Table 4.3 Required Number of New Wells and Drilling Length in Alternative 3

Item		Soroca	Balti	Falesti	Riscani
Water Demand in 2015 (m^3/d)		12,200	45,000 (75,000)	5,200 (8,700)	4,400 (7,300)
Existing Wells	No of existing wells	10	58	15	5
	Average depth of the existing wells (m)	50	170	180	150
	Total discharge from the existing wells (m^3/d)	3,500	27,000	1,350	1,500
	Average discharge from the existing wells (m^3/d/well)	350	466	90	300
Required New Wells	Required No. of wells to meet the water demand in 2015	12,200/350 =35	75,000/466 =161	8,700/90 =97	7,400/300 =25
	Required No. of new wells to be constructed	35-10 = 25	161 - 58 = 103	97 - 15 = 82	25 - 5 =20
	Total drilling length of the new wells (m)	25 x 50 = 1,250	103 x 170 =17,510	82 x 180 =14,760	20 x 150 = 3,000

4.3 Facility Development Master Plan and Costs

(1) Selection of the Optimum Development Alternative

Table 4.4 shows the comparison of the three Alternatives for the facility development master plan.

Table 4.4 Comparison of Development Alternatives

Item	Alternative 1	Alternative 2	Alternative 3
Construction cost (US$)	17,800,000	26,000,000	67,000,000
	◎	○	△
Operation and maintenance cost (US$/year)	1,900,000	2,100,000	4,800,000
	◎	○	△
Reliability of water source	Nistru River	Nistru River Prut River	Groundwater
	◎	◎	△
Easiness of construction	◎	△	○
Construction period	○	△	○
Overall Evaluation	◎	○	△

Note: ◎: excellent ○: good △: not good

Table 4.4 clearly shows that Alternative 1 is superior to the other 2 Alternatives. Therefore, Alternative 1 is proposed as the facility development master plan.

(2) Costs

1) Initial Cost

Table 4.5 shows the preliminary initial cost for the implementation of the facility development master plan. For the master plan to be effective, the 4 cities/towns need to improve their water distribution networks by replacing deteriorated pipes to reduce leakage, and in the towns Falesti and Riscani, by expanding the networks to new service areas. These costs were tentatively estimated and are shown in Table 4.6.

Table 4.5 Initial Project Cost for the Master Plan (US$)

Work Item		Cost (US$)
Direct Construction Cost	Rehabilitation of Pumping Station and Transmission Main	5,450,000
	Improvement of Water Treatment Plant	3,430,000
	Construction of new reservoirs and suspended reservoirs	1,290,000
	Expansion of Transmission Main to Falesti and Riscani and Construction of Reservoirs	7,580,000
Total		17,750,000≒17,800,000
Engineering Cost (8%)		1,420,000
Physical Contingency (10%)		1,780,000
Grand Total		21,000,000

Table 4.6 Costs for Pipe Replacement and Extension in 4 Cities/Towns

City/Town	Work Item	Cost (US$)
Balti	Cost of Distribution Pipe Replacement	7,299,000
	Cost of Distribution Pipe Extension	0
	Total	7,299,000
Soroca	Cost of Distribution Pipe Replacement	887,800
	Cost of Distribution Pipe Extension	0
	Total	887,800
Riscani	Cost of Distribution Pipe Replacement	72,600
	Cost of Distribution Pipe Extension	505,700
	Total	578,300
Falesti	Cost of Distribution Pipe Replacement	118,300
	Cost of Distribution Pipe Extension	395,200
	Total	516,500
Grand Total		9,278,600

2) Operation and Maintenance Cost

The annual operation and maintenance cost of ACSB is as follows:

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Supply water (m^3/d)	52,800	54,500	56,100	57,800	59,600	61,400	63,100	64,900	66,700
O/M cost (1,000 US$/year)	1,139	1,170	1,200	1,232	1,264	1,298	1,331	1,364	1,396

4.4 Plan for Institutional Development and Operation and Maintenance Systems Improvement

The progress of restructuring of administrative and operating systems in the water supply sector at all levels toward market economy is slow in Moldova. As a result, high efficiency cannot be expected there. From the market economy point of view, the legislative provisions of Moldova as the base of the sector administration are premature and inadequate. At the water utility level, the organizational structures of water utilities including ACSB, which has nominally become a joint-stock company, are rather anomalous and complex. Therefore, balanced and efficient business operation cannot be realized.

The Water Act and the Drinking Water Law of Moldova do not clearly provide clauses on the procedures for the licensing of water utilities, preconditions for the application for licensing, the eligibility and authority of the administrator of the utility, the utilities' obligation for quality control of tap water, etc. Although there are the joint-stock company law and the state enterprises law, the law of local public utilities is non-existent. So water utilities lack the legislative base to run the business on the beneficiary-to-pay principle. Given this, an improvement plan for institutional and legislative systems are drawn as follows:

(1) At the National Level

1) Development of the System of Administration of the Water Supply Sector

- The government shall make it clear that the MAFI (or other ministry) is the primary administrative authority of the water supply sector. In addition, the plan to create a department responsible for the administration of water supply and sewerage (including sanitation) must be quickly implemented.

- The government shall firmly establish the system of licensing water supply utilities with the provision of prerequisite conditions for license application and its procedures. Counties shall assume the authority of licensing small-scale water supplies. The government and counties shall monitor the operation of water supply utilities under their jurisdiction.

- The water utilities should be obliged to undertake the laboratory testing of tap water, and report the result to respective supervising authorities. The government shall cause public laboratories, or their substitutes, to carry out water testing on behalf of water utilities, which possess no laboratory, or promote the establishment of regional public laboratories.

2) Provision and Enhancement of Water Law, Public Utilities Law, Public Finance Law, Labor Sanitation and Safety Law, etc.

- A new water law shall be enacted, and it shall set forth not only the purpose of the new or altered water supply and the scope of responsibility of water supply utilities but also the procedures of licensing the utilities and the authority and obligation of their administrators. The duty of the utilities to warrant the safety of tap water is to be also included in the law.

- Laws of public utilities, public finance, labor sanitation and safety, etc., which are related to water supply, shall be provided. The law of public utilities must contain clauses on the organizational structure of public utilities, the status of their employees, the basic principles of business including financial operation, the general rule of setting tariffs, the method of accounting, corporate liabilities, etc.

- In addition, there is a need to provide such laws as the fire-fighting law, building code, road law, river law, water pollution prevention law, measurement law, etc. Ordinances on national subsidies and subsidies of local governments must also be enacted.

- There also be a need to enact laws or decrees on (1) protection of water sources, (2) technical standards of water supply facilities, (3) guidelines for maintenance of water distribution mains, control of non-revenue water, disposal of water treatment plant sludge, and water quality control, (4) standards for water service fittings, (5) small water supply systems for apartment houses, etc.

(2) At the Water Utility Level

1) Restructuring of the Organization of Water Utilities

- It should clearly be defined that ACSB is a joint-stock company with full capital participation from Soroca and Balti Counties. The board of directors shall be established so as to authorize the policy-making by ACSB. ACSB should make the government to provide a law or ordinance so that ACSB can legally set its water tariff, which enables ACSB financially viable.

- The existing organizational structure of ACSB, which is complex but premature from the market economy point of view, shall be reformed. The new organizational structure should consist of sections, which shall be grouped in respective divisions according to their categories of operations.

- The form of organization of other Apa Canals under the project shall remain publicly-owned for the time being. Like ACSB, the categorized division-section structure shall be adopted.

Smaller organization and staff size will be appropriate for other utilities than Apa Canal Balti depending on the size of their business.

2) Establishment of Facility Maintenance System (for all Apa Canals)

- Efficient use of water resources, facilities, supplies and materials, and personnel shall be practiced. Systems of asset and logistics control need to be established.

- For maintenance of facilities, the principle of preventive maintenance should be practiced. Operation and maintenance systems shall be established for inspection and function evaluation of equipment, categorization of day-to-day works, provision of manuals for regular inspection and repair, stockpiling of materials and spare parts for repair and maintenance, etc.

- Facility renewal plans should be provided.

- To realize the above objectives, required are the preparation of job descriptions at all the levels, various manuals, education and training of personnel, etc.

- For rational operation of facilities and efficient maintenance works, a computer system should be introduced. It must include the functions of the illustration of facilities and equipment, positioning of facilities by GIS, recording of maintenance works, indication of the maintenance and the renewal schedules, logistics of materials and spare parts for maintenance, etc. The computer system shall not be too high-tech from the beginning, but should step-by-step be upgraded.

(3) At the Beneficiary Level

1) Renovation of the conscience of beneficiaries

- The recovery rate of water charges is low even if the water rate in general is rather low. One of the basic reasons is the general attitude of consumers, which was acquired during the Soviet era, that water, a basic human need, must be provided for free. A campaign should be mounted for them to recognize the basic concept that the consumers have the right to receive safe and affluent water, and at the same time have the obligation to pay for it.

2) Measures to improve the tariff collection ratio

- Every water utility should provide service (customer) location maps in their service area, and customer cadastres as the very basic means to firmly grasp the property of customers.

- The cadastres shall bear the code, name, address, type of house, size of connection, status of metering (metered or non-metered), etc. of each customer.

- Customer metering should be completed as early as possible to not only rationalize tariff collection but also prevent waste. The key points are following:

(i) Complete (100 %) metering should be aimed for independent houses.

(ii) In the case of apartment houses, a block meter must be installed on the main service line leading to the apartment building. Each flat should be metered with identical number of meters as the number of service lines connected to the flat. The water charges for customers without meters for any reason shall be based on the estimate of water consumption, often by means of applying the standard norm of water consumption per head.

(iii)The houses, independent or apartment, to be newly built should be metered, or designed to that requirement.

3) Improvement of measurement, billing and collection methods

- The water supply utility should provide slips for meter reading and consumption estimation (for non-metered customers) to be carried by each meter reader. The slip (or the folder of the slips) must bear instructions how to read meters and estimate non-metered consumption. It shall also describe how to check the irregularity of meters.

- The methods how to record the meter reading and prepare water charge bills should be provided for the customer section of the water utility, to which the meter readers bring their reports for each working day. There must be a written instruction for the customer section how to provide the bills with the numbers, customer codes, dates, amounts of the charges, etc. and the method how to report the transactions to the accounting section.

- The written instructions shall be provided for the issuance of bills as well as the method of tariff collection.

- The water utility will need to revise the conditions, under which service connections are installed, disconnected or demolished. It is especially important to improve the prerequisites on the penalties for non-payment.

- The merit of introducing hand-held meter reading terminals so as to improve the efficiency of meter reading, reporting and billing while the cost of such operation must carefully be examined beforehand.

(4) Recommendations on Privatization

Despite the government's general policy for, among others, water supply utilities to be privatized, they are yet too weak in institutional and financial terms as they lack experience in market economy. ACSB, which has nominally become a joint-stock company, is not an exception, and still far from self-reliant.

Under the circumstances, ACSB must carry out all possible measures for the rationalization of its organizational structure and augmentation of income so as to near the status of self-supporting. On the other hand, the government should support water utilities through the legislative provisions for improved tariff systems, and such financial assistance as government loans and equities. It is advisable that other water utilities than ACSB, avoiding abrupt privatization, shall remain publicly owned enterprises for the time being. Their privatization can only be considered after their condition will have been improved.

4.5 Financial Management Plan

(1) Roles of the Central Government

As described earlier all of the Apa Canals concerned in the present study are in deep financial problem. There must be the roles of the central government in correcting the situation.

The first issue that the central government must do is the timely allocation of water cost to all budget organizations whose arrears of water bill are the largest. If this is not achieved, the healthy financial management of water supply activities is absolutely impossible.

The second task for the government is concerned with the improvement of water tariff system. The financial assistance from the government for operational deficit is impossible and not desirable also. Every Apa Canal has to meet all the cost with its own tariff revenue. The tariff system should eliminate the cross-subsidy from business enterprise to population (domestic uses). The water demand by business activities has decreased remarkably recently and will not recover forever. For the correction and improvement of water tariff systems, the strong initiative of the central government is required.

The third and final critical task of the central government is to coordinate ACSB and retail Apa Canals, especially, ACB, the largest customer of ACSB. The low tariff system and low water bill collection of ACB are the cause of financial trouble of ACSB. Without financial improvement of ACB, the financial stability of ACSB is not achieved.

(2) Financial Rehabilitation of Water Supply Utilities

We divide the master plan in three stages in terms of financial rehabilitation. Phase I (2003 - 2006) is urgent rehabilitation period. The main issues are to realize new tariff structure covering all the costs and to eliminate cross-subsidy from business enterprises to population and bill collection from the budget organizations. Regarding the short-term trade liabilities and taxes, the long-term payment plan must be developed and approved by creditors. Every effort has to be done to realize financial surplus in each fiscal year.

The correction of tariff structure will require step-by-step improvements. In Phase II (2007-2010), we expect the completion of tariff system correction and the elimination of water bill arrears. Corporate accounting system has to be improved and cost control system should be introduced. By paying salary and wages timely with cash, the moral of employees will be improved significantly. In this period, real GDP increase will allow substantial increase of tariff comparing to former level. Financial surplus in operation should be firmly established in Phase II.

The effort in Phase III (2011-2015) will concentrate in the payment of accumulated liabilities. As financial surplus established by Phase II, the surplus from operation can be used for the payment of accumulated liabilities. The constant financial surplus allows the long-term borrowing or the issuance of bonds. Then Apa Canals will able to swap the accumulated trade liabilities and taxes with long-term stable financing to eliminate these liabilities.

The fundamental principle to be observed is financial sustainability with water tariff. The task of the central government is mainly three points as mentioned already. Especially, as the local governments have insufficient interest in financial sustainability of Apa Canals and try to keep low tariff structure, the central government has to take decisive actions.

4.6 Implementation Schedule for the Master Plan

A tentative implementation schedule for the master plan is shown in Table 4.7.

Table 4.7 Tentative Implementation Schedule for the Master Plan

Item		02	03	04	05	06	07	08	09	10	11	12	13	14	15
FS, Design and Tendering		■	■												
Rehabilitation and Construction				■	■	■									
Operation and Maintenance							■	■	■	■	■	■	■	■	■
Expansion and Replacement of Distribution Pipeline	Balti			■	■	■	■	■	■	■	■				
	Soroca				■	■	■	■	■						
	Riscani			■	■	■	■	■	■	■	■	■	■	■	
	Falesti			■	■	■	■	■	■	■	■	■	■	■	
Financial Rehabilitation	Phase 1		■	■	■	■									
	Phase 2						■	■	■						
	Phase 3									■	■	■	■	■	■
Institutional Development			■	■	■	■	■	■	■	■	■	■	■	■	■

4.7 Economic and Financial Analyses of the Master Plan

4.7.1 Economic Analysis

As for economic effects from the implementation of the Master Plan, we can think of the increase of local residents' welfare by the improvement of water supply (especially for the residents in high-rise apartments without wells, labor saving for women and young residents engaging in water carrying), the positive effects for individual health by the improvement of water quality. Among these possible positive effects, we have quantified the labor saving of water carrying. The economic internal rate of return (EIRR) at 14.50% has been obtained. The estimation is based on the average disposable income in the Study Area.

4.7.2 Financial Analysis

(1) Method of Financial Analysis

The financial analysis has been done for three categories, the first is for ACSB, the second is for Apa Canals in four cities/towns, and the last is for consolidated financial analysis for ACSB and the municipal Apa Canals together. The price used in financial analysis is 2001 price. The physical life of investment is 40 years for civil engineering facilities and 20 years for machinery and electrical equipment. In both cases, salvage value is assumed to be 10 percent. The project life for financial analysis is 40 years.

(2) Financial Analysis for ACSB

We established four cases for the financial analysis of ACSB as follows:

1) Main Line (Soroca + Balti) : called Case M
2) Main Line + Riscani : called Case M+R
3) Main Line + Falesti : called Case M+F
4) Main Line + Riscani + Falesti : called Case M+R+F

As for the availability of government subsidy, we have assumed three cases, i.e., 0 %, 50 %, and 70 %. Remaining portion is assumed to be financed with borrowing. The O&M cost and the general administration expenses will be borne by the organization. The general and administration expenses are based on the data of 1999 and expected to increase proportionally with the O&M cost. The wholesale price of water to be paid by the municipal Apa Canals is set to 1.62 lei/m^3, which is the price being planned by ACSB against current 1.43 lei/m^3 and expected to be realized within a few years. The rate of collection of water tariff from the municipal Apa Canals is assumed to be 100 percent.

The result of financial analysis is shown in the following table as financial internal rate of return (FIRR) and net present value (NPV). It is clear in this summary table that Case M has the best FIRR, and the additional investment in water supply to ACR and ACF reduces FIRR.

Case	FIRR			NPV at 7 % (US$ 1,000)		
	①	②	③	①	②	③
M	2.70%	8.10%	13.24%	(4,254)	672	2,642
M+R	1.29%	5.97%	10.18%	(7,635)	(843)	1,874
M+F	1.36%	6.07%	10.38%	(7,458)	(754)	1,927
M+R+F	-	3.46%	7.10%	(13,627)	(3,839)	76

Note ①: 100 % of initial investment is covered by loan.
②: 50 % of initial investment is covered by loan.
③: 30% of initial investment is covered by loan.

(3) Financial Analysis of Retail Apa Canals

The analysis for each municipal Apa Canal was performed for the difference between the cases of WITH project and WITHOUT project. The NPVs at 7% discount rate are positive in all four cities. It represents substantial financial benefits to these Apa Canals. Especially, ACR and ACF have higher financial benefit than in ACB because ACR and ACF have tremendous benefit from new water supply from ACSB.

(4) Consolidated Financial Analysis of ACSB and Retail Apa Canals

The summary table of FIRR and NPV is shown below. The best FIRR is shown in Case M, and the water supply to ACR and/or ACF will reduce FIRR. The same can be said for NPV in the case of 100 % loan. However, inclusion of ACR or ACF or both results in NPV higher than that of Case M when the government subsidy is increased.

Case	FIRR			NPV at 7 % (US$ 1,000)		
	①	②	③	①	②	③
M	9.34%	19.30%	32.89%	2,618	7,543	9,513
M+R	7.84%	15.83%	25.70%	1,365	8,157	10,873
M+F	7.88%	16.10%	26.53%	1,376	8,079	10,760
M+R+F	5.79%	12.31%	19.66%	(2,753)	7,079	11,011

Note ① : 100% of initial investment is covered by loan.
② : 50% of initial investment is covered by loan.
③ : 30% of initial investment is covered by loan.

In comparison to non-consolidated financial analysis, the FIRR and NPV are improved remarkably. But the results depend significantly on wholesale water tariff, retail tariffs and tariff collection rates.

CHAPTER 5 SELECTION OF THE PRIORITY PROJECT

A feasibility study will be conducted on the priority project. The priority project should consist of the priority components out of all the facility improvement components of the master plan. The selected the priority components are shown in Table 5.1 together with the selection criteria considered.

Table 5.1 Components of the Priority Project

Priority Components	Criteria for the Selection			
	Urgency	Number of Beneficiaries	Operational Cost Efficiency	Improvement of Health
(1) Renewal of intake and transmission pumps with repair of some sections (urgent portion) of the Soroca - Balti pipeline	XXX	XXX	XXX	X
(2) Rehabilitation and improvements of the water treatment plant in the Soroca-Balti water supply system	XXX	XXX	X	XXX
(3) Completion of suspended construction of distribution reservoirs in Balti (urgent portion)	XXX	XXX	XXX	X
(4) Extension of the Soroca - Balti pipeline to Falesti with provision of a distribution reservoir	XX	X	XX	XXX
(5) Extension of the Soroca - Balti pipeline to Riscani with provision of a distribution reservoir	XX	X	XX	XXX

Evaluation mark: XXX: highest importance, XX: high importance, X: importance

The project locations are shown in Figure 6.1.

PART 3

FEASIBILITY STUDY

CHAPTER 6 INTRODUCTION

6.1 Priority Project

As described in Chapter 5, the following are the components of the priority project on which a feasibility study has been conducted. Locations and dimensions of the project components are shown in Figure 6.1.

(1) Renewal of the existing transmission pumps for raw and clear waters and urgent repair works of the transmission mains of the Soroca-Balti water supply system,

(2) Rehabilitation and improvement of the existing water treatment plant of the Soroca-Balti water supply system,

(3) Completion of the unfinished distribution reservoir in Balti,

(4) Extension of the clear water transmission main to Falesti with provision of a distribution reservoir, and

(5) Extension of the clear water transmission main to Riscani with provision of a distribution reservoir.

6.2 Project Areas and Water Demand

The project areas are the 4 cities/towns. The present and future (2015) demand of water in the project areas are shown in Table 6.1:

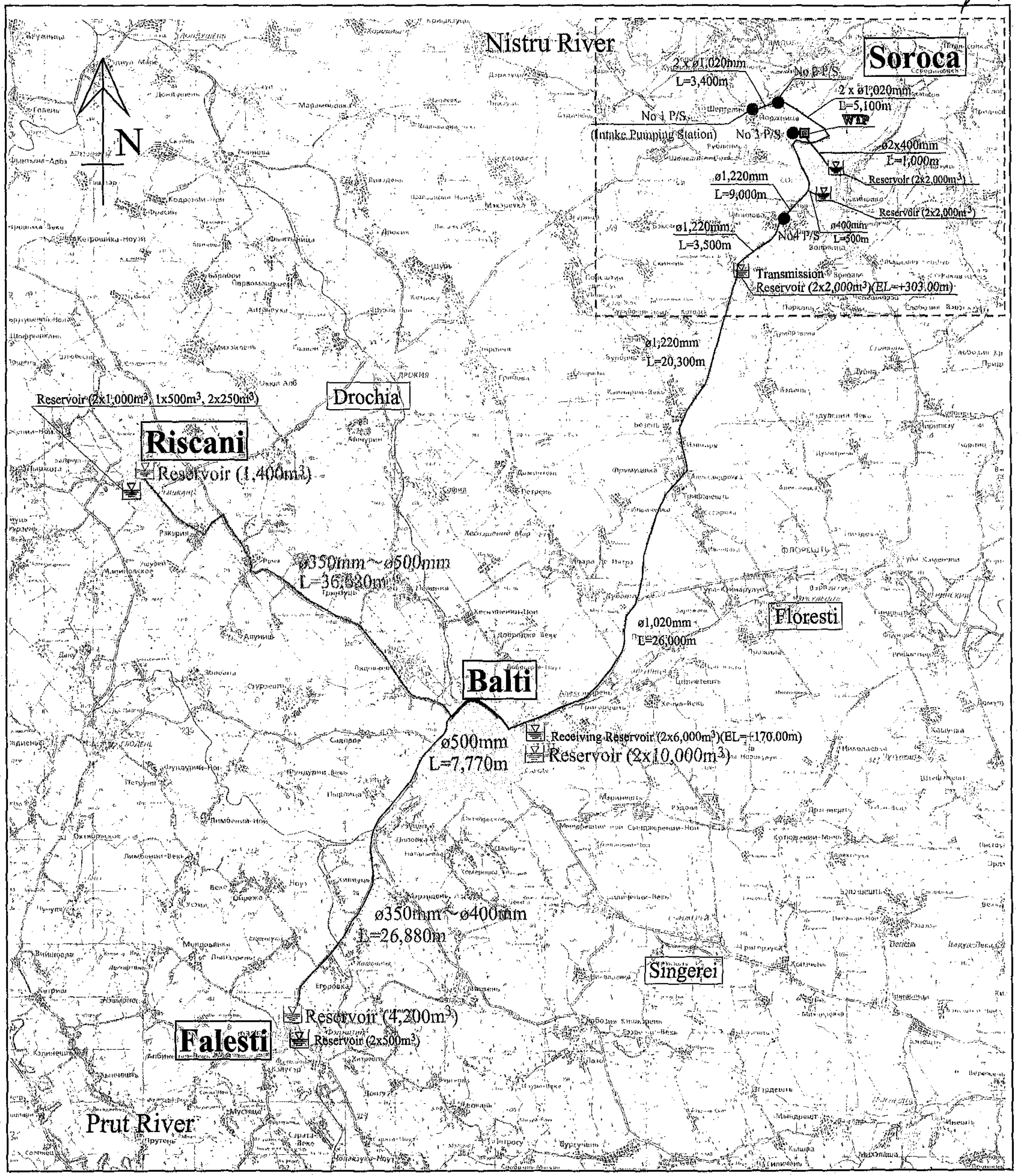
Table 6.1 Water Demand in the project Areas

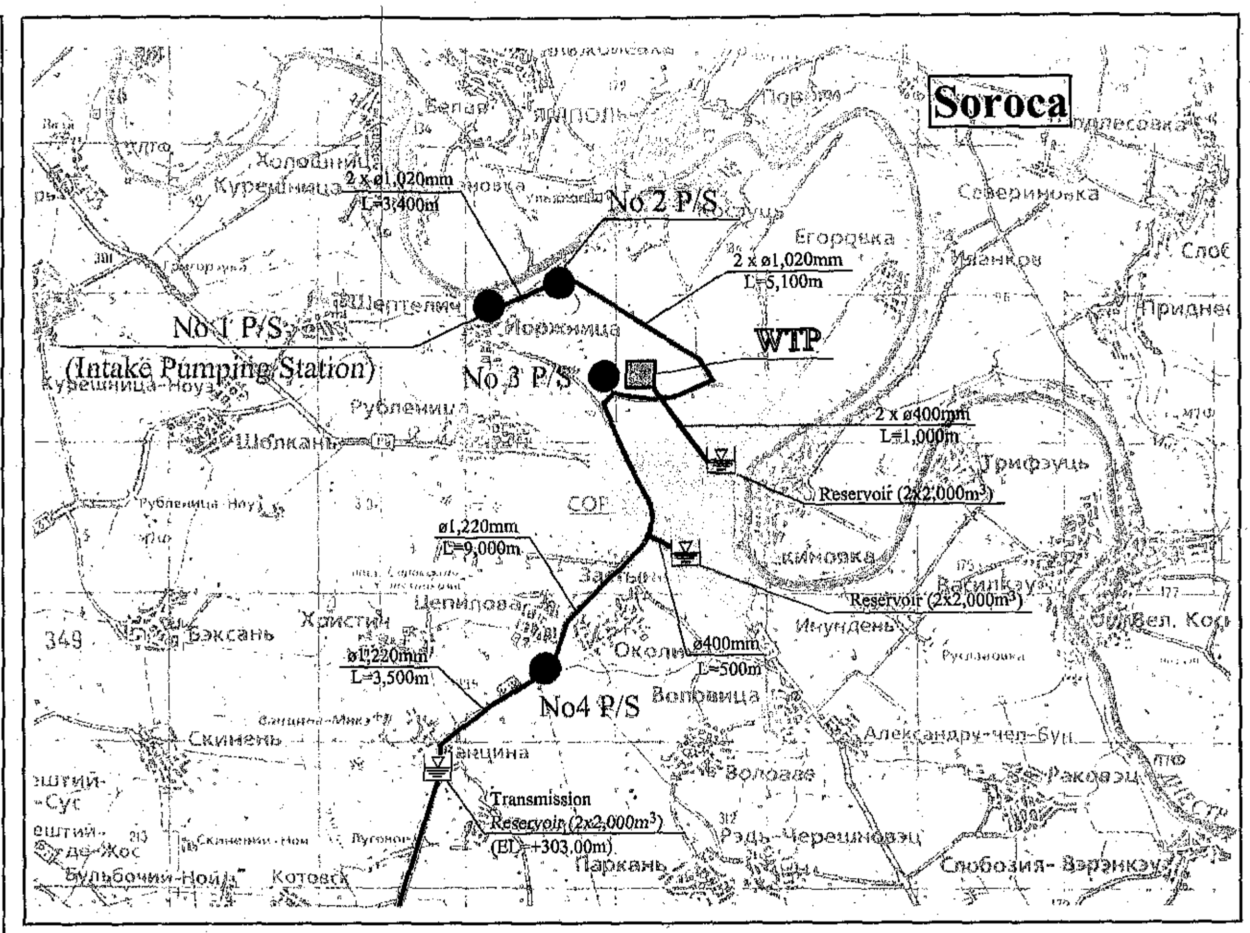
City/Town/Village	Population served		Water demand (m^3/d)	
	2000	2015	2000	2015
Soroca	44,988	46,442	7,961	12,178
Balti	158,230	168,086	33,907	44,950
Riscani	4,366	16,182	1,100	4,347
Falesti	9,500	18,749	2,718	5,197
Sub-total	217,084	249,459	45,688	66,673
Other towns & villages	50,340	109,512	7,812	24,051
Total	267,424	358,972	53,500	90,724

The water demand from all the areas in 2015 projected in the master plan is about 91,000 m^3/d, but the water demand from the priority project areas (4 cities/towns) is about 67,000 m^3/d as shown in the sub-total in Table 6.1.

6.3 Water Source

Nistru River is the water source of the water supply facilities in the priority project, as is the water source of the present Soroca-Balti water supply system. In the master plan stage, it was confirmed that Nistru River is the reliable source of raw water for the water supply systems for the project area. The quality of the Nistru river water has no problem when treated by conventional water treatment technologies.





LEGEND
(Project Components)

C-1	■	Renewal of intake and transmission pumps / Urgent repair work of Soroca-Balti pipeline
C-2	▒	Improvement of the water treatment plant (WTP)
C-3	■	Completion of suspended construction of distribution reservoirs in Balti (20,000 m3)
C-4	■	Extension of transmission pipeline to Falesti / Construction of distribution reservoir
C-5	■	Extension of transmission pipeline to Riscani / Construction of distribution reservoir

Figure 6.1 Locations of Priority Project

CHAPTER 7 PRELIMINARY DESIGN

7.1 Water Demand in the Feasibility Study

The water demand in the feasibility study in 2015 is 66,700 m3/d, which is the total demand of the 4 cities/towns, Soroca, Balti, Riscani and Falesti. The demand of each is as follows:

City of Soroca:	12,200 m^3/d
City of Balti:	45,000 m^3/d
Town of Riacani	4,300 m^3/d
Town of Falesti:	5,200 m^3/d

Specific design flow rates for the major facilities are shown in Figure 7.1

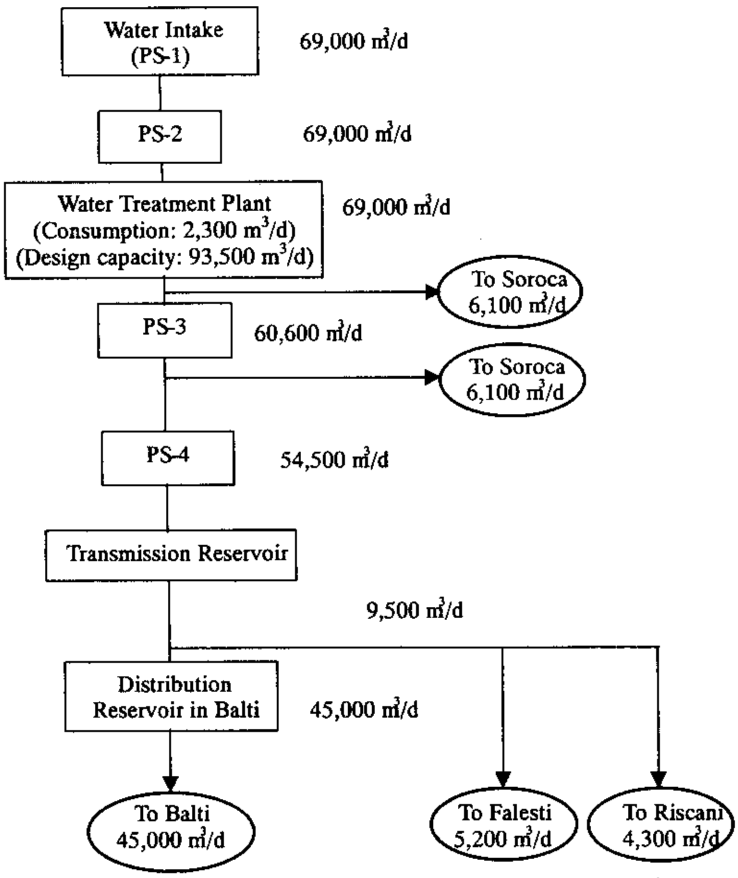


Figure 7.1 Design Water Flow Rate for the Priority Project

7.2 Design Criteria

Design criteria are basically extracted from "Construction Norms and Rules (CN & R) 2.04.02-84-Water Supply External Networks and Facilities", which has been derived from GOST and adopted in Moldova. When necessary, other criteria such as that given in "Guidelines for Design of Water Supply Facilities in Japan", which is generally used in Japan, are also referred.

7.3 Facility Development Plan

7.3.1 Rehabilitation of the Existing Pumping Stations

(1) Outline

There are 4 existing pumping stations in the Apa-Canal Soroca-Balti water supply system. (See Figure 7.3)

The raw water from the Nistru River is conveyed to the Soroca-Balti water treatment plant by the PS-1 and PS-2 in sequence. The treated water is transmitted from the PS-3, which is located in the water treatment plant premises, to the No.1 transmission reservoir (TR-1). PS-4 conveys the water further to No.2 transmission reservoir (TR-2), which is located at the highest point. From TR-2 to the receiving reservoir in Balti the water flows by gravity.

(2) Type, Number and Specification of Pumps

Due to high delivery pressure, ranging from 55 m to 93 m, the pumps of a horizontal centrifugal type with double suction are selected. To save the energy cost, the pumps must have high efficiency of 80 - 85%.

There will be three pumps in each pumping station. At normal time, two of the three pumps are operated in each station while remaining one stands by.

Specifications of the pumps were determined as shown in Table 7.1. Replacement of valves related to the pumping stations is shown in Table 7.2.

Table 7.1 Pump Specifications

Pumping Station	Function of Pump	Pump Specification	Number of Pump*
PS-1	Intake	24.0 m^3/min×52.3m×300kW	3
	Bilge	1.0 m^3/min×20.0m×7.5kW	2
PS-2	Booster	24.0 m^3/min×90.0m×500kW	3
PS-3	Transmission	21.3 m^3/min×75.0m×360kW	3
	Backwash	15.0 m^3/min×21.0m×75kW	2
PS-4	Transmission	17.7 m^3/min×80.0m×350kW	3

* Including one standby each

Table 7.2 List of Valve Replacement

Place	Name	Movement		Type	Dia. (mm)	Piece	Remark
		motor	manual				
PS-1	suction	○		butterfly	500	3	pump connect
	check		○	swing	400	3	pump connect
	delivery	○		gate	400	3	pump connect
	check		○	swing	100	2	bilge
	delivery		○	gate	100	2	bilge
PS-2	suction	○		butterfly	500	3	pump connect
	check		○	swing	400	3	pump connect
	delivery	○		gate	400	3	pump connect
	intake collector		○	gate	800	2	open air
	outlet collector		○	gate	800	2	open air
PS-3	suction	○		butterfly	500	3	pump connect
	check		○	swing	400	3	pump connect
	delivery	○		gate	400	3	pump connect
	suction	○		butterfly	400	2	pump connect
	check		○	swing	300	2	pump connect
	delivery	○		gate	300	2	pump connect
	pipeline	○		butterfly	1,000	1	
PS-4	suction	○		butterfly	450	3	pump connect
	check		○	swing	350	3	pump connect
	delivery	○		gate	350	3	pump connect

(3) Water Hammer Prevention

The existing facilities in the pumping stations for water hammer prevention are not functioning at all. New facilities to prevent the water hummer are necessary.

The water hammer can be prevented by either one or combination of the following measures:

i) A flywheel is installed on the pump axis for the purpose of increasing rotating inertia of pump

ii) A surge tank is placed on the pipeline for the purpose of reducing the pressure.

iii) Air vessel is placed on the delivery main for the purpose of rapid pressure drop.

iv) Air valves are mounted at a negative pressure point(s) on the pipeline for the purpose of introducing air when water hammer occurs.

As a result of a water hammer computation, the following measures are adopted for the water hammer prevention at respective pumping station (see Figure 7.3).

Pumping Station	Water hammer prevention measure	Remark
PS-1	Flywheel (GD2=150kg-m^2)	
PS-2	-	No measure is necessary
PS-3	Air vessel (V=50 m^3)	Requires frost protection
PS-4	Air vessel (V=30 m^3)	Requires frost protection

7.3.2 Improvement of Intake Facility

Two steel pipes with a diameter of 1,220 mm intake Nistru River water through respective intake boxes made of concrete. However, the boxes have been damaged since years ago, and ACSB has been compensating to fishermen until now. The intake boxes should be replaced to the new ones. Upon the replacement, the following should be taken into consideration:

- Intake velocity should be less than 0.1 m/s for fish protection.
- Mesh size of the screen on the box windows should be less than 25 mm.
- Material of the screen should be steel with corrosion protection work.

7.3.3 Rehabilitation of the Existing Transmission Mains

Outlines of the existing transmission mains of ACSB are shown in Table 7.3:

Table 7.3 Existing Transmission Mains

Section	Pipe Diameter (mm)	Length (m)
Intake (PS-1) - PS-2 - WTP	1,020	8,500 x 2 lines
WTP (PS-3) - PS-4 - Transmission Reservoir	1,220	12,500
Transmission Reservoir - Branch for Falesti	1,220	20,300
Branch for Falesti - Distribution Reservoir in Balti	1,020	26,000
Total		67,300 (75,800)

Note: ( ) means the total length of the pipes

Some portions of the pipelines are exposed due to the change of the direction of a brook and the soil erosion. These portions of the pipeline should be protected by concrete.

Air-relief valves, air inlet valves, blow-off valves for the drain, and gate valves are installed at appropriate positions of the transmission mains. Branch connection valves are also installed to distribute the water to the villages along the pipeline. However, these valves are not functioning any more. Replacement of the existing valves is required to keep the transmission mains in a good condition

Cathode protection system is adopted to prevent the pipe corrosion. Four transformers and 12 sacrificed steel bars with 1.8 m long were installed between the PS-1 and No.2 transmission reservoir. However, these have been stolen, and need to be installed again.

Table 7.4 shows the length of the protection, numbers of the replacement and reinstallation.

Table 7.4 Rehabilitation Plan for the Existing Transmission Pipeline

Description	Specification (mm)	Quantity
Protection of the pipes	φ1000 mm	L = 150 m
	φ1200 mm	L = 50 m
Replacement of the Air-relief valves	φ100	37 pcs
Replacement of the Air inlet valves	φ150	8 pcs
Replacement of the Blow-off valves	φ600	2 pcs
	φ400	3 pcs
	φ300	25 pcs
	φ150	16 pcs
Replacement of the Gate valves	φ1000	5 pcs
	φ800	5 pcs
Replacement of the Branch connection valves	φ300	1 pcs
	φ150	1 pcs
Reinstallation of cathode system		4 sets

7.3.4 Improvement of the Existing Water Treatment Plant

(1) Existing Water Treatment System

Figure 7.2 shows the system of water treatment in the existing Soroca-Balti water treatment plant, and Figures 7.4 and 7.5 show its plan and the hydraulic profile, respectively.

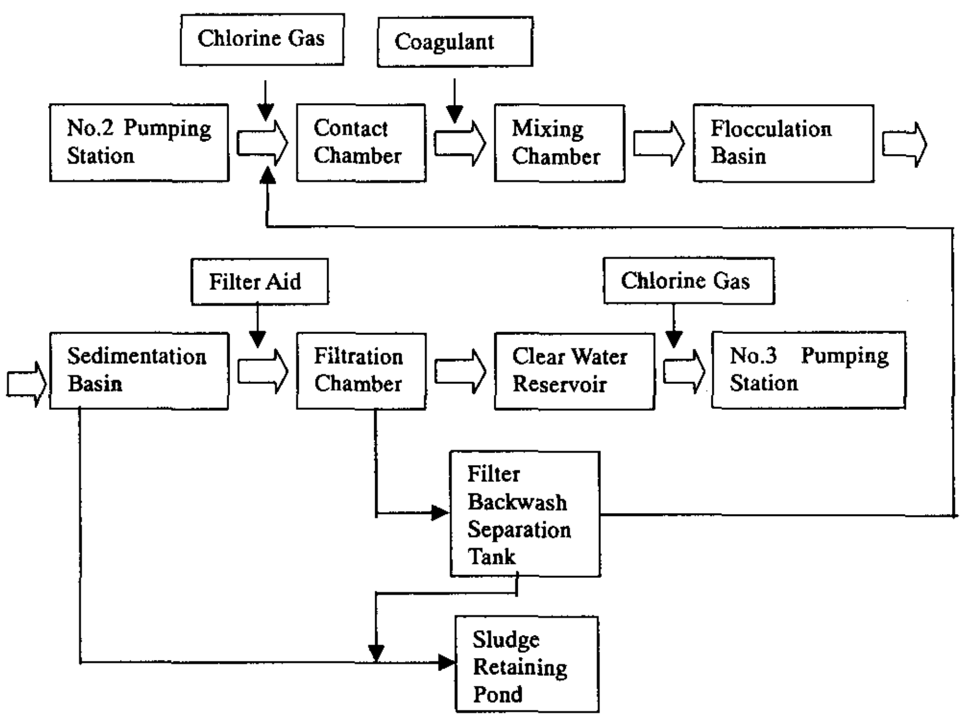


Figure 7.2 Treatment System of the Existing ACSB Water Treatment Plant

(2) Improvement Plan

Based on the examination of the existing water treatment plant facilities, the following improvements are recommended to rehabilitate the plant.

1) Contact Chamber and Sedimentation Basin

The facilities which are still serviceable will be in use, but the facilities which are deteriorated or broken at places need to be replaced or repaired. The works necessary for the rehabilitation of the contact chamber and the sedimentation basins are shown in Table 7.5.

2) Chemicals Injection Facilities

The existing chemicals dissolving and dosing facilities need to be repaired and the equipment needs to be replaced by new one. The existing chlorine gas injection equipment must be also replaced by new one. Table 7.6 shows items to be replaced or newly installed for chemicals dissolving and dosing.

Table 7.5 Improvement Plan of Contact Chamber and Sedimentation Basin

No	Item	Measures	Quantity
1	Wooden well of sedimentation basin	Repair	200 m^2
2	Leakage from sedimentation basin and contact chamber	Elimination	
3	Ventilators on the roof of sedimentation basin and contact chamber	Replacement	30 pieces
4	Bridges, gangways and their supporting metallic structures	Repair and Replacement	5 t
5	Pipe	Painting	1900 m^2
6	Electric static censor type water level gage in the filtration chambers	Replacement	2 pieces
7	Flow indicator and recorder for quantity of water supplied to the contact chamber	Replacement	2 pieces
8	Sludge outlet valves: 300mm	Replacement	24 sets

Table 7.6 Improvement Plan of Chemical Injection Facilities

Name of facilities	Specification	Quantity*
Alum dissolving tank pump	0.3 m^3/min × 10m × 1.5kW	2 (1)
Alum transmission pump	0.4 m^3/h × 10m × 0.2kW	2 (1)
Alum dosing pump	0.02～0.4 m^3/h × 3.0 kg/cm^2 × 0.2kW	2 (1)
Polymer pump	10～80 l/h × 3.0 kg/cm^2 × 0.1kW	2 (1)
Fluorosilicate sodium pump	0.2 m^3/h × 3.0 kg/cm^2 × 0.2kW	2 (1)
Mixing blower	12 m^3/min × 0.6 kg/cm^2 × 15kW	3 (1)
Mixer	15 m^3 × 7.5kW	2
Chlorine gas evaporator	5～20 kg/hr	2
Chlorine dosing machine	5～20 kg/hr × 3.0 kg/cm^2	3 (1)
Counteraction equipment	Caustic soda dosing equipment	1 set

* (1) means that one standby is included.

3) Filtration Chamber

The existing facilities still serviceable will be in use, but the facilities which are deteriorated or broken at places need to be replaced or repaired. Table 7.7 shows necessary works for the rehabilitation of the filtration chambers and the buildings.

Table 7.7 Improvement Plan of Filtration Chamber

No	Item	Measures	Quantity
1	Supporting layer(polymer concrete slabs)	Repair	Epoxy resin 50 kg
2	Sand (or zeolite)for No.6 filter	Replacement	190 m^3
3	Enameled tiles on filters	Repair	
4	Ventilators	Replacement	9 pieces
5	Sample taking hoses (15 mm PE hose)	Replacement	250 m
6	Hoses for the upper washing of filters(15 mm rubber hose)	Replacement	80 m
7	Bridges, gangways and their supporting metallic structures	Replacement	10 t
8	Slate roof	Repair	870 m^2
9	Roof of filtration chamber building	Repair	3,100 m^2
10	Pipe	Painting	3,200 m^2
11	Walls of the building	External lining	6,000 m^2
12	Window frames and glasses	Replacement	77 m^2
13	Devices for the measurement of pressure losses on filter	Replacement	5 pieces
14	Flow indicator and recorder for quantity of filtered water	Replacement	1 piece
15	Flow indicator and recorder for quantity of backwashing water for sand filters	Replacement	1 piece
16	Electric static censor type water level gage in the filtration chambers	Replacement	5 pieces
17	Powered inlet and outlet valves: 1000 mm	Replacement	11 sets
18	Powered inlet valves:600 mm, from the sedimentation basins	Replacement	5 sets
19	Powered outlet valves:600 mm, to the clear water reservoirs	Replacement	5 sets
20	Powered inlet valves: 1000 mm, of the clear water reservoirs	Replacement	1 set
21	Powered delivery valves: 1000 mm, to the filtration chambers	Replacement	1 set

4) Filter Backwash Separation Tank

Since the points of the backwash wastewater influent and the supernatant effluent are close to each other, short-cut currents occur and the sludge settling efficiency is low. In order to improve the performance, it is necessary to provide the guide walls thereby ensuring a sufficient settling time.

Specifications of the pumps for replacement are as follows. The badly deteriorated and broken valves and pipes are also replaced.

Pump to be Replaced	Specification	Quantity*
Supernatant water return pump	1.39 m^3/min×10m×3.7kW	2
Sand pump	0.3 m^3/min×10m×2.2kW	2

* Including one standby each

5) Drain System of the Sludge Retaining Ponds

At the present, the discharges from the sludge deposit ponds are made through the upper and the lower steel-made discharge pipes. It is proposed to provide a gate as specified below to the lower discharge pipe so that only the supernatant can be discharged steadily. It prevents escaping of the sludge to be dried naturally.

Discharge gate: 800 mm dia. x 2 gates

6) Natural Drying Bed for Escaped Filter Sand

This drying bed was provided originally to retrieve the filter sand escaped from the filter together with the filtered sludge separated in the backwash separation tanks. However, this drying bed specified below is not used at the present, and need to be rehabilitated.

Natural drying bed: 25 m^2 x 2 beds

7.3.5 Improvement of the Electrical Facilities in the Pumping Stations and the Water Treatment Plant

(1) Electric Power Supply for the Pumping Stations and the Water Treatment Plant

Electric power for the pumping stations and the water treatment plant is supplied from the existing 110/35/10 kV open switchyard substation of Moldelectrica Northern Power Supply Networks with two transformer banks at Soroca. There are two 35/10 kV open switchyard substations at Cosauti and Tsepilovo for supplying the electric power to the pumping stations.

Electric power for PS-1 and PS-2 is supplied with two 10 kV feeder cables from the substation at Cosauti, for PS-3 supplied with two 10 kV feeder cables from the open switchyard substation at Soroca, and for PS-4 supplied with two 10 kV feeder cables from the substation at Tsepilov. Electric power for the water treatment plant is supplied through the PS-3.

(2) Improvement of the Electrical Facilities

According to the life assessment evaluation, the existing electrical facilities in the pumping stations and water treatment plant are over the life time. The followings are recommended in order to maintain safe and stable operation of the pumping stations and water treatment plant.

- Existing high voltage motors shall be replaced to the smaller and more efficient motors to meet the new water demand. New features of the motors will be a squirrel cage induction motor with 6 kV instead of a synchronous motor with 10 kV.

- As the low voltage motor, a squirrel cage induction motor with 380 V will be adopted.

- The existing electrical equipment and materials will be replaced with new ones. Figure 7.6 shows the scope of the replacements.

7.3.6 Control System for the Pumping Stations and Water Treatment Plant

(1) Existing Control System

At the present, operation of the pumping stations and water treatment plant is controlled manually. After the receipt of command from the dispatcher at the water treatment plant, the site operators operate by themselves. This means that control of the operation relies on operator's skill, and there is a high risk of occurrence of troubles. It is considered necessary to introduce supervisory control and data acquisitions (SCADA) system in order to establish easy and stable operation of the overall water supply system.

(2) SCADA System

- Main feature of the SCADA system (see Figure 7.7 for SCADA configuration)
  - The SCADA system can control the operation of pumping stations and water treatment plant from the central control room.
  - The SCADA system can be simple, such as gathering the field data and transmitting such data to a control room.
  - The SCADA system can be complex and include the pipeline data, control of the water treatment plant, pumping stations and transmission pipeline.
- Control system for the water treatment plant and pumping stations

Main control system will be established at the control room in the water treatment plant, and the supervisory control and data acquisitions will be implemented. Local control panels will be installed at the required places in the water treatment, enabling the control of operation also by operators at site. The data from the treatment plant will be transmitted to the SCADA system through the control cable.

In the pumping stations, local control panels will be installed to control operation at site. The remote terminal unit (RTU) will be also connected to the control panel, and the data will be transmitted to the SCADA system by the RTU through the fiber optic cable.

7.3.7 Completion of the Unfinished Distribution Reservoir in Balti

The unfinished reservoir in Balti, located adjacent to the existing distribution reservoir operated by Apa- Canal Balti, will be completed. The reservoir consists of 2 basins, each having a capacity of 10,000 m^3. One basin is at 90 % of completion, and the other at 70 %. The foundation is of the spread type.

These structures need to be completed. Works include: 1) reconstruction of the remaining columns, slabs and walls, 2) installation of air-ventilation facility, man-hole for the maintenance, over flow pipes, wall for the inlet pipe, 3) cleaning of the basement, 4) reforming of the openings between the walls, 5) lining of wall and plugging by the mortar or tar-epoxy for the water leakage prevention, and 6) covering the reservoir by the selected material.

7.3.8 Extension of the Transmission Pipelines to Riscani and Falesti

(1) General

Plan of the extension of transmission pipelines to Riscani and Falesti is shown in Figure 7.8. Transmission pipeline is divided into 3 sections: a common section, Riscani section and Falesti section. The length, flow rates, and optimum diameters of these pipeline sections are shown below.

Section	Length (m)	Flow rate (m^3/s)	Diameter (mm)
Common pipeline section	7,770	0.11	500
Pipeline to Riscani	36,630	0.05	350, 400, 500
Pipeline to Falesti	26,880	0.06	350, 400
Total	71,280		

(2) Transmission Pipeline to Riscani

Gravity flow system is applicable for the transmission pipeline to Riscani. Pressure control by the gate valves installed in the transmission main Pressure control by the gate valves installed in the transmission main will be required because the surplus pressure is very high. The minimum covering depth of the pipe is 1.0 m to prevent the pipe freezing. Location of the pipelines is mostly in the agricultural field along the road except for the cases where there are obstacles or no space to install. Water pipe bridge, railway crossing and highway crossing by the jacking method, and inverted siphon are necessary as the site conditions require. Total pipe length, number of valves, railway crossing, highway crossings and etc. in the common section and Riscani section are summarized in Table 7.8.

Table 7.8 Quantity of Common and Riscani Sections

Item	Common Section (ϕ500 mm)	Riscani Line (ϕ350, ϕ400, ϕ500 mm)	Total
Pipeline length	7,770 m	36,630 m	44,400 m
No. of air relief valves	5	18	23
No. of blow-off valves	6	17	23
No. of gate valves	2 (every 3 - 4 km)	10 (every 3 - 4 km)	12
Railroad crossing by the jacking method	1	0	1
Highway crossing by the jacking method	2	1	3
No. of inverted siphons	1	2	3
No. of water pipe bridges	1	2	3

(3) Transmission Pipeline to Falesti

The total length, flow rate, and diameter of the transmission pipeline to Falesti are 26,880 m, 0.06 m^3/s, and 350 - 400 mm, respectively. Gravity flow system is applicable, and pressure control by the gate valves will be required for the same reason as that in Riscani. Total pipe length, number of valves, railroad crossing, highway crossings, and etc. from the Riscani-Falesti junction to the new reservoir are summarized in Table 7.9.

Table 7.9 Quantity of Falesti Section

Item	Transmission pipeline to Falesti (ϕ350, ϕ400 mm)
Distance	26,880m
Number of air relief valves	18
Number of blow-off valves	18
Number of gate valves	8 (every 3 - 4 km)
Railroad crossing by the jacking method	2
Highway crossing by the jacking method	3
Number of inverted siphons	21
Connection pipeline (ϕ300mm)	1,500 m

7.3.9 Construction of Distribution Reservoirs in Riscani and Falesti

(1) Distribution Reservoir in Riscani

The new reservoir in Riscani will be located near the existing reservoir. The altitude of the new reservoir is approximately 210 m, allowing the gravity flow for the water distribution system. The required capacity of the new reservoir is 1,400 m^3. For the ease of maintenance, two 700 m^3 basins will be constructed. The grid type structure composed of the beams and columns, and the spread type foundation will be adopted. Since the distance from the treatment plant is large, a chlorination facility will be provided.

(2) Distribution Reservoir in Falesti

The new reservoir in Falesti will be located on the highest hill near the town of Falesti. The altitude of the site is approximately 190 m, allowing the gravity flow for the distribution system. The required capacity of the new reservoir is 4200 m^3. Two basins of 2100 m^3 each will be constructed. The grid type structure composed of the beams and columns, and the spread type foundation will be adopted as is the case in Riscani. Also a chlorination facility will be provided.

Pumping Station	Name of pump	Pump Specification	Number of pump
№ 1 P/S	Intake pump	24.0m3/min x 52.3m x 300kW	3
	Bilge pump	1.0m3/min x 20.0m x 7.5kW	2
№ 2 P/S	Booster pump	24.0m3/min x 90.0m x 500kW	3
№ 3 P/S	Transmission	21.3m3/min x 75.0m x 360kW	3
	Backwash pump	15.0m3/min x 21.0m x 75kW	2
№ 4 P/S	Transmission	18.9m3/min x 80.0m x 350kW	3

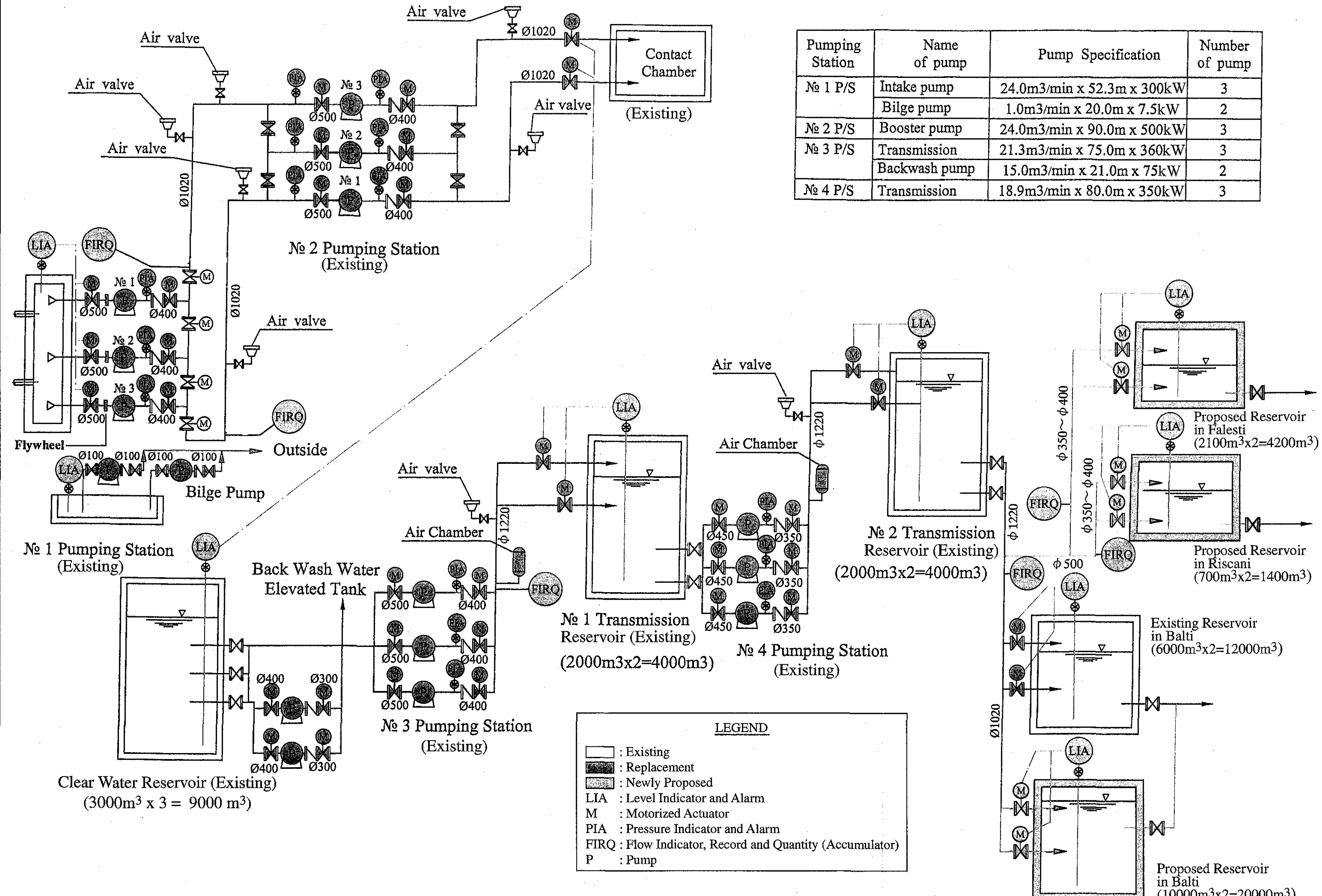


Figure 7.3 Flow Diagram for Pumping Stations and Reservoirs

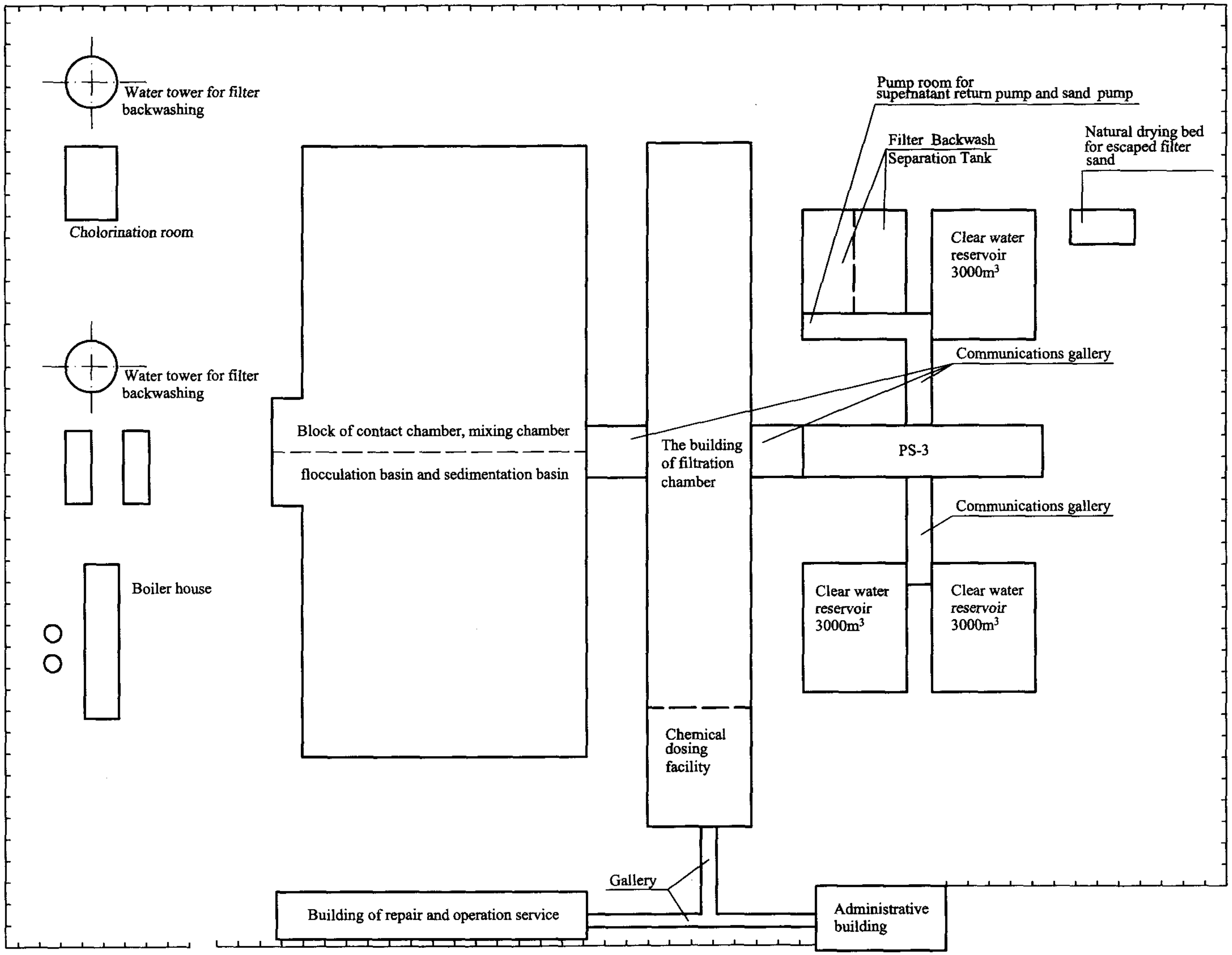


Figure 7.4 Plan of Apa-Canal Soroca-Balti Water Treatment Plant

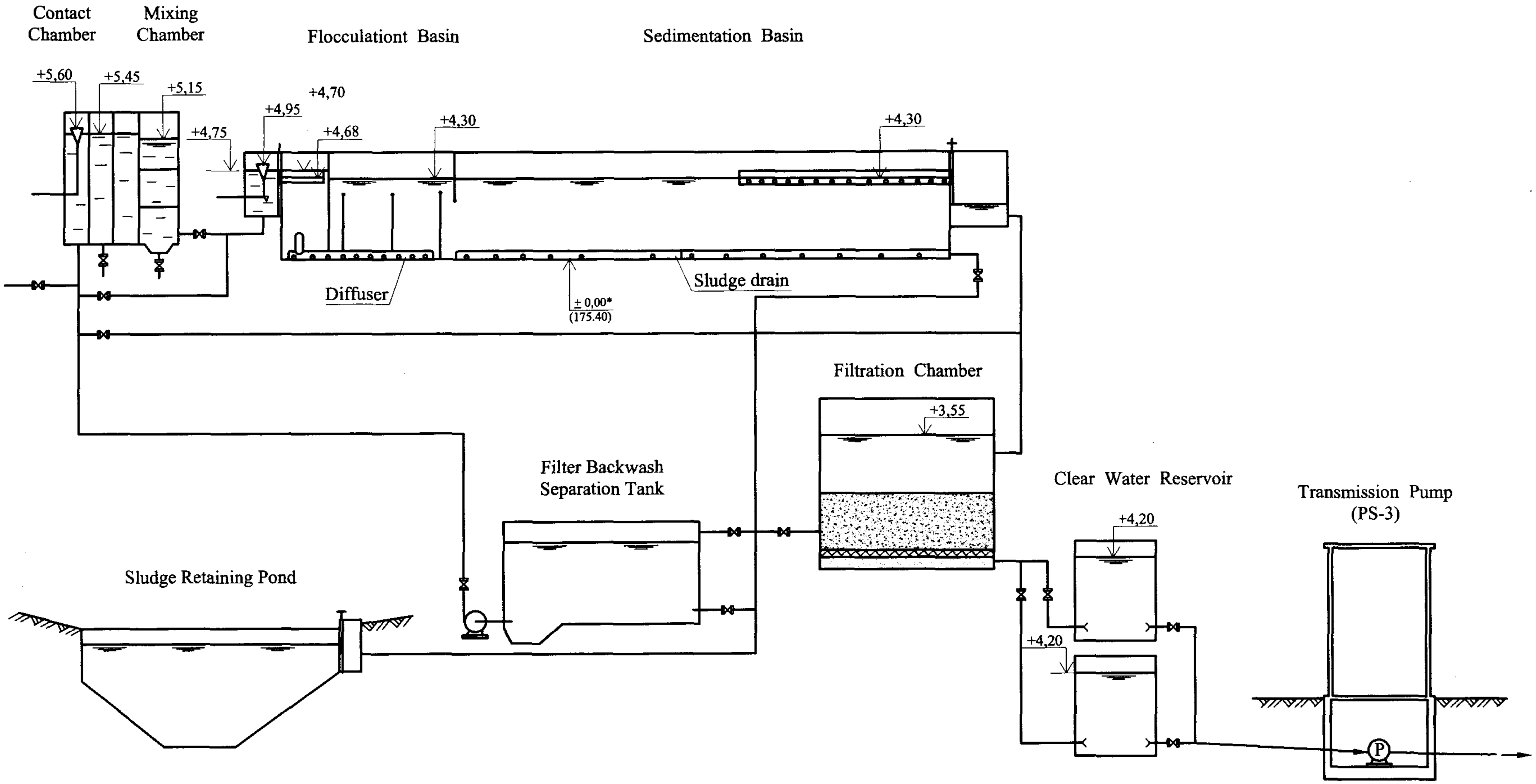


Figure 7.5 Hidraulic Profile of the Treatment Plant

Note: * For the level ±0.00 is refered to elevation of 175.40

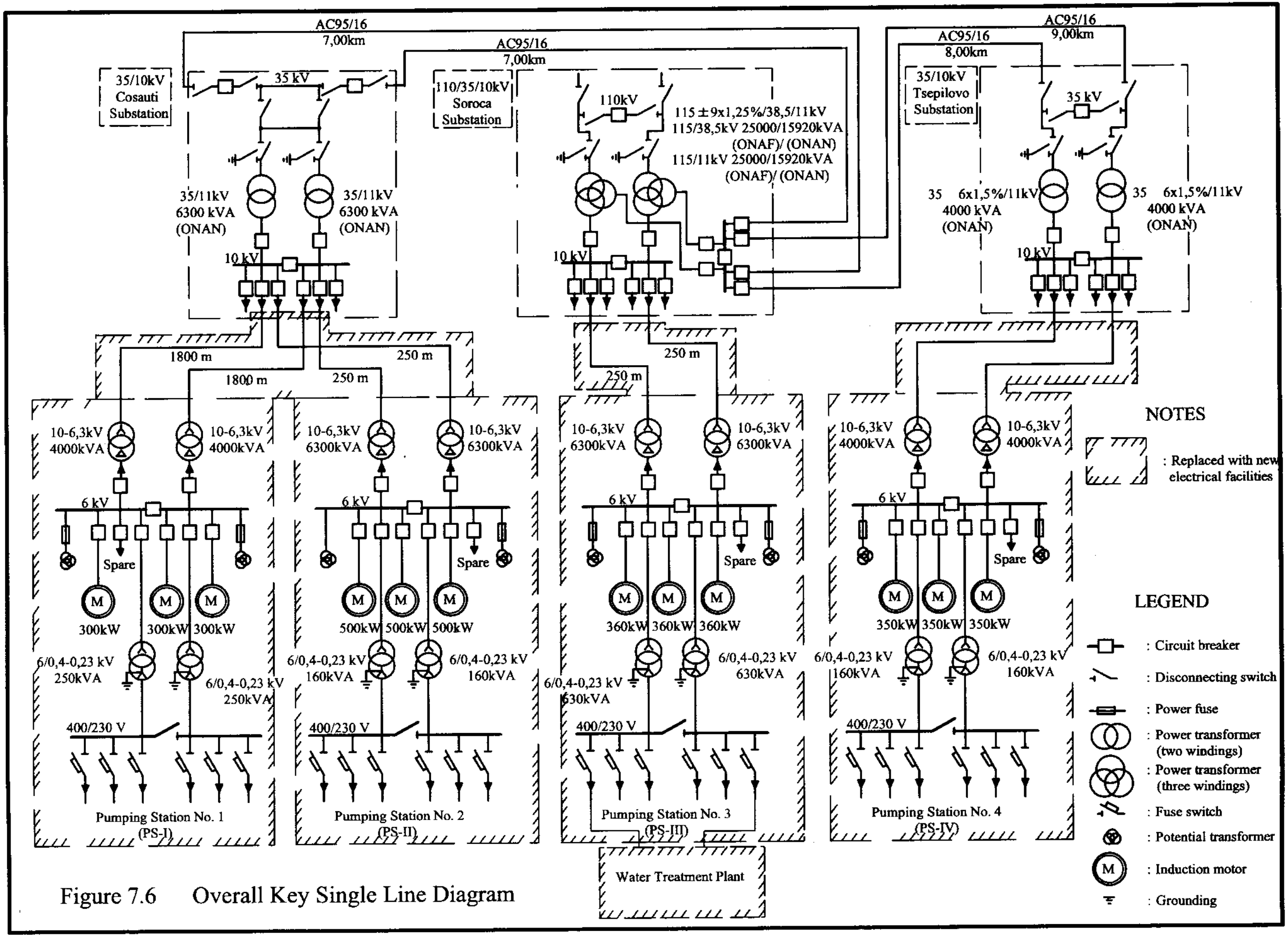


Figure 7.6 Overall Key Single Line Diagram

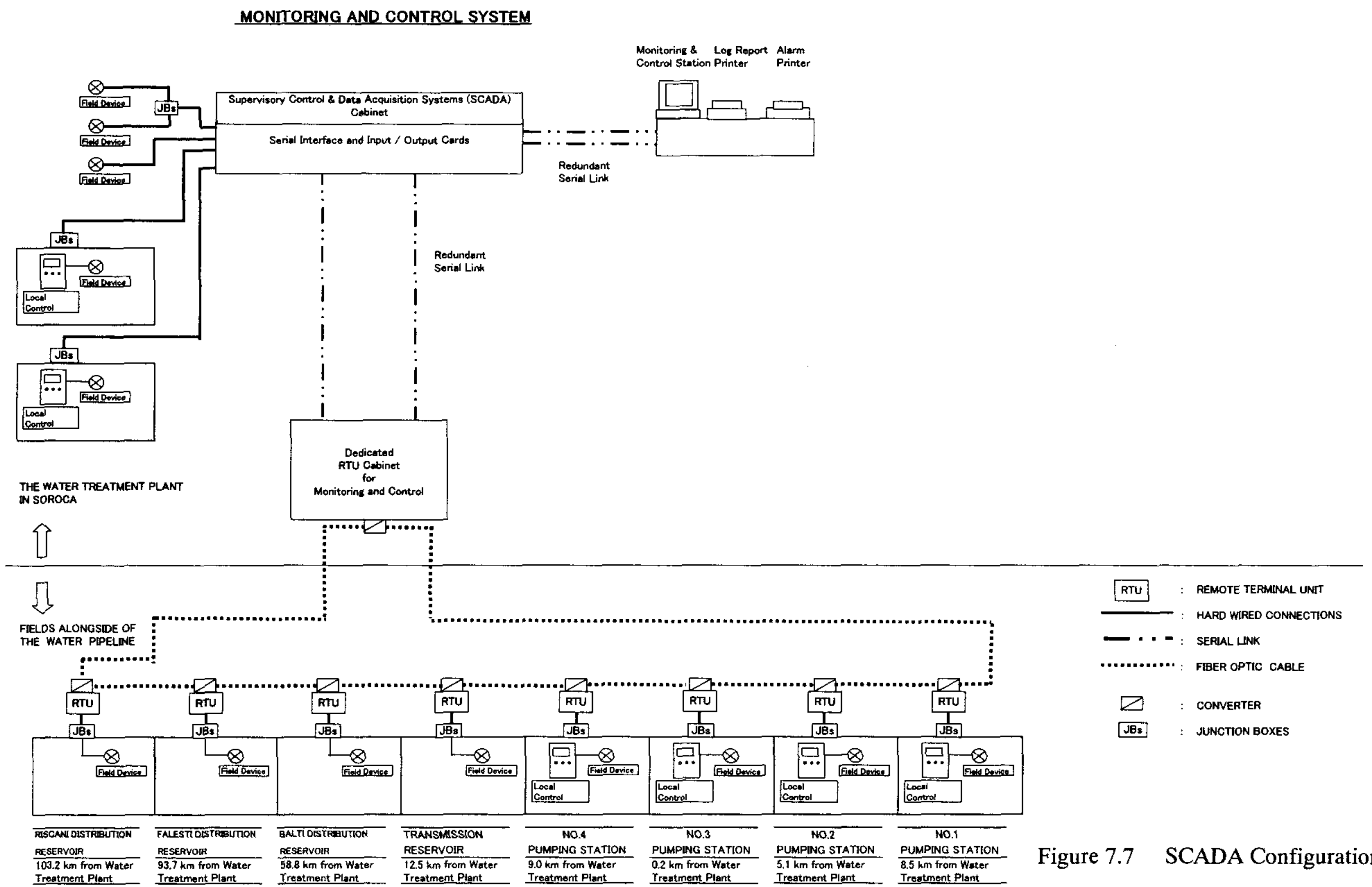


Figure 7.7 SCADA Configuration

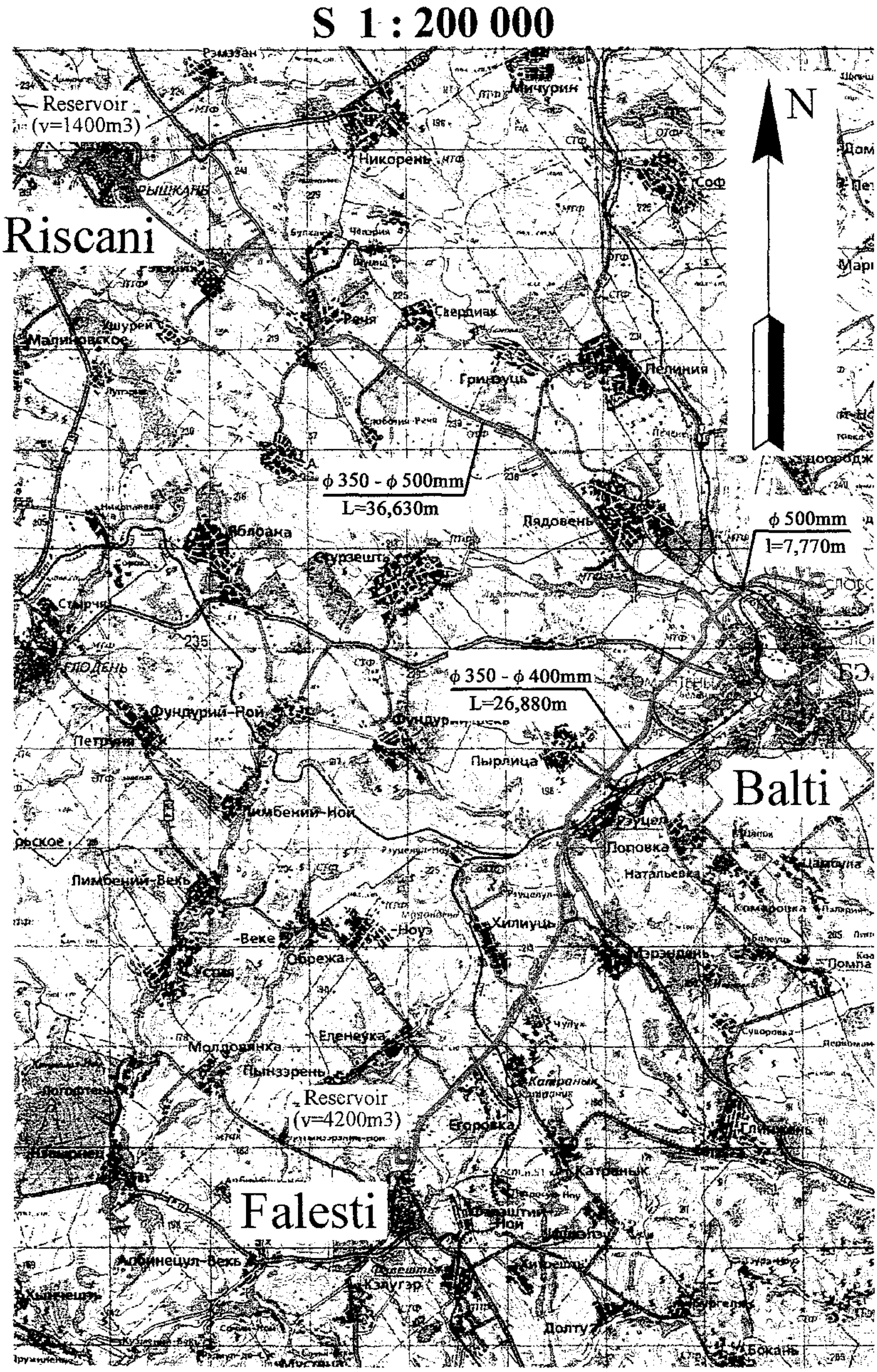


Figure 7.8 Plan of Transmission Pipelines to Riscani and Falesti

CHAPTER 8 CONSTRUCTION SCHEDULE AND PROJECT COST

8.1 Construction Schedule

The project is divided into the following 4 packages

Package 1: Rehabilitation of all the pumping stations, the water treatment plant, and the transmission pipeline of the ACSB system

Package 2: Completion of the unfinished reservoir in Balti

Package 3: Construction of the common section of the new transmission pipeline to Riscani and Falesti

Package 4: Construction of the Riscani and Falesti sections of the new transmission pipeline

During the above rehabilitation and construction works, the operation of ACSB facilities should be stopped at least for 6 months. Because it will be required not to supply the electricity during the replacement of the transformers, local control panels, and motors and pumps.

It is expected that the procurement of the mechanical and electrical facilities for replacement will take about 6 months. Table 8.1 shows construction schedule of the priority project.

Table 8.1 Construction Schedule of the Priority Project

Package	Work Item	Period				
		2003	2004	2005	2006	2007
Package 1	Design	▬▬▬▬				
	Tendering		▬			
	Equipment Procurement		▬▬			
	Construction		▪▪▪▪ ▬	▬▬▬▬		
Package 2	Design	▬▬▬▬				
	Tendering		▬			
	Construction		▬▬			
Package 3	Design		▬▬▬▬			
	Tendering		▬	▬		
	Construction			▬▬	▬	
Package 4	Design		▬▬▬▬			
	Tendering		▬	▬		
	Construction			▬▬	▬▬▬▬	
ACSB System not Operable			▪▪	▪▪▪▪		

8.2 Project Cost

The estimated total project cost is 25.7 million US$. Engineering service cost and physical contingencies were assumed, respectively, to be 10 % of the construction cost based on the similar projects. Breakdown of the project cost is shown in Table 8.2.

Table 8.2 Project Cost

Item		Cost (US$)	Remarks
1.Construction	1) Rehabilitation of the ACSB water supply system	10,731,000	
	2) Completion of the unfinished reservoir in Balti	336,000	
	3) Expansion of the transmission pipeline of common section	1,410,000	
	4) Expansion of the transmission pipeline to Riscani and Falesti	8,596,000	
	Subtotal	21,073,000	
2. Land Acquisition		9,000	
3. Engineering Service		2,110,000	10 % of Construction Cost
4. Physical Contingency		2,110,000	10 % of Construction Cost
Total		25,300,000	

8.3 Operation and Maintenance Cost

The major items of the operation and maintenance cost are electric power cost for the water treatment plant and the pumping stations, personnel cost and repairing cost. The costs for the water treatment plant were estimated by referring to the Chisinau water treatment plant. The electric power cost of the pumping stations was estimated based on the outputs of the motors in the pumping stations. The repairing cost of pumps was estimated by assuming 3 % of the equipment cost in reference to similar projects. The O & M costs thus estimated are shown in Table 8.3.

The electric power for the pumping stations is the largest cost item. A comparison of electric power consumption per 1 m^3 of water between the present system and the planned system is shown below. The electricity consumption will decrease by approximately 30 %.

	Water supply amount	Power consumption	Unit consumption	%
Present system	75,890 m^3/day (average in 1994)	87,400 kWh/day	1.15 kWh/m^3	100
Planned system	69,000 m^3/day	58,000 kWh/day	0.84 kWh/m^3	73

Table 8.3 Annual Operation and Maintenance Cost

Unit; US$

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Supplied Water (m3/d)	45,100	48,800	54,500	56,100	57,800	59,600	61,400	63,100	64,900	66,700
Supplied Water (m3/y)	16,461,500	17,812,000	19,892,500	20,476,500	21,097,000	21,754,000	22,411,000	23,031,500	23,688,500	24,345,500
Accounted-for water (m3/d)	36,080	39,040	43,600	44,880	46,240	47,680	49,120	50,480	51,920	53,360
Accounted-for water (m3/y)	13,169,200	14,249,600	15,914,000	16,381,200	16,877,600	17,403,200	17,928,800	18,425,200	18,950,800	19,476,400
Electricity	717,000	776,000	867,000	892,000	919,000	948,000	976,000	1,003,000	1,032,000	1,061,000
Chemical for WTP	50,000	54,000	61,000	62,000	64,000	66,000	68,000	70,000	72,000	74,000
Personnel and Repairing for WTP	157,000	170,000	190,000	195,000	201,000	207,000	214,000	220,000	226,000	232,000
O/M cost for Pumping Station	132,000	132,000	132,000	132,000	132,000	132,000	132,000	132,000	132,000	132,000
Total (Annual Operation and Maintenance Cost)	1,056,000	1,132,000	1,250,000	1,281,000	1,316,000	1,353,000	1,390,000	1,425,000	1,462,000	1,499,000

Note: 1.Excahnge Rate: 1US$ = Lei 13.6 = Yen 120.0
2. Life spans for facilities and equipment are as follows:
1) Civil and architecural facilities: 40 years
2) Mechanical and electrical equipment: 20 years

CHAPTER 9 INSTITUTIONAL AND FINANCIAL ARRANGEMENTS

9.1 Institutional Arrangements

9.1.1 Present Institutional and Legislative Systems

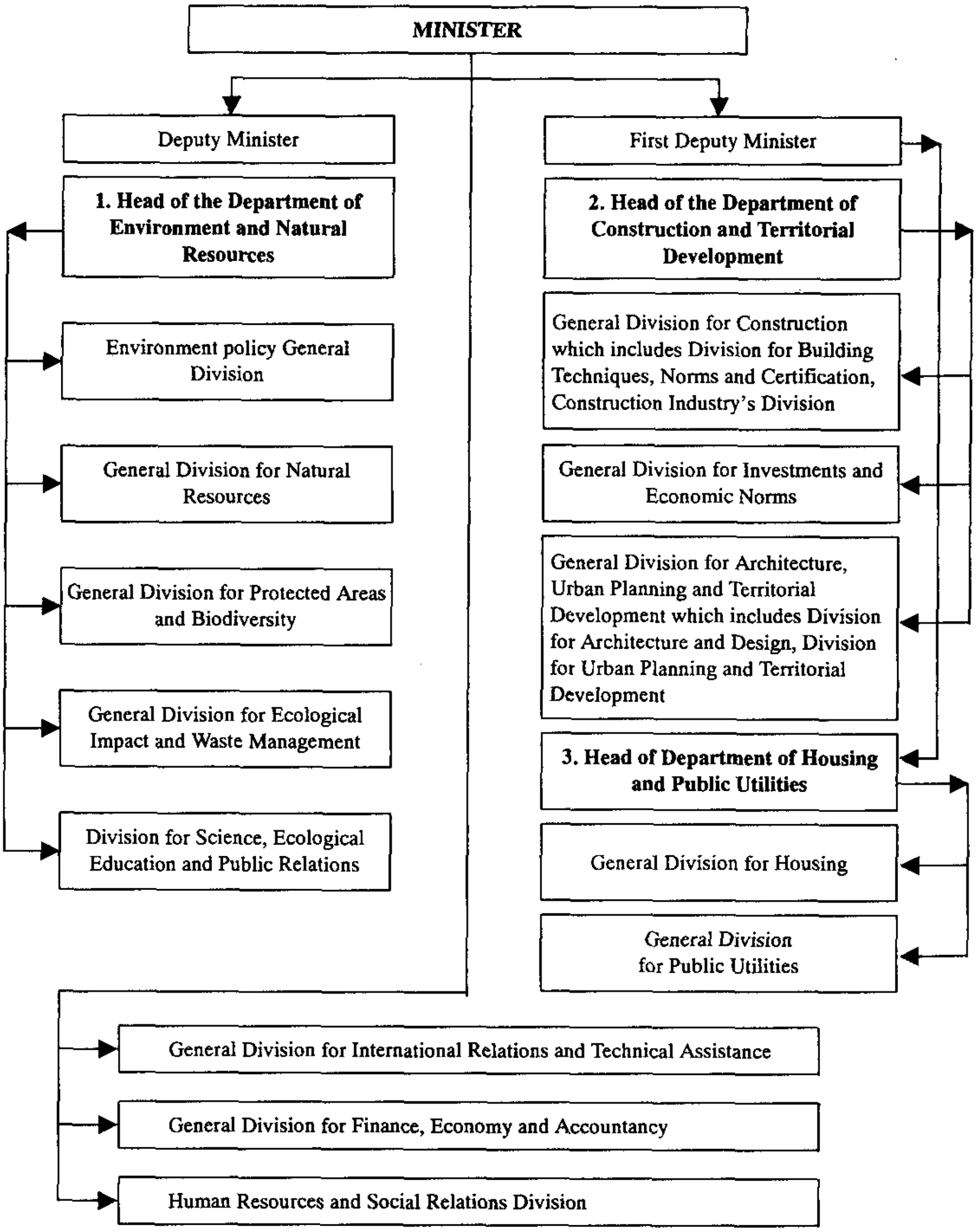
(1) Administrative Structure

The administration of the water supply (and sewerage) sector comes under the jurisdiction of the Ministry of Environment, Construction and Territorial Development (MECTD) in Moldova. The organizational structure of the MECTD is shown in Figure 9.1. The Department of Housing and Public Utilities (DHPU) of the MECTD assumes the sector administration at the national level including the preparation of laws and ordinances.

Due mainly to the limited clerical and technocratic resources of the DHPU (5 staff altogether), the government vests the authorization to license new and altered water supply utilities in the State Water Resources Management Concern "Apele Moldovei". Apele Moldovei also grants water right on surface water sources to, among other users, water supply utilities, and conducts such activities as (1) development of a long-term national water supply (and sewerage) development plan, (2) planning, design and construction of water supply (and sewerage) facilities, and (3) construction and operation of irrigation, flood control, land corrosion control facilities, etc.

In actual operation, Apele Moldovei sublets design and engineering activities to The Water Resources Management System Design Institute "ACVAPROIECT" (Acvaproiect). Acvaproiect is an independent juristic person.

In principle, a water supply utility should warrant, when obtaining a license, such items as responsible area (service area), water sources and water rights, capacity and safety of the facility, quality of served water, and financial integrity of the utility. However, there is no definite system of licensing water supplies in Moldova, therefore, no straightforward administrative system of warranting performance of water suppliers. In Moldova, decentralization of power has become the rule also in the water supply administration with the transition from the centrally planned economy to the market economy. However, the local administrative power in water supply including licensing has rarely been practiced.



List of enterprises which are subordinated to the Ministry of Environment, Construction and Territorial Development:

6 state inspection and control institutes
9 research and design institutes
7 enterprises
2 training centers
7 service enterprises
21 Joint-stock companies (with shares belonging to the state)

Figure 9.1 Organizational Structure of the Ministry of Environment, Construction and Territorial Development

(2) Legislative Provisions

The legislative framework in the water sector in Moldova is complex and still immature. There are two principal laws, Water Code and Potable Water Law, and three complementary decrees. In addition, there are two regulations related to the measurement of water quantity served to consumers and the payment of water charges.

The Water Code primarily deals with the utilization of water resources and its control, and the Potable Water Law generally stipulates bases of water sector administration, hygienic conditions of drinking water, and responsibilities of water supply utilities. However, there exists no straightforward provision on the procedures of licensing of water supplies. This may be due to the historical background where water supply facilities had been constructed under the plans and financial resources of the central government of the Soviet Union, and the facilities had been operated by the branch offices of the central government, not by autonomous local bodies.

(3) Institutional Status of Water Supply Utilities

1) Apa Canal Soroca-Balti

Apa Canal Soroca-Balti (ACSB) was formerly a state enterprise prior to its transfer, in accordance with the Resolution of June 2000, to the counties of Soroca and Balti and the simultaneous formation of the joint-stock company. The shares of its statutory capital have been in dispute between the Soroca county and the Balti county even though the above Resolution sets forth the shares to be 40% for the Soroca county and 60% for the Balti county. The former has been demanding 50%. As the decision-making body, ACSB does not have the board of directors since there is only a director. Actual decisions are at present made by the council of the Soroca county without representation from the Balti county.

Under the Director, there are one Chief Engineer and 13 sections. Four sections including Personnel Sec. and Accounting Sec. are directly under the Director. The Chief Engineer oversees 9 sections including the Sections of Water Treatment, Pumping Station, and Laboratory. There is no document definitely providing the division of duties (or it may be lost).

ACSB makes single-year wholesale agreements separately with its customers, i.e., Apa Canal Balti and Apa Canal Soroca. The contract stipulates, among others, (1) water tariff, (2) the method of determining the quantity of water supplied, (3) the condition to discontinue the supply, but does not set forth the obligation of the customer to receive a prescribed amount of water in each month or year.

2) Apa Canal Balti and Apa Canal Soroca

Apa Canal Balti (ACB) and Apa Canal Soroca (ACS) are public utilities to supply water to final consumers in the respective cities. ACB and ACS have organizational structure similar to that of ACSB. In ACB the Director directly supervises eight sections including (1) Customer Sevices Sec., (2) Planning Sec., (3) Accounting Sec., and (4) Personnel Sec. The Chief Engineer, under the director, oversees 12 sections including (1) Distribution Network Sec., (2) Sewer Network Sec., and (3) Pumping Stations Sec.. The central issue in the operation of both Apa Canals is the financial difficulty due to the shortage of revenue. This leads to deterioration of the facilities and high rate of water leakage due to the inadequate financial resources for maintenance and renewal works. Because the water supply from ACSB is only intermittent, both Apa Canals are forced to use groundwater resources of which water quality is a problem. ACB has been applying a single water tariff at 5.66 Lei/m^3 since July 2002, and expects an improvement in the financial management. But it is afraid that the number of consumers who can not afford the new tariff may increase. The new tariff system has been determined based on the minimum necessary expenses for such items as power cost, personnel cost, and repair costs. However, there is a problem of the social structural nature that the share of the expense for the water in the very low expendable family income has to exceed the proper level.

9.1.2 Institutional Arrangements for the Project Implementation and Operation

(1) Institutional Arrangements at the National Level

Given the inadequacies in the sector administration as described earlier, the government is planning to strengthen the Department of Housing and Public Utilities of the MECTD (or another ministry to be newly established) for its administrative functions related to the water supply sector in the near future. The areas of administration, for which the state government is responsible, shall be, among other things, the following:

1) Licensing of water utilities in the case they are newly established or altered in terms of water source, service area, method of water treatment, population served and the quantity of water to be served, etc. At the time of license application, the water supply utilities have to demonstrate the engineering integrity of their water supply facilities, the safety of tap water, and the financial viability of their operation.

2) General rule-making on such conditions on the water rate, cost allocation of the installation of services, and the obligation for the water supply utilities to report on their operating performance to respective local authorities.

3) Establishment and enactment of technical standards for water supply facilities to warrant their physical integrity and the safety of drinking water.

4) Coordination on the financing for water supply projects with funds to be provided by the government, external sources or the private sector, etc.

Apele Moldovei may still be the sole national authority to allocate water right on surface water sources to, inter alia, those who run a water supply utility.

(2) Legislative Arrangements

There is a need to simplify and streamline the legislative provisions that are markedly complex in Moldova. First of all, a water supply law must be newly enacted; or the Portable Water Law shall be revised and renamed Water Supply Law. The existing Water Code may be left unchanged. The new Water Supply Law shall set forth, among other things, the following:

1) Principal responsibilities of the central and local governments

The central and local governments are responsible to establish policies on systematic development of the water supply sector. The central government shall plan and undertake basic and comprehensive measures such as the development of water resources for the improvement of water supply; and give technical and financial assistance to local governments and water supply utilities.

2) Safety of drinking water

The government shall obligate water supply utilities to fulfill the quality of water served by them in accordance with the water quality standards of Moldova.

3) Licensing

Those who intend to run a water supply utility, or alter it in terms of size, water source, etc. shall have a license of the governor/head of the county where the facilities of the water supply are situated.

Water supplies shall be operated by a city, town, village or a joint body thereof or a privately owned enterprise.

The license application document shall bear such description of the water supply as: 1) The service area; 2) Outline of facilities; 3) Construction cost of the facilities and its source of financing; 4) Population served and the base for quantity of water to be served; 5) Outline of projected revenue, expenditure and their balance; 6) Water rate; 7) Type of water source and the location of water intake; 8) Method of water treatment; 9) Planned commencement and completion dates of construction

4) Obligation to serve and obligation to pay

The water supply utility shall not reject, with no justifiable grounds, a water service contract proposed by a user who resides in the service area. The water supply utility can suspend its service to a user when he has not paid the water charges for an excessively prolonged period of time.

5) Water supply technical administrator

The water supply utility should instate a water supply technical administrator (chief engineer) who supervises: the inspection of technical conformity of water supply facilities, water quality testing, examination of technical conformity of water service products (fittings), health check of personnel, etc.

6) Water quality testing

In accordance with the ordinance of the Ministry of Health, the water supply utility should carry out regular and ad hoc water quality testing.

In addition to the above, there must be related laws such as the following:

1. Public Utilities Law
2. Local governments law
3. Local finance law
5. Labor union law
7. Labor safety and sanitation law
8. Building code law, etc.
9. Measurement law

(3) Institutional Arrangements at the Local Level

1) Licensing and Monitoring

The authority of licensing a water supply utility is vested in each county. The county government shall issue a license to the water supply utility upon confirmation of meeting the afore-mentioned requirements. The county government shall also monitor the water supply activities of the utility concerning safety of the supplying water, soundness of the management, appropriateness of the water rate, etc.

2) Organizational Structure of Water Supply Utilities

2)-1 Apa Canal Soroca-Balti (ACSB)

The existing organizational structure of ACSB is markedly complex, so a simplified structure shall be employed by delineating the sections by major function. A proposed organizational structure of ACSB is illustrated in Figure 9.2.

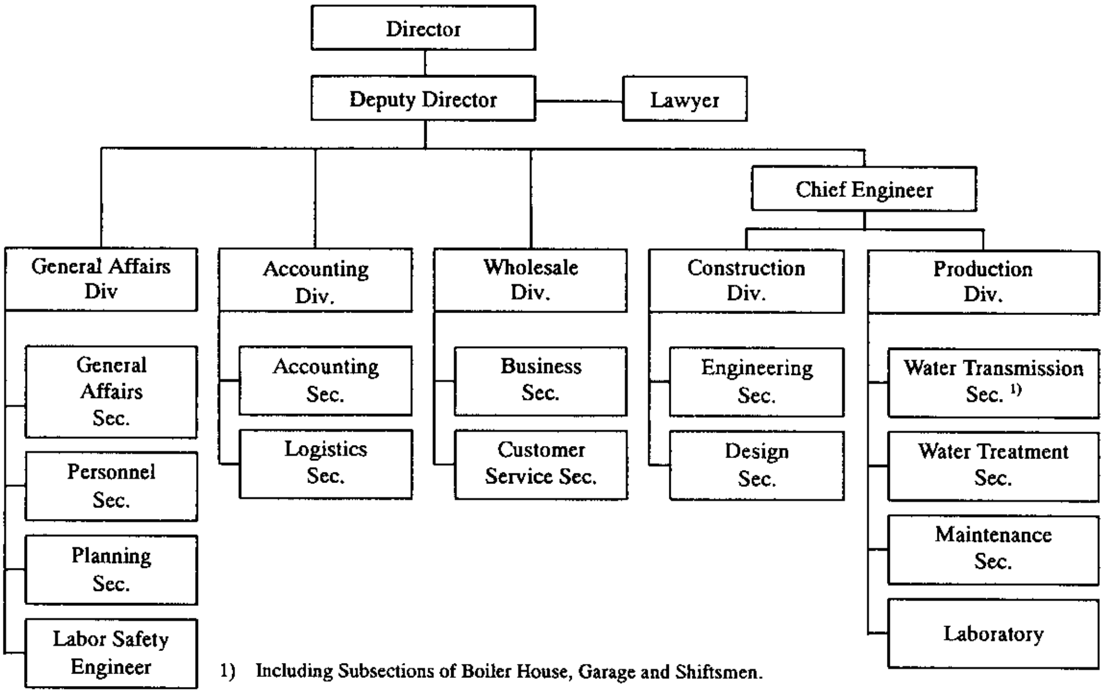


Figure 9.2 Proposed Organizational Structure of ACSB

Functions of the Sections shall be clarified as shown in the following example.

i) General Affairs Division

- Preparation and renewal of job descriptions for the employees (General Affairs Sec.)
- Preparation of budget plans, its implementation, monitoring and reporting (Planning Sec.)
- Preparation for the general meeting of stockholders, and its implementation (as the secretariat) (General Affairs Sec.)
- Personnel management (Personnel Sec.)

ii) Accounting Division

- Accounting of cash revenues, cash expenditures, accounts receivables and accounts payables (Accounting Sec.)
- Book-keeping of acquisition, re-evaluation, depreciation and disposal of tangible and intangible assets (do)

- Contract-making and logistics (control of acquisition, storage, deployment and book-keeping) of materials and equipment (Logistics Sec.)

In the same manner, the functions are clarified for the other Divisions.

Business policy and customer relations of ACSB shall be established. The ACSB's position to its customers, i.e., ACB and ACS is weak. For example, ACSB had to accept the wholesale price that cannot cover the actual cost when the customers disagreed with the price proposed by ACSB. On the part of ACB, it tended to use own groundwater resources to reduce the amount of water received from ACSB, even though the groundwater has the quality problem. Under such situation, it is impossible for ACSB to make sound water supply operation. And final water consumers have no choice but to use the water of poor quality. Therefore, the central government should prohibit the use of poor quality groundwater for water supply, and implement the water rate policy that assures the sound management of water supply utilities.

2)-2 Apa Canal Balti and Apa Canal Soroca

An organizational structure similar to that for the ACSB is recommended for both ACB and ACS. However, the Customer Division (instead of the Wholesale of ACSB) needs a larger number of staff, since the number of their customers is much larger. Both have divisions for not only water supply but also sewerage services. The functions of each Section shall be similar to that of ACSB. A proposed organizational structure of Apa Canal Balti is illustrated in Figure 9.3.

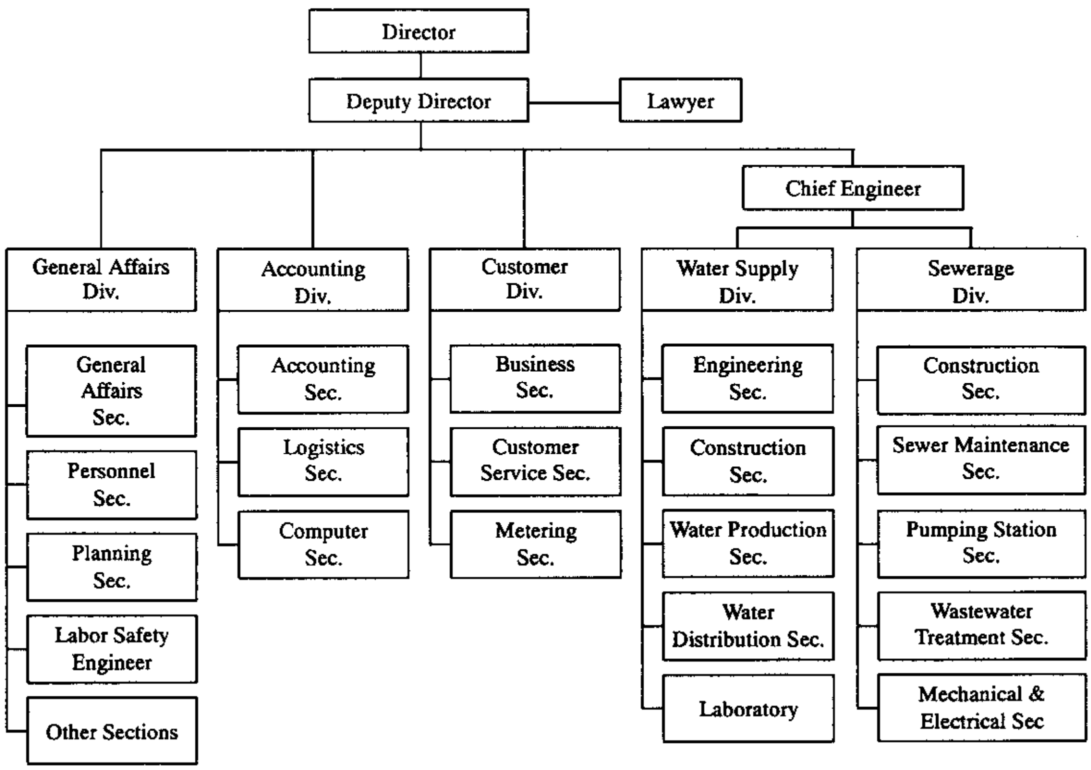


Figure 9.3 Proposed Organizational Structure of Apa Canal Balti

2)-3 Apa Canal Falesti and Apa Canal Riscani

Although the same recommendations as for Apa Canal Balti shall apply to Apa Canal Falesti and Apa Canal Riscani, guidance and technical and institutional assistance by the government may be required to realize the required improvements in its institution and operational practices. As to the organization, the similar structure shall apply to Apa Canal Falesti and Apa Canal Riscani since they need to achieve basically the same functions.

(4) Development of Facility Maintenance System

In general the water supply utility should establish a proper plan for facility replacement and written rules of preventive maintenance of facilities and equipment, which are currently non-existent or not functional in ACSB, ACB and ACS. As the basis of the facility maintenance system, the daily inspection and the regular diagnosis of functions of the facilities should be implemented, and as necessary, replacement plans shall be drawn for the facilities.

(5) Stepwise Restructuring of Water Supply Utilities Toward Privatization in Moldova

The following are representative types and magnitudes of privatization, which may be considered by water supply utilities in Moldova for their stepwise restructuring.

1) Out-sourcing Contracts

Part of operations of the water supply utility, e.g., meter reading, tariff collection, the operation and maintenance of water treatment plants and water distribution networks and so forth are sublet to specialized private firms.

2) O&M Management Contracts

The operation and maintenance (O&M) of the entire system of the water supply utility are contracted out. The contracted firm receives remuneration, i.e., the fee depending on its performance (activities).

3) Lease Contract

The municipality, namely the owner of the water supply, leases out their water supply facilities to a private firm. The firm charges and collects the water tariff from its customers, part of which revenues it appropriates to the payment of the lease. This type of privatization is suitable in case the size of initial investment is relatively small.

4) Concession Contract

This is the most advanced form of trust, under which the trusted private firm directly undertakes construction, maintenance and replacement of the facilities. The firm invests money for the construction, and recovers the capital cost by means of water tariff. The ownership of the utility rests with the municipality.

5) Complete Privatization

The entire body of the water utility is sold to the private firm together with all the corporate rights for the operation. The municipality, however, maintains the role of controlling the level of water rate and the quality of service.

The selection among above alternatives will be affected by various conditions such as the age of the facilities, the financial position of the utility, the availability of competent trustees, and the support of the consumers to the privatization. As to the present project, ACSB is not privately owned even though it has become a joint-stock company, and neither classified as a lease contract nor a concession contract. The only prospective way-out is the government policy including its intervention with the enactment of a law or ordinance to guarantee the self-reliance of the wholesale water utility, namely ACSB, through the prohibition of the use of hazardous (unsafe) groundwater and its endorsement for profitable water rates. Otherwise, no other form of corporation can be possible than the present status with the actual ownership by both Soroca and Balti counties and their subsidization for making up the deficits in operation.

In effect, on the other hand, the present water charge to be collected from the customers of ACB and ACS is considered to be close to the affordable limits of the customers while the financial position of the water utilities is still weak or unprofitable. It does not appear that the position of the sector has reached the level at which any private firms can own the utilities and make profits from their operation. All the same, it is hopefully possible that, if privatized, a water supply utility may avoid loose, inefficient operation, which has been ubiquitous under the publicly owned corporate form, and can elevate the level of service as a result of its efficient operation. Thus the consumers can ipso facto benefit even if the water rate would be somewhat higher. To this end, the government should undertake such measures as stated above to warrant the self-reliance of the water utilities; and the consumers, on the other hand, shall be enlightened to show their willingness to pay for the cost of valuable services they receive

9.2 Financial Management

(1) Tariff Policy of the Water Supply Systems

The most important critical issue in this feasible study is the financial restructuring of ACSB.

During the past planned economy, the water supply systems of the country was constructed by the budget allocated from the central government of the Soviet Union and the operation cost was mainly borne by commercial users and public institutions. The residents did not need to worry about the water supply cost.

The situation has been changed completely after the independence of 1991. The financial transfer from Moscow has been stopped. The planned constructions of factories have been canceled. The many existing factories faced the decrease of demand or financial loss due to the lack of competitiveness of the products in the market and therefore reduced the operating level or closed, and the tariff revenue from the enterprises was sharply decreased.

In order to survive in market economy, the most of enterprises switched their water sources from the public water supply to domestic wells. Many budget organizations lacked their water budget due to the economic turmoil and the decrease of tax revenue. Large amounts of overdue were from the hot water and heating supply organizations.

Thus, the system that the most of water supply cost was borne by enterprises and budget organizations and the residents enjoyed almost free water became impossible. Further, the price of the electricity that is now imported from Ukraine and Russia has been increased several times from 1998 to 2002. The sixty-nine percent of water supply cost in ACSB is the electricity cost. The facility of ACSB is old and excessively large against current level of water demand. The operation of ACSB is inefficient.

More than 90 percent of the water sales of ACSB are toward ACB and the remaining is for ACS. If the financial performance of ACB becomes negative, the operation of ACSB reaches deadlock. This is the fundamental structure of the current ACSB issue.

In spite of the frequent increase of power cost after 1998, it was politically infeasible to increase water tariff for population and it resulted in the power cutoff to ACSB.

In order to solve the situation, the following two conditions must be established.

(1) The water supply business should be sustained with water tariff. The external financial assistance at continuing basis shall not be expected.

(2) The cross subsidy cannot be allowed. All water users must pay their water costs.

In case of larger cities where large enterprises exist in substantial numbers, moderate level of cross subsidy may exist, say, in one to two ratios between population and enterprise. But, in this study area of northern region, such a number of enterprises do not exist.

From such point of view, new ACB's uniform tariff system that was introduced on 1 July 2002 was truly epoch making. It took eleven years after independence and the introduction of market economy for new uniform tariff to be realized in Balti, Moldova. Only this new uniform tariff will bring financial stability to water supply systems.

Currently, elder population, especially pension recipients, is resisting this new uniform tariff. But as new tariff is the absolute key factor for financial stability of water supply systems, the retreat should not be allowed. The effect of new tariff will appear in August monthly financial report. The resumption of power transmission to ACSB is highly correlated with the financial improvement of ACB.

The water supply from the facilities proposed in the feasibility study will start at the year of 2006 to Balti and Soroca. Within four years from now to 2006, the financial sustainability that all water supply cost must be recovered with tariff revenue should be achieved. This is the task of the Phase One of the Master Plan.

The success of uniform tariff system at Balti will influence on the neighboring small cities for adoption. Within five or six years, new uniform tariff systems will be adopted in many Apa Canals and the financial troubles of the water supply systems will be improved substantially.

In the current feasibility study, the water supply to Falesti and Riscani will start in the year of 2007. Within five years until 2007, the Apa Canals of these two cities will succeed to adopt new tariff principle i.e. (1) the water supply costs shall be covered by tariff revenue and (2) all water users must pay the respective costs.

Regarding macroeconomic aspect, real per capita GDP growth of five percent is expected from 2003 to foreseeable future. It is not impossible to expect financial improvement of the Apa Canals in the study area within five to six years.

By the reduction of the tariff for enterprises, the water demand from enterprises will be increased because water quality from ACSB is far better than the water quality from the local wells. Then, the sales revenue of Apa Canals will increase and the operating cost will decrease. The rationalization will be accelerated by the improvement of financial position. Desperate situation will discourage the effort for improvement.

The new uniform tariff in Balti is 5.66 lei/m^3 for water supply, and 6.16 lei/m^3 including sewerage service. Monthly water and sewerage bill will be about 48 lei per family assuming the water consumption of 8 m^3 per family per month.

This new tariff is far higher than internationally accepted water tariff level of five percent of household income but the municipal council accepted this uniform tariff after the deliberation. This new tariff is the prerequisite for the water purchase from ACSB and the water quality improvement. Therefore, the new tariff must be maintained with resolved effort.

The collection rate from population is expected to decrease but overall total revenue is expected to increase substantially. Some pension recipients and low income population will not be able to pay the water bill but multiple water tariff corresponding to income levels should not be introduced. Every family's effort to new tariff must be the saving of water consumption if necessary. Welfare policy is the task of the administrative government and it should not be introduced into tariff structure. In order to maintain the full cost recovery, any cross-subsidy should be rejected.

It will take at least two years for the new uniform tariff in Balti to be rooted. During these two years, many resistance and objection to uniform tariff will be seen repeatedly but the retreat should not be allowed absolutely. After the revenue inflow increases, the rationalization of the operation and the introduction of management accounting etc. will be accelerated. The resumption of power supply and the stabilization of power supply will make operational issues improved.

(2) Financial Management of ACSB

The operational performance of ACSB in the period from 1 August 2000 to 1 June 2002 is shown in Figure 9.4, and the financial relationship between ACSB and the power supply company is shown in Figure 9.5. The unpaid power cost had been accumulating, and the power supply was cut off on 1 June 2002. Figure 9.6 shows the cost structure of ACSB. In comparison to the structures in Tokyo (Figure 9.7) and Nagano City (Figure 9.8) in Japan, the share of the power cost in the total cost is abnormally high.

As for the prospect on power supply, at least following several conditions must be satisfied. The involvement of the central government, especially the Ministry of Finance, is crucial. MECTD does not have the specific plan or power to solve the power supply issue at the present.

(1) The substantial portion of the current liability has to be paid.
(2) The result of new uniform tariff in Balti shows positive prospect.
(3) The assurance of future payment
(4) The repayment plan of the outstanding liability

As the 99 percent of water is sold to ACB, the positive and persuasive result in ACB's financial position is critical to the power supply to ACSB.

The major change during past one year is that ACB has become able to understand that the key factor on the power supply to ACSB is the tariff improvement at ACB. Until last year, ACB kept the position that the financial trouble of ACSB was not directly connected to ACB. And the purchase policy on the water from ACSB was not clear in the last year.

(3) Role of the Central Government

Formerly, the central government controlled 53 Apa Canals as the state enterprises. But now they have been transferred to the local governments, counties or municipalities. Some of them are further transformed into Joint Stock Companies. Now the department in charge of water supply and other utility services of the central government (MECTD) has only five staff members. But they are seeking new role as the central government. For example, they have established the committee to coordinate the tariff issues.

As written in the Master Plan, the role of the central government in this situation is as follows.

(1) To arrange the water budget to the budget organizations.
(2) To improve the tariff systems to recover the water supply costs.
(3) To coordinate multi-county project such as ACSB project.

During the past one year, the coordination between ACSB and ACB has been improved. As for the tariff systems, the local governments and individual Apa Canals seem to know the situation better than the central government. Therefore, the major task of the central government will be (1) above, i.e., the water budget issues and the coordination concerning the cumulative debts of Apa Canals that should be separated from the current liabilities. As for the tariff systems, the central government must promote uniform tariff system too. Higher tariff on the enterprises will decrease the demand from enterprises and will suppress the local economies.

(4) Arrangements for the Financial Issues

As for the financial rehabilitation, three phases were proposed in the Master Plan.

(1) To realize the tariff systems to recover the water supply cost (2003 - 2006).
(2) To realize the financial surplus (2007 - 2010).
(3) To repay the cumulative debt (2011 - 2015).

In this feasibility study, the Phase zero (2003 - 2004) should be added. The tasks of the Phase zero are: 1) to resume the operation of ACSB, and 2) to keep the stable operation of ACSB.

There are several preconditions for the power supply to ACSB. The key factor is the result of the introduction of the uniform tariff system in Balti. The remarkable revenue increase to support the sustainable payment for power bill of ACSB has to be realized. As ACB receives 99 % of the water from ACSB, the revenue increase in ACB is critical. This is the task for the year of 2003 and 2004.

The Phase One is from 2004 (later half) to 2005 (in case of Falesti and Riscani, until 2006). The task of the Phase One is to recover the water supply cost with water tariff. ACS has shown the profit in the first quarter of 2002. Both ACF and ACR have to realize the financial equilibrium until 2006. But during the Phase One, the repayment of the cumulative debt is very difficult. The central government has to try the cumulative liabilities to be transformed to long-term debts payable in installment.

The water from the new system that is planned in this feasibility study will come to Balti and Soroca in 2006 (in case of Falesti and Riscani, in 2007). The financial analysis to be presented later treats the water revenue of new facility from the year of 2006 (in Falesti and Riscani, from 2007).

If the finance of Apa Canals achieves equilibrium in the Phase One, then the financial management in Phase two will be favorable. While the water cost from ACSB is higher than the water cost from the existing wells, the demand by enterprises will increase due to the better water quality and uniform tariff system and the water supply cost of ACSB will decrease eventually. The stable operation of ACSB will facilitate the rationalization of the ACSB management. The real economic growth is expected at annual rate of 5 percent in foreseeable future and the tariff increase in proportion to the economic growth will be possible.

In the Phase Two, not only the financial equilibrium but also the financial surplus must be achieved for the improvement of the financial position. The financial surplus will be the resources for the repayment of the cumulative debts, which will be completed by 2015. The involvement of the central government is necessary for the conversion of the short-term debts to long-term debts or long-term bonds secured by the government.

Figure 9.4 The Financial Result of the Ten Months Operation of ACSB

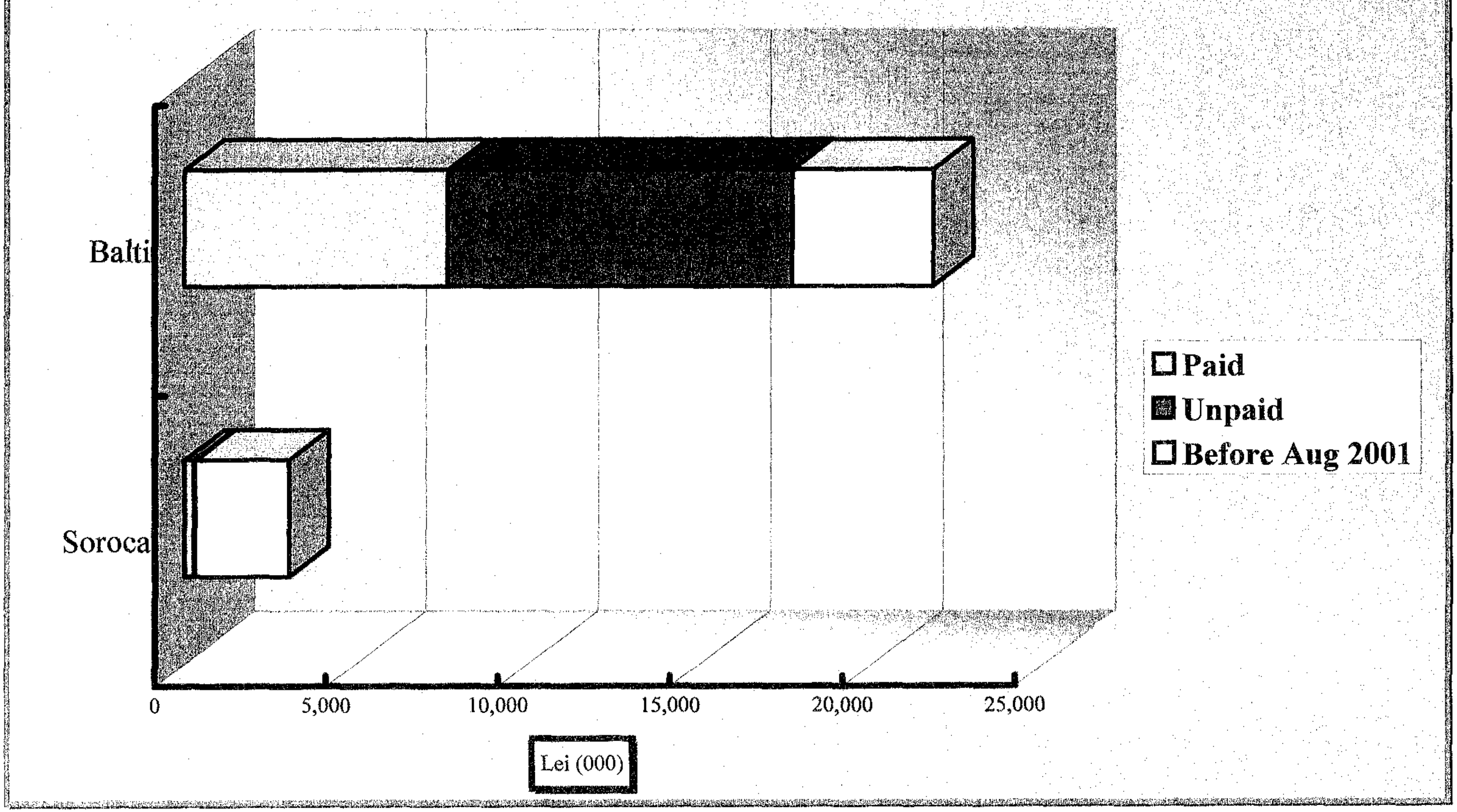


Figure 9.5 The ACSB Payment to RED Nord-Vest

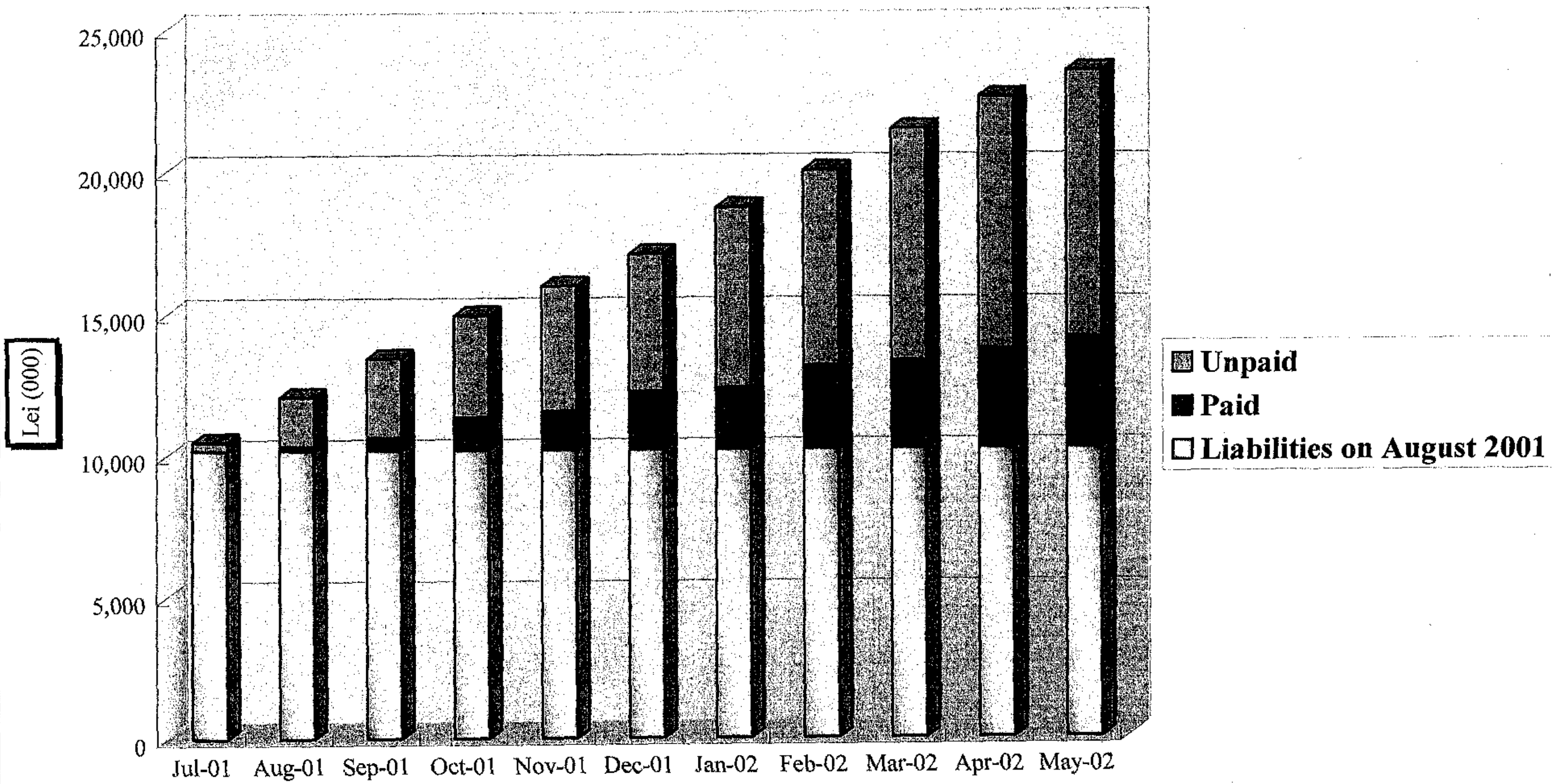


Figure 9.6 The Cost Structure of ACSB (2000)

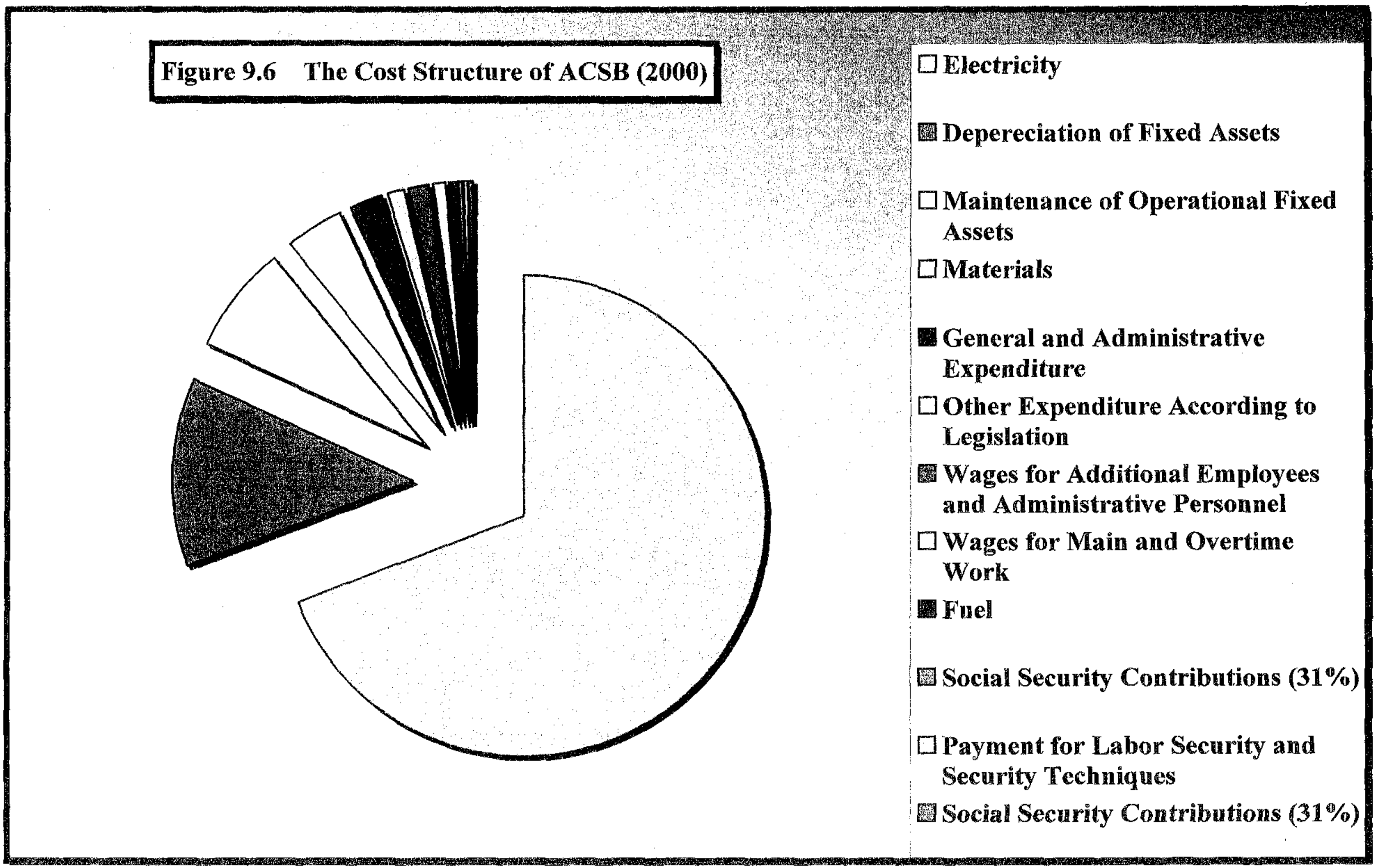


Figure 9.7 The Cost Structure of Tokyo Water Supply

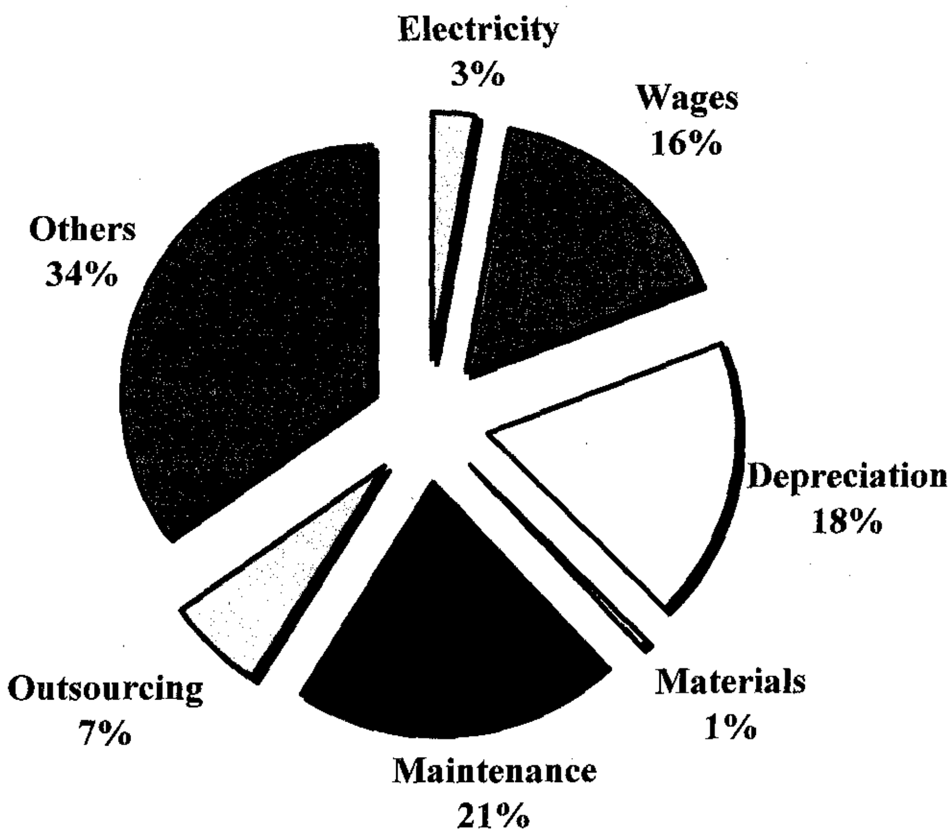


Figure 9.8 The Cost Strucuture of Nagano Water Supply