2.3 Water Sources and Water Quality

In this section, according to the data collection and results of field survey, the situation of water sources and their water quality conditions are described, and water quality problems are categorized.

2.3.1 Groundwater Sources and Quality

(1) Aquifer

The basic characteristics of Moldova's main aquifers are given in Table 2.3.1. Approximately 70 % of the groundwater resources are contained within the Baden-Sarmat formation, 10 % in the Middle Sarmat formation and 10 % in the Mel formation, the remaining 10 % being distributed over the other aquifers (Ref. 11).

(2) Extractable Amount of Groundwater

Data and information on groundwater flow in the northern part of Moldova are inadequate. However, the groundwater flow direction is generally, but not always, similar to the surface drainage pattern.

In general the extractable groundwater volume of a deep well may be calculated by the following Thiem formula. This formula is based on the assumption that the inflow from peripheral aquifer is equal to the extracted flow.

$$Q = \frac{2\pi \cdot k\ M(H-h)}{2.3\log_{10}(R/rw)}$$

where,

Q: Extractable Groundwater (m^3/s)

K: Coefficient of Permeability (cm/s)

H-h: Groundwater Level Fluctuation (m)

M: Thickness of Aquifer (m)

R: Influence Radius (m)

rw: Available Radius of Well (m)

No data have been available for the coefficient of permeability of the soil of the Study Area, but general figures are available from references such as that shown in Table 2.3.2.

Table 2.3.1 Characteristics of Main Aquifers in Moldova

Formation	Period	Thick-ness (m)	Average depth of wells (m)	Range of yield (m^3/h)	Main contaminants	Lithology /Comments
Gruntovi	Quaternary	2-20	10-15	0.05-0.12	NO_3, SO_4, Hardness, Microbiology TDS	Sand and Sandstone. Most private wells draw from this aquifer
Middle Sarmat	Neogene	20-30	100-300	2-10	Turbidity Sand Iron	Sand , sandstone with some clay horizons
Lower Baden -Sarmat	Neogene	30-50	NM=50 CM=100-200 SM=200-260	2-5	NO_3, SO_4, F, TDS, Hardness	Limestone with some sand horizons Moldova's main aquifer containing 70% of groundwater resources
Mel	Cretaceous Silurian	30-50	NM=50-100 NCM=150-200	2-100	F, TDS	Mainly sandstone with some limestone Exists in northern Moldova only
Upper Sarmat	Neogene	10	Generally 100, but 250 in Prut valley	3-10	Fine sand	Clay with sand lenses. Local aquifer in southern Moldova
Pont	Neogene		Ditto	5-10	Fine sand	Sand with limestone horizons. Local aquifer in Southern Moldova

Legend: NM= Northern Moldova; CM= Central Moldova; SM= Southern Moldova; NCM= North-Central Moldova
Source: Ref. 11

Table 2.3.2 Estimated Coefficient of Permeability of Soil

	Clay	Silt	Micro Sand	Fine sand	Middle sand	Coarse sand	Fine gravel
d (mm)	0.00~0.01	0.01~0.05	0.05~0.10	0.10~0.25	0.25~0.50	0.50~1.0	1.0~5.0
K(cm/s)	3×10^{-6}	4.5×10^{-4}	3.5×10^{-3}	1.6×10^{-2}	8.6×10^{-2}	3.4×10^{-1}	2.8

Source: Japan Water Works Association, Guidelines for Design of Water Supply Facilities, 2000.

As a trial estimation, it was assumed that permeability coefficient values for the soil of the extracting points in the Study Area are 1.6×10^{-2}cm/s (fine sand) and 8.6×10^{-2}cm/s (middle sand), and the thickness of the aquifer is 80m, and the fluctuation of groundwater level is kept around 10 - 20 cm. The calculated extractable groundwater volumes of wells are shown in Table 2.3.3.

Table 2.3.3 Estimated Extractable Groundwater Volume in the Study Area

	K	M	H-h	R	rw	Q
Area	(cm/s)	(m)	(m)	(m)	(m)	(m^3/day)
Soroca	1.6×10^{-2}	80.0	0.2	25.0	0.25	301.96
Balti	8.6×10^{-2}	80.0	0.1	25.0	0.25	811.53
Falesti	1.6×10^{-2}	80.0	0.2	25.0	0.25	301.96
Riscani	1.6×10^{-2}	80.0	0.2	25.0	0.25	301.96

The extractable amount of shallow well is reported (Ref. 1). Base on this report, the extractable amount of shallow well in the Study Area is considered to be limited to below 0.5 m^3/hr. While, the aquifers underlying the alluvial plains of the Nistru and Prut Rivers, being fed from water infiltrating from the flood plans and rivers, and having greater permeability due to its coarser lithology, have greater potential with yields in the order of 5 to 15 m^3/hr.

The shallow wells in the Study area are widely utilized for private and community water use. These shallow wells in the central areas of the cities/towns are compensating the insufficiency of central water supply systems. Through the water quality survey, however, it was found that one shallow well in the densely populated area in Falesti has now much smaller yield than before as a result of over extraction.

The groundwater potential has not been estimated precisely, but it can be said that the extraction of groundwater in the Study Area needs more careful consideration from the following points of view.

- It seems that the exploitation of groundwater in the 4 cities/towns has been already at high level.
- The excess of potential evaporation over precipitation is around 180 mm/year or more in the Study area.
- In the Study Area generally, shallow well waters contain minerals and nitrates with much higher concentrations than those of deep well waters. Excessive extraction of deep well water may cause groundwater flow from the upper aquifer, and thus increasing concentrations of minerals and nitrates.

The extractable amount is limited by meteorological, topographic and geological condition. It is clear that the over exploitation of groundwater causes serious problems in extractable amount and groundwater quality.

(3) Quality of Groundwater

At present, the water supply systems in the towns of Falesti and Riscani use deep well water as water source, and the pumped groundwater is supplied to consumers without disinfection. The situations were the same for the cities of Balti and Soroca until August 2001 when the operation of the Soroca - Balti pipeline was resumed.

The qualities of deep well water and shallow well water were surveyed in the current Study. Detailed results are presented in the Supporting Report. The quality data have been evaluated against the relevant standards and criteria: deep well water against the quality standards for drinking water of the centralized water supply, and shallow well water against the quality standards for drinking water of non-centralized water supply. The results are summarized below (also refer to the Supporting Report).

Number of Unsatisfactory Samples of Groundwater (Deep well)

Items	Balti	Soroca	Riscani	Falesti
Color	6/9	0/4	0/3	3/3
Total Solids	1/9	0/4	3/3	3/3
Ammonia	8/9	0/4	3/3	2/3
Nitrates	0/9	1/4	0/3	0/3
Fluorides	7/9	0/9	3/3	3/3

Note: number of unsatisfactory samples / total number of samples

For the most of deep well waters in Balti, Riscani and Falesti, values of color, total solids, ammonia, and fluorides exceeded the standards for drinking water in the centralized water supply.

The water quality of deep wells in Soroca met the standards except for the nitrates concentration of one well.

Number of Unsatisfactory Samples of Groundwater (Shallow well)

Items	Balti	Soroca	Riscani	Falesti
Total Hardness	3/3	2/2	2/2	2/3
Total Solids	3/3	0/2	2/2	3/3
Nitrates	3/3	2/2	2/2	2/3
Sulfates	1/3	0/2	0/2	1/3
Fluorides*	1/3	0/2	0/2	1/3
E.coli	0/3	0/2	0/2	2/3

Note: number of unsatisfactory samples / total number of samples
*: using the Water Quality Standard for centralized water supply

For the almost of shallow well water samples, values of total hardness, total solids and nitrates exceeded the quality standards for drinking water in the non-centralized water supply. High values of sulfates, fluoridse and E.coli were observed in some wells.

The bacteriological contamination (total colifroms) was observed in the most of shallow wells and some of deep wells.

Concentrations of total hardness and nitrates, and bacteriological contamination are higher in shallow wells than in deep wells. However, concentrations of ammonia and fluorides were higher in deep wells.

(4) Quality of Supply Water

At the time of the water quality survey, the water supply systems in all the four cities/towns were using deep or shallow wells as water source, and the pumped water was supplied to consumers without disinfection. Therefore, the problems of tap water quality are roughly the same as the problems of well water. The survey result of tap water is summarized below (also refer to the Supporting Report).

Number of Unsatisfactory Samples of Tap Water

Items	Balti	Soroca	Riscani	Falesti
Color	2/6	0/4	0/3	1/1
Turbidity	0/6	1/4	0/3	0/1
Total Solids	5/6	0/4	3/3	1/1
Ammonia-N	0/6	0/4	2/3	1/1
Sulfate	4/6	0/4	0/3	0/1
Fluoride	3/6	0/4	3/3	1/1
T-microbes	2/6	0/4	0/3	0/1

Note: number of unsatisfactory samples / total number of samples
*: using the guideline of WHO

2.3.2 Surface Water Sources and Quality

(1) Quantity of River Waters

The main sources of surface water for water supply in Moldova are Nistru River and Prut River.

1) Prut River

Prut River forms the boundary between Moldova and Romania. The water resources of Prut River are evenly shared by the two countries (50% each by Moldova and Romania) in accordance with the convention of April 1, 1986 between Romania and the former Soviet Union (Ref. 23-2) and the treaty of October 1, 1993 between Apele Moldovei (then ACVA) and Apele Romane. In order to ensure an uninterrupted allocation of water for all the users, a reservoir of the Costesti-Stinca hydrosystem was constructed in 1978. The distribution schedule of the available river water sets forth the highest priorities to dispatch the water for drinking water supply to the population, and to maintain the minimum river flow of 17 m^3/s to satisfy ecological requirements. Maximum extractable amount of water is as shown below.

	Extractable Amount of Water (million m^3/y)	
	Normal year	Drought year
Moldova	1,450	910
Romania	1,450	920

Source: Apele Moldovei

Data for the water level of Prut River are shown in Tables 2.3.4.

Table 2.3.4 Water Levels of Prut River (at Taxobeni, 1946 - 1987)

	Average (m)	Maximum (m)	Minimum (m)
Water Level (amsl)	41.43	46.80	39.94
Difference from the average	0	+5.37	-1.49

Source: Apele Moldovei

Particular attentions should be paid to the difference between maximum and minimum water levels, the need to provide water intake structures such as weir, tower, gate or pipe to maintain minimum levels, and to ensure that the works are protected from floods.

In general, the water intake facilities are planned to take water at 0.3 m below the past lowest droughty water level. The past lowest droughty water level of Prut River is 1.49 m lower than the average water level.

It is recommended that the design lowest droughty water level be 2.00 m lower than the average water level with a level margin of 0.51 m from 1.49 m, i.e., the design water intake level be 2.30 m below the average level of the intake point.

Table 2.3.5 provides the data for the discharge rate from the Costesti-Stinca reservoir during 1979 - 2001, since the start of the operation of the reservoir. The minimum water discharge observed in this period ensures the water demands from the towns of Falesti and Riscani and nearby villages throughout any year: in the dry years, in the summer, and in the winter.

Table 2.3.5 Water Discharges in Prut River (at the Costeti-Stinca Hydrosystem to Taxobeni)

Year	Average daily discharge (m^3/sec)	Maximum daily discharge (m^3/sec)	Minimum daily discharge (m^3/sec)	
			Winter period	Summer period
1979	106,0	500,0	25,0	90,0
1980	125,0	530,0	30,0	35,0
1981	128,0	461,0	52,0	71,0
1982	90,1	440,0	33,0	48,0
1983	65,9	320,0	31,0	23,0
1984	82,6	692,0	25,0	39,0
1985	73,0	189,0	20,0	54,0
1986	46,9	142,0	17,0	40,0
1987	34,4	130,0	17,0	20,0
1988	86,1	575,0	22,0	61,0
1989	66,7	600,0	25,0	67,0
1990	41,8	143,0	24,0	34,0
1991	102,0	636,0	24,0	28,0
1992	66,1	202,0	31,2	36,0
1993	70,1	135,0	31,7	70,4
1994	51,3	204,0	22,4	32,0
1995	66,1	204,0	28,0	32,0
1996	247,0	518,0	34,0	39,0
1997	100,0	192,0	64,1	69,3
1998	117,0	605,0	36,5	62,1
1999	116,0	552,0	42,1	54,1
2000	61,7	140,0	25,0	39,3
2001	73,3	200,0	24,5	49,1
Average	**92,7**	**361,3**	**29,8**	**47,5**

Note : Minimum flow to be maintained by ecological requirement : 17 m^3/sec (11.5 m^3/sec before 1991)
Source : I. Burlaca, Head of Administration of Costesti-Stinca Hydrosystem

The daily minimum flow after the year 1991, when the minimum flow to maintain was determined as 17 m^3/s, was 22.4 m^3/s in 1994. Therefore, the Moldova's share of usable water in that day was:

$$(22.4\ m^3/s - 17\ m^3/s) / 2 = 2.7\ m^3/s = 233{,}280\ m^3/d$$

This amount is about 16 times the water supply demand quantity projected for the towns of Falesti and Riscani, and nearby villages together.

Considering the complete regulation of the water discharge from the Costesti-Stinca reservoir and the actual discharge data shown in Table 2.3.5, the uninterrupted water supply to the towns of Falesti and Riscani and nearby villages is ensured throughout any year, including the driest periods.

2) Nistru River

The flow of Nistru River is regulated by the reservoir of the Nistru Complex Hydrosystem in Novo-Dniestrovsk, located upstream from Soroca near the border between Ukraine and Moldova on the side of Ukraine. The regulatory capacity of the reservoir ensures the uninterrupted water supply to all the settlements in the catchment areas in Moldova and Ukraine. The water distribution schedule sets the first priorities to distribute the water for drinking water supply and to maintain a minimum flow of 80 m^3/s to satisfy ecological requirements in all the periods of the year.

Nistru River is used for navigation, water supply (water intake for the Soroca-Balti pipeline), irrigation (two irrigation schemes have been build in the Soviet era, but currently both are not in operation) and recreation.

According to the agreement between Moldova and Ukraine concluded on 28 November 1994 (Ref. 23-1), use of available water of the river is shared by two countries. Maximum extractable amount of water is as shown below.

	Extractable Amount of Water (million m^3/y)	
	Normal year	Drought year
Moldova	5,200	2,400
Ukraine	5,000	2,300

Data for the water level and the flow rate of Nistru River are shown in Tables 2.3.6 and 2.3.7, respectively.

Table 2.3.6 Water Levels of Nistru River (Soroca, 1946 - 1987)

	Average	Maximum	Minimum
	(m)	(m)	(m)
Water level	43.12	52.44	42.14
Difference from the average	0	+9.32	-0.98

Source: Apele Moldovei

Table 2.3.7 Flow Rates of Nistru River (at Soroca, 1991 - 1995)

Year	Daily Flow Rate				
	Average m^3/s	Maximum m^3/s	Minimum m^3/s		
			Summer	Winter	Year
1991	285	1,370	108	111	108
1992	261	882	108	137	108
1993	286	1,020	134	133	133
1994	215	631	119	107	107
1995	248	732	121	121	121
1996	303	1,030	126	112	112
1997	322	791	130	124	124
1998	436	1,645	132	152	132
1999	370	1,060	141	118	118
2000	259	1,153	123	116	116
2001	320	1,049	115	125	115
Average	300	1,033	123	123	118

Note: Minimum flow to be maintained by ecological requirement: 80 m^3/s
Source: Apele Moldovei.

The past lowest droughty water level of Nistru River is 0.98m lower than the average water level. This water level difference is smaller than that of Prut River. It can be said that the water level of Nistru River is more stable than that of Prut River.

From the data shown in Table 2.3.7, amount of the river water usable in Moldova is roughly evaluated as follows.

The 11-year daily minimum flow was 107 m^3/s in 1994, and the required minimum flow to be maintained is 80 m^3/s. Therefore, the Moldova's share of usable water in that day was:

$$(107\ m^3/s - 80\ m^3/s) / 2 = 13.5\ m^3/s = 1,166,400\ m^3/d$$

This amount is more than twelve times the projected water supply demand quantity for all the 4 cities/towns and peripheral towns/villages together. It is considered that stable water supply can be achieved in the region by taking water from Nistru River.

(2) Quality of River Water

Water quality of Prut River and Nistru River was surveyed in the current Study. Details of the survey result are presented in the Supporting Report. The results have been evaluated against the raw water quality standards for surface water (GOST 2781-84). Consequently, no serious problem was found in the water quality of the both rivers. Heavy metals and toxic chemical substances were not detected. On the other hand, color and total coliform values exceeded the standards as shown below.

	Nistru River		Prut River		Quality Standard	
Items	Average	Maximum	Average	Maximum	(Class 1)	(Class 2)
Color (grade)	29.7	35.6	31.3	60.6	35	120
COD (mg/l)	2.4	2.4	1.5	1.6	7	15
T-coli. (n/l)	$6.4x10^4$	$6.8x10^4$	$9.8x10^3$	$3.4x10^4$	$1.0x10^3$*	$1.0x10^4$*
BOD (mg/l)	1	1	1	1	3	5
NH_4 (mg/l)	0.11	0.11	0.08	0.10	-	-
NO_3 (mg/l)	9.0	9.0	4.2	5.0	-	-
PO_4 (mg/l)	0.05	0.05	0.03	0.04	-	-
SS (mg/l)	158	171	122	171	-	-

*: Lactozo-positive bacteria

The water quality monitoring of Nistru River was also conducted by the Environmental Inspectorate in 1998-1999. The yearly average BOD concentrations ranged from 1.5 to 2.5 mg/l at the point upstream from Soroca city, and 2.0 - 2.7 mg/l at the downstream. The concentration of ammonia was 0.15 mg/l at the upstream and 0.28-0.33 mg/l at the downstream, and nitrates ranged from 0.02 to 0.03 mg/l at the upstream, and from 0.04 to 0.13 mg/l at the downstream. These data indicate that Soroca city is an important source of pollution of Nistru River.

In summary, the waters of both Nistru River and Prut River generally meet the raw water quality standards of class 2 except for the microbiological parameter.

2.4 Present Water Supply Systems

2.4.1 Outline of Water Supply Coverage

(1) Outline in the Country

Water supply coverage in Moldova is 55% with higher coverage in urban areas and lower coverage in rural areas (17%). Before 1990, investments in the water sector were active, and water supply facilities expanded. However, since the independence of Moldova in 1991, new installation and expansion of water supply facilities have been deeply stagnated. Because considerably large part of water supply facilities in urban areas were constructed during 1950 - 1970, some of these old facilities have been abolished, resulting in contraction of water service areas, and therefore, decrease in the population in these localities. Added to this is sharp economic decline that brought about reduction of water consumption. Due to all these factors, national total consumption of water has been decreasing in recent years.

A study report "Improvement of Water Supply and Sewerage System for the Priority Regions of Moldova, 2000" (Ref. 1-1) reported that in 50 settlements of the population between 300 - 21,000, piped water service coverage was 30%. And in 13 towns and villages out of these 50, the coverage was 62% in urban areas, and 27% in rural areas.

(2) Study Area

1) Population Served

According to the data in 1998, the water supply coverage in the 4 cities/towns in the Study Area was 96% in Balti, 97% in Saroca, 50% in Falesti, and 27% in Riscani. With these cities/towns together, the service coverage was 67%. However, amount of water supply is less than the water demand because hours of water supply are limited, not 24-hour supply. In Riscani particularly, the served population decreased substantially as a result of stoppage of the supply to those households that did not pay water charges.

2) Water Consumption by Use

According to the statistical data of Apele Moldovei concerning water consumption by users, the water consumption in 2000 in the 4 cities/towns decreased drastically from the levels of 1990. The domestic consumption in 2000 decreased to 20% - 30% of the 1990 levels, and the industrial consumption in 2000 decreased to 20% - 45% of the 1990 levels. The domestic consumption was still in the decreasing trend during the year 2000. On the other hand, the industrial consumption is in the trend of recovery after the bottom in 1999. As a whole, it is considered that the water consumption trend during the year 2000 was level or slightly downward.

2.4.2 Apa Canal Balti

The following description applies to the situation before August 2001 when the operation of the Soroca-Balti water supply system was resumed. The existing water supply system in Balti is shown in Figure 2.4.1.

(1) Water Source

When groundwater is used as water source, 58 deep wells scattered over the city area are used. The depth and capacity of the wells vary widely: the depth being between 60 m and 280 m, and the capacity being between 10 m^3/hour and 160 m^3/hour. All the intake pumps are of the centrifugal submersible type. The power of the motors ranges between 8 kW and 65 kW. The pumps are operated without much problem. The oldest ones were made in 1956, and the most of the pumps are over 30 years of age. It is considered that these pumps have been maintained with good care including the period of out of operation when the Soroca - Balti pipeline system was in operation. However, the costs of maintenance and repair are considered to be increasing towards future.

In the case when the treated water from the Soroca - Balti pipeline is used, the water is received in the distribution reservoirs provided at a suburb site of high altitude. Since the total capacity of these reservoirs is not sufficient, additional reservoirs need to be provided.

(2) Water Supply Amount

When groundwater is the water source, the total water supply capacity is about 27,000 m^3/day. Supply of water to consumers is made during 2 periods in a day: 6:00 am - 11:00 am, and 6:00 pm - 11:00 pm.

In the case when the treated water from the Soroca - Balti pipeline is used, 24-hour supply is possible since the amount of the pipeline water is sufficient.

(3) Distribution Reservoirs

There are 14 distribution reservoirs corresponding to the scattered deep wells, having a total capacity of 24,000 m^3, more than a half of daily consumption. However, this capacity becomes insufficient when well water is not transferred stably under the condition of unstable electric power supply, as it is prevailing presently.

(4) Distribution Network

The total length of distribution pipes is said to be approximately 266 km. There is one distribution pumping station. In addition, a total of 30 lift pumps are provided at sites of high buildings such as apartment buildings. The pumps are in a power range of 4 kW - 250 kW, and operated under generally good maintenance conditions. The oldest ones are made in 1967. The most of the pumps are 23 - 34 years of age. It is considered that they have been under the good maintenance including the period of out of commission when the Soroca - Balti pipeline system was operated. However, most of them have reached economic life and need to be replaced sooner or later. About 1/3 of valves have small leakages, and they need to be replaced as leakages grow larger.

(5) Water Meters

Although pipe water is connected to about 36,000 households, only 14,500 households (40 %) are provided with water meters. The remaining connections should be provided with them as soon as possible.

(6) District Hot Water Supply

District hot water supply stopped in 1998. Apa Canal Balti considers that this service will never be resumed since required costs will be too large.

2.4.3 Apa Canal Soroca

The following description applies to the situation before August 2001 when the operation of the Soroca-Balti water supply system was resumed. The existing water supply system in Soroca is shown in Figure 2.4.2.

(1) Water Source

When groundwater is used as water source, 10 deep wells with 50 m depth extract groundwater flowing along Nistru River at a rate of about 3,500 m^3/day. All the intake pumps are of the centrifugal submersible type, having a lifting capacity of 25 m^3/h each and power of 11 kW - 16 kW. They have been operated without problems since 1973 except for the period when the Soroca - Balti pipeline was operated. It is considered that the pumps have been under good management of maintenance, but the operation and maintenance costs will be increasing towards the future.

In the case when the treated water from the Soroca - Balti pipeline is used, the water is received in the distribution reservoir located at the hill-top area, and distributed to the city areas.

(2) Water Supply Amount

When groundwater is the water source, about 3,500 m^3/day of water is supplied by the pumping operation of 19 hours/day. The pumping operation is stopped during the period of 0:00 AM - 5:00 AM to save the electricity cost. For a part of the city area where water can be supplied by the gravitational flow from the reservoir, the supply is made at 24 hours/day. There is a distribution pumping station where 3 units of 90 kW horizontal centrifugal pump are operated under generally good maintenance. These pumps were commissioned in 1993; only 8 years of operation by now. They can be used continually for a considerable period of time.

In the case when the treated water from the Soroca - Balti pipeline is used, no pumping operation is necessary since the water received by the reservoir on the hill-top can be supplied gravitationally for 24 hours/day. This case also enables expansion of water supply area.

(3) Distribution Reservoirs

There are distribution reservoirs at 2 locations. No.1 has one 2,000 m^3 reservoir, and No.2 has 2 of 2,000 m^3 reservoir, making a total capacity of reservoirs at 6,000 m^3. This capacity is sufficient since it is more than one day of the water demand.

(4) Distribution Network

The total length of distribution pipes is 69 km. Major materials of pipes are steel, cast iron and asbestos cement. These pipes are old and have not been replaced for more than 30 years. Incidents such as water leakage have been occurring at rates exceeding 1,000 times per year, and only ad-hoc measures have been taken. Since the distribution pipes have been deteriorated, they need to be replaced in orderly manner.

(5) Water Meters

About 26 % of the households connected to the supply network are provided with water meters, for which costs are borne by households. Since dissemination of water meters are the basis of healthy development and operation of water supply systems, installations of water meters should be promoted.

2.4.4 Apa Canal Falesti

The existing water supply system in Falesti is shown in Figure 2.4.3.

(1) Water Source

There are total of 21 deep wells. Nineteen (19) of them are located in the valley area in the north-western part of the town territory, and two are located in the south-eastern part of the territory. Among these, fifteen (15) wells are usable presently as water sources. Their average depth is about 180 m and total capacity is 1,200 - 1,500 m^3/day. All these 15 intake pumps are of the centrifugal submersible type. Power of each pump is considered to be relatively small at 4 kW - 8 kW. The most of these have been operated over 30 years and oldest ones were made in 1963. Although they have been maintained well to the present, they need to be replaced when groundwater is to be used continually as water source.

(2) Water Supply Amount

The water is supplied at rates of 1,200 - 1,500 m^3/day to 9,500 people or 50 % of the total population. In the south-eastern area, where water is supplied by the 2 pumps exclusively, the water is available for 24 hours a day. In the remaining large areas, water is supplied only intermittently. This is largely due to inability to pay electricity charges resulted from un-paid water charges of households and decreased number of large customers associated with shut-downs or reduced operation rates of factories. Intermittent supply is made by days and hours. Certain areas are supplied with water on Monday and Thursday, and others are supplied on Tuesday and Friday. Areas are also divided by supply hours: certain areas are supplied with water during 5:00 AM - 9:00 AM, and others are supplied during 5:00 PM - 9:00 PM. This supply scheme by area is applied in cyclic manner.

(3) Distribution Reservoirs

There are distribution reservoirs at 2 locations. No.1 has two 500 m^3 reservoirs, but one of them is out of use due to water leakage. No.2 reservoir has a capacity of 500 m^3. The total capacity of 1,000 m^3 is usable. This capacity is considered to be about half a day of supply amount. But it is not sufficient since peak demand is relatively high as the scale of the supply system is small, and pumping operation is unstable due to unstable power supply.

(4) Distribution Network

The total length of distribution pipes is 31 km and many of them were laid during 1980s. Materials of pipes used are: steel (25.1 km), asbestos cement (4.7 km), and cast iron (1.6 km). Distribution pumping stations are provided at 2 locations. A part of the distribution area exists where water is distributed by gravitational flow. The pumping station No.2 has 4 pumps of the horizontal, single-step, console type (power unknown). Their commission was in 1990 and relatively new with 11 years of operation. Some of valves have small leakages, and they need to be replaced as leakages grow larger.

(5) Water Meters

Nearly 80 % of the amount of supplied water is measured by flow meters installed at key points of distribution network, entrances to apartment buildings and specific residence areas. However, only 6 % of individual residences are equipped with water meters.

(6) District Hot Water Supply

Until 2000 hot water was supplied by the district system during the 5-months winter period of November through March. As the Ministry of Public Utilities was abolished in 2000, this service authority was transferred to the municipalities. The municipal public service corporation in Falesti is in financial trouble. Supply of water from Apa Canal Falesti stopped since the corporation could not pay the charges, and consequently, the service of supplying hot water has been stopped. There is no prospect of resuming the service, and it will be terminated.

2.4.5 Apa Canal Riscani

The existing water supply system in Riscani is shown in Figure 2.4.4.

(1) Water Source

There are total of 16 deep wells provided in various locations in the town territory. Their total water lifting capacity is 3,000 m^3./day. Three of these are out of commission, and presently, five (5) out of remaining 13 wells are used to provide 1,500 m^3/day of water, although all of the intake pumps in 13 wells are operable. The average depth of the wells is about 150 m. All of the pumps are of the centrifugal, submersible type. Power of each pump is considered to be relatively small at 4 kW - 8 kW. The oldest ones were commissioned in 1964, and most of the rest have been in commission over 17 years. Although they have been maintained well to the present, they need to be replaced in order of age when groundwater is to be used continually as water source.

(2) Water Supply Amount

The water is supplied at rates around of 1,500 m^3/day to 4,400 people or 27 % of the total population. From a peak of 3 years ago, the water supply population has been gradually decreasing resulting from the stoppage of supply to those who did not pay water charges and contraction of the supply area due to the super-annuation of distribution pipes. Electric power is supplied under the condition of one-month advanced payment of the power charge. Due to non payment of water charges and reduced operation of factories, Apa Canal Riscani is only able to pay advance payment for electricity worth for two days of operation, and to supply water in 2 days of a week: Wednesday and Friday. Still 24 hours supply in these 2 days is only possible for high apartment building in the central part of the town. One or two floored residences in suburb areas have supply of water from 8:00 AM to 11:00 PM.

(3) Distribution Reservoirs

Water distribution reservoirs are provided at corresponding locations of the deep wells. There are 2 distribution reservoirs of the capacity at 1,000 m^3 each, one 500 m^3 reservoir, and 2 reservoirs of the capacity at 250 m^3 each, making the total capacity of 3,000 m^3. This capacity is considered to be sufficient since it exceeds the daily supply amount.

(4) Distribution Network

The total length of distribution pipes is 27 km and the distribution of water has been made since 1950s. The distribution is mostly made gravitationally since the distribution reservoirs are located at sufficient height. But there is one distribution pumping station equipped with 2 pumps of the horizontal, single-step, console type (power unknown). These have been operated since 1980 and are reaching economic life to be replace before long. Some of valves have small leakages, and they need to be replaced as leakages grow larger.

(5) Water Meters

Nearly 100 % of the amount of supplied water is measured by flow meters installed at intake pumps and exits of distribution reservoirs. However, only 800 or 30 % of the individual residences connected to water supply pipes are equipped with water meters. The households not having water meters are charged at the rates which assume the water consumption of 300 liter/person per day. As a result, people dissatisfied with this rule tend to refuse payments of the water charges. Apa Canal Riscani is recommending those people to install water meters at their own cost so that water charges can be paid according to the meters.

(6) District Hot Water Supply

The district hot water supply was suspended in 1985, and there is no prospect of its resumption.

2.4.6 Apa Canal Soroca-Balti

(1) Outline of the Soroca-Balti Water Supply System

The Soroca-Balti water supply system was commissioned in 1984 to transmit treated water to the cities/towns of Soroca, Balti and Floresti and settlements along the Soroca-Balti pipeline. The water source is surface water from Nistru River. The originally planned total amount of water to be supplied was 182,000 m^3/d, which included 115,000 m^3/d for Balti, 39,400 m^3/d for Soroca, 21,200 m^3/d for Floresti and 10,700 m^3/d for other settlements along the pipeline.

The first stage of construction of the water treatment plant was started in 1976 and completed in 1980. Other water supply facilities, which are the water intake, pumping stations, transmission main and reservoirs, were completed in 1983. The operation of the water supply system was started in 1984. The amount of supplied water at that time was 90,000 m^3/d, which was a half of the initial plan, 182,000 m^3/d.

The 24-hour operation was continued until the end of May 2000. From June to September 2000 the system was operated intermittently and finally it was stopped on 26th September because of the discontinuation of power supply to the system due to its default to pay the power bills.

The operation was started again for a short time from August 2001 to June 2002.

The components of Apa-Canal Soroca-Balti water supply system are as follows:

- Water Intake (No 1 Pumping Station (PS-1))
- No 2 Pumping Station (PS-2)
- Water Treatment Plant (Clear water reservoir capacity: 3 x 3,000 m^3)
- No 3 Pumping Station (PS-3)
- No 4 Pumping Station (PS-4, Clear water reservoir; Altitude = +236.00m, Capacity = 2 x 2,000 m^3)
- Transmission Reservoir (Altitude = +303.00m, Capacity = 2 x 2,000 m^3)
- Receiving Reservoir (Altitude = +170.00m, Capacity = 2 x 6,000 m^3)
- Transmission Main; 2 x

ϕ 1020 mm	(Steel Pipe)	L = 8,500 m
ϕ 1220 mm	(Steel Pipe)	L = 32,800 m
ϕ 1020 mm	(Steel pipe)	L = 26,000 m
Total		L = 67,300 m

The plan and profile of the Soroca-Balti water supply system are shown in Figure 2.5.5 and 2.5.6, respectively.

(2) Water Treatment Plant

1) Treatment Processes

The water treatment processes consist of pre-chlorination, coagulation, flocculation, sedimentation, rapid filtration and chlorination.

Chlorine is injected to the raw water transmitted from the PS-2 before the water enters the contact chamber. The coagulant, aluminum sulfite $Al_2(SO_4)_3$ is also injected before the mixer where the coagulation proceeds.

The following figure shows flow diagram of water treatment process.

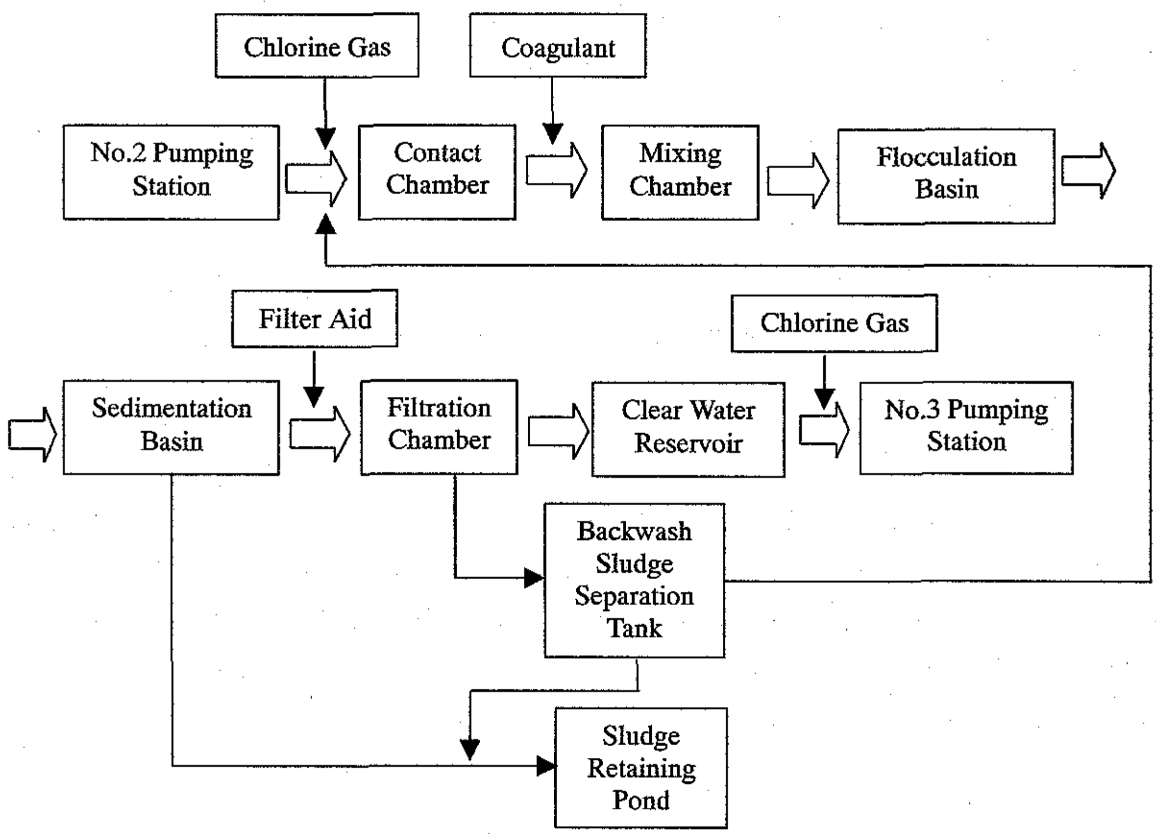


Figure 2.4.7 shows the plan of existing Soroca-Balti water treatment plant

2) Outline of Each Facility

(a) Flocculation Basin

Flocculation basins are of the horizontal roundabout channel type. All the flocculation basins are covered so they are not physically observed. Each basin is divided into three long compartments and two corridors of 6 m each. In each flocculation basin, water is distributed by means of two perforated steel receivers. The sediment extraction pipe is provided at the bottom of the middle part of sedimentation basin. Water passes from the flocculation basins to the sedimentation basins through a header channel.

(b) Sedimentation Baisin

The inside of the sedimentation basins are not physically observable because they are also covered.

The sedimentation basins are provided with perforated pipe laid at the bottom of the basins so that the sludge is to be drained out by opening the valves. There are two slopes inclined towards the center of the bottom of the basins, where the perforated pipes are laid. However, since the chambers do not have mechanical sludge collectors, so that the sludge is not collected and discharged efficiently. The accumulated sludge needs to be removed from the basins by manpower.

(c) Filtration Chamber

Filtration chamber is of a down flow type with single medium of sand. The filters are provided in two series, of which one series is operated currently. Each series consists of five filters with only one layer of sand with 1.8 - 2 m thickness. The filters have a central channel to discharge the backwashing water.

Problems will not occur if the filters function well during both filtration and backwash processes, even though the processes of coagulation and sedimentation are inefficient. A sufficient quality of filtered water is obtained insofar as the raw water quality is not abnormal. However, when the turbidity or color of raw water becomes high, the sufficient water quality will not be obtained without the efficient processes of coagulation and sedimentation.

(d) Elevated Water Tank for Backwashing

The elevated water tank for backwashing is cylindrical and appears to be superannuated as the whole outer wall is rusted. The capacity of the elevated water tank is 400 m^3 each, which is lifted water up by the pumps of the PS-3.

(e) Clear Water Reservoir

The filtered water flows into the clear water reservoirs by gravity. There are three clear water reservoirs in the water treatment plant. The capacity of each is 3,000 m^3. From the reservoirs water is pumped to the PS-4 via two pipes with the diameter of 1,220 mm.

3) Evaluation

The water demand in the study area for the design year of 2015 is estimated at around 93,000 m^3/day (see Chapter 3), including self-consumption in the treatment plant. The design capacity of Soroca-Balti water treatment plant is 180,000 m^3/day, so near one half of that capacity is not needed.

Since the plant construction was completed in 1980 and the plant was operated from 1984 to 2000, the economic lives of the pumps, blowers and valves of the plant, especially the equipment for coagulation, appear to expire soon. As outside walls of many pipes in the plant are badly corroded, the pipes may need to be replaced or painted in the near future. Though such replacements will be carried out year by year together with regular maintenance works, but painting will be done as soon as possible.

Both the filter backwash separation tanks and the supernatant water return pumps have never been used from the beginning. The equipment on these facilities must be replaced and a backwash wastewater treatment facility must be rehabilitated as soon as possible.

Regarding the electrical equipment and their associated matters, in order to safe operation and continuous production of the water treatment plant by reducing or eliminating system interruption, it is considered necessary to take the following actions as soon as possible:

1. To establish electrical preventive maintenance (EPM) programs, which are defined as managed programs of inspecting, testing, analyzing and servicing electrical systems and equipment. EPM relies on the knowledge of the electrical systems and equipment being maintained and on knowing operating experience, loss exposures, a potential for injury and maintenance resources.

2. Repair and fixing of the relay protection systems for all electrical equipment.

3. Control power source of the 10 kv switchgear must use direct current (DC) instead of alternating current (AC 220V); otherwise the issues of motor winding damage after instant power failure at 10 kV will not be tolerated.

For the control systems in the water treatment plant, the followings have to be refurbished and reconstructed in order to assure the necessary production and quality of water delivered to the consumers:

1. Dispatcher control system, controlling the water supply system based on control means, transfer orders and feedback of information.

2. Automatic control systems for the water supply system that includes use of the dispatcher control system with computer allowing calculation of the optimum parameters of the operation such as quality and efficiency. These automatic control systems are to be implemented only based on cost recovery program.

As for the concrete strength of substructure, the structures such as sedimentation basins, filtration chambers, control room and administration building in the water treatment plant, except the steel structures and the sedimentation columns, are not damaged. The concrete strength tests were performed using the Schmitt Hammer test. Most of the results of the concrete strength indicate a higher strength than the standard one. Only the sedimentation columns strength are under the standard, however those value is of 80 % of standard strength, they will not affect the structure.

Superstructures in the water treatment plant are made of bricks. Some of the mortar surface of the concrete is coming off and window glass is broken. These damaged portions must be reformed in order to keep the proper operation.

(3) Pumping Stations and Reservoirs

1) Outline of Pumping Stations

The raw water is conveyed to the Soroca-Balti water treatment plant from the PS-1 through the PS-2. The clear water reservoirs (3 x 3,000 m^3) and the PS-3 are located in the water treatment plant premise. A part of water in the clear water reservoirs is distributed to Soroca city by gravity. The PS-3 conveys the treated water to No.1 transmission reservoirs (2 x 2,000 m^3). On the way to No.1 transmission reservoirs, a part of water is also distributed to Soroca city under pressure. The PS-4 conveys the water further to No.2 transmission reservoirs (2 x 2,000 m^3). From these reservoirs to the receiving reservoir in Balti city, the water flows through one pipeline with the diameter 1,220 mm, 1,020 mm and length 20.3 km and 26.0 km, respectively by gravity.

Figure 2.4.8 and 2.4.9 show the plan of the water intake and the PS-2, respectively

2) Pumps at Each Pumping Station

There are three pumps in each 4 pumping stations. Two of them are for operation and the remaining one is for stand-by. These three pumps are identical and have one-stepped average pressure. The pumps are of a centrifugal type with horizontal frame and one operating wheel. These pumps were produced in 1980 and commissioned in 1984. The nominal certificated data of the pumps are as follows:

- Pressure: 90 m, Operating range 87-99 m
- Output: 78.3 m^3/min
- Operating range: 63.3-80 m^3/min
- Revolution: 950 r.p.m
- Input Power: 1250 kW

3) Evaluation

The air blowers for cooling at the PS-1 are broken and have been out of service for a long time.

The PS-2 has three booster pumps. Their operation is very difficult since, while the delicate hydraulic interlocking is required in the case of smooth boosting operation between the two pumping stations, there is no automation devices provided for such interlocking. During the operation, the operators communicate only through a telephone or a radio communication.

Since the mechanical facilities including pumps, cranes and valves of the four pumping stations were manufactured in or around 1980 and were operated from 1984 to 2000, the economic lives of the pumps, blowers, motor valves, cranes and other mechanical facilities are likely to expire soon. As outside walls of many pipelines in those pumping stations are badly corroded, the machines and pipes may need to be painted or replaced year by year together with regular maintenance works.

Although four pumping stations are different from each other in terms of required capacity, lift and location, the three pump units at each station have the identical specification as previously shown. This appears to be irrational, considering the different conditions of pump installation and operation.

The pump capacity is too large at the PS-1, 3, 4, and the pump head is insufficient at the PS-2. The pump efficiency is considerably lower than those made in other countries. The intake pumps, the booster pumps and the transmission pumps should be replaced to smaller and more efficient pumps.

Electrical power supply network of 35 KV and 10 KV feeders provide stability of power supply to the pumping stations PS-1, 2, 3, and 4. For PS-1, it is considered necessary to lay down one more cable or to construct one 10 KV overhead line from the 35/10 KV substation at Cosauti to PS-1, taking into consideration the stability of power supply, due to so many damage points in the cable feeders from the 35/10 KV substation to PS-1.

Regarding life assessment of metal-enclosed switchgear and 1250 KV synchronous motors for PS-1, 2, 3 and 4, the following measures will be considered necessary;

1. To perform major maintenance and testing
2. To establish newly replacement plan

(4) Problems Encountered at the Resumption of the Operation

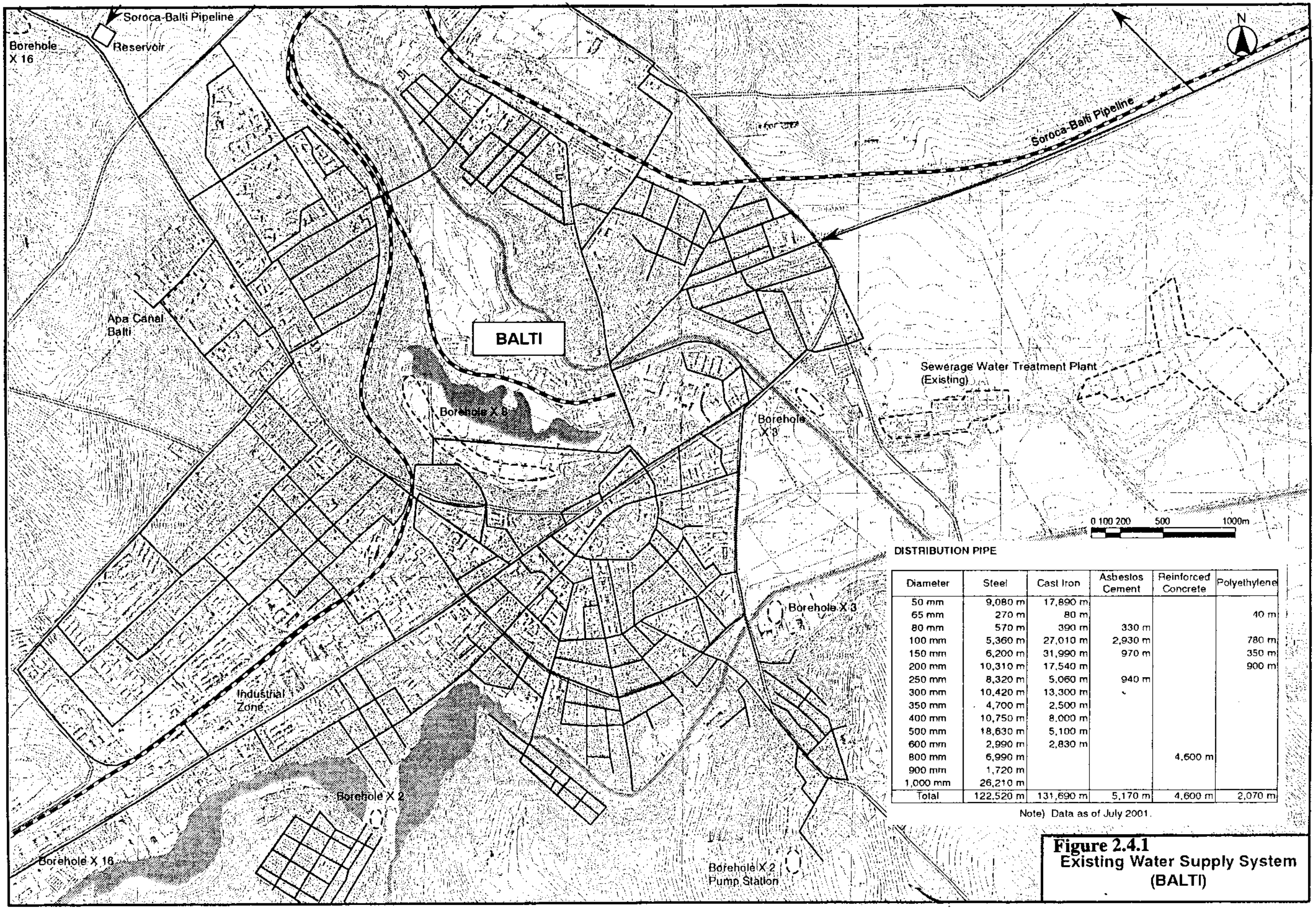
The Soroca-Balti Water Supply System resumed the operation in the summer of 2001. The test operations of water intake, treatment and transmission facilities by Apa Canal Soroca-Balti started on

20 July, while Apa Canal Balti and Ana Canal Soroca prepared their part to receive and distribute the pipeline water, instead of well water. The commercial operation of the whole system started on 3 August 2001.

Some technical problems were encountered at the initial stage of the resumed operation.

In the facilities of Apa Canal Soroca-Balti, the following problems occurred by 24 August:

- In the water treatment plant, a part of the filter bed of the rapid sand filter basin was broken and repairing work was under way.
- Chlorine injection pipe had a leakage, and it was replaced.
- The bearing and the relay of a pump in PS-1 were broken and replaced.
- On 24 August, the electricity supply, therefore, the water supply operation stopped in the morning because of non-payment of the electricity bill since the start of the test run. The operation resumed at night after the arrangement for the bill payment by Apa Canal Soroca-Balti and Apa Canal Balti.
- Because of the insufficient capacity of the distribution reservoirs in Balti, the water transmission operation had to be stopped sometimes with filling up of the reservoirs. This caused troubles in the operation of the treatment plant such as in the chlorination system that is not adaptable to intermittent operation since the operation is not controlled automatically.
- At the initial period of the resumed operation, there were frequent incidents of water leakage from distribution and service pipes in Balti. The leakage was as frequent as 40 times a day.

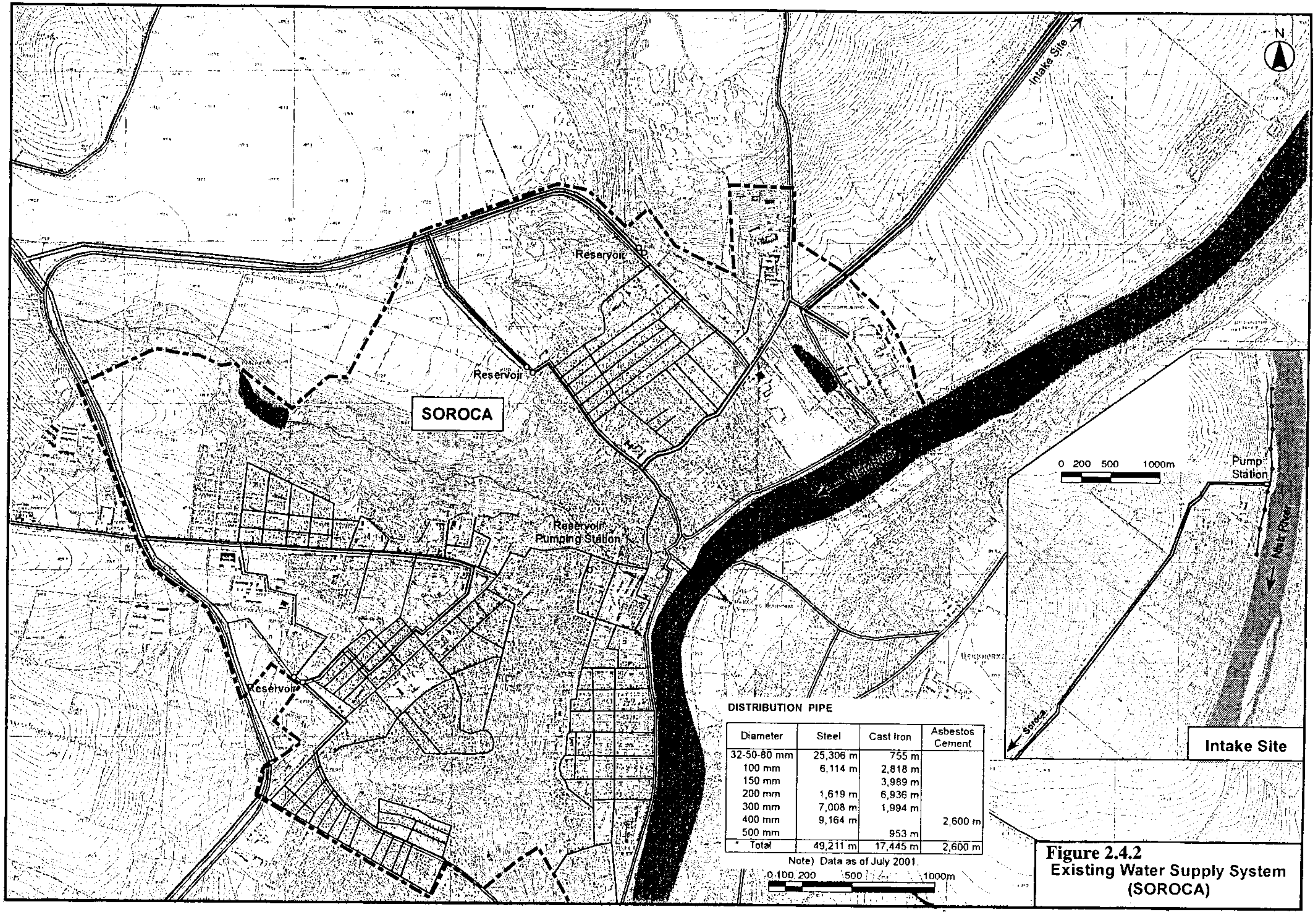


DISTRIBUTION PIPE

Diameter	Steel	Cast Iron	Asbestos Cement	Reinforced Concrete	Polyethylene
50 mm	9,080 m	17,890 m			
65 mm	270 m	80 m			40 m
80 mm	570 m	390 m	330 m		
100 mm	5,360 m	27,010 m	2,930 m		780 m
150 mm	6,200 m	31,990 m	970 m		350 m
200 mm	10,310 m	17,540 m			900 m
250 mm	8,320 m	5,060 m	940 m		
300 mm	10,420 m	13,300 m			
350 mm	4,700 m	2,500 m			
400 mm	10,750 m	8,000 m			
500 mm	18,630 m	5,100 m			
600 mm	2,990 m	2,830 m			
800 mm	6,990 m			4,600 m	
900 mm	1,720 m				
1,000 mm	26,210 m				
Total	122,520 m	131,690 m	5,170 m	4,600 m	2,070 m

Note) Data as of July 2001.

Figure 2.4.1
Existing Water Supply System (BALTI)

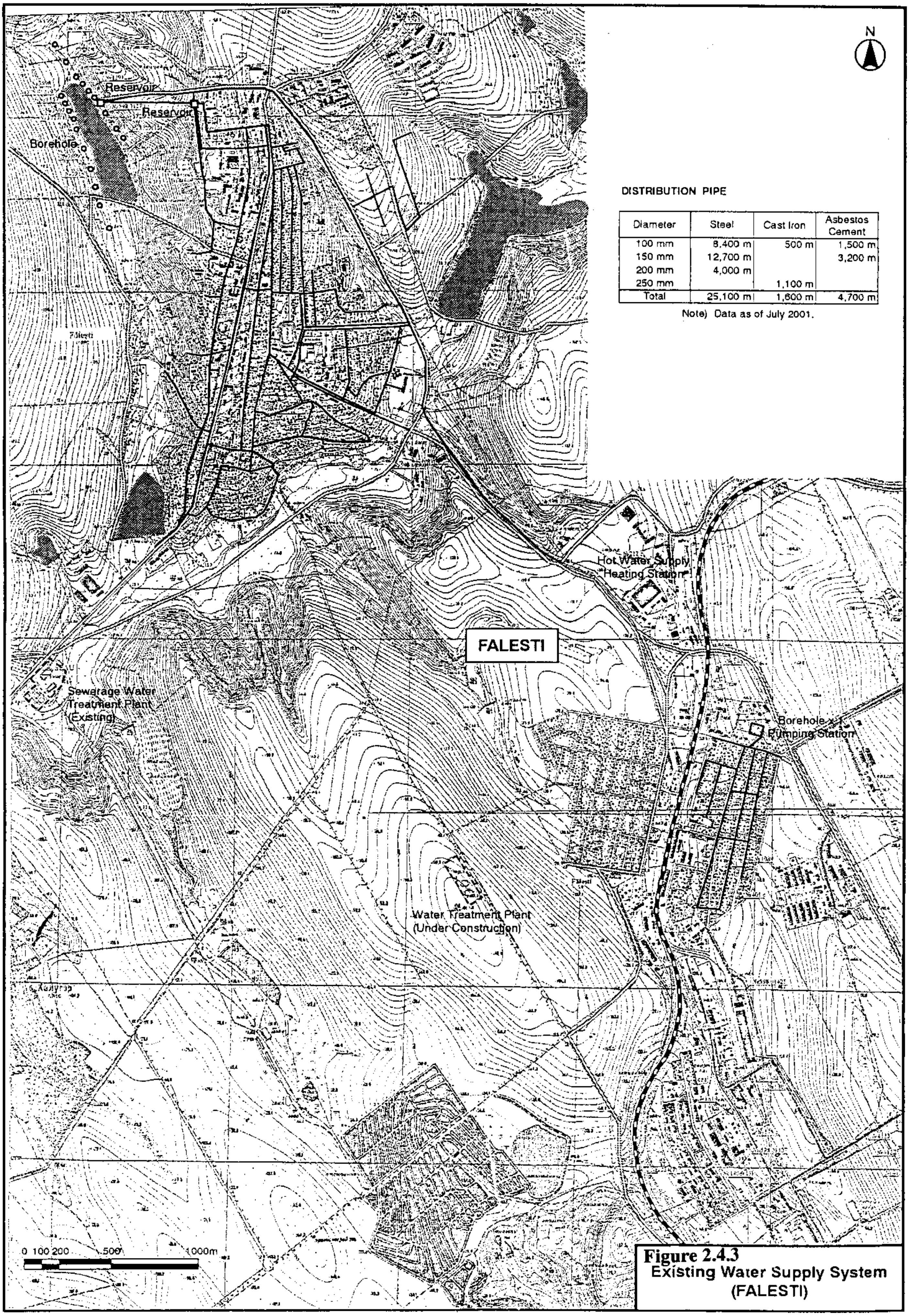


DISTRIBUTION PIPE

Diameter	Steel	Cast Iron	Asbestos Cement
32-50-80 mm	25,306 m	755 m	
100 mm	6,114 m	2,818 m	
150 mm		3,989 m	
200 mm	1,619 m	6,936 m	
300 mm	7,008 m	1,994 m	
400 mm	9,164 m		2,600 m
500 mm		953 m	
Total	49,211 m	17,445 m	2,600 m

Note) Data as of July 2001.

Figure 2.4.2
Existing Water Supply System (SOROCA)

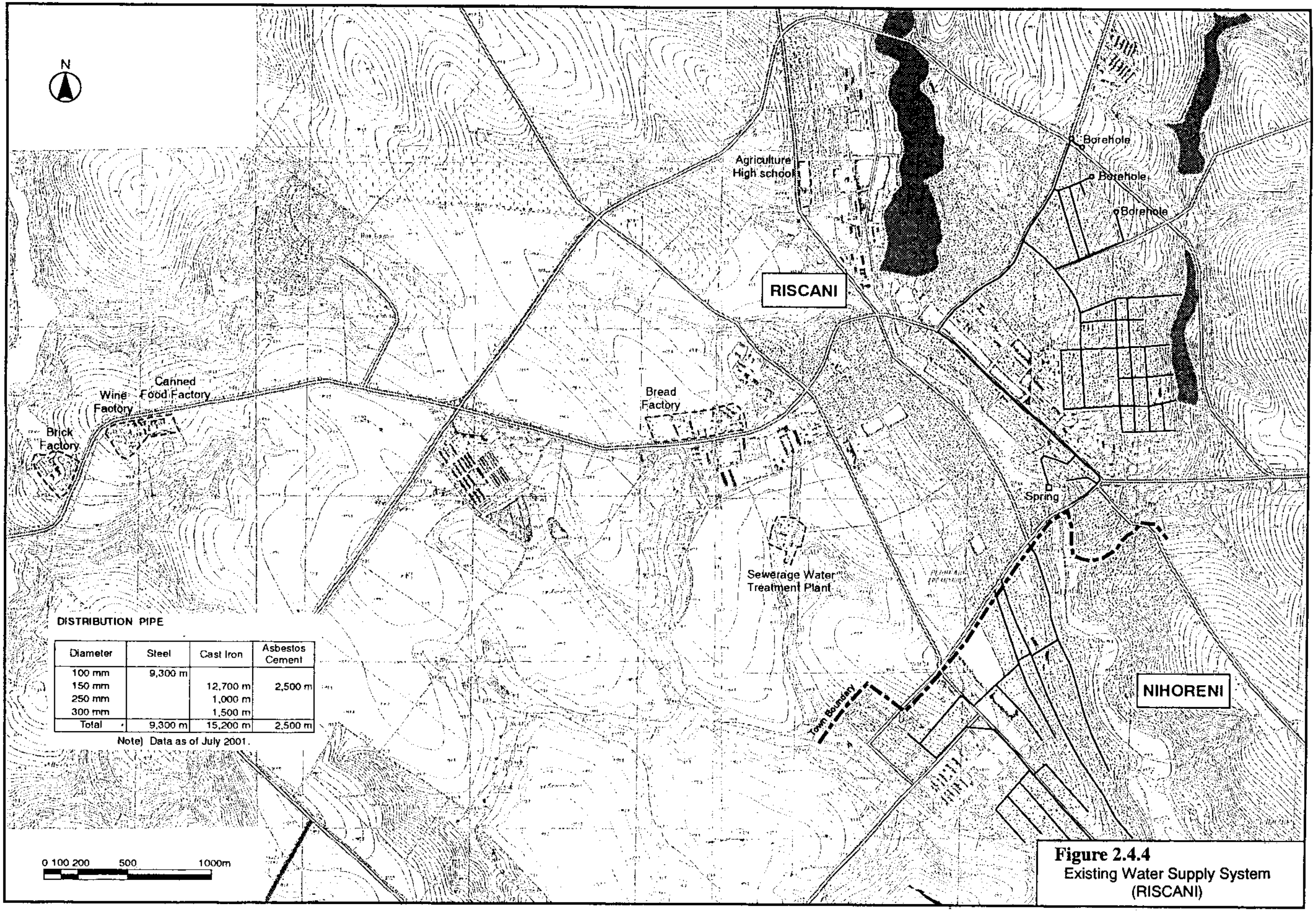


DISTRIBUTION PIPE

Diameter	Steel	Cast Iron	Asbestos Cement
100 mm	8,400 m	500 m	1,500 m
150 mm	12,700 m		3,200 m
200 mm	4,000 m		
250 mm		1,100 m	
Total	25,100 m	1,600 m	4,700 m

Note) Data as of July 2001.

Figure 2.4.3
Existing Water Supply System
(FALESTI)



DISTRIBUTION PIPE

Diameter	Steel	Cast Iron	Asbestos Cement
100 mm	9,300 m		
150 mm		12,700 m	2,500 m
250 mm		1,000 m	
300 mm		1,500 m	
Total	9,300 m	15,200 m	2,500 m

Note) Data as of July 2001.

Figure 2.4.4
Existing Water Supply System
(RISCANI)

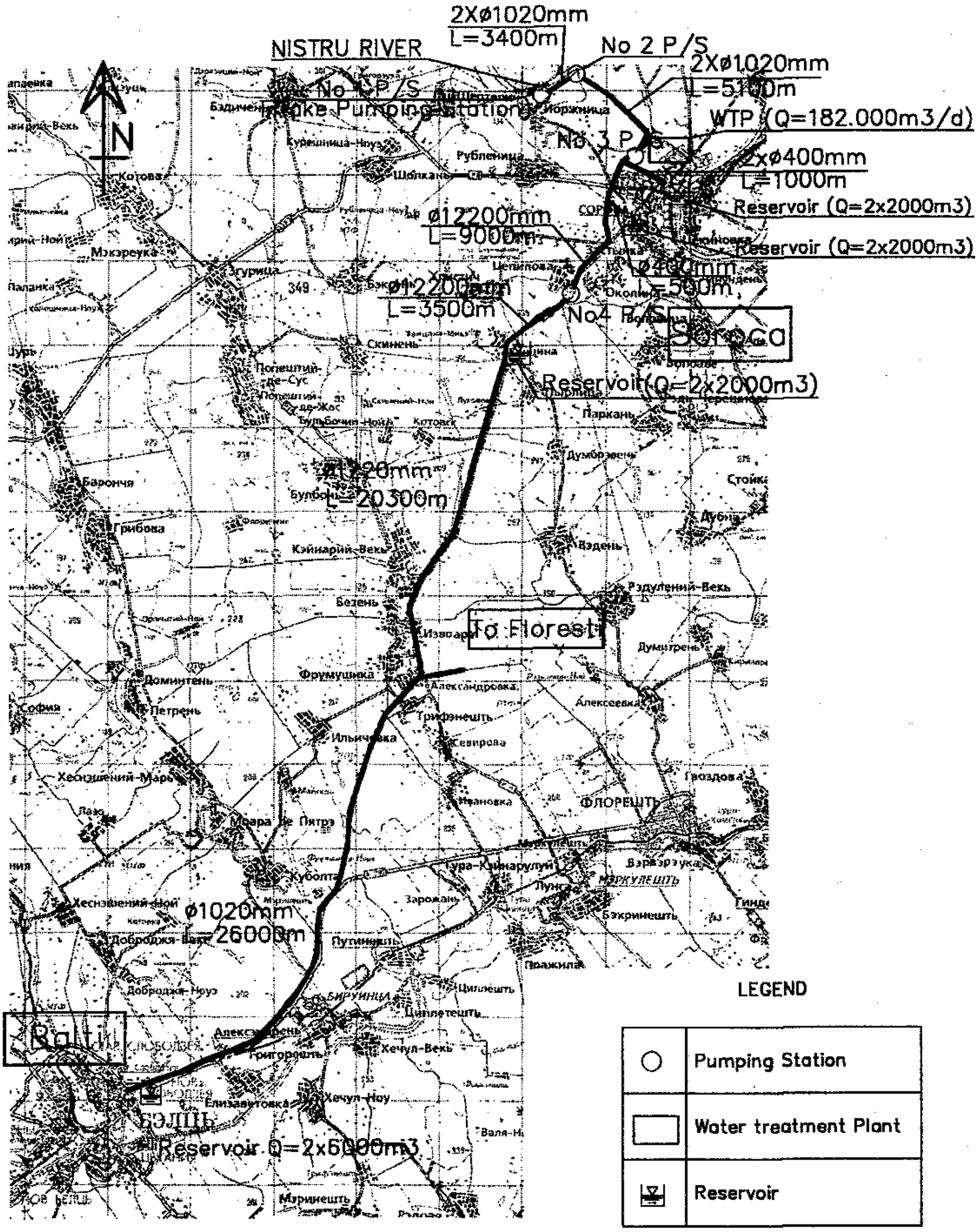


Figure 2.4.5 Plan of Existing Soroca-Balti Water Supply System

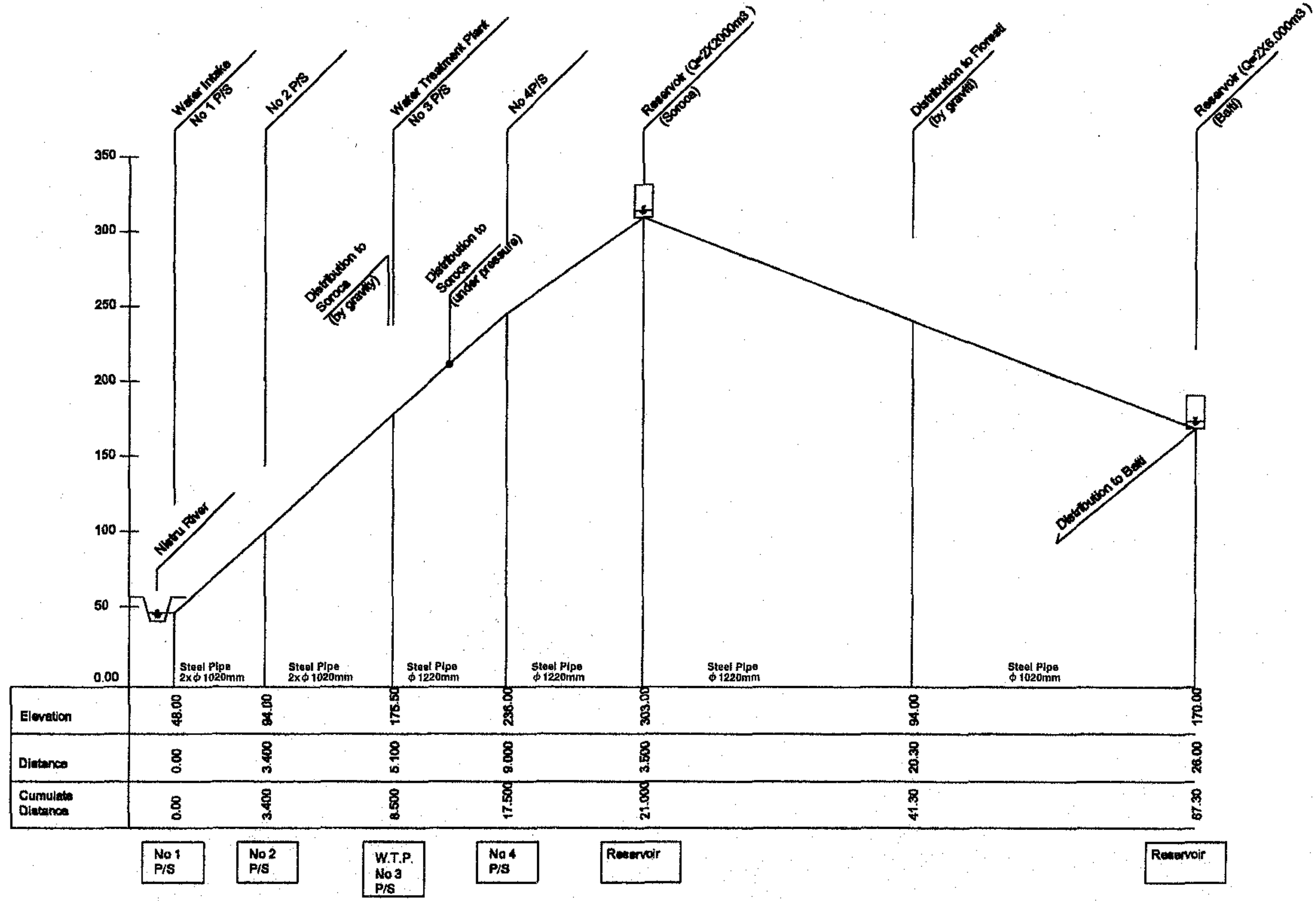
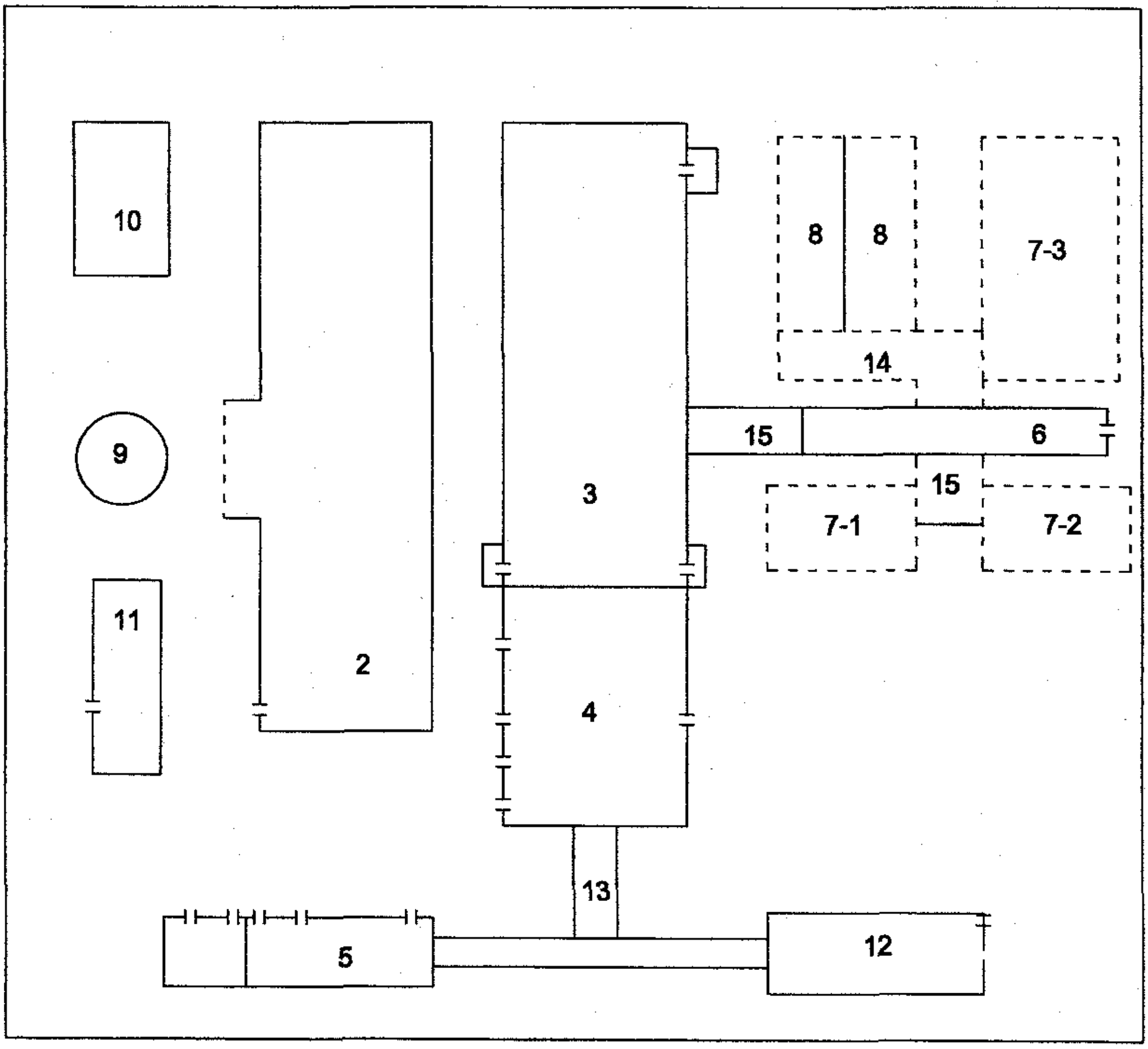


Figure 2.4.6 Profile of Existing Soroca-Balti Water Supply System



No.	Item
2	Sendiment tanks, chem. storage tanks
3	RSFs
4	Chemical dosing compartiment
5	Service shops
6	PS-III
7	Clear water reservoir 3000m3
8	Compensantion reservoir
9	Watertower for filter bakwashing
10	Chlorination 30 kg/h, 25m3 stonage
11	Boiler-house with coal storage
12	Administrative building
13	Junction Gallery
14	Repumping compartiment
15	Communications Gallery

Figure 2.4.7 Plan of Soroca-Balti Water Treatment Plant

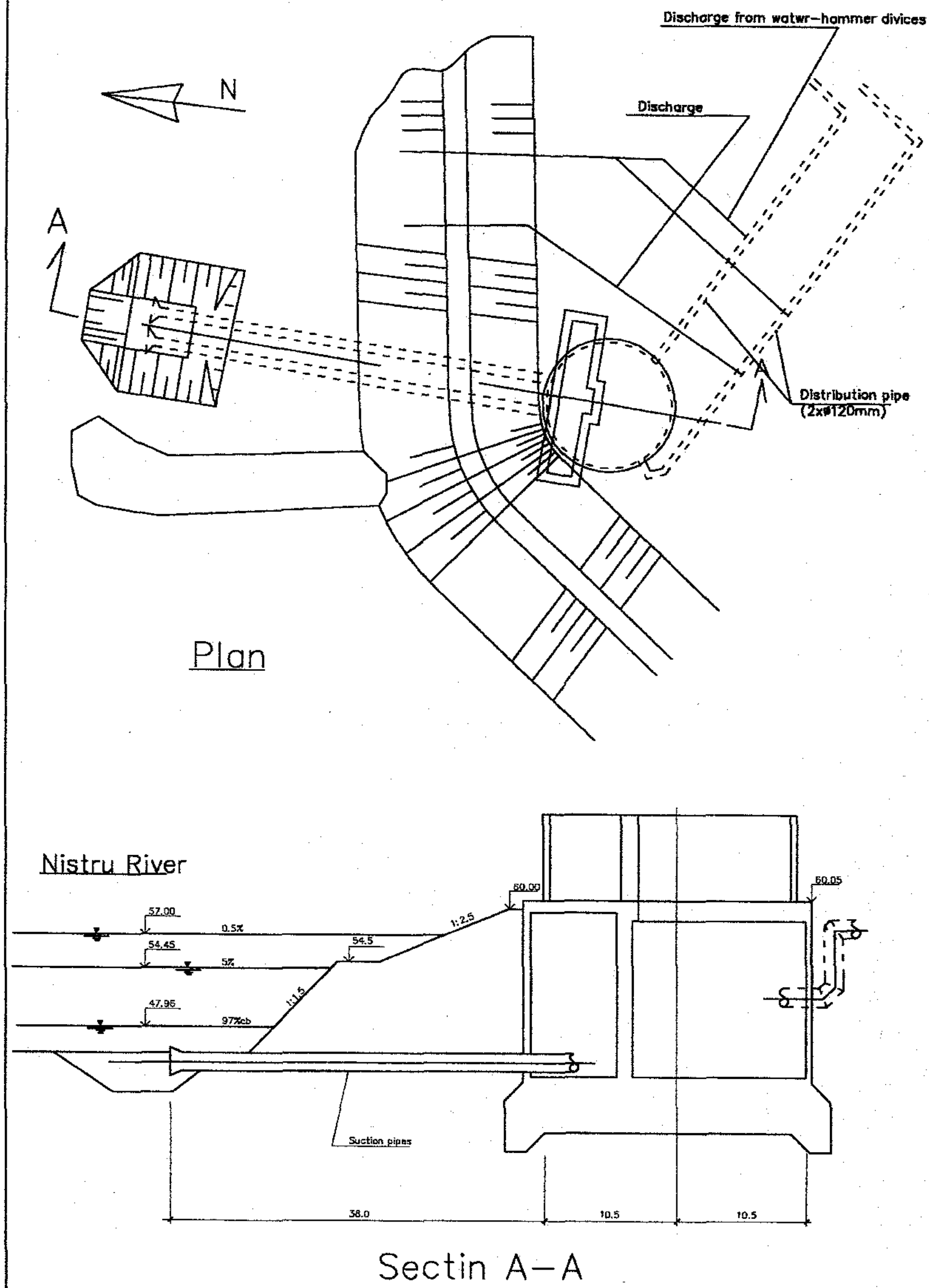


Figure 2.4.8 Plan and Section of Soroca-Balti Water Intake

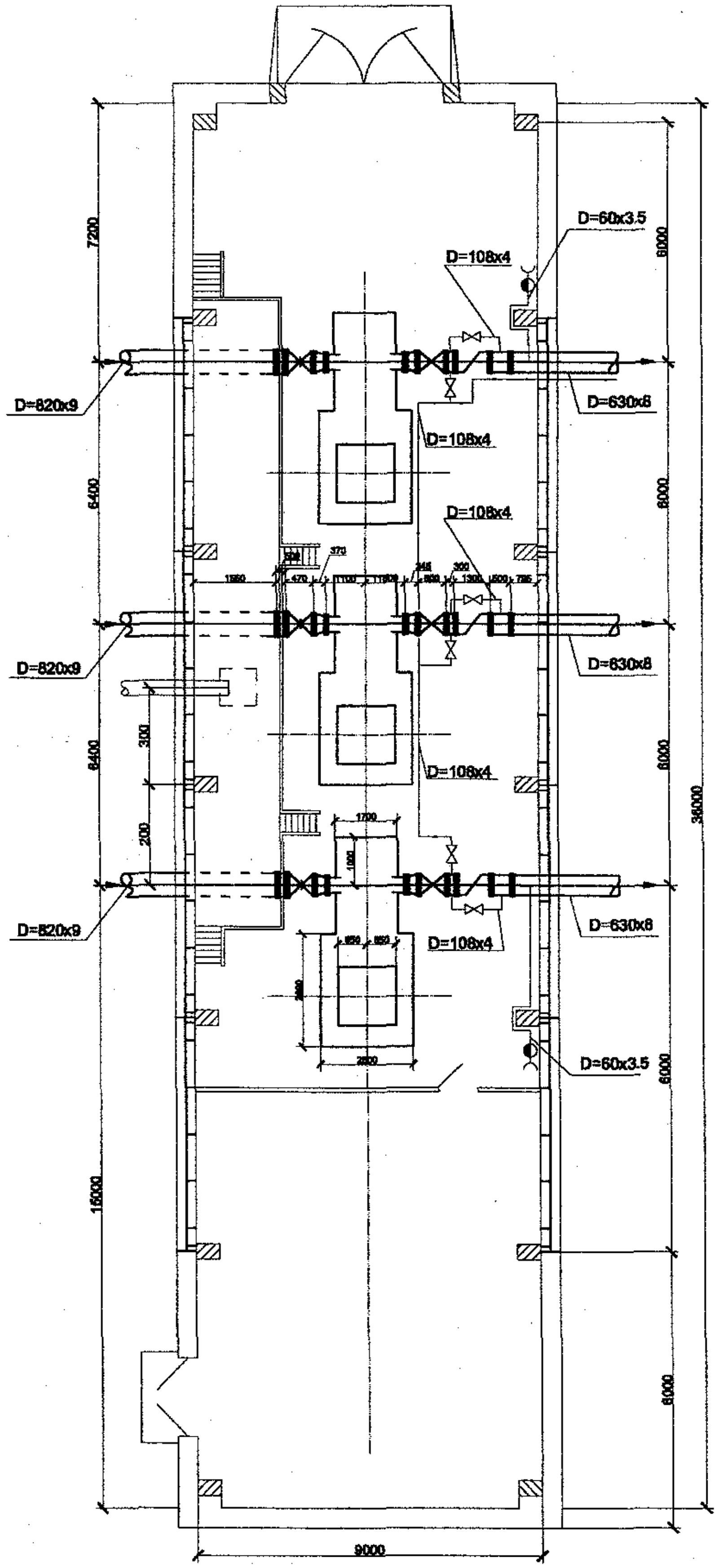


Figure 2.4.9 Plan of No.2 P/S for Soroca-Balti Water Supply System

2.5 Uncompleted Water Supply Facilities and Their Evaluation

2.5.1 Water Supply Facilities in Falesti

(1) Outline

Water quality from the boreholes in Falesti is characterized by the content of fluorine that is 3 times the maximum admissible concentration and the concentration of ammonia that is 2 times the maximum admissible concentration.

Under the above situation, the construction of Apa-Canal Falesti water supply facilities started in 1984 with the aim to supply water of the good quality for the population and irrigation; the water source is Prut River. The flow of water is as follows: the water from the Prut River enters the intake and is pumped by the No.1 and No.2 pumping stations (PS-I and PS-II) via the pressure main with the diameter of 920 mm and length of 21 km to the water treatment plant near Falesti town. Water is distributed for irrigation from two irrigation outlets. However, the construction works were stopped several years ago.

The components of planned water supply facilities for Apa-Canal Falesti are as follows,

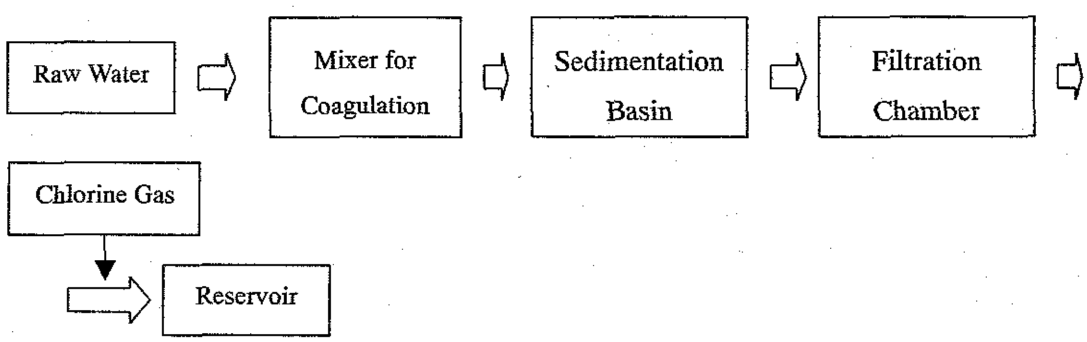
- Water Intake (PS-I)
- PS-II
- Water Treatment Plant
- Reservoir (Clear water reservoir, Capacity = 2 x 6,000 m^3)
- Transmission Main; ϕ 920 mm (Steel Pipe) L = 21,000 m

The plan of the system is shown in Figure 2.5.1.

(2) Water Treatment Plant

1) Treatment Processes

The water treatment processes consist of coagulation, sedimentation of the sludge-blanket type, rapid filtration and chlorination. The following figure shows flow chart of treatment processes.



In the water treatment plant, mechanical facilities, such as coagulant dosing pumps, flocculant dosing pumps and chlorination pumps are not installed. Only three backwash pumps and drainage pumps with respective motors are installed.

On the other hand, an administration building, a water treatment building, a chlorination house and an elevated backwash water tank are constructed in the premise of on the water treatment plant. Also there are two unfinished large reservoirs (2 x 6,000m^3) remained. However, all the concrete structures are unfinished and their mortar surfaces are coming off.

Figure 2.5.2 shows the plan of the designed water treatment plant in Falesti

2) Evaluation

The coagulation tank, which is made of steel and has never been painted, is badly corroded. The sedimentation tanks are of the sludge-blanket type, the design of which is different from that of the plants of Apa-Canal Soroca-Balti and Chisinau. It is construed that the sedimentation tanks in Falesti were designed with the sludge-blanket type after the lesson learnt from the operation of the sedimentation in the Apa-Canal Chisinau plant, where sludge discharging has never been carried out smoothly due to the inappropriate design.

The pipelines and valves without motors are installed between the concrete tanks, but the outside of the pipelines and valves is badly corroded. The existing mechanical facilities inside the house will probably work, however it seems to be very difficult to salvage this unfinished water treatment plant economically. The outside wall of backwash water tank is badly rusted. Also the concrete structures, some of which are broken and their mortar surfaces are coming off, can not be economically salvaged.

The electrical equipment and materials were installed at about 70 % and left as they were. It might be advisable that the water treatment plant needs to be provided with new equipment for revival of service since the current industry does not produce suitable parts and/or refurbishment of such equipment.

The design capacity of this plant is too large at 24,000 m^3/d, while the water demand in the Falesti area in year of 2015 is estimated about 7,000 m^3/d. It is very uneconomical to complete and operate this treatment plant.

(3) Water Intake (PS-I)

The water intake was built on the left bank of Prut River. It has only a substructure and a superstructure. The first is a concrete chamber to serve as an intake pump house. At present, half the depth of the house is under water. The quality of the concrete is poor and partly falling off because of aging and lack of maintenance. There is no mechanical equipment, electric panels and pipelines. The concrete stairs have no handrails, and steel stairs are badly corroded, so the structure of the water intake is out of use.

Three intake pumps and two traveling screens are retained outdoor in the premises of the water treatment plant. They have been left in the outdoor for 13 years from 1988, so the traveling screens are badly corroded. Since the intake pumping station is physically ruined, it cannot be salvaged economically.

All electrical equipment is dismantled and some of it is stored outdoor in the water treatment plant. 6 KV motors and 6 KV metal-enclosed switchgear for pumps are considerably corroded, damaged and partially dismantled so that they may not be used for service. Other equipments, such as power transformer, power capacitors, control transformers, 380/220V distribution panels and cables, is not stored in the water treatment plant

(4) PS-II

The doors and windows of the PS-II have been closed and welded in order to preserve the equipment and prevent stealing. It is said that all the equipment was installed in accordance with the final design documents and is in good condition for service.

However, since the current industry does not produce suitable parts for repair and/or refurbishment of such equipment, it's use for practical operation will be very difficult.

2.5.2 Water Supply Facilities in Riscani

(1) Outline

The source of water supply in Riscani has been mainly underground water. Artesian and shallow wells have been used. The quality of underground water does not meet the standard requirements of GOST. Therefore a new water supply system using Prut River water was planned to meet the water quality standard.

- The water supply system was started in 1988. Components of planned water supply facilities for the Riscani area are as follows:
- Water Intake (PS-I)
- PS-II
- Water Treatment Plant

- PS-III
- PS-IV
- Reservoir
- Transmission Main;

Transmission Main;	ϕ 500 mm(Concrete Pipe)	L = 23,000 m
	ϕ 500 mm (Cast Iron Pipe)	L = 2,800 m
	ϕ 500 mm (Steel Pipe)	L = 2,300 m
	ϕ 400 mm (Steel Pipe)	L = 1,600 m
	ϕ 300 mm (Cast Iron Pipe)	L = 4,300 m
	Total	L = 34,000 m

The plan of the system is shown in Figure 2.5.1.

(2) Water Treatment Plant

1) Treatment Process

The water treatment processes consist of coagulation, sedimentation by the sludge-blanket type settling tank, rapid filtration and chlorination. The design of the sedimentation basins is the same as that of the Falesti water treatment plant.

The construction of the water treatment plant was suspended in around 1988. All concrete structures are unfinished. Some of structures such as the main building, the chemical storage and the watchman's room have not been constructed. No mechanical and electrical facilities such as pumps, blowers, electrical panels, pipelines and valves were installed.

The plan of designed water treatment plant is shown in Figure 2.5.3.

2) Evaluation

The design capacity of this plant is too large at 21,000 m^3/day, while the water demand in the Riscani area in the year of 2015 is estimated at 7,700 m^3/day. Since this water treatment plant is too large for the water demand of Riscani, and no facilities have been installed and most of concrete structures are damaged by robbery and weathering, it appears that this water treatment plant cannot be salvaged economically.

(3) Water Intake (PS-I)

The intake pumping station is situated on the shore of the Costesti Stenka impounding reservoir.

The construction of the pumping station was interrupted in 1988. The pump house was made of rough looking reinforced concrete. There are no mechanical and electrical facilities and pipelines installed inside the house. It seems to be very difficult to salvage the intake pumping station economically.

(4) PS-II and PS-IV

Both of the PS-II and the PS-IV are of 6 m x 25 m at the exterior and the electric power switches, a WC and a room for the service personnel are also within in the building. It was designed to install 3 - 5 pumps, but no pumps have been installed. The structure is heavily damaged. It is not recommendable to rehabilitate these structures for use.

2.5.3 Distribution Reservoirs in Balti

There are uncompleted water distribution reservoirs at 2 locations in the city of Balti. One is located at the northeastern part of the city adjacent to the distribution reservoir presently operated by Apa Canal Balti. This unfinished reservoir has 2 basins, each of which having a capacity of 10,000 m^3. Another is located at the northwestern part of the city having 2 basins, each of which has a capacity of 6,000 m^3.

These reservoirs are made of pre-cast concrete parts: wall panels, pillars, and roof panels. They were almost completed when the construction works stopped, and remain relatively undamaged to the present. Since there is a serious shortage in the capacity of operable distribution reservoirs in Balti, these unfinished reservoirs can be effectively utilized after appropriate works for the completion.

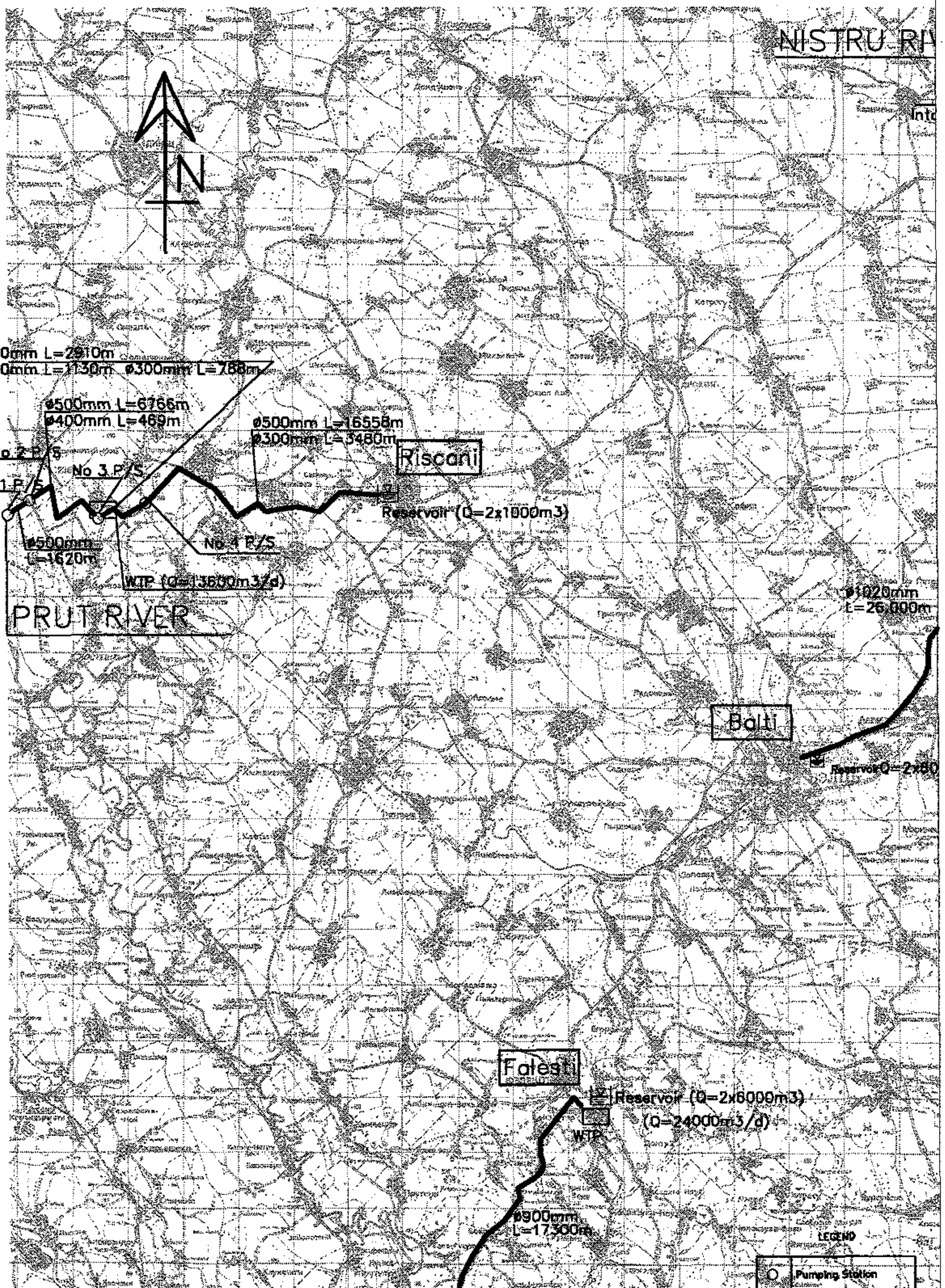
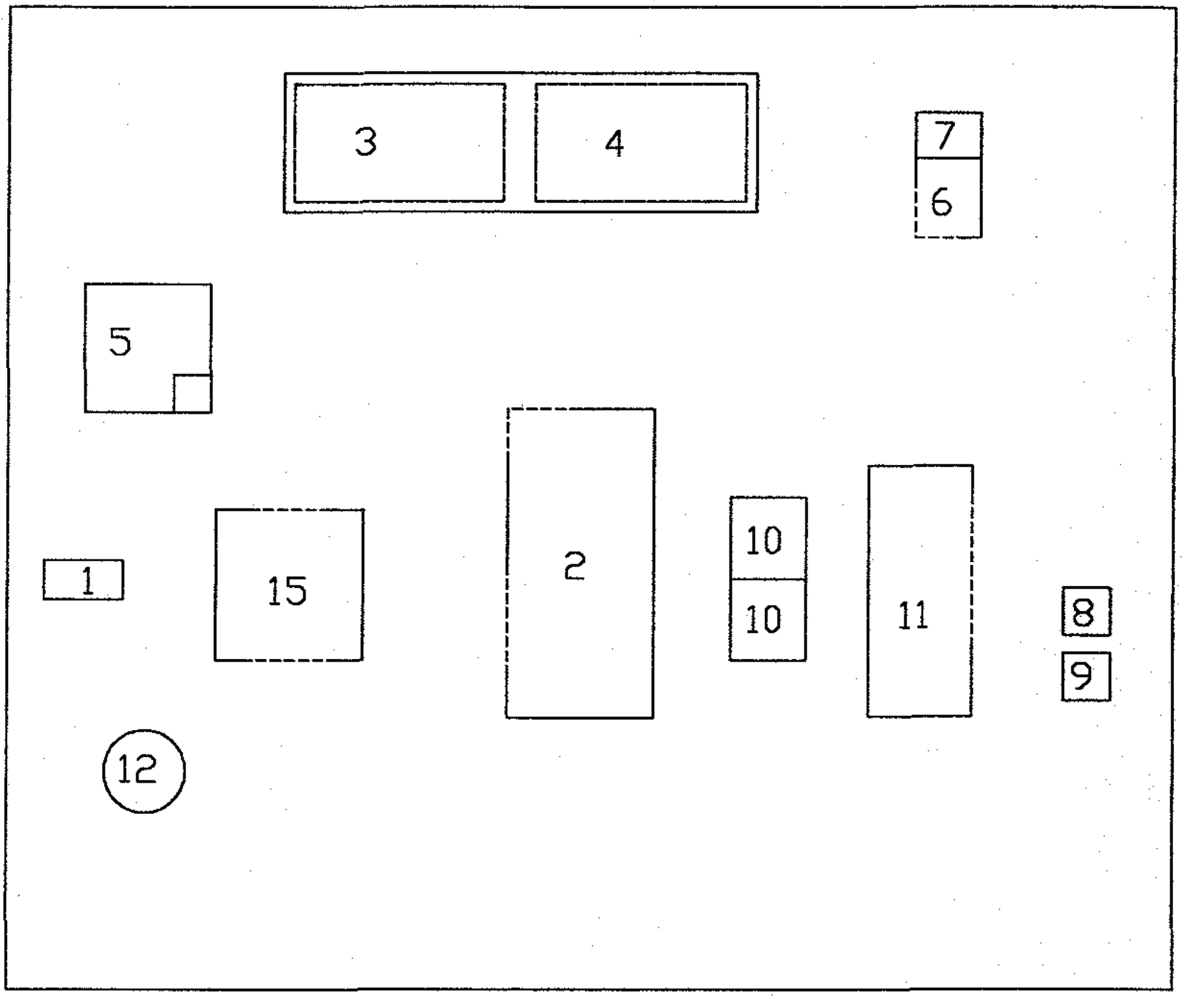
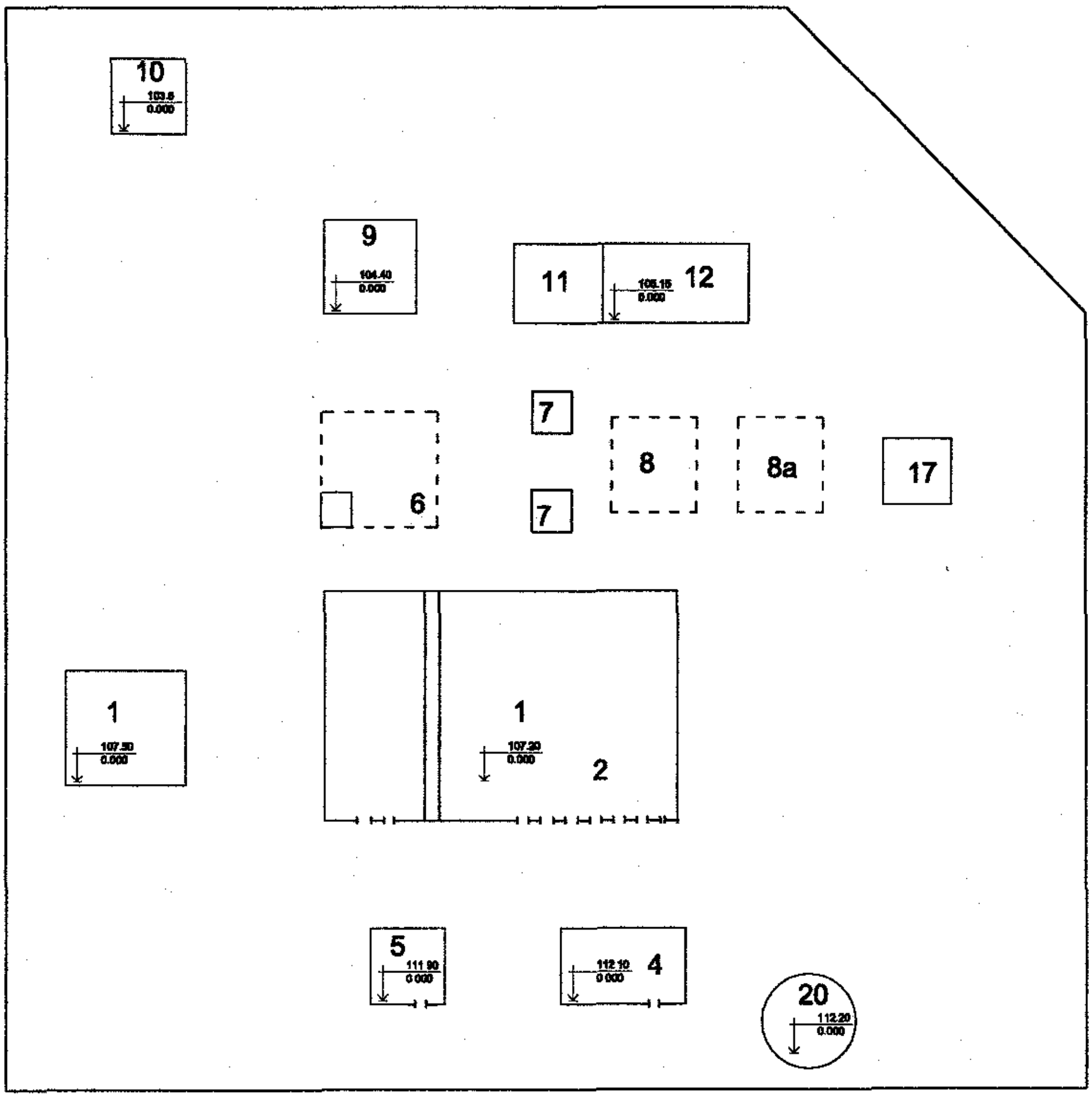


Figure 2.5.1 Plan of Uncompleted Water Supply System for Riscani and Falesti



No.	Item
1	Sedimentation and RSFS
2	Water treatment plant facility
3	Clear water reservoir
4	Clear water reservoir
5	Installation for secondary water use
	after filter cleaning
6	Chlorination chamber
7	Ammoniation room
8	Charcoal board
9	Board for ashes
10	Board for sand
11	Household block
12	Water tower for filter backwash

Figure 2.5.2 Plan of Designed Water Treatment Plant of Falesti



No.	Item
1,2	Sedimentation and RSFS
4	Chlorinating station
5	Ammoniation station
7	Air filter for clean water tank
8,8a	Clean water tanks, vol. 500m3
9	Transforming sub-station
10	Sewerage water pumping station
11	Boiler-house
12	Pumping station 3
17	Clear water tank 500m3
20	Water-tower 300m3

Figure 2.5.3 Plan of Designed Water Treatment Plant of Riscani