

Stage 2 – Situation Analysis



URBAN GROUNDWATER QUESTIONNAIRE



Example undertaken for Bishkek, Kyrgyzstan

COVER SHEET

Name of City	Bishkek
Country	Kyrgyz Republic
Currency	som
Exchange Rate (and date)	1\$=30,2018som 21.01.1999 1\$=17,6955som 20.01.1998
Inflation rate (and date)	6% per month in 1998 year

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Date:	
Who was questionnaire completed by? (state name and position)	Litvak R. G. Head of Ground Water Laboratory of KNIIR

A. SOCIO-ECONOMIC CONTEXT

A1	DEMOGRAPHIC CHARACTERISTICS			
1.1	Population figures and estimates			
		City proper	Metropolitan areas	Urban agglomeration
		Population (thousand)		
	Year 1994	591.300	601.000	
	Year 1995	583.900	593.600	
	Year 1996	585.800	595.700	
	Year 1997	589.400	599.300	
	Year 1998	592.600	602.500	
	Year...			
	Year...			
1.2	Population density and growth rate			
	Land areas (km ²) and population density (1997)	157,25 km ² 3748 persons/km ²		
	Annual growth rate (%/year)	2,72		
	Additional comments/description:			
	<ul style="list-style-type: none"> Metropolitan areas is equal to the city proper plus population of Chon-Aryk and Orto-Sai. Average annual growth rate from 1993 to 1997. 			

A2	INCOME AND ECONOMIC STRUCTURE		
2.1	Income		
	Regional domestic product per capita per year	\$/cap/year	161 (1997 year)
	Urban poverty line?	\$/cap/year	504 (1997 year)
	Population below poverty line	%	62% families, 51% persons (1996 year)
2.2	Economic activities		
	<ul style="list-style-type: none"> Agro-industry/processing (✓) Transport hub/port (✓) Manufacturing (inc. light and heavy engineering; petrochemical and refining) (✓) Mining Finance/insurance (✓) Commerce/retailing (✓) Tourism 	Please tick (✓) most important economic activities in your city, then rank in order of importance: <ol style="list-style-type: none"> Manufacturing Transport hub/port Commerce/retailing Finance/insurance Agro-industry/ processing Tourism 	
	Additional comments/description:		
	Population below poverty calculated like minimum food product for person, data for Kyrgyz Republic, !996 year. (information from Kyrgyz representative of World Bank)		

A3	MUNICIPAL SERVICES			
3.1	Services provided by municipal government			
		Yes - all (✓)	Yes - some (✓)	None (✓)
	Water supply		✓	
	Sewerage	✓		
	Wastewater treatment	✓		
	Drainage		✓	
	Solid waste collection and disposal	✓		
	Additional comments/description:	<ul style="list-style-type: none"> • Central sewerage is under responsibility of municipal government. Substantial part of individual houses no combine with central sewerage and use individual pour hole. • Solid waste collection disposals to north of the city border. 		

Main sources of information:

1. Bishkek city in values 1997 year. Short statistical collection. Bishkek 1998year, 100p.
2. Data from the documents of World Bank.

B. HYDROGEOLOGICAL SETTING

B1	AQUIFER SYSTEM
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see file bb. jpg

B2	GEOLOGY
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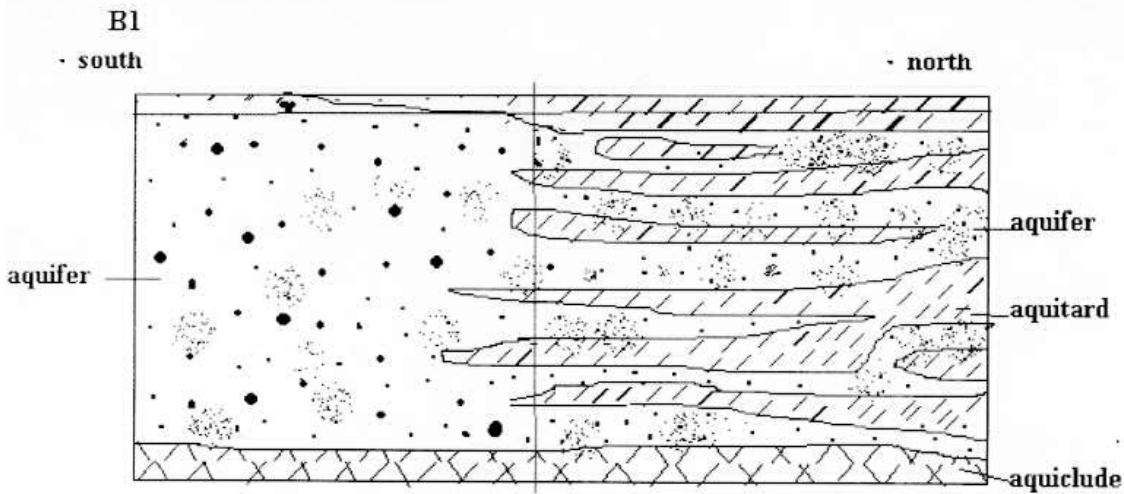
see file bb. Jpg

B3	SHALLOW UNCONFINED AQUIFER								
	If your city is underlain by a shallow unconfined aquifer please answer the following questions otherwise tick the box below questions not applicable Γ								
3.1	Is there significant leakage from the unconfined aquifer to deeper confined aquifer(s) under?:								
		Yes (✓)	No (✓)	Don't know (✓)					
	natural conditions?	✓							
	pumping induced conditions?	✓							
3.2	What is the regional groundwater gradient in the unconfined aquifer?								
	From 0,005 to 0,03								
3.3	What is the depth to the water-table from the ground surface in metres?								
		(metres)							
	3.3.1(for south part)								
	maximum	80,0							
	minimum	5,0							
	3.3.1(for north part)								
	maximum	5,0							
	minimum	0,0							
	average								
B4	AQUIFER PARAMETERS								
4.1	Estimate the average transmissivity for each aquifer unit and tick the range within which the value falls.								
		Transmissivity (m ² /d)							
		<10	10-100	100-500	500-1000	>1000			
	South part (O.Alysh)					6000			
	For south part (city)					10000			
	for north part				900-1500				
	Give details of the source of the information on which you based the estimate of aquifer parameters given above: 1)								
4.2	Estimate the average storativity and porosity for each aquifer unit and tick the range within which the values fall								
		Storativity (-)				Porosity (%)			
		<10 ⁻⁴	10 ⁻⁴ -10 ⁻³	10 ⁻³ -10 ⁻²	10 ⁻² -10 ⁻¹	>10 ⁻¹	<1	1-10	>10
	Aquifer					✓			✓
	Give details of the source of the information on which you based the estimate of aquifer parameters given above: (1)								

B5		AQUIFER RECHARGE			
5.1	What is the mean annual rainfall for your city in mm/ per year?				
	400				
5.2	Tick the appropriate range for mean annual natural aquifer recharge to the aquifer system beneath your city.				
		<50	50-100	100-200	>200
	Aquifer recharge (mm/year)		✓		
	Give details of the source of the information on which you based the estimate of aquifer recharge given above: This table includes only natural rainfall- recharge from losing reaches of rivers and canals is very important, much more so than recharge from precipitation 2) and 3)				

B6		MAPS			
It would be helpful if you could provide copies of maps that add detail to the information provided in this section. Please send any other maps that you think are relevant in describing the physical setting of your city:					
Tick boxes for maps included.					
Map of city showing topography and surface water features		✓	Transmissivity		✓
Geology	✓		Storativity		✓
Depth to water-table		✓	Porosity		X
Height of the water-table		X	Aquifer recharge		X
Other				X
			Map of Geological and geological complexes		X
				X

- 1) Krivchenko O.S. and other. Regulation of the regime observation wells for ground water Balance exploration for Chu Valley Kyrghyz State Geological Service, Frunze. 1980
- 2) Litvak R. G. (Head of the Project), Substantiation of drainage measures on the housing estate Bakay-Ata. Scientific report, KNIIR, Bishkek, 1996, 30 pp
- 3) Kaplinsky M.I., 1977. Prediction of changing of the drainage runoff under the influence of the water economical measures. Frunze. "Ilim".



B2

for south part

	5 m		loam
	20 m	paQ_s^L	coarse boulder - coarse-gravel + sandy, gravel Transmissivity -4000-6000 m ² /d gradient - 0,003-0,009
	90 m	paQ_n^L	
	350 m	paQ_n	
		N	conglomerate+clay

B2

for north part

	10 m		loamy
	40 m	apQ_n^L	gravel+sand+loam+ clay Transmissivity - 900 m ² /d gradient -0,005-0,01
	120 m	apQ_n	
	350 m	apQ_n	
		N	conglomerate+clay

Figure Cross-sections through city multi-aquifer system. Bishkek

C. GROUNDWATER USE

Complete this section by providing the most up to date and verifiable information you can obtain. If you cannot provide quantitative data, please provide a qualitative response, referring to the Help Sheet for guidance. Provide all volumes in Megalitres/day (= 000 m³d).

C1		URBAN WATER RESOURCES	
	Source	Abstraction (MI/d)	%
1.1	Surface water		
	River	73,74	
	Lake		
	Reservoir		
	Inter-basin transfer		
	Other		
	Total	73,74	12,85
1.2	Groundwater		
	City centre	?	
	City	250	
	Metropolitan area	250	
	Total	500	87,15
1.3	Other		
	TOTAL	573,74	100%
	Additional comments/description:		

C2		GROUNDWATER SUPPLY AND USE											
2.1		Supply sources, uses and volumes (D = Domestic; I = Industrial; M = Municipal; O = Other)											
		Piped supply (state agency; utility) (Gross MI/d, before distribution losses)				Licensed, legally sanctioned private supply (MI/d)				Unlicensed, unregulated private supply (MI/d)			
	Aquifer Unit	D	I	M	O	D	I	M	O	D	I	M	O
	1												
	2												
	3												
	4												
	All Units												
	TOTAL ABST.	500											
2.2	Groundwater use, net of distribution (unaccounted for) losses												
	TOTAL USE	500											
	Additional comments/description: The information about lossees is absent												

C3		GROUNDWATER DELIVERY								
3.1		Technology type (BH = Borehole; SW = Shallow well; S = Spring)								
		Piped supply (public; utility company) (Gross MI/d)			Licensed, legally sanctioned private supply (MI/d)			Unlicensed, unregulated private supply (MI/d)		
Aquifer Unit		BH	SW	S	BH	SW	S	BH	SW	S
A1										
A2										
A3										
A4										
All Units		500	0	0		0	0		0	0
3.2		Typical yield range (m ³ /d) Not known								
A1										
A2										
A3										
A4										
All Units										
		Additional comments/description:								

C4		TRENDS IN GROUNDWATER USE						
4.1		Total abstraction from aquifer for any purpose (MI/d) and % of total urban supply						
		Past trend					Future projection	
Aquifer Unit		Year.....	Year.....	Year.....	Year.....	Year... 1998...	Year... 2010...	Year.....
A1								
A2								
A3								
A4								
TOTAL						500	1296	
		Additional comments/description						

C5		WATER QUALITY CONSTRAINTS					
5.1		Groundwater contamination and treatment					
	Aquifer Unit	Within WHO drinking water norms? (Y/N)	Problem parameters*	Water treated before use? (Y/N)			Widespread/local problem? (W/L)
				Piped supply	Licensed supply	Unlicensed supply	
	A1						L
	A2						
	A3						
	A4						
		Y	N	Y	?	N	
<p>Note *water quality problems:</p> <p>F = faecal pathogens; S = salinity; H = heavy metals; N = nutrient compounds (principally nitrogen); T = taste/odour/stain (manganese, iron); O = micro-organics inc. petroleum products (LNAPLs), solvents (DNAPLs) and/or organic load (dissolved organic carbon, BOD)</p>							
<p>Additional comments/information:</p>							

E. GROUNDWATER MANAGEMENT

Tick (✓) the box that best describes water resources policy

E1		POLICY FRAMEWORK			
1.1	National water policy				
	Sustainable management and conservation of water resources (including groundwater) is an integral part of national development policy	Fully ✓	Partially	A little	Not at all
1.2	Urban groundwater policy				
	An urban groundwater management and development policy exists and is effectively implemented	Yes - policy exists and is implemented	Exists, but not effectively implemented ✓	Exists, but ineffective	No policy; no implementation
	Goals for urban groundwater management and development are clearly defined, responsibilities allocated, and resources committed	Yes - goals exist, with full provision to implement	Goals exist, but only partial provision to implement ✓	Goals exist, but no provision to implement	No goals or provision to implement
1.3	Strategies and action plans				
	A specific strategy and action plan (S&AP) for urban groundwater development and management is laid out, responsibilities allocated, and resources committed	S&AP exists; full provision to implement	S&AP exists; partial provision to implement ✓	S&AP exists; no provision to implement	No S&AP or provision to implement
	Additional comments/description:				

Tick (✓) the box that best describes the institutional framework for groundwater management

E2		INSTITUTIONAL FRAMEWORK/ARRANGEMENTS			
2.1	Coordination				
	Formal arrangements exist to ensure cooperation between water-related agencies, and are implemented on an ongoing basis	Formal arrangements are fully effective ✓	Formal arrangements are partially effective	There is informal coordination	There is active competition between agencies
	Formal arrangements enable participation of groundwater users, NGOs and other non-government stakeholders in groundwater planning and management	Yes			No ✓
2.2	Regulation				
	Legally binding procedures exist, with machinery to implement them, to allocate groundwater and resolve conflicts between competing users and uses	Procedures exist; full provision to implement ✓	Procedures exist; partial provision to implement	Procedures exist; no provision to implement	There are no procedures
	There is a functional separation, but legal link between, groundwater regulation and groundwater development.	Yes ✓			No
2.3	Capacity				
	Institutions dealing with groundwater management have the technical, financial and management skills and resources to fulfil designated tasks and functions	Fully	Partially	A little ✓	Not at all
	Regulatory body has the capacity and authority to monitor compliance with groundwater-related legislation, and to enforce controls	Regulations strictly monitored and enforced	Partial monitoring and enforcement ✓	Some monitoring but little enforcement	Inadequate monitoring and enforcement of controls
	Additional comments/description: For 2.3 There are low financial resources to fulfil designated tasks and functions.				

Please tick (✓) the appropriate box

E3 POLICY INSTRUMENTS FOR GROUNDWATER MANAGEMENT					
		Measure exists and is fully implemented	Measure exists but is only partially implemented	Measure exists but is not implemented	Measure does not exist
3.1	Pollution control - regulation				
	Ambient groundwater quality standards (listing permissible concentrations)	✓			
	Effluent standards (quality; quantity) -for specific industries -for specific pollutants -in vulnerable recharge areas	✓			
	Industrial process standards	✓			
	Mandatory pretreatment/treatment	✓			
	Discharge permit system -for specific industries -for specific pollutants -for specific areas	✓			
	Technical standards	✓			
	Land use and building controls	✓			
3.2	Pollution control - economic incentives				
	Effluent charges/taxes	✓			
?	Marketable discharge permits ???				
	Subsidies for clean technologies		✓		
3.3	Pollution control - other				
	Self monitoring and reporting				✓
3.4	Abstraction controls - regulations				
	Abstraction licenses/permits	✓			
	Abstraction quotas	✓			
	Technical standards/controls	✓			
	Process standards	✓			
	Land use and building controls - zoning	✓			
3.5	Abstraction controls - economic incentives				
	Groundwater tariffs -mains piped -private industrial/household	✓			
	Enforcement incentives	✓			
?	Administration charges ???				
?	Marketable quotas/licenses ?????				
	Subsidies for water efficient technologies		✓		
3.6	Abstraction controls - other				
	Metering		✓		
	Additional comments/description: For 3.3 The self-acting monitoring for pollution is absent				

E4 INSTITUTIONAL INVENTORY				
4.1 Classification				
Status: G = Government; SG = Semi -government agency; P = Private; NGO = Non-government Organisation; A = Academic; O = Other (please specify)				
Jurisdiction: C = City/municipality; R = Region; B = Basin; N = National				
	Function	Name of institution(s)	Status	Jurisdiction
1	Groundwater resource assessment and research	Kyrgyz Hydrogeology Expedition Kyrgyz Institute of Irrigation	G G	N N
2	Groundwater resource policy formulation	Municipal Power Kyrgyz Hydrogeology Expedition Department of water economy Kyrgyz Institute of Irrigation	G G G G	C N N N
3	Coordination of water-related activities	Government of Kyrgyz Republic	G	N
4	Groundwater resource planning	Bishkekvodokanal Department of water economy Municipal Power	G G G	C N C
5	Regulation and enforcement of controls and standards	Sanitary and Epidemiological Station	G	C
*6	Operations management	Bishkekvodokanal	G	C
Additional comments/description:				

Please tick (✓) the appropriate box

E5 INFORMATION, PLANNING AND PUBLIC AWARENESS					
5.1	Information availability				
	Information on groundwater conditions and rates of change is sufficient for planning, development and management of the resource	Fully sufficient	Adequate	Insufficient ✓	No information available
5.2	Information use				
	Information on groundwater conditions and rates of change is routinely used in urban planning and groundwater management	Yes - full use	Partial use ✓	Little use	Not use at all
5.3	Administration and support				
	Information collection, processing and dissemination is handled by a specialist support unit, independent of other line agencies, and serves all government agencies and the private sector	Yes - specialist unit provides comprehensive, prompt service	Specialist unit provides limited support	No specialist unit; data holdings fragmented ✓	No specialist unit or data holdings
5.4	Public knowledge				
	Information about water resources are available to the public to aid their participation in planning and decision-making	Extensive information readily available	Limited official information supplements news media	Limited information is available by via news media ✓	No information is available through any medium
5.5	Consensus				
	There is broad consensus on the causes and consequences of degradation among groundwater users/polluters, city residents generally, and professional planning/regulatory agencies	Yes	Problem/facts not disputed; action is generally supported ✓	Facts, interpretation, and action disputed	No debate therefore nothing to dispute
Additional comments/description:					

Comments on the Questionnaire.

1. In connection of Bishkek city conditions the Questionnaire would be useful for Institutes and persons which are connected with control of ground water intake (for our country there are Section of Water Resources of the Department of Water Economy, Ministry of the Environment protection and so on). The Questionnaire would help them in designing of start data structure for future monitoring of the ground water using and for the decision the licence problems.

2. The Questionnaire would be use by local and foreign managers for project substantiation of reconstruction and building of plants and other objects in the cities and in suburbs The questionnaire is really useful as a means of identifying and collecting key data, and identifying gaps which need to be filled.

3. Our laboratory of the Hydrogeology Modelling of the Kyrghyz Irrigation Institute will use the Questionnaire like part of the information for designing of groundwater balance of Bishkek city .

Our suggestions for improvement:

(a) Questionnaire has not questions regarding hot water supply. Majority part of big cities on the territory of former Soviet Union (for example Bishkek) use Heat power stations for hot water supply. In Bishkek Heat power station takes approximately 30% of all fresh water from city supply and sends hot water to flats and to other users with the help of the system of underground pipes. It would be useful to introduce suitable section in the Questionnaire

(b) Very important characteristic of water supply situation is quotient of fact ground water intake to maximum potential water intake (without damage to environment). May be it would be useful to introduce this parameter to section "c" of questionnaire. It is important value for ground water management.

Litvak R. G., Head of Ground Water Laboratory of KNIIR