free simple plumbing repairs Run public information campaigns to use water wisely	Install water metering to encourage water conservation and provide means to raise extra revenue from large or profligate users Amend building regulations to include water conservation technologies, subsidise water-efficient technologies/appliances
	5. Value groundwater realistically to aid management of finite natural resource	Introduce pricing policies for public water supply to at least recover cost of providing present supply	Devise fair and transparent water charging system to fund future additional treatment requirements and expanded capacity (i.e. long-run marginal costs) Implement collection measures to enhance recovery of costs of supply e.g. privatisation of meter reading/bill collection
Safeguard water quality	6. Monitor groundwater quality and use results to manage urban aquifer	Install/maintain a water quality monitoring system and use surveillance results to assess trends in water quality, at key locations in both upper and middle aquifer.	Use results in directing/controlling abstraction
	7. Increase understanding of aquifer resource so as to develop it in a sustainable way	Use capture zone delineation methods to provide protection zones for potable supply well catchments	Use aquifer management model and monitoring data to predict quality impacts and timescales

Objectives	Urban water management policies	Examples of policy measures to achieve targets Degree of intervention Weak → Moderate	→ Strong *Policies in left-hand column plus:*
Safeguard water quality	8. Control contaminant load on aquifer outcrop	Amend town planning zoning system to include aquifer vulnerability criteria Classify industrial/municipal activities into hazard classes and zone new sites in accordance with vulnerability criteria Establish voluntary (non-statutory) controls on land use/activities using vulnerability zoning, backed by information dissemination on main supply threats Assess land use/activities on protection zones of key wells to identify likely nature, magnitude and proximity of contaminants which would threaten public health	Enforce statutory controls on land use/activities within well protection zones e.g. prohibit all on-site sanitation/agricultural faecal waste disposal within 100-day time-of-travel zone around potable supply wells. Restrict all further housing, industrial , resort construction in Orto-Alysh valley by outright prohibition or by building controls Segregate effluent-producing and effluent-neutral industries, so that zoning controls only apply to industrial activities most likely to adversely affect underlying groundwater e.g. by directing new effluent-producing industries, where possible, to northern part of the city and discouraging expansion of city to south-west, south and south-east where aquifer is of medium to high vulnerability Restrict further development of fuel filling gasoline stations south of city centre, and ensure modern construction and pollution control methods are specified on all new stations e.g. double-skin tanks, interceptor drains, consumption metering to check for leaks
	9. Control rate and quality of new well construction	Introduce awareness programme on wellhead preventive maintenance and proper abandonment procedures to eliminate shallow aquifer pollution due to poor well construction/ operation	Ensure compliance with well construction guidelines for all new wells, private or public Provide and assess training/quality assurance of drilling teams
	10. Segregate water use to conserve resource	Improve public information on value of deep aquifer for drinking water supply and need for its conservation through pollution control and demand management Establish voluntary controls with recommended well/screen depths for new wells within protection zones	Reserve good-quality water for potable/sensitive use and encourage use of shallow (poorer-quality) groundwater for non-sensitive purposes e.g. licensing and charging for different uses. Enforce segregation of use by statutory control e.g. permits based on end-water use as well as volume or quota system to direct new wells not requiring potable quality towards shallow aquifer
	11. Support integrated pollution control for all existing industries	Use hazard + vulnerability classifications to identify industries posing threat to groundwater	Prioritise industries posing main threat for integrated pollution control measures or relocation
	12. Implement existing laws and regulations to achieve national policy goals	No lesser-scale intervention effective, see right-hand column	Central government (executive and legislature) to explicitly support municipal and utility efforts to enforce existing pollution and abstraction control regulations