7.7 Water Supply System and Operation and Maintenance

7.7.1 Present and Future Problems and Countermeasures

Present and future problems and countermeasures are presented in Table7.7.1.

(1) Present Problems

1) WTPs

Present problems of WTPs are described below:

- Primary automation is not yet introduced.
- Majority of facilities are deteriorated.
- Most of the flow meters are not working.
- Most of the electric facilities are out of order.
- Reservoirs at WTPs and distribution system are too small, are retention time of them is also too short.
- Repair and improvement budget of Tashkent City Vodokanal is too small, and that lead to difficulty for proper repair, replacement and improvement.

2) PSs

Present problems of PSs are described below:

- To cope with increasing water demand and low water pressure in the city, there are too many Booster pump station.
- Boosted water is directly distributed to user resulting in inefficiency.
- Electricity cost is high owing to pressure of many PSs with low efficiency.

3) Pipelines

Table 7.7.1 Present and Future Ploblems and Couentermeasures

Object	Facilities	Problem			Counter measures
		Present		Future	
		Common	Individual	Common	Common
WTP	Kadirya	-Primary automation is not yet introduced -Major of facilities are deteriorated -Most of the flow meters are non operational -Most of electric facilities are out of order -Detention time of reservoir is not enough -Repair and improvement budget is insufficientl	-Accutual production volume is exceeding the nominal capacity.	-Distribution volume in Tashkent City can not be increased due to limited water intake right of Boz-su canal -Huge budget for repair and replacement of facilities will be needed in near future -If water demand decreases, operation of WTPs will be very difficult to the fluctuation in water distribution volume	-Reduction of distribution volume by reduction of water leakage, by prohibition of irrigation by piped water and saving water -Abolition of WTPs with small capacity by deduction of distribution volume -Construction and Expantion of reservoirs -Introduction of Automatic operation systm - Installtion of flow/pressure meters
	Kibray		-Electricity cost is high		
	Boz-su		-Accutual production volume is exceeding the nominal capacity.		
	South		-Electricity cost is high -Distribution pressure is too high		
	Karazov		- There is no reservoir -Wells are dispersed in the city -Capacity is too small		
	Sergeri		-Capacity is too small		
	Bektemir		-Facilities are divided into three cite -Capacity is too small		
PS	Large scale PSs with reservoir	-Exessive number of booster pump station - -Electricity is high	-Detention time of reservoir is not enough	-If distribution volume decreases, some PSs will not be needed -If distribution volume increases, PSs shall be constructed or enlarged	-Abolition of unnecessary PSs by deduction of Distribution volume -Introduction of automatic operation system
	Small scale PSs		-Unstable operation by direct intake by pipes		
Pipelines	Tansmission	-Many pipes and accessories are deteriorated and are not repaired properly -Majority of pipes are steel pipe that is easily rusted -Inner lining is not installed for these steel pipes -"Faucet Joint" which causes leakage easily, is adopted for connection of cast iron pipe. -Repair and improvement budget is insufficient -Many leakage points -Water quality is derteriorated by rust of steel. -Low water pressure in the city	-All pipes are steel pipe	-Water leakage will increase and huge budget for repair and replacement will be needed in near future -Complaint for rusty water, interruption of water and other will increase because of risen tariff -Water leakage and interruption will be increased by deteriorated pipes	-Replacement of pipes -Installation of inner lining -Plastic pipe shall be adopted in small diameter pipes -Pipeline replacement and budget shall be prepaired
	Distribution		-Proper leakege detection is not conducted because of the lack of detection equipment -Old pipes shall be replaced -Pipe diameter is too small		
O&M	WTPs	-Many operational staffs are needed for manual control -Plants are not operated properly without grasping the necessary operational information, such as flow, pressure, etc. -Repair and improvement budget is insufficient -Lack of machines and equipment and materials for repair	-Many operational staffs are needed -Distribution volume is not monitored because operater donot grasp proper operationanl imformation	-Proper operation is very difficult due to be lack of needed information -Unstable operation by manual oprartion system	-Automatic operation system shall be introduce -Installation of observation equipment such as, flow/pressure meter and water level indicator in reservoir
	PSs		-Many operational staffs are		
	Pipelines		-Complaint from Hot Water Authority		
Consumer	Individual	-People awareness fowords the importace and benefit of water supply system is very scarce -People's "Save water" consiousness is very poor, due to cheap water tariff and to the non meter-rate system	-Inceasing population and water demand -Exisisting water meters are very few - Water tariff is cheap	-By meter-rate system and new tariff table, water charge will be sharply risen especially in water leaking houses -People must repair their water leaking points	-Installation of water meters shall be pushed strongly -Repair of leaking equipment and pipes -Loan arrangement for repair works -Preparation of criteria for water meter and accessaries, installation method, etc. -Adoption of Plastic pipes -Installation of water meters for hot water -Introduction of disciplinary tariff system -Water saving campaign by Vodocanal shall be conducted
	Communal Service		-Water tariff is relatively cheap -Aggressive saving waters activities are not conducted -Non-metered consumer still exist -Some parks and green belt are irrigated by piped water		
	Industry		-Aggressive saving water activities are not conducted		
	Hot water and Heating water		-Systems and facilities are deteriorated -Heating water was drained because of equipments of consumer are not proper working		

- Although many leakage points exist in pipeline network, these can not be repaired properly.
- The water quality aggravated by the rust of steel pipes.
- Distribution pipes were designed for less volume than present flow therefore, distribution pressure in the city is too low because of excessive drop of dynamic pressure.

4) O&M

Present problems in O&M are described below:

- Many operational staffs for manual control.
- Operator of Plants are not grasping operational information such as flow volume, distribution pressure and storage volume of reservoir with real time therefore plants are not operated properly.
- Repair and improvement budget of Tashkent Vodokanal is too small and repair and improvement works are not be conducted properly.
- Machines, equipment and materials for repair is always insufficient

5) Water Consumer

Present problems of consumer are described below:

- In spite of huge water leakage at houses and buildings, people do not repair it because most of the them are not adopted the meter-rate system and water charge is very cheap. If they repair the leakage, the water charge of them shall be the same.
- People are wasting water because of cheap tariff and the non meter-rate system.
- People did not notice the significant of problem of water leakage and waste.

(2) Future problems

1) WTPs

Expected future problems of WTPs are described below:

- Distribution volume in Tashkent City can not be increased due to limited water intake right of Bozsu canal.
- Huge budget of repair and replacement will be needed in near future.
- If water demand decreases, operation of WTPs will be very difficult to deal with hourly demand fluctuation.

2) PSs

Anticipated future problems of PSs are described below:

- If distribution volume decreases, majority of PSs will not be needed.
- If distribution volume increases, Further number of PSs shall be constructed or enlarged

3) Pipelines

Future problems of pipelines will be as follows:

- Water leakage will increase and huge budget of repair and replacement will be needed in near future.
- Complaint for rusty water, interruption of water and other will increase because of risen water charge.
- Water leakage and interruption will be increased by deteriorated pipes.

4) O&M

Supposed future problems of O&M are described below:

- Proper operation is very difficult due to the lack of needed information such as flow volume, water pressure, storage volume of reservoirs and other.
- Unstable manual operation system.

5) Water Consumer

Supposed future problems of consumer are described below:

- By meter-rate system and new tariff table, water charge will be sharply risen especially for owner of the water leaking house.
- Therefore, people must repair their leaking water equipment and pipes

(3) Countermeasures

1) WTPs

Proposed countermeasures for problem in WTPs are described below:

- Deduction of distribution volume will be realized by repair of water leakage at houses and buildings, by repair of distribution pipelines, by prohibition of irrigation by piped water and by saving water.
- When distribution volume in Tashkent City decreases, some small capacity WTPs can be abandoned.

- The volume of reservoirs in Tashkent City should be enlarged and constructed.
- Automatic operation system should be introduced at operation of pumping and other.
- Measuring equipment of distribution flow, water pressure in the city, and water level of reservoirs should be installed and these data can be observed in WTPs.

2) PSs

Proposed countermeasures for problem in PSs are described below:

- Unnecessary PSs should be abandoned because of risen pressure by deduction of Distribution volume.
- Automatic operation system should be introduced for PSs.

3) Pipelines

Proposed countermeasures for problems in pipelines are described below:

- Replacement of pipes should be facilitated.
- Replacing pipes should have inner lining.
- Plastic pipe should be adopted for small diameter pipes.
- Pipeline replacing plan should be prepared, budget should be ensured and replace budget will be need.

4) O&M

Proposed countermeasures for O&M problems are described below:

- Automatic operation system should be introduced.
- The observation equipment for measurement of distribution flow, pressure, storage volume of reservoir should be installed

5) Water Consumer

Proposed countermeasures for problems in consumer are described below:

- Installation of water meters should be promoted strongly.
- Repair of leaking equipment and pipes should be pushed strongly.
- Loan arrangement for repair works should be prepared.

- Criteria for selection of proper water meters and accessories, proper installation method, installation place should be instituted.
- Plastic pipes should be used for housing water pipes.
- Water meters for hot water should be installed.
- Disciplinary tariff system should be introduced.
- Saving campaign by Vodokanal should be conducted.

7.7.2 Proposed Improvement Plan

Proposed Improvement Plan for Water Supply System in Tashkent City is presented in Table 7.7.2.

The major points of recommendation are described below:

- Reduction of the water supply volume.
- Countermeasures for water leakage reduction and prevention of water wasting.
- Estimation on effect by water supply volume reduction and systems improvement.
- Improvement and replacement of system, facilities (especially pipelines) and O&M
- Estimation of the necessary cost for countermeasures and other

(1) Reduction of Water Supply Volume

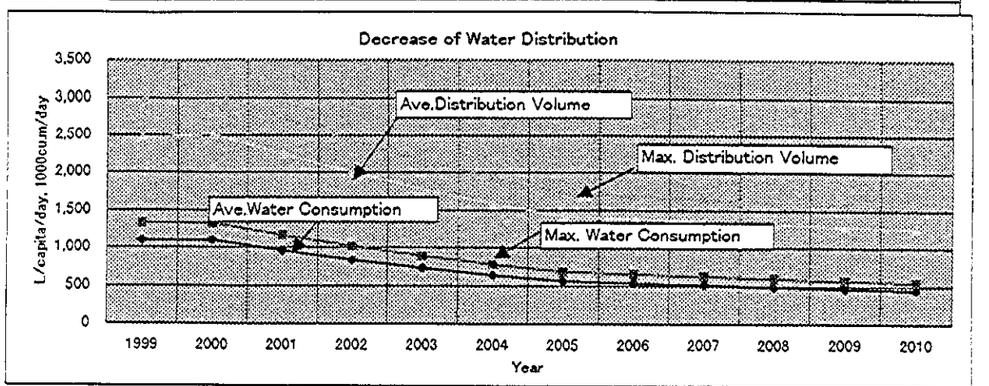
It was estimated that water consumption (including leakage and waste) in Tashkent City was too high and therefore, distribution volume should be decreased sharply.

As the result of the water demand survey by the Team for detached house in Tashkent City, water consumption of individual can be sharply decreased by introduction of meter-rate system.

Individual of occupied apartment and large consumer can be also decreased by introduced the meter-rate system and disciplinary tariff system because of this result.

Table 7.7.2 Proposed Improvement Plan of Water Supply Systems in Tashkent City

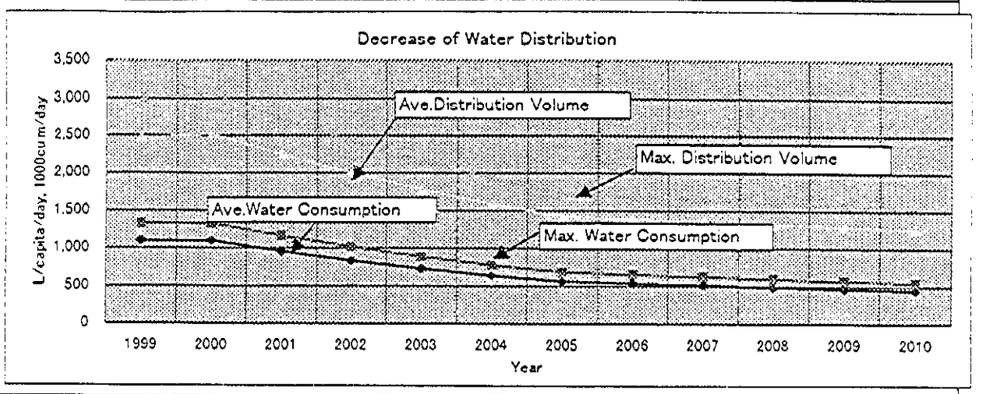
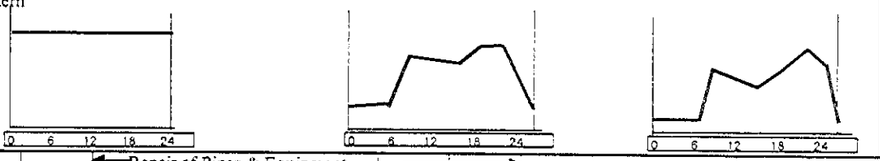
Year				1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Decreasing Plan															
Served Population			X1000	2,260	2,304	2,350	2,397	2,445	2,494	2,544	2,595	2,647	2,700	2,754	2,809
Item			Units				Assumptive Value								
Water Consumption	Apartment	Average:534*0.752	L/capita/day	401	401	339	286	242	205	173	165	158	151	145	138
		Maximum:650*0.752		489	489	410	344	289	242	203	194	186	178	170	162
	Detached House	Average:534*0.248		132	132	118	105	94	83	74	71	68	65	62	60
		Maximum:650*0.248		161	161	145	131	119	107	97	92	88	85	81	77
	Communal Service	Average:473,400/2,260		209	210	183	159	139	121	105	100	96	92	88	84
		Maximum:597,600/2,260		264	264	230	200	174	152	132	126	121	115	110	106
	industry	Average:150,400/2,260		67	67	64	61	59	56	54	51	49	47	45	43
		Maximum:140,900/2,260		62	62	59	57	54	52	50	47	45	43	41	40
	Hot/Heating Water	Average:410,500/2,260		182	182	158	138	120	105	91	87	83	80	76	73
		Maximum:308,300/2,260		136	136	118	103	90	78	68	65	62	59	57	54
	Water Leakage	Average		100	100	90	82	74	66	60	57	55	52	50	48
		Maximum		216	216	195	176	159	144	130	124	119	113	108	104
	Total	Average		1,091	1,092	952	831	727	636	557	533	509	487	466	446
		Maximum		1,328	1,328	1,158	1,011	884	774	679	649	621	594	568	543
Distribution Volume(Ave.)		Average	1000cu.m/day	2,466	2,516	2,238	1,993	1,776	1,586	1,417	1,382	1,348	1,315	1,283	1,251
		Maximum		3,001	3,060	2,722	2,424	2,162	1,931	1,727	1,685	1,644	1,603	1,564	1,526
Flow Pattern			Flow	Flat Pattern											
Counter Measures	Decrease of Leakage	Apartment	—	← Repair of Pipes & Equipment →											
		Detached House		← Repair of Pipes & Equipment →											
		Communal Service		← Repair of Pipes & Equipment →											
		Enterprise		← Repair of Pipes & Equipment →											
		Hot Water & Heating		← Repair of Pipes & Equipment →											
		Pipelines	—	← Leakage detection, Quick repair, Replace of pipes →											
	Saving	Apartment	—	← Campaign →											
		Detached House		← Installation of meter →											
		Communal Service	—	← Campaign, Disciplinary Tariff →											
		Enterprise	—												
		Hot Water & Heating	—	← Campaign, Disciplinary Tariff →											
		WTP & PS	—	← Improvement of system and O&M →											
Cost of Counter-Measures	Decrease of Leakage	Apartment	10^6sum			113	113	113	113	113					
		Detached House				125	125	125	125	125					
		Communal Service				94	94	94	94	94					
		Indutry				15	15	15	15	15					
		Hot Water & Heating				81	81	81	81	81					
		Distribution pipes repair				Included Running cost									
		WTP & PS				10	10	10	10	10					
		Total				438	438	438	438	438	0	0	0	0	0
	Saving	Campaign				10	10	10	10	10	10	10	10	10	10
		Meter installation			434	434	434	434	434						
		Total			434	444	444	444	444	10	10	10	10	10	10
Effect	Staff Arrangement	Addministration	Number	100	100	102	104	106	108	110	112	114	116	118	120
		O&M of Facilities		1070	1070	1070	1070	1070	1070	1070	990	920	785	630	460
		Water Network		1708	1708	1,665	1,622	1,581	1,541	1,502	1,463	1,426	1,390	1,354	1320
		Service & sales		183	183	196	210	225	241	258	262	267	271	275	280
		Construction & Repair		280	280	301	323	347	372	400	400	400	400	400	400
		Total		3341	3,341	3,333	3,329	3,328	3,332	3,339	3,227	3,126	2,962	2,778	2,580
		Surplus Workers*1		0	0	8	12	13	9	2	114	215	379	563	761
	Running Cost	Chemicals & Electricity	10^6sum/y	860	880	797	721	653	592	536	485	439	398	360	326
		Repair & Improvement	%	100	100	96	93	90	87	84	81	78	75	73	70
	Simplification of Facilities	Abolish of WTP	—							Karazov	Bektemir	South	Sergeiri	Boz-su	
		Working PS		92	92	83	75	68	61	55	39	28	20	14	10
		Pipe Line								Need of replace and abandon					
		Cost	10^6sum/y			90	80	70	70	160	260	210	180	160	40
	Others	Water Resource			Intake Right of Boz-su Canal 2,090,000cu.m/day										
		Water Intake Volume	10^3cu.m/d		2,090	1,949	1,818	1,696	1,581	1475	1,442	1,409	1,375	1,375	1,375
		Environment Effluent BOD	t/day		36	34	33	31	30	28	27	26	24	23	22
Needed Improvement of Systems	Contents	WTP	—	← Automatic Improvement of Pumps →											
		PS					To abandon in order								
		Pipe Line Replace	Km			10	20	30	40	50	50	50	50	50	50
		Reservoir Construction	cu.m				50,000	50,000	5,000	50,000		50,000		50,000	
	Cost	WTP	1000$/y			1,000	1,000	7,500							
		PS							2,000						
		Pipe Line				3,000	6,000	9,000	12,000	15,000	15,000	15,000	15,000	15,000	15,000
		Reservoir					10,000	10,000	1,000	10,000		10,000		10,000	
		Total				4,000	17,000	26,500	15,000	25,000	15,000	25,000	15,000	25,000	15,000
Total Cost		Investment	10^6sum		0	428	428	428	428	428	0	0	0	0	0
		〃 by Vodocanal	10^6sum	0	434	544	534	524	524	180	270	220	190	170	50
		〃 by Vodocanal	1000$			4,000	17,000	26,500	15,000	25,000	15,000	25,000	15,000	25,000	15,000
		O&M Cost	10^6sum/y	860	880	797	721	653	592	536	485	439	398	360	326



*1:Surplus Worker can rearrenge for construction.

Role of Vodokanal

Table 7.7.2 Proposed Improvement Plan of Water Supply Systems in Tashkent City

Year				1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Decreasing Plan															
Served Population			X1000	2,260	2,304	2,350	2,397	2,445	2,494	2,544	2,595	2,647	2,700	2,754	2,809
Item			Units				Assumptive Value								
Water Consumption	Apartment	Average:534*0.752	L/capita/day	401	401	339	286	242	205	173	165	158	151	145	138
		Maximum:650*0.752		489	489	410	344	289	242	203	194	186	178	170	162
	Detached House	Average:534*0.248		132	132	118	105	94	83	74	71	68	65	62	60
		Maximum:650*0.248		161	161	145	131	119	107	97	92	88	85	81	77
	Communal Service	Average:473,400/2,260		209	210	183	159	139	121	105	100	96	92	88	84
		Maximum:597,600/2,260		264	264	230	200	174	152	132	126	121	115	110	106
	industry	Average:150,400/2,260		67	67	64	61	59	56	54	51	49	47	45	43
		Maximum:140,900/2,260		62	62	59	57	54	52	50	47	45	43	41	40
	Hot/Heating Water	Average:410,500/2,260		182	182	158	138	120	105	91	87	83	80	76	73
		Maximum:308,300/2,260		136	136	118	103	90	78	68	65	62	59	57	54
	Water Leakage	Average		100	100	90	82	74	66	60	57	55	52	50	48
		Maximum		216	216	195	176	159	144	130	124	119	113	108	104
	Total	Average		1,091	1,092	952	831	727	636	557	533	509	487	466	446
		Maximum		1,328	1,328	1,158	1,011	884	774	679	649	621	594	568	543
Distribution Volume(Ave.)		Average	1000cu.m /day	2,466	2,516	2,238	1,993	1,776	1,586	1,417	1,382	1,348	1,315	1,283	1,251
		Maximum		3,001	3,060	2,722	2,424	2,162	1,931	1,727	1,685	1,644	1,603	1,564	1,526
Flow Pattarn			Flow	Flat Pattern											
Counter Measures	Decrease of Leakage	Apartment	---	◄ Repair of Pipes & Equipment ►											
		Detached House		◄ Repair of Pipes & Equipment ►											
		Communal Service		◄ Repair of Pipes & Equipment ►											
		Enterprise		◄ Repair of Pipes & Equipment ►											
		Hot Water & Heating		◄ Repair of Pipes & Equipment ►											
		Pipelines	---	◄ Leakage detection, Quick repair, Replace of pipes ►											
	Saving	Apartment	---	◄ Campaign ►											
		Detached House		◄ Installation of meter ►											
		Communal Service	---	◄ Campaign, Disciplinary Tariff ►											
		Enterprise	---												
		Hot Water & Heating	---	◄ Campaign, Disciplinary Tariff ►											
		WTP & PS	---	◄ Improvement of system and O&M ►											
Cost of Counter-Measures	Decrease of Leakage	Apartment	10^6sum			113	113	113	113	113					
		Detached House				125	125	125	125	125					
		Communal Service				94	94	94	94	94					
		Indutry				15	15	15	15	15					
		Hot Water & Heating				81	81	81	81	81					
		Distribution pipes repair				Included Running cost									
		WTP & PS				10	10	10	10	10					
		Total				438	438	438	438	438	0	0	0	0	0
	Saving	Campaign				10	10	10	10	10	10	10	10	10	10
		Meter installation				434	434	434	434	434					
		Total				434	444	444	444	444	10	10	10	10	10
Effect	Staff Arrangement	Addministration	Number	100	100	102	104	106	108	110	112	114	116	118	120
		O&M of Facilities		1070	1070	1070	1070	1070	1070	1070	990	920	785	630	460
		Water Network		1708	1708	1,665	1,622	1,581	1,541	1,502	1,463	1,426	1,390	1,354	1320
		Service & sales		183	183	196	210	225	241	258	262	267	271	275	280
		Construction & Repair		280	280	301	323	347	372	400	400	400	400	400	400
		Total		3341	3,341	3,333	3,329	3,328	3,332	3,339	3,227	3,126	2,962	2,778	2,580
		Surplus Workers*1		0	0	8	12	13	9	2	114	215	379	563	761
	Running Cost	Chemicals & Eectricity	10^6sum/y	860	880	797	721	653	592	536	485	439	398	360	326
		Repair & Improvement	%	100	100	96	93	90	87	84	81	78	75	73	70
	Simplification of Facilities	Abolish of WTP	---							Karazov	Bektemir	South	Sergeiri	Boz-su	
		Working PS		92	92	83	75	68	61	55	39	28	20	14	10
		Pipe Line								Need of replace and abandon					
		Cost	10^6sum/y			90	80	70	70	160	260	210	180	160	40
	Others	Water Resource Water Intake Volume	10^3cu.m/d		Intake Right of Boz-su Canal 2,090,000cu.m/day 2,090	1,949	1,818	1,696	1,581	1475	1,442	1,409	1,375	1,375	1,375
		Environment Effluent BOD	t/day		36	34	33	31	30	28	27	26	24	23	22
Needed Improvement of Systems	Contents	WTP	---		◄ Automatic Improvement of Pumps ►										
		PS					To abandon in order								
		Pipe Line Replace		Km		10	20	30	40	50	50	50	50	50	50
		Reservoir Construction		cu.m			50,000	50,000	5,000	50,000		50,000		50,000	
	Cost	WTP	1000$/y			1,000	1,000	7,500							
		PS							2,000						
		Pipe Line				3,000	6,000	9,000	12,000	15,000	15,000	15,000	15,000	15,000	15,000
		Reservoir					10,000	10,000	1,000	10,000		10,000		10,000	
		Total				4,000	17,000	26,500	15,000	25,000	15,000	25,000	15,000	25,000	15,000
Total Cost		Investment	10^6sum		0	428	428	428	428	428	0	0	0	0	0
		〃 by Vodocanal	10^6sum	0	434	544	534	524	524	180	270	220	190	170	50
		〃 by Vodocanal	1000$			4,000	17,000	26,500	15,000	25,000	15,000	25,000	15,000	25,000	15,000
		O&M Cost	10^6sum/y	860	880	797	721	653	592	536	485	439	398	360	326

*1:Surplus Worker can rearrenge for construction.

Role of Vodokanal

1) Reduction of Distribution Volume

Base of reduction is shown in Table 7.7.3 and is explained below.

Table 7.7.3 Base of Reduction of water consumption

Year		2000			2005			2010	
Item		Sym-bol	Base L/cap/d	Rate %	Sym-bol	Base L/cap/d	Rate %	Base L/cap/d	Rate %
Apartment	Ave.	a	534*0.752	36.7	B	230*0.752	31.1	b*0.8	31.1
	Max.	c	650*0.752	36.8	d	270*0.752	29.9	d*0.8	29.9
Detached House	Ave.	e	534*0.248	12.1	F	300*0.248	13.4	f*0.8	13.4
	Max.	g	650*0.248	12.1	H	390*0.248	14.2	h*0.8	14.2
Communal Service	Ave.	i	473,400/2,260	19.2	J	I*0.5	18.9	J*0.8	18.9
	Max.	k	597,600/2,260	19.9	L	k*0.5	19.4	l*0.8	19.4
Industry	Ave.	m	150,400/2,260	6.1	N	m*0.8	9.6	n*0.8	9.6
	Max.	o	140,900/2,260	4.7	P	o*0.8	7.3	P*0.8	7.3
Hot/Heating Water	Ave.	Q	410,500/2,260	16.7	R	q*0.5	16.3	r*0.8	16.3
	Max.	S	308,300/2,260	10.2	t	s*0.5	10.0	s*0.8	10.0
Leakage Water	Ave.	U	Total-(a+e+I+m+q)	9.2	v	u*0.6	10.8	v*0.8	10.8
	Max.	W	Total-(c+g+k+o+s)	16.3	x	w*0.6	19.1	x*0.8	19.1
Total	Ave.		1,091	100.0		581	100.0	465	100.0
	Max.		1,328	100.0		693	100.0	554	100.0
Distribution Volume	Ave.	cu.m/d	2,465,000	100.0		1,479,000	60.0	1,306,000	53.0
	Max.		3,000,000	100.0		1,762,000	58.7	1,556,000	51.9

- Consumption of apartment buildings and detached house including Large volume of leakage are shown Table 5.3.7. Repair work of water supply system should be conducted during 2000 till 2005. Reduction volume by this repair and saving volume till 2005 are estimated as leakage volume in Table 5.3.7.
- Communal service must have large volume of leakage at buildings and waste. Therefore 50 % of distribution volume will be decreased until 2005.
- Industries must pay relatively high cost water tariff by meter- rate system thus they will save water now. Therefore, only 20 % of distribution volume is estimated to be decreased for industries.
- It is said that there are huge leakage rate in heating water systems, therefore hot and heating water systems can be decreased to 50% until 2005.
- Water leakage rate of pipeline network is relatively low, but leakage volume per capita, 100L/capita/day is large. Therefore Vodokanal should conduct water leakage detection and rapid repair.

Water distribution volume can be sharply decreased as shown Table 7.7.2 by conduction of afore-mentioned countermeasures.

2) Countermeasures for Reduction of Water Leakage and Saving Water

i) Introduction of Loan System for Repair

- When meter-rate system and disciplinary tariff system is introduced to detached houses and apartment, which consume large volume of water, must pay expensive water charge.
- Therefore, water wasting should be stopped immediately and water leakage from water equipment and pipes must repair. Thus, people must pay the repair cost but many people can not afford to pay. If people can not repair water leakage and must pay expensive charge, they will complain of that strongly.
- Thus when meters are installed, leaking pipes and equipment within houses and buildings must be repaired for saving water rapidly. However some repairs will be costly, therefore introduction of loan system will be needed for efficient repair works.

ii) Repair of Pipes and Equipment in Buildings and Houses

- Leaking units at Apartment buildings are estimated as below:

  Average Water consumption (as Consumption on November): 500L/capita/day

  Leakage from Toilet 3L/min*1440min/day/3.9capita=1107L/capita/day

  Real consumption as assumed: 230L/capita/day

  Leaking unit rate: (500-230)/1107*100=24.3%---25%

- Several detached houses are consuming very large volume.

  Rate of these houses is estimated as 10 to 20%. It is supposed that water leakage in these houses occurs in toilet or pipes.

- Communal service is consist of governmental offices, school, store, restaurant and other. Most of the toilets of these building are leaking water thus these toilet and pipes they shall be repaired immediately.
- Water tariff for industry is relatively high and most of them were equipped with water meter.

  Therefore it is supposed that majority of industries already repaired pipes and water equipment, and were saving water. But some leakage pipes and equipment are remained as they are because of poor installation and low equipment quality.

iii) Repair of Distribution and Transmission Pipes

- Though pipelines have many leakage points, they were not repaired rapidly due to lack of water leakage detection equipment.

iv) Saving Water

- Introduction of meter-rate system is the most effective measure for saving water according to the result of water demand survey. Proper water meters should be selected be installed by appropriate method.
- Vodokanal should accelerate campaign for saving water.
- Disciplinary tariff system should be introduced.
- Water meters for hot water should be installed

(2) Estimation of Effect by Reduction of Water Supply Volume

1) Rearrangement of Plants and Facilities

- Some WTPs and PSs will be unnecessary if distribution volume is decreased.

  Nominal capacity of Kadirya and Kibray WTP is 1,375,000 and 455,200 cu.m/day (total 1,830,200cu.m/day) respectively, therefore, as shown in Table 7.7.2 in 2005, another WTP will be unnecessary because maximum distribution volume will be 1,762,000 cu.m/day.

- In 2005, maximum total distribution volume will be deducted to 1,762/3,000= 58%.

  Difference of elevation from Kadirya WTP to Boz-su WTP is approximately 60 m while Kadirya WTP to South WTP is 140 m. If water pressure in the point nearby Boz-su WTP distributed by Kadirya WTP is 0.5 kgf/sq.cm, pressure loss will be 6.0 - 0.5 = 5.5kg/sq.cm. If flow volume is decreased 58%, the pressure will be increased to $6.0 - 5.5x (0.58)^2 = 4.1$kgf/sq.cm.

  Therefore, most of PSs will be unnecessary.

2) Rearrangement of Staffs

Staff rearrangement plan is shown in Table7.7.2.

- The number of staff for water supply systems is 3,341 while that for O&M of plants is 1,070. Due to the abolition of the plants these O&M member will be decreased .
- The budget of repair, improvement and replace shall be increased and these staff shall be increased.
- The staffs of service and sales department shall be increased for meter reading and others.

3) Running Cost

i) Chemicals and Electricity

- Chemicals and Electricity cost was estimated as approximately 860 million Sum in 1999. Chemicals cost were 55 million Sum when distribution volume was 898 million cu.m.
- Distribution volume ratio is assumed as 80 % of for Kadirya and 20% for Kibray in 2010.
- The chemical cost in 2010 is calculated as below.

  (41 million/ 556million x 0.8+2.3million/ 165million x0.2) x 900million x 1,306million/ 2,465million= 29 million Sum
- Electricity consumption of PSs is supposed as 25% of total, and these consumption will decreased to 20% of 1999 year's level in 2010.
- The electricity cost in 2010 is calculated below.

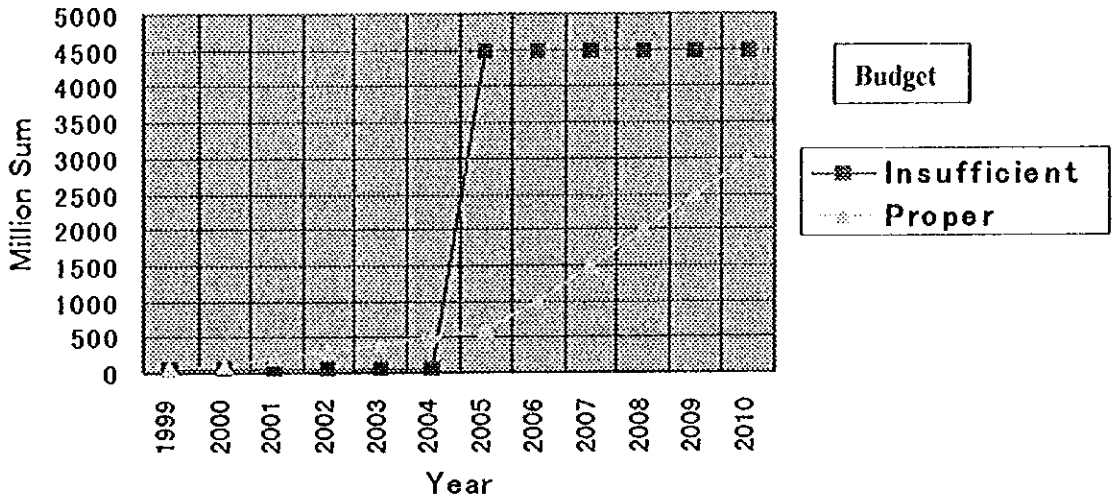
  (0.132kwh x 0.8+0.399 x 0.2) x 2.9sum/kwh x 900million x 1,306million/ 2,465million +804million x 0.25 x 0.2 =297 million Sum
- Total cost of Chemicals and Electricity is 297+29=326 million Sum in 2010, and is 326million/ 860million = 38 % to the cost in 1999.

ii) Repair, Improvement and Replace Cost

- Water supply cost was about 1.7 dollar per cu.m, and repair cost and repayment of loan is about 8 % and 20% to total budget in Japan as of 1997 (source: Water Supply Statistics). This loan repayment is for the cost of system enlargement, improvement and replacement in Japan. The average repair cost is 0.12 dollar per cu.m.
- If needed repair cost of Tashkent is assumed as 20% to Japanese level, it will be 900 million cu.m x 0.2 x 0.12dollar x 150 Sum/dallar=3,240 million Sum/year. It exceeds to total budget of about 2,700 million Sum and will not be applicable. However annual budget for repair, improvement and replace works shall be secured at maximum.
- Therefore it will be assumed that repair budget will be 600 million Sum corresponded to 20% to total budget in 2005 and 3,000 million Sum need in 2010. But the budget of this purpose in 1999 was only 50 million Sum.

- If this budget is small, excessive budget will be need in later years because the equipment which can be used longer by proper maintenance must be replaced in shorter time because of lack of proper maintenance (See Figure 7.7.1).

Figure7.7.1 Repair and Improvement Cost for Water Supply System



- Repair and improvement cost shall be decreased of 70 % of necessary budget in 1999 by rearrangement of plants by reduction of distribution volume: the number of WTPs shall be decreased from seven to two, PSs: from 92 to about 10.

4) Other

i) Water source

- Surface water of intake right of Boz-su canal is about 2,100,000 cu.m/day correspond to 70 % to maximum distribution volume. The rest of the water source (30%) is groundwater.
- Due to the limitation of capacity of the groundwater resources, it can not cope with rapid demand growth.
- Therefore distribution volume cannot be increased rapidly in Tashkent City.

ii) Water Pollution by Sewer System

- The discharged organic material per capita to sewer systems is estimated 40g/capita/day as BOD and sewer volume per capita is calculated is about 900L/capita/day.

Therefore, BOD density is only 40,000mg/900L=44mg/L and this density is too low for bacterial treatment. Furthermore, this density sharply fluctuates and bacterial sewage treatment is difficult because this treatment needs stable load and proper density of BOD (100-300mg/L).

- At present, average BOD removal rate of sewage treatment system is 60%, and this rate in future should be more than 80% because according to reduction of distribution volume and BOD density of raw water will rise to 100-200mg/L.

In 2000, BOD discharge load: (population) 2,260,000 x 40g/capita/day

$$\times 1/10^6 \times (1-0.6)=36 \text{ t BOD/day}$$

In 2010, BOD discharge load: (population) 2,810,000 x 40g/capita/day

$$\times 1/10^6 \times (1-0.8)=22 \text{ t BOD/day}$$

(3) Improvement and Replacement of System, Facilities and O&M

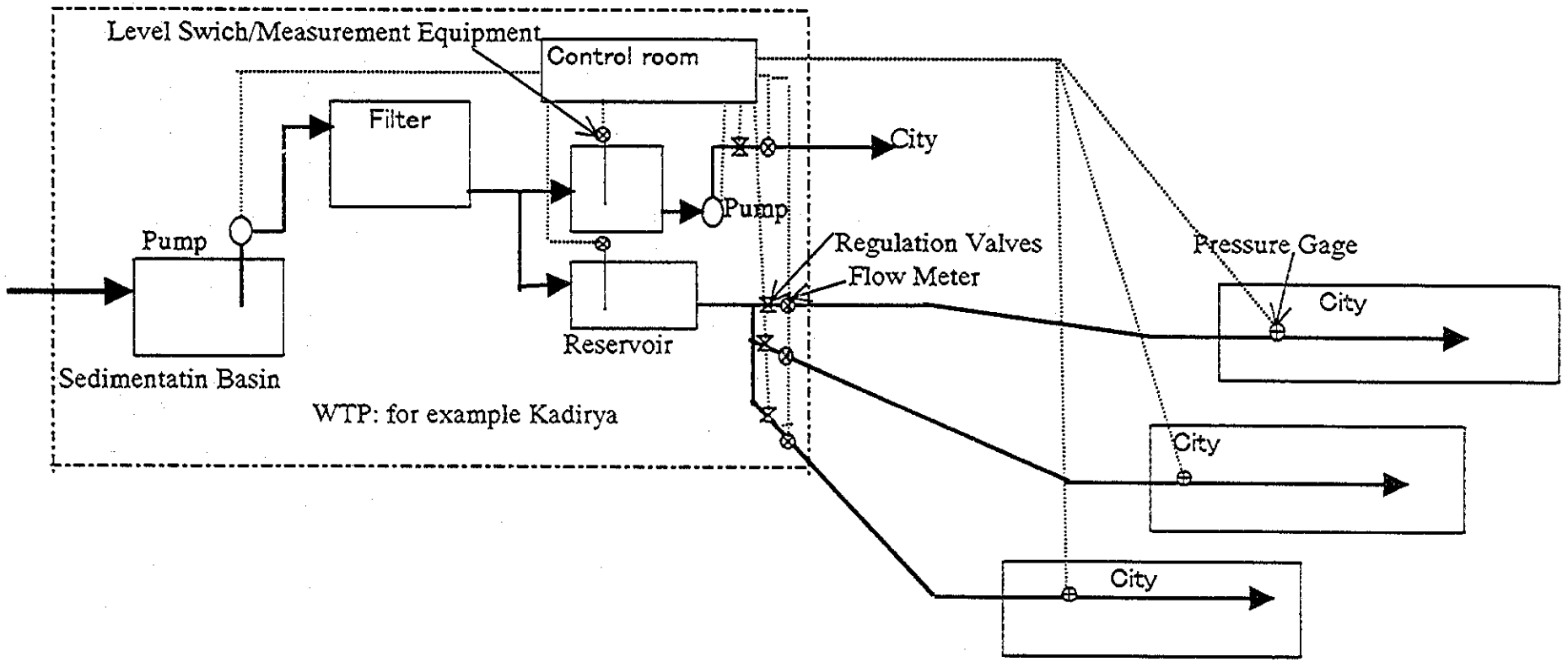
1) WTPs

- The automatic operation with the use of sensor and switches should be introduced for pumps.
- The flow meters should be introduced to major distribution pipeline and measured flow rates should be transmitted, indicated and recorded at control room.
- The water level measuring equipment should be installed at reservoirs and water level and storage volume should be indicated and recorded at control room, too.
- The pressure gages should be installed at major distribution points in the city and the measured data shall be indicated and recorded at control room.
- An example of these systems is shown in figure 7.7.2.

2) PSs

- The number of PSs should be decreased to meet lower pressure need than present condition, corresponding to the reduction of distribution volume because of rising pressure for reduction of distribution volume.
- Large PSs will be remained for example Mirzo-Ulugbek, Chiklanzar and Sergeri PSs.
- These remained PSs should be introduced automatic operation system for pumps, the flow meters, level measuring equipment and pressure gages of major points in the city.

Figure 7.7.2 Improvement of System for WTPs



3) Pipelines

- The old pipes aged over 40 to 50 years must be replaced as early as possible.
- The pipelines of Tashkent City shall be provided with the inner lining therefore replacing pipes should be used the pipes provided inner lining.
- The plastic material should be used for the distribution and service pipes of small diameter (less than 150 mm).
- Pipelines must be renewed at the certain intervals. If the longest interval for replacement in Tashkent city is assumed at 50 years, 72 km (3,600/50) of pipeline must be replaced annually.
- Therefore, at least 50 km of pipeline should be replaced every year.

4) Reservoir

- Provision of service reservoir is required to regulate flow fluctuation.
- Retention time needed at service reservoir is assumed at 4 hours in 2,005 and 6 hours in 2010.

In 2005: Maximum daily distribution volume 1,762,000 cu.m/day x 4/24 = 293,000 cu.m

As shown in 3.5.8, the effective volume of reservoir is 100,000 cu.m, therefore needed construction volume will be about 200,000cu.m.

In 2010: Maximum daily distribution volume 1,556,000 cu.m/day x 6/24 = 389,000 cu.m

Therefore additional Volume of 100,000 cu.m will be required.

(4) Estimate of the Cost for Countermeasures

1) Decrease of Leakage

i) Units of Apartment Buildings

- The number of leaking apartment unit is supposed to be 25% of total number of units, and most of leakage point is identified to be toilet. According to the survey of repair cost for leaking toilet with low flushing water tank, 2,000 to 8,000 Sum is necessary.
- Thus an average repair cost of leaking toilet is assumed at 5,000 sum.

Total cost: 450,306 units x 0.25 x 5,000 Sum/unit = approximately 563 million Sum

Repair work in five year: 563/5 = 113 million Sum/year.

ii) Detached House

- The number of leaking detached house is supposed at 20% of the total and leakage points are identified at toilet and service pipes in the house. The repair cost of toilet is supposed to be 5,000 Sum/house for 10% of the number of detached house.
- The maximum repair cost of service pipes of house is estimated at about 130,000 Sum/house, thus the average cost is about supposed 50,000 sum for the 10% of the number of detached house.
- Total repair cost: 113,471 houses x (0.1 x 5,000 sum+ 0.1 x 50,000 sum)= 624 million sum

  Repair work in five year: 125 million Sum /year.

iii) Communal Service, Industry and Hot and Heating Water

Repair cost in this category is calculated based on their consumption ratio domestic consumption (consumption of apartment and detached house). Since the industry has already invested considerable amount for leakage repair, the required repair cost is ~ assumed at ~ 50% of the estimated cost.

Communal service: (113+125) million Sum x 210/534 = 94 million Sum/year

Industry: (113+125) million Sum x 67/534 x 0.5= 15 million Sum/year

Hot and heating water: (113+125) million Sum x 182/534 = 81 million Sum/year

iv) Distribution Pipeline

The leakage detection must be conducted and the necessary equipment, and materials for leakage repair shall be prepared. For smooth implementation of leakage detection and repair works, replace plan of pipeline shall be decided.

2) Saving Water

i) Campaign

The division for water saving campaign shall be instituted in Vodokanal, and its operation cost is supposed to be about 10 million Sum, to cover personal expense, pamphlet, poster and other.

ii) Meter Installation

The meter installation is the most important action for saving water.

The cost for meter installation will be paid by Vodokanal as calculated below.

For apartment, water meter is installed at inlet part of buildings.

Apartment: 30,000 Sum/apartment building x 10,000 buildings=300 million Sun.

Detached house: 17,000 Sum/house x 110,000=1,870 Sum

Total cost =2,170 million Sum, divided by five years =2,170/5=434 million Sum/year

3) Improvement of plants and facilities

i) WTPs

- Improvement of WTPs shall be conducted Kadirya and Kibray WTP.
- Automatic control of pumps: Unit cost --20,000 Dollar/pump

  Kadirya 23units + Kibray 10units (excepting well pump) --- 33 x 20 = 660 thousands dollar
- Flow meter: 50 thousands dollar/unit (including electric work)

  Kadirya 8 units + Kibray 7 units---15 x 50 = 750 thousand dollar
- Level measurement equipment: Unit cost – 30 thousands dollar/unit (including electric work)

  Kadirya 8 units (including chemical storage tank) + Kibray 2 units---10 x 30 = 300 thousands dollar
- Pressure gage of major points in the city: Installation of gages and electric transmission line (by telephone line) ---10 points (gages and transmission systems): 3,000 thousands dollar
- Control room: Kadirya--- 3,000 thousand dollar, Kibray--- 2,000 thousand dollar
- Total cost: 660 + 750 + 300 + 3,000 + 5,000 = 9,410 thousands dollar
- Demolition of WTPs: 100 million sum/WTP

ii) PSs

- No. of PSs remaining in 2010 are supposed to be 10.
- Improvement cost of these plants is estimation at an average of 200 thousands dollar.

  ----200 x 10 = 2,000 thousands dollar
- Demolition of PSs: 10 million Sum/WTP

iii) Pipeline

- Average diameter of pipeline is 300 mm in Tashkent City.

  Average replacement cost of 300 mm pipe is estimated at 300 dollar/m=300 thousands dollar /km

iv) Reservoir

- Reservoir with the storage capacity of 200,000 cu.m shall be constructed by 2005 an d an additional 100,000 cu.m reservoir shall be constructed by 2010.
- Construction cost is estimated at 200 dollar/cu.m of storage volume.

7.8 Summary of the Immediate Solutions

The following is a summary of the solutions.

(1) Revised tariff policy

1) Early transition into metered rate system in order to give an incentive of conservation of water
2) Setting up the adequate repair costs and metered rate system in order to offset the new investment costs including a policy on maintenance and improvement of water supply services which will mention in the chapter 7.4
3) Improvements in cost management and the efficiency of operation
4) Tariff system which incorporates the concept of social safety net
5) On a premise condition before implementing metered rate system, reexamining the way to collect the costs of meter installation and the method to install the meters, and investigating technical aspects, for example, improvement in reliability of the structure of water meter
6) Introduction of computer technology in order to improve the level of efficiency in collecting the water charges

(2) Fair accounting system

1) Introduction of accounting system which conforms to the actual situation and implementing an adequate measure of disclosing financial information
2) Reexamination of introduction of inflation accounting in order to adequately earmark depletion

(3) Cost management and improvement in the level of efficiency in operations

1) Introduction of computer technology in order to improve operation
2) Introduction of management accounting
3) Introduction of improvement in the other operations

(4) Improvement and Maintenance of water supply services

1) Improvement of water pumping and constructing water distribution network, e.g. construction

of in order to deal with decrease in the volume of water distribution in future.

2) Improvement in water quality and reconstruction of aging facilities and equipment in order to prevent from water leakage.

(5) Improvement in awareness of water conservation

1) Strengthening of publicity on water conservation to general public

2) Enlightment and education

CHAPTER 8

PROPOSED SOLUTIONS FOR CHIRCHIK CITY VODOKANAL

Chapter 8 Proposed Solutions for Chirchik City Vodokanal

This chapter refers to the proposed solutions to the issues in water supply services in Chirchik City stated in chapter 4. However, basic aspects of the solutions follow the same way as Tashkent Vodokanal. Therefore, the details of the solutions are only mentioned in 8.2.

8.1 Overview of Proposed Solutions

8.1.1 Issues on Water Supply Services in Chirchik City

The current issues of water supply services in Chirchik City are roughly summarized as below.

(1) A project of installation of water meters at public users' sites has not proceeded as planned, and the users in general public are charged water bills based on fixed rate system. Also, there is a large gap in charges between the general public and corporations.

(2) As the result, large part of precious water resources have been wasted and Vodokanal has spent on the costs of wasted water treatment and supply.

(3) A lag in water tariff policy creates that the financial foundation is weak because sufficient water charges can not be collected to offset these wasted costs and the facilities and equipment are not adequately maintained as required.

8.1.2 Step-by-step Approach

The Study Team set up three stages so that each stage has an aim to be targeted in order to draft solutions to the above issues.

(1) The first stage - Provision of requirements for a self-supporting system

The targets for the 1st stage are :

1) To change the collection system from a fixed rate to a usage-based rate

2) To reform the charge policy

3) Clear clarification of the division of responsibility between the government and Vodokanal and establishment of a system

4) Introduction of the concepts of capital reservation and profit reservation – developments of mid- and long-range management plans

5) To design and implement an improvement program for efficient management

6) To design and implement an introduction program for computer system

7) To enrich information disclosure on accountability

8) Introduction of sound accounting principles

9) To inaugurate domestic liaison meetings on reforms in the water works business in Uzbekistan

10) To carry out technology transfer from overseas including the introduction of management techniques.

11) Maintaining and repairing apartment buildings

12)To implement an evaluation of the current facilities and to design an investment plan for new facilities with the aims of improving both the services and the efficiency of management operations

13) Improving other water supply services

14) To prepare and implement an enlightenment and education program to promote water conservation

15) To reform and establish the organization and legal systems, which would enable these targets to be achieved.

(2) The second stage - Establishment of business operations on a self-supporting basis and initial preparations for privatization

The targets for the second stage are as follows. With respect to certain of these targets, preparations for a financial system and credit market are stressed as essential external environmental elements, which are too difficult to achieve during the first stage.

1) To establish an efficient system for the collection using bank accounts

2) To implement the collection of charges reflecting mid- and long-term investment costs

3) To raise capital locally through Vodokanal and abroad on overseas credit markets

4) To implement investments in plant and equipment with the aim of improving the efficiency of management

5) To implement a continuous investment plan for sustainable operations

6) To introduce computerization with the aim of achieving labor-saving automation

7) To examine and implement an organization which can take responsibility for excess personnel

8) To stabilize the financial condition of Vodokanal

(3) The third stage - Operation on a self-supporting basis and examination of privatization

The targets for the third stage are :

1) To examine privatization and conduct deliberations with the unions

2) To transfer technology to other cities and countries

8.1.3 The Proposed Solutions

In order to achieve the above stages and targets, we propose the following measures to ensure reforms.

(1) The First Stage – Requirements for a self-supporting system

1) Converting the charge system from a fixed-rate to a usage-based system

Converting the charge system for the collection of utility charges from a fixed-rate to a usage-based system is necessary so that water consumption is controlled and the water works business can operate as a self-supporting system. However, this has not proceeded as expected due to problems in the method of collecting the meter installment costs, as outlined in Section 3.6.1. The following solutions to this problem are proposed.

Proposed solutions:

i) The costs for the installation of meters should be included in the basic utility charges and be collected uniformly from all the water users. A period of 5 years will be necessary to complete the installation which the government has designed.

ii) In this first stage, meters to apartments shall be initially installed only on shared tap. Whether or not a meter is installed for each household depends on the decision of each apartment block.

iii) Vodokanal shall manage the apartments blocks with the shared taps and collect the charges based on the readings of the meters on the shared taps.

2) Changes in charge policy

A new charge policy should be introduced as outlined below along with the conversion of the charge system from a fixed-rate basis to a usage-based system.

Proposed solutions;

i) The revised charge system is designed to facilitate conversion from a fixed-rate to a usage-based rate.

ii) The usage-based system will employ increased block rates in order to encourage the conservation of water.

iii)A portion of the fixed costs including the meter installation costs is collected at a basic rate

iv) The charge system has been carefully designed to consider various aspects of the social safety net.

v) It is necessary to design a charge policy from a mid- and long-term point of view as well as a policy which will operate from the present through 5 to 10 years in the future. In this first stage, a period of approximately 3 years is the target period for calculation of utility charges.

vi) The disparity between the charge for the general public and for corporations is regarded as appropriate compared with international standards although the living conditions of the population are a concern.

3) Clear clarification of the division of responsibility between the government and Vodokanal and the establishment of a system

It is necessary to clarify the roles played by the government as an administrative body and Vodokanal as a water works business . The following points can be stated.

i) A plan for plant and equipment investment is designed and established. For this purpose, Vodokanal should raise the initial funds and handle the construction.

ii) The government should be in charge of the expenses related to the various aspects of the social safety net.

iii) In the cases where the government exempts an existing form of water tariff , the government should bear the related cost.

4) Introduction of the concepts of capital reservation and profit reservation – developments of mid- and long-range management plans

It is necessary to prepare mid-term and long-range plans for the introduction of the new charge policy for future operation based on a self-supporting system. Therefore, it is necessary to develop mid- and long- range management plans incorporating the concepts of capital reservation and profit reservation to replace the current management strategy which emphasizes single fiscal year accounts.

5) Designing and implementing a program for the improvement of management efficiency

i) Managerial accounting should be introduced. This would include the introduction of an analysis of standard cost and actual budget variance which will lead to cost reduction.

ii) This system aims at an improvement of the incentives for employees which can be achieved by a reexamination of the current personnel evaluation system, the establishment of a proposal system, and the introduction of uniform and quality control activities, and so forth. Moreover, if the results of a comprehensive evaluation of personnel are duly reflected in their wages, a result of a rise in present wage levels should be regarded as inevitable.

6) Designing and implementing the introduction of computerization.

i) As the method of collection is to be changed as a result of the installation of meters, a new computer system needs to be designed and phased in.

ii) With the shift to usage-based charges, the system for the collection charges employing portable terminals.

iii) Improvement of the banking system in Uzbekistan is necessary for the introduction of computerization regarding tariff collection. But at present, the banking system is not enough and population does not use the bank account so much. And so tariff collection is a difficult for Vodokanal from the viewpoint of workload and cost. On the other hand, the introduction of an advance payment system would decrease the workload of tariff collection. If Vodokanal offers a discount for advance payment, the number of users who make payments will increase. Thus discounts are used to make advance payments as attractive option. The introduction of such discount system may be considerable until the banking system is improved.

7) Disclosure of information for the purpose of accountability

i) It will be necessary to introduce a new charge system based on sound financial operations and mid- and long-range plans and prepare cash flow statements for self-financing in the future.

ii) To clarify the entrusted responsibilities of management, it will be necessary to enhance the documents which support water works business report. Reference should be made to various reports including the annual reports disclosed by water works organizations in other countries.

8) Introduction of sound accounting principles

The following points assume that the current system of accounting does not present the reality and should thus be improved.

We propose that :

i) An allowance for repairs be provided based on an evaluation of the current facilities.

ii) The introduction of proper inflation accounting be taken into consideration.

iii) Disclosure of net amounts be charged to disclosure of accounts receivable and advances

iv) Unrecoverable claims be treated as bad debts and covered by an allowance for bad debts.

v) Evaluation of retirement pension property and debt

State-owned retirement pension trustees exist and the following issue concerning retirement pensions does not apply only to Vodokanal. This will be an information disclosure item in the future.

9) Inaugurating domestic liaison meetings to promote reforms in the water works business in Uzbekistan.

The managerial and technical problems have much in common although the locations may differ. Therefore, it is necessary to promote exchanges primarily at the level of the personnel in charge and to inaugurate domestic liaison meetings.

10) Carrying out technology transfer from other countries which are at forefront of the introduction of management techniques

Further technology transfer from overseas should be promoted in order to make the shift to operation on a self-supporting basis. Continuous technology transfer with various countries, including Japan, will be required.

11) Maintaining and repairing apartment buildings.

JEK is in charge of the maintenance and repair of apartment buildings, a current survey shows the need to improve the practice of maintenance and repairs.

12) Conducting an evaluation of the current facilities and designing new investment measures for plant and equipment aiming at improving services and the level of efficiency in business operations.

Many of the present water works facilities were built in the time of the Soviet Union and have already exceeded their period of durability, or will exceed within the next10 years. Although Vodokanal is trying hard to maintain these facilities, there is no statistical data on the period of technical durability remaining. Therefore, a technical re-evaluation of facilities is required.

Due to the introduction of usage-based rates, water consumption is expected to be reduced and the level of the water supply will be also reduced. However, this will create a surplus in terms of the use of the facilities. Therefore with regard to the facilities after water consumption has been, constructing a water reservoir and scrapping outdated plants should be examined. In addition, the reconstruction of certain facilities will be required so that the level of operating efficiency can be improved. Consequently, concrete investment measures for plant and equipment need to be designed.

13) Improving other water supply services

The results of the questionnaire show a great deal of dissatisfaction by the population with the level of water cloudiness . Vodokanal has the responsibility to deliver safe water to the end users as part of its water services, it is necessary to establish an organization, i.e. a water quality management section to settle this kind of issue. The improvement of water supply services is necessary to justify increasing the water tariff s.

14) Designing and implementing an enlightenment and training program to raise public consciousness concerning water conservation.

Vodokanal is taking an active part in publicity on water conservation. However, there is much room for improvement in the substance and means. For example, introducing a way to spread the information, establishing the necessary organization, and carrying out a training program for water conservation an early age could be added to accomplish this goal.

15) Reforming and establishing organizations and legislation to enable the above targets to be met

Measures to meet the targets above would involve changes and the establishment of an organization. In addition, the preparation of legislation is necessary to realize the solutions.

(2) The Second Stage - Establishment of business operations as a self-supporting system and preparation for privatization

The targets for the second stage are as follows. In the second stage, the implementation of the measures for improvement adopted in the first stage are continued and, thus, the second stage primarily involves a credit market and a financial system which would be difficult in the first stage as they are external elements.

1) Establishing an efficient tariff collection system using bank accounts

If the general public open bank accounts in the future, an automatic deduction system should be introduced. Transactions between the banks and Vodokanal should be dealt with by electronic data processing.

2) Implementing a tariff collection system reflecting mid- and long-term investment costs

After meters have been installed, this system of measurement should reinforce the fundamental rule that the water supply users as beneficiaries bear their own costs so that water tariff s can be rationally reflected in the investment costs of each business operation. Therefore, by designing concrete mid- and long-term investment plans, the sum of such legitimate costs can be incorporated into a usage-based table of utility charges.

3) Implementing fund-raising at home by Vodokanal and abroad through overseas credit markets

Vodokanal needs to raise funds on its own for the legitimate costs involved in future investments in its water works operations. Vodokanal should be able to raise funds by issuing bonds if a domestic credit market is well established. However, if this kind of credit market is not available, Vodokanal needs to look to other parties for financing. In any case, this would require financial stability and some form of guarantee by the government, etc. so that loans can be obtained.

4) Introducing investments in plant and equipment aiming at improving the efficiency of business operations

Investments in plant and equipment should be undertaken with a view to improving the efficiency of business operations based on the measures designed in the first stage.

5) Introducing a computer system to achieve labor-savings automation

A computer system aimed at achieving labor-saving automated should be introduced based on the plan designed in the first stage.

6)Examining and implementing an organization which can take responsibility for redundant personnel

It is anticipated that a large number of personnel would be made redundant as a result of the changes mentioned above. Therefore, the following measures could be taken to cope with this situation:

i) As a result of improvements in management, redundant personnel could be absorbed into newly established or expanded sections. The following sections can be identified as newly established or expanded sections: The following sections can be identified as newly established or expanded:

- Cost management section
- Capital section
- Accounting section
- Information management section (computing section)
- Central monitoring center
- Public relations section
- Water quality research section
- Environment section

ii) Introducing a retirement system

7) Financial stability of Vodokanal

As a requirement for privatization, the financial condition of Vodokanal must be stabilized by implementation of the reforms outlined above.

(3) The Third Stage – Self-supporting operations and examination of privatization

1) Examination of privatization and holding deliberations with the unions

2) Technology transfer not only with other cities but also with other countries

It can be safely said that the original goals in reforming the water works business should have been achieved by the third stage. By this time, it should be possible for Vodokanal to transfer technology not only to other cities in Uzbekistan but also to other countries, thus making use of their experience.

8.1.3. Consideration of Priority of Proposals

We summarize our proposals mentioned in the chapter 7.1.2, as the Fig 7.1.1. It mainly concerns the 1st stage.

We consider the priority of our proposals from a viewpoint of emergent requirements.

8.2 Solutions to Finance and Management

8.2.1 The Current Issues

As mentioned in 4.6 Summary of CWS, the current issues of CWS regarding finance and management portion are roughly classified as below and these are the same as in the case of Tashkent City Vodokanal.

1) High volume of Population consumption
2) Cross Subsidy
3) Incomplete Self-Supporting System
4) Shortage of cash for salary payment
5) Low Consciousness for Accountability
6) Inefficient Operating Activity

8.2.2 Proposals

As countermeasures against these current issues, we consider several proposals as follows:

1) Reconsideration of procedures regarding installation of a meter system
2) Water saving
3) Introduction of Reserve of fund
4) Clarification of responsibility between the government and Vodokanal
5) Improvement of Management Control
6) A Step-up in Staff (employee) Motivation
7) Improvement of Service
8) Improvement of Computer System
9) Technological points
10) Technology Exchange Meetings
11) The surplus of employees

12) External Factors

8.2.3 Detail of Proposals

For the detail of proposals mentioned above please refer to 7.2.3.

8.3 Solutions to Tariff Collection

In this section, the Study Team proposes the improved tariff collection procedure.

8.3.1 Improvement Plans on Business Procedures

We arranged the basic principles, before proposing the improvement of the tariff collection procedure.

(1) Business Restructuring Based on Functionality

It may be efficient for the staff to take charge of tasks, according to users category as currently at the beginning period of meter installation. But after meter installation substantially progresses and more than ten thousand meters will be installed for population users, it will be necessary that Vodokanal should do their business more efficiently. Moreover if the method of meter installation is standardized and the banking system in the country improves, the business share system based on function is more effective than based on user difference.

Currently a particular user is served by one controller for all tasks: mater reading, billing and collection. There is a shortcoming in view of internal control. We think that it is necessary to separate workers who read meter and workers who collect water tariff. It is not only for efficiency but also for internal control.

Now, controllers are separated into two groups; one group is for industry, communal service, and house user, and the other group is for apartment users. Because the public transport at Chirchik City is not so good, it will be more efficient to do meter reading according to area, not user category. Regarding tariff collection, it will make personnel control be more dynamic to visit intensively the same area, or focus an effort to collect the older credit.

In the near future there will be about 10,650 industry, communal service and house users in Chirchik. Taking into consideration that 11 controllers currently assigned for industry, communal service and house users read meters in 20 working days (1 month), we estimate that one

controller will have to read 49 meters per one day. But if each apartment building is equipped with a meter in future, the number of meter will be approximately 700. There are 16 controllers for apartment users now. If they read meters once a month, one controller will read only 3 meters per a day. The bias of personnel arrangement between industry, communal service and house group and apartment group should be corrected.

In addition, all controllers should be trained as specialists. We propose that they belong to the same group and take charge of tasks according to the geographical area. For example, one controller should serve an industry user as well as an apartment user, if they are neighbors.

It will be not only for efficiency but also for internal control to separate workers who read meter and workers who collect water tariff. It is a common principle for a medium or big company to assign different persons for billing and repayment respectively, in order to prevent fraud or innocent human errors. We therefore propose that the tasks of the controllers be reviewed and separated into meter reading and tariff collection for purpose of preventing fraud and innocent human errors.

Moreover the main policy of proposed tariff table by the Study Team that one common table is adapted for all users - industry, communal service, house, and apartment users. As a result, it will not be necessary to separate the works - calculation of water tariff by consequence of meter reading, billing etc. It is rather effective that regular staff takes in charge of calculation.

(2) Standardization of Meters Installation

For the effective meter reading, it is essential that the standardization pertaining to meter installation should be established.

First, we propose the standardization of installation sites of meters. We propose that the meters be basically installed outside houses or buildings, so that the staff in charge of meter reading can do their work, even if the user is away from the house or building. It is however important to maintain the security of meters to prevent robbery. We then propose that each meter be

covered and locked.

Secondly, we propose the standardization of method of meter installation. The standardization rule should include the appropriate position of meter, taking into account the easy meter reading, maintenance and exchange of the meter. It is also necessary to request the user to facilitate the meter reading to access, e.g. not to put items beside the meter.

We believe that the method of meters installation should be standardized prior to the actual implementation of meters, otherwise the repair and exchange of installed meters will burden Chirchik City Vodokanal in future.

In view of efficient meter reading, method of meters installation should not be modified according to the special conditions of particular users. Establishment of standardization will enable the staff in charge of meter reading to serve any users - not of one user category - at particular area.

(3) Frequency of Meter Reading

At the present situation, the meter reading is conducted every month for industry and communal service, every quarter for population user. Namely, the frequency of meter reading is deferent depending on the user category. In consideration of effectiveness, all users should be read by the same frequency, every month in the future. We however propose meter reading and tariff collection be conducted every two months at an initial stage.

According to the questionnaire survey, a controller assigned for industry, communal service and house spend about 40 to 50 percent of his total working time for meter reading on average and reads about 17.3 meters per one day on average. It is estimated that it takes a controller about 14 minutes to read one meter. If it is abolished to read meters in presence of users, and it is established to standardize meters installation to use hand-held terminals for meter reading, etc, the Study Team estimates that it will take one controller only 10 minutes to read meter for one industry or communal service user and 8 minutes for one house user.

Regarding the apartment users, as they do not almost have meter and we did not get the statistics about meter reading. But if it is abolished to read meters in presence of users, and it is established to standardize meters installation to use hand-held terminals for meter reading, etc as well as Tashkent City Vodokanal, we estimate that the controller will be able to read meter for 5 minutes per one apartment user. If a controller can spend five hours for meter reading, and three hours for traveling from place to place, he will be able to read 60 meters per one day. There are about 700 apartment buildings, thus Vodokanal will need 1 staff for monthly meter reading of apartment users.

The next table shows the estimated number of staff in charge of meter reading. If the 27 current controllers are divided into the staff in charge of meter reading, billing and tariff collection, the adequate frequency of meter reading is once two months.

Table 8.3.1 Human Resource No.1

	Industry	Communal	House	Apartment	Total
The number of meter	450	200	10,000	700	11,350
The time of meter reading; 1999	10	10	10	-	-
The time of meter reading; 2004	10	10	8	5	-
The number of meter reading site per day, per controller	30	30	38	60	-
The number of staff for meter reading at every month operation	1	1	13	1	16
The number of staff for meter reading at once 2 months operation	1	1	7	1	10
The number of staff for meter reading at once a quarter operation	1	1	4	1	7

If controllers sections are unified regardless of user group, Vodokanal can treat all the users and all the areas for meter reading by a fewer staff. Namely if meter installation is advanced, a fewer staff can read meter than the grope separated by user category. We estimate that 8 staffs will read water metes once in two months, as shown in the following table.

Table 8.3.2 Human Resource No.2

	Industry	Communal	House	Apartment	Total
The number of meter	450	200	10,000	700	47,650
The time of meter reading; 2004	10	10	8	5	-
The total time for reading ; min	4,500	2,000	80,000	3,500	90,000
The number of staff for meter reading at every month operation	-	-	-	-	15
The number of staff for meter reading at once 2 months operation	-	-	-	-	8
The number of staff for meter reading at once a quarter operation	-	-	-	-	5

(4) Fixed Rate Users

While the meters installation plan should go ahead, fixed rate users may be going to still exist although there are not many. It is thus necessary to make a guideline of tariff collection from fixed rate users.

We propose that fixed rate users keep their bill for a whole year and that they pay the divided amount every month. If a fixed rate user pays in advance, the tariff will be discounted. Oppositely, if he pays in arrears, the penalty will be charged.

Since a fixed rate user does not have a meter, Vodokanal does not need to conduct meter reading. Instead, we propose that Vodokanal send a bill for the next year at the end of every year. The staff in charge of tariff collection should check whether fixed rate users have paid or not. If a fixed rate user has paid in arrears or not paid yet, he should be imposed more penalties and

earlier than the users who have meters. In addition, the grace period before suspension of water supply for fixed rate users should be shorter.

Regarding the fixed rate users, we propose that Sales Department monitor them in view of payment, not water consumption. On the other hand, it is important to request fixed rate users to have keen awareness of water saving. In other chapters, we describe our proposals on education or publicity of water saving, repair or maintenance piping and equipment, and so on.

(5) Apartment Users

Regarding the apartment users, it is better to install a meter at all apartment household in the future, but in short term we propose that a meter should installed at all apartment buildings so that Chirchik City Vodokanal monitors each building's water consumption. Vodokanal also should control all meters that are installed for whole apartment building.

We propose that Vodokanal make a contract with representative (probably JEK or the apartment council) which collects tariff from each household user. Vodokanal will read meter installed at apartment buildings, and divide the total water consumption by number of households of the apartment. The water tariff per household will be estimated by the divided consumption. Then the total tariff of the apartment will be calculated by multiplying the water tariff per household by the number of households. The reason why the tariff calculation will be so complicated is that the proposed tariff table is progressive, and the apartment users would have to pay comparatively more amount of water tariff, than the other users, if the total consumption amount would be the basis of tariff calculation. Vodokanal will then collect tariff from representative according to the schedule of meter reading.

8.3.2 New Tariff Collection Procedures

In this section, the Study Team describes our proposals on not only installation of computer systems at Vodokanal but also effective work and improvement plans of quality of works by using computer systems.

The proposed procedure is based on the improvement plans described in previous section, as well as some other factors which are scheduled to almost complete in 2004.

The fundamental policy in establishing the appropriate tariff collection procedures is that simple tasks should be automatically operated by using the computer systems as much as possible. Namely the human resource should be allocated on more important tasks which cannot be done by a computer; planning, decision making etc. The computer systems should be used strategically, not just as a data storage.

(1) Application for Water Supply and Change of Condition

We propose that Vodokanal establish a new section, Customer Service Desk, which will process applications for water supply and the change of user's conditions. Customer Service Desk will also receive the information about faulty of meters, pipes, or other equipment from users, answer the queries regarding the tariff, collect requests to improve quality of supply water and so on from users. One of their key works will be receiving application for water supply and change information of user's condition.

Customer Service Desk should cover all users – industry, communal service, house and apartment.

1) Application for Water Supply

We propose that a particular form for application for water supply be prepared at Vodokanal. New users should come to Vodokanal, fill the form including the date to start using water and submit it to Customer Service Desk. At the desk, a simple check should be carried out. If all information is appropriately filled in form, the staff should input the information into the computer system subsequently. At the same time, the computer system automatically should issue the user number uniquely allocated for the user. This user number will be a key item in the computer system.

We propose Technical Department be also able to access the computer data provided by the users. Technical Department should check the data every day and make a plan to visit new users who have applied for water supply. The staff at Technical Department will visit the user, open the water plug, inspect meters, and seal the meter on the requested starting date to use supply water.

If a user constructs a new house or a building where a meter should be equipped, the user should discusses the meter installation, piping and water equipment and other technical matters with Vodokanal in advance. After that, Vodokanal should install a meter installation. On the first day to use water, Technical Department should do the aforementioned tasks.

After all procedures are finished, Technical Department inputs information including the date and figures indicated by the meter.

2) Change of Conditions

The procedures of change of user's conditions are almost same as those of application.

We propose that a particular form for change of user's conditions be also prepared at Vodokanal. The user should visit Vodokanal, fill in the form and submit it to Customer Service Desk. At the desk, a simple check should be carried out. If all information is appropriately filled in the form, the staff should input the information into the computer system subsequently.

If change of conditions requires actions by other departments, Customer Service Desk should distribute a memorandum which is printed out from computer system to the departments where appropriate actions should take place. After they finish processing, they should return the memo to Customer Service Desk after signing it. Customer Service Desk should input information and the user conditions will be changed in the computer system.

(2) Meter Reading

In this section we propose the meter reading procedure, which will be operated by the meter reading section. And we propose the staff in charge of meter reading should be assigned for almost fixed users and areas to read meter.

1) Preparations

We propose that Chirchik be divided into two geographical areas. It is important to equalize the number of users and estimated collection amount of water tariff at each area. The staff in charge of meter reading does not have to cover whole Chirchik area for one month, which makes their works be effective. And since the estimated collection amount of each area will be the same, even if frequency of tariff collection from industry and communal service will be changed to once two months, there should be no problem about the finance.

Vodokanal should review this classification at least two times in one year in consideration of the above points. This master plan for meter reading should be inputted into the computer system. The computer system will make automatically schedule for each staff.

The staff in charge of meter reading should follow the schedule produced by the computer system. They should visit Vodokanal every morning and check their own schedule and the area for meter reading. They will then confirm the information on users whom they are scheduled to read meter on that day and download it to a memory card of hand-held terminal.

2) Meter Reading at User Sites

The staff in charge of meter reading should input the figure indicated by the meter into their hand-held terminal at the user sites. They will then print out a slip specifying the results of meter reading, and leave the slip in the users post. The slip should not be used as a bill but only as a notice of meter reading.

If malfunction of meter or water robbery is discovered, the staff should not read the users meter and do appropriate treatment accordingly. He should then write down the situation to process at Vodokanal office later. It will be necessary to prepare a manual book to process irregular cases and provide staff in charge of meter reading with necessary training.

3) Post-processing

After staff in charge of meter reading finishes his schedule of meter reading for a day, he should upload the meter reading data accumulated in memory card of hand-held terminal to the computer system at Vodokanal.

After data is uploaded, validity checks should be conducted by the computer system, for example, whether the result of meter reading is too big or small, whether the water consumption decreases or increases too much compared to past records. The computer system should print out the list of such data that is supposed to be invalid. The staff in charge of meter reading should then research and correct the figure if necessary. If the tariff is adjusted, a new bill should be sent to the user as soon as possible.

If any breakdown or malfunction is discovered, staff should input the information into computer system according to his note. Technical Department will then be able to identify where repair is required. After the repair, the department should update the data on the computer system. On the other hand, other conditions which do not relate to Technical Department should be printed out from the computer system by staff in charge of meter reading. The printed list should be distributed to relevant departments for their treatments.

We propose that the departments which will not access the computer systems inform the staff in charge of meter reading about the treatment to facilitate him to update the data.

(3) Billing

We propose that billing procedures be undertaken by the billing section. He should print out the bills specifying water tariff calculated by the computer system according to meter reading results, and visit to distribute the bills to users. For fixed rate users, the staff in charge of billing should visit to distribute a bill for the whole year once a year.

In the future, when the number of user who pays water tariff through his bank account increases or the average personnel expense in Uzbekistan increases, we propose that Vodokanal should mail bills to users instead of human distribution.

1) Users with Meter

The tariff should be automatically calculated by the computer system according to meter reading results accumulated in computer system. Only confirmed data should be only processed for calculation. The computer system should also calculate the exemption and discount of water tariff so that staff will not have to carry out complicated calculation.

However the staff should check the changed tariff amount which is led by the irregular list, broken meter or equipment, etc. The staff checks whether all treatments are appropriately done or not. In case of changing tariff amount, the staff in charge of billing should send correct bill to the user as soon as possible likewise the correct slip by the staff of meter reading.

The computer system should automatically determine the date payment due. The computer system should print out a bill specifying a tariff amount and payment due. Then the staff in charge of billing should distribute bills to all users.

2) Fixed Rate Users

The staff in charge of billing should distribute a bill for the whole year to fixed rate users nearly at the end of every year. The bill should be composed of monthly payment slips, bi-annual payment slips, and an annual payment slip. If a user pays the tariff bi-annually or

annually in advance, his tariff amount should be discounted.

Fixed rate users can also choose automatic bank transfer facility optionally. In this case, the staff in charge of billing should print out notice of deduction from user's bank account from the computer system and distribute them to the users, instead of sending a bill to users. The frequency of sending the notice should tally with that of meter reading, i.e., every month, every six months or every year.

3) Automatic Transfer Facilities

Supposing that the financial systems in Uzbekistan develops and more people have their own bank accounts, Vodokanal should urge the users to utilize automatic transfer facilities. If a user applies it and pays the entire amount by the due date, his tariff should be discounted.

For the automatic transfer facilities of water tariff, a user will have to open his own bank account. Because increase of bank accounts might satisfy with bank, Vodokanal should urge the users to utilize automatic transfer facilities and negotiate about transfer fee with bank.

(4) Receipting

In this section we describe the proposed tariff collection procedures. We propose that the tariff collection section will collect water tariff from all users. The staff at collection section should not visit the users to collect tariff, and process automatic transfer facilities and payment at bank or post office.

Without cooperation of banks, it will be impossible to exchange payment orders and information on tariff collection by electronic data between Vodokanal and the banks. Currently, payment orders and information on tariff collection are printed out from the computer systems at Vodokanal and banks respectively. By using the data kept in each computer system, we believe that it is comparatively easy to realize the digital data exchange.

1) Dispatching Digital Data to Banks

Firstly, tariff collection section should download the inevitable information about automatic transfer facilities, including user code, bank account code, transfer date, tariff, and order number into a magnetic tape or a floppy disk several days prior to the transfer date.

There will be a need to implement the sufficient security measures for this procedure because a large amount of money will be involved. For example, the staff who will process this task should have a special password allocated only for this work. The two staff should attend the operation of electronic data for the internal control.

The staff should then bring the electronic data to banks for their processing.

2) Receiving Digital Data from Banks

The users who do not utilize the automatic transfer facilities will pay at bank or post office according to the distributed bill. Vodokanal should discuss with banks or post office about easy way to pay for users. When the user pays at bank or post office, he does nothing but telling that he is going to pay water tariff. By only telling that, the money should be transferred to the bank account of Vodokanal.

Vodokanal will then be informed by the banks that the user has paid at bank or post office.

The tariff collection section will get the cash-in information from bank by electronic data. The cash-in information should include user code, user account code, tariff, and cash-in date.

After the data is transferred to the computer system, the balance of user accounts will be checked. If the amount of cash-in matches with the credit amount, the balance will be automatically cancelled. Otherwise, the staff in charge of tariff collection should print out the list of unmatched credit data from the computer system, for further investigation and appropriate action.

(5) Overdue Account Control

We propose that the tariff collection section monitor the cash-in information before and after due date, while the outstanding control section should deal with overdue account over the given days after due date.

1) Overdue Control

After due date of payment, the computer system should automatically print out the payment list, notification of overdue, and request for payment. The staff in charge of overdue account control should bring the notification to the users to urge them to pay the overdue account.

The outstanding users should pay penalty, which will be specified in the notification of overdue and request for payment. The implementation of penalty implies two things. The first is that the cost of overdue account control should be shared by outstanding users who are the cause of the cost. The second is that penalty will promote smooth tariff collection.

During the certain period, the staff in charge of overdue account control should print out the list of outstanding users and notification of overdue, and request payment from the computer system. The staff should visit outstanding users with the notification every day.

After the period, the staff should visit the users to request payment several times. Even if the user has not paid, then Vodokanal should submit the final request to the user. After various factors are examined, for example, user's willingness to pay or partial payment, water supply should be suspended.

2) Important Control

In addition to the overdue account controls as stated above, the computer system should print out a credit age analysis covers from the credit occurrence day to present day and the breakdown table are printed out properly from computer system. We propose the chief of overdue account control should treat the more important outstanding by using the age ana-

lysis and the breakdown table, instead of routine outstanding control. Namely the chief conducts emphatically the more important outstanding control - older or bigger overdue account.

(6) The Accounting Information, Reporting

We propose that the regular reports, lists and accounting data be processed automatically by the computer system.

1) Accounting Information

We propose that the accounting and financial data be transferred automatically to Accounting System every day.

At the time of proceeds marking, water tariff is automatically calculated according to meter reading data whose status is determination. The total tariff amount for one day should be transferred to the Accounting System as journal of account receivable and sales. If a user has paid in advance, the same amount should be reduced from account receivable and transferred to the Accounting System.

At the time of cash-in, the computer system should check the account receivable, make journal and transfer it to the Accounting System. If a user has paid more than the amount of account receivable, the advanced received journal is made and also transferred to the Accounting System.

The computer systems should process the above tasks, so that the staff of Sales Department will be able to submit the accounting information every day without doing any tiresome procedures. We also suggest that the staff had better check the total amount once a month.

2) Reporting

The computer system should have reporting function including the list of sales, account receivable, and cash-in. These lists should be printed out regularly as the computer system will have a capacity to produce them timely and instantly.

We also propose that the computer system have function of exporting data to package software, on condition that sufficient security measures are implemented. Vodokanal can do readily strategic works e.g. plan and achievement analysis, management index analysis, and other analysis by using download function and table calculation packaged software. It is useless, however if the staff can not use the package software. We propose the computer training for end users should be conducted.

8.4 Introduction of Suitable Tariff Table

8.4.1 Approach for Revised Tariff Policy

As a mentioned in the chapter 4.3.1 we consider the tariff policy for long-term and establish its Goal the applicable tariff policy for the self supporting system under the market economy. As a result of examination, our proposed tariff policy for the Chirchik City is basically similar to the Tashkent City. Therefore please refer to the 7.4.1 regarding our proposed tariff policy.

(1) Stage 1 –1st half (the year 2000 - the year 2003)

If the plan of meter instrument by government proceed on the schedule, approximately 80% of population will install meters in their houses by the year 2003. We consider it is difficult to apply the Vodokanal management of the self supporting system without meter instrument and we put the first priority to increase the number of meter instrument. On the other hand, it is necessary for the tariff to cover reserve cost for future repair; in consideration of current physical obsolesce facilities.

As a mentioned above, we establish the tariff policy for the Stage 1 –1st half as follows;

1) Promotion of Meter Instrument
2) Dissolution of Cross Subsidy
3) Inclusion of reserve for repair cost

As a result of the tariff policy mentioned above, at least the tariff should cover all cost without capital cost. At this point the government should reconsider taxation policy for the Vodokanal because it is necessary for the Vodokanal to fund for future investment and to reserve as follows:

1) Legal Reserve on the Balance Sheet of the Vodokanal

2) Reserve for Special Accounting Regarding Water Supply Business on the Government Budget

(2) Stage 1 –2nd half (the year 2003-the year 2005)

If the plan of meter instrument by government proceed on the schedule, approximately 100% of population will install meters in their houses by the year 2005. We consider it is possible for the tariff to cover all cost basically. However it may be difficult for the Vodokanal to do self-financing because it is some possibility for the bond market not be grow well. Therefore we omitted interest expense from tariff covered cost.

As a mentioned above, we establish the tariff policy for the Stage 1 –2nd half as follows;

1) Inclusion of Capital Cost except for interest expense

The government authority says that the Vodokanal will succeed to take finance from foreign banks whose purpose is Official Development Assistance. If this realizes, the tariff should cover interest expense, too.

(3) Stage 2 (the year 2005-the year 2010)

The Vodokanal should improve and keep stable business operation under self supporting system after growing up economic environment including the bond market.

We establish the tariff policy for the Stage 2 as follows;

1) Self-finance for Cost for Construction

2) Inclusion of All Capital Cost

(4) Stage 3 (After the year 2010)

The Vodokanal will be available to privatize after the Stage 2. This means the Vodokanal will be stock company, which is owned by private sector. The decision whether the Vodokanal is reformed to a private company as a stock company or not should be determined by the government authority in consideration of socioeconomic conditions and impact to employees. It is necessary to agree with the Labor Union.

We establish the tariff policy for the Stage 3 as follows;

1) Preparation for Privatization

8.4.2 Revised Tariff Table

As a mentioned in the Chapter 4.3.1, we consider the revised tariff table for short-term (ex. 2-3 years) with the approach as follows:

- Applicable to users with and without meters.
- Consideration for low income families
- Incentive for saving water consumption
- Percentage of water tariff to the total living cost
- Elimination of cross-subsidy
- Applicable for next 2 to 3 years
- Comparison of costs used for the proposed table with actual costs in the future for measurement of efficiency of management
- Keeping current schedule for instrument of meters

(1) Kinds of the Tariff System

Firstly, we examine several tariff systems to consider the revised tariff table. In a detail, we mentions the 7.4 (2) 1) and so please refer to there.

(2) Consideration of revised water tariff for Chirchik

We considered which model should be used for Chirchik as a new tariff system as below. This is the same as the case of Tashkent City Vodokanal.

A plan has been proceeding to install meters for the population by 2004 as a target. This means that two types of users exist for the time being; the ones with meters and the others with yet-to-be installed. Therefore a tariff table for the both types was prepared. This is the first half of the 1st Stage mentioned in (1) Approach for Revised Tariff Policy.

As far as the users with yet-to-be installed meters concerned, tariff is collected by flat rate that is based on the various elements shown in the Fig 7.4.2, such as the area, asset value, number of family members and number of water machinery used. In the case of Tashkent, the tariff is based on the number of family members. The Revised Tariff Table basically sticks to the current standards due to the limited information. However if the trend of the water usage is clearly found out in relation to the stand-alone house, such as watering the garden in summer, the area, asset value, presence or absence of swimming pool, it needs to be incorporated in the flat tariff. As to apartments, since the survey found a high percentage of water leakage in apartments, this can be reflected in the water tariff system by regarding the number of years apartment has built and the maintenance conditions as constants.

As for the users with meters, either dispensing rate or two ways tariff rate; flat rate combined with dispensing rate, can be employed. However, reducing usage-based tariff is used to encourage use of more water and does not apply to the case of Vodokanal where promotes water conservation.

Per-object tariff is a system Chirchik employs today, that is to ask different water tariff to the population and the enterprises to pay in accordance with the ability to bear the cost. In this case the more water they use, the wider gap exists in water tariff between the two groups. Per-Diameter Tariff does not consider the users' conditions and the only cost differentiated by the length of

diameter is reflected in the tariff. Per-living standard tariff employs the different tariff system to suit the users' living standards and this is regarded as an extreme case of per-objective tariff. However, few projects have used this approach and Colombia is the one of the few as far as we know.

In these circumstances, water tariff system shown below is prepared for the users with meters.

Table 8.4.1 Matrix of Water Tariff System

	Uniformed usage-based tariff	Increasing usage-based tariff
Usage-based tariff		
Basic tariff + Usage-based tariff		

Per-object tariff, Per-diameter tariff and Per-living standard tariff can be applied to each case.

The two tariff system including the parts of basic tariff, was adopted because of the need to collect the fixed expenses such as the cost for meter instrument etc. and depreciation expense. Also whether per-object tariff or per-diameter tariff, the latter is basically desirable as it calculates based on the cost needed for the water works production and supply. However, the former is rather appropriate after considered with the social-economic conditions in Uzbekistan where is in transition process towards market economy. Also increasing types of usage-based tariff was adopted in order to stimulate the incentive for water conservation. However today there is a wide disparity in the tariffs between the population and enterprises , so the tariff for the population has been modifying to correct it. Although the tariff system is temporary getting closer to the per-diameter from per-object as a result of the modification, the tariff to the enterprises will increase and there will be a need to employ the increasing types of usage-based tariff if the inflation rate relatively rises and the tariff to the enterprises decrease.

As a future method to install meters for the population in Tashkent and Chirchick, Vodokanal buys and install the meters for the stand-alone houses. This is strictly for the purposes of renting to the population and it is suggested to collect the cost together with water tariff as a whole.

As a reason for that, it is desirable that Vodokanal has the title to the water meters because the meters need to be managed and inspected. Also if this administrative cost is collected from all users by a kind of water tariff method, the financial expenses should not become too burdensome for Vodokanal. Also, load on the population is also lessened, since they do not have to buy and install it by themselves.

In the case of apartments, Vodokanal can buy meters to be installed only for the shared incoming pipes and does not deal with the each household in apartments. In other words, Vodokanal signs a water supply contract with the representatives of apartments and manages the water tariff by reading the meter installed on the shared incoming pipes. Accordingly, Vodokanal receives the tariff from the representatives. However, in order not to create any unfairness among the users in apartments and in stand-alone houses, the procedure below helps to calculate the tariff for users in the apartments.

1) The amount of water usage is measured by reading the meters installed on the shared incoming pipe in an apartment.
2) In order to obtain the average water usage, it divides up the total water usage obtained at 1 by number of households in the apartment.
3) The average water usage is checked on the tariff table to find out the average water tariff.
4) To determine the total water tariff, it multiplies the average water tariff obtained at 3 by number of households in the apartment.

The tariff determined by the above procedure is asked to the representatives of the apartments to pay. It is up to them whether they divide up the tariff by number of households or install a meter for the each household in order to collect the tariff from the households. In this case representative or administrators of the apartments include JEK, Mahalia Committee, president of autonomous body and head of association.

(3) Simple Model for the Revised Tariff Table

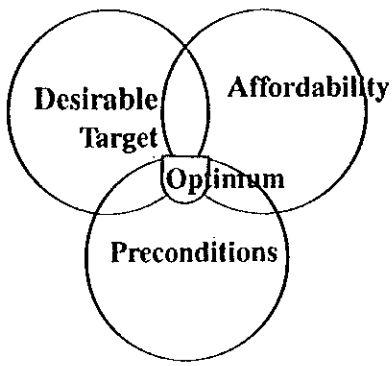
A simple model for the new tariff was prepared along the lines as follows.

The calculation period should be in the neighborhood of 3-5 years as mentioned earlier. However, a term of 3 years is regarded as a limit because of the uncertain social-economic conditions in future of Uzbekistan. In short, the term of 3 years is equivalent to a term by 2003; the first half period of the 1st stage in our revised Tariff Policy Plan.

The total revenue and expenditure is basically balanced in calculation period and the revenue should not come below the level of the expenditure. Therefore, the necessary revenue in total multiplied an estimated inflation rate and other necessary.

Moreover, the standards of the population's affordability refer to the global standards mentioned in the Chapter 4.3.1. To conclude the points so far, the water tariff can be set up based on the concept as follows.

Fig 8.4.1 Base Idea for Establishment of the Tariff Policy



Thus, the simple model of the new tariff was prepared as below. We have attached details of the calculation in the Supporting Report.

Table 8.4.2 Proposed Revised Tariff Table for Chirchik city (Applicable year : 2000-2002)

	Users		Water supply
Fixed rate system	Population 132 sum		Sum/month/person 9 Sum/m3×0.490m3×30days
Metered	Population 0 10m3 11 20m3 21 30m3 31 40m3 41 50m3 51m3		Basic payment 70 sum/month 8 sum/m3 9 12 17 23.4
	Budget Organizations		9 sum/m3
	Self-accounting Communal Organizations		23.4 sum/m3
	Production, Transportation, Construction, etc..		23.4 sum/m3
Collection of costs of the meters (instruments)	For all users		85 sum
Social Safety Net	Fixed rate	Monthly living expense 0-5,000 sum	A Cost of the meters amounting 85 sum is free. Sum/month/person 55 sum
		5,001-10,000	A Cost of the meters amounting 85 sum is free. Sum/month/person 106 sum
	Metered	Monthly living expense 0-5,000 sum	A Cost of the meters amounting 85 sum is free. A Cost of basic payment amounting 70 sum is free.
		5,001-10,000	A Cost of the meters amounting 85 sum is free.

Value Added Tax (VAT) is charged on the above amounts.

8.4.3 Explanation of the Processes for Setting Proposed Revised Tariff Table

The process for setting proposed revised tariff table is as follows:

(1) Estimation of the Cost for 3 years extending to 2003

(2) Calculation of Average Unit Cost (sum / m3)

(3) Examination of the Revised Tariff Table with consideration of the Global Standard

(4) Consideration of Social Safety Net

(1) Estimation of the Cost for 3 years extending to 2003

1) Estimation based on current situation

The reasonable tariff table is determined based on the necessary revenue and the revenue should cover the cost needed in the period when the revised tariff table will be applied at least. We consider the revised tariff table, which is available for 3 years extending to 2003. Therefore firstly we estimates the expenditure for 3 years extending to 2003 to know necessary revenue amount.

Fig 8.4.2 and Table 8.4.3 shows our estimated cost for 3 years and Table 8.4.4 shows the historical fluctuation ratio of the cost composition of the Tashkent City Vodokanal. We project the future cost by multiplying the current cost with some factors, referring to the historical fluctuation ratio of the cost composition.

Applying the water meters will decrease the volume of consumption. We calculate the amount of reducing variable cost due to save water by applying metered tariff and we deduct it from the total cost. The deducted cost is mainly due to electric power expenses and it is 117,324 thousands Sum. As a result of our estimation, the cost composition in the year 2010 will be shown by the Fig 8.4.3.

Fig 8.4.2 Estimated Cost For 3 years

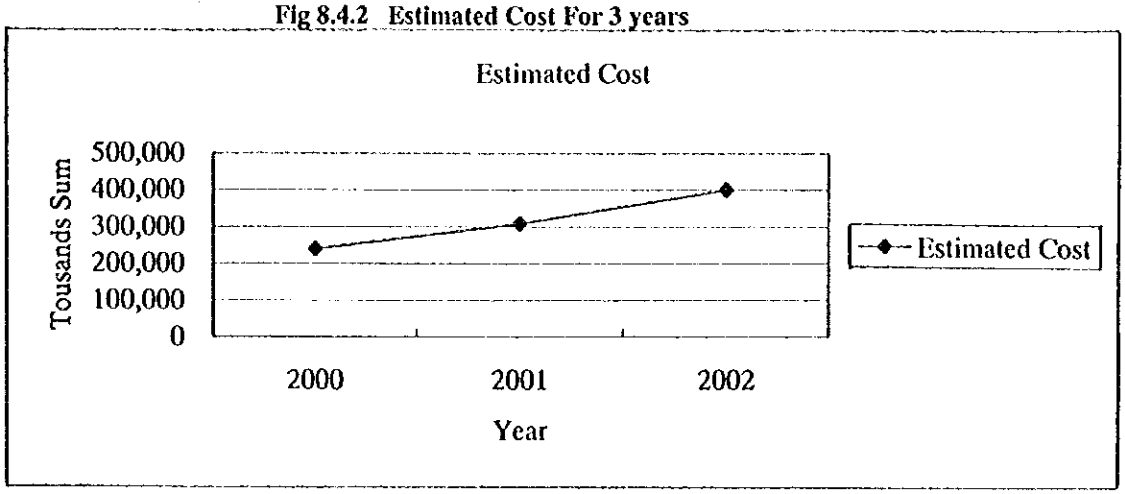


Table 8.4.3 (1) Estimated Cost For 3 years

Item	2000	2001	2002	For 3 years
Materials	13,071	17,777	24,196	
Elect. power	154,089	191,835	239,015	
Main produc. salary	11,041	15,730	22,177	
Social Insurance	4,879	7,478	11,462	
Capital repairs	18,876	29,258	45,349	
Depreciation	7,269	9,232	11,724	
Expenses for the period	9,902	13,516	18,449	
Others	20,351	23,822	27,885	
Subtotal	239,478	308,647	400,258	
(Expenses for the period)	0	0	0	
Total (Thousands Sum)	239,478	308,647	400,258	948,382
Fluctuation Ratio	34%	29%	30%	

Table 8.4.3 (2) Example of Estiamtion

Item	1999	A	B	C	2000
Materials	9,024	44.8%	0%	0%	13,071
Elect. power	116,213	32.6%	0%	0%	154,089
Main produc. salary	7,958	32.1%	0%	5%	11,041
Social Insurance	3,183	53.3%	0%	0%	4,879
Capital repairs	12,178	55.0%	0%	0%	18,876
Depreciation	5,724	27.0%	0%	0%	7,269
Expenses for the period	7,254	30.0%	0%	5%	9,902
Others	17,386	17.1%	0%	0%	20,351
Total	178,920				239,478

Note:
The figures in column of "2000" is calculated as follows;
"2000"="1999" x (1+A) x (1+B) x (1+C)

" A " is the historical fluctuation ratio in "1999"of table 8.4.4. However the ratio of "Main produc. salary' , "Capital repairs" and "Others"includes unusual factors and so we put other ratio in Table 8.4.3 (2). The figures of 32.1% and 55.0% 17.1% are average fluctuation ratio.

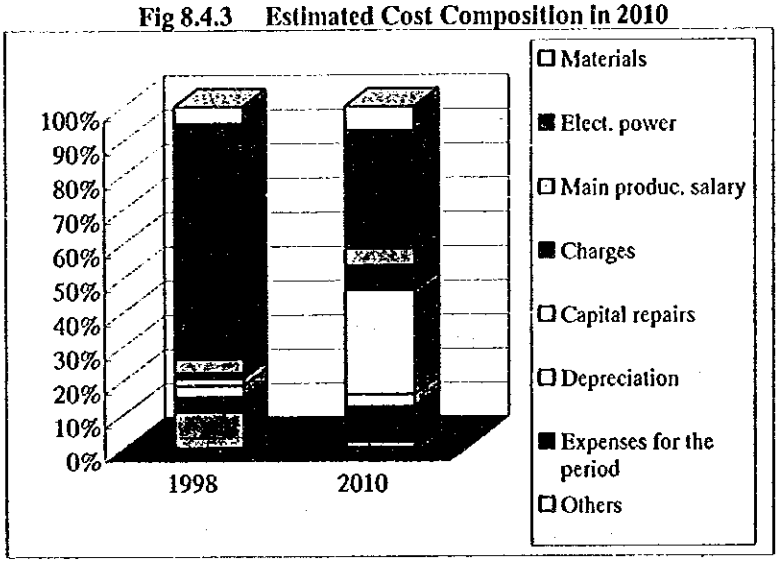
" B " is the estimated increase ratio of volume of water supply. This ratio mainly relates the volume of "materials" and "Elect. Power"

" C " is the estimated increase ratio of salary due to increase IT experts. This ratio mainly relates "Main product. salary" and "Expenses for the period"

Table 8.4.4 The Historical Fluctuation Ratio of the Cost Composition

Item	1998	1999	Average
Materials	77%	45%	61%
Elect. power	60%	33%	46%
Main produc. salary	10%	53%	32%
Social Insurance	10%	53%	32%
Capital repairs	-80%	352%	55%
Depreciation	31%	27%	29%
Expenses for the period	30%	30%	30%
Others	6%	28%	17%
Total	29%	41%	35%

Fig 8.4.3 Estimated Cost Composition in 2010



2) Consideration of Decreasing Volume of Consumption by the Metered Tariff

We assume some factors shown by the Table 8.4.6 to estimate volume of consuming water and the total cost. As a result of calculation, the Table 8.4.5 shows the estimated volume of consuming water.

Table 8.4.5 Estimated Volume of Consumption (m3)

	2000	2001	2002	For 3 years
Householder with the Meter	839,970	1,682,694	2,542,272	
Householder without the Meter	8,771,490	6,799,516	4,788,102	
Families living in the Apartment With/Without the Meter	22,028,585	19,446,366	16,812,503	
Enterprise	7,546,253	7,546,253	7,546,253	
Total (m3)	39,186,298	35,474,829	31,689,130	106,350,257

Table 8.4.6 Assumption

	2000	2001	2002
The number of population	150,858	153,875	156,953
Rate of increase of population	2%	2%	2%
Rate of coverage of water supply	98.5%	98.5%	98.5%
Rate of increase of enterprises	-7%	0	0
The average number of persons per one family			
- Householder	3.9	3.9	3.9
- Apartment	5.1	5.1	5.1
The average number of volume of water consumption after installing the meter (liters/one person/one day)	250	250	250
The average number of volume of water consumption before installing the meter (liters/one person/one day)	650	650	650

(2) Calculation of Average Unit Cost (soum / m3)

We calculate the average unit cost from a result of calculation at (1). The total cost for 3 years is 948,382 thousand soum shown by Table 8.4.3 and the total volume of consuming water is 106,350 thousand m3 shown by table 8.4.5. The average unit cost is approximately 9 soum/m3 (948,382 thousand soum /106,350 thousand m3). The revised tariff table should cover this estimated average unit cost.

(3) Examination of the Revised Tariff Table with consideration of the Global Standard

The present tariff for enterprises is 23.4 soum /m3 and this figure is much higher than the average unit cost. On other hand, the present tariff for the population is 3.0 soum /m3 and this figure is much lower than the average unit cost. The government's tariff policy is to get rid of "cross subsidy" from the enterprises to the population. Therefore this time we focus on increasing the tariff for the population.

We mentioned the global standard in the (6) of the chapter 3.3.1 and we refer to the global standard when we consider the revised tariff table.

1) Metered Tariff

With reference to the global standard, we set the standard volume of consuming water per one family as 20m3 /month and we consider it is necessary for the tariff to cover the average unit cost at the standard point. On the other hand, we take a percentage of living expenses and we set the percentage at approximately 2.5 % of the standard volume of consumption. Monthly income of Chirchik City in 1998 is less than 10,000 soum and we refer to this income level to consider a percentage of living expenses.

We propose a progressive tariff for the metered tariffs to make users save water, however in the case of exceeding 50m3 /month, the tariff almost becomes flat tariff and equalizers every user on the global standard.

As a result of examining conditions mentioned above, we determined the metered tariff for the population as follows:

Metered	Population	
	0 10m3	Basic payment of 70 soum/month
	11 20m3	8 soum/m3
	21 30m3	9
	31 40m3	12
	41 50m3	17
	51m3	23.4

2) Fixed Rate (Flat Tariff)

We have to consider the flat tariff for the population without meters and it is called "Norm" in the Uzbekistan. It is necessary to determine an appropriate fixed rate. On the other hand, it is necessary to promote the installing of meters for the population without meters. Therefore we will set the fixed rate to be higher than the metered tariff, assuming the population without meters does not save water.

As a result of this analysis, we propose the fixed rate for population without meters as follows:

Fixed rate system	Population	Soum/month/person
	132 soum	9
		Soum/m3×0.490m3×30days

4) Enterprises

We don't revise and increase the tariff for the enterprises because it is already extreme high. However next time the revision of tariff for the enterprises should be considerable.

(4) Consideration of Social Safety Net

We propose some tariff exemption for low-income population. We consider the tariff exemption with reference to a percentage of living expenses as shown in the Table 8.4.8 and we determine as follows:

Social Safety Net	Fixed rate	Monthly living expense 0-5,000 sum	A Cost of the meters amounting 85 sum is free. Sum/month/person Is 55 sum
		5,001-10,000	A Cost of the meters amounting 85 sum is free. Sum/month/person Is 106 sum
	Metered	Monthly living expense 0-5,000 sum	A Cost of the meters amounting 85 sum is free. A Cost of basic payment amounting 70 sum is free.
		5,001-10,000	A Cost of the meters amounting 85 sum is free.

8.4.4 Potential Impact of the Proposed Revised Tariff Table

The potential impact of the revised tariff table on the financial status of Vodokanl and on the living lifestyle of the present population may be summarized as follows:

(1) Impact on the Financial Status of the Vodokanal

The Fig 8.4.4 shows the potential impact of the revised tariff table on the financial status of the Vodokanal. As a shown in Fig 8.4.4 it is anticipated that there will be retained earnings by the year 2003 and this means that the revised tariff table will have been implemented by 2003.

The Fig 8.4.5 shows the revenues and costs, for the water meters. Our proposal is as follows:

Vodokanal will buy and install the meters for private houses. This is strictly for the purposes of renting these back to the population and it is suggested that the cost of the meters be collected with the water tariff as a whole.

In the case of apartments, Vodok76anal will buy only the meters to be installed on the shared intake pipes and does not have to deal with each household in the various apartments. In other words, Vodokanal signs a water supply contract with the representatives of the apartment buildings and manages the water tariff by reading the meter installed on the shared incoming pipes. Vodokanal receives the charge from the representatives.

Fig 8.4.4 Impact on the Financial Status of Vodokanal

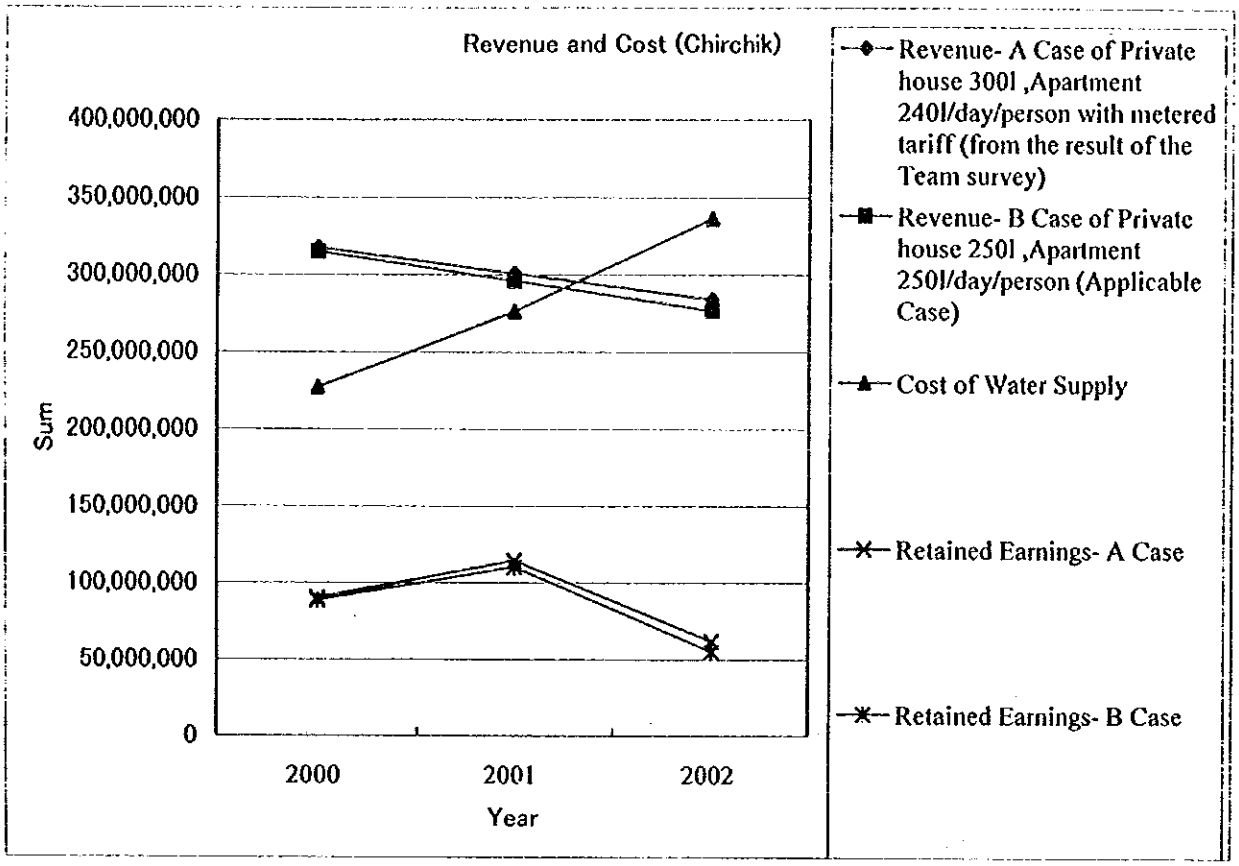


Fig 8.4.5 Revenue from and Costs for Water Meters

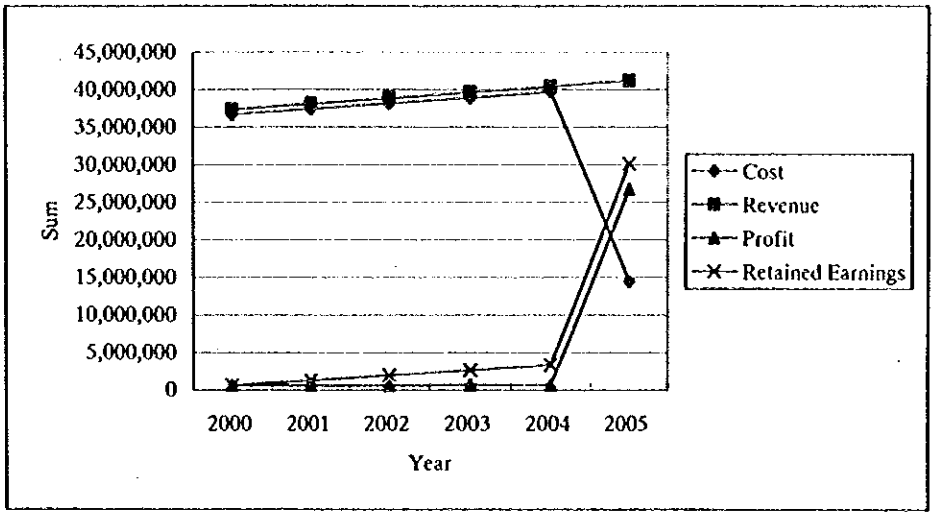


Table 8.4.7 Revenue from and Costs for Water Meters

	1999	2000	2001	2002	2003	2004	2005
Householder							
The number of householders	9,000	9,180	9,364	9,551	9,742	9,937	10,135
The number of water meter installations per year	0	1,800	1,836	1,873	1,910	1,948	738
Balance of houses with meters	30	1,830	3,666	5,539	7,449	9,397	10,135
Balance of houses without meters	8,970	7,350	5,698	4,012	2,293	539	0
Apartment							
The number of families living in apartments	26,912	27,451	28,000	28,560	29,131	29,713	30,308
The number of water meter installations at intake p	0	108	110	112	114	117	30
Balance of apartments with meters	0	108	217	329	444	560	590
Balance of families living in apartments with mete	0	5,382	10,873	16,472	22,184	28,011	29,511
Balance of families living in apartments without m	26,912	22,068	17,127	12,087	6,946	1,703	797
Cost and Collection							
The cost of water meter installations per year (Not	Sum	36,705,969	37,440,089	38,188,890	38,952,668	39,731,722	14,484,000
The revenue of water tariff per year (Note 3)	Sum	37,363,165	38,110,428	38,872,637	39,650,090	40,443,091	41,251,953
Profit	Sum	657,196	670,340	683,746	697,421	711,370	26,767,953
Retained Earnings	Sum	657,196	1,327,535	2,011,282	2,708,703	3,420,073	30,188,026

Assumption
Note 1 : One apartment has 50 families on the average.
Note 2 : The cost of installing one meter is 18,000 sum for householder and 40,000 sum for intake pipe of apartment.
Note 3 : Monthly 85 sum is charged to every users for covering the cost of installing meters..

(2) Impact on Lifestyle of the Population

The Fig 8.4.6 shows the monthly living expenses for the population in Chirchik City as compiled from the results of our questionnaire. Table 8.4.8 shows the percentage of the water tariff for each level of monthly living expenses. We believe that the revised tariff table is affordable even at the low-income level and that the difference between quota and the metered tariff will serve to the installation of water meters.

Fig 8.4.6 Monthly Living Expenses for the Population in Tashkent City

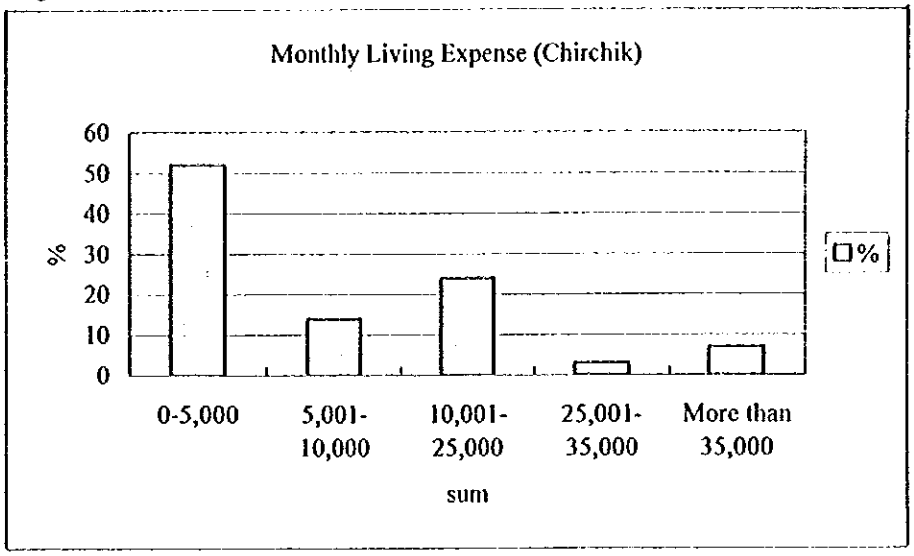


Table 8.4.8 Water Tariff as a Percentage of Monthly Living Expenses

Monthly Income	Per Living expense		
	Norm		Metered tariff
	(Apartment)	(Householder)	
0-5,000 (Sum)	9%	16%	7%
5,001-10,000	6%	5%	3%
10,001-25,000	3%	2%	2%
25,001-35,000	2%	1%	1%
More than 35,000	2%	1%	1%

(3) Improving the Imbalance between the Population and Enterprises

1) Fixed rate

The imbalance between the population and enterprises will be reduced to 2.6 (23.4/9).

2) The Metered tariff

The imbalance between the population and enterprises will be reduced to 2.9 (23.4/8) assuming a volume of consumption of 20m3／month.

These figures are acceptable from a viewpoint of the global level.

(4) Budget Organizations

Budget Organizations may be permitted to have a lower tariff than other users, considering their benefit to the public. However, as it is necessary to cover a minimum of the unit costs, the tariff will be 9 sum/m3.

The revised tariff table has been calculated for the next 3 years; however, it may be necessary to re-examine it in the short-term depending on local socioeconomic factors.

(5) Cost of Meters

The government is considering making the users purchase the meters. In foreign countries, the property rights to the meters may be held by the water supply utility companies. The reasons why the property rights to the meters are held by the water supply utility companies are that this makes it convenient to read the meters and easier to manage the meters. On other hand, there are several other ways to make users bear the cost of the instruments. For example, there are some cases where the

user is charged a connection fee or a rental fee for the meter, etc. in addition to the standard water tariff. We propose that Chirchik City Vodokanal retain the property rights to the meters.

(6) Difficulties in Installing Water Meters

Many public households and users living in apartment buildings are supplied with water via several intake pipes from the main pipeline to the house. It is difficult for Chirchik to install a meter on each pipe to record the accurate volume of water consumed by each household.

We have conducted that it will be necessary to replace multi-pipe systems with single intake pipes when installing the meters. This is important for the future management of the water supply business.

Therefore, we propose that the following regulations be established:

1) Users must either replace their multi-pipe systems with single intake pipes or install meters on each of the pipes.
2) If the users choose to install a meter on each pipe, the users must bear the entire expense.
3) If the users choose to replace the multi-pipe systems with single intake pipes, the government will cover a portion of the expense for the replacement.
4) It will be necessary to enact new laws to enforce these regulations, and to impose penalties for any violation of these laws.

However, it may be difficult for all users living in apartment buildings to abide by the above regulations. Therefore an interim countermeasure, consideration may be given to allocating the total volume of consumption in the apartment buildings to each occupant based on certain appropriate guidelines. Chirchik City Vodokanal should determine and publicize these guidelines.

(7) The Social Safety Net

As shown in Table 8.4.2, we have considered certain tariff exemptions for low-income users.

Generally speaking, the government should ensure that the social safety net is maintained and shall cover the cost of doing so. The government should bear the cost of the social safety net or give subsidies to these low-income users, considering the inclusion of the tariff from other public services.

(8) Concept for Future Revised Tariff Table

We have proposed a concept for a future revised tariff table and it is shown in Figures 7.4.9 and 7.4.10. Vodokanal and the government authorities should examine the flow when considering future revisions to the tariff.