The next figure shows the water production for the years 2003 – 2008.

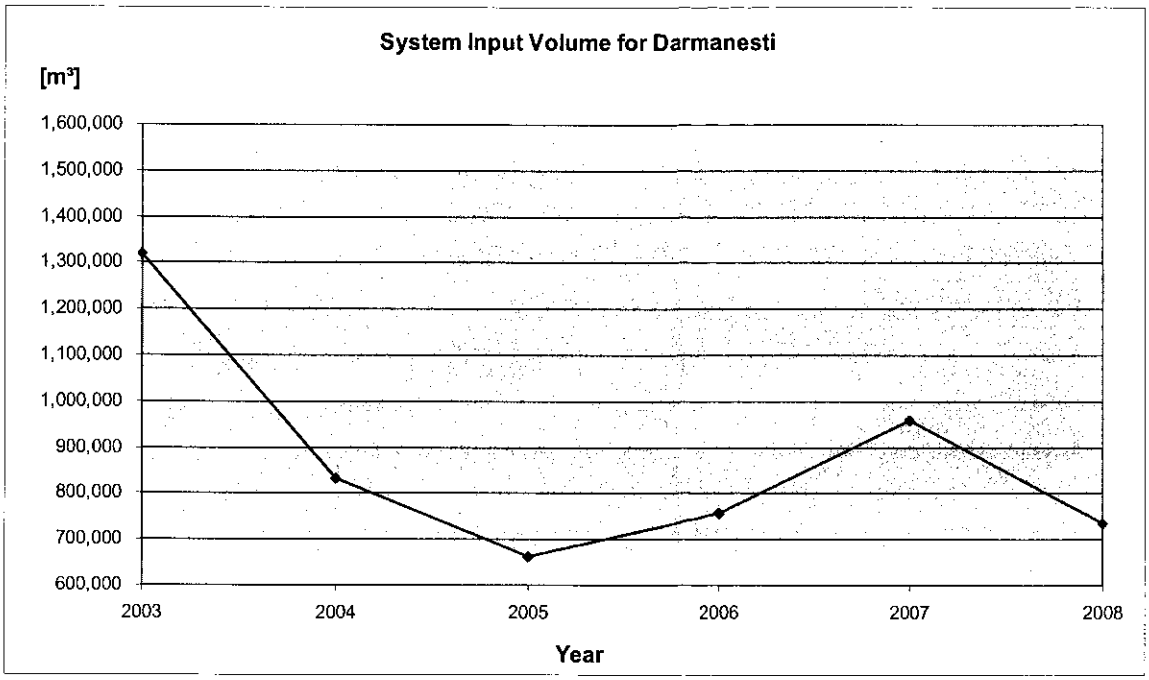

Figure 5-20: System Input Volume from 2003 – 2008 for WSZ Darmanesti

In 2008 the administrative for water supply services switched to Apa Serv Bacau. By switching the administration also the billing system has changed.

The figures in the next table confirm that the capacity of the existing systems is sufficient to supply drinking water to the inhabitants of the WSZ over the project horizon.

Nbr.	Raw water source	Number of pumps	Pumping Station	Maximum capacity [l/s]	Maximum demand until 2037 [l/s]
1	**WTP Caraboaia**	**2**	**Caraboaia**	**230**	**24**

Table 5-13: Overview of capacity vs. demand WSZ Darmanesti

The maximum demand in the table above includes demands calculated in Annex to the CBA, and shows sufficient capacity of the main, which was designed also to supply Moinesti and partly Comanesti.

5.1.1.6.1 Water Quality

For the situation of water quality just refer to the following table.

Parameters	Limit EC 98	Treated water			
		2005	2006	2007	2008
Oxidability	5 mg/l O_2				
Turbidity	1 NTU				
Ammonium NH_4^+	0.5 mg/l				
Nitrate NO_3	50 mg/l				
Nitrite NO_2^-	0.05 mg/l				
Aluminium Al^{+++}	0.2 mg/l				
Iron Fe	0.2 mg/l				

yearly average in RSV at WTP

Table 5-14: Water quality, WSZ Darmanesti

5.1.1.7 WSZ Targu Ocna

5.1.1.7.1 Water Quantity

WSZ Targu Ocna is supplied only by Water Treatment Plant Caraboaia. It is connected to the pipe which is feeding also Onesti supply system by gravity.

Monthly variation of water production / supply

The next figures provide the production of water for the year 2008 and 2009.

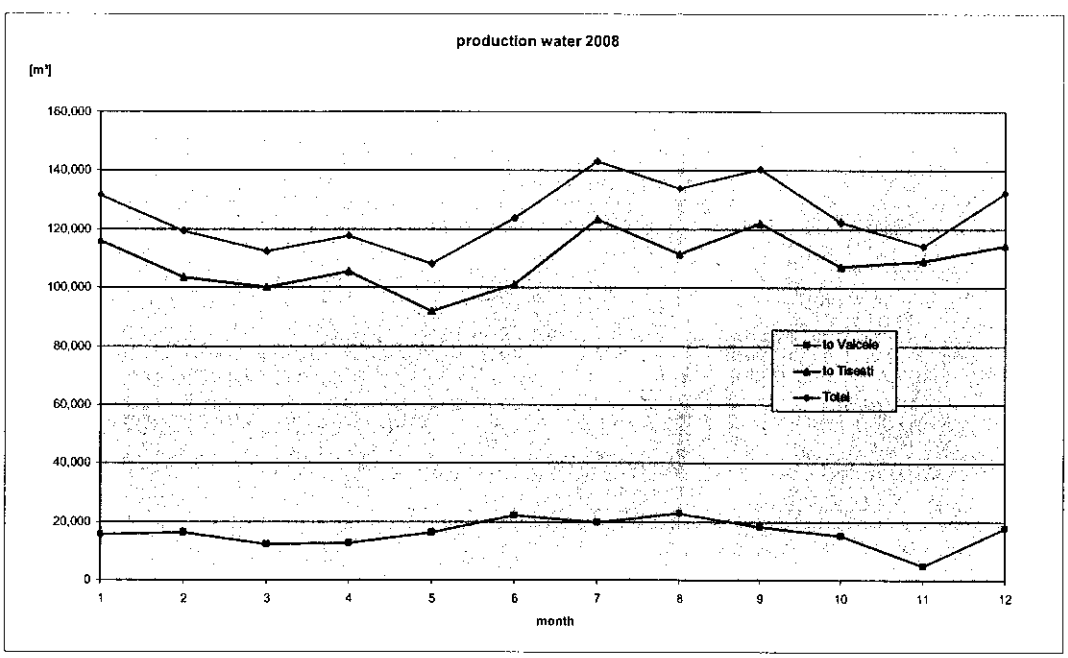

Figure 5-21: Monthly production of water for WSZ Targu Ocna in 2008

A total of 1,498,150 m³ were supplied in 2008, 100% from the WTP Caraboaia at Darmanesti.

The next figure gives an overview of the situation of billed and produced water in the year 2008.

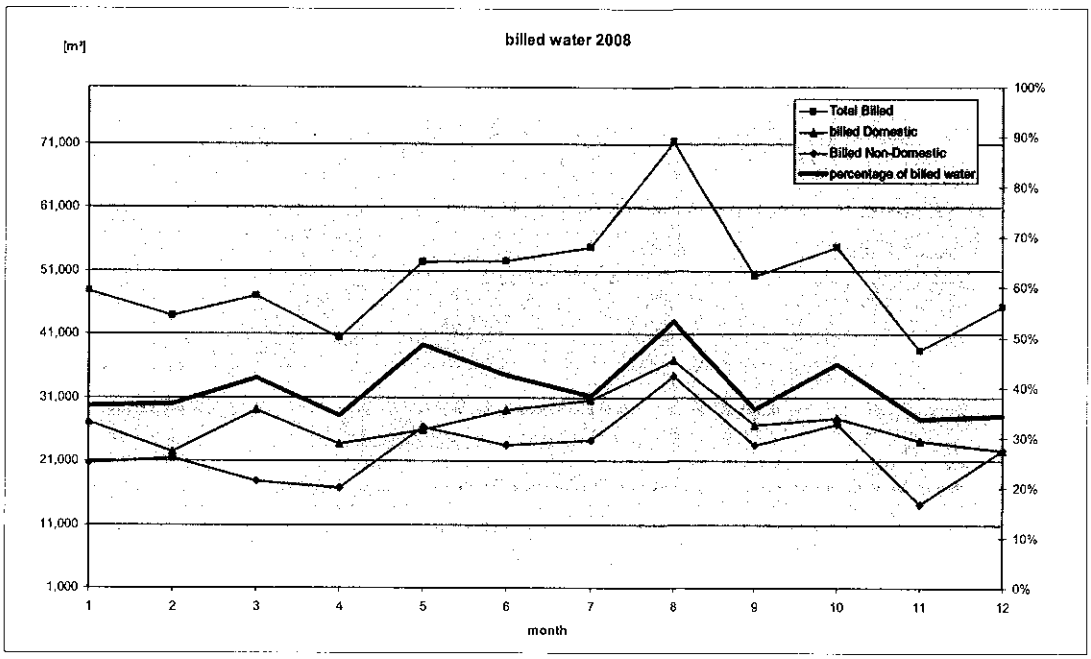

Figure 5-22: Overview of produced and billed water in 2008 for WSZ Targu Ocna

The yearly average of billed water in 2008 sums up to 40 %.

A total of 1,498,150 m³ were supplied in 2008, 100% from the WTP Caraboaia at Darmanesti.

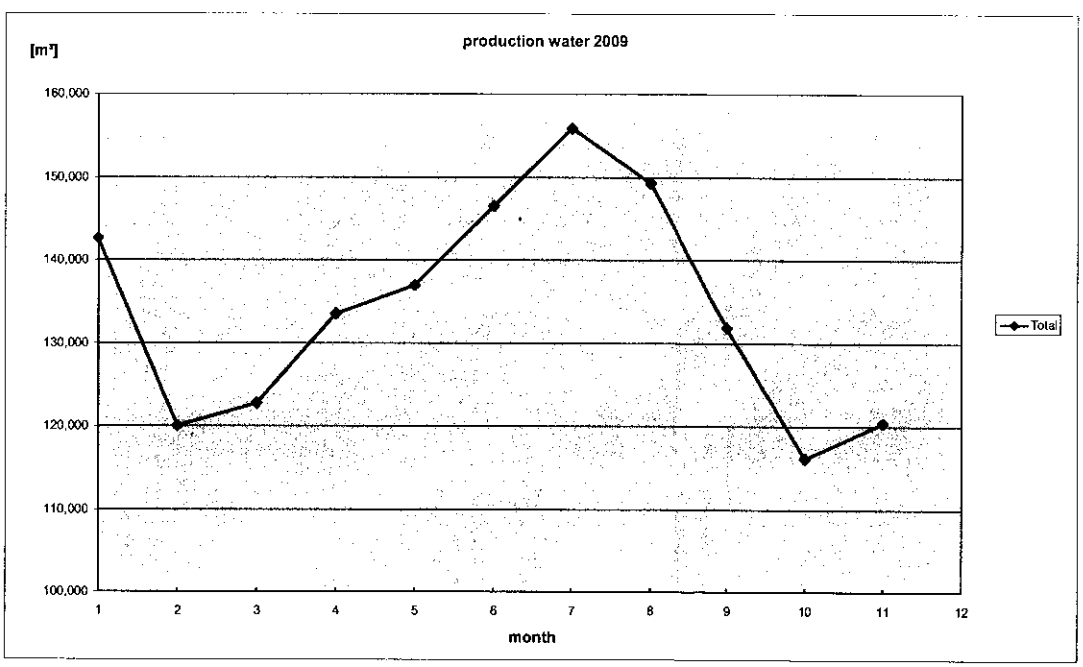

Figure 5-23: Monthly production of water for WSZ Targu Ocna in 2009, except December

A total of 1,475,829 m^3 were supplied in 2009 until November 2009, 100 % from the WTP at Darmanesti.

The next figure gives an overview of the situation of billed and produced water in the year 2009, except December.

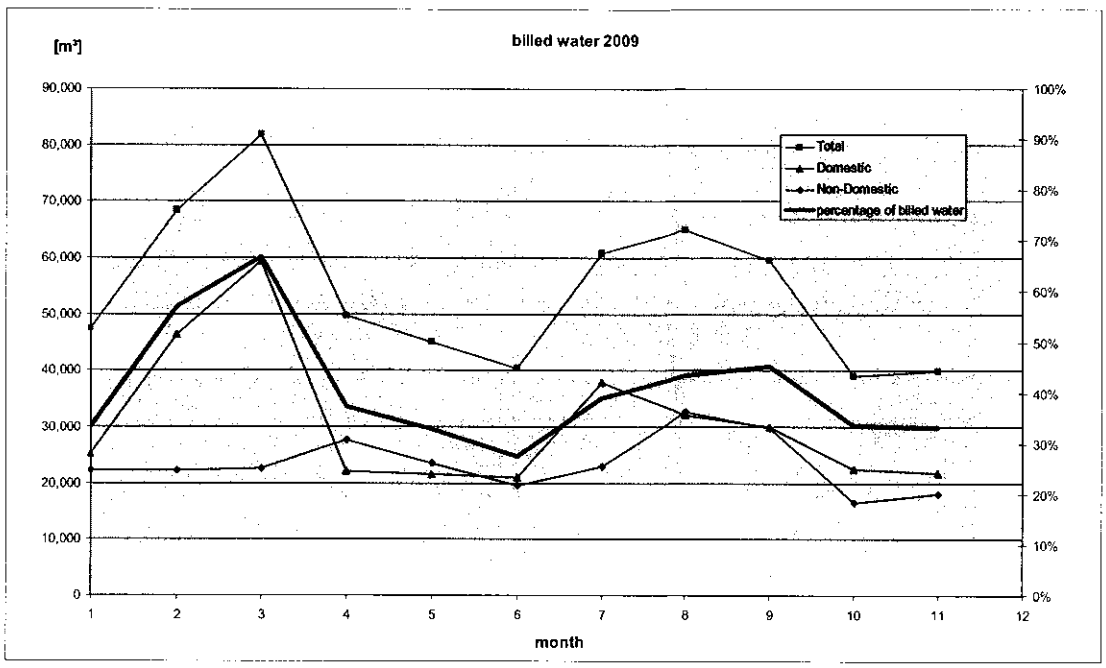

Figure 5-24: Overview of produced and billed water in 2009, except December for WSZ Targu Ocna

The yearly average of billed water in 2009, except December, sums up to 41 %.

The next figure shows the water production for the years 2003 – 2008.

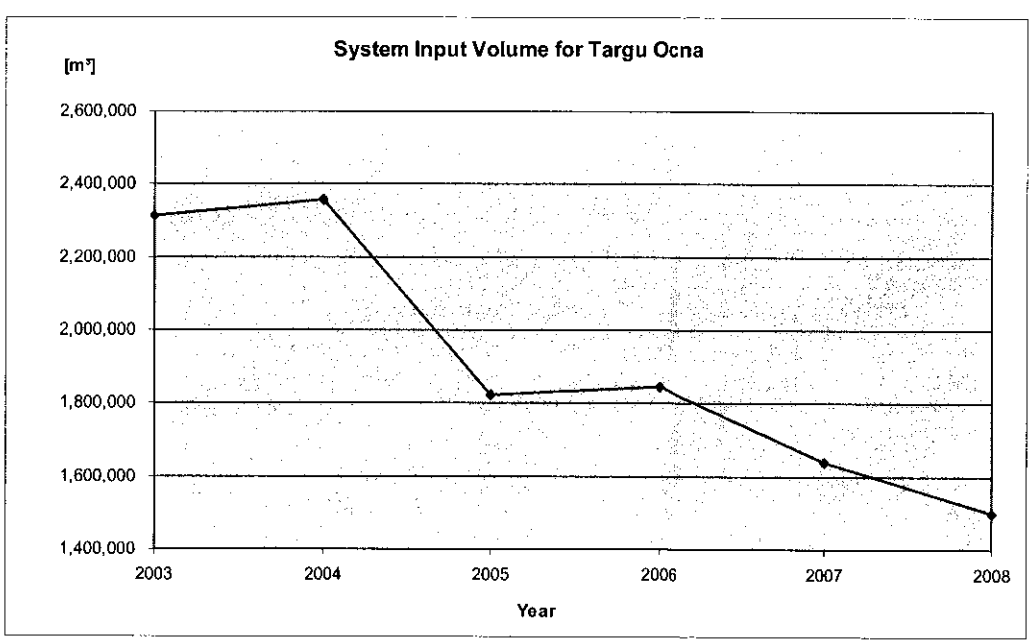

Figure 5-25: System Input Volume from 2003 – 2008 for WSZ Targu Ocna

The figures in the next table confirm that the capacity of the existing systems is sufficient to supply drinking water to the inhabitants of the WSZ over the project horizon.

Nr.	Raw water source	Number of pumps	Capacity Main [l/s]	Maximum demand until 2037 [l/s]
1	WTP Caraboaia	By gravity	>200	44

Table 5-15: Overview of capacity vs. demand Targu Ocna

The maximum demand in the table above includes demands calculated in Annex to the CBA, and shows sufficient capacity of the main, which was designed also to supply Onesti and some industries.

5.1.1.7.2 Water Quality

Quality of distributed water to the WSZ is shown in the following table.

WATER QUALITY DATA:

Parameters	Limit EC 98	Inflow RSV
Oxidability	5 mg/l O_2	
Turbidity	1 NTU	
Ammonium NH_4^+	0.5 mg/l	
Nitrate NO_3	50 mg/l	
Nitrite NO_2^-	0.05 mg/l	
Iron Fe	200 µg/l	
Chlorid Cl-	250 mg/l	
Sulfat SO42-	250 mg/l	
pH	>6.5 / <9.5	
maximum values from 16/03/2010 - 07/05/2010		

Table 5-16: Water Quality of water in WSZ Targu Ocna

As shown in the table above in Targu Ocna there is also a problem with turbidity what is caused by the insufficient treatment at WTP Caraboaia. Due to the fact that not all important parameters are controlled and measured it is important that the water quality analysis system and water quality monitoring system must be improved.

5.1.2 Water Pollution

There are four main sources for pollution of water – poorly working WWTP, poor working or non existing industrial WWTP, both municipal and industrial sludge discharges, leaky sewerages as well as agricultural fertilization of large areas.

5.1.2.1 Pollution of Surface Water

Surface waters are mainly affected by discharge of untreated or insufficiently treated municipal and industrial wastewater. The majority of existing municipal WWTP is only functioning with a much reduced treatment efficiency. Due to the fact that aerators of activated sludge tanks are not functioning, treatment processes are reduced to sedimentation of suspended solids.

According to the report "River Basin Management, Annual Report 2004", the following sources of pollution to the surface water have been mentioned (Source: "Apele Romane", "River basins Management plans, National Report 2004").

No	Pollution source	Source type	Locality
1	SC Agricultural International SA Bacau	Agricultural	Bacau
2	SC Prest Serv SA Moinesti	Municipal	Moinesti
3	RAGC Bacau	Municipal	Bacau
4	SGCL Sascut	Municipal	Sascut
5	SC Sofert SA Bacau	Industrial	Bacau
6	SC Apa Canal SA Onesti	Municipal	Onesti
7	SC Noble Drinks SA Comanesti	Municipal	Comanesti
8	SC Letea SA Bacau	Industrial	Bacau
9	SC Carom SA Onesti	Industrial	Onesti
10	SC Chimcomplex SA Onesti	Industrial	Onesti
11	DGC Buhusi	Municipal	Buhusi
12	Mayoralty of Tg.Ocna	Municipal	Tg.Ocna
13	SC Rafo SA Onesti	Industrial	Onesti
14	Sc Danubiana SA Roman	Industrial	Roman
15	Mayoralty of Darmanesti	Municipal	Darmanesti
16	Mayoralty of Dofteana	Municipal	Dofteana
17	Mayoralty of N.Balcescu	Municipal	N.Balcescu
18	Mayoralty of Oituz	Municipal	Oituz

Table 5-17: List of biggest polluters in Bacau County

Furthermore a summary of the main non-compliant industrial wastewater discharges according EPA is shown in the table below.

Name of Company	Receiving water Body	Sampling point	Flow [l/s]	pH	Quality Parameters	Concen-tration [mg/l] or [µ/l]	Discharge Limits Concen-tration NTPA-001 [mg/l]/[µg/l]	Exceedings [%]	Analyses Laboratory
SFPPA Tg. Ocna - Livestock	Trotus River	Discharging point	10.000	7.8	NH4	36.959	30.000	23.2	Siret Water Directorate
SC Cosna SA Tg. Ocna Wood industry	Trotus River	Discharging point	0.095	7.7	Suspended Solids	115.333	35.000	229.5	Siret Water Directorate
					CBO5	23.667	20.000	18.3	
					CCO-Cr	109.417	70.000	56.3	
					Total Nitrogen	11.849	10.000	18.5	
SC Depcoimf SRL Targu Trotus Food industry - dairy	Trotus River	Discharging point	0.700	7.8	Suspended Solids	100	130.133	30.1	Siret Water Directorate
					CCO-Cr	150	273.133	82.1	
SC Carom SA Onesti - chemical processing	Trotus River	Discharging point	19.026	7.8	CCO-Cr	125	141.240	13	Siret Water Directorate

Table 5-18: Non-compliant industrial discharges (source EPA)

5.1.2.2 Pollution of Ground Water

The pollution of ground water is difficult to quantify due to the fact, that it has various sources that are difficult to measure. These sources mainly are:

- Waste water ex-filtration from existing leaky sewerage;
- Corroded septic tanks and latrines;
- Infiltration from landfills with insufficient leakage collection;
- Accidental pollution.

As a lot of septic tanks and sewerages will be rehabilitated or replaced over the next years the ground water quality will improve as well. However, the nitrogen infiltration from agricultural fertilization has to be reduced using other measures.

5.1.2.3 Impact of Wastewater Discharge

The measures proposed in this Project are in line with the River Basin Management Plan for Bacau County as presented by Apele Romane. For assessment of impact of wastewater discharges on surface waters reference is made to this RBMP.

5.1.3 Current Water Consumption and Water Demand Projection

5.1.3.1 Current Water Consumption

Water consumption

The next table summarizes the actual billed domestic consumption figures provided by the operators for the years 2008 until 2009.

	Water Demand		Bacau	Moinesti	Buhusi	Darmanesti	Targu Ocna
2007	Domestic Water Consumption	Mil m³/year	6.915	0.649	0.362	0.487	0.335
	Non-Domestic Water Consumption	Mil m³/year	1.457	0.328	0.042	0.141	0.236
	Total Water Consumption (Domestic + Non-D.)	Mil m³/year	8.372	0.977	0.404	0.629	0.571
	Specific Domestic Consumption	l/cd	107	88	59	129	78
	Specific Total Water Consumption	l/cd	129	133	66	166	133
2008	Domestic Water Consumption	Mil m³/year	6.717	0.643	0.286	0.231	0.326
	Non-Domestic Water Consumption	Mil m³/year	3.355	0.272	0.047	0.047	0.273
	Total Water Consumption (Domestic + Non-D.)	Mil m³/year	10.072	0.916	0.334	0.278	0.599
	Specific Domestic Consumption	l/cd	104	88	47	61	76
	Specific Total Water Consumption	l/cd	156	125	55	73	140
2009	Domestic Water Consumption	Mil m³/year	6.720	0.639	0.276	0.222	0.325
	Non-Domestic Water Consumption	Mil m³/year	3.288	0.272	0.089	0.047	0.274
	Total Water Consumption (Domestic + Non-D.)	Mil m³/year	10.008	0.911	0.365	0.269	0.599
	Specific Domestic Consumption	l/cd	104	87	45	59	76
	Specific Total Water Consumption	l/cd	155	125	60	71	140

Table 5-19: County of Bacau – actual billed domestic consumption figures

The consumption figures for Buhushi, Darmanesti (except 2007) and Targu Ocna are low due to their rural type. The 2007 value in Darmanesti is untypical high, probably due to a low metering level.

As the graph below shows, the domestic consumption tends to stay constant over the years in all agglomerations except Darmanesti.

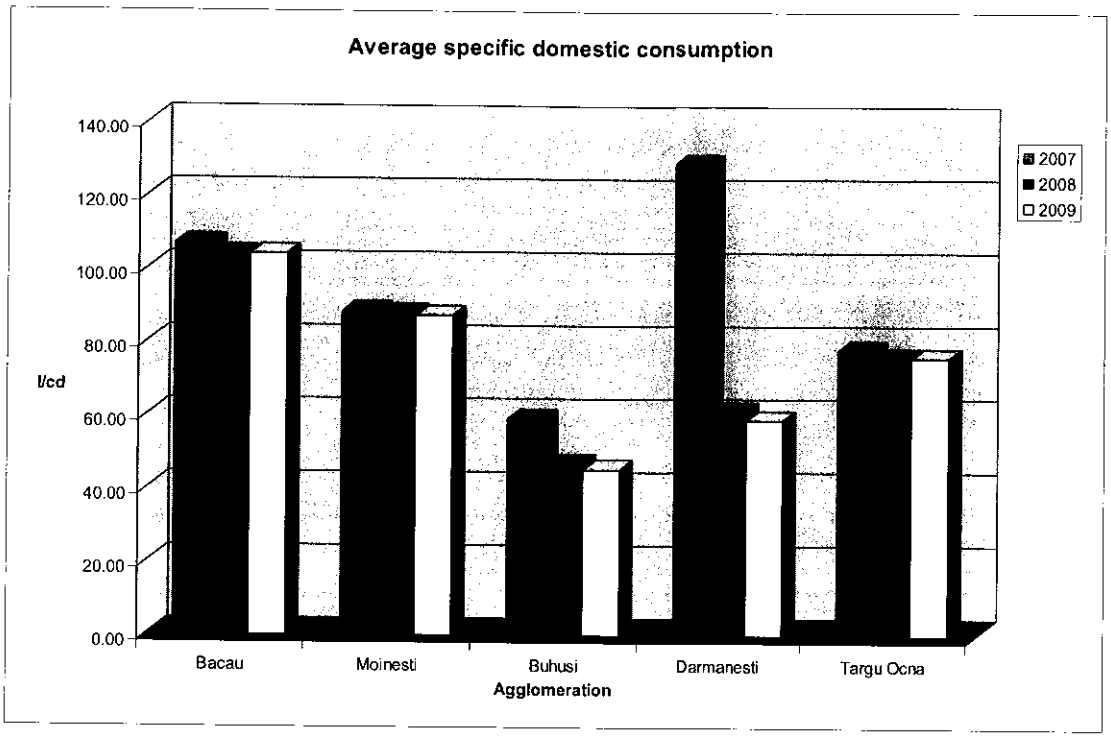

Figure 5-26: Domestic Consumptions 2007-2009

Field measurements

In order to quantify the current water consumption in the different agglomerations within Bacau County, a metering campaign has been conducted. The metering has been carried out for different consumer categories and consumption patterns have been calculated for each type of consumer.

Water meter reading has been carried out for the following consumers:

- Detached houses (domestic consumption);
- Apartment blocks (domestic consumption).

The consumption figures and results of measurements in other counties give us a clear idea about the current domestic and non-domestic consumptions and reveal the average specific consumption in the agglomerations as well as in small settlements or rural areas.

The metering campaign has been conducted in the following towns:

- Bacau (197,013 Inhabitants);
- Onesti (50,092 Inhabitants).

Note: At the time of the campaign Onesti was part of the priority zones.

Results of hourly meterings

The present meterings have been performed over a period of three days in order to assess consumption behaviour of the different consumer categories. The results of the data evaluation show that domestic water consumption within detached houses is less than for blocks of flats.

This result could also be confirmed through the daily metering as presented later in this chapter. In addition, water consumption within the block of flats generally varies over a relatively wide range. Specific consumption values of more than 200 l/c/d and some below 100 l/c/d were registered.

As an example, the results of the hourly meterings within the town of Onesti are shown in the following figure.

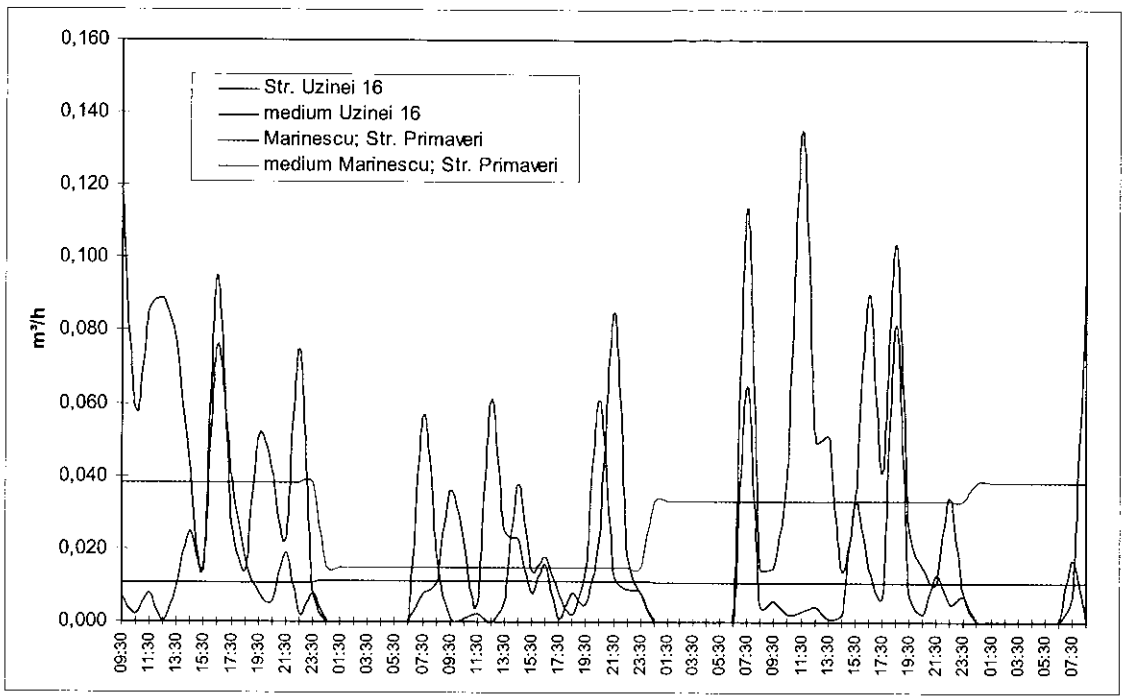

Figure 5-27: Hourly consumption figure of detached houses

As already shown in the figure resulting from the meterings of different detached households, two main consumption peaks could be registered. The morning consumption between 7:00 and 9:00 hours and the consumption between 16:00 and 19:00 hours. More than 50% of the total daily consumption was registered in the evening. The maximum daily consumption peak was calculated at 7.5.

The hourly peak factors for water consumption of individual households are single values and therefore cannot be used to make a general assumption about the global consumption variation in the whole town. Hourly peak factors for supplied agglomerations generally depend on the settlement size.

Between 1:30 and 05:30 in the morning, the consumption is about 0.0 m³/h, which indicates the night flow. The night flow figures indicate the absence of losses in the house connection pipes and/or within the internal house installations.

According to the hourly meterings, the specific consumption within the metered individual households yield relatively low average values of 36 l/c/day for a 3-person household (Uzinei 16) and a value of 72 l/c/day for a 4-person household (primaverii).

Results of daily meterings

The daily meterings were performed over a period of more than 2 weeks. Detached houses, block of flats as well as supply pipes to different supply zones were monitored. The examples presented in the next figures show the daily consumption figures of detached houses and blocks of flats within the towns of Onesti and Bacau.

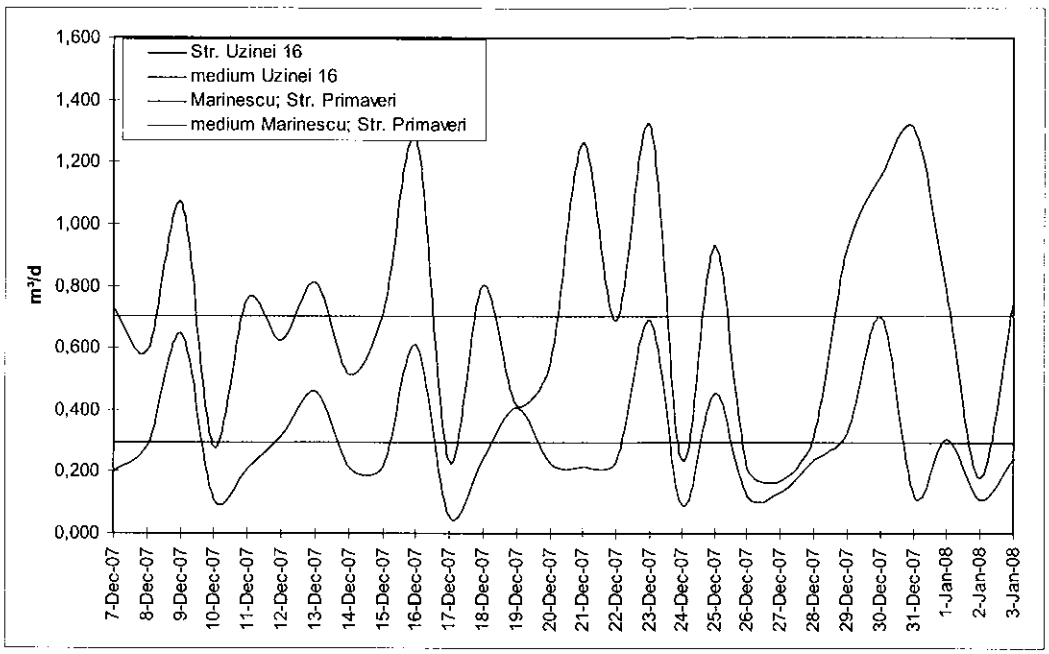

Figure 5-28: Daily consumption figure of detached houses

The particularly low values of specific consumptions have not been confirmed by the daily readings for the same households. Specific consumptions have been calculated at 97l/c/day for Uzinei 16 and 175 l/c/day for Primaveri.

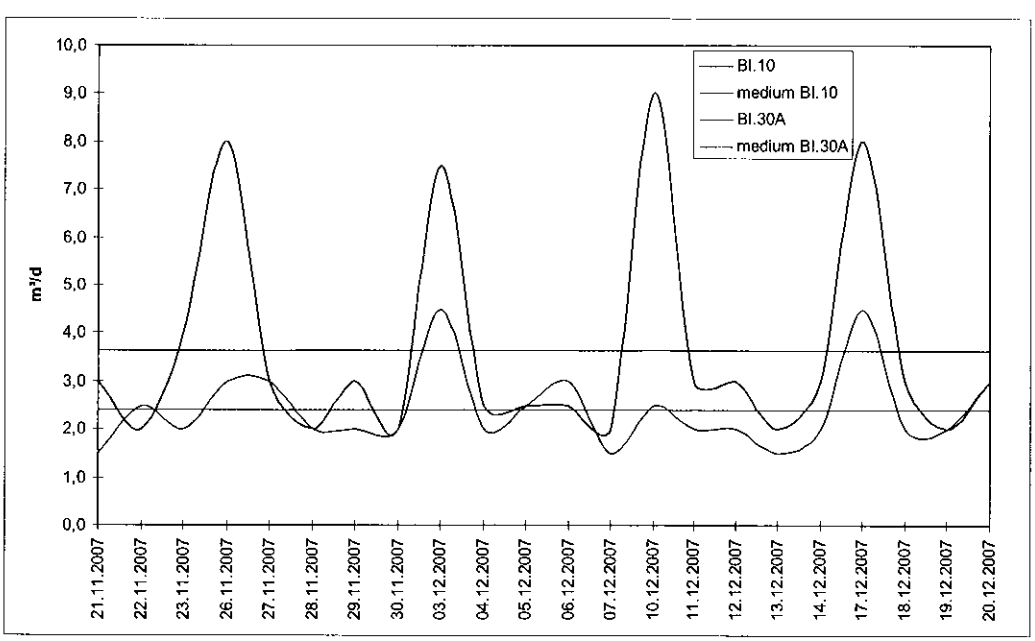

Figure 5-29: Daily consumption figure of block of flats

It becomes obvious from the figure above that daily consumption patterns are more meaningful and show daily consumptions of an average of 2.5 m³/day for the block 30A with 20 Inhabitants (= 125 l/c,d) and of 3.7 m³/day for block 10 with 32 inhabitants (= 116 l/c,d). The biggest water consumption, which occurred on 10 December, shows a consumption peak factor of 2.5 between medium and maximum day. The consumption patterns within blocks of apartments present more reliable figures, especially in the case of the present meterings.

Within block of flats, water consumption is shown to vary between 114 and 128 l/c/day.

5.1.3.2 Water Losses

Current Water Losses

Water Supply Zone Bacau:

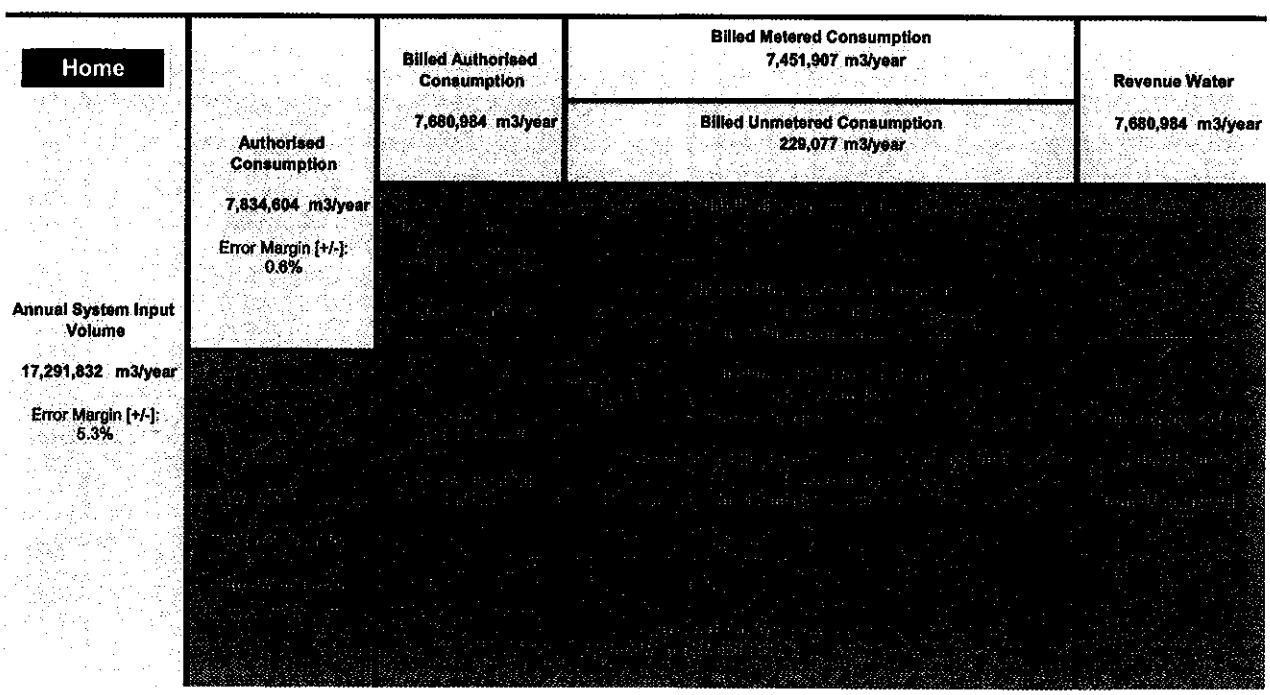

Table 5-20: WSZ Bacau – IWA Water Balance Year 2008

The values/data in the water balance table here were provided by the operator. A detailed breakdown including all remarks and assumptions is shown in the following table.

BACAU CITY - Yearly Quantities of Water for Water-balance [m³]

		Year:	2003	2004	2005	2006	2007	2008	Average 03-08
1. System Input Volume SIV = Produced Water - Total sum:			23,327,198	19,401,376	15,990,585	15,730,985	15,722,147	17,355,366	17,921,276
1. System Input Volume SIV to city network =1.2+1.3+1.4:			23,190,499	19,275,426	15,872,935	15,620,908	15,636,608	17,291,832	17,814,701
Nr.	Type/Note	Source							
1.1	Treated SW	Outflow at Caraboaia WTP for Bacau	9,290,185	6,247,900	7,340,541	8,114,188	8,256,400	8,970,392	8,036,601
1.2	Groundwater	Outflow at Gheraiesti Station	8,072,102	6,786,514	3,195,324	3,634,248	3,794,120	4,008,008	4,915,053
1.3	Groundwater	Outflow at Margineni Station	5,964,911	6,366,962	5,454,720	3,982,549	3,671,627	4,376,966	4,969,623
Flow at Barati Reservoir:									
1.4	Inflow	from Caraboaia main pipe	9,153,486	6,121,950	7,222,891	8,004,111	8,170,861	8,906,858	7,930,026
1.5	Inflow	from Margineni (= ca.1.3)	5,964,911	6,366,962	5,454,720	3,982,549	3,671,627	4,376,966	4,969,623
1.6	Outflow	To city network (= 1.4+1.5)	15,118,397	12,488,912	12,677,611	11,986,660	11,842,488	13,283,824	12,899,649
2. Authorized Consumption AC		Sum:	12,625,519	10,365,993	9,334,234	8,929,113	8,371,742	7,834,604	9,576,867
Nr.	Code	Type							
2.1	BAC	Billed authorized consumption	12,377,960	10,162,738	9,151,210	8,754,032	8,207,590	7,680,984	9,389,086
2.1.1	BMC	Billed metered consumption	11,964,065	9,812,175	8,870,445	8,471,501	7,961,990	7,451,907	9,088,681
		Domestic consumption	10,216,143	8,361,581	7,458,976	6,791,391	6,574,408	6,387,500	7,631,667
		Industrial (non-domestic) consumption	1,747,922	1,450,594	1,411,469	1,680,110	1,387,582	1,064,407	1,457,014
2.1.2	BUC	Billed unmetered consumption	413,895	350,563	280,765	282,531	245,600	229,077	300,405
2.2	UAC	Unbilled authorized consumption	247,559	203,255	183,024	175,081	164,152	153,620	187,782
3. Water Losses WL		Sum:	10,564,980	8,909,433	6,538,701	6,691,795	7,264,866	9,457,228	8,237,834
Nr.	Code	Type							
3.1	AL	Apparent Losses	2,777,614	2,280,518	2,053,532	1,964,405	1,841,783	1,723,613	2,106,911
3.1.1	UC	Unauthorized consumpt.-assump.20%of AC	2,525,104	2,073,199	1,866,847	1,785,823	1,674,348	1,566,921	1,915,373
3.1.2	MIE	Metering inaccuracies - assumption 2% of AC	252,510	207,320	186,685	178,582	167,435	156,692	191,537
3.2	RL	Real Losses	7,787,366	6,628,915	4,485,169	4,727,391	5,423,083	7,733,616	6,130,923
(RL = SIV city network - AC - AL)									
Percentage of Losses WL/SIV			46%	46%	41%	43%	46%	55%	46%
			red...calculated values			... Data from Operator RAGC			
Notes:	Point 1.4	The inflow of Barati from Caraboaia: the difference between the outflow of Caraboaia plant and the cumulated consumptions on the route of the transmission main was calculated.							
	Point 2.1.1	The consumptions recorded by the public institutions were not considered.							
	Point 2.1.2	Billed unmetered consumption: the two categories of consumers (domestic and industrial) without the public institutions were considered.							
	Point 2.2	No data available, assumption: 2 % of 2.1							

Table 5-21: WSZ Bacau – detailed breakdown of Water Balance Figures

Current Water Losses

Water Supply Zone Moinesti:

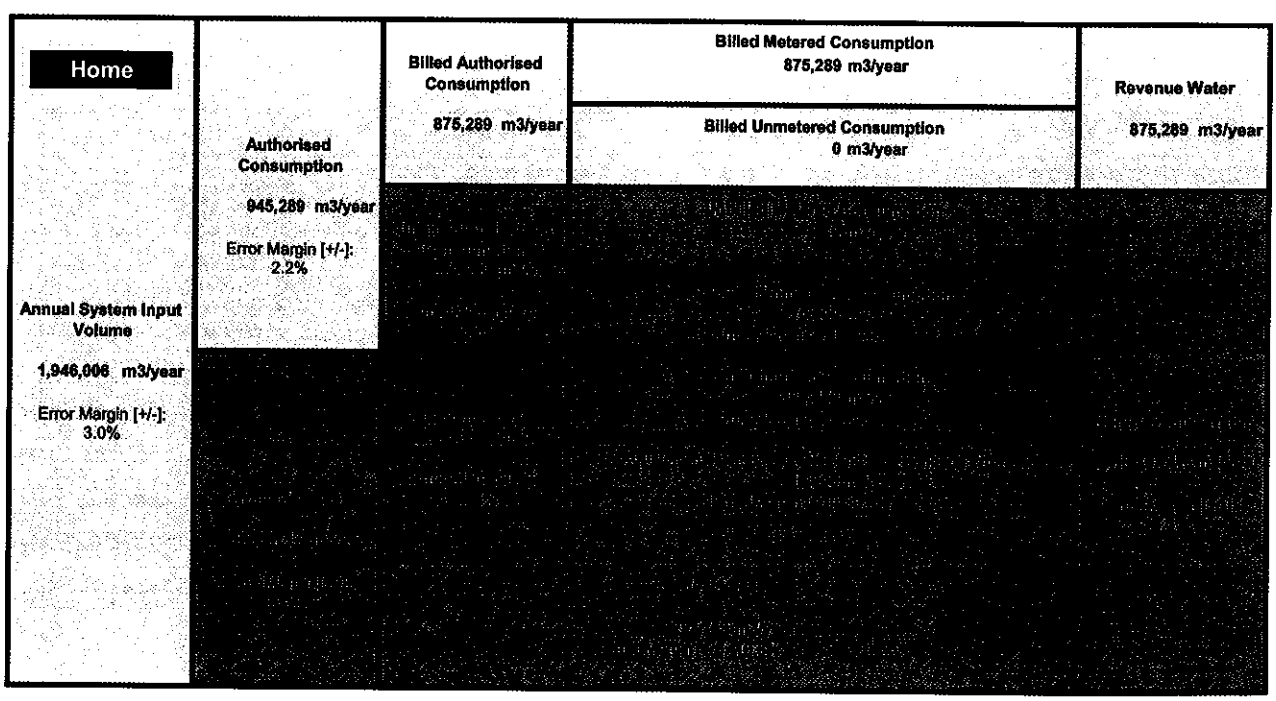

Table 5-22: WSZ Moinesti – IWA Water Balance Year 2008

The values/data in the water balance table here were provided by the operator. A detailed breakdown including all remarks and assumptions is shown in the table below.

MOINESTI - Yearly Quantities of Water for Water-balance [m³]									
		Year:	2003	2004	2005	2006	2007	2008	Average
1. System Input Volume SIV = Produced Water		Sum:	3,125,000	2,664,550	2,371,785	2,199,189	1,879,555	1,946,006	2,364,348
Nr.	Type/Note	Source							
1.1	Treated SW	Inflow from Apaserve	3,125,000	2,664,550	2,371,785	2,199,189	1,879,555	1,946,006	2,364,348
2. Authorized Consumption AC		Sum:	1,897,000	1,933,744	2,137,960	1,198,116	1,046,926	945,289	1,526,506
Nr.	Code	Type							
2.1	BAC	Billed authorized consumption	1,827,000	1,863,744	2,067,960	1,128,116	976,926	875,289	1,456,506
2.1.1	BMC	Billed metered consumption	1,827,000	1,863,744	2,067,960	1,128,116	976,926	875,289	1,456,506
		Domestic consumption	1,006,000	841,612	817,558	737,459	648,599	625,158	779,398
		Non-domestic consumption	821,000	1,022,132	1,250,402	390,657	328,327	250,131	677,108
2.1.2	BUC	Billed unmetered consumption	included in 2.1.1						
2.2	UAC	Unbilled authorized consumption*	70,000	70,000	70,000	70,000	70,000	70,000	
2.2.1	UMC	Unbilled metered consumption							
2.2.2	UUC	Unbilled unmetered consumption							
3. Water Losses WL		Sum:	1,228,000	730,806	233,825	1,001,073	832,629	1,000,717	837,842
Nr.	Code	Type							
3.1	AL	Apparent Losses	417,340	425,424	142,759	263,586	230,324	207,964	281,233
3.1.1	UC	Unauthorized consumpt.-assump.20%of AC	379,400	386,749	100,000	239,623	209,385	189,058	250,703
3.1.2	MIE	Metering inaccuracies - assumption 2% of AC	37,940	38,675	42,759	23,962	20,939	18,906	30,530
3.2	RL	Real Losses	810,660	305,382	91,066	737,487	602,305	792,753	556,609
(RL = SIV - AC - AL)									
Percentage of Losses WL/SIV			39%	27%	10%	46%	44%	51%	36%
	... Data from Operator		red...calculated values		*...assumption, no data available other value assumed than 20% of AC				

Table 5-23: WSZ Moinesti – detailed breakdown of Water Balance Figures

Current Water Losses

Water Supply Zone Buhusi:

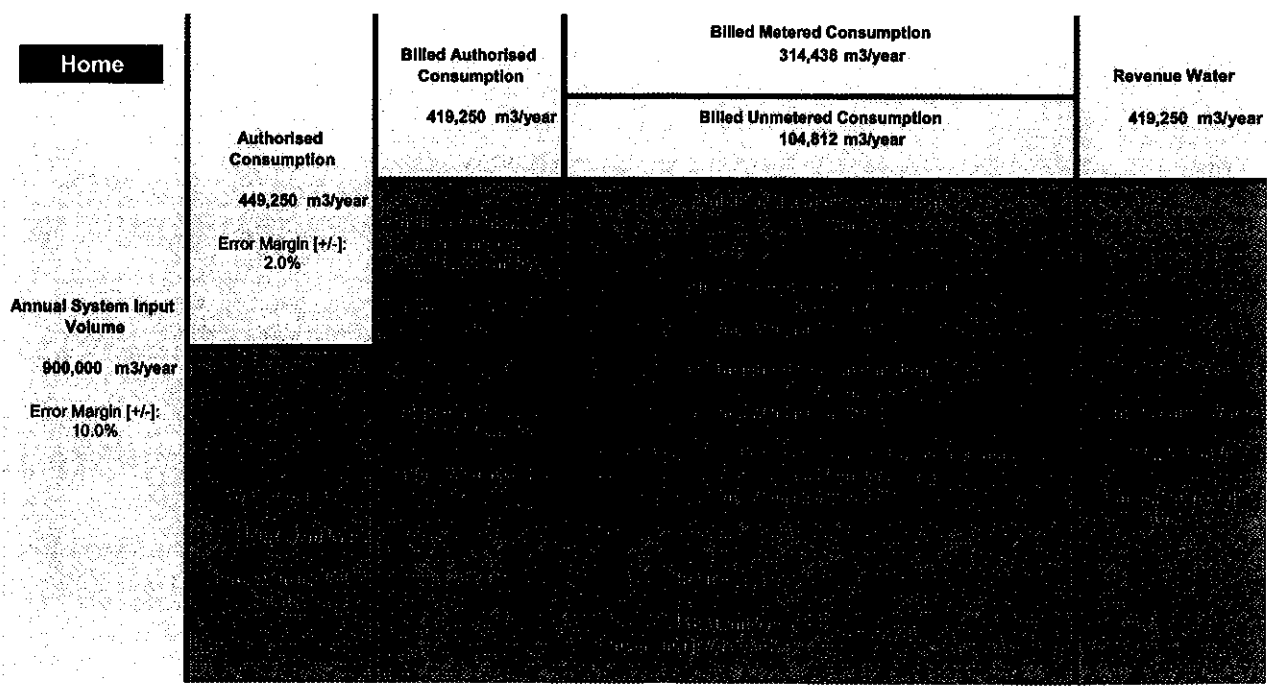

Table 5-24: WSZ Buhusi – IWA Water Balance Year 2008

The values/data in the water balance table here were provided by the operator. A detailed breakdown including all remarks and assumptions is shown in the table below.

BUHUSI - Yearly Quantities of Water for Water-balance [m³]									
		Year:	2003	2004	2005	2006	2007	2008	Average
1. System Input Volume SIV = Produced Water		Sum:	1,000,000	1,000,000	950,000	950,000	900,000	900,000	950,000
2. Authorized Consumption AC		Sum:	653,379	531,058	455,717	422,559	434,137	449,250	491,017
Nr.	Code	Type							
2.1	BAC	Billed authorized consumption	623,379	501,058	425,717	392,559	404,137	419,250	461,017
2.1.1	BMC	Billed metered consumption	311,700	275,582	255,430	255,163	282,896	314,438	282,535
		Domestic consumption	264,945	234,245	217,116	216,889	240,462	267,272	240,155
		Non-domestic consumption	46,755	41,337	38,314	38,274	42,434	47,166	42,380
2.1.2	BUC	Billed unmetered consumption	311,679	225,476	170,287	137,396	121,241	104,812	178,482
2.2	UAC	Unbilled authorized consumption *	30,000	30,000	30,000	30,000	30,000	30,000	
2.2.1	UMC	Unbilled metered consumption							
2.2.2	UUC	Unbilled unmetered consumption							
3. Water Losses WL		Sum:	346,621	468,942	494,283	527,441	465,863	450,750	458,983
Nr.	Code	Type							
3.1	AL	Apparent Losses	143,743	116,833	100,258	92,963	95,510	98,835	108,024
3.1.1	UC	Unauthorized consumpt.-assump.20%of AC	130,676	106,212	91,143	84,512	86,827	89,850	98,203
3.1.2	MIE	Metering inaccuracies - assumption 2% of AC	13,068	10,621	9,114	8,451	8,683	8,985	9,820
3.2	RL	Real Losses	202,878	352,109	394,025	434,478	370,353	351,915	350,960
(RL = SIV - AC - AL)									
Percentage of Losses WL/SIV			35%	47%	52%	56%	52%	50%	48%
... Data from Operator			red...calculated values		*...assumption, no data available				

Table 5-25: WSZ Buhusi – detailed breakdown of Water Balance Figures

Current Water Losses

Water Supply Zone Darmanesti:

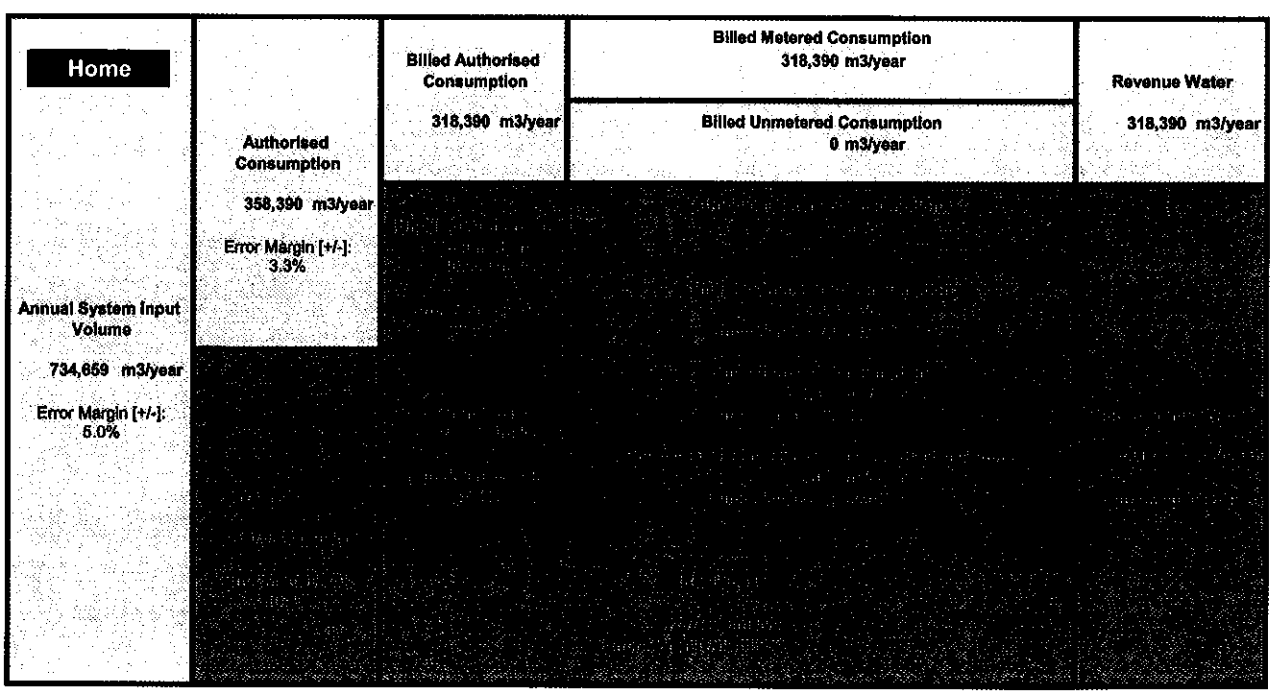

Table 5-26: WSZ Darmanesti – IWA Water Balance Year 2008

The values/data in the water balance table here were provided by the operator. A detailed breakdown including all remarks and assumptions is shown in the table below.

DARMANESTI - Yearly Quantities of Water for Water-balance [m³]								
		Year:	2003	2004	2005	2006	2007	2008	Average
1. System Input Volume SIV = Produced Water		Sum:	1,319,580	831,215	661,827	756,000	957,000	734,659	876,714
Nr.	Type/Note	Source							
1.1	Treated SW	Inflow from Apaserve	1,319,580	831,215	661,827	756,000	957,000	734,659	876,714
2. Authorized Consumption AC		Sum:	990,816	609,714	455,395	514,012	668,749	358,390	599,513
Nr.	Code	Type							
2.1	BAC	Billed authorized consumption	950,816	569,714	415,395	474,012	628,749	318,390	559,513
2.1.1	BMC	Billed metered consumption	694,095	461,468	403,725	465,803	626,598	318,390	495,013
		Domestic consumption	552,095	327,468	274,725	332,803	485,598	260,020	372,118
		Non-domestic consumption	142,000	134,000	129,000	133,000	141,000	58,370	122,895
2.1.2	BUC	Billed unmetered consumption	256,721	108,246	11,670	8,209	2,151	-	64,500
2.2	UAC	Unbilled authorized consumption *	40,000	40,000	40,000	40,000	40,000	40,000	40,000
2.2.1	UMC	Unbilled metered consumption							
2.2.2	UUC	Unbilled unmetered consumption							
3. Water Losses WL		Sum:	328,764	221,501	206,432	241,988	288,251	376,269	277,201
Nr.	Code	Type							
3.1	AL	Apparent Losses	217,980	134,137	100,187	113,083	147,125	78,846	131,893
3.1.1	UC	Unauthorized consumpt.-assump.20%of AC	198,163	121,943	91,079	102,802	133,750	71,678	119,903
3.1.2	MIE	Metering inaccuracies - assumption 2% of AC	19,816	12,194	9,108	10,280	13,375	7,168	11,990
3.2	RL	Real Losses	110,784	87,364	106,245	128,905	141,126	297,423	145,308
(RL = SIV - AC - AL)									
Percentage of Losses WL/SIV			25%	27%	31%	32%	30%	51%	33%
... Data from Operator			red...calculated values		*...assumption,no data available				

Table 5-27: WSZ Darmanesti – detailed breakdown of Water Balance Figures

It must be remarked that the operator for WSZ Darmanesti has changed in the year 2008. Since 2008 Apa Serv Bacau is operating the system and has changed the billing system According to the consultant's information the billing system before 2008 was based on lump-sum contracts.

Current Water Losses

Water Supply Zone Targu Ocna:

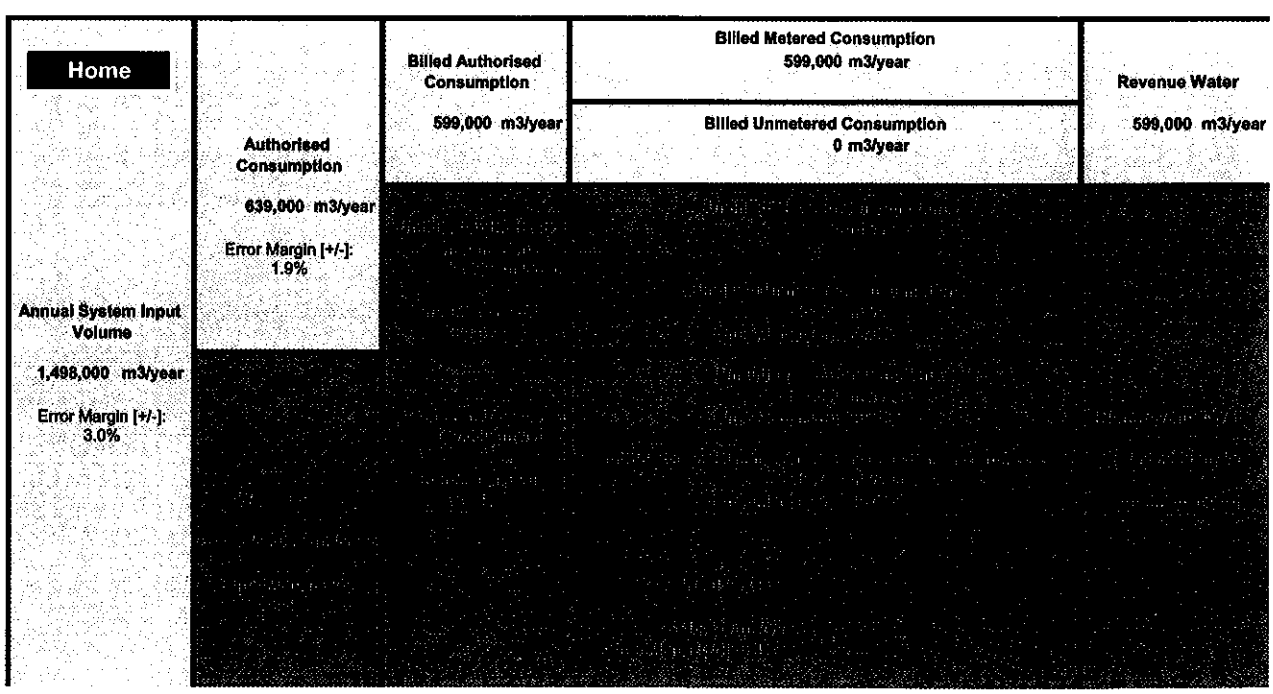

Table 5-28: WSZ Targu Ocna – IWA Water Balance Year 2008

The values/data in the water balance table here were provided by the operator. A detailed breakdown including all remarks and assumptions is shown in the table below.

TARGU OCNA - Yearly Quantities of Water for Water-balance [m³]									
		Year:	2003	2004	2005	2006	2007	2008	Average
1. System Input Volume SIV = Produced Water		**Sum:**	2,312,000	2,358,000	1,824,000	1,847,000	1,638,000	1,498,000	1,912,833
Nr.	Type/Note	Source							
1.1	Treated SW	Inflow from Apaserve	2,312,000	2,358,000	1,824,000	1,847,000	1,638,000	1,498,000	1,912,833
2. Authorized Consumption AC		**Sum:**	1,219,000	918,000	743,000	654,000	611,000	639,000	797,333
Nr.	Code	Type							
2.1	BAC	Billed authorized consumption	1,179,000	878,000	703,000	614,000	571,000	599,000	757,333
2.1.1	BMC	Billed metered consumption	1,179,000	878,000	703,000	614,000	571,000	599,000	757,333
		Domestic consumption	719,000	656,000	416,000	362,000	335,000	326,000	469,000
		Non-domestic consumption	460,000	222,000	287,000	252,000	236,000	273,000	288,333
2.1.2	BUC	Billed unmetered consumption							
2.2	UAC	Unbilled authorized consumption*	40,000	40,000	40,000	40,000	40,000	40,000	40,000
2.2.1	UMC	Unbilled metered consumption							
2.2.2	UUC	Unbilled unmetered consumption							
3. Water Losses WL		**Sum:**	1,093,000	1,440,000	1,081,000	1,193,000	1,027,000	859,000	1,115,500
Nr.	Code	Type							
3.1	AL	Apparent Losses	268,180	201,960	163,460	143,880	134,420	140,580	175,413
3.1.1	UC	Unauthorized consumpt.-assump.20%of AC	243,800	183,600	148,600	130,800	122,200	127,800	159,467
3.1.2	MIE	Metering inaccuracies - assumption 2% of AC	24,380	18,360	14,860	13,080	12,220	12,780	15,947
3.2	RL	Real Losses	824,820	1,238,040	917,540	1,049,120	892,580	718,420	940,087
(RL = SIV - AC - AL)									
Percentage of Losses WL/SIV			47%	61%	59%	65%	63%	57%	59%
... Data from Operator			red...calculated values		*...assumption, no data available				

Table 5-29: WSZ Targu Ocna – detailed breakdown of Water Balance Figures

The Infrastructure Leakage Indices for the Water Supply Zones are shown in the next table below.

WSZ	Pipes length L [km]			HC	Real Water Losses [m³/year]	UARL [l/HC/d]	CARL [l/HC/d]	ILI
	Networks	Mains	Total					
Bacau*	116	79	195	15,533	7,733,616	36	1,364	**38**
Moinesti*	24	22	46	7,964	792,753	32	273	**9**
Buhusi*	36	18	54	4,700	351,915	35	205	**6**
Darmanesti *	41	10	51	2,453	297,423	41	332	**8**
Targu Ocna*	21	6	27	4,665	718,420	32	422	**13**

HC: House Connections
* Year: 2008
UARL: UnAvoidable Real Losses per houseconnection =
(18 x L/HC + 0.8) x p with p = 35 m; Lp = 0 according to guide
CARL: Current Real Losses per house connection
ILI = CARL/UARL

Table 5-30: Determination of Infrastructure Leakage Index

The Physical Loss Assessment Matrix was published by IWA in 2005 to classify the leakage levels for utilities into four categories:

- Category A: further loss reduction may be uneconomic unless there are shortages; careful analysis needed to identify cost-effective improvement;
- Category B: Potential for marked improvements; consider pressure management; better active leakage control practices, and better network maintenance;
- Category C: Poor leakage record; tolerable only if water is plentiful and cheap; even then, analyse level and nature of leakage and intensify leakage reduction efforts;
- Category D: highly inefficient; leakage reduction programs imperative and high priority.

Technical Performance Category	**Litres/connection/day when the system is pressurized at an average pressure of:**					
	ILI	**10 m**	**20 m**	**30 m**	**40 m**	**50 m**
A	1-2	-	< 50	< 75	< 100	<125
B	2-4	-	50-100	75 – 150	100 – 200	125 – 250
C	4-8	-	100 – 200	150 – 300	200 – 400	250 – 500
D	>8	-	> 200	> 300	> 400	> 500

Table 5-31: Physical Loss Assessment Matrix for Developed Countries

The network rehabilitation needs (leakage reduction) are summarized in the next table considering an average pressure of 3.5 bars in the systems.

WSZ	**'IWA' Technical Performance Category**	**Need for 'Rehabilitation'**	**Remarks**
Bacau	D	Yes	old system, poor maintenance
Moinesti	D	Yes	old system, poor maintenance
Buhusi	C	Yes	old system, poor maintenance
Darmanesti	D	Yes, especially detailed review of metering and billing system	System commissioned in 2001-2006
Targu Ocna	D	Yes	old system, poor maintenance

Table 5-32: Summary of network rehabilitation necessary

Comparing the ratio of connected inhabitants and House Connection in the system, provided by the operators, it seems that only by improvement of the billing and metering system several systems would also improve regarding the Category.

Targets for development of future water losses

The targets for leakage reduction (technical losses) are provided in the next table.

		Target leakages in % of System Input Volume		
Water Supply Zone	**2008 level of technical losses**	**Phase 1: end of 2015 (efforts of ROC also considered)**	**Phase 2: 2016 - 2018**	**Phase 3: 2019 - 2037**
Bacau	33%	30%	25%	15%
Moinesti	42%	37%	30%	15%
Buhusi	42%	30%	25%	15%
Darmanesti	53%	28%	24%	15%
Targu Ocna	52%	34%	28%	15%

Table 5-33: Target for leakage reduction

To reach these targets, the following investments (according masterplan) are necessary for each WSZ.

		Amounts [x1,000 Euro]	**Financing [x 1,000 euro]**
	Investments	**Phase 2 and Phase 3**	**Other Funds**
BACAU	Rehabilitation of AC and aged network central zone	9,505	9,505
	Rehabilitation main pipes	13,125	13,125
	Rehabilitation of other parts of city network	22,492	22,492
MOINESTI	Rehabilitation piping of RSVs	3,000	3,000
	Rehabilitation of aged network parts	6,698	6,698
	Rehabilitation main pipes	1,409	1,409
BUHUSI	Rehabilitation piping of RSVs	700	700
	Rehabilitation main pipes	1,625	1,625
	Rehabilitation of AC and aged network central zone	900	900
	Rehabilitation of other parts of city network	6,349	6,349
TARGU OCNA	Rehabilitation of other parts of city network and network parts in Valcele	2,090	2,090

Table 5-34: Investments necessary to reach leakage targets in the Water Supply Zones

These investments are not included in the present Cohesion Funds project. Therefore also these targets could not be included in performance indicators and CBA as they both had to be related to the CF project.

Water loss indicator for County Bacau

Item	Indicator	Unit	Before project	After project
2.2.1	Total system input (raw water input)	m^3/d	**76,470**	**60,238**
2.5.1	Total non-revenue water (IWA standard: Total system input - total water sold)	m^3/d	41,579	28,029
2.5.2	Percent of non-revenue water (2.5.1/2.2.1)	% of 2.2.1	54	47
2.5.3	Real water losses (physical losses) in the network (excluding technical losses in the WTP)	m^3/d	27,107	24,933
2.5.4	Percent of real water losses (physical losses) in the network (excluding technical losses in the WTP)	%	35	41
2.5.5	Real water losses per number of connections (at average system pressure of 30 -40 m)	Liters/conn./day	763	690
2.5.8	Infrastructure Leakage Index (ILI as defined by IWA)*	-	22	20

Table 5-35: Water Losses Indicators

This table is considering only the CF project.

Furthermore there is a commitment that the ROC will finance a water loss reduction programme by other funds to reduce the losses, improve the water metering system and increase the connection rate to 100%. Details can be found in Annex 3-6 and Annex 8-1.

5.1.3.3 Water Demand Projection

The detailed projection is shown in the CBA and its annexes, the following tables shall give a general overview:

Projection of individual domestic demand

	Water Demand		Bacau	Moinesti	Buhusi	Darmanesti	Targu Ocna
County Bacau	Population (2037)	number	183,710	22,178	18,227	10,678	11,244
	Specific Water Demand - Domestic	lcd	123	106	105	107	108
	Domestic Water Demand	m³/year	8,231,853	860,257	700,741	415,515	442,816
	Non-Domestic Water Demad	m³/year	3,796,309	274,804	101,149	49,498	289,285
	TOTAL Water Demand (Domestic+Non-Domestic)	**m³/year**	**12,028,162**	**1,135,061**	**801,889**	**465,013**	**732,102**
	Real Water Losses	m³/year	5,532,954	499,427	360,850	209,256	351,409
	TOTAL Water Demand incl. Losses	**m³/year**	**17,561,116**	**1,634,488**	**1,162,740**	**674,269**	**1,083,510**

Table 5-36: Summary of individual demand

Domestic Water Quantity

Domestic Demand [m³/d]	2008	2010	2015	2020	2025	2030	2037
Domestic Water Demand Bacau	20,446	19,724	18,878	19,849	20,672	21,467	22,553
Specific Demand [l/cd]	104	100	97	103	108	114	123
Domestic Water Demand Moinesti	2,098	2,060	1,979	2,079	2,164	2,245	2,357
Specific Demand [l/cd]	88	87	84	89	94	99	106
Domestic Water Demand Buhusi	923	900	1,612	1,694	1,762	1,829	1,920
Specific Demand [l/cd]	47	46	83	88	93	98	105
Domestic Water Demand Darmanesti	703	699	956	1,004	1,045	1,085	1,138
Specific Demand [l/cd]	61	61	84	89	94	99	107
Domestic Water Demand Targu Ocna	921	918	1,019	1,070	1,114	1,156	1,213
Specific Demand [l/cd]	76	76	85	90	95	100	108
Total Dom.Demand CF Agglom.	25,091	24,301	24,445	25,697	26,757	27,782	29,181
Difference [%]	0%	-3.2%	0.6%	5.1%	4.1%	3.8%	5.0%
Difference to 2008 [%]	0%	-3.2%	-2.6%	2.4%	6.6%	10.7%	16.3%

Table 5-37: Domestic Quantity

Non-domestic Water Quantity:

Non Domestic Demand [m³/d]	2008	2010	2015	2020	2025	2030	2037
Non Domestic Water Demand Bacau	10,433	9,009	8,356	8,782	9,230	9,701	10,401
Non Domestic Water Demand Moinesti	746	731	675	692	709	727	753
Non Domestic Water Demand Buhusi	129	239	223	234	246	258	277
Non Domestic Water Demand Darmanesti	128	128	130	131	132	134	136
Non Domestic Water Demand Targu Ocna	748	751	758	766	774	782	793
Total Dom.Demand CF Agglom.	12,184	10,858	10,142	10,605	11,091	11,602	12,359
Difference [%]	0%	-10.9%	-6.6%	4.6%	4.6%	4.6%	6.5%
Difference to 2008 [%]	0%	-10.9%	-16.8%	-13.0%	-9.0%	-4.8%	1.4%

Table 5-38: Non-domestic Quantity

Evolution of Water Losses

Evolution of level of losses	2008	2010	2015	2020	2025	2030	2037
Bacau	55%	52%	46%	46%	46%	46%	46%
Moinesti	51%	51%	44%	44%	44%	44%	44%
Buhusi	50%	50%	45%	45%	45%	45%	45%
Darmanesti	51%	49%	45%	45%	45%	45%	45%
Targu Ocna	57%	55%	48%	48%	48%	48%	48%

Table 5-39: Evolution of Losses

Design water demand/flow

Design Water Flow (incl Losses 40%)	Unit	Bacau	Moinesti	Buhushi	Darmanesti	Targu Ocna
Average daily consumption	m³/day	35,346	4,249	3,569	2,270	2,512
Average daily losses (40% of total)	m³/day	23,564	2,833	2,379	1,513	1,674
Total average daily flow	m³/day	58,909	7,082	5,949	3,783	4,186
Maximum daily flow: Qmax,day *	m³/day	67,746	8,144	6,841	4,351	4,814
Maximum hourly flow: Qmax,hour **	m³/hour	3,559	428	359	229	253
Average yearly flow	m³/year	21,501,891	2,584,979	2,171,235	1,380,876	1,527,970
Design year	Year	2009	2009	2009	2009	2009
Note: For later designs losses shall be reduced according respective achieved situation * Factors for consumption 1.25, for losses 1, ** Factors for consumption 1.4, for losses 1,						

Table 5-40: Summary of the design water flow

5.1.4 Wastewater Flows and Loads

The detailed methodology for calculating flows and loads is presented in Chapter 8.3 of the FS.

The following sub-chapters summarize the flows for each agglomeration. It has to be observed that the design data of the WWTP may differ from these data because the WWTP design includes the whole clustered agglomeration as well as target infiltration rates that may be lower than measured values to avoid hydraulic overdimensioning of WWTPs.

5.1.4.1 Wastewater Flows

The following chapter provides a summary indicating the development of the domestic waste water flow, non-domestic wastewater flow and infiltration for each agglomeration.

The assessment of the existing infiltration (flow measurement) is presented in Annex 4.4.1 – 4.4.5 and chapter 8.3.

Bacau Agglomeration:

	Unit	2010	2013	2015	2018	2021	2024	2030	2037
P.E. connected to WW system	p.e.	183,132	207,504	215,377	214,594	213,612	212,372	209,388	205,339
Capita connected to WW system	capita	143,132	167,504	175,377	174,594	173,612	172,372	169,388	165,339
Q,Domestic	m³/d	14,689	16,579	17,021	17,562	18,048	18,493	19,355	20,334
Q,Industry (Public + Small Commerce + Industry)	m³/d	10,810	9,303	9,192	9,470	9,757	10,053	10,671	11,441
Q,Infiltration	m³/d	32,000	27,965	27,965	27,965	27,965	27,965	27,965	27,965
QDaily Flow Dry Weather	m³/d	57,499	53,847	54,177	54,997	55,770	56,511	57,991	59,740

Table 5-41: Domestic wastewater flow in Bacau agglomeration

Comanesti-Moinesti Agglomeration (only settlements Moinesti, Gazarie):

	Unit	2010	2013	2015	2018	2021	2024	2030	2037
P.E. connected to WW system	p.e.	19,875	23,788	25,057	24,950	24,820	24,660	24,281	23,775
Capita connected to WW system	capita	16,060	19,973	21,242	21,135	21,005	20,845	20,466	19,960
		1,389	1,675	1,746	1,801	1,850	1,894	1,981	2,080
Q,Domestic	m³/d	658	618	607	616	626	635	654	678
Q,Industry (Public + Small Commerce + Industry)	m³/d	1,925	1,787	1,787	1,787	1,787	1,787	1,787	1,787
Q,Infiltration	m³/d	3,972	4,079	4,141	4,205	4,263	4,317	4,423	4,544
QDaily Flow Dry Weather	m³/d	19,875	23,788	25,057	24,950	24,820	24,660	24,281	23,775

Table 5-42: Domestic wastewater flow in Comanesti-Moinesti agglomeration

Buhusi Agglomeration:

	Unit	2010	2013	2015	2018	2021	2024	2030	2037
P.E. connected to WW system	p.e.	19,875	23,788	25,057	24,950	24,820	24,660	24,281	23,775
Capita connected to WW system	capita	16,060	19,973	21,242	21,135	21,005	20,845	20,466	19,960
		1,389	1,675	1,746	1,801	1,850	1,894	1,981	2,080
Q,Domestic	m³/d	658	618	607	616	626	635	654	678
Q,Industry (Public + Small Commerce + Industry)	m³/d	1,925	1,787	1,787	1,787	1,787	1,787	1,787	1,787
Q,Infiltration	m³/d	3,972	4,079	4,141	4,205	4,263	4,317	4,423	4,544
QDaily Flow Dry Weather	m³/d	19,875	23,788	25,057	24,950	24,820	24,660	24,281	23,775

Table 5-43: Domestic wastewater flow in Buhusi agglomeration

Darmanesti Agglomeration:

	Unit	2010	2013	2015	2018	2021	2024	2030	2037
P.E. connected to WW system	p.e.	7,160	14,843	17,387	17,335	17,273	17,196	17,014	16,770
Capita connected to WW system	capita	0	7,683	10,227	10,175	10,113	10,036	9,854	9,610
		0	595	860	887	911	933	976	1,025
Q,Domestic	m³/d	116	116	117	118	118	119	120	122
Q,Industry (Public + Small Commerce + Industry)	m³/d	0	7	8	8	8	8	8	8
Q,Infiltration	m³/d	116	719	985	1,013	1,038	1,061	1,105	1,155
QDaily Flow Dry Weather	m³/d	7,160	14,843	17,387	17,335	17,273	17,196	17,014	16,770

Table 5-44: Domestic wastewater flow in Darmanesti agglomeration

Targu Ocna Agglomeration:

	Unit	2010	2013	2015	2018	2021	2024	2030	2037
P.E. connected to WW system	p.e.	8,238	11,378	12,407	12,352	12,287	12,205	12,014	11,757
Capita connected to WW system	capita	6,600	9,740	10,769	10,714	10,649	10,567	10,376	10,119
		502	799	917	946	971	995	1,040	1,092
Q,Domestic	m³/d	676	680	683	687	691	695	703	713
Q,Industry (Public + Small Commerce + Industry)	m³/d	802	802	802	802	802	802	802	802
Q,Infiltration	m³/d	1,979	2,281	2,402	2,434	2,464	2,492	2,546	2,607
QDaily Flow Dry Weather	m³/d	8,238	11,378	12,407	12,352	12,287	12,205	12,014	11,757

Table 5-45: Domestic wastewater flow in Targu Ocna agglomeration

5.1.4.2 Summary Hydraulic Wastewater Flow and Load

The following sub-chapter provides a summary indicating the hydraulic wastewater flow and load for each agglomeration.

	Unit	2010	2013	2015	2018	2021	2024	2030	2037
P.E. connected to WW system	p.e.	8,238	11,378	12,407	12,352	12,287	12,205	12,014	11,757
Capita connected to WW system	capita	6,600	9,740	10,769	10,714	10,649	10,567	10,376	10,119
		502	799	917	946	971	995	1,040	1,092
Q,Domestic	m³/d	676	680	683	687	691	695	703	713
Q,Industry (Public + Small Commerce + Industry)	m³/d	802	802	802	802	802	802	802	802
Q,Infiltration	m³/d	1,979	2,281	2,402	2,434	2,464	2,492	2,546	2,607
QDaily Flow Dry Weather	m³/d	8,238	11,378	12,407	12,352	12,287	12,205	12,014	11,757

Table 5-46: Summary of future wastewater flow for the year 2037

[1)] only settlements Moinesti, Gazarie

The following table summarizes the hydraulic design data for the WWTPs (after project, year 2015). Since the WWTPs are designed for 100 % connection rate of clustered agglomerations, the data of the table below cannot be compared to the agglomeration flow data.

The agglomerations flow data only reflect 90 % connection rate (investments included in CF project) and do not include flow contribution from additional settlements of the cluster that will be connected during project period until 2037.

Wastewater Flow Design Parameter	Units	Bacau	Comanesti-Moinesti [1)]	Buhusi	Darmanesti	Targu Ocna
Average daily flow (Dry Weather)	m^3/day	73,965	7,470	7,238	4,410	3,304
Maximum hourly flow Qmax, hour (Dry Weather)	m^3/hour	3,720	474	464	266	220
Maximum hourly flow Qmax, hour (Storm Weather)	m^3/hour	5,899	823	828	471	395
Average yearly flow (365 x Av. daily flow))	m^3/year	26,997,372	2,726,685	2,642,018	1,609,509	1,206,092
Design year	Year	2015	2015	2015	2015	2015

Table 5-47: Summary of the design[1] wastewater flow WWTP

[1)] only settlements Moinesti, Gazarie

The following table summarizes wastewater flow data, separately for each agglomeration (before and target after project implementation).

N°	Performance Indicators	Unit	Bacau		Comanesti-Moinesti [1)]		Buhusi		Darmanesti		Targu Ocna	
			Before Project	After Project	Before Project	After Project	Before Project	After Project	Before Project	After Project	Before Project	After Project
3.2.1	Total wastewater volume collected (average wastewater flow)	1000 m^3/d	59.9	54.2	4.0	4.1	1.7	2.5	0.1	1.0	2.0	2.4
3.7.2	Hydraulic design capacity of WWTPs	1000 m^3/d	no data	73.9	no data	8.0	no data	7.7	no data	4.6	no data	3.5
3.7.3	Biological design capacity	1000 kg BOD/d	no data	15.8	no data	1.9	no data	2.1	no data	1.3	no data	1.0
3.7.5	Percent of biologic design capacity used (3.4.1 / 3.7.3)	%	no data	82	no data	100	no data	99	no data	100	no data	100
3.7.7	Capacity of WWTPs in Population equivalent (p.e.); *calculation base Art. 2.6 – dir - 91/271 EEC*	1000 p.e.	no data	241	no data	32	no data	35	no data	22	no data	16
3.7.8	Total volume of wastewater treated in WWTPs (yearly average at the outlet of WWTP)	1000 m^3/d	63	54	4	4	1	2	0	1	2	2
3.7.8.10	Volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC	1000 m3/d	no data	54	no data	4	no data	2	no data	1	no data	2
3.7.8.11	Percent of volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC Article 4 (5) (3.7.8.11 / 3.2.1.)	% of 3.2.1	no data	100	no data	100	no data	100	no data	100	no data	100

[1] design horizon 2037 (maximum demand during the planning horizon; note: for decreasing demand the design year is the year after completion date)

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N°	Performance Indicators	Unit	Bacau		Comanesti-Moinesti [1]		Buhusi		Darmanesti		Targu Ocna	
			Before Project	After Project	Before Project	After Project	Before Project	After Project	Before Project	After Project	Before Project	After Project
3.7.8.12	Total BOD treated / removed	1000 kg BOD/d	no data	12.9	no data	1.5	no data	2.1	no data	1.3	no data	1.0
3.7.8.13	Total COD treated / removed	1000 kg COD/d	no data	28.9	no data	3.8	no data	4.2	no data	2.6	no data	1.9
3.7.8.14	Total N treated / removed	kg N/d	no data	2.6	no data	348.9	no data	383.0	no data	236.8	no data	175.0
3.7.8.15	Total P treated / removed	kg P/d	no data	0.5	no data	132.1	no data	70.0	no data	43.1	no data	32.0

Table 5-48: Summary indicators – Hydraulic Wastewater Flow (2009/2015)

[1] only settlements Moinesti, Gazarie

N°	Performance Indicators	Unit	Bacau		Comanesti-Moinesti [1]		Buhusi		Darmanesti		Targu Ocna	
			Before Project	After Project	Before Project	After Project	Before Project	After Project	Before Project	After Project	Before Project	After Project
3.3.1	Total volume of storm water (from separated sewer system)	m3/d	no data	142	separate system	0	no data	21	no system	separate system	separate System	0
3.3.1.3	Percent of storm water discharging to WWTP	% of 3.3.1	n/a	142	n/a	n/a	no data	21	n/a	n/a	n/a	n/a
3.3.1.4	Percent of storm water discharging to receiving waters without treatment	% of 3.3.1	n/a	0	n/a	n/a	no data	0	n/a	n/a	n/a	n/a
3.3.2	Peak factor for storm drainage flow (Q24 max)	-	n/a	31	n/a	0	n/a	34	n/a	n/a	n/a	n/a

Table 5-49: Summary indicators – Storm water Flow

[1] only settlements Moinesti, Gazarie

N°	Performance Indicators	Unit	Bacau		Moinesti		Buhusi		Darmanesti		Targu Ocna	
			Before Project	After Project	Before Project	After Project	Before Project	After Project	Before Project	After Project	Before Project	After Project
3.4.1	Total Biological load (BOD5)	kg BOD/d	6	13	1	2	0	2	no data	1	0	1
3.4.1.4	Percent from domestic customers	% of 3.4.1	no data	81	no data	85	no data	48	no data	45	no data	60
3.4.1.5	Percent from industry	% of 3.4.1	no data	13	no data	11	no data	18	no data	32	no data	10
3.4.1.6	Percent from commerce and public service entities	% of 3.4.1	no data	6	no data	5	no data	34	no data	23	no data	30
3.4.2.1	BOD5 concentration	mg/l	84	195	153	225	no data	265	no data	271	290	263
3.4.2.2	COD concentration	mg/l	258	390	332	451	120	529	no data	543	446	526
3.4.2.3	Suspended solids	mg/l	144	228	182	263	233	309	no data	317	439	307
3.4.2.4	Total Nitrogen concentration	mg/l	26	36	20	41	no data	49	no data	50	60	48
3.4.2.5	Total Phosphorus concentration	mg/l	3	7	no data	15	no data	9	no data	9	no data	9

Table 5-50: Current and projected Wastewater Load

[1] only settlements Moinesti, Gazarie

5.1.5 Level of Service

The following sub-chapter summarizes the current level of service for water supply and wastewater.

Item	Indicator	Unit	Bacau	Comanesti-Moinesti [1]	Buhushi	Darmanesti	Targu Ocna
Water Supply							
2.1	**Level of water supply service coverage**						
2.1.1	Total population in service area concerned (water supply zone)	capita	197,013	23,902	19,644	11,508	12,118
2.1.2	Service Coverage: Percent of population connected to water supply system (2.1.3/2.1.1)	% of 2.1.1	90	84	85	90	97
2.1.3	Population served (population connected to/served by a central water supply system through house/yard connections, public tap)	capita	177,311	20,078	16,697	10,357	11,754
2.3	**Water consumption/demand***						
2.3.6	Specific domestic water consumptions	lcd	104	88	61	61	76
2.3.9	Depressed consumption (insufficient quantity available)	yes/no	no	no	no	no	no
2.6	**Supply security and system failures**						
2.6.2	Supply interruptions due to system failures per length of network per year	number/km/ year	No data				
2.6.5	Hours of water supply per day	Number of hours	24	19	24	24	24
2.9	**Water Quality**						

Item	Indicator	Unit	Bacau	Comanesti-Moinesti [1)]	Buhushi	Darmanesti	Targu Ocna
2.9.2	Population supplied with drinking water quality compliance with EC Drinking Water Directive 98/83/EC and transition treaty chapter 22	number	0				
2.9.3	Percent of population supplied with drinking water quality compliance with EC Drinking Water Directive 98/83/EC and transition treaty chapter 22	% of 2.1.1					
Wastewater							
3.1.1	Total population in agglomeration concerned	Capita	197.013	23.902	19.644	11.508	12.118
3.1.2	Service coverage: Percent of population connected to wastewater network	% of 3.1.1	73	67	54	0	54
3.1.3	Population connected to a wastewater network	Capita *1000	143.132	16.060	10.700	0.115	6.600
3.1.12	Percent of population connected to a WWTP compliant with EU UWWTD 91/271/EEC Article 4 (5)	% of 3.1.1	No data	No data	No data	No data	No data

Table 5-51: Level of Service

[1)] only settlements Moinesti, Gazarie

5.1.6 Land Occupation and Legal Status

The proposed infrastructure is without exception public land. There is no need for acquisition of land foreseeable.

5.1.7 Summary of Geotechnical Studies

For the proposed measures detailed geotechnical studies are ongoing. The general county-wide hydrogeological situation is described in the masterplan.

5.2 Existing Water Supply Infrastructure

The main water source in the county of Bacau is the artificial Poiana Uzului Lake located in the Carpathian mountains which has a volume of 90 Millions m^3. The untreated water flows after passing a hydropower plant to the Water Treatment Plant Caraboaia, located on approx. 420 m.a.s.l. nearby Darmanesti. There, coagulation and flocculation, sedimentation, filtration and chlorination process take place. The treated water is conducted by three transmission mains to several cities and communes in Bacau county.

The southern branch is approx. 29 km long and supplies Onesti and Targu Ocna as well as several localities in between. The water flows by gravity.

The northern branch supplies Darmanesti, Moinesti as well as several other localities.

The third branch – the largest with approx. 65 km passes its highest point in Moinesti and supplies WSZ Bacau. Furthermore Bacau City has also additional groundwater sources. To supply localities by the northern branch and as well as Bacau City the water is pumped from WTP Caraboaia.

Besides the Poiana Uzului water from WTP Caraboaia, there is also the WTP Ciobanus which supplies Comanesti. Furthermore there are several additional groundwater sources in Bacau County, e.g. in Buhusi and Bacau City.

5.2.1 Water Treatment Plant Caraboaia

The Water Treatment Plant is operated by S.C. Apa Serv S.A. Bacau.

Figure 5-30 : Entrance of WTP Caraboaia nearby Darmanesti

5.2.1.1 Water Abstraction

Surface water is taken from the lake Poiana Uzului.

Volume of reservoir: 90 mill. m^3.

The barrage was built for abstraction of surface water for potable water production and for hydropower use. Withdrawal of raw water is possible at 3 different levels, a Francis turbine at the foot of the barrage produces electricity.

Figure 5-31 : Poiana Uzului lake

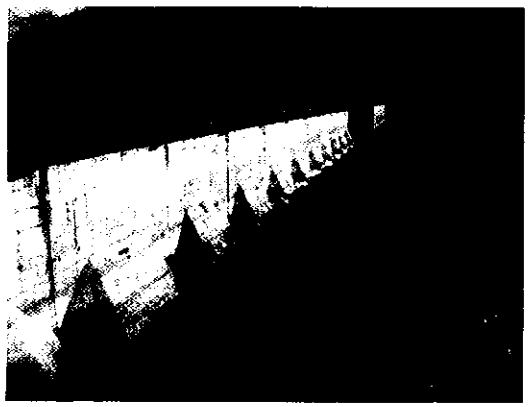

Figure 5-32: Barrage of Lake Uzului

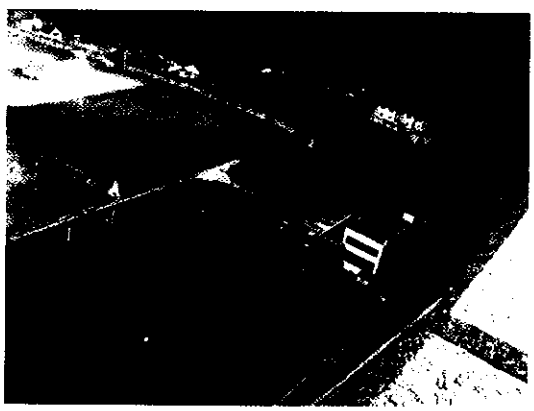

Figure 5-33: Downstream view of barrage

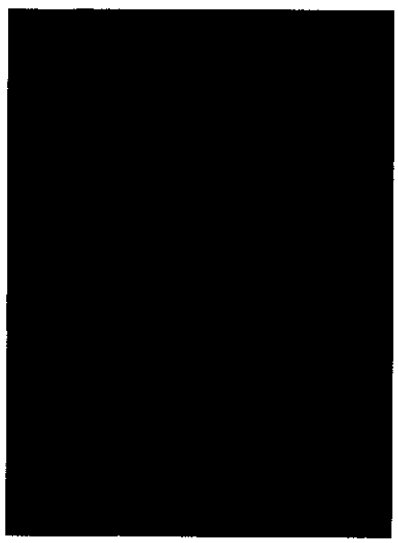

Figure 5-34: Withdrawal pipe

5.2.1.2 Water treatment

WTP Caraboaia treats water of the Poiana Uzului Lake. The WTP is located approx. 10 km downstream of the barrage from Lake Poiana Uzului. There are a coagulation and flocculation process using aluminium sulphate, clarifier for sedimentation and a final disinfection using chlorine gas.

Basic Data:

- Year of commissioning: 1973
- Design capacity Filter Hall: total capacity 1500 l/s (18 filters, 1000 m² filter area)
- Design capacity clarifier: 750 l/s (only 2 of 4 planned clarifier have been built)
- Current water production: approx. 750 l/s (maximum)
- Laboratory existing
- Raw water pipeline, DN1000 – 8,500 m
- Inlet & Mixing Chamber
- Clarifier (2 circular units, diameter 45 m, total surface 3,180 m^2)
- Filter Station (18 rapid sand filters, total filter area = 1,000m^2)

- Filter backwash facility
- $A_2(SO_4)_3$ make-up, storage and dosing facility (new)
- Polymer make-up, storage and dosing facility (new)
- Final disinfection by chlorine
- Inlet and outlet flow metering (new)
- Treated water reservoir (2 units, 3,000 m^3 each)
- Final effluent pumping station

5.2.1.3 Sludge treatment

Not existing, the backwash water and the sludge from the clarifier are discharged into a creek. Pictures below show the existing situation of the most important units of the WTP Caraboaia.

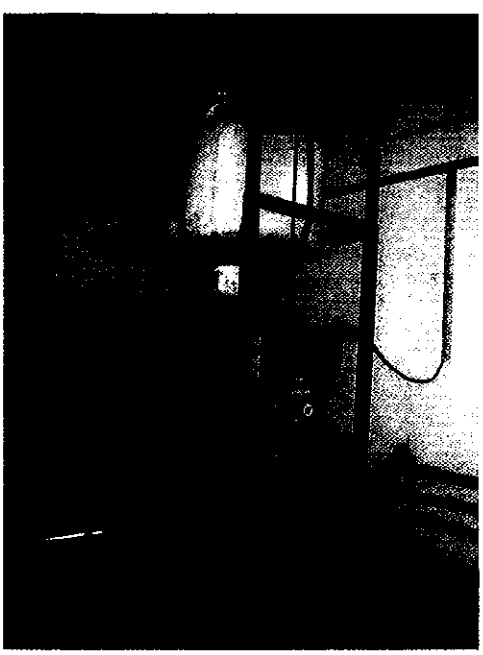

Figure 5-35: $A_2(SO_4)_3$ make-up

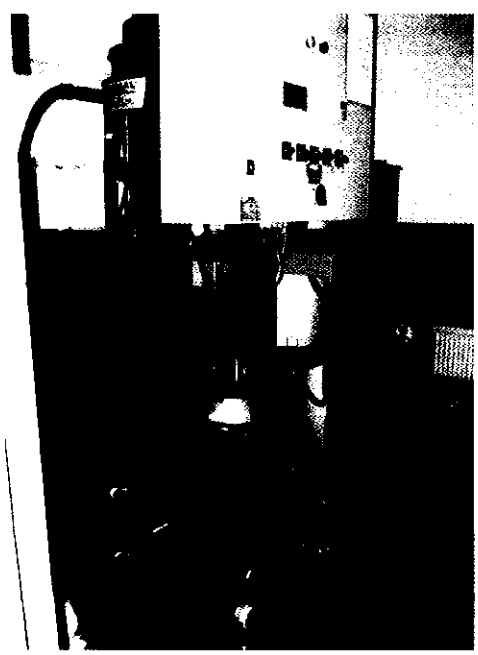

Figure 5-36: Polymer make-up

Figure 5-37: Intake/Mixing chamber I

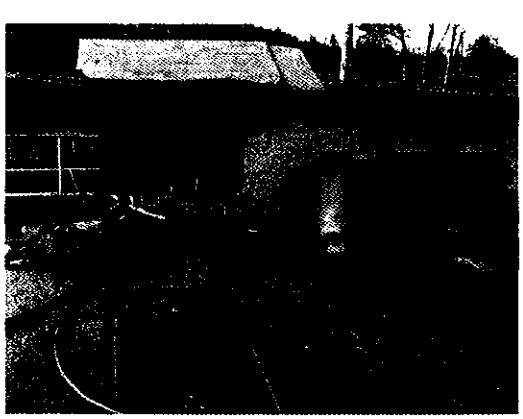

Figure 5-38: Intake/Mixing chamber II

Figure 5-39: Clarifier

Figure 5-40: Filter hall

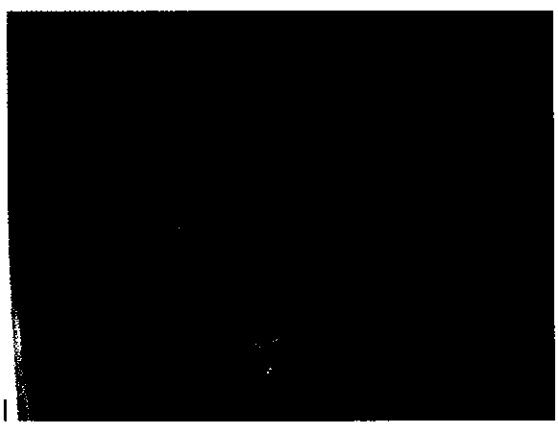

Figure 5-41: Sand filter

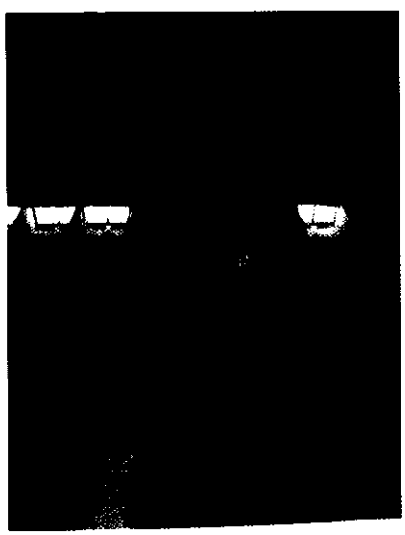

Figure 5-42: Sand filter after backwash

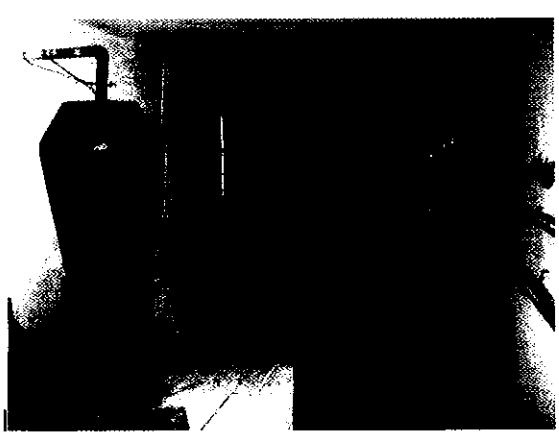

Figure 5-43: Filter pipe gallery

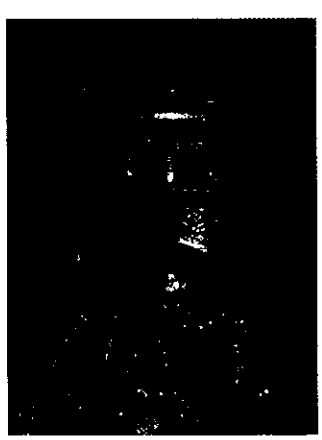

Figure 5-44: Valve of filter pipe gallery

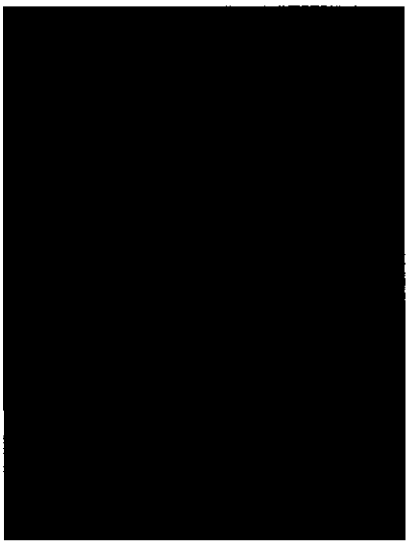

Figure 5-45: Control panel for backwash

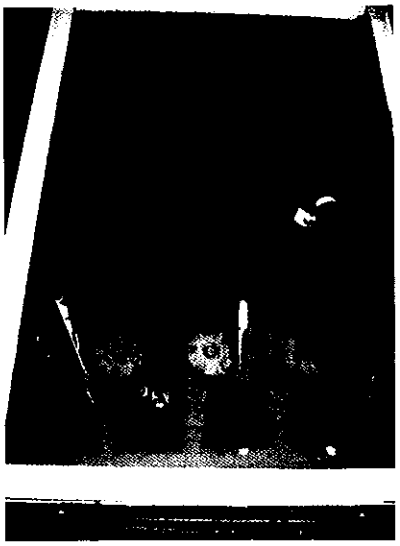

Figure 5-46: Control panel opened

Figure 5-47: Installed flow meters

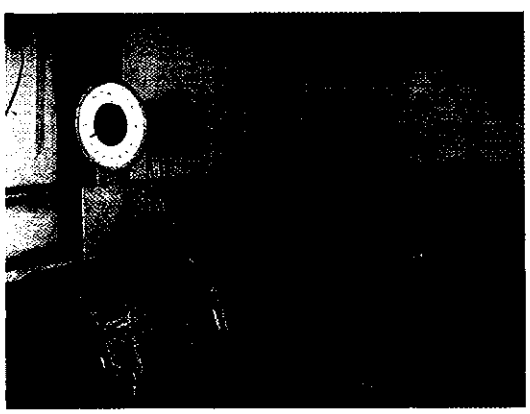

Figure 5-48: Chlorination unit

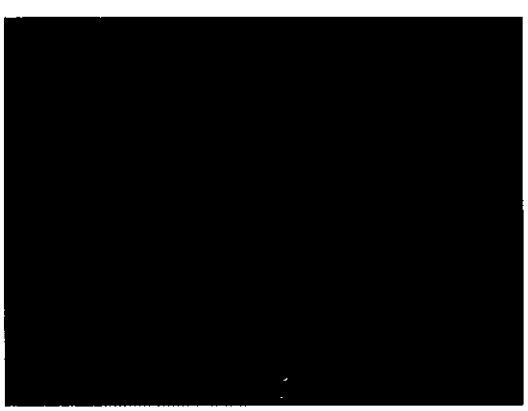

Figure 5-49: Filter backwash pumps

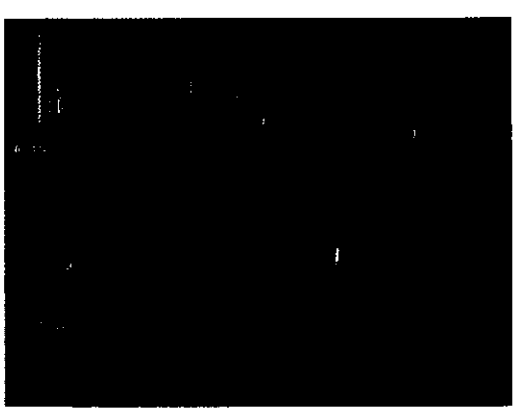

Figure 5-50: Main LV distribution

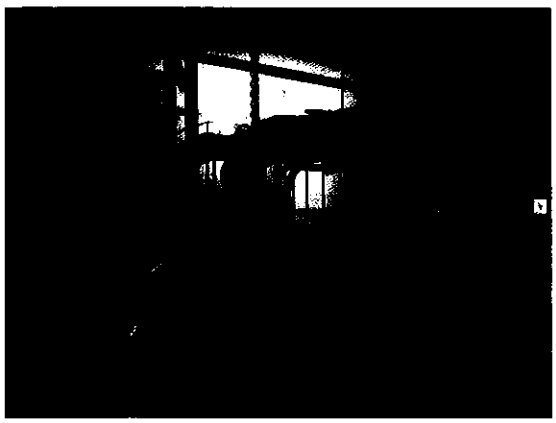

Figure 5-51: Pumping hall

Figure 5-52: Pumping hall

The following figure shows the general supply scheme of WTP Caraboaia.

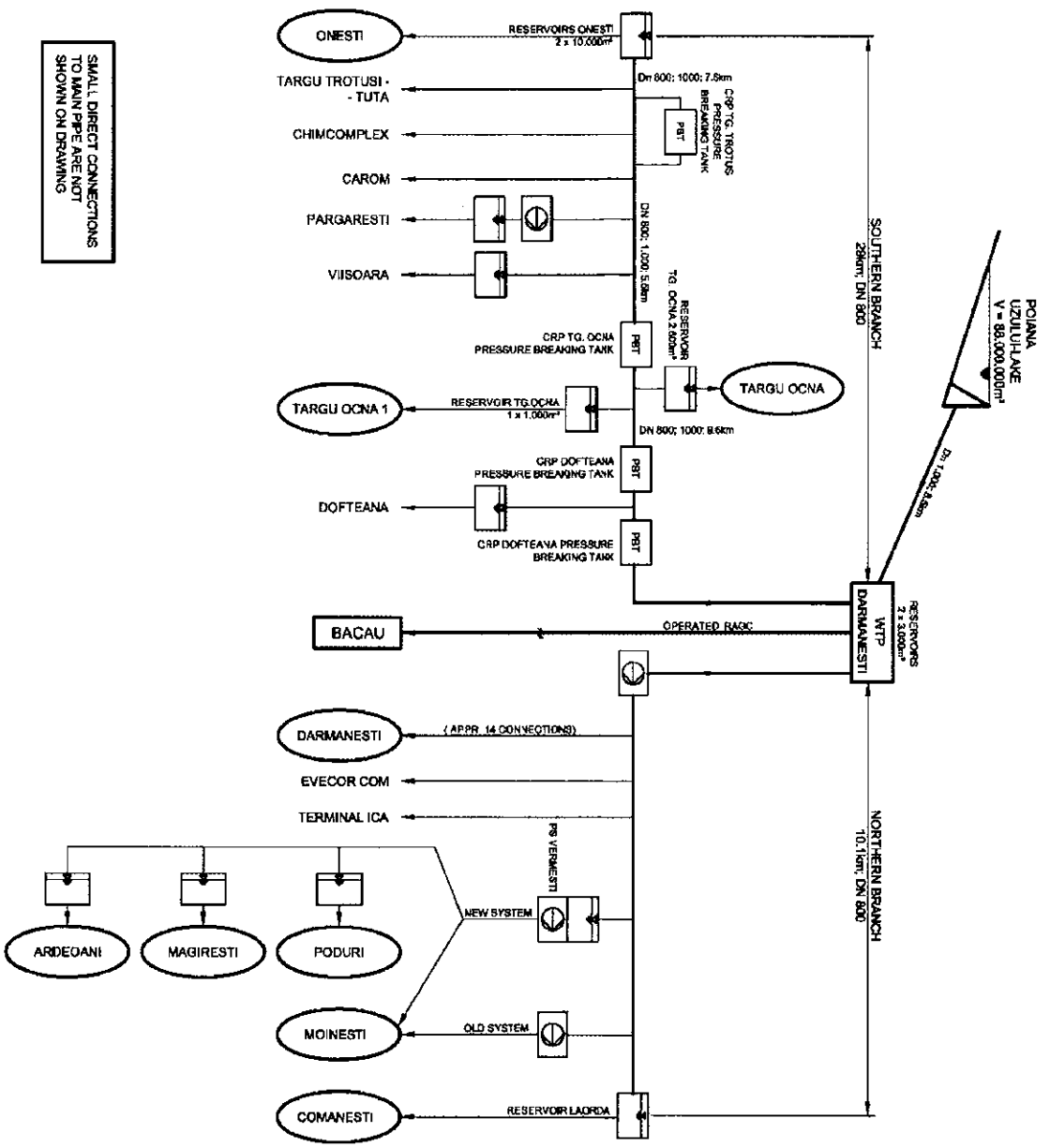

Figure 5-53: General Supply Scheme WTP Caraboaia

5.2.1.4 Details about water treatment and water quality

In the tables below, a summary for the most important water quality parameters is shown for raw and treated water at WTP Caraboaia. For more details see Annex 3-1.

Parameters	Raw Water 2005	2006	2007	2008
Oxidability	16.6	3.9	3.3	3.34
Turbidity	54.8	12.1	8.95	8.55
Ammonium NH_4^+	0.38	0.16	0.028	0.027
Nitrate NO_3	4.2	3.19	3.41	3.66
Nitrite NO_2^-	0.026	0.019	0.022	0.028
Aluminium Al^{+++}	-	-	-	-
Iron Fe	0.3	0.13	0.062	0.074

yearly average in lake

Table 5-52: Water Quality of raw water of lake from 2005 – 2008

Parameters	Limit EC 98	Treated water 2005	2006	2007	2008
Oxidability	5 mg/l O_2				
Turbidity	1 NTU				
Ammonium NH_4^+	0.5 mg/l				
Nitrate NO_3	50 mg/l				
Nitrite NO_2^-	0.05 mg/l				
Aluminium Al^{+++}	0.2 mg/l				
Iron Fe	0.2 mg/l				

yearly average in RSV at WTP

Table 5-53: Water Quality of treated water from WTP Caraboaia from 2005 – 2008

As shown in the table above there is a permanent problem of turbidity. This can also be seen in the two figures below.

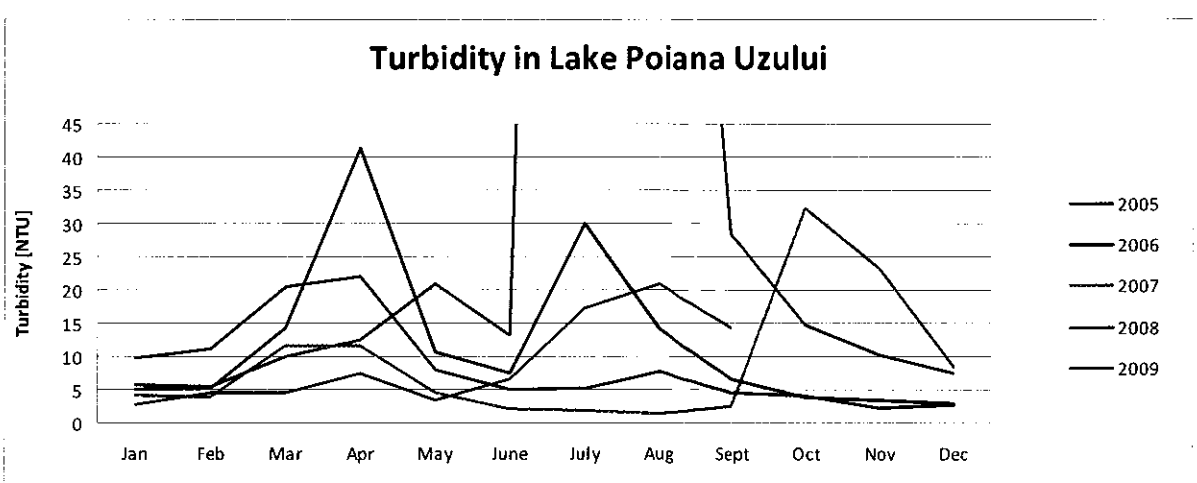

Figure 5-54: Turbidity of raw water from 2005 - 2009 (monthly averages)

To show the ranges, the peaks in July 2005 (377 NTU) and August 2005 (152 NTU) are out of scale in Figure 5-54.

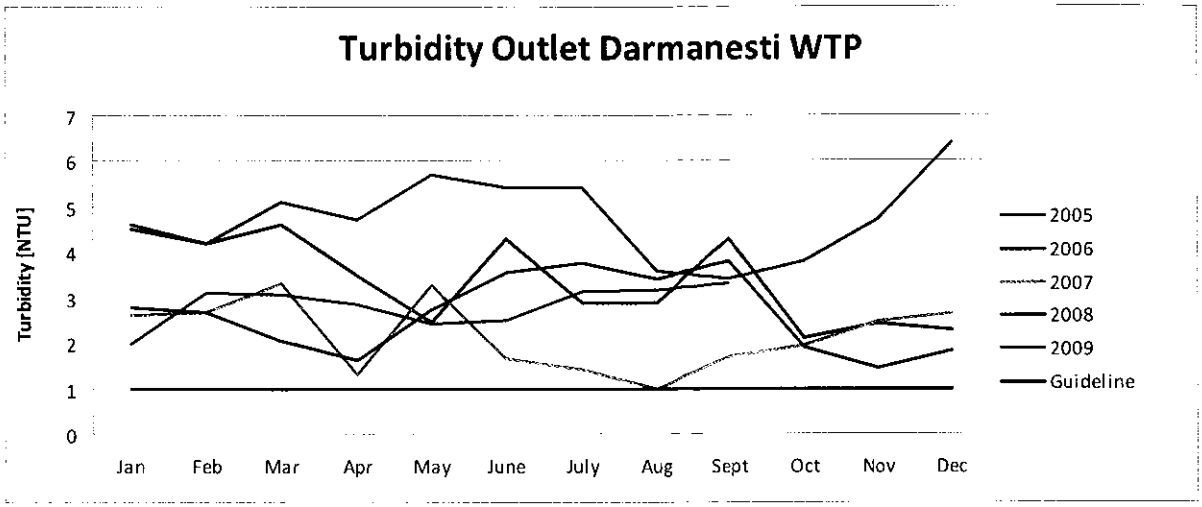

Figure 5-55: Turbidity of treated water from 2005 - 2009 (monthly average)

The high turbidity in treated water is resulted by using aluminium sulphate and a polymer for coagulation and flocculation. Aluminium Sulphate is not working very well above pH of 7. So the relatively high Aluminium content in the treated water is explainable (a bigger part of aluminium will be dissolved instead of be used for flocculation process). By using monthly average values in the figure below it is obvious that the limit of 200 µg/l is exceeding on several days a month, especially in spring and autumn.

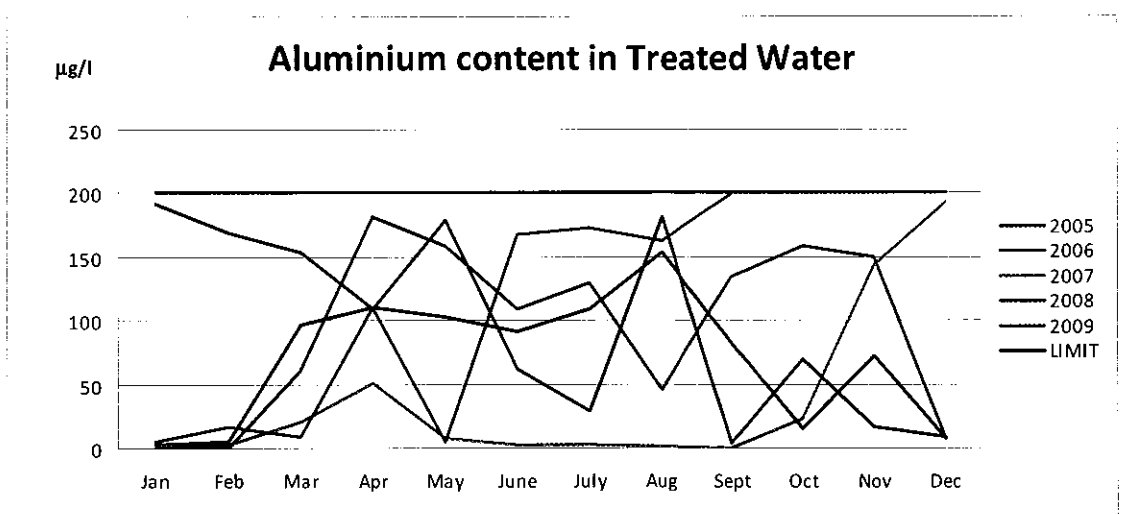

Figure 5-56: Aluminum Content in treated water from 2005 – 2009 (monthly average)

At WTP Caraboaia there are high backwash rates of the backwash filters comparing to a well operated WTP. By backwashing the sand filters all the backwash water is discharged untreated into a creek nearby the plant. So high water losses are resulting by the water treatment process. Because of not well working flocculation process there are also high sand losses (no detailed data available).

The water losses resulting by treatment process in the year 2008 are shown in the table below.

Year 2008	Produced TOTAL [m³]	Produced Onesti [m³]	Produced Bacau [m³]	Produced Comanesti [m³]	for Process [m³]	for Process [%]
Jan	2,551,245	no data	no data	no data	no data	no data
Feb	2,322,901	878,084	756,316	366,901	321,600	13.84%
March	2,415,447	887,124	790,766	399,007	338,550	14.02%
Apr	2,132,211	881,991	741,751	347,658	160,811	7.54%
May	2,093,835	960,145	702,813	366,286	64,591	3.08%
June	2,177,798	999,337	714,667	384,170	79,624	3.66%
July	2,233,001	1,065,989	747,079	392,957	26,976	1.21%
Aug	2,256,270	1,056,959	749,035	418,652	31,624	1.40%
Sep	2,203,495	946,681	734,735	371,201	150,878	6.85%
Okt	2,255,819	896,333	761,324	279,067	319,095	14.15%
Nov	2,150,800	890,365	704,375	352,319	203,741	9.47%
Dec	2,211,414	925,968	742,099	393,055	150,292	6.80%
TOTAL	**27,004,236**	**10,388,976**	**8,144,960**	**4,071,273**	**1,847,782**	**6.84%**

Table 5-54: Overview of produced water and process water from WTP Caraboaia in 2008

The tables and figures above show that the existing treatment process might not be adequate and /or that the process of flocculation / coagulation and filtration is not efficient enough to treat the water from the lake.

5.2.1.5 Main Deficiencies at Water Treatment Plant Caraboaia

Main deficiencies of the WTP Caraboaia are presented in the table below.

Item	Components	Main deficiency
1	Civil Structures and Buildings	Generally poor, is to renew, especially inlet and mixing chamber
2	Electrical Equipment and Structures	Generally poor, is to renew
3	Mechanical Equipment and Structures	Partly just rehabilitated or new (effluent pumps, make up and dosing units), but main parts are to renew (esp.: filter gallery, filter backwash facility, chlorination equipment)
4	Treatment Process	Insufficient, is to improve
5	Sludge Treatment	Not existing, is to implement
6	Piping	Generally poor, is to renew
7	Operation	Lack of skills and process understanding, improvement of operational skills required
8	Maintenance	Fair but improvement required
9	Process Control	Poor, no automatic process control in place
10	Laboratory	Good, is to upgrade

Table 5-55: Overview of main deficiencies at WTP Caraboaia

5.2.2 Water Supply Zone Bacau City

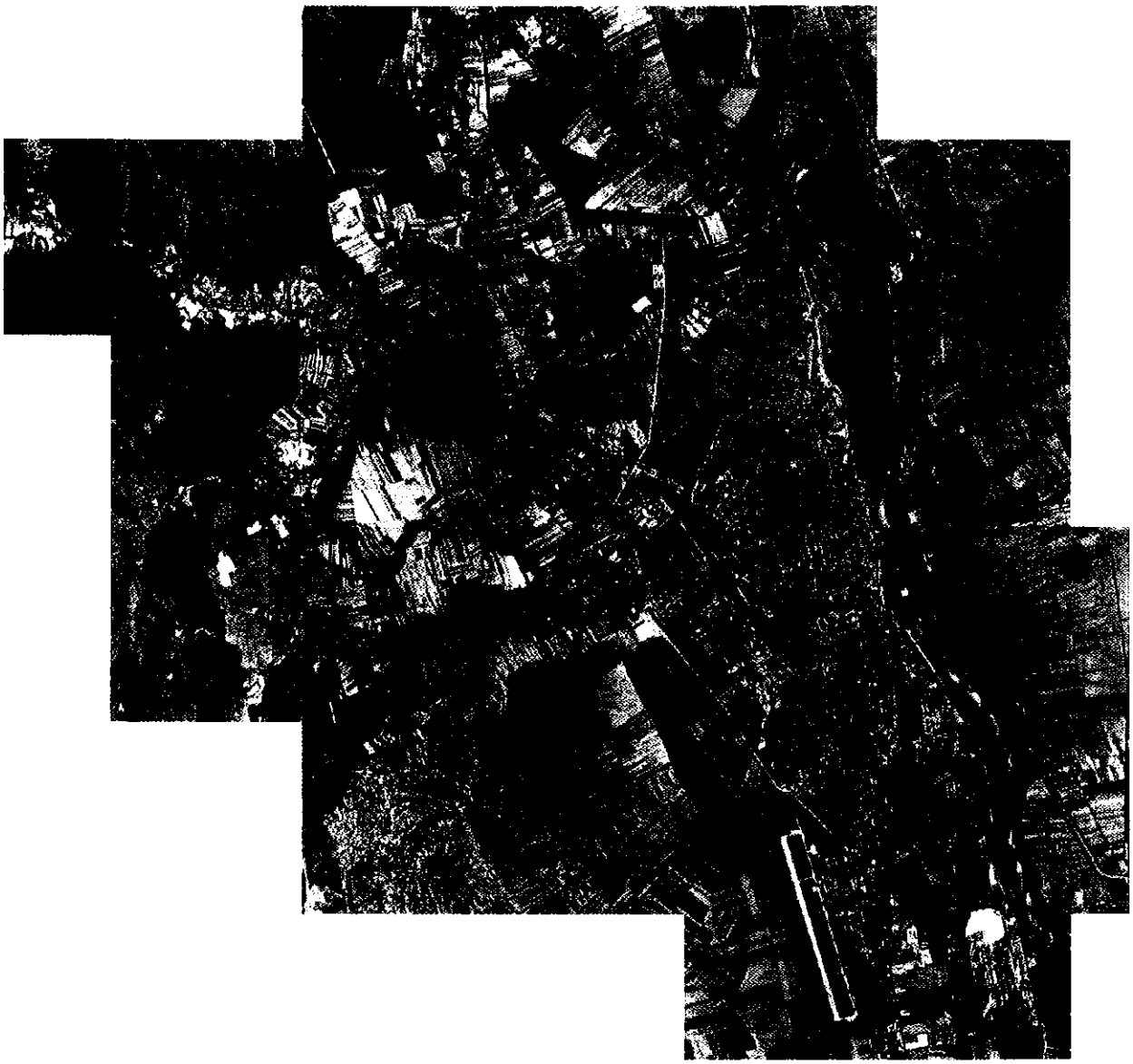

Figure 5-57: Existing water supply network Bacau City

5.2.2.1 Water abstraction and distribution to reservoirs

WSZ Bacau contains Bacau City, one of the largest cities in Romania, and several surrounding localities. WSZ Bacau is inhabited by approx. 197,013 inhabitants. It is supplied by four sources. Besides the above described water from WTP Caraboaia there are also additional groundwater sources. This water is distributed to the supply system by two pumping stations: PS Gheraiesti and PS Margineni.

PS Gheraiesti

Water of ground water field Margineni II (16 wells) and Gheraiesti I + II (44 + 44 wells) goes first to the RSV Gheraiesti.

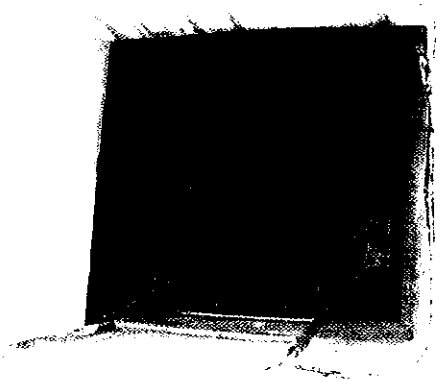

Figure 5-58: Well at groundwater source Gheraiesti

Figure 5-59: Pump of well at groundwater source Gheraiesti

There are 4 RSVs; two of them have a capacity of 5,000 m³ (shape : circular) and two of them have a capacity of 10,000 m³ (shape : circular). The total storage capacity at Gheraiesti is 30,000 m³.

From these RSVs the water is chlorinated and pumped directly at the pumping station Gheraiesti into the network of Bacau. The figure below shows the general situation of PS Gheraiesti.

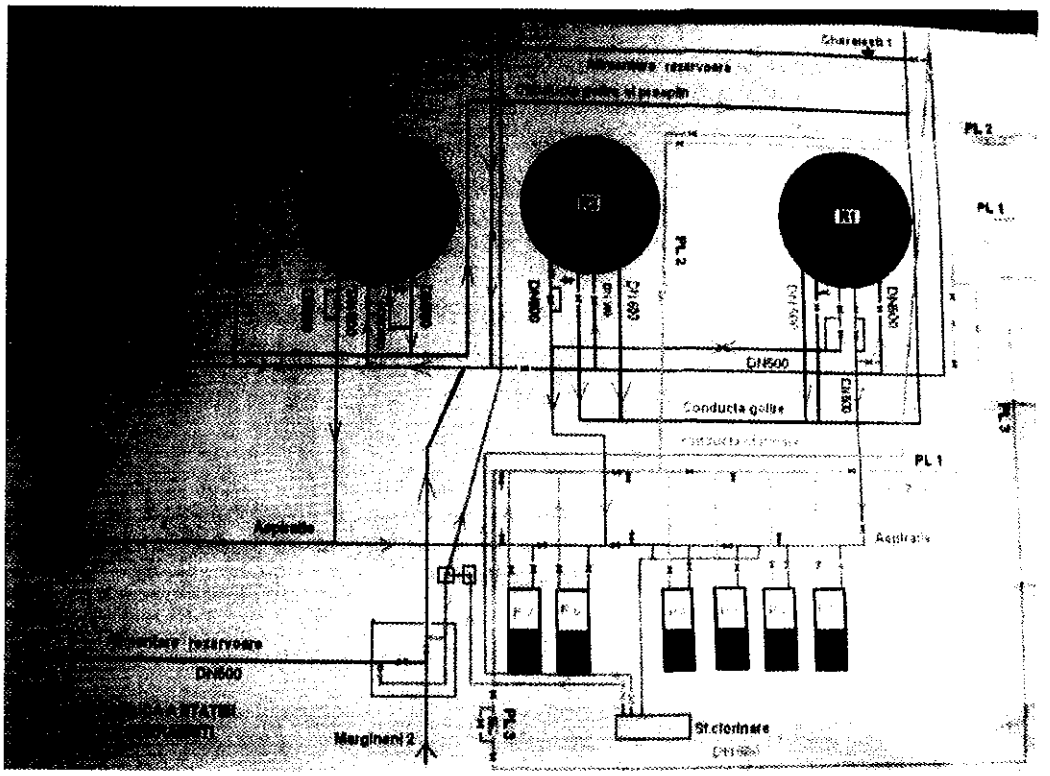

Figure 5-60: Overview Pumping Station Gheraiesti

There are six pumps installed at PS Gheraiesti. The next table gives an overview about the capacities of pumps installed at PS Gheraiesti.

Pump No	Head [m]	Discharge [m³/h]	Type
1	20	1,100	Constant speed
2	25	1,100	Constant speed
3	30	1,200	Constant speed
4	55	1,250	Constant speed
5	Not used any more		
6	Not used any more		

Table 5-56 : Overview about installed pumps at PS Gheraiesti

To control the volume of water pumped into the network by the PS Gheraiesti they use the position of the valves after the pumps, see picture below.

Figure 5-61: Control valve after pump at PS Gheraiesti (nearly closed)

PS Margineni

Water of ground water fields Margineni I (28 wells) and Hemeius I + II (13 + 5 wells) flow first to the RSV Margineni. There is a RSV with a capacity of 10,000 m³ (shape: circular) and another RSV with 200 m³ for emergency cases (shape: circular). The total storage capacity at Margineni is so 10,200 m³.

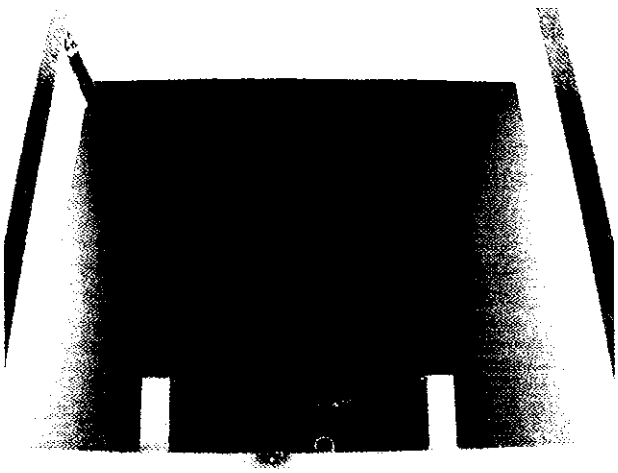

Figure 5-62: Well at groundwater source Margineni

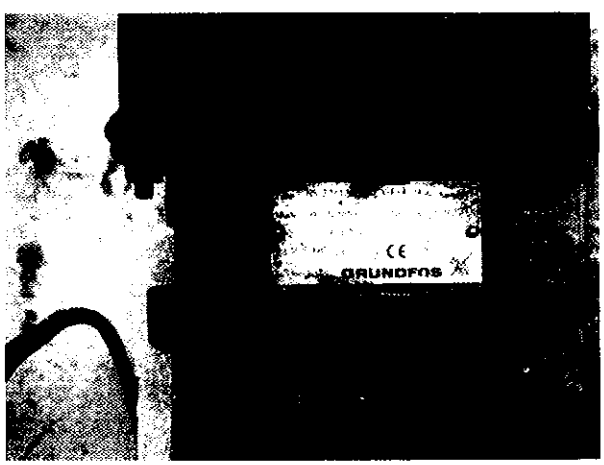

Figure 5-63: Pump of well at groundwater source Margineni

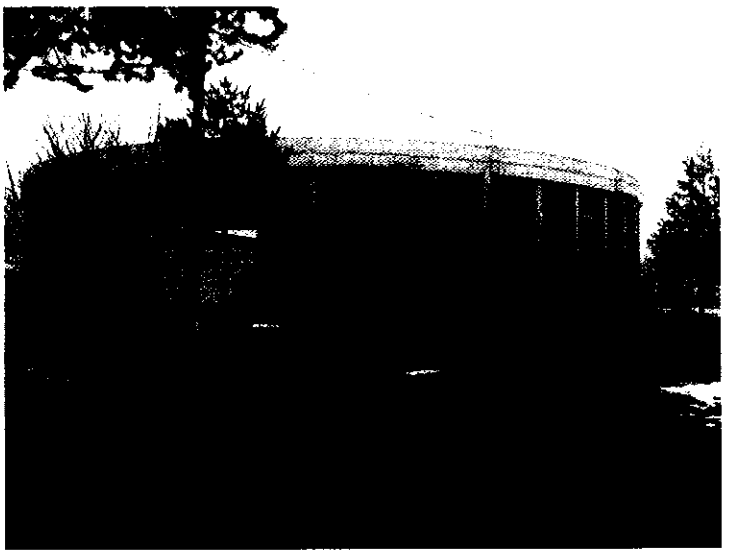

Figure 5-64: RSV (capacity 10,000 m³) at PS Margineni

The internal and external walls have been rehabilitated in 2006/2007

Water from RSV Margineni is chlorinated at the PS Margineni and pumped to RSV Barati. Only a rather small fraction of water is distributed to consumers on the way to RSV Barati.

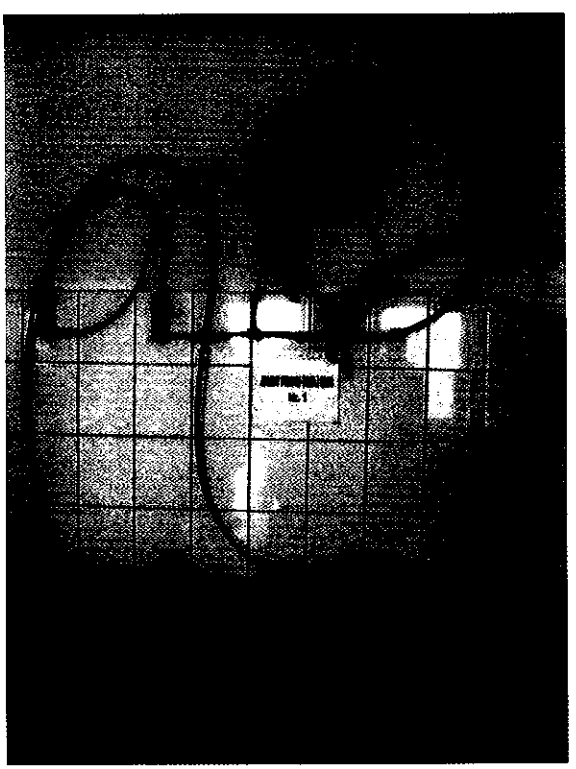

Figure 5-65: Chlorination injector at PS Margineni

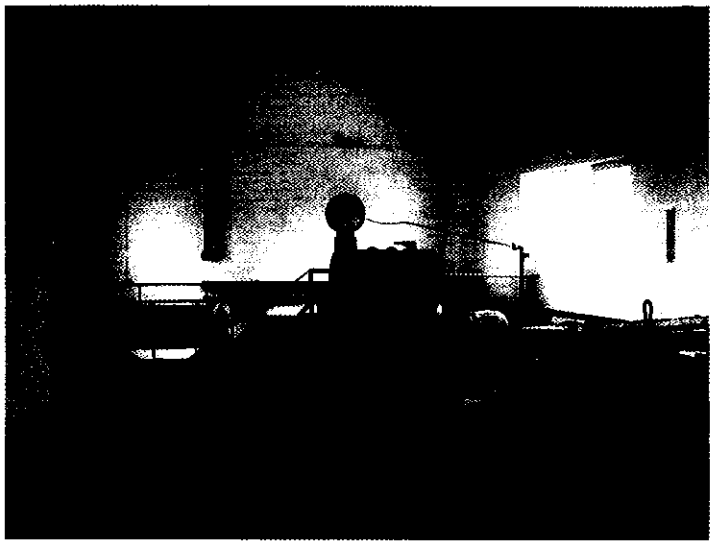

Figure 5-66: Chlorine storage room at PS Margineni

The figure below shows the general situation of PS Margineni.

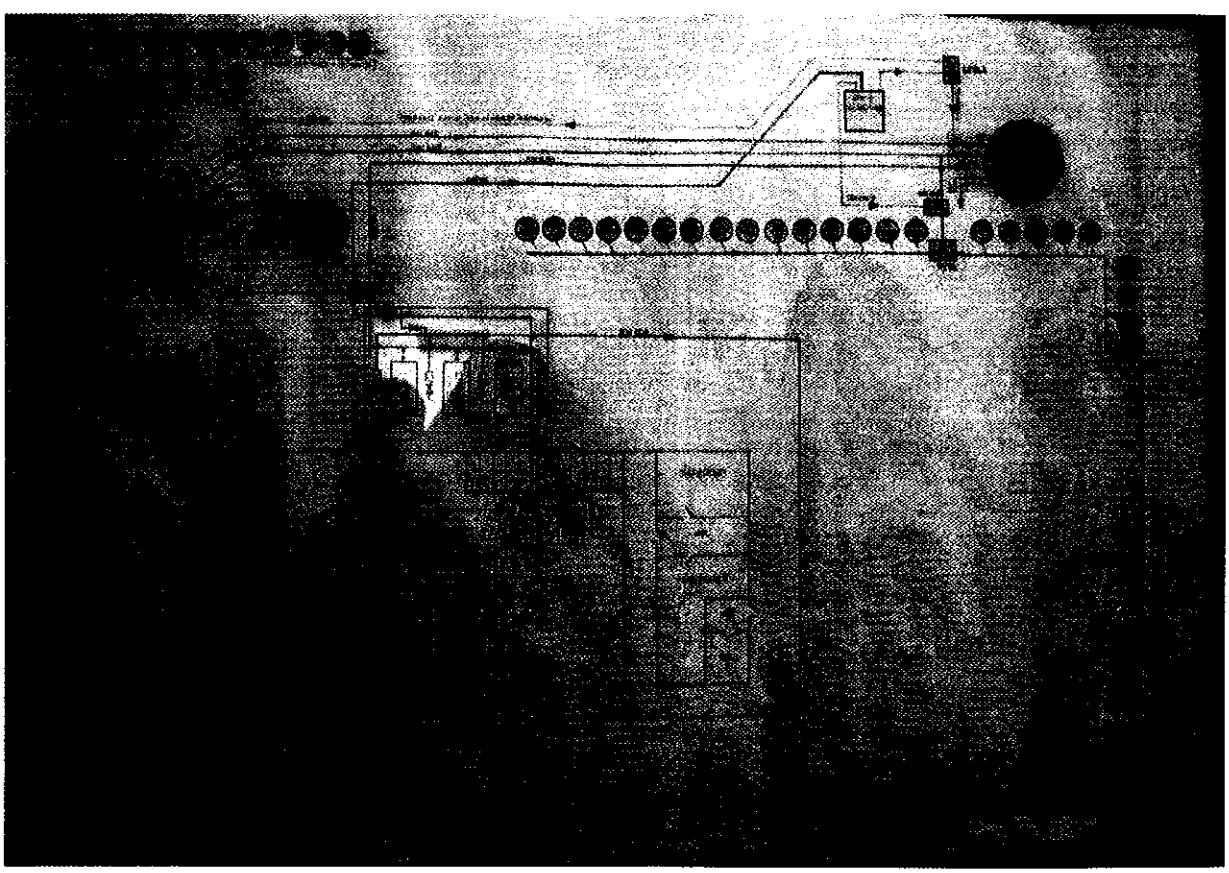

Figure 5-67: Overview Pumping Station Margineni

There are two pump rooms with 3 pumps installed each at PS Margineni.

Figure 5-68: Pump room I at PS Margineni

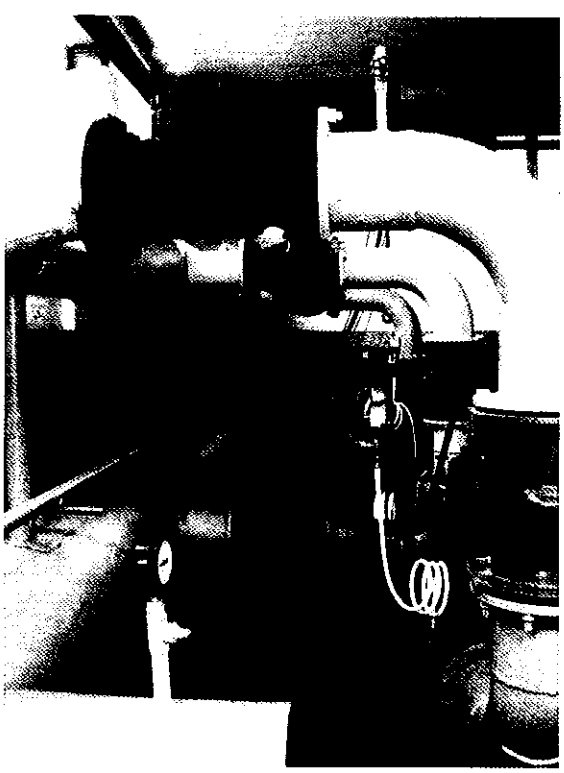

Figure 5-69: Pump room II at PS Margineni

The next table gives an overview about the capacities of pumps installed at PS Margineni.

Pump No	Discharge [m³/h]	Location	Type
3	1,200	Pump room I	Constant speed
3	900	Pump room II	Constant speed

Table 5-57 : Overview about installed pumps at PS Margineni

The pumps of the wells are controlled and managed by a system installed in 2001. There are control stations at the two pumping stations and at the wellfield Hemeius (for Hemeius I and II) to switch the well pumps on or off.

In the West of Bacau City RSV Barati is located at approx. 220 m.a.s.l. There are two RSVs (shapes : both rectangular) with a capacity of 20,000 m³ (10,000 m³ each). One RSV is filled by water from WTP Caraboaia. This water is re-chlorinated in Stejaru, approx. 17 km in the west of the City. The other RSV has two chambers with a capacity of 5,000 m³ each. This RSV is filled by PS Margineni.

The water from RSV Barati is distributed by gravity to the city (situated approx. 165 m.a.s.l.).

A general supply scheme of Bacau supply system is shown in the next figure.

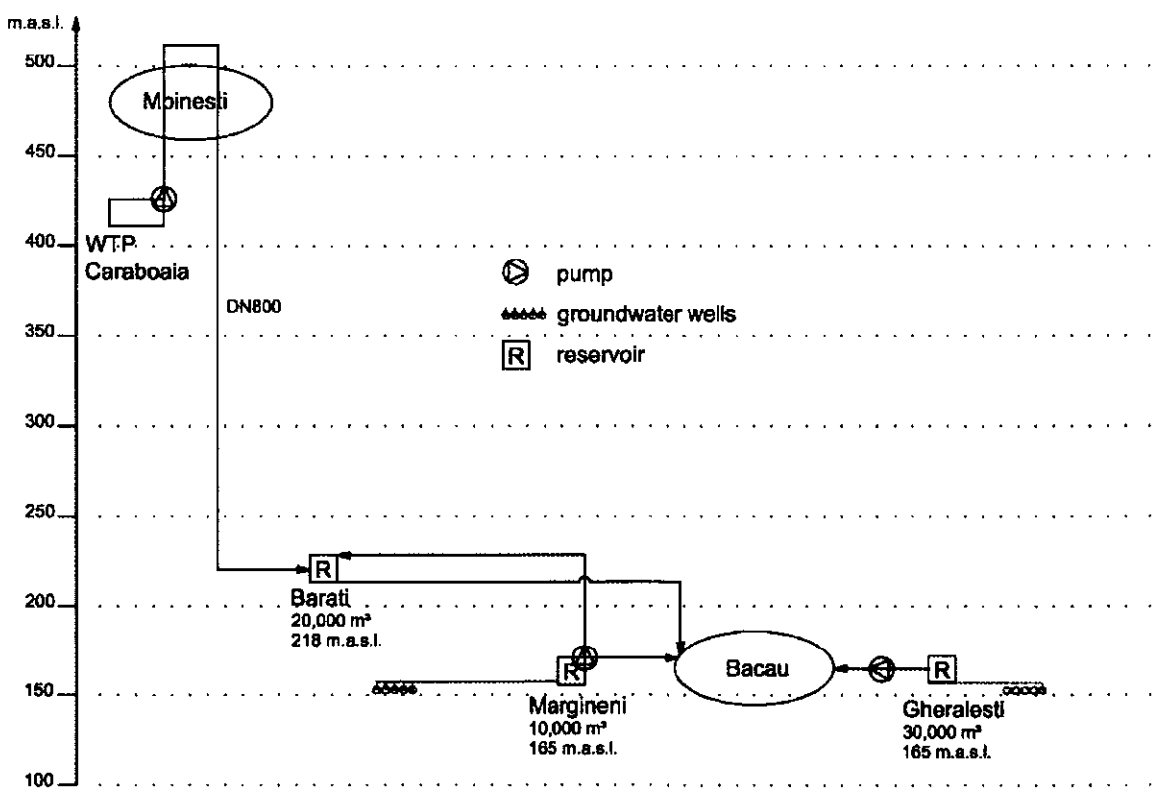

Figure 5-70: Bacau supply system

There is a general overview of the existing RSVs in WSZ Bacau.

RSV	Barati	Margineni	Gheraiesti
Shape	rectangular	circular	circular
Volumes [m³]	10,000	10,000	10,000
	10,000	200	10,000
		-	5,000
	-	-	5,000
Sum:	**20,000 m³**	**10,200 m³**	**30,000 m³**

Table 5-58: Overview of RSVs in Bacau city

Measures of an ongoing ISPA project (No 2002 RO 16 P PE 018) consist of investments concerning water supply sector, transport and treatment, also refer to chapter 2. A new main pipe from Poiana Uzului including intake at the barrage and pumping station is planned to be built. Furthermore a micro-hydro-power plant at Stejaru is in construction (capacity 650 l/s) and as well a new Water treatment Plant at RSV Barati is also under construction. By this measure the groundwater sources shall only be used for industry. This is shown in the next figure.

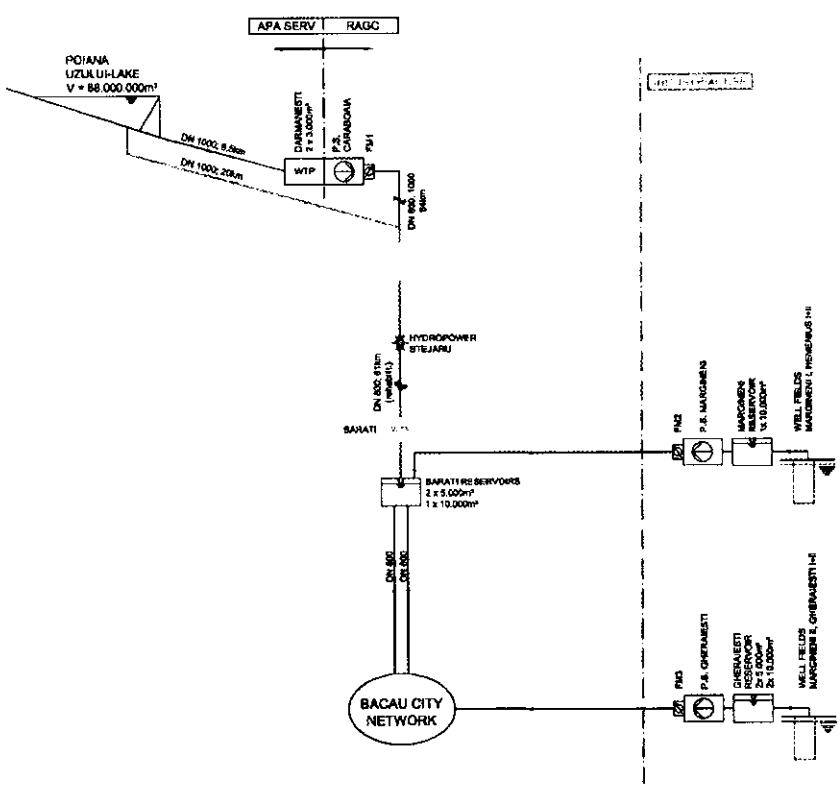

Figure 5-71: Bacau supply system in future after ongoing ISPA Project

5.2.2.2 Distribution network

The existing network of Bacau city consists of different materials and diameters as shown in the table below.

Material	Diameter [mm]	Length [m]	Length %
Asbestos Cement	100	9,407	4.82%
	150	19,613	10.06%
	200	2,349	1.20%
	300	1,297	0.67%
Sub-total AC		**32,665**	**16.75%**
Cast Iron	100	3,283	1.68%
	150	10,122	5.19%
	200	11,012	5.65%
	250	513	0.26%
	300	4,891	2.51%
	400	4,552	2.33%
	500	3,085	1.58%
	600	11,165	5.73%
	700	1,312	0.67%
Sub-total Cast Iron		**49,935**	**25.61%**
Concrete	600	16,330	8.38%
	800	5,011	2.57%
Sub-total Concrete		**5,011**	**2.57%**
HDPE	110	24,567	12.60%
	125	1,935	0.99%
	150	3,613	1.85%
	200	473	0.24%
Sub-total HDPE		**30,588**	**15.69%**
Steel	50	327	0.17%
	100	13,087	6.71%
	125	163	0.08%
	150	19,047	9.77%
	200	15,241	7.82%
	250	1,753	0.90%
	300	5,702	2.92%
	325	528	0.27%
	400	4,834	2.48%
	500	5,388	2.76%
	600	9,198	4.72%
	700	1,360	0.70%
	800	153	0.08%
Sub-total Steel		**76,779**	**39.38%**
Total lenght		**194,978**	**100%**

Table 5-59: Overview of existing water distribution network in Bacau city

Table 5-59 contains only the network of the city of Bacau. Furthermore there are several other localities in the Water Supply Zone Bacau which have also an existing water supply network. Details can be found in the table below.

WSZ	City/commune	Locality	WS-network existing
BACAU	BACAU CITY	BACAU	YES
	MARGINENI	MARGINENI	YES
		BARATI	YES
		PADURENI	YES
		TREBES	YES
		VALEA BUDULUI	YES
	MAGURA	CRIHAN	**NO**
		DEALU MARE	**NO**
		MAGURA	YES
	HEMEIUS	LILIECI	YES
		HEMEIUS	YES
	LETEA VECHE	LETEA VECHE	YES

Table 5-60: Overview of existing water distribution network in Water Supply Zone Bacau – breakdown by locality

In WSZ Bacau an existing connection rate of 90 % was evaluated during this FS by taking in consideration the ongoing projects for water supply networks in Crihan, Letea Veche and Hemeius (but also in Sohodol and Fantanele which are not part of the WSZ Bacau).

These extensions by other the projects are shown on the drawing no BC-FS-WS-121 and are also described in chapter 2.

5.2.2.3 Main Deficiencies of Water Supply Zone Bacau

Main deficiencies of the WSZ Bacau are presented in the table below.

Item	Components	Main deficiency
1	Water abstraction	A fraction of water from WTP Caraboaia, refer to chapter 5.2.1.5
2	Pumping Stations	In good condition, SCADA/Process control is missing
3	Water Treatment	Problems with treatment technology, refer to WTP Caraboaia (chapter 5.2.1.5), High Manganese values in groundwater
4	Storage	In good condition
5	Transmission Mains	Old pipes are to replace in future
6	Distribution Network	Old network, esp. AC parts are to replace

Table 5-61: Overview of main deficiencies of WSZ Bacau

5.2.3 Water Supply Zone Moinesti

Figure 5-72: Existing water supply network Moinesti

5.2.3.1 Water abstraction and distribution to reservoirs

WSZ Moinesti contains the city of Moinesti city and locality Gazarie. WSZ Moinesti is inhabited by approx. 23,902 inhabitants.

Water from WTP Caraboaia is pumped approx. 20 km by a steel pipe DN 800 which changes into two pipes before entering the city (1x DN 300, 1x DN 400) . The water flows first into the RSVs of PS Vasiesti located in the south of Moinesti, situated at approx. 420 m.a.s.l. From there the water is pumped by two pipes DN 300 and DN 400, both made up of steel, to several RSVs.

Figure 5-73: Reservoirs at PS Vasiesti in WSZ Moinesti

At PS Vasiesti there are two pumps installed. Usually only one is in operation, the other one is for stand by. To feed the RSVs they are pumping 400 m³/h by a head of 120 m (constant speed). There are also some consumers connected to this PS (of course they have only access to water when the pump is running).

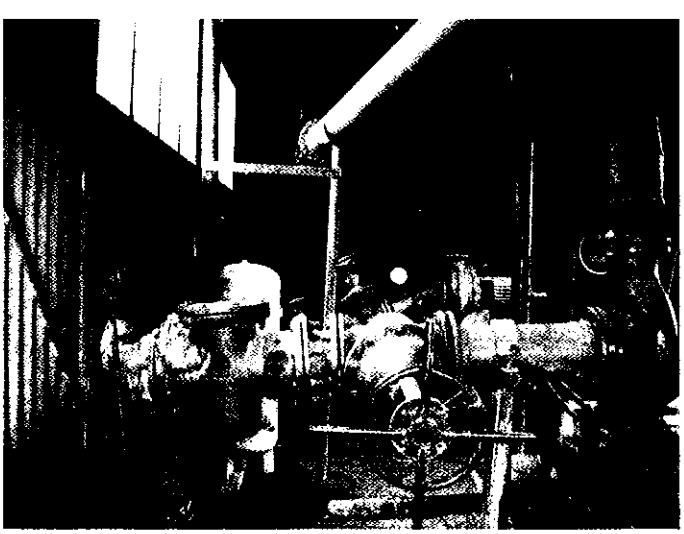

Figure 5-74: Pumps at PS Vasiesti in WSZ Moinesti

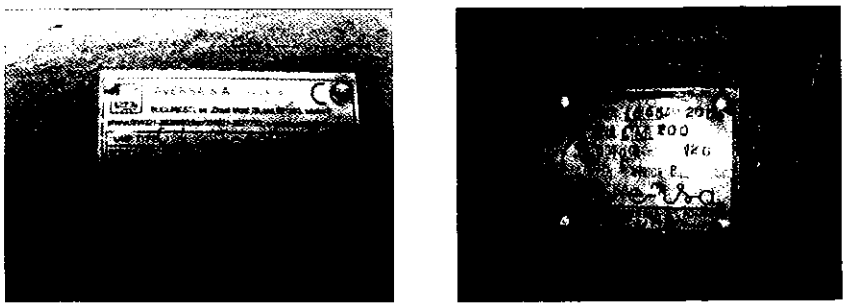

Figure 5-75: Plates of installed Pumps at PS Vasiesti in WSZ Moinesti

The table below shows the situation of RSVs in WSZ Moinesti.

RSV	Capacity [m³]	Elevation [m a.s.l.]	Shape / type	Fed by
RSV at PS Vasiesti	1 x 200 1 x 40 TOTAL: 250	420	Steel Tanks	WTP Caraboaia
Hangani	1 x 500 TOTAL: 500	446	Circular/concrete/ buried	PS Vasiesti
Pini	2 x 2,500 2 x 2,000 TOTAL: 9,000	512	All of them: circular The 2 x 2000 are buried	PS Vasiesti
Cristea	2 x 200 1 x 240 (not installed) TOTAL: 400	476	Circular/concrete/ buried	RSV Pini (by gravity)
Micleasca	2 x 300 TOTAL: 600	505	Circular/concrete/ buried	PS Vasiesti
STORAGE CAPACITY	**10,740**			

Table 5-62: Overview of RSVs in WSZ Moinesti

RSV Hangani is located in the south, RSVs Pini in the West and RSV Micleasca is located in the East. From RSV Pini the water flows by gravity to RSV Cristea located in the North of RSV Pini. Every RSV supplies a separate part of the network. They are separated by valves which are usually closed.

A general supply scheme of Moinesti supply system is shown in the next figure.

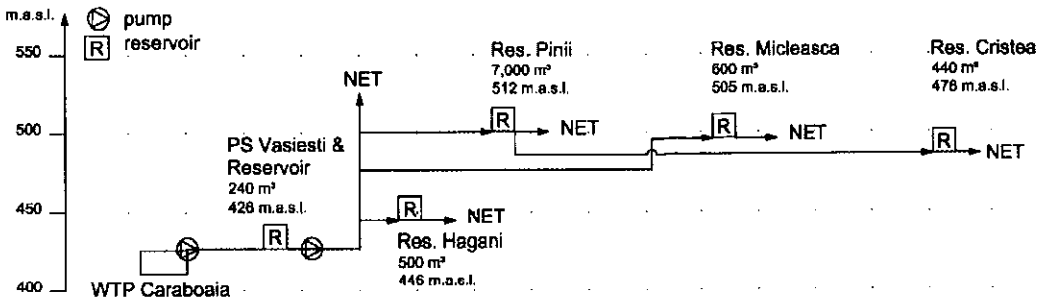

Figure 5-76: Moinesti supply system

At RSV Micleasca and Cristea the inflow is controlled by automatic valves which are controlled by installed level control sensors. If the RSV is full the valve at the inflow will be closed automatically.

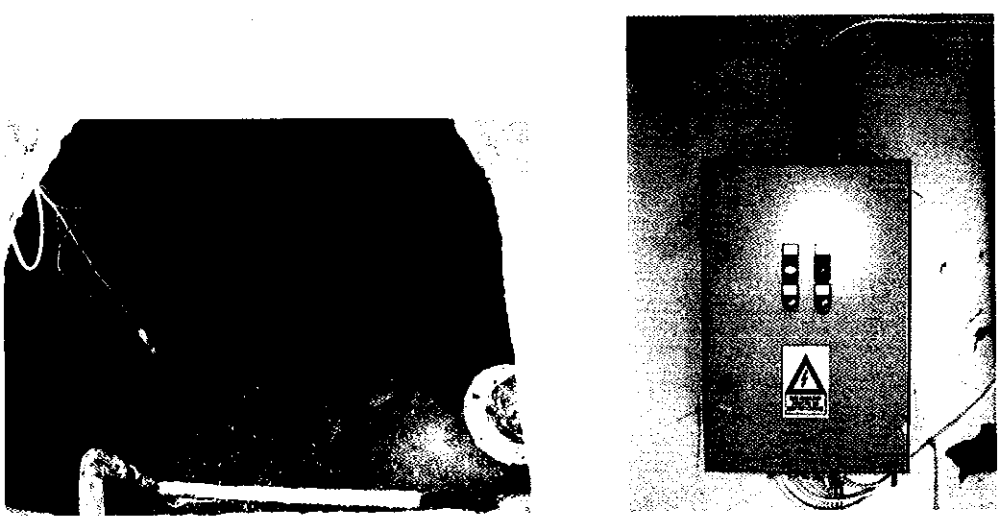

Figure 5-77: Level controller and control of valves at RSV

At RSV Pini there is also a chlorination station where the chlorinated water from WTP Caraboaia is re-chlorinated with chlorine gas.

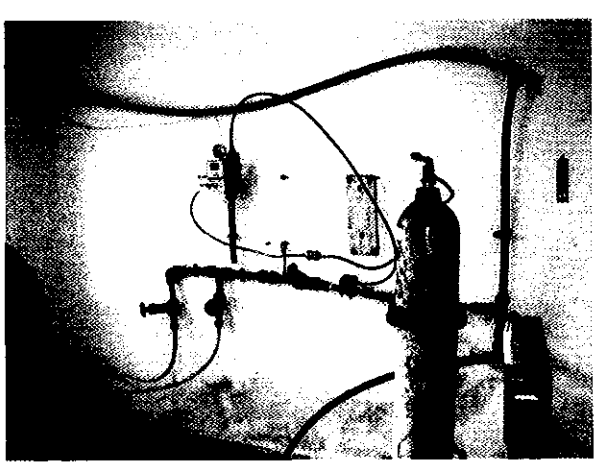

Figure 5-78: Chlorination at RSV Pini

At RSV Hangani and RSV Micleasca it was reported that chlorination is done by using Calciumhypochlorite, $Ca(OCl)_2$, in form of pills.

5.2.3.2 Distribution network

The existing network of Moinesti city consists of different materials and diameters as shown in the table below.

Material	Diameter [mm]	Length [m]	Length %
Cast Iron	80	634	1.38%
	100	1,096	2.39%
	150	114	0.25%
Sub-total Cast Iron		**1,844**	**4.02%**
HDPE	32	394	0.86%
	40	232	0.50%
	50	292	0.64%
	63	265	0.58%
	90	379	0.83%
	110	713	1.55%
	160	318	0.69%
	225	2,443	5.32%
Sub-total HDPE		**5,036**	**10.97%**
Steel	50	5,376	11.72%
	75	1,232	2.69%
	100	7,864	17.14%
	125	949	2.07%
	150	5,132	11.18%
	200	1,432	3.12%
	219	1,319	2.87%
	250	2,690	5.86%
	300	6,436	14.03%
	400	6,577	14.33%
Sub-total Steel		**39,007**	**85.01%**
Total lenght		**45,886**	**100.00%**

Table 5-63: Overview of existing water distribution network in WSZ Moinesti

In WSZ Moinesti an existing connection rate of 84 % was evaluated during this FS.

5.2.3.3 Main Deficiencies of Water Supply Zone Moinesti

Main deficiencies of the WSZ Moinesti are presented in the table below.

Item	Components	Main deficiency
1	Water abstraction	Water from WTP Caraboaia, refer to chapter 5.2.1.5
2	Pumping Stations	PS Vasiesti is in bad condition, is to be abandoned
3	Water Treatment	Problems with treatment technology, refer to WTP Caraboaia (chapter 5.2.1.5), Chlorination stations are to renew and to implement at several RSVs, where chlorination is actually done with Calciumhypochlorite
4	Storage	Bad condition, rehabilitation needed, especially piping
5	Transmission Mains	Bad condition, are to rehabilitation / replacement needed
6	Distribution Network	Old network, high losses, No supply during the night due to high losses

Table 5-64: Overview of main deficiencies of WSZ Moinesti

5.2.4 Water Supply Zone Buhusi

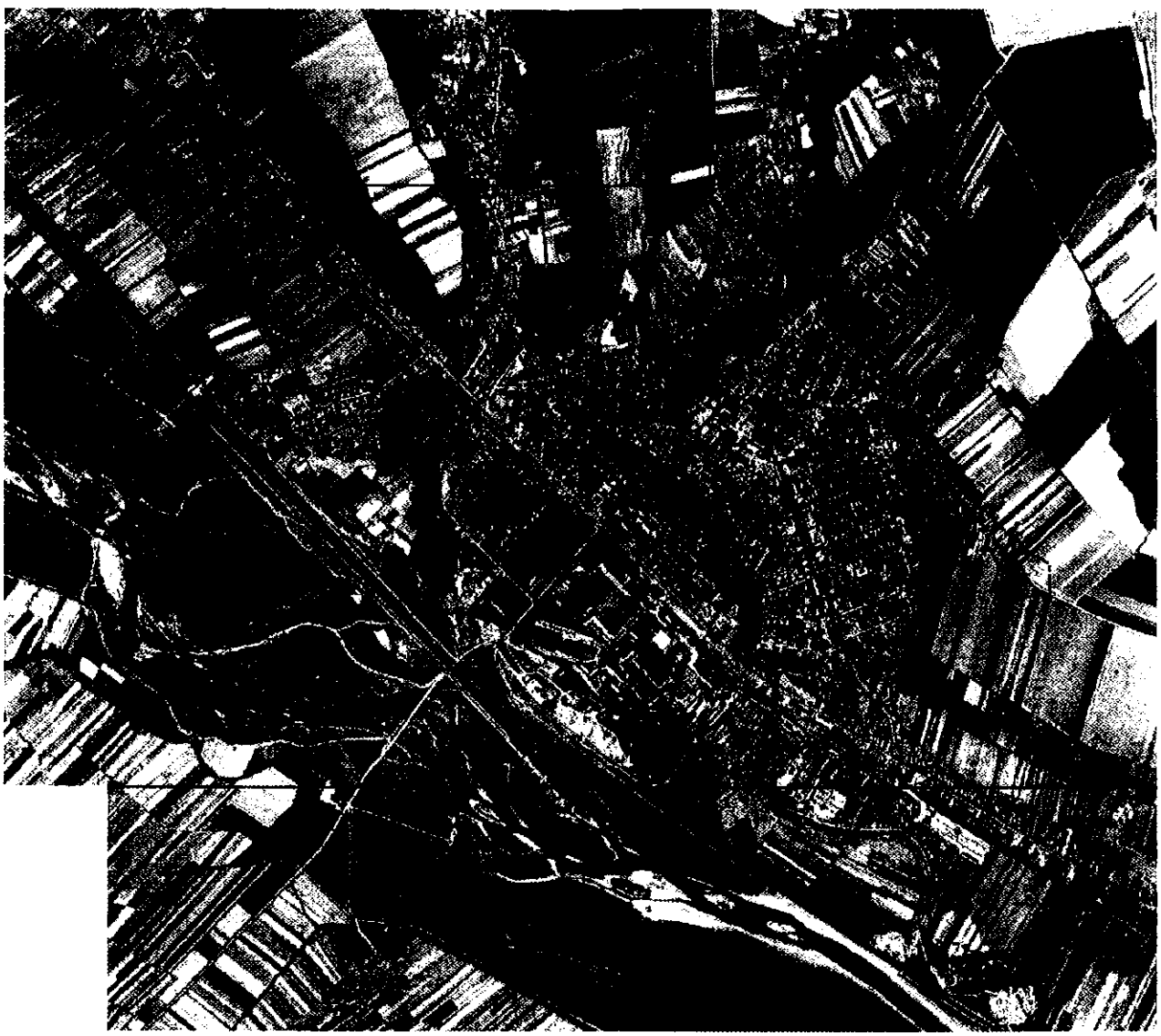

Figure 5-79: Existing water supply network Buhusi

5.2.4.1 Water abstraction and distribution to reservoirs

WSZ Buhusi contains only city of Buhusi which is inhabited by approx. 19,644 inhabitants. There are three groundwater sources whereas only source Poiana Morii is usually in operation. The sources Coscau and Bistrita are used additional in peak days when the demand of water is very high.

Figure 5-80: Coscau Catching Font

Figure 5-81: Wellfield Poiana Morii

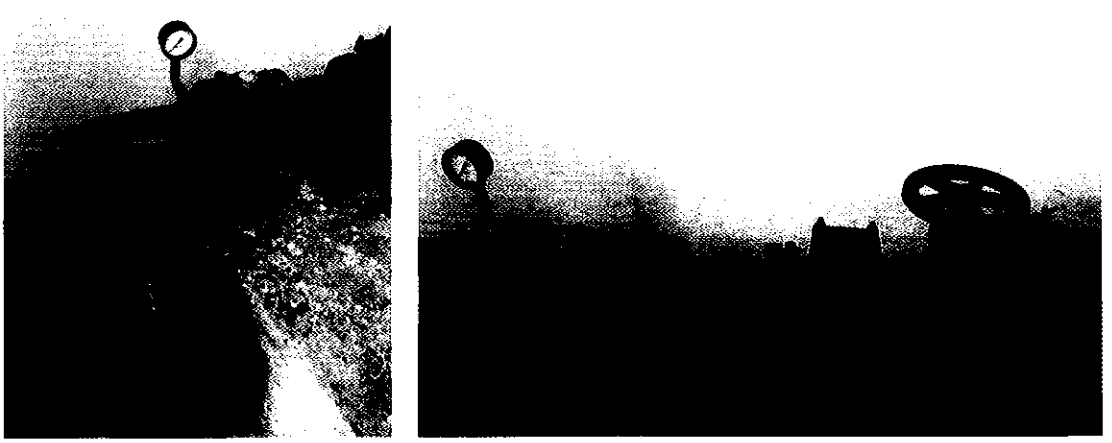

Figure 5-82: Well at groundwater source Poiana Morii

All the captured water is pumped to a RSV situated at approx.272 m.a.s.l which has a capacity of 1,000 m³. From there the water is chlorinated and pumped into the network and into another RSV. The pumps have been installed in 2002. The old pumps are not used any more but. This RSV with a capacity of 1,500 m³ is situated at approx. 312 m a.s.l. From there the water is pumped by a small booster pump to several consumers and also distributed by gravity to the network of the city which located lower.

The next table gives an overview of installed well pumps at Poiana Morii which are feeding the RSV 1,000 m³:

Well no	Capacity [m³/h]	Head [m]	Pump	Power [kW]
1	Not used any more			
2	Not used any more			
3	40	90	Ebara 65/250	22
4	46	87	Grundfos	15
5	46	87	Grundfos	22
6	30	85	Grundfos	9,2
7	30	85	Grundfos	9,2
8	30	85	Grundfos	9,2
9	30	85	Grundfos	9,2
10	30	85	Grundfos	9,5

Table 5-65: Overview of installed pumps at Poiana Morii

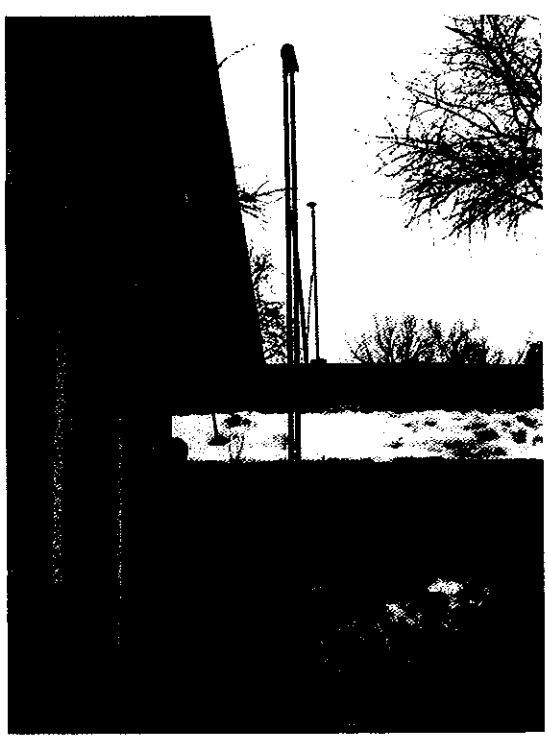

Figure 5-83: Reservoir 1,000 m³ in WSZ Buhusi

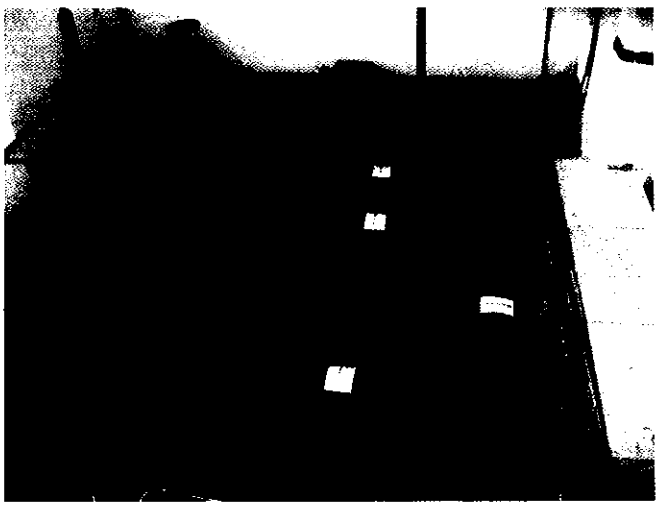

Figure 5-84: Old Pumps (abandoned in 2002) at Reservoir 1,000 m³ in WSZ Buhusi

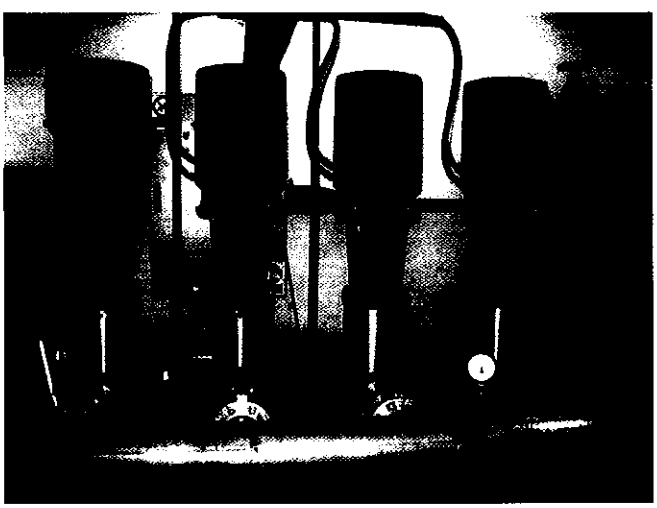

Figure 5-85: Pumps (installed in 2002) at Reservoir 1,000 m³ in WSZ Buhusi

Type of pumps:

- Grundfos tip CR 4 x CR 90 – 3 (each 22 kW)

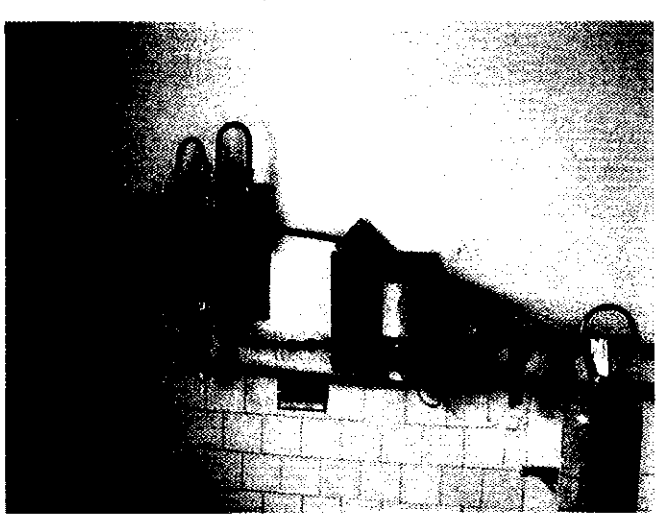

Figure 5-86: Chlorination at RSV 1,000 m³

Figure 5-87: Storage for chlorine gas at RSV 1,000 m³

The table below shows the situation of RSVs in WSZ Buhusi.

RSV	Capacity [m³]	Elevation [m a.s.l.]	Shape / type	Fed by
RSV 1,000 m³	1,000	272	Circular/ concrete/buried	Poiana Morii
RSV 1,00 m³	1,500	312	Circular/ concrete/buried	PS at RSV 1,000 m³
STORAGE CAPACITY	**2,500**			

Table 5-66: Overview of RSVs in WSZ Buhusi

A general supply scheme of Buhusi supply system is shown in the next figure.

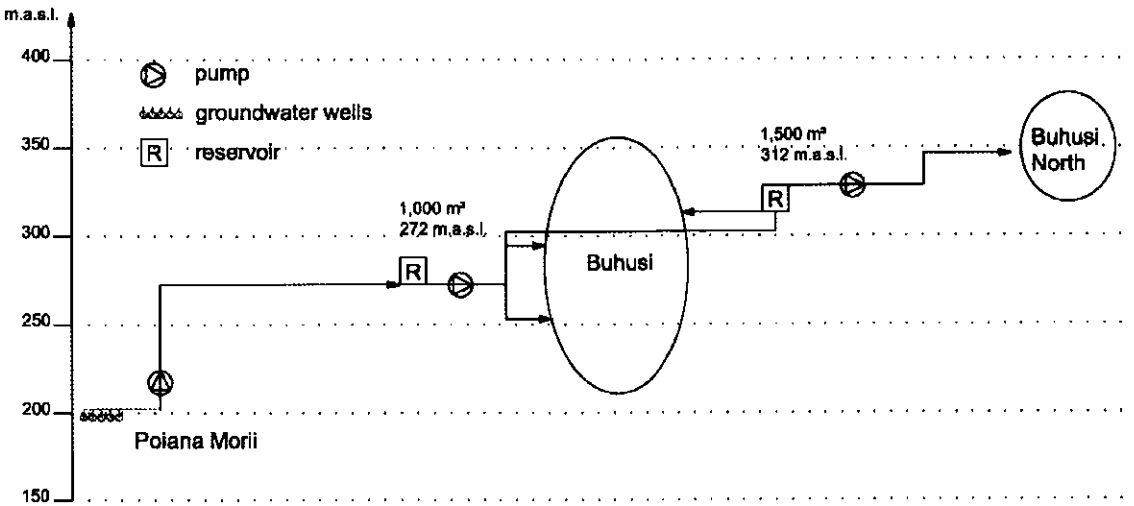

Figure 5-88: Buhushi supply system

Figure 5-89: Booster Pump at northern RSV 1,500 m³

5.2.4.2 Distribution network

The existing network of Buhusi consists of different materials and diameters as shown in the table below.

Material	Diameter [mm]	Length [m]	Length %
Asbestos Cement	150	661	1.22%
	200	2,090	3.86%
	400	806	1.49%
Sub-total AC		**3,557**	**6.57%**
Cast Iron	80	492	0.91%
	100	2,501	4.62%
	125	2,006	3.70%
	200	1,668	3.08%
Sub-total Cast Iron		**6,668**	**12.31%**
HDPE	32	214	0.39%
	40	196	0.36%
	50	344	0.64%
	63	3,876	7.16%
	90	1,253	2.31%
	100	4,092	7.55%
Sub-total HDPE		**9,975**	**18.42%**
Steel	20	231	0.43%
	25	1,112	2.05%
	50	3,293	6.08%
	80	278	0.51%
	100	14,283	26.37%
	150	2,224	4.11%
	200	299	0.55%
	219	1,072	1.98%
	250	74	0.14%
	273	4,478	8.27%
	325	5,777	10.67%
	400	836	1.54%
Sub-total Steel		**33,958**	**62.70%**
Total length		**54,157**	**100.00%**

Table 5-67: Overview of existing water distribution network in WSZ Buhusi

In WSZ Buhusi an existing connection rate of 85 % was evaluated during this FS.

5.2.4.3 Main Deficiencies of Water Supply Zone Buhusi

Main deficiencies of the WSZ Buhusi are presented in the table below.

Item	Components	Main deficiency
1	Water abstraction	Acceptable condition, but SCADA/Process control is missing
2	Pumping Stations	In good condition, SCADA/Process control is missing, Pumps installed in 2002, surge vessel is actually under rehabilitation
3	Water Treatment	Chlorination is to renew
4	Storage	Bad condition, are to rehabilitate, especially piping
5	Transmission Mains	Old pipes are to replace in future
6	Distribution Network	Old network, esp. AC parts are to replace Some pipes are too small, esp. in the north of the city

Table 5-68: Overview of main deficiencies of WSZ Buhusi

5.2.5 Water Supply Zone Darmanesti

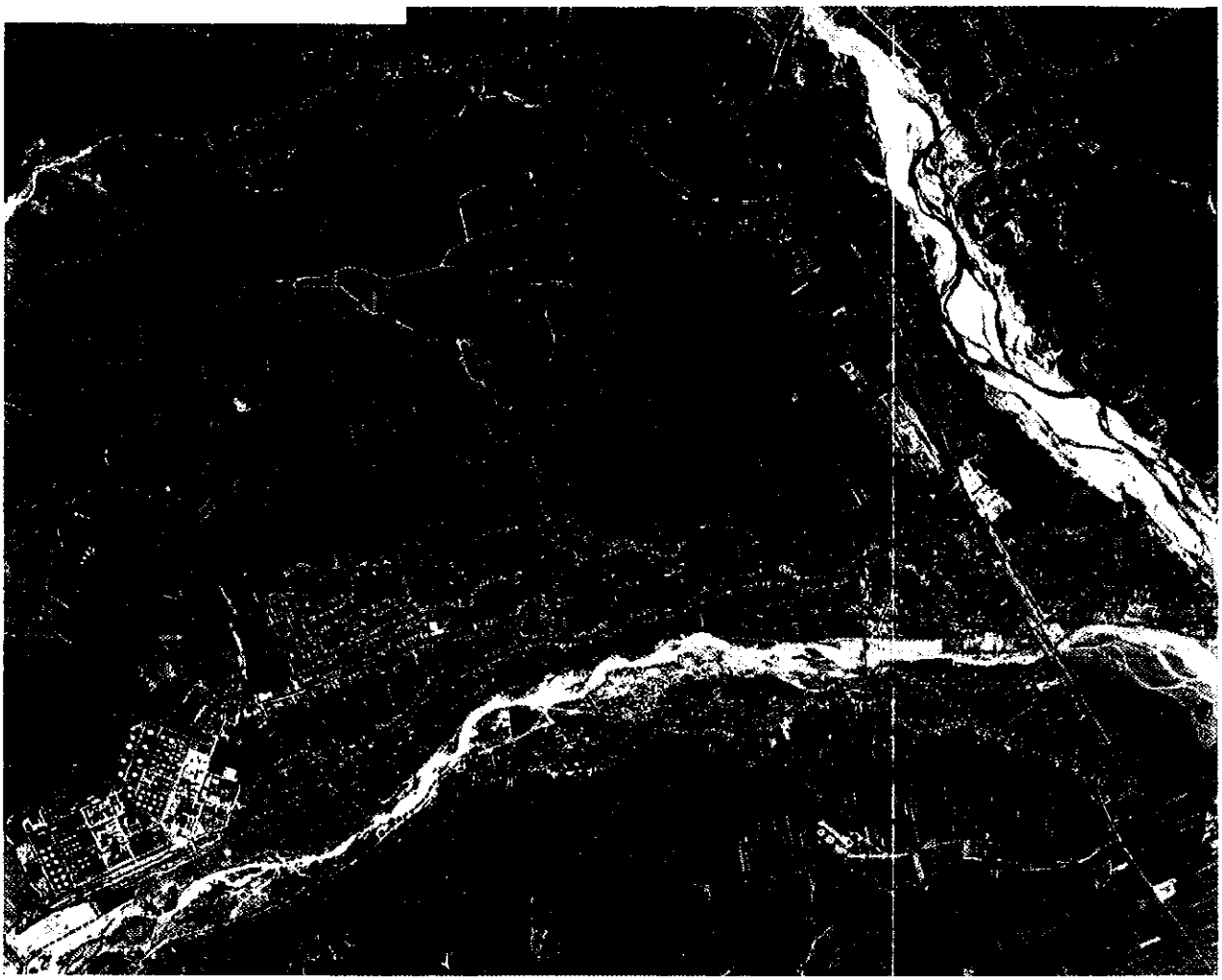

Figure 5-90: Existing water supply network Darmanesti

5.2.5.1 Water abstraction and distribution

WSZ Darmanesti contains Darmanesti city, Darmaneasca and Lapos. WSZ Darmanesti is inhabited by approx. 11,508 inhabitants.

It is supplied by the Water Treatment Plant Caraboaia which is located just upon the hill in the south of Darmanesti on approx.420 m.a.s.l. The WSZ is connected to the pressure pipe which is supplying WSZ Moinesti. To supply locality Lapos which is situated relatively higher than Darmanesti and Darmaneasca there is a pumping station. This pumping station is also connected to the pressure pipe which supplies WSZ Moinesti. In this WSZ there is no RSV, but at the WTP Caraboaia there are two RSVs with a capacity of 3,000 m³ each.

The connections branches from the pressure pipe to the network are equipped with pressure reducers. The network is made up of HDPE pipes which have been installed from 2001 – 2006.

There are two pumps installed for supply of Lapos:

- 2 x MXV 40-810
  - Q=11 m³/h
  - H= 75 m
  - P = 4 kW

A general supply scheme of Darmanesti supply system is shown in the next figure.

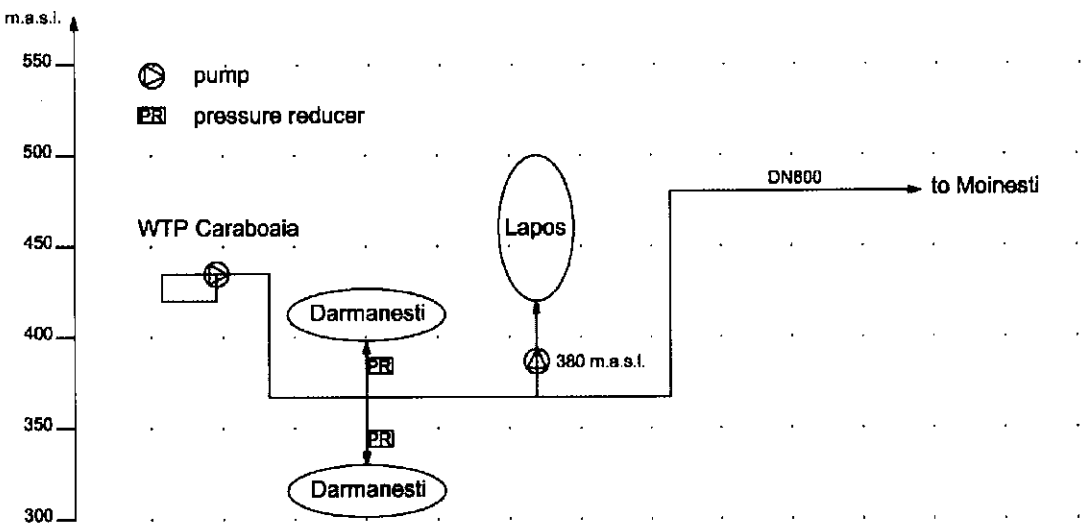

Figure 5-91: Darmanesti supply system

5.2.5.2 Distribution network

The existing network of Darmanesti consists of different materials and diameters as shown in the table below.

Material	Diameter [mm]	Length [m]	Length %
HDPE	50	6,465	12.75%
	75	17,519	34.54%
	90	7,420	14.63%
	110	8,881	17.51%
	160	10,430	20.57%
Sub-total HDPE		**50,716**	**100.00%**
Total length		**50,716**	**100.00%**

Table 5-69: Overview of existing water distribution network in WSZ Darmanesti

In WSZ Darmanesti an existing connection rate of 90 % was evaluated during this FS.

5.2.5.3 Main Deficiencies of Water Supply Zone Darmanesti

Main deficiencies of the WSZ Darmanesti are presented in the table below.

Item	Components	Main deficiency
1	Water abstraction	Water from WTP Caraboaia, refer to chapter 5.2.1.5
2	Pumping Stations	Acceptable condition, but SCADA/Process control is missing
3	Water Treatment	Problems with treatment technology, refer to WTP Caraboaia (chapter 5.2.1.5)
4	Storage	No separate RSVs are existing(except the RSV at the WTP), it is directly connected to the main pipe from WTP
5	Transmission Mains	Generally good condition, new network built in the last years
6	Distribution Network	Generally good condition, new network built in the last years; several pipes are too small

Table 5-70: Overview of main deficiencies of WSZ Darmanesti

5.2.6 Water Supply Zone Targu Ocna

Figure 5-92: Existing water supply network Targu Ocna

5.2.6.1 Water abstraction and distribution

WSZ Targu Ocna contains city of Targu Ocna and locality of Valcele. WSZ Targu Ocna is inhabited by approx. 12,118 inhabitants.

WSZ Targu Ocna is supplied only by WTP Caraboaia. It is connected to the pressure pipe which is supplying also city of Onesti. Water flows by gravity from WTP to Onesti.

To supply city of Targu Ocna there is a RSV with a capacity of 2,500 m in the south of the city situated at approx. 302 m a.s.l. The water is re-chlorinated at that RSV.

Figure 5-93: RSV to supply city of Targu Ocna, capacity: 2,500 m³

To supply locality Valcele which is situated relatively higher than Targu Ocna there is a pumping station and another RSV as well equipped with pumps. At this RSV the water is also re-chlorinated.

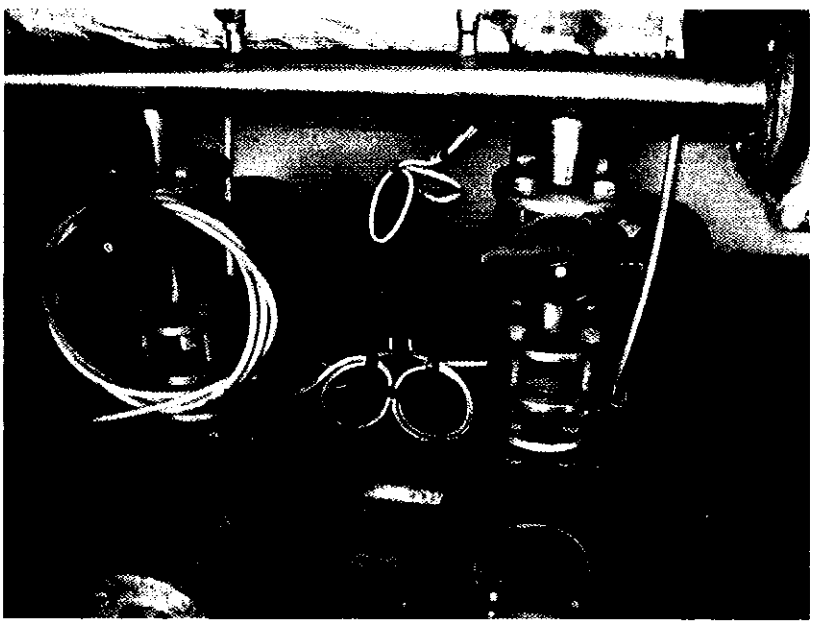

Figure 5-94: Installed pumps at the PS to feed the RSV at Valcele

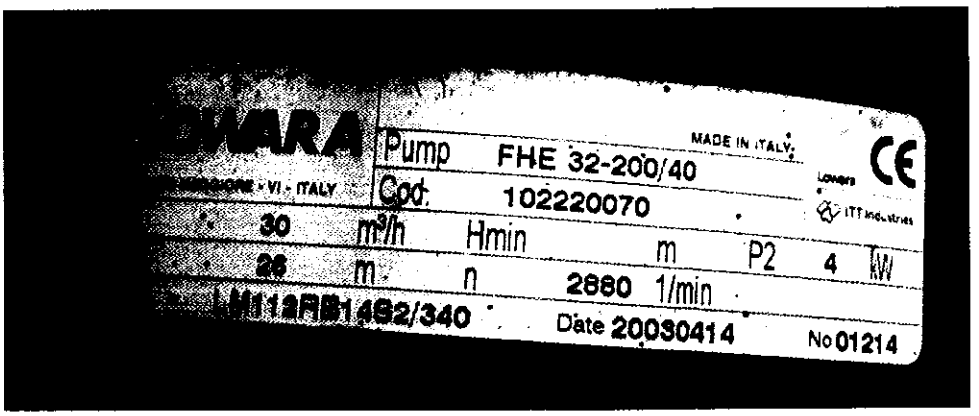

Figure 5-95: Plate of pumps which feed RSV at Valcele

Figure 5-96: RSV to supply Valcele, capacity: 1,000 m³

Figure 5-97: Chlorination at RSV to supply Valcele

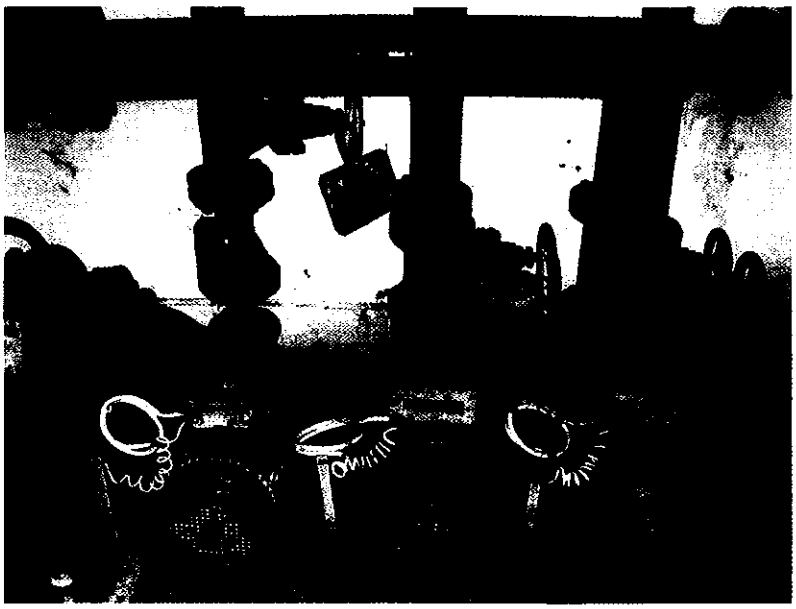

Figure 5-98: Installed pumps at RSV to supply Valcele

There are two pumps for supply Valcele and one additional in case of fire fighting.

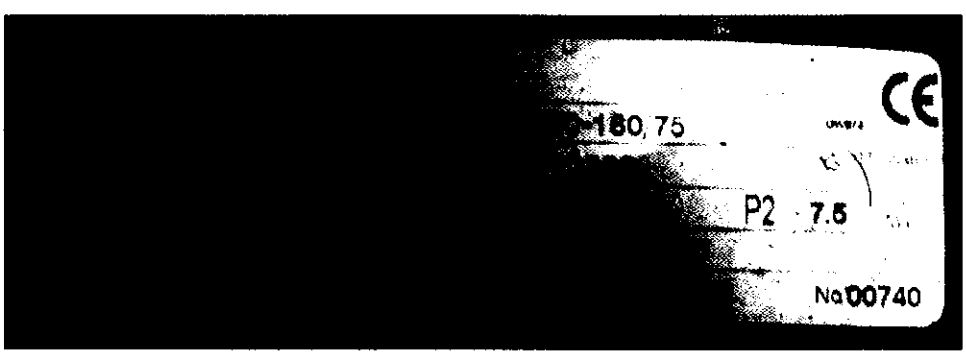

Figure 5-99: Plate of pumps at the RSV which supply Valcele

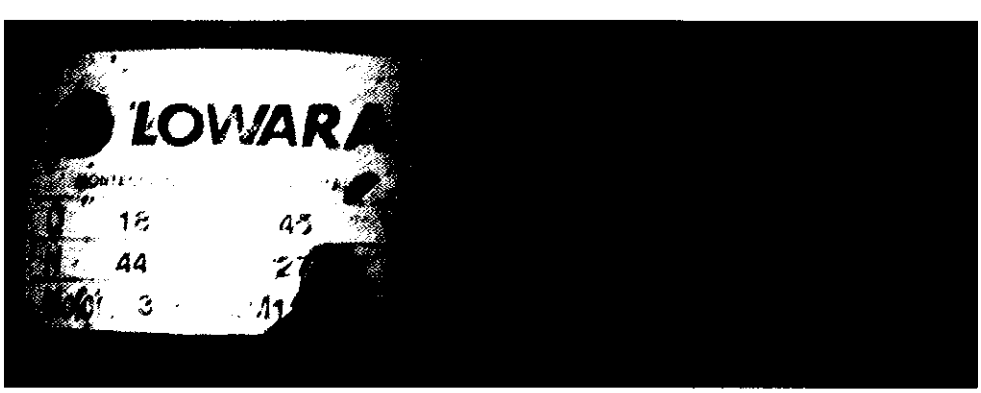

Figure 5-100: Plate of fire fighting pump at the RSV which supply Valcele

A general supply scheme of Targu Ocna supply system is shown in the next figure.

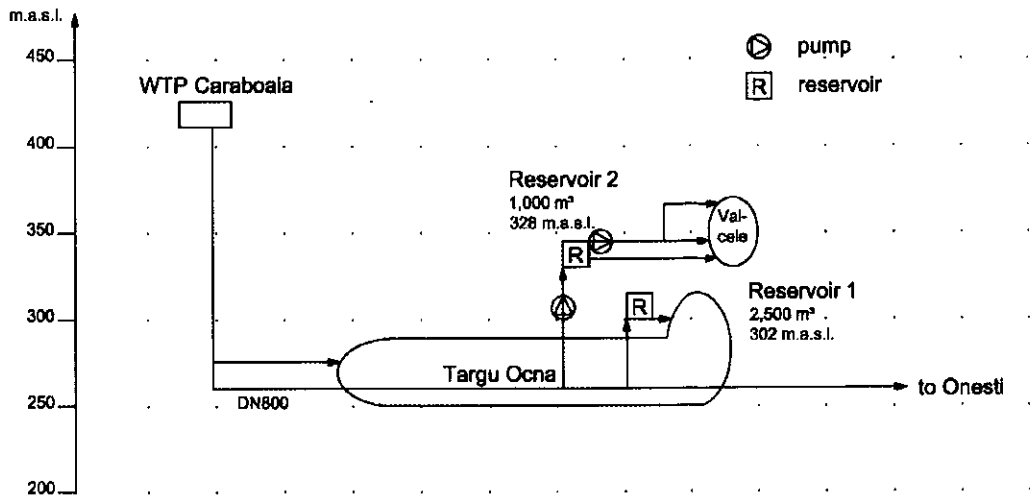

Figure 5-101: Targu Ocna supply system

5.2.6.2 Distribution network

The existing network of Targu Ocna consists of different materials and diameters as shown in the table below.

Material	Diameter [mm]	Length [m]	Length %
Asbestos Cement	100	151	0.56%
	150	4,784	17.76%
	250	263	0.98%
	350	1,273	4.73%
Sub-total AC		**6,471**	**24.02%**
Concrete	800	534	1.98%
Sub-total Concrete		**534**	**1.98%**
HDPE	40	97	0.36%
	50	164	0.61%
	63	1,506	5.59%
	90	779	2.89%
	100	534	1.98%
	110	7,906	29.35%
	125	890	3.31%
	160	941	3.49%
	225	2,030	7.54%
	400	676	2.51%
Sub-total HDPE		**15,523**	**57.62%**
Steel	50	1,133	4.20%
	80	1,661	6.17%
	100	793	2.94%
	110	204	0.76%
	125	287	1.06%
	350	133	0.49%
	400	203	0.75%
Sub-total Steel		**4,413**	**16.38%**
Total length		**26,941**	**100.00%**

Table 5-71: Overview of existing water distribution network in WSZ Targu Ocna

In WSZ Targu Ocna an existing connection rate of 97 % was evaluated during this FS.

5.2.6.3 Main Deficiencies of Water Supply Zone Targu Ocna

Main deficiencies of the WSZ Targu Ocna are presented in the table below.

Item	Components	Main deficiency
1	Water abstraction	Water from WTP Caraboaia, refer to chapter 5.2.1.5
2	Pumping Stations	Bad condition
3	Water Treatment	Problems with treatment technology, refer to WTP Caraboaia (chapter 5.2.1.5), Chlorination stations are to renew to implement at several RSVs, where chlorination is actually done with Calciumhypochlorite
4	Storage	Bad condition, RSVs are to rehabilitate
5	Transmission Mains	Bad condition, are to rehabilitate
6	Distribution Network	Old network, high losses

Table 5-72: Overview of main deficiencies of WSZ Targu Ocna

5.3 Existing Wastewater Infrastructure

5.3.1 Agglomeration Bacau

5.3.1.1 Location of Current and Proposed Infrastructure

Since the preparation of the Master Plan the boundaries of Agglomeration Bacau have only been insignificantly adjusted to reflect new land use developments.

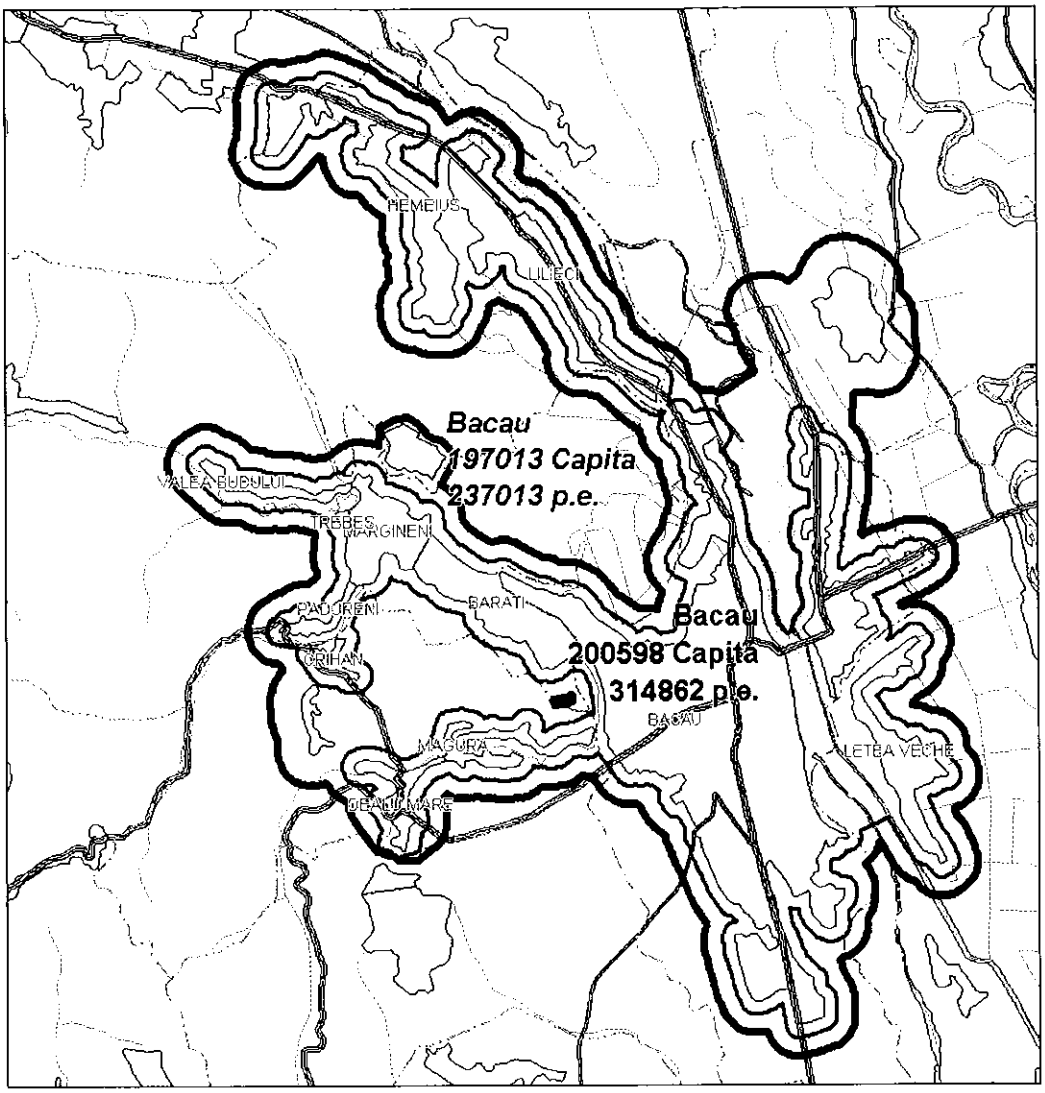

Figure 5-102: Overview Map Bacau Agglomeration

5.3.1.2 Description of Current Infrastructure

5.3.1.2.1 Wastewater Network

The sewer network in Bacau is a combined wastewater collection system. The system consists of 138 km of sewers. The overall connection rate in the service area is 73 %.

Connection Rate		Before Project	After Project
Total population in agglomeration concerned	capita * 1000	197	195
Service coverage: Percent of population connected to wastewater network	%	73	90
Population connected to a wastewater network	capita * 1000	143	175

Table 5-73: Connection rates Bacau agglomeration before/after project

275

The wastewater collection system and treatment system is presently owned and operated by C.A.B. (former name: R.A.G.C. Bacau). A regional operation company for the County of Bacau (CRAB – Comania Regionala De Apa Bacau) has already been formed but is not operating yet.

The following table summarizes the Bacau system.

Diameter DN	Asbestos Cement [m]	Concrete [m]	Iron [m]	Steel [m]	Ceramic [m]	PVC [m]
300		68,607				17,300
400		5,112				
500		10,543				
600		1,805				
750		830				
800		4,500				
900		9,451				
1000		6,113				
1200		4,252				
1400		763				
1500		2,490				
1800		660				
2000		3,050				
2200		2,927				
Total		121,104				17,300

Table 5-74: Bacau wastewater network (current situation)

The wastewater collection system of Bacau can be summarized as follows:

Item	Indicator	Unit	Before	After
3.6.1	Total length of wastewater network (incl. storm water & main collectors)	km	138	181
3.6.1.1	Length of combined system	km	121.1	121.1
3.6.1.2	Length of separated system	km	17.3	59.8
3.6.1.3	Length of partially combined/separated system	km	0.0	0.0
3.6.1.4	Percent of length of combined system	% of 3.6.1	88	67
3.6.1.5	Percent of length of separated system	% of 3.6.1	13	33
3.6.1.6	Percent of length of partially combined/separated system	% of 3.6.1	0	0
3.6.2	Length of main collectors	km	20	20
3.6.2.1	Length of main collectors rehabilitated	km	0	0
3.6.2.2	Percent of main collectors rehabilitated (related to existing main collectors)	% of 3.6.2		0
3.6.3	Number of wastewater pumping stations	number	8	14
3.6.4	Capacity wastewater pumping stations	1000 m^3/d	31.1	35.2
3.6.5	Length of wastewater network (excl. Stormwater and main collectors)	km	119	161
3.6.5.1	Length wastewater network rehabilitated	km	0	0
3.6.5.2	Percent of wastewater network rehabilitated (related to existing network)	% of 3.6.6	0	0
3.6.7	Population served per length of wastewater network	capita/km	1034	970
3.6.8	Number of overflow devices in the network	number	8	8
3.6.9	Capacity of storm water retention basins	1000*m^3	no data	

Table 5-75: Current wastewater collection system parameters – Bacau

5.3.1.2.2 Wastewater Pumping Stations

The existing sewer network of Bacau Agglomeration includes 8 pumping stations with the following summarised characteristics.

No.	Name of Pumping Station	Number of Pumps	Q[1]	Hp	P	Energy Efficiency	Year of Installation	Rating of Physical Condition of E&M Equipment	Rating of Physical Condition of Civil Structures
			[m³/h]	[m]	[kW]	[kWh/m³]	[year]		
1	Serbaneşti (WW + SW)	3	3 x 270	20	30	3,4	2009	No data	No data
2	ANL - Gheraieşti	2	2 x 50	15	2.2	2	2006	Fair	Fair
3	Arcade Septilici (WW + SW)	2 WW 3 SW	2 x 25 3 x 110	15 8	2.2	No data	2003	Fair	Fair
4	Triumfului (WW + SW)	2	2 x 80	8	No data	No data	No data	No data	No data
5	Muncii	2	2 x 65 1 x 4	5	No data	No data	No data	No data	No data
6	Rozelor	4	9 - 72	12	No data	No data	No data	No data	No data
7	Ciprian Porumbescu (WWTP)	5	36	14	No data	No data	No data	No data	No data
8	Magura	1+1	No data	No data	No data	No data	2007	Poor	Poor

Table 5-76: Assessment of the existing pumping stations – Bacau agglomeration

1. Wastewater Pumping Station Serbanesti

   The Consultant got no access and no documents from the local council regarding the Wastewater Pumping Station Serbanesti.

2. Wastewater Pumping Station Gheraiesti

   The WWPS Gheraiesti is located in the north of Bacau City close to Lilieci locality and has been built in 2006 in order to discharge the wastewater of the new residential area to Bacau wastewater network. The overflow is located on the close-by channel.

Figure 5-103: WWPS Gheraiesti Civil Stuctures

Figure 5-104: WWPS Gheraiesti Civil Stuctures

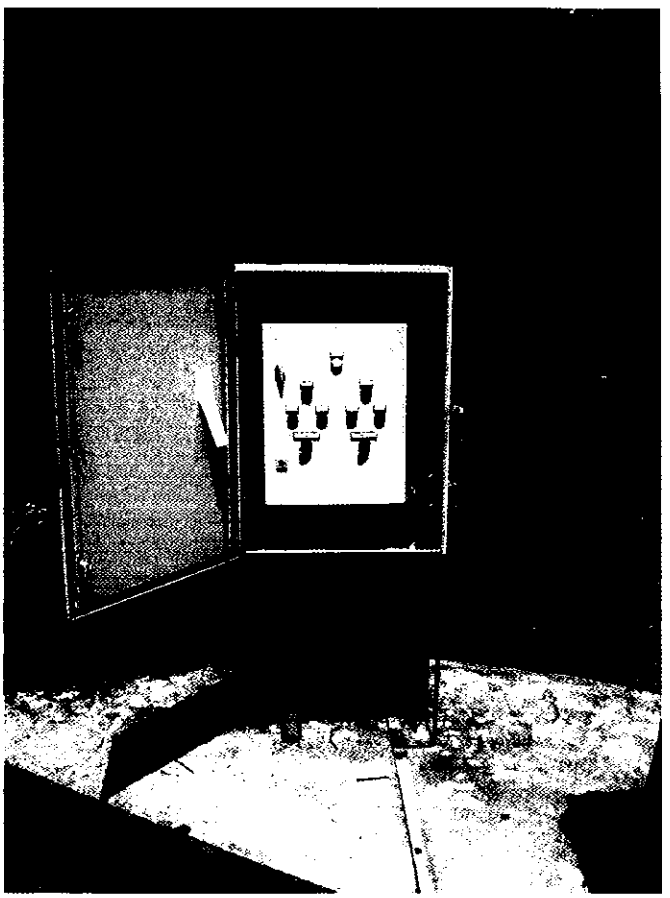

Figure 5-105: WWPS Gheraiesti E/M Equipment

3. Wastewater Pumping Station Arcadie Septilici

The WWPS Gheraiesti is located in the west of Bacau City close to Margineni Commune and has been built in 2003 in order to discharge the wastewater of the area to Bacau wastewater network. The overflow is located on the close-by channel.

Figure 5-106: WWPS Arcadie Septilici Civil Structures

Figure 5-107: WWPS Arcadie Septilici Civil Structures

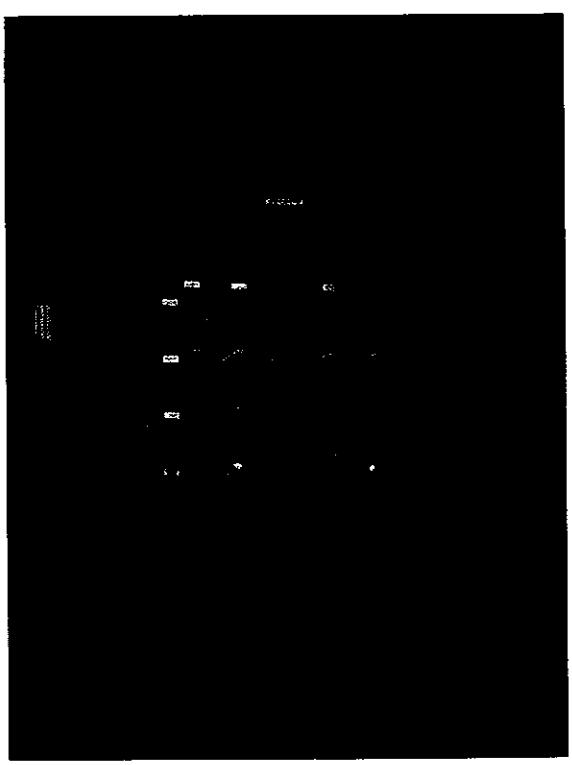

Figure 5-108: WWPS Arcadie Septilici E/M Equipment

4. Wastewater Pumping Station Triumfului

   The consultant got no access and no documents from the local council, which is the owner, regarding the Wastewater Pumping Station Triumfului.

5. Wastewater Pumping Station Muncii

   The consultant got no access and no documents from the local council, which is the owner, regarding the Wastewater Pumping Station Muncii.

6. Wastewater Pumping Station Rozelor

   The consultant got no access and no documents from the local council, which is the owner, regarding the Wastewater Pumping Station Rozelor.

7. Wastewater Pumping Station Ciprian Porumbescu

   The consultant got no access and no documents from the local council, which is the owner, regarding the Wastewater Pumping Station Ciprian Porumbescu.

8. Wastewater Pumping Station Magura

   The WWPS Magura was subject to a project of the Romanian government and has been built in combination with the respective wastewater network in 2007. The structure of the WWPS consists of two plastic earthtanks which are partly destructed meanwhile due to earth pressure. The pumps are not in operation anymore as well.

   At present the wastewater is discharging directly into the river through a temporary outlet.

Figure 5-109: WWPS Magura Civil Structures

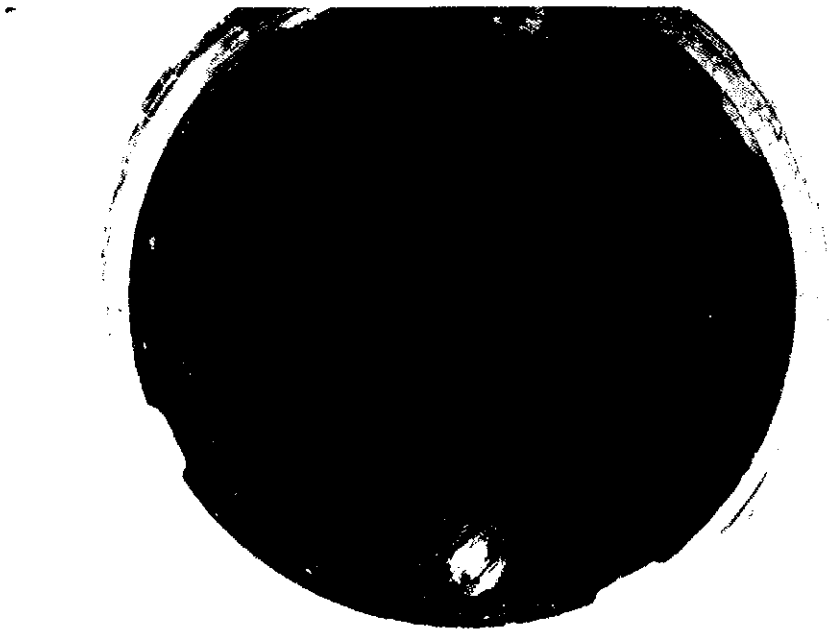

Figure 5-110: WWPS Magura Civil Structures

Figure 5-111: WWPS Magura, temporary outlet

5.3.1.2.3 Wastewater Treatment Plant

At the existing WWTP Bacau reconstruction activities are ongoing and will probably be finished in 2010. The following table shows a compilation of the main process steps that will be installed but are not yet in operation (status as per May 2009).

No.	Process Step	Description	Technical Data
1	Inlet Channel with Coarse Screen	1 line with manually raked screen	Inlet Channel, Capacity 9.300 m³/h,Coarse screen, 100 mm width , Capacity 9.300 m³/h
2	Diversion Chamber 1	By-pass to Bistritia River	Capacity 9.300 m³/h, equipped with Penstock 1.5 m width
3	Diversion Chamber 2	By-pass to storm water tanks	Capacity 9.300 m³/h, overflow length 5 m
4	Storm water Tanks	4 storm water tanks (former primary clarifiers), equipped with mixers	30 m diam., approx. 8.000 m³ total Volume, 1 mixer each tank, submersible with propeller, approx. 4.5 kW
5	Storm water Pumping Station	The storm water is pumped back to the influent of the WWTP	Pumping Station, 2 Pumps, 1 for backup, approx. 7.5 kW, 200 m³/h, pressure head 8 m each
6	Coarse Screens new	2 lines of automatically raked screens with screw compactor	2 Coarse Screens, 25 mm width, hydraulic capacity 3,100 m³/h, 0,75 kW each, screw compactor 4 kW, HUBER Nr.286190 3300 / 1125 / 25 mm
7	Fine Screens new	2 lines of automatically raked screens, with screw compactor	2 Fine Screens, 6 mm width, hydraulic capacity [ ] m³/h, 2,3 kW each, screw compactor 4 kW, HUBER Nr.286190.2 4000 / 1226 / 6 mm
8	Combined Grit Chamber / Grease Removal (aerated)	Grit Chamber / Grease Removal 2 Lines	Length 25 - 30 m, depth 3.95 m with scraper; 2 submersible pumps for grit removal approx. 2.2 kW, 25.4 m³/h, pressure head 8 m each / 2 submersible pumps for grease removal approx. 0.5 kW, 2 m³/h, pressure head 5 m each; 2 rotary piston blowers, 1 for backup, 900 m³/h, approx. 18,5 kW; Grit classifier approx. 2.2 kW, 25.4 m³/h
9	Distribution Chamber 3	Distribution Chamber to primary settling tanks	2 Penstocks
10	Primary Settling Tanks	4 round Tanks (2 tanks never in use, 2 tanks are rehabilitated)	4 tanks, 45 m diam., side depth 2.6 m, 4970 m³ each, total surface 3,180 m²;scrapers 1 kW each
11	Intermediate Pumping Station (PS)	The waste water is pumped into the distribution chamber to the aeration tanks.	3 submersible pumps (Flygt), 1 backup, 110 kW, 3,100 m³/h, pressure head approx. 10 m each,
12	Distribution Chamber 4	Distribution Chamber to aeration tanks	6 adjustable distribution weirs, 3 closed for extension, connected with 6 pipes DN 1000
13	Aeration Tanks new	Existing aeration tank, anoxic section with mixers and nitrification section with fine bubble aerators and internal recirculation	3 lines, length 100 m, width 16.5 m depth 4.5 m each, 20,000 m³ total Volume, Length of anoxic zone 33 m, Length of nitrification zone 67 m; Fine bubble aerators, Membrane elements, Maximum air flow 29,500 m³/h; Submersible propeller mixers 1 mixer per line, 3 total, approx. 5 kW each; Recirculation pumps, 1 pump per line, 3 total, 2,160 m³/h, approx. 11 kW, suction head 1 m each
14	Aeration Tanks old	Existing aeration tank, aerob with surface aerators	3 lines 21,600 m³ total, 2,8 mg O2/L; 28 Surface aerators, 22 kW each
15	Blower Station	Blower Station Building	Blower Station with 3 or 4 Blowers, max air flow approx. 25,000 m³/h

No.	Process Step	Description	Technical Data
16	Secondary Settling Tanks	Existing secondary settling tanks. 4 round Tanks with circular scraper	4 tanks, diameter approx. 45 m, side depth ca. 3.5 m, volume approx. 1590 m³ each
17	Return Sludge Pumping Station	The return sludge is pumped into the distribution chamber to the aeration tanks.	3 pumps, 1 backup, approx. 90 kW, 2,250 m³/h, pressure head 7 m each
18	Primary Sludge Pumping Station	The primary sludge is pumped to the mechanical sludge thickener	2 pumps, 1 backup, approx. 3 kW, 60 m³/h, pressure head 8 m each
19	Secondary Sludge Pumping Station	The secondary sludge is pumped to the mechanical sludge thickener	2 pumps, 1 backup, approx. 3 kW, 60 m³/h, pressure head 8 m each
20	Sludge Dewatering Building	The aggregates for sludge dewatering are installed in this building	12 x 22 m
21	Mechanical Primary Sludge Thickener	The primary sludge is de-watered by a mechanical sludge thickener.	1 Sludge Thickening machine 60 m³/h , DS content after thickening is 6 % (with polymer dosing unit)
22	Mechanical Secondary Sludge Thickener	The secondary sludge is de-watered by a mechanical sludge thickener.	1 Sludge Thickening machine 60 m³/h , DS content after thickening is 6 % (with polymer dosing unit)
23	Sludge Dewatering	The anaerobic stabilized sludge is dewatered in a mechanical sludge dewatering machine.	1 Sludge Dewatering machine 15 m³/h , DS content after thickening is 21 % (with polymer dosing unit)
24	Anaerobic digesters	4 anaerobic digesters.	4 digesters, 1.500 m³ each, equipped with feed pumps, recirculation pumps, heat exchangers, Mixers etc.
25	Sludge Holding Tank	The anaerobic stabilized sludge is buffered before dewatering	1 tank 150 m³ with mixer
26	Gas Storage Tank	Biogas from the anaerobic digester is stored in the Gas storage tank	1 Tank , Volume approx. 1,000 m³, polypropylene membrane
27	Central Heating Plant	2 boilers, 1 x powered by natural gas, 1 x powered by fuel oil	2 x 930 kWth
28	Cogeneration Unit	The biogas is utilized in the cogeneration plant to produce heat for the anaerobic digester and electricity	1 Cogeneration unit approx. 400 kWel, 600 kWth
29	Gas Flare	Surplus biogas is burnt off in the gas flare	1 Gas flares 300 m³/h
30	Transformer Station	Transformer station in new building	Existing capacity is 1,600 kVA, 2 oil filled transformers, 1 backup
31	Sludge lagoons	Sludge Lagoons as backup for sludge dewatering	

Table 5-77: Description of main components of Bacau WWTP

The physical condition of electro-mechanical equipment and civil structures is assessed as follows.

No.	Process Step	Process Component	Description [7]	Year of Installation	Rating of physical condition of E&M equipment	Rating of physical condition of Civil Structures	Need for renovation [8]
1	Inlet Channel with Coarse Screen	Civil Structure Inlet Channel	adequate, capacity sufficient	2008/ 2009		good (work in progress)	no renovation necessary
		Coarse Screens	capacity sufficient	2008/ 2009	good (work in progress)		no renovation necessary
2	Diversion Chamber 1	Civil Structure Diversion Chamber	adequate, capacity sufficient	2008/ 2009		good (work in progress)	no renovation necessary
3	Diversion Chamber 2	Civil Structure Diversion Chamber	adequate, capacity sufficient	2008/ 2009		good (work in progress)	no renovation necessary
4	Storm water Tanks	Civil Structure Storm water Tanks	adequate, capacity sufficient	2008 / 2009 (renovation)		adequate (work in progress)	no renovation necessary
		Mixers	capacity sufficient	2009 +	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	capacity sufficient	2009 +	good (work in progress)		no renovation necessary
5	Storm water Pumping Station	Civil Structure pumping	capacity sufficient	2009 +		good (work in progress)	no renovation necessary

No.	Process Step	Process Component	Description [7]	Year of Installation	Rating of physical condition of E&M equipment	Rating of physical condition of Civil Structures	Need for renovation [8]
		Station					
		Pumps	capacity sufficient	2009 +	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	capacity sufficient	2009 +	good (work in progress)		no renovation necessary
6	Coarse Screens new	Civil Structure Flow Channels Coarse Screens	capacity sufficient	2008		good (work in progress)	no renovation necessary
		Coarse Screens	capacity sufficient	2008	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	capacity sufficient	2008	good (work in progress)		no renovation necessary
7	Fine Screens new	Civil Structure Flow Channels Fine Screens	capacity sufficient	2008		good (work in progress)	no renovation necessary
		Fine Screens	capacity sufficient	2008	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	capacity sufficient	2008	good (work in progress)		no renovation necessary
8	Combined Grit Chamber / Grease Removal (aerated)	Civil Structure Flow Channel	capacity sufficient	2008		good (work in progress)	no renovation necessary
		Pumps	capacity sufficient	2008	good (work in progress)		no renovation necessary
		Blowers	capacity sufficient	2008	good (work in progress)		no renovation necessary
		Grit classifier	capacity sufficient	2008	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	adequate / adequate	2008	good (work in progress)		no renovation necessary
9	Distribution Chamber 3	Civil Structures Distribution Chamber	capacity sufficient	2008		good (work in progress)	no renovation necessary
10	Primary Settling Tanks	Civil Structures Settling Tanks, 2 tanks with circular scraper	capacity sufficient	2008 / 2009(renovation)		good (work in progress)	no renovation necessary
		Scrapers	adequate	2008 / 2009	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	adequate / adequate	2008 / 2009	good (work in progress)		no renovation necessary
11	Intermediate Pumping Station (PS)	Civil structure pumping station	adequate	2008 / 2009		good (work in progress)	no renovation necessary
		Pumps	capacity sufficient	2009 +	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		no renovation necessary
12	Distribution Chamber 4	Civil Structures Distribution Chamber	capacity sufficient	2009 +		good (work in progress)	**Adjustment for extension necessary**
13	Aeration Tanks new	Civil Structure Tank	ratio anoxic to nitrification zone too small	1993 (renovation 2009+)		good (work in progress)	**Adjustment for extension of anoxic zone necessary**

No.	Process Step	Process Component	Description [7]	Year of Installation	Rating of physical condition of E&M equipment	Rating of physical condition of Civil Structures	Need for renovation [8]
		Aerators	adjustment to smaller nitrification zone necessary	2009 +	good (work in progress)		**Adjustment for extension of anoxic zone necessary**
		Mixers	adequate	2009 +	good (work in progress)		no renovation necessary
		Pumps	adequate	2009 +	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	not finished	2009 +	good (work in progress)		**Adjustment for extension necessary**
14	Aeration Tanks old	Civil Structure Tank	Concrete in poor condition, water depth to small for fine bubble aerators, shape of tanks disadvantageous	1972		poor	**Demolition of old tanks and build new Tanks**
		Aerators	outworn	1972	poor		**Install new fine bubble aeration system**
		Electric Equipment / Process Control	outdated	1972	poor		**Extension of Electric Equipment / Process Control**
15	Blower Station	Civil Structure Blower Station Building	adequate	2009 +		adequate (work in progress)	**Adjustment for extension necessary**
		Blowers	capacity sufficient	2009 +	good (work in progress)		**provide 1 blower for backup**
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		**Extension of Electric Equipment / Process Control**
16	Secondary Settling Tanks	Civil Structure Tank	capacity sufficient	1972 / 1993 renovation 2008/2009		adequate (work in progress)	no renovation necessary
		Scrapers	adequate	2009 +	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		no renovation necessary
17	Return Sludge Pumping Station	Civil Structure pumping Station	adequate	2009 +		good (work in progress)	no renovation necessary
		Pumps	capacity sufficient	2009 +	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		no renovation necessary
18	Primary Sludge Pumping Station	Civil Structure pumping Station	adequate	2009 +		good (work in progress)	no renovation necessary
		Pumps	capacity sufficient	2009 +	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		no renovation necessary

No.	Process Step	Process Component	Description [7]	Year of installation	Rating of physical condition of E&M equipment	Rating of physical condition of Civil Structures	Need for renovation [8]
19	Secondary Sludge Pumping Station	Civil Structure pumping Station	adequate	2009 +		good (work in progress)	no renovation necessary
		Pumps	capacity sufficient	2009 +	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		no renovation necessary
20	Sludge Dewatering Building	Civil Structure Sludge Dewatering Building	too small for backup aggregates	2009 +		adequate but too small for backup aggregates	**Extension of the existing building to provide additional space for backup aggregates**
21	Mechanical Primary Sludge Thickener	No civil structure, only machinery equipment		2009 +			
		Mechanical Equipment	capacity sufficient	2009 +	good (work in progress)		**provide 1 backup aggregate**
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		**provide 1 backup aggregate**
22	Mechanical Secondary Sludge Thickener	No civil structure, only machinery equipment		2009 +			
		Mechanical Equipment	capacity sufficient	2009 +	good (work in progress)		**provide 1 backup aggregate**
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		**provide 1 backup aggregate**
23	Sludge Dewatering	No civil structure, only machinery equipment		2009 +		good (work in progress)	
		Mechanical Equipment	capacity sufficient	2009 +	good (work in progress)		**provide 1 backup aggregate**
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		**provide 1 backup aggregate**
24	Anaerobic digesters	Civil Structures Anaerobic digesters	insufficient capacity	2009 +		adequate (work in progress)	**Additional digestion volume has to be provided incl. mechanical and electrical equipment**
		Mechanical Equipment	adequate	2009 +	good (work in progress)		**Adjustment for extension necessary**
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		**Extension of Electric Equipment / Process Control**
25	Sludge Holding Tank	Civil Structures Anaerobic digesters	adequate	2009 +		good (work in progress)	no renovation necessary
		Mechanical Equipment	capacity sufficient	2009 +	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		no renovation necessary
26	Gas Storage Tank	Civil Structures Tank	adequate	2009 +		good (work in progress)	no renovation necessary
		Mechanical Equipment	capacity sufficient	2009 +	good (work in progress)		no renovation necessary

No.	Process Step	Process Component	Description [7]	Year of Installation	Rating of physical condition of E&M equipment	Rating of physical condition of Civil Structures	Need for renovation [8]
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		no renovation necessary
27	Central Heating Plant	Civil Structures	adequate	1972 / 1993		adequate (work in progress)	no renovation necessary
		Mechanical Equipment	capacity sufficient	2004	adequate (work in progress)		no renovation necessary
		Electric Equipment / Process Control	adequate	2009 +	adequate (work in progress)		no renovation necessary
28	Cogeneration Unit	Civil Structures	adequate	2009 +		good (work in progress)	no renovation necessary
		Mechanical Equipment	capacity sufficient	2009 +	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		no renovation necessary
29	Gas Flare	No civil structure, only machinery equipment		2009 +		good (work in progress)	no renovation necessary
		Mechanical Equipment	capacity sufficient	2009 +	good (work in progress)		no renovation necessary
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		no renovation necessary
30	Transformer Station	Civil Structures	adequate	2008		good (work in progress)	no renovation necessary
		Electric Equipment / Process Control	adequate	2009 +	good (work in progress)		no renovation necessary
31	Sludge lagoons			???		adequate	no renovation necessary

Table 5-78: WWTP Bacau – Assessment of physical condition of electro-mechanical equipment and civil structures

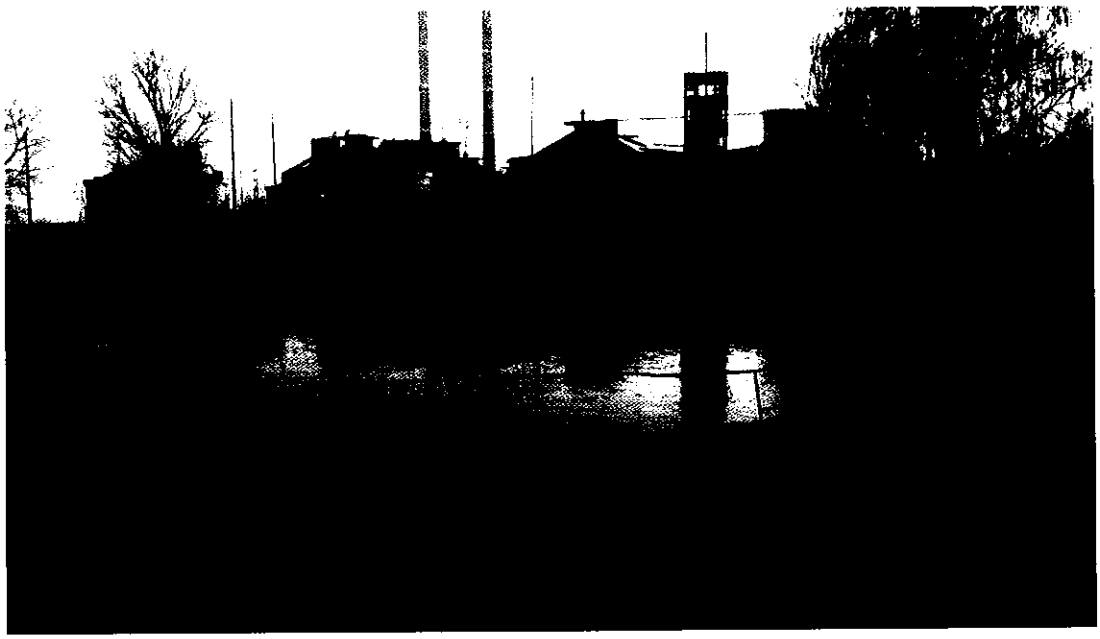

Figure 5-112: WWTP Bacau

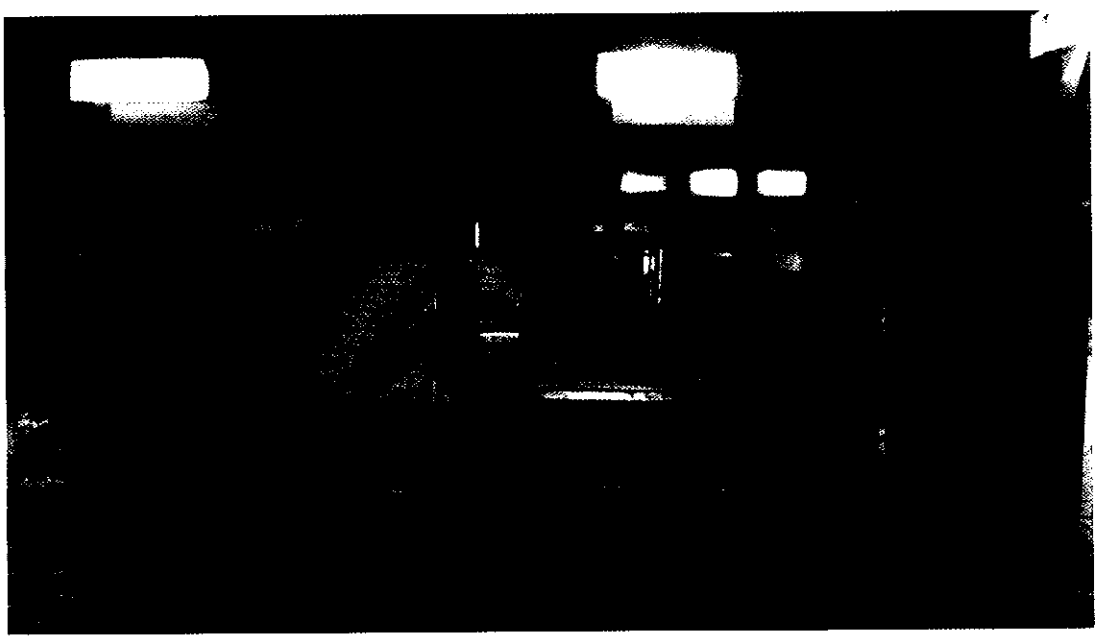

Figure 5-113: WWTP Bacau

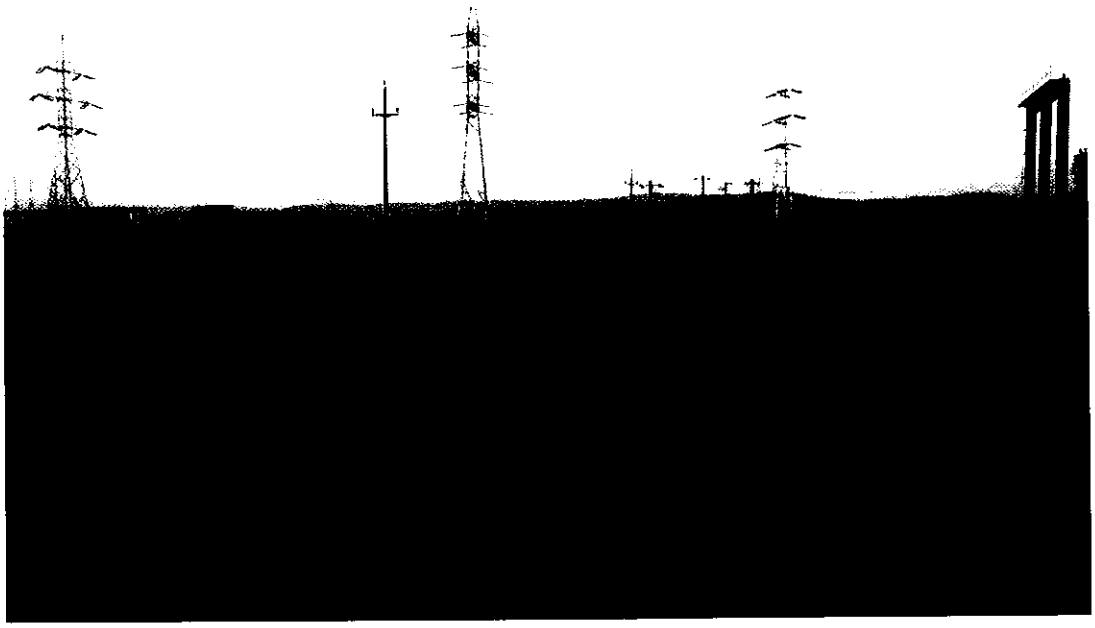

Figure 5-114: WWTP Bacau

The treatment performance after the completion of the ISPA Project is shown in the table below. The Assessment is based on the measured inflow values using the chemical analyses (monthly average values) of the WWTP's laboratory and the discharge effluent parameters as set out in the Urban Wastewater Treatment Directive 91/271/EEC, implemented in the Romanian standard NTPA 001 – 011, apply to the WWTP Bacau. These Values are guaranteed by the Contractor for non sensitive areas – excluding Nitrogen and Phosphorus.

No.	Parameter	Date	Influent WWTP	Effluent WWTP guaranteed by the contractor	Eliminated Concentration	Treatment Performance
			mg/l	mg/l	mg/l	%
1	**BOD_5**					
1.1	BOD_5	2008 average	84.2	25	59.2	70%
1.2	BOD_5	2007 average	81	25	56	69%
		Average 2008, 2007	**82.6**	**25**	**57.6**	**70%**
2	**COD**					
2.1	COD	2008 average	217.1	125	92.1	42%
2.2	COD	2007 average	199.3	125	74.3	37%
		Average 2008, 2007	**208.2**	**125**	**83.2**	**40%**
3	**Suspended Solids (SS)**					
3.1	SS	2008 average	144.4	35	109.4	76%
3.2	SS	2007 average	221	35	186	84%
		Average 2008, 2007	**182.7**	**35**	**147.7**	**80%**
4	**Total N**					
4.1	Ntot	2008 average	26	not guaranteed approx. 20 - 25	6.0 - 1.0	23 - 4 %
4.2	Ntot	2007 average	25.3	not guaranteed approx. 20 - 25	5.3 - 0.3	21 - 1 %
		Average 2008, 2007	**25.65**	**20 - 25**	**5.7 - 0.7**	**22 - 3 %**
5	**Total P**					
5.1	Ptot	2008 average	2.8	not guaranteed approx. 2 - 2.8	0.8 - 0.0	29 - 0 %
5.2	Ptot	2007 average	2.9	not guaranteed approx. 2 - 2.9	0.9 - 0.0	31 - 0 %
		Average 2008, 2007	**2.85**	**2 - 2.9**	**0.9 - 0.0**	**30 - 0 %**

Table 5-79: WWTP Bacau – Assessment of treatment efficiency after reconstruction

The current treatment performance is commented as follows.

Parameter	Discharge Limit mg/l	Effluent WWTP mg/l	Comment
BOD_5	25	< 25	No problems with BOD5 effluent.
COD	125	< 125	No problems with COD effluent.
SS	35	< 35	The treatment efficiency is lower than 90 % due to the low influent concentration.
Total N [1)]	10	20 - 25	There is no full nitrification / de-nitrification process at the existing WWTP Extension of the secondary treatment is necessary
Total P	1	2 - 2.9	There is no tertiary treatment step at the existing WWTP Installation of tertiary treatment is necessary

[1)] total Kjeldahl-nitrogen (organic N + NH4-N), nitrate (NO3-N)-nitrogen and nitrite (NO2)-nitrogen

Table 5-80: Current treatment performance

A summarization of the WWTP's performance is given in the table below.

The values in the column "Before Project" are based on the design parameters of the ISPA Project and taken from the "Final Design Report Rehabilitation of BACAU WWTP – PWT Wasser- und Abwassertechnik GmbH January 18th, 2006 Revision: 0".

N°	Performance Indicators	Unit	Bacau	
			Before Project	After Project
3.2.1	Total wastewater volume collected (average wastewater flow)	1000 m^3/d	59.9	54.2
3.7.2	Hydraulic design capacity of WWTPs	1000 m^3/d	no data	73.9
3.7.3	Biological design capacity	1000 kg BOD/d	no data	15.8
3.7.5	Percent of biologic design capacity used (3.4.1 / 3.7.3)	%	no data	82
3.7.7	Capacity of WWTPs in Population equivalent (p.e.); *calculation base Art. 2.6 – dir - 91/271 EEC*	1000 p.e.	no data	241
3.7.8	Total volume of wastewater treated in WWTPs (yearly average at the outlet of WWTP)	1000 m^3/d	60	54
3.7.8.10	Volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC	1000 m3/d	no data	54
3.7.8.11	Percent of volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC Article 4 (5) (3.7.8.11 / 3.2.1.)	% of 3.2.1	no data	100
3.7.8.12	Total BOD treated / removed	1000 kg BOD/d	no data	12.9
3.7.8.13	Total COD treated / removed	1000 kg COD/d	no data	28.9
3.7.8.14	Total N treated / removed	kg N/d	no data	2.6
3.7.8.15	Total P treated / removed	kg P/d	no data	0.5

Table 5-81: Performance Indicators for Wastewater Treatment

5.3.1.3 Operation and Maintenance

The current O&M cost of the wastewater system have been analyzed for energy, chemicals, staff, material and other (i.e. external services like excavation, construction etc.) cost.

The following table shows a compilation of current O&M cost.

	2008
Cost Item	**Amount [€/year]***
Energy	246,742
Chemicals/Materials	164,210
Staff	1,438,749
Maintenance	89,692
Others	669,625
TOTAL	**2,609,018**

Table 5-82: Current Operation & Maintenance Costs Wastewater

Item*	**Indicator**	**Unit**	**before project**	**after project**
3.9.1	Number of sewer blockages per year	number/year	no data	0
3.9.2	Number of sewer blockages per km of sewer network per year (3.9.1 / 3.6.1)	number/km/a	no data	0
3.9.3	Number of days with flooding caused by sewerage system	number	no data	0
3.9.4	Number of days with flooding caused by sewerage system per km per year (3.9.3 / 3.6.1)	days/km/a	no data	0
3.9.5	Average electricity consumption per year	1000 kWh/a	1,967	5,062
3.9.6	Average electricity consumption per volume of wastewater treated (3.9.5./3.7.8)	kWh/m³	0.0900	0.2559

Table 5-83: Efficiency of Sewerage System

5.3.1.4 Main Deficiencies in Wastewater System

Item	Components	Main Deficiencies*
1	Wastewater Network	The high infiltration of the sewerage network is a main factor of the total flow. Lack of adequate equipment for operation and maintenance of the sewerage network is also a reason for the difficult operation of the sewerage system.
2	Wastewater Pumping Stations	No structures known.
3	Wastewater Treatment Plant	Adjustment of aeration zone and aeration system in existing activated sludge tanks necessary, backup for blowers necessary, Additional activated sludge tanks required, No phosphor precipitation existing, Existing anaerobic digester reaction volume not sufficient, Mechanical sludge dewatering facilities at the operation limit.

Table 5-84: Main Deficiencies in Wastewater System

5.3.2 Agglomeration Comanesti- Moinesti

5.3.2.1 Location of Current and Proposed Infrastructure

Since the preparation of the Master Plan the boundaries of Agglomeration Comanesti-Moinesti have only been insignificantly adjusted to reflect new land use developments.

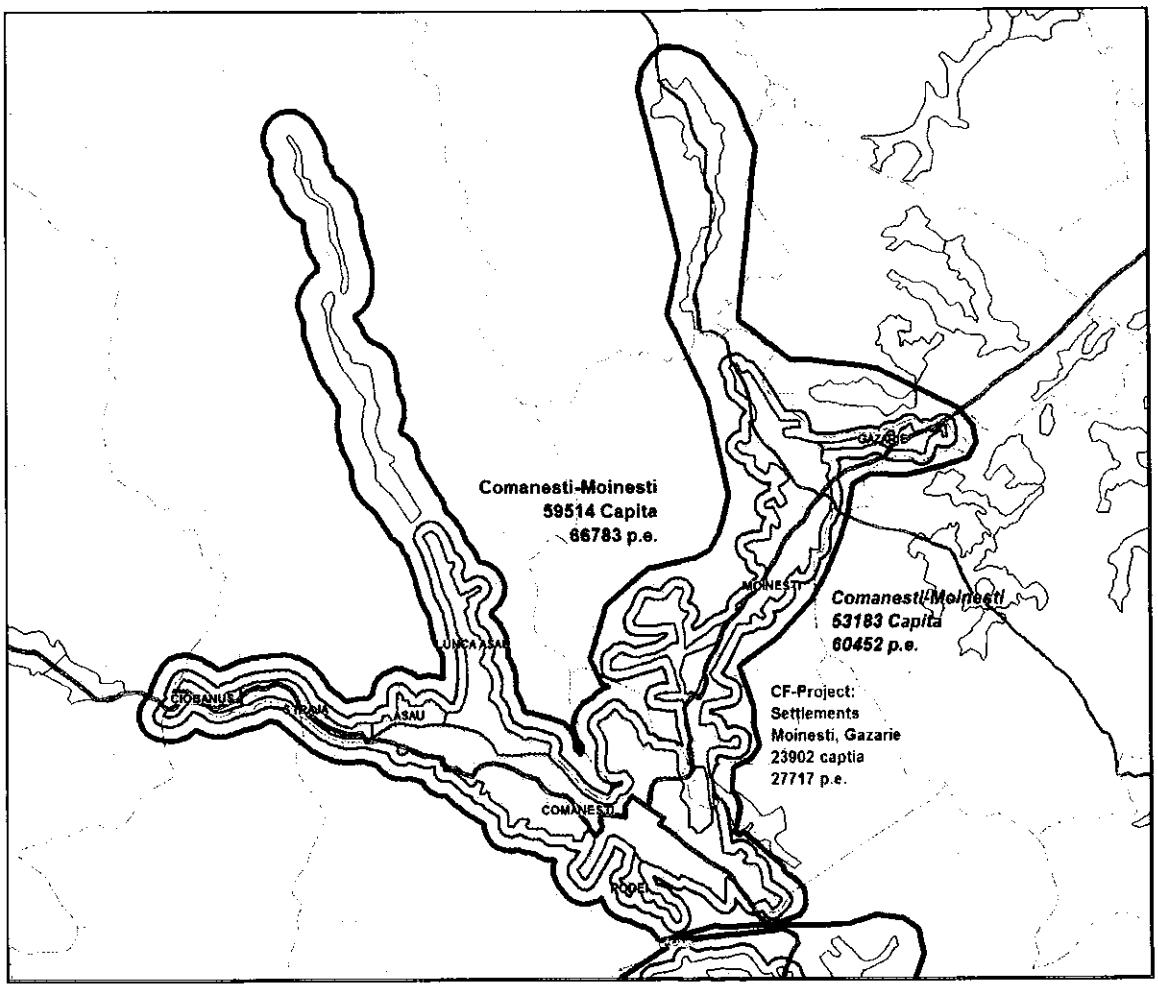

Figure 5-115: Overview Map Comanesti-Moinesti Agglomeration

Due to the fact that Comanesti is not eligible for CF because it refused to join the IDA and the ROC, the following descriptions, figures and performance indicators only refer to Moinesti and Gazarie as part of the agglomeration Comanesti-Moinesti.

5.3.2.2 Description of Current Infrastructure

5.3.2.2.1 Wastewater Network (Moinesti, Gazarie)

Moinesti has a separate wastewater collection system. The wastewater collection system is basically confined to the City of Moinesti and has presently around 67 % connection rate in this service area.

Connection Rate		Before Project	After Project
Total population in agglomeration concerned	capita * 1000	23.9	23.6
Service coverage: Percent of population connected to wastewater network	%	67	90
Population connected to a wastewater network	capita * 1000	16.1	21.2

Table 5-85: Connection rates Moinesti (Moinesti, Gazarie) before/after project

The storm water drainage system was built in 1984 and has a total length of 2.2 km. The total sewer network is 11.7 km long, of which 2.9 km are main collectors. The sewer network is currently owned and operated by Apa Prim. A regional operation company for the County of Bacau (CRAB – Comania Regionala De Apa Bacau) has already been formed but is not operating yet.

The following table summarizes the Moinesti system.

Diameter DN	Asbestos Cement [m]	Concrete [m]	Iron [m]	Steel [m]	Ceramic [m]	PVC [m]
200		1,489				
300		2,039				
400		1,294				
500		1,695				
600		2,943				
Total		**11,701**				

Table 5-86: Moinesti (Moinesti, Gazarie) wastewater network (current situation)

The wastewater collection system of Moinesti (Moinesti, Gazarie) can be summarized as follows:

Item	Indicator	Unit	Before	After
3.6.1	Total length of wastewater network (incl. storm water & main collectors)	km	12	33
3.6.1.1	Length of combined system	km	0	0
3.6.1.2	Length of separated system	km	11.7	33.3
3.6.1.3	Length of partially combined/separated system	km	0	0
3.6.1.4	Percent of length of combined system	% of 3.6.1	0	0
3.6.1.5	Percent of length of separated system	% of 3.6.1	100	100
3.6.1.6	Percent of length of partially combined/separated system	% of 3.6.1	0	0
3.6.2	Length of main collectors	km	3	3
3.6.2.1	Length of main collectors rehabilitated	km	0	0
3.6.2.2	Percent of main collectors rehabilitated (related to existing main collectors)	% of 3.6.2		0
3.6.3	Number of wastewater pumping stations	number	2	5
3.6.4	Capacity wastewater pumping stations	1000 m^3/d	no data	0.0
3.6.5	Length of wastewater network (excl. storm water and main collectors)	km	9	30
3.6.5.1	Length wastewater network rehabilitated	km	0	0
3.6.5.2	Percent of wastewater network rehabilitated (related to existing network)	% of 3.6.6	0	0
3.6.7	Population served per length of wastewater network	capita/km	1373	637
3.6.8	Number of overflow devices in the network	number	no data	4
3.6.9	Capacity of storm water retention basins	1000*m^3	no data	

Table 5-87: Current wastewater collection system parameters – Moinesti

5.3.2.2.2 Wastewater Pumping Stations (Moinesti, Gazarie)

The existing sewer network includes two pumping stations:

No.	Name of pumping station	No. of pumps	Q [m^3/h]	Hp [m]	P [kW]	Energy efficiency [kWh/m^3]	Year of installation	Rating of physical condition of E&M equipment	Rating of physical condition of civil structures
1	str. Plopilor - Zona Locuinte	1 WW + 1 SW	9	10	1.1	n.i.	2006	new	good
2	str.Plopilor - Zona Blocuri	1 WW + 1 SW	4	10	1	n.i.	2010	new	new

Table 5-88: Assessment of the existing pumping stations – Moinesti

5.3.2.2.3 Wastewater Treatment Plant (Moinesti, Gazarie)

The existing WWTP is operated without secondary and tertiary treatment. The existing WWTP Moinesti currently consists of the following main components.

No.	Process Step	Description	Technical Data
1	Diversion Chamber	By-pass to Tazlaul Sarat River Junction of Wastewater from Lucacesti and Moinesti	no data
2	Coarse Screen old	1 line of manually raked screens (Coarse / Fine)	25 / 15 mm width
3	Coarse Screen new	1 line of manually raked Coarse screen	20 mm width , perforated metal plate used as sieve 10 mm width
4	Grit Chamber old	Grit chamber 2 lines	no data
5	Grit Chamber new	Grit chamber 1 line	Length 11 m
6	Grease Removal Chamber new	2 lines with aeration (not in use)	Q_{design} 100 L/s, Blowers 3 x 5,5 kW
7	Primary Settling Tanks old	Imhoff tanks desludged every 6 days (water flows through horizontally), desludged by gravity flow	2 Imhoff tanks
8	Primary Settling Tanks new	round tanks desludged every 8 hours (water flows through vertically), desludged by gravity flow	2 tanks, 8 m diameter each, depth ca. 8 m
9	Pumping Station (PS 1)	From the primary settling tanks the wastewater is pumped into the biologic filters.	4 submersible pumps 19,6 kW, 82 L/s, pressure head 36,5 m each
10	Biologic Filter	Biologic filter, 2 lines, 1 line renewed	20m diameter, recirculation possible
11	Secondary Settling Tanks old	Existing secondary settling tanks (Imhoff tanks)	2 Imhoff tanks, diameter approx. 10 m, water depth ca. 8 m
12	Secondary Settling Tanks new	Existing secondary settling tanks round tanks	2 tanks, diameter approx. 8 m, water depth ca. 8 m
13	Effluent Chlorination	The treated effluent is chlorinated.	1 chlorine contact tank 30 min contact time, with dosing unit
14	Pumping Station (PS 2)	Sludge pumping station	submersible pumps
15	Sludge Treatment	Cold digestion aeration tanks	2 tanks, coarse bubble aerators
16	Pumping Station (PS 3)	Sludge pumping station	2 pumps ACV100, 11 kW, 80 L/s pressure head 15 m each
17	Sludge drying beds	Sludge drying beds	ca. 16 x 54 m
18	Transformer Station		

Table 5-89: WWTP Moinesti – Description of main components

The physical condition of electro-mechanical equipment and civil structures is assessed as follows.

No.	Process Step	Process Component	Description [7]	Year of Installation	Rating of physical condition of E&M equipment	Rating of physical condition of Civil Structures	Need for renovation [8]
1	Diversion Chamber	Diversion Chamber with Bypass	insufficient capacity	2002		poor	to be demolished, build new plant at same site
2	Coarse Screen old	Flow Channels Coarse Screens	insufficient capacity	1968		poor	to be demolished, build new plant at same site
		Coarse / fine screens	insufficient capacity	1968	poor		to be demolished, build new plant at same site
		Electric Equipment / Process Control	not existing				
3	Coarse Screen new	Flow Channels Coarse Screens	insufficient capacity	2002		poor	to be demolished, build new plant at same site
		Coarse Screens	insufficient capacity	2002	poor		to be demolished, build new plant at same site
		Electric Equipment / Process Control	not existing				

No.	Process Step	Process Component	Description [7]	Year of Installation	Rating of physical condition of E&M equipment	Rating of physical condition of Civil Structures	Need for renovation [8]
4	Grit Chamber old	Grit Chamber	insufficient capacity	1968		poor	to be demolished, build new plant at same site
		Pumps	not existing				
		Electric Equipment / Process Control	not existing				
5	Grit Chamber new	Grit Chamber	insufficient capacity	2002	poor	poor	to be demolished, build new plant at same site
		Pumps	not existing				
		Electric Equipment / Process Control	not existing				
6	Grease Removal Chamber new	Grease Removal Chamber	insufficient capacity	2002	poor	poor	to be demolished, build new plant at same site
		Pumps	not existing				
		Blowers	outworn, insufficient capacity	ca. 2002	poor		to be demolished, build new plant at same site
		Electric Equipment / Process Control	outdated / not existing	ca. 2002	outdated		to be demolished, build new plant at same site
7	Primary Settling Tanks old	Civil Structures Settling Tanks	insufficient capacity	1968	not existing	poor	to be demolished, build new plant at same site
		Pumps, Mixers	not existing				
		Electric Equipment / Process Control	not existing				
8	Primary Settling Tanks new	Civil Structures Settling Tanks	insufficient capacity	2002		poor	to be demolished, build new plant at same site
		Pumps, Mixers	not existing				
		Electric Equipment / Process Control	not existing				
9	Pumping Station (PS 1)	No civil structure, only machinery equipment	Pumping station and operation building	1968		poor	to be demolished, build new plant at same site
		Pumps	capacity sufficient	2007	good		to be demolished, build new plant at same site
		Electric Equipment / Process Control	adequate / not existing	2008	good / not existing		to be demolished, build new plant at same site
10	Biologic Filter	civil structure tank	Filters seem to be plugged, no backflushing possible	1968 / 2002		poor	to be demolished, build new plant at same site
		Distribution nozzles	outworn	1968 / 2002	poor		to be demolished, build new plant at same site
		Electric Equipment / Process Control	not existing				
11	Secondary Settling Tanks old	Civil Structure Tank	insufficient capacity	1968	not existing	poor	Reconstruction as gravity sludge thickener necessary
12	Secondary Settling Tanks new	Civil Structure Tank	insufficient capacity	2002	not existing	poor	to be demolished, build new plant at same site
13	Effluent Chlorination	Civil Structure chlorination building / reaction tank	underground tank, insufficient capacity	ca. 2002		poor	to be demolished, build new plant at same site
		Mechanical Equipment	adequate	2008	good		to be demolished, build new plant at

No.	Process Step	Process Component	Description [7]	Year of Installation	Rating of physical condition of E&M equipment	Rating of physical condition of Civil Structures	Need for renovation [8]
							same site
		Electric Equipment / Process Control	adequate / not existing	2009	good / not existing		to be demolished, build new plant at same site
14	Pumping Station (PS 2)	Civil structure pump station	sludge from the old line is pumped to the sludge drying beds	1968		poor	to be demolished, build new plant at same site
		Pumps	sludge from the new line is pumped to the cold digestion tanks (not in use)	2007	good		to be demolished, build new plant at same site
		Electric Equipment / Process Control	adequate / not existing	2007	good / not existing		to be demolished, build new plant at same site
15	Sludge Treatment	Civil Structures Imhoff tanks	not in use / insufficient capacity	2002	not existing	poor	to be demolished, build new plant at same site
16	Pumping Station (PS 3)	Civil structure, pump station	sludge from the aerobic digestion is pumped to the sludge drying beds (not in use)	1968		poor	to be demolished, build new plant at same site
		Pumps	outworn	ca. 2002	poor		to be demolished, build new plant at same site
		Electric Equipment / Process Control	outdated / not existing	2007	poor / not existing		to be demolished, build new plant at same site
17	Sludge drying beds	old sludge drying beds		1978		poor	to be demolished, build new plant at same site
		new sludge drying beds	not in use because of problems with drainage	2002		poor	to be demolished, build new plant at same site
		additional sludge drying area, not specified		???			to be demolished, build new plant at same site
18	Transformer Station	Electric Equipment / Process Control	No civil structures, outdated	1978	poor		to be demolished, build new plant at same site

Table 5-90: WWTP Moinesti – Assessment of physical condition of electro-mechanical equipment and civil structures

The current treatment performance of the existing WWTP was analysed, using the chemical analyses (monthly average values) of the WWTP's laboratory.

No.	Parameter	Date	Influent WWTP	Effluent WWTP	Eliminated Concentration	Treatment Performance
			mg/l	mg/l	mg/l	%
1	**BOD_5**					
1.1	BOD_5	2008 average	69,0	no data	no data	no data
1.2	BOD_5	2007 average	65,0	no data	no data	no data
		Average 2008, 2007	**67,0**	no data	no data	no data
2	**COD**					
2.1	COD	2008 average	236,5	no data	no data	no data
2.2	COD	2007 average	225,8	no data	no data	no data
		Average 2008, 2007	**231,2**	no data	no data	no data
3	**Suspended Solids (SS)**					
3.1	SS	2008 average	62,0	no data	no data	no data
3.2	SS	2007 average	64,2	no data	no data	no data
		Average 2008, 2007	**63,1**	no data	no data	no data
4	**Total N[2]**					
4.1	Ntot	2008 average	14,2	no data	no data	no data
4.2	Ntot	2007 average	18,3	no data	no data	no data
		Average 2008, 2007	**16,2**	no data	no data	no data
5	**Total P**					
5.1	Ptot	2008 average	no data	no data	no data	no data
5.2	Ptot	2007 average	no data	no data	no data	no data
		Average 2008, 2007	no data	no data	no data	no data

Table 5-91: WWTP Moinesti – Assessment of current treatment efficiency

The current treatment performance is commented as follows.

Parameter	Discharge Limit mg/l	Effluent WWTP mg/l	Comment
BOD_5	25	No data	No data
COD	125	No data	No data
SS	35	No data	No data
Total N [1)]	15	No data	There is no nitrification / de-nitrification process at the existing WWTP
Total P	2	No data	No data

[1)] total Kjeldahl-nitrogen (organic N + NH4-N), nitrate (NO3-N)-nitrogen and nitrite (NO2)-nitrogen

Table 5-92: Current treatment performance

[2] Only NH_4+NO_2 have been analysed

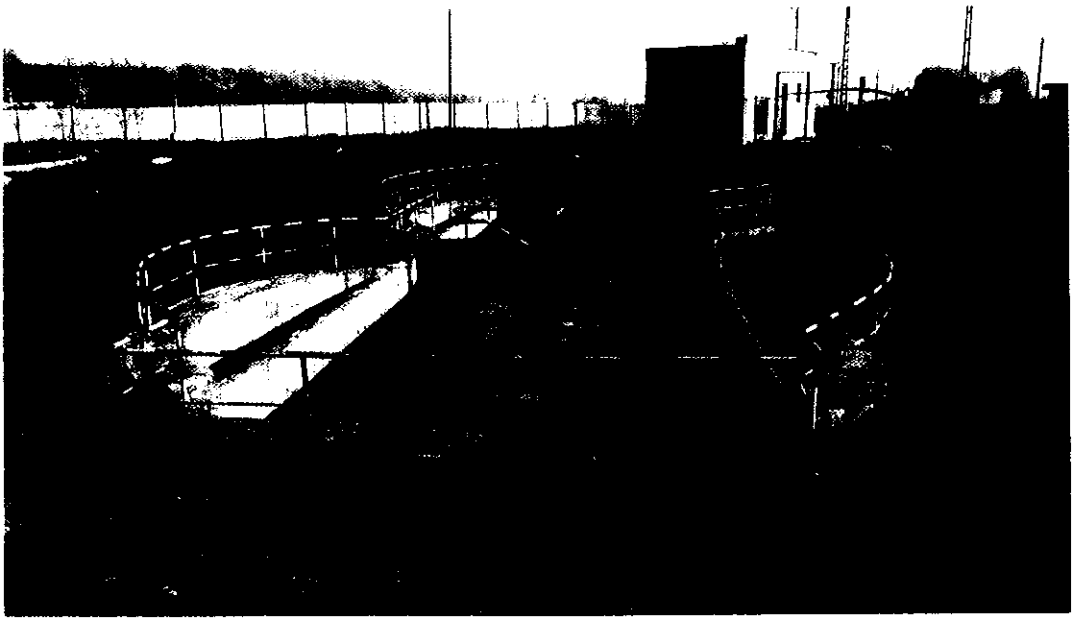

Figure 5-116: WWTP Moinesti

Figure 5-117: WWTP Moinesti

A summarization of the WWTP's performance is given in the table below.

N°	Performance Indicators	Unit	Roman	
			Before Project	After Project
3.2.1	Total wastewater volume collected (average wastewater flow)	1000 m^3/d	4.0	4.1
3.7.2	Hydraulic design capacity of WWTPs	1000 m^3/d	no data	8.0
3.7.3	Biological design capacity	1000 kg BOD/d	no data	1.9
3.7.5	Percent of biologic design capacity used (3.4.1 / 3.7.3)	%	no data	100
3.7.7	Capacity of WWTPs in Population equivalent (p.e.); *calculation base Art. 2.6 – dir - 91/271 EEC*	1000 p.e.	no data	32
3.7.8	Total volume of wastewater treated in WWTPs (yearly average at the outlet of WWTP)	1000 m^3/d	4	4
3.7.8.10	Volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC	1000 m3/d	no data	4
3.7.8.11	Percent of volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC Article 4 (5) (3.7.8.11 / 3.2.1.)	% of 3.2.1	no data	100
3.7.8.12	Total BOD treated / removed	1000 kg BOD/d	no data	1.9
3.7.8.13	Total COD treated / removed	1000 kg COD/d	no data	3.8
3.7.8.14	Total N treated / removed	kg N/d	no data	348.9
3.7.8.15	Total P treated / removed	kg P/d	no data	132.1

Table 5-93: WWTP Moinesti – Performance Indicators for Wastewater Treatment

5.3.2.3 Operation and Maintenance

The current O&M cost of the wastewater system have been analyzed for energy, chemicals, staff, material and other (i.e. external services like excavation, construction etc.) cost.

The following table shows a compilation of current O&M cost.

	2008
Cost Item	**Amount [€/year]***
Energy	9,901
Chemicals/Materials	542
Staff	78,067
Maintenance	165
Others	41,544
TOTAL	**130,219**

Table 5-94: Current Operation & Maintenance Costs Wastewater

Item*	Indicator	Unit	Before project	After project
3.9.1	Number of sewer blockages per year	number/year	no data	0
3.9.2	Number of sewer blockages per km of sewer network per year (3.9.1 / 3.6.1)	number/km/a	no data	0
3.9.3	Number of days with flooding caused by sewerage system	number	no data	0
3.9.4	Number of days with flooding caused by sewerage system per km per year (3.9.3 / 3.6.1)	days/km/a	no data	0
3.9.5	Average electricity consumption per year	1000 kWh/a	87	582
3.9.6	Average electricity consumption per volume of wastewater treated (3.9.5./3.7.8)	kWh/m³	0.110	0.385

Table 5-95: Efficiency of Sewerage System

5.3.2.4 Main Deficiencies in Wastewater System

Item	Components	Main Deficiencies*
1	Wastewater Network	The high infiltration of the sewerage network is a main factor of the total flow. Lack of adequate equipment for operation and maintenance of the sewerage network is also a reason for the difficult operation of the sewerage system.
2	Wastewater Pumping Stations	No structures known
3	Wastewater Treatment Plant	Insufficient screens and grit and grease separation, No operative inlet flow meter for the old WWTP, No nitrification / de-nitrification, No phosphor precipitation existing, No sludge dewatering facilities, No Scada, no Process control, Generally a lack of funding for spare parts and preventive maintenance is evident, No locally financed re-investment in worn-out civil structures or electromechanical equipment

Table 5-96: Main Deficiencies in Wastewater System

5.3.3 Agglomeration Buhusi

5.3.3.1 Location of Current and Proposed Infrastructure

Since the preparation of the Master Plan the boundaries of Agglomeration Buhusi have only been insignificantly adjusted to reflect new land use developments.

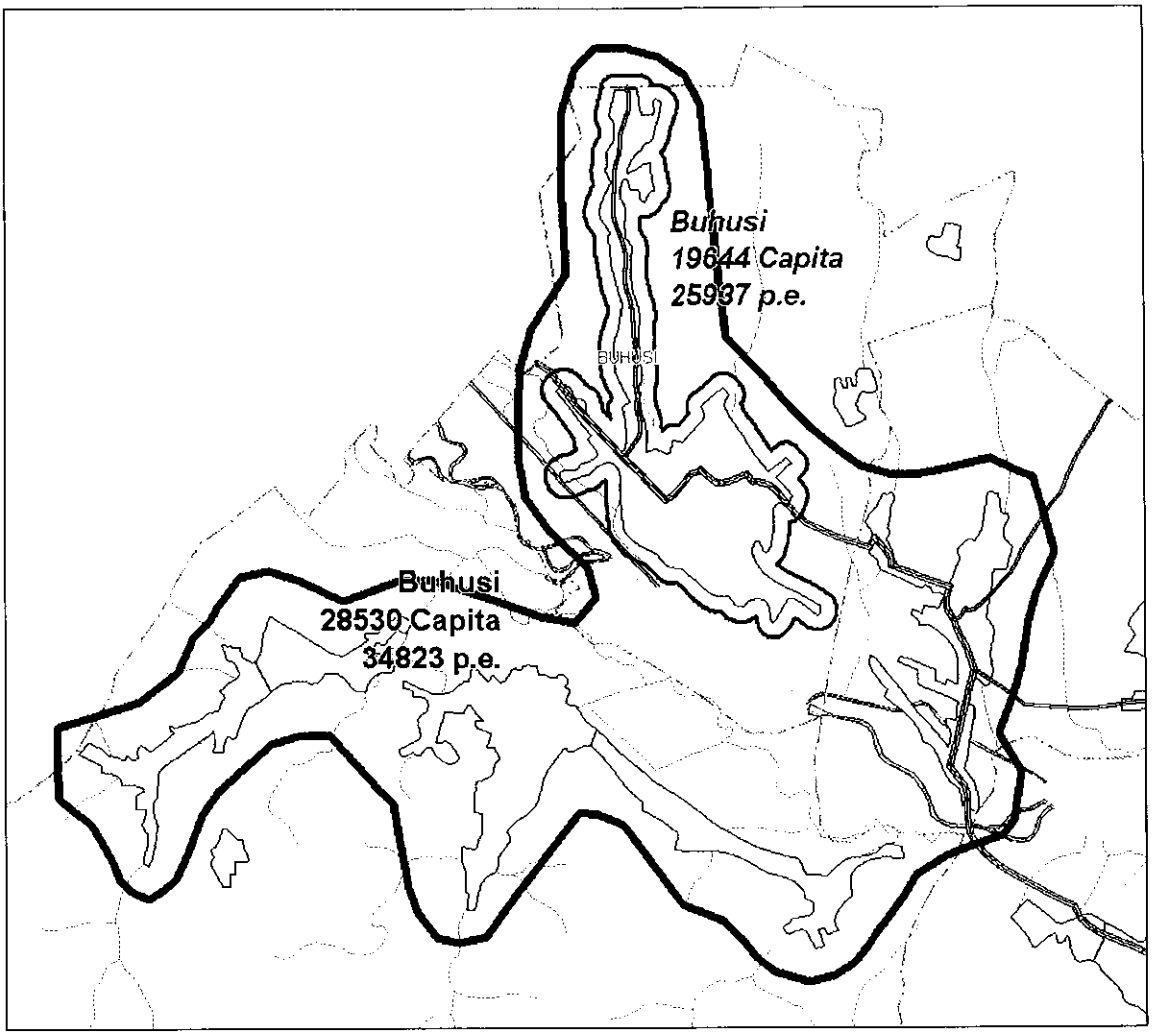

Figure 5-118: Overview Map Buhusi Agglomeration

5.3.3.2 Description of Current Infrastructure

5.3.3.2.1 Wastewater Network

The sewer network in Buhusi is a combined wastewater collection system. The system consists of 24.6 km of sewers, of which 6.7 km are main collectors. No information is available on the number of overflow devices in the network. The overall connection rate in the service area is 54 %.

Connection Rate		Before Project	After Project
Total population in agglomeration concerned	capita * 1000	19.6	19.4
Service coverage: Percent of population connected to wastewater network	%	54	90
Population connected to a wastewater network	capita * 1000	10.7	17.5

Table 5-97: Connection rates Buhusi agglomeration before/after project

The wastewater collection system and treatment system is presently owned and operated by Directia de Gospodarire Comunala.

The following table summarizes the Buhusi system.

Diameter DN	Asbestos Cement [m]	Concrete [m]	Iron [m]	Steel [m]	Ceramic [m]	PVC [m]
160				130		
200	4,797					
250				439		
300				6,314		
315				691		
400				3,180		
500		465		1,963		
1000				4,393		
OV 140/80			362			
OV 140/89			816			
OV 75/50			1,090			
Total	**4,797**	**465**	**2,268**	**17,110**		

Table 5-98: Buhusi wastewater network (current situation)

The wastewater collection system of Buhusi can be summarized as follows:

Item	Indicator	Unit	Before	After
3.6.1	Total length of wastewater network (incl. storm water & main collectors)	km	25	45
3.6.1.1	Length of combined system	km	24.6	24.6
3.6.1.2	Length of separated system	km	0	20.1
3.6.1.3	Length of partially combined/separated system	km	0	0
3.6.1.4	Percent of length of combined system	% of 3.6.1	100	55
3.6.1.5	Percent of length of separated system	% of 3.6.1	0	45
3.6.1.6	Percent of length of partially combined/separated system	% of 3.6.1	0	0
3.6.2	Length of main collectors	km	7	7
3.6.2.1	Length of main collectors rehabilitated	km	0	0
3.6.2.2	Percent of main collectors rehabilitated (related to existing main collectors)	% of 3.6.2	0	0
3.6.3	Number of wastewater pumping stations	number	1	12
3.6.4	Capacity wastewater pumping stations	1000 m^3/d	0.2	0.0
3.6.5	Length of wastewater network (excl. storm water and main collectors)	km	18	38
3.6.5.1	Length wastewater network rehabilitated	km	0	0
3.6.5.2	Percent of wastewater network rehabilitated (related to existing network)	% of 3.6.6	0	0
3.6.7	Population served per length of wastewater network	capita/km	435	390
3.6.8	Number of overflow devices in the network	number	1	1
3.6.9	Capacity of storm water retention basins	1000*m^3	no data	

Table 5-99: Current wastewater collection system parameters – Buhusi

5.3.3.2.2 Wastewater Pumping Stations

The existing sewer network in Buhusi includes only one pumping station:

No	Name of pumping station	No. of pumps	Q [m3/h]	P [kW]	Energy efficiency [kWh/m3]	Year of installation	Rating of physical condition of E&M equipment	Rating of physical condition of civil structures
1	Chebac	1	10	1.5	n.i.	2007	good	good

Table 5-100: Assessment of the existing pumping stations – Buhusi

5.3.3.2.3 Wastewater Treatment Plant

The existing WWTP is operated without secondary and tertiary treatment. The existing WWTP Buhusi currently consists of the following main components.

No.	Process Step	Description	Technical Data
1	Diversion Chamber	By-pass into small stream leading to Bistrita River	manually opened slider
2	Coarse Screen	1 line of manually raked screens (coarse / fine)	-
3	Grit Chamber	Grit chamber 2 lines	manually cleaned
4	Primary Settling Tanks		4 Imhoff tanks, water depth ca. 8 m 2 tanks inoperative
5	Pumping Station 1 (PS 1)	From the settling tanks the wastewater is pumped into the tickling filters.	5 pumps
6	Biologic Filter	Biologic filter, 2 lines, 1 line inoperative	diam. ca. 20 m
7	Secondary Settling Tanks	Existing secondary settling tanks.	4 Imhoff tanks (1 in use, 3 never finished), water depth ca. 8 m
8	Effluent Chlorination	The treated effluent is chlorinated.	1 chlorine contact tank ca. 100 m^3 volume with dosing unit
9	Pumping Station 2 (PS 2)	Sludge pumping station above sludge tank	-
10	Sludge storage	sludge tank, the sludge is pumped into the sludge drying beds	1 tank, Equipment in tank:1 mixer, 1 sludge pump
11	Sludge drying beds	ca. 16 x 54 m	
12	Transformer Station		

Table 5-101: WWTP Buhusi – Description of main components

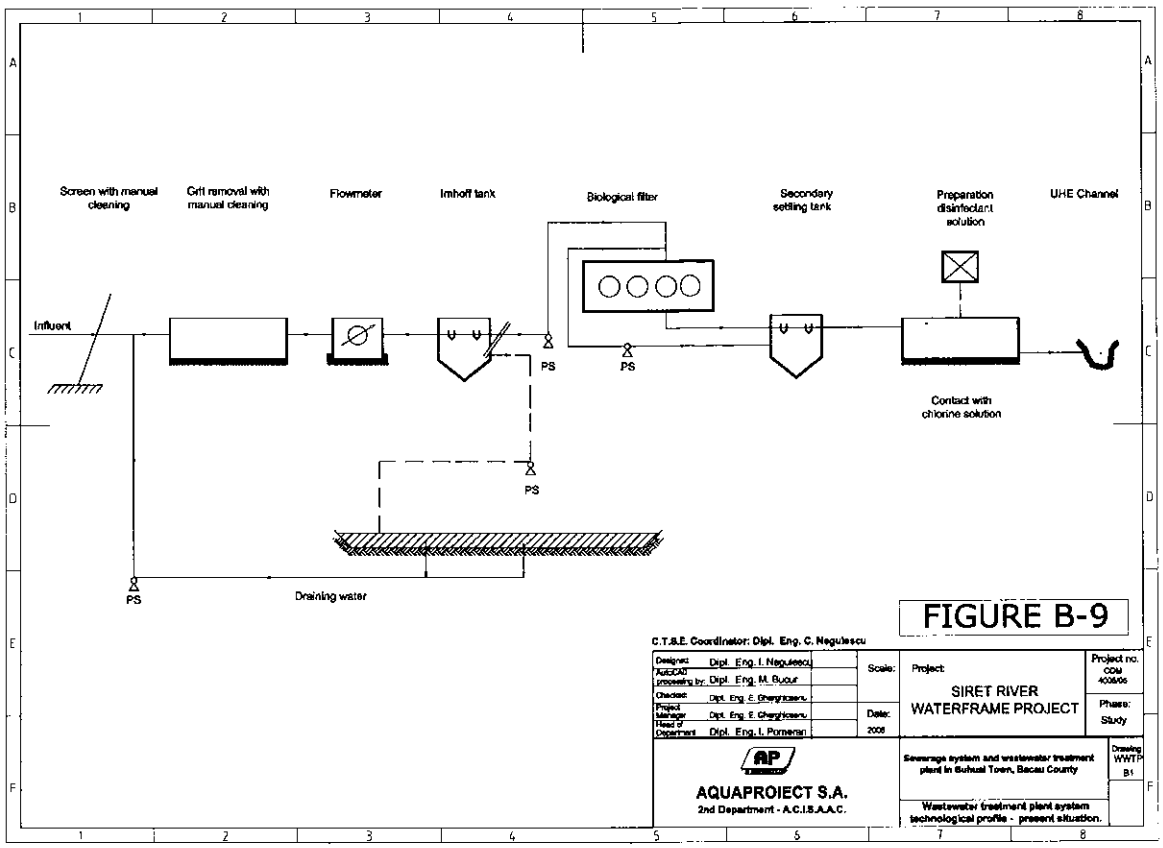

Figure 5-119: Existing WWTP Buhusi – Flow Scheme

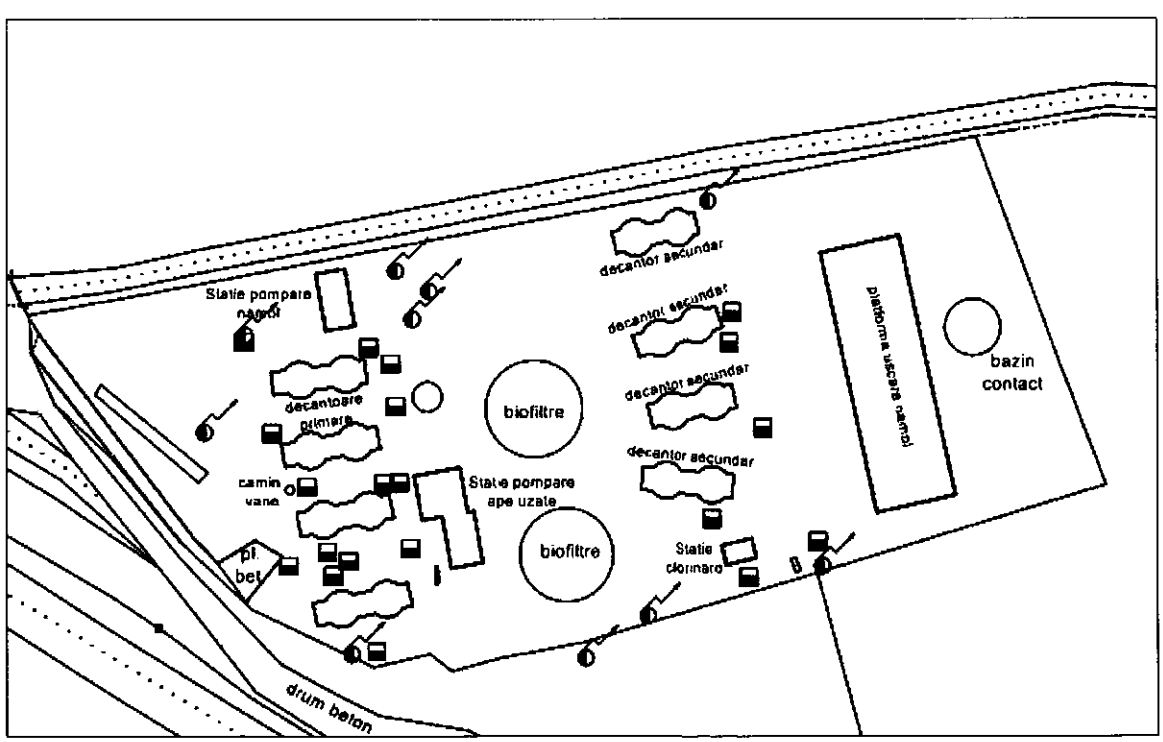

Figure 5-120: Existing WWTP Buhusi

The physical condition of electro-mechanical equipment and civil structures is assessed as follows.

No.	Process Step	Process Component	Description	Year of Installation	Rating of physical condition of E&M equipment	Rating of physical condition of Civil Structures	Need for renovation
1	Diversion Chamber	Diversion Chamber	insufficient capacity	1978		poor	not usable, build new plant at new site
2	Coarse Screen	Flow Channels Coarse Screens	insufficient capacity	1978		poor	not usable, build new plant at new site
		Coarse Screens	outworn	1978	poor		not usable, build new plant at new site
		Fine screens	outworn	1978	poor		not usable, build new plant at new site
3	Grit Chamber	Grit Chamber	insufficient capacity	1978		poor	not usable, build new plant at new site
		Pumps	not existing				
		Electric Equipment / Process Control	not existing				
4	Primary Settling Tanks	Civil Structures Settling Tanks	insufficient capacity	1978		poor	not usable, build new plant at new site
		Pumps, Mixers	not existing				
		Electric Equipment / Process Control	not existing				
5	Pumping Station 1 (PS 1)	civil structure pump station	insufficient capacity	1978		poor	not usable, build new plant at new site
		Pumps	outworn	1978	poor		not usable, build new plant at new site
		Electric Equipment / Process Control	outdated	1978	poor		not usable, build new plant at new site
6	Biologic Filter	civil structure tank	operated filter insufficient capacity, other filter not usable	1978		poor	not usable, build new plant at new site
		Distribution nozzles	outworn	1978	poor		not usable, build new plant at new site
		Electric Equipment / Process Control	not existing				
7	Secondary Settling Tanks	Civil Structure Tank	insufficient capacity	1978		poor	not usable, build new plant at new site
		Pumps, Mixers	not existing				
		Electric Equipment / Process Control	not existing				
8	Effluent Chlorination	Civil Structure Chlorination building / tank	poor	1978		poor	not usable, build new plant at new site
		Mechanical Equipment	outdated	ca. 1978	poor		not usable, build new plant at new site
		Electric Equipment / Process Control	not existing				
9	Pumping Station 2 (PS 2)	civil structure pump station		1978			not usable, build new plant at new site
		Pumps	outworn	1978	poor		not usable, build new plant at new site
		Electric Equipment / Process Control	outdated	1978	poor		not usable, build new plant at new site
10	Sludge storage	Civil Structures Sludge tank	insufficient capacity	1978			not usable, build new plant at new site
		Mechanical Equipment	outdated	1978			not usable, build new plant at new site

No.	Process Step	Process Component	Description	Year of Installation	Rating of physical condition of E&M equipment	Rating of physical condition of Civil Structures	Need for renovation
		Electric Equipment / Process Control	outdated	1978			not usable, build new plant at new site
11	Sludge drying beds	old and new sludge drying beds		ca. 1978			not usable, build new plant at new site
12	Transformer Station	Electric Equipment / Process Control	No civil structures, Electric Equipment outdated	1978	poor		not usable, build new plant at new site

Table 5-102: WWTP Buhusi – Assessment of physical condition of electro-mechanical equipment and civil structures

The current treatment performance of the existing WWTP was analysed, using the chemical analyses (monthly average values) of the WWTP's laboratory.

No.	Parameter	Date	Influent WWTP	Effluent WWTP	Eliminated Concentration	Treatment Performance
			mg/l	mg/l	mg/l	%
1	**BOD_5**					
1.1	BOD_5	2008 average	No data	No data	No data	No data
1.2	BOD_5	2007 average	No data	No data	No data	No data
		Average 2008, 2007	No data	No data	No data	No data
2	**COD**					
2.1	COD	2008 average	No data	No data	No data	No data
2.2	COD	2007 average	No data	No data	No data	No data
		Average 2008, 2007	No data	No data	No data	No data
3	**Suspended Solids (SS)**					
3.1	SS	2008 average	No data	No data	No data	No data
3.2	SS	2007 average	No data	No data	No data	No data
		Average 2008, 2007	No data	No data	No data	No data
4	**Total N**					
4.1	Ntot	2008 average	No data	No data	No data	No data
4.2	Ntot	2007 average	No data	No data	No data	No data
		Average 2008, 2007	No data	No data	No data	No data
5	**Total P**					
5.1	Ptot	2008 average	No data	No data	No data	No data
5.2	Ptot	2007 average	No data	No data	No data	No data
		Average 2008, 2007	No data	No data	No data	No data

Table 5-103: WWTP Buhusi – Assessment of current treatment efficiency

The current treatment performance is commented as follows.

Parameter	Discharge Limit mg/l	Effluent WWTP mg/l	Comment
BOD_5	25	No data	No data
COD	125	No data	No data
SS	35	No data	No data
Total N [1)]	15	No data	There is no nitrification / denitrification process at the existing WWTP
Total P	2	No data	No data

[1)] total Kjeldahl-nitrogen (organic N + NH4-N), nitrate (NO3-N)-nitrogen and nitrite (NO2)-nitrogen

Table 5-104: Current treatment performance

A summarization of the WWTP's performance is given in the table below.

N°	Performance Indicators	Unit	Roman	
			Before Project	After Project
3.2.1	Total wastewater volume collected (average wastewater flow)	1000 m^3/d	1.7	2.5
3.7.2	Hydraulic design capacity of WWTPs	1000 m^3/d	no data	7.7
3.7.3	Biological design capacity	1000 kg BOD/d	no data	2.1
3.7.5	Percent of biologic design capacity used (3.4.1 / 3.7.3)	%	no data	99
3.7.7	Capacity of WWTPs in Population equivalent (p.e.); *calculation base Art. 2.6 – dir - 91/271 EEC*	1000 p.e.	no data	35
3.7.8	Total volume of wastewater treated in WWTPs (yearly average at the outlet of WWTP)	1000 m^3/d	1.7	2.5
3.7.8.10	Volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC	1000 m3/d	no data	3
3.7.8.11	Percent of volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC Article 4 (5) (3.7.8.11 / 3.2.1.)	% of 3.2.1	no data	100
3.7.8.12	Total BOD treated / removed	1000 kg BOD/d	no data	2.1
3.7.8.13	Total COD treated / removed	1000 kg COD/d	no data	4.2
3.7.8.14	Total N treated / removed	kg N/d	no data	383.0
3.7.8.15	Total P treated / removed	kg P/d	no data	70.0

Table 5-105: WWTP Buhusi – Performance Indicators for Wastewater Treatment

5.3.3.3 Operation and Maintenance

The current O&M cost of the wastewater system have been analyzed for energy, chemicals, staff, material and other (i.e. external services like excavation, construction etc.) cost.

The following table shows a compilation of current O&M cost.

	2008
Cost Item	**Amount [€/year]***
Energy	18,617
Chemicals/Materials	5,000
Staff	112,678
Maintenance	33
Others	9,619
TOTAL	**145,948**

Table 5-106: Current Operation & Maintenance Costs Wastewater

Item*	**Indicator**	**Unit**	**Before project**	**After project**
3.9.1	Number of sewer blockages per year	number/year	no data	0
3.9.2	Number of sewer blockages per km of sewer network per year (3.9.1 / 3.6.1)	number/km/a	no data	0
3.9.3	Number of days with flooding caused by sewerage system	number	no data	0
3.9.4	Number of days with flooding caused by sewerage system per km per year (3.9.3 / 3.6.1)	days/km/a	no data	0
3.9.5	Average electricity consumption per year	1000 kWh/a	151	299
3.9.6	Average electricity consumption per volume of wastewater treated (3.9.5./3.7.8)	kWh/m³	0.850	0.323

Table 5-107: Efficiency of Sewerage System

5.3.3.4 Main Deficiencies in Wastewater System

Item	Components	Main Deficiencies*
1	Wastewater network	The high infiltration of the sewerage network is a main factor of the total flow. Lack of adequate equipment for operation and maintenance of the sewerage network is also a reason for the difficult operation of the sewerage system.
2	Wastewater Pumping stations	No structures known
3	Wastewater treatment Plant	Insufficient screens and grit and grease separation, No operative inlet flow meter for the old WWTP, No nitrification / de-nitrification, No phosphor precipitation existing, No sludge dewatering facilities, No Scada, no Process control, Generally a lack of funding for spare parts and preventive maintenance is evident, No locally financed re-investment in worn-out civil structures or electromechanical equipment

Table 5-108: Main Deficiencies in Buhusi Wastewater System

5.3.4 Agglomeration Darmanesti

5.3.4.1 Location of Current and Proposed Infrastructure

Since the preparation of the Master Plan the boundaries of Agglomeration Darmanesti have only been insignificantly adjusted to reflect new land use developments.

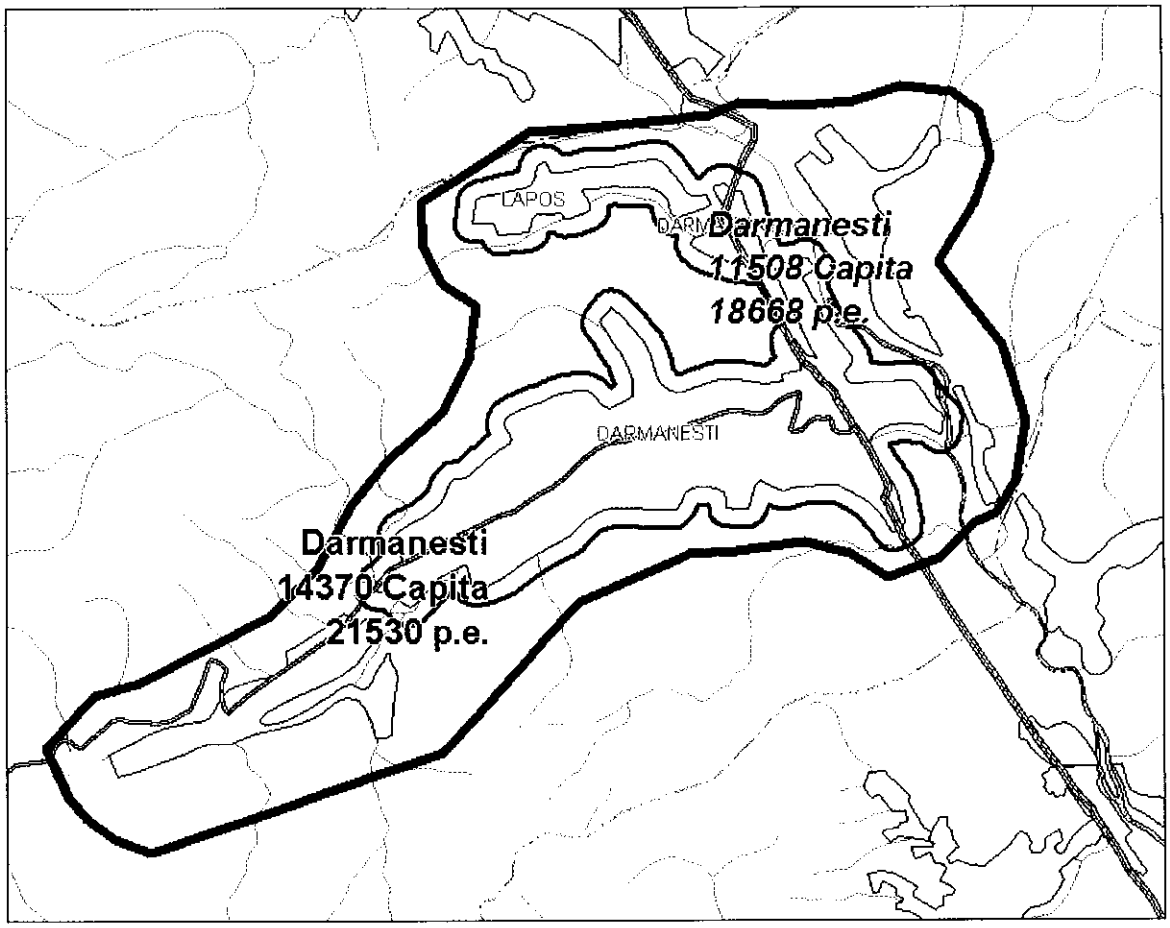

Figure 5-121: Overview Map Darmanesti Agglomeration

5.3.4.2 Description of Current Infrastructure

5.3.4.2.1 Wastewater Network

The Agglomeration of Darmanesti does not have a functioning wastewater collection system at present. There are currently only 0.5 km of sewers which are in a very poor condition. The existing sewer system will not be used in the future. Instead an entirely new wastewater collection system will be built.

Connection Rate		Before Project	After Project
Total population in agglomeration concerned	capita * 1000	11.5	11.4
Service coverage: Percent of population connected to wastewater network	%	0	90
Population connected to a wastewater network	capita * 1000	0	10.2

Table 5-109: Connection rates Darmanesti agglomeration before/after project

The wastewater collection system of Darmanesti can be summarized as follows:

Item	Indicator	Unit	Before	After
3.6.1	Total length of wastewater network (incl. storm water & main collectors)	km	0	51
3.6.1.1	Length of combined system	km	0	0
3.6.1.2	Length of separated system	km	0	50.8
3.6.1.3	Length of partially combined/separated system	km	0	0
3.6.1.4	Percent of length of combined system	% of 3.6.1	0	0
3.6.1.5	Percent of length of separated system	% of 3.6.1	0	100
3.6.1.6	Percent of length of partially combined/separated system	% of 3.6.1	0	0
3.6.2	Length of main collectors	km	0	0
3.6.2.1	Length of main collectors rehabilitated	km	0	0
3.6.2.2	Percent of main collectors rehabilitated (related to existing main collectors)	% of 3.6.2		0
3.6.3	Number of wastewater pumping stations	number	0	14
3.6.4	Capacity wastewater pumping stations	1000 m^3/d	0	
3.6.5	Length of wastewater network (excl. storm water and main collectors)	km	0	51
3.6.5.1	Length wastewater network rehabilitated	km	0	0
3.6.5.2	Percent of wastewater network rehabilitated (related to existing network)	% of 3.6.6	0	0
3.6.7	Population served per length of wastewater network	capita/km	0	201
3.6.8	Number of overflow devices in the network	number	0	0
3.6.9	Capacity of storm water retention basins	1000*m^3	no data	

Table 5-110: Current wastewater collection system parameters – Darmanesti

5.3.4.2.2 Wastewater Pumping Stations

There are presently no pumping stations in the Darmanesti Agglomeration.

5.3.4.2.3 Wastewater Treatment Plant

The existing WWTP of Darmanesti is located in the middle of the town and serves a block of flats with high population density. It has only mechanical treatment and is not sufficient for the whole town. Because of the size and the location of the WWTP, it is recommended to dismantle the old WWTP and build a new central WWTP in the south eastern part of Darmanesti where a site in public ownership is available.

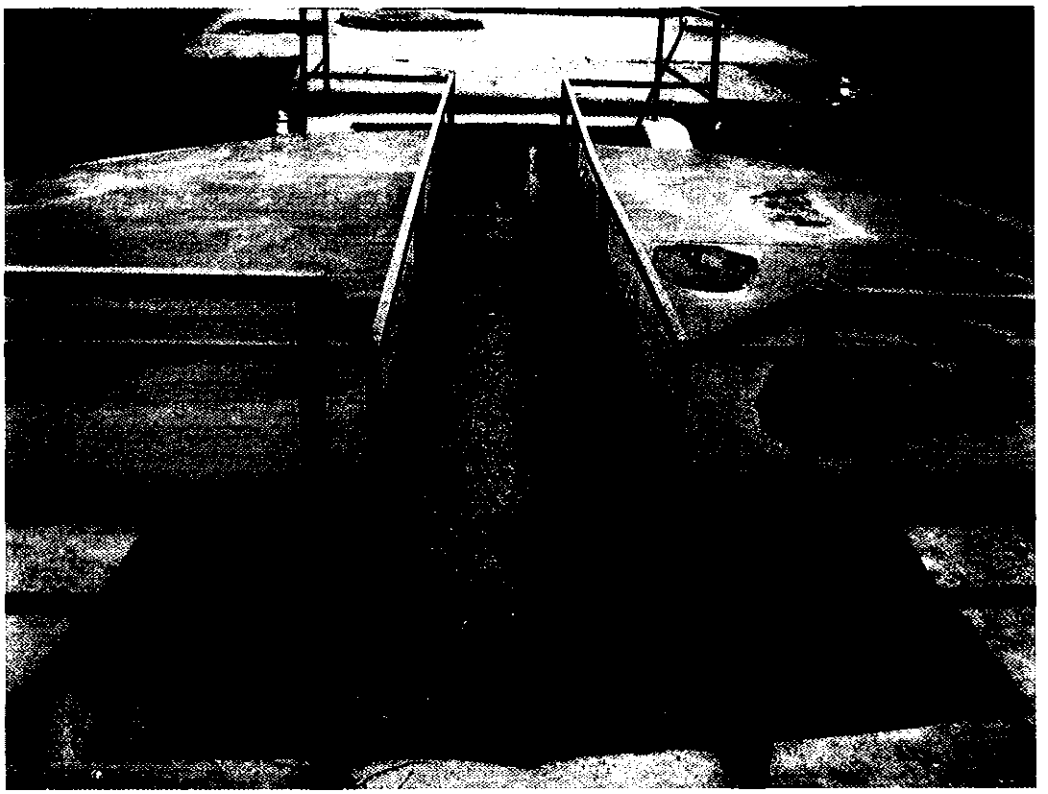

Figure 5-122: WWTP Darmanesti

Figure 5-123: WWTP Darmanesti

No Data was provided for the existing waste water treatment.

A summarization of the WWTP's performance is given in the table below.

N°	Performance Indicators	Unit	Roman	
			Before Project	After Project
3.2.1	Total wastewater volume collected (average wastewater flow)	1000 m^3/d	0.1	1.0
3.7.2	Hydraulic design capacity of WWTPs	1000 m^3/d	no data	4.6
3.7.3	Biological design capacity	1000 kg BOD/d	no data	1.3
3.7.5	Percent of biologic design capacity used (3.4.1 / 3.7.3)	%	no data	100
3.7.7	Capacity of WWTPs in Population equivalent (p.e.); *calculation base Art. 2.6 – dir - 91/271 EEC*	1000 p.e.	no data	22
3.7.8	Total volume of wastewater treated in WWTPs (yearly average at the outlet of WWTP)	1000 m^3/d	0	1
3.7.8.10	Volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC	1000 m3/d	no data	1
3.7.8.11	Percent of volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC Article 4 (5) (3.7.8.11 / 3.2.1.)	% of 3.2.1	no data	100
3.7.8.12	Total BOD treated / removed	1000 kg BOD/d	no data	1.3
3.7.8.13	Total COD treated / removed	1000 kg COD/d	no data	2.6
3.7.8.14	Total N treated / removed	kg N/d	no data	236.8
3.7.8.15	Total P treated / removed	kg P/d	no data	43.1

Table 5-111: WWTP Darmanesti – Performance Indicators for Wastewater Treatment

5.3.4.3 Operation and Maintenance

The current O&M cost of the wastewater system have been analyzed for energy, chemicals, staff, material and other (i.e. external services like excavation, construction etc.) cost.

The following table shows a compilation of current O&M cost.

	2008
Cost Item	**Amount [€/year]***
Energy	0
Chemicals/Materials	0
Staff	0
Maintenance	0
Others	0
TOTAL	**0**

Table 5-112: Current Operation & Maintenance Costs Wastewater

Item*	Indicator	Unit	Before project	After project
3.9.1	Number of sewer blockages per year	number/year	no data	0
3.9.2	Number of sewer blockages per km of sewer network per year (3.9.1 / 3.6.1)	number/km/a	no data	0
3.9.3	Number of days with flooding caused by sewerage system	number	no data	0
3.9.4	Number of days with flooding caused by sewerage system per km per year (3.9.3 / 3.6.1)	days/km/a	no data	0
3.9.5	Average electricity consumption per year	1000 kWh/a	0	134
3.9.6	Average electricity consumption per volume of wastewater treated (3.9.5./3.7.8	kWh/m³	0.000	0.373

Table 5-113: Efficiency of Sewerage System

5.3.4.4 Main Deficiencies in Wastewater System

Item	Components	Main Deficiencies*
1	Wastewater network	No existing structures
2	Wastewater Pumping stations	No structures known
3	Wastewater treatment Plant	Insufficient screens and grit and grease separation, No operative inlet flow meter for the old WWTP, No nitrification / de-nitrification, No phosphor precipitation existing, No sludge dewatering facilities No Scada, no Process control, Generally a lack of funding for spare parts and preventive maintenance is evident, No locally financed re-investment in worn-out civil structures or electromechanical equipment

Table 5-114: Main Deficiencies in Darmanesti Wastewater System

5.3.5 Agglomeration Targu Ocna

5.3.5.1 Location of Current and Proposed Infrastructure

Since the preparation of the Master Plan the boundaries of Agglomeration Targu Ocna have only been insignificantly adjusted to reflect new land use developments.

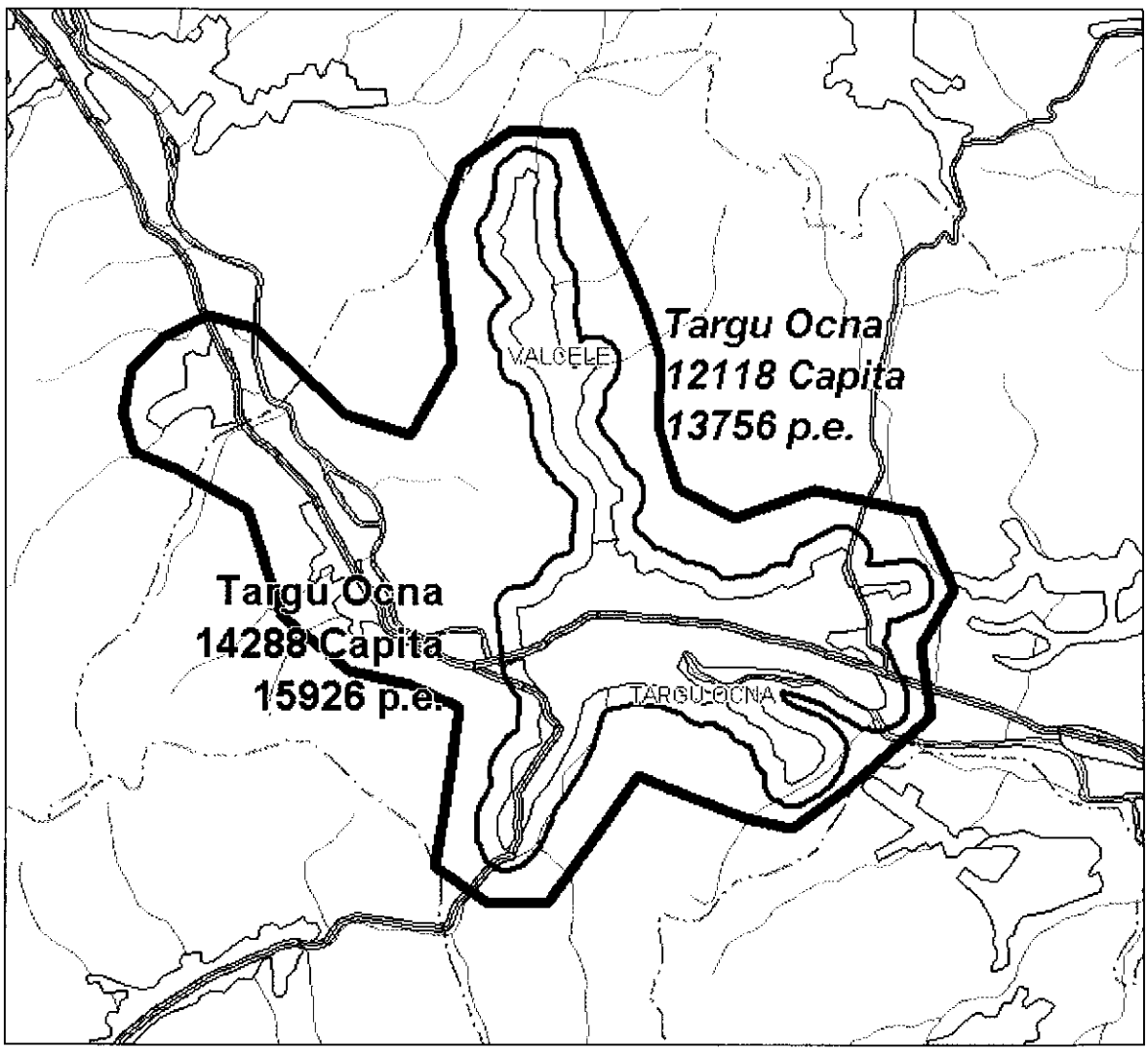

Figure 5-124: Overview Map Targu Ocna Agglomeration

5.3.5.2 Description of Current Infrastructure

5.3.5.2.1 Wastewater Network

Targu Ocna has a separate wastewater collection system. The wastewater collection system is basically confined to the City of Targu Ocna and has presently around a 54 % connection rate in this service area.

Connection Rate		Before Project	After Project
Total population in agglomeration concerned	capita * 1000	12.1	12.0
Service coverage: Percent of population connected to wastewater network	%	54	90
Population connected to a wastewater network	capita * 1000	6.5	10.8

Table 5-115: Connection rates Targu Ocna agglomeration before/after project

The storm water drainage system was built in 1984 and has a total length of 5.9 km. The total sewer network is 15.5 km long, of which 2.1 km are main collectors. Although the main area of the agglomeration is connected to the existing central Wastewater Treatment Plant, parts of the network are covered by a small-sized Biological Wastewater Treatment Plant (BWWTP). The sewer network is currently owned and operated by Consiliul Local Targu Ocna. A regional operation company for the County of Bacau (CRAB – Comania Regionala De Apa Bacau) has already been formed but is not operating yet.

The following table summarizes the Targu Ocna system.

Diameter DN	Asbestos Cement [m]	Concrete [m]	Iron [m]	Steel [m]	Ceramic [m]	PVC [m]	PEHD [m]
225							560
300		2,690					
350		3,210					
450		8,990					
Total		**14,890**					**560**

Table 5-116: Targu Ocna wastewater network (current situation)

The wastewater collection system of Targu Ocna can be summarized as follows:

Item	Indicator	Unit	Before	After
3.6.1	Total length of wastewater network (incl. storm water & main collectors)	km	16	40
3.6.1.1	Length of combined system	km	0	0
3.6.1.2	Length of separated system	km	16	40
3.6.1.3	Length of partially combined/separated system	km	0	0
3.6.1.4	Percent of length of combined system	% of 3.6.1	0	0
3.6.1.5	Percent of length of separated system	% of 3.6.1	100	100
3.6.1.6	Percent of length of partially combined/separated system	% of 3.6.1	0	0
3.6.2	Length of main collectors	km	2	2
3.6.2.1	Length of main collectors rehabilitated	km	0	0
3.6.2.2	Percent of main collectors rehabilitated (related to existing main collectors)	% of 3.6.2		0
3.6.3	Number of wastewater pumping stations	number	0	9
3.6.4	Capacity wastewater pumping stations	1000 m^3/d	0.0	6.2
3.6.5	Length of wastewater network (excl. storm water and main collectors)	km	13	38
3.6.5.1	Length wastewater network rehabilitated	km	0	0
3.6.5.2	Percent of wastewater network rehabilitated (related to existing network)	% of 3.6.6	0	0
3.6.7	Population served per length of wastewater network	capita/km	422	272
3.6.8	Number of overflow devices in the network	number	0	0
3.6.9	Capacity of storm water retention basins	1000*m^3	no data	

Table 5-117: Current wastewater collection system parameters – Targu Ocna

5.3.5.2.2 Wastewater Pumping Stations

There are presently no pumping stations in the Targu Ocna Agglomeration.

5.3.5.2.3 Wastewater Treatment Plant

Targu Ocna Agglomeration is served by a central wastewater treatment plant and a small sized biological wastewater treatment plant (BWWTP) which is covering just a part of the agglomeration.

The existing central WWTP is operated without secondary and tertiary treatment. The existing WWTP Targu Ocna currently consists of the following main components.

No.	Process Step	Description	Technical Data
1	Coarse Screen	1 line of manually raked screens	
2	Grit Chamber	Grit chamber 2 lines	Volume [ ] m³, manual Sand removal
3	Primary Settling Tanks		1 Imhoff tank, 8 m depth
4	Pumping Station (PS)	From the primary settling tanks the wastewater is pumped into the biologic filters.	1 pump 30 kW, 200 m³/h, pressure head 5-6 m each
5	Biologic Filter	Biologic filter, 1 line	ca. 20 m diameter
6	Secondary Settling Tanks	Existing secondary settling tank.	1 Imhoff tank, 800 - 1000 m³ volume, water depth ca. 8 m
7	Pumping Station	Sludge pumping station	1 submersible pump 7.5 kW, 50 m³/h, pressure head 12 m
8	Sludge Dewatering	the sludge is dewatered in sludge drying beds	sludge drying beds ca. 15 x 50 m = 750 m²
9	Effluent Chlorination	The treated effluent is chlorinated.	1 chlorine contact tank ??? m³ volume with dosing unit
10	Transformer Station		Existing capacity is 100 kVA

Table 5-118: WWTP Targu Ocna – Description of main components

The physical condition of electro-mechanical equipment and civil structures is assessed as follows.

No.	Process Step	Process Component	Description [7]	Year of Installation	Rating of physical condition of E&M equipment	Rating of physical condition of Civil Structures	Need for renovation [8]
1	Coarse Screen	Flow Channel Coarse Screen	insufficient capacity	1960-1970, rebuilt 2002 (flood damage)		poor	not usable, build new plant at new site
		Coarse Screen	insufficient capacity	1960-1970, rebuilt 2002	poor		not usable, build new plant at new site
		Electric Equipment / Process Control	not existing				
2	Grit Chamber	Grit Chamber	insufficient capacity	1960-1970, rebuilt 2002		poor	not usable, build new plant at new site
		Pumps	not existing				
		Electric Equipment / Process Control	not existing				
3	Primary Settling Tanks	Civil Structures Settling Tanks	insufficient capacity	1960-1970, rebuilt 2002		poor	not usable, build new plant at new site
		Pumps, Mixers	not existing				
		Electric Equipment / Process Control	not existing				
4	Pumping Station (PS)	No civil structure, only machinery equipment	insufficient capacity	1960-1970, rebuilt 2002		poor	not usable, build new plant at new site

No.	Process Step	Process Component	Description [7]	Year of installation	Rating of physical condition of E&M equipment	Rating of physical condition of Civil Structures	Need for renovation [8]
		Pumps	outdated	1960-1970, rebuilt 2002	poor		not usable, build new plant at new site
		Electric Equipment / Process Control	not existing				
5	Biologic Filter	civil structure tank	insufficient capacity	1960-1970, rebuilt 2002		poor	not usable, build new plant at new site
		Electric Equipment / Process Control	not existing				
6	Secondary Settling Tanks	Civil Structure Tank	insufficient capacity	1960-1970, rebuilt 2002		poor	not usable, build new plant at new site
7	Pumping Station	Civil structure, Pumping station + tank	adequate	1960-1970, rebuilt 2002		poor	not usable, build new plant at new site
		Pumps	outdated	1960-1970, rebuilt 2002	poor		not usable, build new plant at new site
		Electric Equipment / Process Control	not existing				
8	Sludge Dewatering	Civil structure, sludge drying beds	insufficient capacity	1960-1970, rebuilt 2002		poor	not usable, build new plant at new site
9	Effluent Chlorination	Civil Structure Tank	insufficient capacity	1960-1970, rebuilt 2002		poor	not usable, build new plant at new site
		Mechanical Equipment	insufficient capacity	2008	good		not usable, build new plant at new site
		Electric Equipment / Process Control	insufficient capacity	2008	good		not usable, build new plant at new site
10	Transformer Station	Electric Equipment / Process Control	outdated	1960-1970, rebuilt 2002		poor	not usable, build new plant at new site

Table 5-119: WWTP Targu Ocna – Assessment of physical condition of electro-mechanical equipment and civil structures

The current treatment performance of the existing WWTP was analysed, using the chemical analyses (monthly average values) of the WWTP's laboratory.

No.	Parameter	Date	Influent WWTP	Effluent WWTP	Eliminated Concentration	Treatment Performance
			mg/l	mg/l	mg/l	%
1	**BOD_5**					
1.1	BOD_5	2008 average	no data	no data	no data	no data
1.2	BOD_5	2009 average	61.4	no data	no data	no data
		Average 2008, 2009	**61.4**	no data	no data	no data
				no data	no data	no data
2	**COD**			no data	no data	no data
2.1	COD	2008 average	201.2	no data	no data	no data
2.2	COD	2009 average	215.0	no data	no data	no data
		Average 2008, 2009	**208.1**	no data	no data	no data
				no data	no data	no data
3	**Suspended Solids (SS)**			no data	no data	no data
3.1	SS	2008 average	218.5	no data	no data	no data
3.2	SS	2009 average	223.7	no data	no data	no data
		Average 2008, 2009	**221.1**	no data	no data	no data
				no data	no data	no data
4	**Total N[3]**			no data	no data	no data
4.1	Ntot	2008 average	34.7	no data	no data	no data
4.2	Ntot	2009 average	33.5	no data	no data	no data
		Average 2008, 2009	**34.1**	no data	no data	no data
				no data	no data	no data
5	**Total P**			no data	no data	no data
5.1	Ptot	2008 average	no data	no data	no data	no data
5.2	Ptot	2009 average	no data	no data	no data	no data
		Average 2008, 2009	**No data**	no data	no data	no data

Table 5-120: WWTP Targu Ocna – Assessment of current treatment efficiency

The current treatment performance is commented as follows.

Parameter	Discharge Limit mg/l	Effluent WWTP mg/l	Comment
BOD_5	25	No data	No data
COD	125	No data	No data
SS	35	No data	No data
Total N [1)]	15	No data	There is no nitrification / denitrification process at the existing WWTP
Total P	2	No data	No data

[1)] total Kjeldahl-nitrogen (organic N + NH4-N), nitrate (NO3-N)-nitrogen and nitrite (NO2)-nitrogen

Table 5-121: Current treatment performance

[3] Only NH_4+NO_3^-+NO_2^- has been analysed

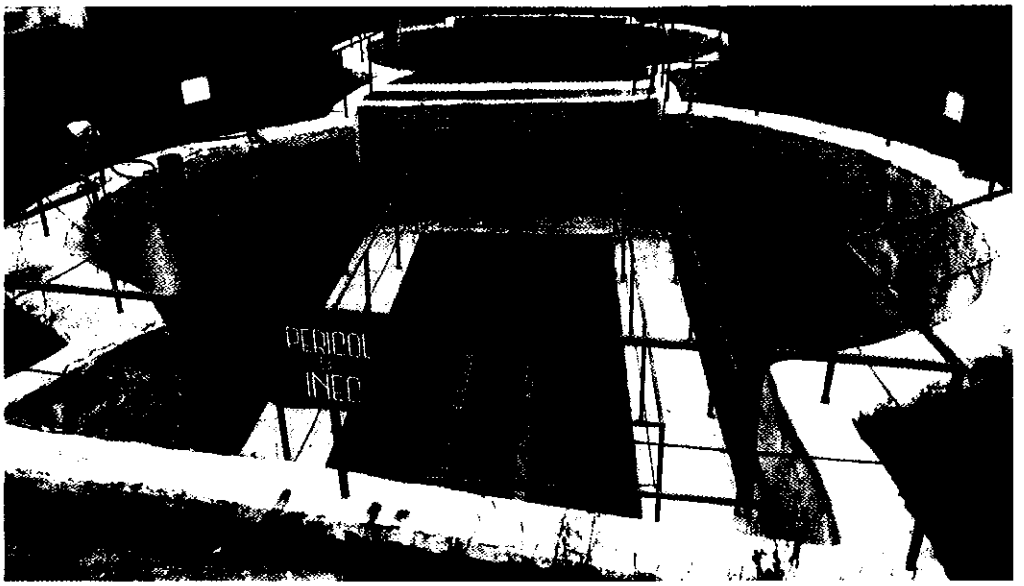

Figure 5-125: WWTP Targu Ocna

Figure 5-126: WWTP Targu Ocna

BWWTP Targu Ocna

The biological treatment plant is supposed to treat the domestic wastewater of a part of the agglomeration Targu Ocna and has been installed in year 2007. The plant is designed to connect approx. 1,200 p.e. and consists of the following components.

No.	Description	Designation	Quantity
1.	Mechanical treatment block	N3-M-38-3.R.22	1 set
2.	Block of tanks	N3-CABT-210-1-SA1.N+P (ZP.4-A1)	1 set
3.	Technical container	N3-CA1TC-01-B1	1 set
3.1	Sediment dewatering station	DU.E-24-2BAG	1 set
3.2	Coagulant dosing unit	DKC-0508x1-500.ET	1 set
4.	Wastewater disinfection unit	N3-UV-200	1 set
5.	GSM modem with UPS unit		1 set
6.	Biopreparation	Bacti-Bio 9500	5 kg

Table 5-122: BWWTP Targu Ocna –List of components

A summarization of the WWTP's performance is given in the table below.

N°	Performance Indicators	Unit	Roman	
			Before Project	After Project
3.2.1	Total wastewater volume collected (average wastewater flow)	1000 m^3/d	2.0	2.4
3.7.2	Hydraulic design capacity of WWTPs	1000 m^3/d	no data	3.5
3.7.3	Biological design capacity	1000 kg BOD/d	no data	1.0
3.7.5	Percent of biologic design capacity used (3.4.1 / 3.7.3)	%	no data	100
3.7.7	Capacity of WWTPs in Population equivalent (p.e.); *calculation base Art. 2.6 – dir - 91/271 EEC*	1000 p.e.	no data	16
3.7.8	Total volume of wastewater treated in WWTPs (yearly average at the outlet of WWTP)	1000 m^3/d	2.0	2.4
3.7.8.10	Volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC	1000 m3/d	no data	2
3.7.8.11	Percent of volume of wastewater treated with effluent quality in compliance with EC UWWTD 91/271/EEC Article 4 (5) (3.7.8.11 / 3.2.1.)	% of 3.2.1	no data	100
3.7.8.12	Total BOD treated / removed	1000 kg BOD/d	no data	1.0
3.7.8.13	Total COD treated / removed	1000 kg COD/d	no data	1.9
3.7.8.14	Total N treated / removed	kg N/d	no data	175.0
3.7.8.15	Total P treated / removed	kg P/d	no data	32.0

Table 5-123: WWTP Targu Ocna – Performance Indicators for Wastewater Treatment

5.3.5.3 Operation and Maintenance

The current O&M cost of the wastewater system have been analyzed for energy, chemicals, staff, material and other (i.e. external services like excavation, construction etc.) cost.

The following table shows a compilation of current O&M cost.

	2008
Cost Item	**Amount [€/year]***
Energy	1,654
Chemicals/Materials	2,305
Staff	24,771
Maintenance	2,750
Others	8,375
TOTAL	**39,856**

Table 5-124: Current Operation & Maintenance Costs Wastewater

Item*	Indicator	Unit	Before projec	After project
3.9.1	Number of sewer blockages per year	number/year	no data	0
3.9.2	Number of sewer blockages per km of sewer network per year (3.9.1 / 3.6.1)	number/km/a	no data	0
3.9.3	Number of days with flooding caused by sewerage system	number	no data	0
3.9.4	Number of days with flooding caused by sewerage system per km per year (3.9.3 / 3.6.1)	days/km/a	no data	0
3.9.5	Average electricity consumption per year	1000 kWh/a	0	361
3.9.6	Average electricity consumption per volume of wastewater treated (3.9.5./3.7.8)	kWh/m³	0.00	0.412

Table 5-125: Efficiency of Sewerage System

5.3.5.4 Main Deficiencies in Wastewater System

Item	Components	Main Deficiencies*
1	Wastewater network	The high infiltration of the sewerage network is a main factor of the total flow. Lack of adequate equipment for operation and maintenance of the sewerage network is also a reason for the difficult operation of the sewerage system.
2	Wastewater Pumping stations	No structures known
3	Wastewater treatment Plant	Insufficient screens and grit and grease separation No operative inlet flow meter for the old WWTP No nitrification / de-nitrification No phosphor precipitation existing No sludge dewatering facilities No Scada, no Process control Generally a lack of funding for spare parts and preventive maintenance is evident No locally financed re-investment in worn-out civil structures or electromechanical equipment

Table 5-126: Main Deficiencies in Targu Ocna Wastewater System

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