REPUBLIC OF MOLDOVA

European Bank
for Reconstruction and Development

And EU Neighbourhood Investment Facility

Chişinau Water Supply and Sewage Treatment Feasibility Study

Project Presentation Report

November 2012

seureca A subsidiary of VEOLIA ENVIRONNEMENT in association with:

and Business Consulting Institute

General Information

Project	CHIŞINAU WATER SUPPLY & SEWAGE TREATMENT Feasibility Study
Funder	EU Neighbourhood Investment Facility
Implementing responsible party	EBRD
Other parties	KfW Entwicklungsbank and European Investment Bank
Beneficiary	S.A. Apa Canal Chişinau (ACC)
Consultant	Seureca with partners Business Consulting Institute and Ingineria Apelor SRL.
Date of Contract	5th November, 2011
Period of Contract	Initially 20 Months but extended until 31st December 2012
Title of the document	Project Presentation Report
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Acronyms and abbreviations

ACC	S.A. Apa Canal Chişinau
ANRE	National Energy Regulation Agency
CAPEX	Capital Expenditure
CIP	Complementary Investments Programme
CRM	Customer Relation Management
CCTV	Closed Circuit Television
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
ERP	Effective Resource Planning
EU	European Union
FIDIC	Fédération Internationale des Ingénieurs Conseil
GDP	Gross Domestic Product
GIS	Geographic Information System
HDPE	High Density Polyethylene
HR	Human Resources
LTIP	Long-Term Investments Programme
MCC	Municipal Council of Chişinau
MIS	Management Information System
MTU	Universitatea Tehnica a Moldovei (Moldovan Technical University)
NRW	Non-Revenue Water
O&M	Operation and Maintenance
OPEX	Operation Expenditure
PIP	Priority Investments Programme
PIU	Project Implementation Unit
ToR	Terms of Reference
VAT	Value-Added Tax
W/W (w/w)	(Foul) Wastewater.
WWTP	Wastewater Treatment Plant

Technical abbreviation

BOD	Biological oxygen demand
BOD	Biological oxygen demand
COD	Chemical oxygen demand
EUR or €	Euro
km	Kilometre
M	Million
m^3/d	Cubic metres per day
MDL	Moldovan Leu
mm	Millimetre
p.e.	Population equivalent
BOD	Biological oxygen demand
COD	Chemical oxygen demand
EUR or €	Euro
km	Kilometre

1 INTRODUCTION

1.1 RATIONALE OF THE PROJECT

As the entity ultimately responsible for the water and wastewater service, the Municipality of Chişinau has initiated a programme of works intended to rehabilitate the city's water supply and wastewater collection and treatment systems.

The main problems identified are:

- High leakage rate from the water supply system and frequent interruptions of the supply;
- High vulnerability of the water resource, which relies almost solely on the Nistru River, subject to upstream pollution;
- Insufficient level of collection and treatment of wastewater;
- Issues associated with sludge disposal, and
- Poor economic and sustainable operation of the assets.

The EBRD put in place in 1997 a US$ 22.8m loan to S.A. Apa Canal Chişinau (ACC)[1] , which is the designated water and wastewater service provider within Chişinau.

The purpose of this first EBRD loan was to finance improvements in the water and wastewater service assets; more precisely the rehabilitation of water pipes.

In the framework of the EU Neighbourhood Initiative, EBRD and its co-funders (EIB and KfW) consider now to further support ACC in its efforts to improve its operations through a new loan enabling a large scale rehabilitation and improvement of water and wastewater systems (WWTP, WTP, pipes, sewers, pumping stations, equipment, …).

In order to prepare the Programme, Seureca Consulting Engineers, in association with their local Moldovan partners (Business Consulting Institute and SC Ingineria Apelor SRL), have been appointed to prepare a Feasibility Study for a more detailed assessment of the identified problems with the service provision in Chişinau, and to identify technical solutions, financially sustainable for the Company.

[1] ACC was created in 1997. It is a joint stock company, with the Municipality holding 100% of the share capital.

1.2 PROJECT OBJECTIVES

The main objectives of the Project are to:

- Support for the Chişinau Municipality's Programme to ensure the adequacy and reliability of the water and wastewater service;
- Prepare a long-term water and wastewater service strategy for ACC;
- Make proposals for improved institutional, business & operational performance and customer service.

Indeed, based on a detailed technical assessment including in particular the implementation of measurements campaigns and the construction of hydraulic models, investment plans have been defined for different horizons. A Priority Investment Programme (PIP) has then been selected using a multi criteria analysis. The PIP (EUR 59m) has been tailored to mainly solve the issue of sludge disposal at WWTP site and to make significant energy savings. Its financial feasibility has been demonstrated (construction of a financial model). In addition to these technical and financial aspects, the Project also included for an institutional assessment of the Company and for the evaluation of environmental and social impacts and issues.

In addition, specific deliverables were part of the scope for the Project:

- The purchase of GIS software and hardware, and the establishment of a GIS database with training of ACC staff in the application of the software;
- A long-term sludge disposal strategy with particular emphasis upon a "quick-fix" solution to the current odour and environmental problems associated with sludge management at the wastewater treatment works;
- A viable and sustainable alternative for the current use of chlorine gas for water disinfection;
- A tariff study and affordability analysis linked with the loan considered, and
- A Non-Revenue Water Pilot Study.

1.3 STRUCTURE OF THE PROJECT & KEY DATES

1.3.1 Phasing of the project

The contract comprises three phases:

- Phase A: An inventory and assessment of the current situation to be delivered within an "Inception Report";
- Phase B: The preparation of the Investment and Action Plan, and
- Phase C: Conclusion of the Study and the elaboration of preliminary designs.

1.3.2 Milestones

The contract for the preparation of the Feasibility Study started on 1st December, 2010.

The initial end date stipulated in the Contract was 14th August, 2012. It has been extended to December 31st, 2012.

The following tables show the milestones and key events.

Table 1: Milestones

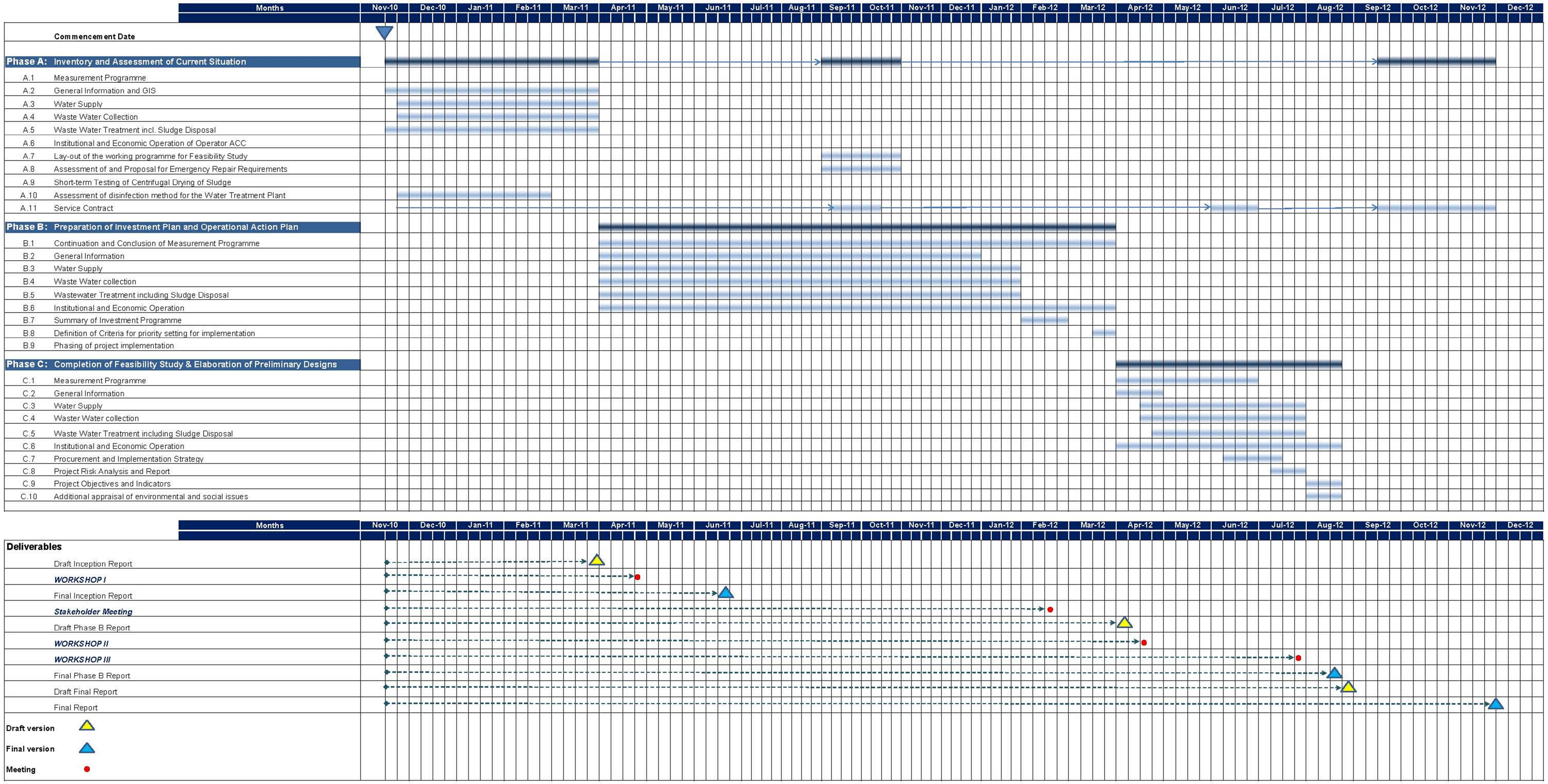
Milestones	Submission of the Draft version	Submission of the Final version
Inception Report	March 2011	July 2011
Phase B Report	March 2012	July 2012
Phase C Report	August 2012	November 2012

Table 2: Key events

Meeting	Purpose	Date
Workshop I	Present the detailed technical assessment of the current situation	May 26th, 2011
Stakeholder meeting	Discuss openly and privately with the Stakeholders the progress that had been made in Phase B; Present the preliminary findings of the Consultants for the Investment Programmes.	February 16th, 2012
Workshop II	Present the Investment Programmes and the financial analysis	April 12th, 2012
Workshop III	Present the progress made during the final stage of the Study and the preliminary outcomes (completion of the GIS, ESAP, procurement strategy, preliminary design, …).	July 27th, 2012

The working plan of the Study is presented on the next page.

Figure 1: The working plan



1.3.3 Deliverables

The list of deliverables submitted in the frame of the Study and approved by the Client is detailed in the table hereafter.

Table 3: Detailed list of deliverables submitted

Phase	#	Reports submitted
Phase A		INCEPTION REPORT
	1	Water Demand Study
	2	Proposals for the Disinfection of Potable Water
	3	Chişinau Wastewater Treatment plant Assessment
	4	Potable Water Network
	5	Sewerage Network
	6	Non-Revenue Water Analysis
	7	Organization of the Company & Quality Management
	8	Customer Services
	9	Geographic Information System (GIS) Report
Phase B		PHASE B REPORT
	1	Assessment of Industrial Discharges
	2	Environmental evaluations of the current practices
	3	Response plan on emergency situation
	4	Institutional Report
	5	Water Supply – Measurement Campaign
	6	Water Demand Assessment 2010 – 2035
	7	Human Resources
	8	Network Operation
	9	SCADA
	10	Management Information System
	11	Water Production
	12	Wastewater Collection System
	13	Water Supply
	14	Wastewater Treatment
	15	Non-Revenue Water Assessment
	16	Underground Water Resources
	17	Water Network Model
	18	Stakeholder Involvement Plan

Phase	#	Reports submitted
Phase C		PHASE C REPORT
	0	Preliminary Engineering Design Drawings (A3 format)
	1	Potential for Carbone Trade
	2	Environmental Impact Assessment
	3	Environmental and Social Action Plan
	4	Under-metering Assessment
	5	Procurement Strategy
	6	Human Resources Report, Good Practices and Recommendations
	7	Revised Public Service Agreement
	8	Tariff Setting and Financial Analysis

1.3.4 Purpose of the Present Report

The Project Presentation Report aims to present the potential Project to ACC and EBRD, including all the findings of the study, an overview of the Project, as well as the justifications of the technical and financial terms of the investments programmes.

2 ASSESSMENT OF THE CURRENT SITUATION

2.1 DEFINITION OF THE PROJECT STUDY AREA

Located between Romania and Ukraine, the Republic of Moldova was declared as an independent state in August 27th, 1991. The total population of Moldova is considered to be 3.6M (UN 2010).

Figure 2: Location map of the Republic of Moldova

Chişinau is the capital city of the Republic and is the most economically developed and industrialised city of the Republic. It is the political, administrative, economical and cultural centre of the country, and is the national centre for strategic urban growth.

The population grew steadily, until the fall of the USSR. Then it has decreased as a direct result of relatively intensive waves of emigration, and now stands at around 800,000 inhabitants.

Chişinau contains approximately 21% of the population of Moldova and produces greater than 60% of the GDP. The city is responsible for over 50% of the national industrial output, and over 75% of the business turnover of Moldova.

The city is situated in the centre of the Republic on the River Bic, a tributary of the River Dniester, which flows into the Black Sea. The city lies on seven hills and occupies the territory of around 120 sq. km.

In 2007, Chişinau Municipal Council approved the Municipality Spatial Development Plan and City General Urban Plan for the period up to 2025. Both documents are based upon the previously approved Concept of Chişinau Urban Development (2004).

The Project Study Area is not specifically designated within the consultant's Terms of Reference; reference is made merely to "Chişinau" or the "Municipality".

Nevertheless, we have considered that the project study area and the ACC service area should have common boundaries.

Following the submission of the Inception Report and the Workshop, the Project Study Area has been defined to be the service area of ACC i.e. to include:

- Those communities that are located within the administrative boundary of the Municipality, irrespective of whether ACC is the water or wastewater service provider, and
- Those communities within which ACC is either the water or wastewater service provider.

As identified within the Inception Report, there is no legal or formal record that defines the service area of ACC. We have recommended in the Inception Report that for the commercial security of ACC, there should be a clear legal definition of the service area that establishes ACC as the sole water and wastewater service provider within the stated geographical area.

2.2 OVERVIEW OF THE WATER AND WASTEWATER SERVICE

The current facilities operated and maintained by ACC are in the condition to be expected when there has been an historic lack of investment for the development and rehabilitation of the assets.

However, the water and wastewater networks are fully operational and a twenty-four hour pressurised water service is provided. Of course, both networks are generally in a poor condition. Leakage, and other causes of non-revenue water, from the water network is high, around 47m^3/km/day, and the wastewater network suffers from blockages and collapses.

Water demand, at around 150litres/head/day, has fallen by around half in Chişinau since 1997, which has resulted in many of the facilities being oversized. Whilst the only significant affect with the water supply is the oversized pump capacities and infrequent turn-over in some water storage facilities, within the sewer network the oversized sewers do not always reach their self-cleansing velocities, and silting and fermentation of the wastewater can occur.

2.3 WATER RESOURCES & TREATMENT

ACC draws water from groundwater sources and from a single river source, the River Nistru, which is located about 20 km east of Chişinau.

Figure 3: The Nistru River

The following figure shows clearly that the supply of Chişinau relies almost exclusively on the Nistru Rver.

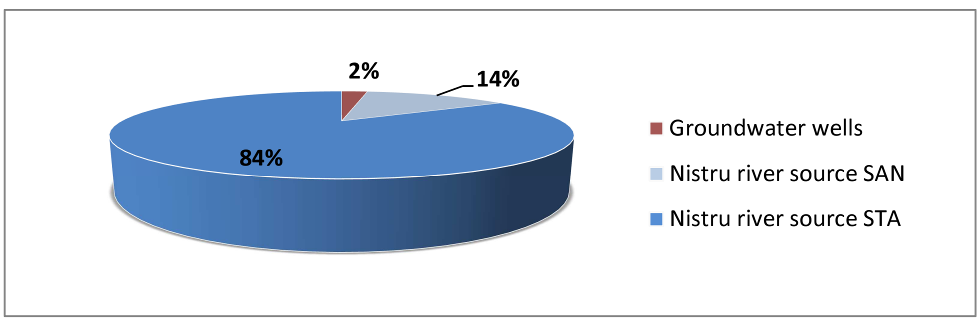


Figure 4: Water Resources

In the current situation, the security of supply within Chişinau is thus very vulnerable. Furthermore, there are no facilities available to rapidly detect pollution within the river, or to maintain supplies should the river be polluted. Mobilizing underground water resources more extensively appears to be a reliable alternative to mitigate the risk.

From the intake, raw water is supplied to the Chişinau (STA) and Nistru (SAN) water treatment plants as shown on the following figure.

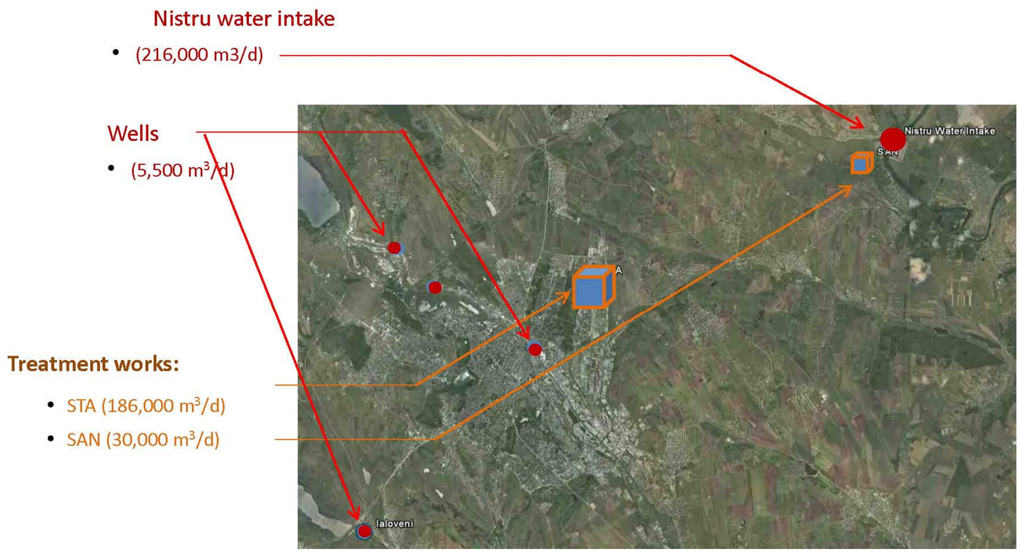


Figure 5: Sources for water

The annual production has decreased over the years. It was about 177 Mm^3 in 1997 and is around 80 Mm^3 today.

The main plant (STA) is in need of rehabilitation. And from our point of view, the other plant (SAN) should be decommissioned.

Figure 6: Water Treatment Plant STA

Moreover, it is worth pointing out that as a result of non-compliance with safety regulation in the provision for chlorine gas disinfection of water at the Chişinau water treatment works, an alternative solution has been implemented within the frame of the project. It consists in bulk supply of sodium hypochlorite with chlorine gas used as a back-up.

Figure 7: Storage of Chlorine at WTP

2.4 WATER DISTRIBUTION NETWORK

The operation of the water network is complex and incorporates twenty pumping stations, around sixty tanks, of which fifty are in operation, and eighty boosters, supplying water within five pressure zones.

The pressure within the network is required to be maintained between 10 and 60 metres (0.1 to 0.6 MPa). Pressure is regulated by valves and by six pressure reducing valves in the network. Energy dissipated by the regulation system is significant.

Boosters, within the basement of buildings, are used to supply to the upper floors of taller buildings that could not otherwise be supplied.

Records of the length of the network vary, but the considered total length is 1,844 km. The length of the different materials used is shown in the following graph.

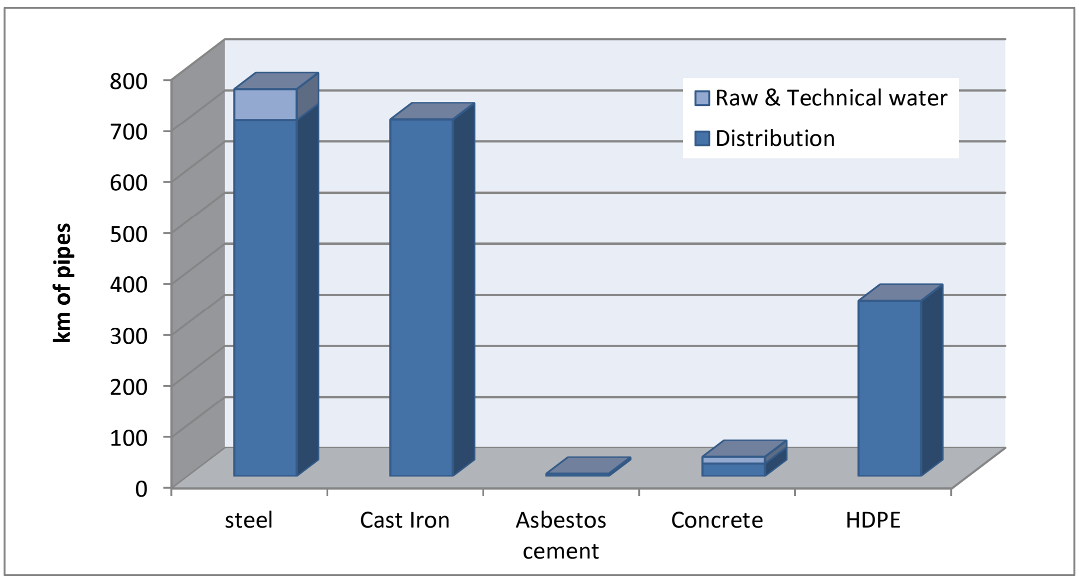


Figure 8: Pipe Materials within the Distribution Network

523km (28%) of the network is of diameter up to 100mm, of which 290km (55%) is of steel. Almost 60% of the pipes are more than 20 years old, and 263km of cast iron pipes were laid over 40 years ago.

We have observed that ACC operate a greater length of network than the official length. Many pipes not included in ACC balance, appear to be accepted by ACC as their responsibility as a part of their system.

Although the current network efficiency is acceptable (about 60%), taking into consideration the present economical conditions of ACC, the estimated volume of NRW represents still 89,000 m^3/d, i.e. 32.5 Mm^3/year. Furthermore, as already stressed in the assessment of the current network, the LLI is around 47m3/day/km and the mean LRI about 8repair/km/year. Those values are very high and evidence the poor condition of the network.

In Western Europe, Veolia ranks urban network within the "Very Poor" category when the linear leakage index is higher than 16m3/day/km and in Bucharest the LRI observed is 5.2 repair/km/year.

Figure 9: Burst on a ND1200 cement pipe threatening the road

2.5 WASTEWATER COLLECTION

Within the older areas of Chişinau, there exist three "wastewater" collection systems:

(i) for sewage wastewater;

(ii) another for surface and storm water drainage including from roads, and

(iii) a drainage system for the collection of groundwater.

ACC is responsible only for the collection of sewage, or foul, wastewater. The surface water drainage system is operated and maintained by a 100% Municipality owned company.

The wastewater collection systems are designed as "separate" systems. As indicated by the flows received at the wastewater treatment works during heavy rainfall, some surface water does find its way inevitably into the "foul" wastewater system.

The sewerage system serves between 70% and 80% of Chişinau city; approximately 66% of the cities and villages in Chişinau Municipality. About 75% of network in the cities and villages outside Chişinau Municipality, are operated by ACC.

The sewer system was commenced in 1912, within the older city centre area which is generally on the left bank of the River Bîc. The latest pipes were laid in the 1970's and 1980's with the development of the city that took place during that period. There have been few sewers laid since that period.

The wastewater network operated and maintained by ACC is considered to comprise approximately 985 km of sewers, of which 77km are considered as "main collectors". All materials commonly used for sewer networks are found in Chişinau with the greatest number being small diameter vitrified clay.

In line with the reduced volumes of potable water supplied, the "return to sewer" flows have also decreased with the result that many of the sewers are over-sized. Over design of the sewers is also a factor in the less than self-cleansing flows found in many sewers.

The wastewater collection system is known to be in a poor condition with blockages, broken pipe and other deficiencies. However, over the past few years, a very few rehabilitation works have been done as no substantial funding has been available for their launch.

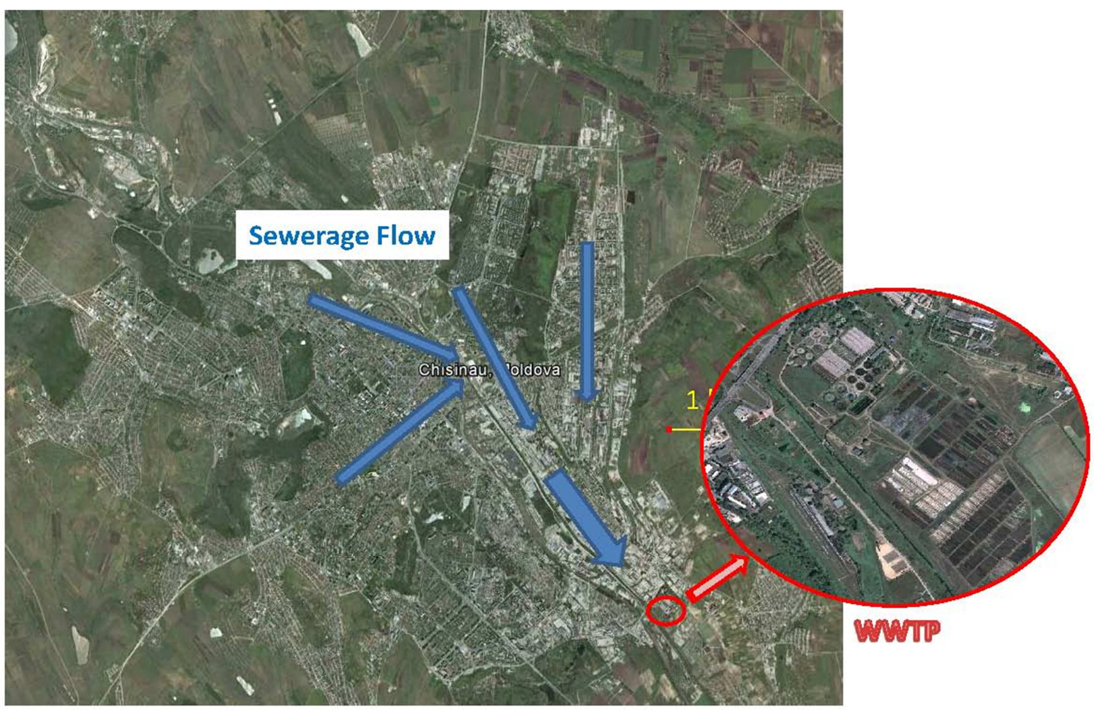


Figure 10: Wastewater collection system

2.6 WASTEWATER TREATMENT

The wastewater treatment plants operated by ACC are the Chişinau plant, and smaller works at Coloniţa, Goianul nou, and Vadul lui Vodă.

2.6.1 Chişinau WWTP

The Chişinau wastewater treatment plant is located southeast of the city, approximately 7km from the city centre, beside the River Bic into which the final effluent is discharged.

With the low flows and the fact that it is within the city area, flowing ultimately into the Black Sea, under EU standards it would be classified as a sensitive watercourse.

The treatment works have been constructed in successive phases; the first phase of the WWTP was put into operation in September 1968.

The wastewater flow to the works is approximately 152,000m^3/d, considerably below the works design capacity.

Figure 11: Wastewater Treatment Plant

Chişinau WWTP suffers from the lack of investment over the past decades. The structural condition of the plant is very poor and the process performance and quality of the final effluent should be improved. Another issue is the odour that emanates from the site, due mainly to poor sludge management.

This last problem has been partially solved using geotubes, as shown on the next photo.

However it is not fully satisfactory and alternatives must be found.

Figure 12: Geotubes at WWTP

The full rehabilitation of the existing structures of Chişinau WWTP is not a good option either economically or technically due to the advanced damage of the works and to the future treatment requirements (compliance with the EU standards on N<10 mg/L and P<1 mg/L for a sensitive receiving body as the Bic River and expected increase of the load received in the future).

However the time and the necessary funds required before a new WWTP being operational is likely to be more than 5 years. Solutions must then be found in order to secure the good operation of the existing – and possibly modified – WWTP until the construction of the new WWTP. In particular efforts should be made to reduce odours.

2.6.2 Other Plants

Coloniţa plant has a capacity of 400m^3/d and was built in1974. The mechanical primary treatment comprises de-gritting and screens. The treatment is biological with biological sludge discharged into the sludge drying beds.

The Vadul lui Voda plant, built in 1975, has a theoretical capacity of 5,600 m^3/d. It has treated an average of 2,000 m^3/d in 2010 from Vadul lui Voda City, Balabaneşti and Vaduleni villages, which includes the bathing areas, poultry farms and the wine factory.

2.7 INSTITUTIONAL ASPECTS

2.7.1 S. A. Apa Canal Chişinau

The designated water and wastewater service provider within Chişinau is S.A. Apa Canal Chişinau, created in 1997, out of the state enterprise Regia Apa Canal Chişinau.

The company is a joint stock company, with the Municipality holding 100% of the share capital. The activities of the company are supervised by a Board, with representation from the Municipality.

2.7.2 Chişinau municipality

Chişinau Municipality comprises (i) the City of Chişinau, which is divided in 5 sectors: Centre, Rascani, Botanica, Buiucani, Ciocana, and (ii) thirty-three suburban settlements that are organized into eighteen first level local public administrations.

The Municipality is an independent second level of local government.

Chişinau City is run by a Municipal Council and Mayor. Both are directly elected every four years. The Council is made of fifty-one councillors.

The city of Chişinau and the other eighteen local governments which comprise the Municipality of Chişinau have two roles, as provided by the Statute of Chişinau Municipality:

- The Municipal Council coordinates and cooperates with the other eighteen mayors and local councils in the implementation of actions with municipal scope, and
- The Municipal Council decides on the transfers from the municipal budget to the other eighteen local budgets.

The eighteen component local governments are independent of the City council and Mayor, in issues of local interest.

The Mayor of Chişinau is the executive authority of the city. He is aided by four Deputy Mayors, elected by the Council. The Mayor runs the City Hall, through which he implements the Council decisions, and oversees the activity of the local institutions and Municipal enterprises.

The Council takes decisions upon: (i) institutional affairs; (ii) financing; (iii) strategies and development projects of the city and Municipal interest; (iv) human resource management; (v) property management, and (vi) the city service delivery.

2.7.3 ACC's Charter

The ACC Charter (Statute) provides details of the respective roles, rights and duties of ACC.

There is no formal mandate from the Chişinau Municipality to ACC to provide the water and wastewater service, on behalf of the Municipality. The delegation of services is implicit, only. A similar situation exists where ACC provides the service within other local authority areas.

The ACC Charter permits ACC to:

- Engage in all businesses associated with the provision of water and sewerage services, under which ACC operates a central heating service (Charter Clause 3.2), and
- Develop businesses not necessarily connected to the water sector (Clause 3.4).

The Charter does not specify:

- The specific area within which ACC can provide the services, nor
- Any exclusivity for ACC to provide the services.

2.7.4 Current organisation

The current organisational structure is similar to that found in local government and is not appropriate for a modern customer orientated service provider.

A suggested organisation has been provided within the Project based upon four directorates of Finance and Administration; Customer Service; Asset Services and Operations.

With a current staffing ratio of 2.5 employees/1000 population compared with 0.9 for Bucharest, ACC staffing levels are high compared with Bucharest, and with the indices provided within the World Bank Utilities Handbook.

3 INVESTMENT PROGRAMMES

3.1 DEFINITION & OBJECTIVES

3.1.1 Long-term Investment Programme

The Long-term Investment Programme ("LTIP") consists in a strategic long-term investment plan for ACC, which aims to achieve maximum improved operational efficiency with sustainable service reliability for both water supply and wastewater systems over a 25 year period.

Based on a deep technical assessment, the LTIP include all CAPEX that are considered as necessary to bring ACC in line with other utilities for the next 25 years, irrespective of affordability and financing capacity of ACC.

3.1.2 Priority Investment Programme

The Priority Investment Programme ("PIP") can be considered as a short term programme (5 years) and constitutes more or less the first phase of the LTIP. It aims to meet the first and most urgent needs of ACC. The PIP must be tailored for the benefit to the wider community and in accordance with ACC and co-funders policy and objectives.

3.2 DEFINITION OF CRITERIA FOR PRIORITY SETTING FOR THE PIP

Projects eligible for PIP have been identified based on a multi criteria analysis and after formal and informal meetings and discussions with the management and technical staff of ACC.

The following main criteria have been adopted in the process of identification and selection of the subprojects included in the PIP:

- Compliance with Moldovan and EU norms & standards;
- Enhancement of the operational efficiency & customer service, resulting from any or a combination of the following: i) substitution of obsolete pumps and electromechanical equipment with energy-efficient alternative equipment, ii) overall improvement of operation and maintenance (O&M) efficiency including safety of workers, iii) reduction of leakage and black spots, all the above resulting in operational cost reduction, and iv) improvement of reliability of equipment;

- Anticipated environmental benefits, mainly consisting of: i) introduction of "International Best Practice", ii) reduction of pollution load in surface water, iii) energy savings and reduction of water wastage, iv) improved quality of water supply;

It is worth pointing out that priorities may be perceived differently depending on who is looking at, as shown on the following figure.

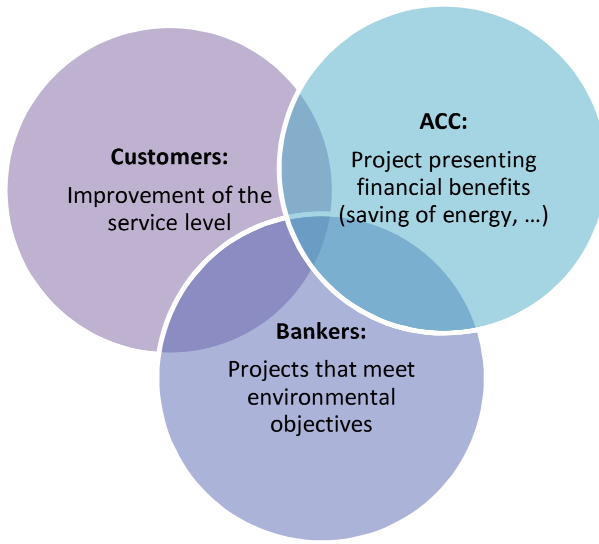


Figure 13: Priorities in the Selection of the PIP

It has to be noted that the PIP is entirely consistent with the LTIP since it constitutes its first stage implementation.

3.3 DESCRIPTION OF THE PIP

The priority of the PIP is slightly given to wastewater which concentrates 55% of the investments. Actually, the PIP has been tailored to:

- **Solve the major issue of sludge disposal at WWTP site**:
    - Implementation of a sustainable solution (1st phase of upgrading the WWTP) to reduce the volumes of sludge produced and to stabilize the sludge that could be used without any setbacks for agricultural purposes.
- **Make significant energy savings**:
    - Optimization of pumps;
    - Reduction of water losses by implementing a targeted pipes renewal;
    - Production of green energy (biogas);
    - Production of hydro-electricity by installing a turbine on the drinking network.

The justification of the PIP is provided in Appendix. The following table shows the content of the PIP:

Table 4: Details of the PIP

Field	Sub-Category	% of PIP	Cost	Description	% of PIP
Drinking Water	Treatment	6%	3,000,000 €	Urgent rehabilitation works including Electro chlorination plant	5.0%
			548,000 €	Treatment of the water produced from Ialoveni well field	0.9%
	Network	25%	12,468,000 €	Rehabilitation of 190 km of water pipes and 3,270 block service connections meters+ hydraulic fittings	20.9%
			2,256,000 €	Rehabilitation of reservoirs	3.8%
			303,000 €	Pressure reduction on the network	0.5%
			108,000 €	Adaptation of the water distribution system to the new production scheme: By-pass of SAN facilitiesNew PS from Zone 2 to TohatinNew PS from Tohatin tanks to VdVGhidighici dilution	0.2%
	Pumping	1%	825,000 €	Rehabilitation of the existing PS	1.4%
	O&M	3%	1,678,000 €	Equipment for operating the drinking water network	2.8%
	Other	7%	4,244,000 €	EMERGENCY PLAN (Rehabilitation of the wells + treatment facilities + adaptation of distribution system)	7.1%
SUB-TOTAL DRINKING WATER			**25,430,000 €**		
Wastewater	Treatment	45%	26,595,000 €	First phase of upgrading the WWTP for Chişinau (New pretreatment, light rehabilitation of primary settling, biological tanks and secondary clarification, separated thickening for biological excess sludge, anaerobic digestion with energy generation, sludge dewatering)	44.6%
	Network	5%	2,903,000 €	Renewal of sewers (15 km)	4.9%
	Pumping	2%	1,051,000 €	Rehabilitation of PS	1.8%

Field	Sub-Category	% of PIP	Cost	Description	% of PIP
	O&M	3%	1,683,000 €	Equipment for operating the wastewater network	2.8%
SUB-TOTAL WASTEWATER			32,232,000 €		
Other	O&M	3%	1,300,000 €	Purchase of MIS equipment	2.2%
			389,000 €	Replacement of the electrical lines in STA, SAN, SESE, SSP	0.7%
			325,000 €	SCADA: Upgrading or renewal of the equipment for drinking & wastewater PS + Data Storage + Implement a unique tool for data processing	0.5%
SUB-TOTAL for OTHER			2,014,000 €		
TOTAL			59,676,000 €		100.0%

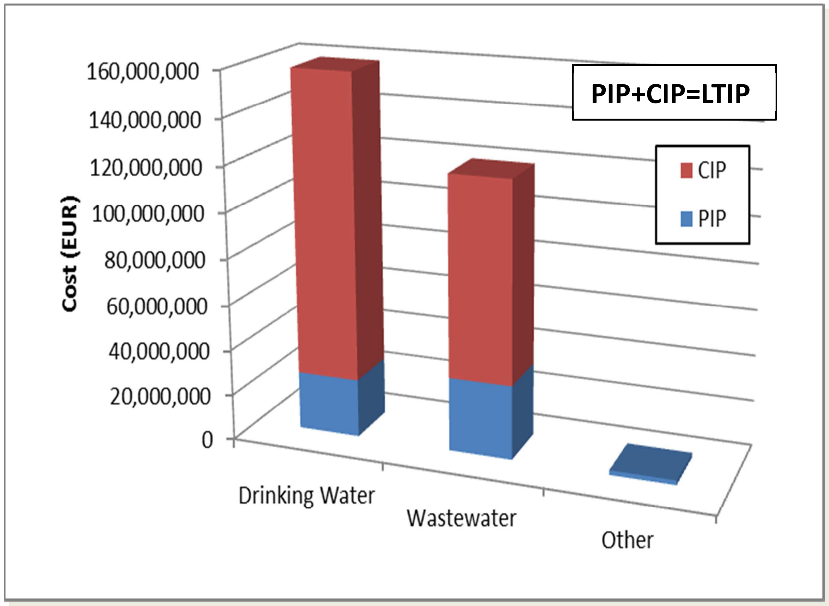
3.4 EXPECTED BENEFITS OF THE PIP

The main benefits expected from the implementation of the PIP are listed hereafter:

- Reduction of the nuisance generated by the sludge: elimination of the odour (stabilization), reduction in volume (by 1/3) for storage; hygienized sludge which can be reused for agriculture;
- Better quality of water: improved disinfection;
- Decrease in energy consumption: -12% in average;
- Reduction in bursts (hence water shortage) on the water network;
- More reliable system with remote data system and emergency response plan.

3.5 COST ESTIMATES OF THE PIP

The total cost of the proposed short-term investment programme is EUR 59.7m including basic implementation costs as well as allowances for physical and price contingencies. No taxes have been included. The PIP represents about 21% of the LTIP estimated at EUR 280.5m.



The following figure shows the main components of the proposed PIP. It clearly appears that the PIP contains two major items:

- Wastewater Treatment (44%), which includes the first phase of upgrading the WWTP;
- Drinking Water Network (25%), which includes the renewal of pipes, replacement of HSC (for blocks only) and rehabilitation of reservoirs.

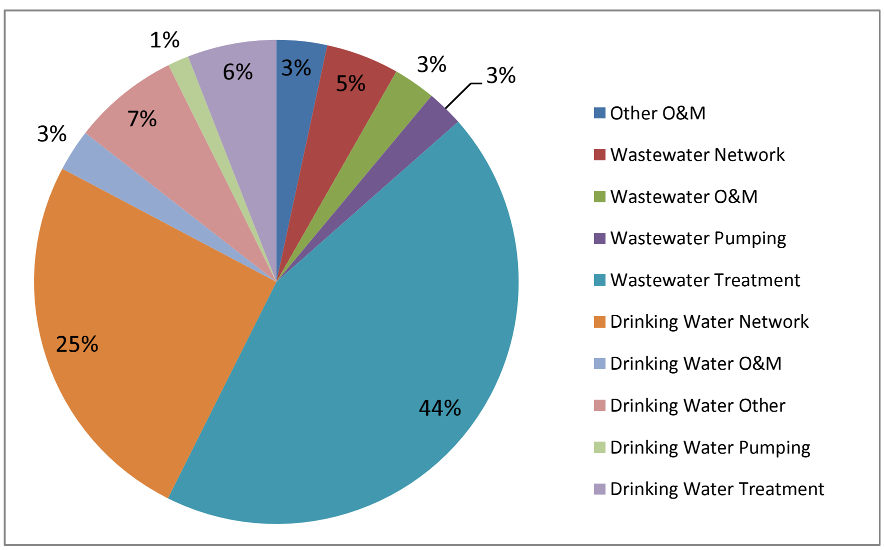


Figure 15: Main Components of the PIP

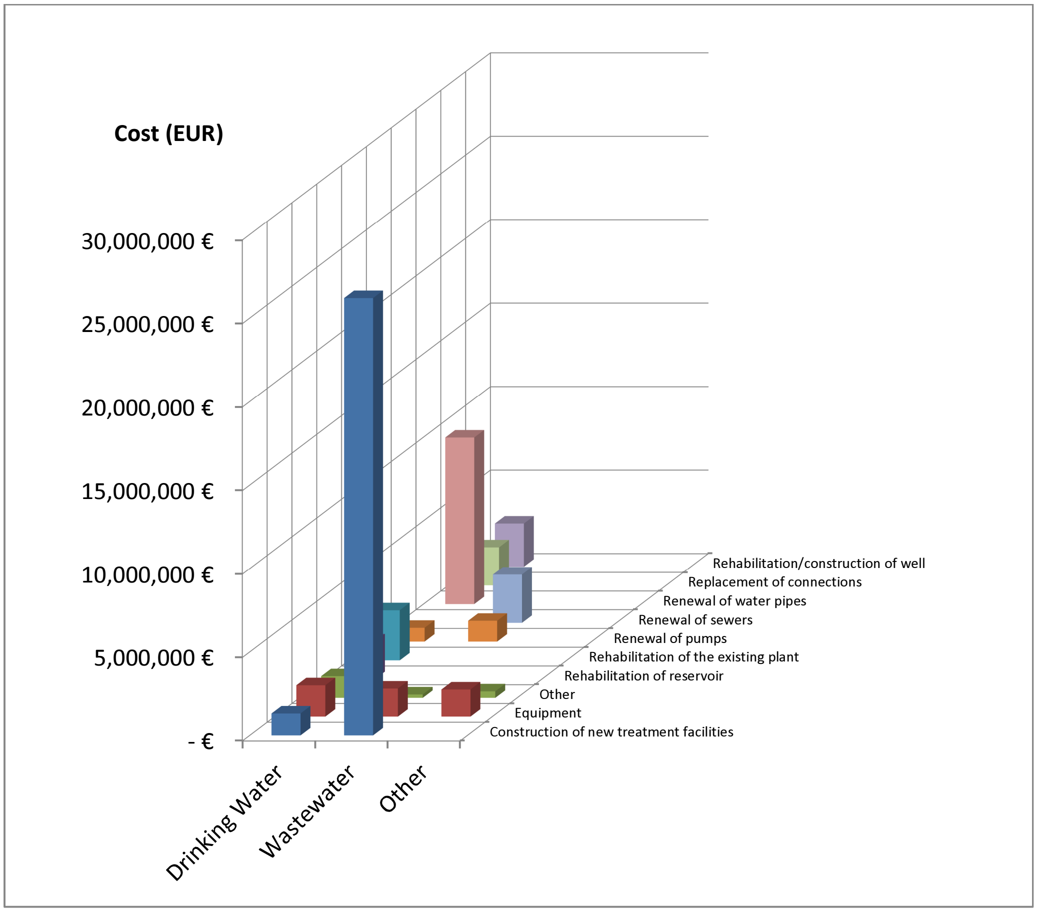


Figure 16: Components of the Proposed PIP

3.6 DESCRIPTION & COST ESTIMATES OF THE LTIP

The total cost of the proposed LTIP is 280.5 M€, as shown in the following table.

Table 5: Summary of PIP, CIP[2] & LTIP

	PIP	CIP	LTIP
Drinking Water	25,430,000 €	133,314,000 €	158,744,000 €
Wastewater	32,232,000 €	87,466,000 €	119,698,000 €
Other	2,014,000 €	-	2,014,000 €
TOTAL	59,676,000 €	220,780,000 €	280,456,000 €

[2] CIP = Complementary Investments Programme; i.e. PIP+CIP=LTIP

A significant part of the programme is dedicated to the rehabilitation of pipes:

- 53% of the CIP for water pipes renewal;
- 21% of the CIP for sewers renewal.

The LTIP also includes heavy investments to comply with the EU norms regarding water treatment. Indeed we propose to:

- Construct a new WWTP;
- Fully rehabilitate the WTP STA.

Both plants are in poor conditions. Investments made in the PIP are the minimum to ensure a partial treatment for the next coming years, assuming the civil works will allow to operate the plants until the implementation of the CIP.

A full and detailed description of LTIP is provided in Appendix.

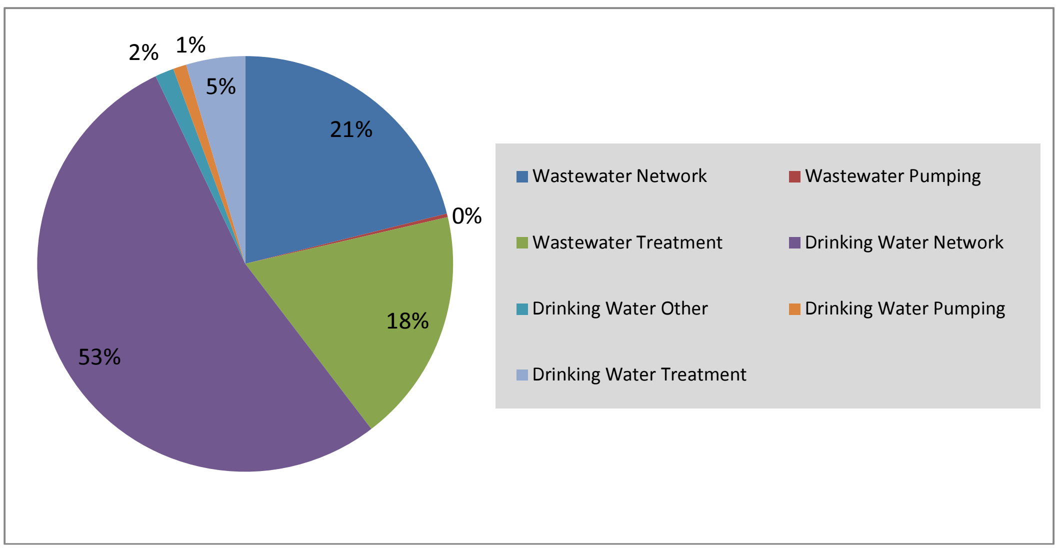


Figure 17: Main Components of the Proposed CIP

4 TECHNICAL SUPPORT TO ACC

4.1 TARIFF SETTING METHODOLOGY

4.1.1 General

The current process for calculating and setting tariffs appears to be subjective and highly dependent on the political environment. **The main risk with tariff setting is not the methodology itself but the non-implementation of the methodology for the annual revision of tariff levels, which threatens the financial sustainability of ACC**.

4.1.2 Current tariff levels

Tariffs applied in Chişinau for drinking water and wastewater are based on price by cubic meter. The tariff is a flat rate, which means that the cost of a unit of water (a cubic meter) is constant for all consumers in a category, and water bills increase linearly with volumes consumed (no change of unit price per cubic meter whatever the volumes billed).

However the tariff is different according to the customer category: domestic (population) and non-domestic (budget organization, commercial and industrial entities).

Today, global tariffs for water and wastewater services delivered by ACC, without VAT, are as follows:

- 9.19 MDL/m^3 for the domestic customers;
- 22.96 MDL/m^3 for the non-domestic customers.

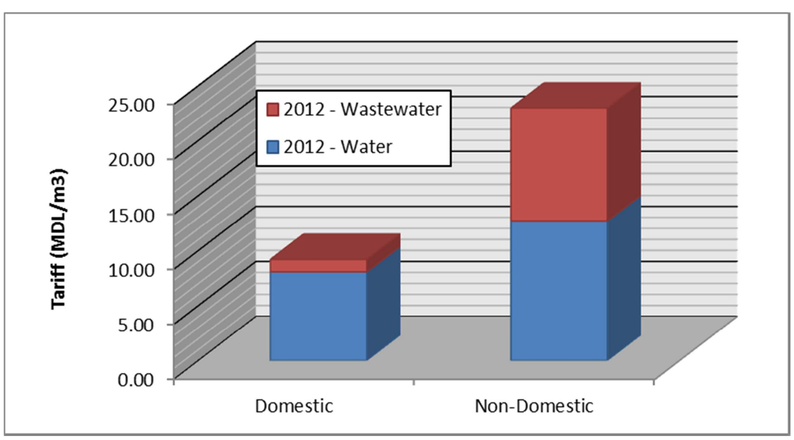


Figure 18: Current Tariffs in Chişinau

The tariff is lower than the tariff in Romanian cities (Bucharest, Ploiesti), but the level of investment in those cities is much higher (20% of the turnover in average is spent in investments in those Romanian cities).

4.1.3 Cross-subsidies

As shown on the previous figure, non-domestic customers pay more for 1 cubic meter of water than domestic customers; i.e. they are "subsidizing" the cost of water of the domestic customers. Today this ratio of cross-subsidies is around 2.5, which is quite high and evidences the significant political factor in the current tariffs setting. However, it is worth pointing out that this ratio has decreased over the last decade: it was more than 5 in 2001 and about 4 in 2007.

The removal, or at least the reduction, of cross-subsidies, is promoted by EBRD in order to secure the financial stability and sustainability of the company (domestic consumption is usually more stable than non-domestic). This should be taken into consideration in the re-composition process for tariff structure in Chişinau.

4.1.4 Tariff evolution for the period 2001-2012

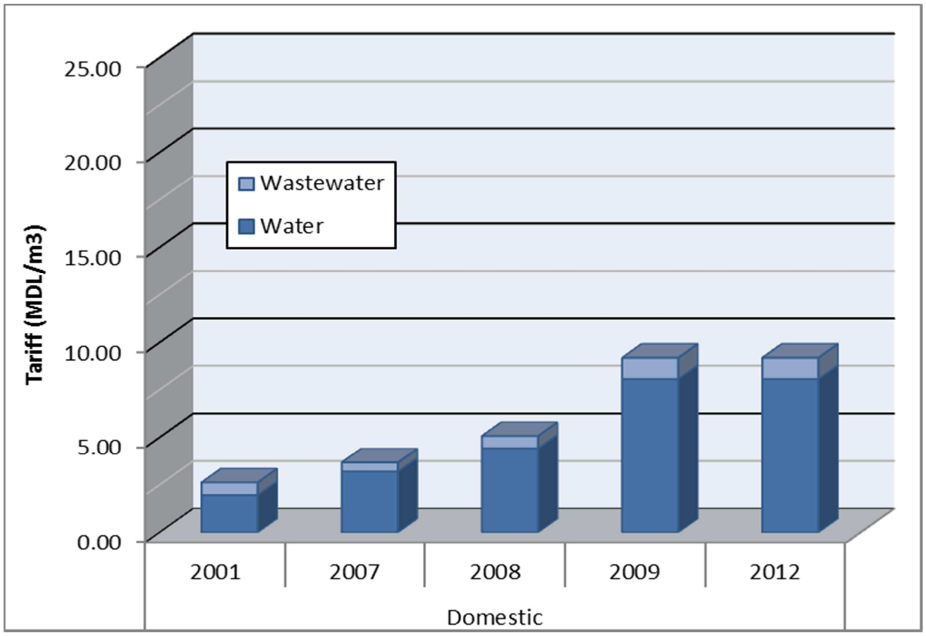
Between 2001 and 2012, the tariffs have been revised only 3 times, twice in 2007 and once in 2009; while the increase of the operating costs was continuous (the inflation rate ranges between 5.5% and 8% per year and energy costs have increased even faster than the inflation).

From 2001 to 2007, the increases in tariffs proposed by ACC have been systematically refused by the Municipal Council.

In 2007, a minor increase has been approved. The same year (2007), the Republic of Moldova and the IMF signed some agreements, which may explain this favorable decision. A second increase, more significant, was done in 2009 in order to restore the economic balance of ACC.

The graphs below show the tariff increases over the last 10 years for both domestic and non-domestic customers.

The increase for water and wastewater services affected domestic and non-domestic customers in 2007 in the same extent. The increase in 2009 focused on the domestic customers, because the non-domestic tariffs had reached a level where further increase was difficult to implement.



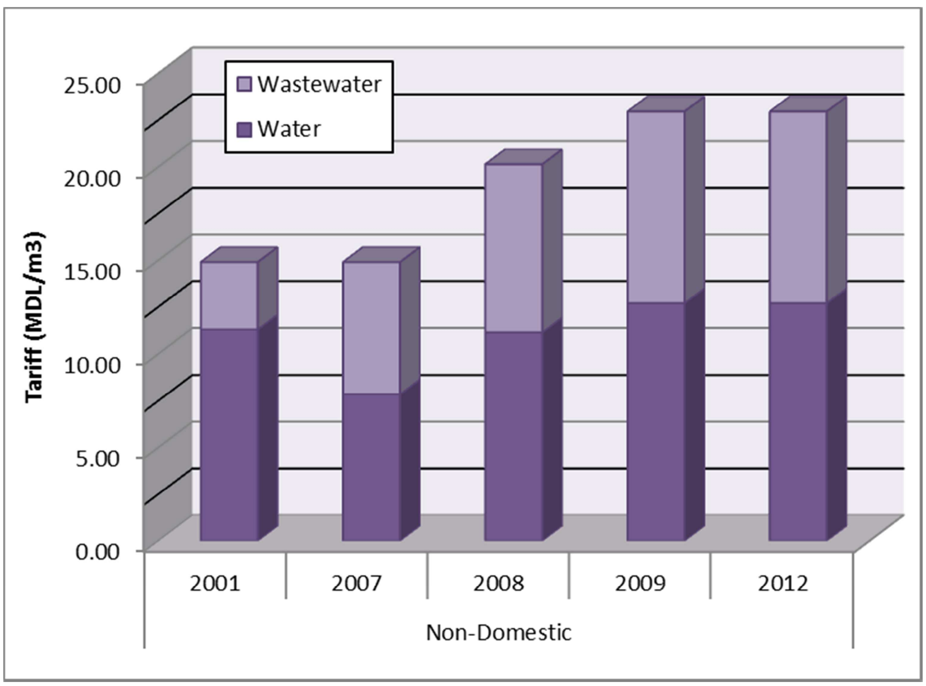


Figure 19: Tariff levels in 2001, 2007, 2008, 2009 and 2012

4.1.5 Current tariff setting mechanism

Some EBRD loan covenants (1997) refer to the tariff calculations (for drinking water and sewerage). Based on the EBRD recommendations and methodology, ACC should determine and adjust the tariff on a quarterly basis.

Starting from 2001, the Municipal Council of Chişinau has refused to approve the tariffs calculated according to the EBRD methodology. Instead of this methodology, the calculation of the tariffs based on a "Cost + Fee" calculation, supported by estimations of yearly budgets and volumes, has been approved. The MCC constitutes, with ANRE, the main key player in tariff setting approval.

Calculations are established separately for the water service, the wastewater service and the technological service. The tariff per cubic meter is calculated as follows:

Average Tariff = (cost + fee + adjustment) / volume billed

There is no fixed charge. The [cost + fee + adjustment] represents the targeted turnover that the tariff should provide to ACC.

The general opinion of ACC on existing tariff setting mechanism is that the Methodology is good, but some comments can be made:

- The Methodology can be described as being too general. This allows subjective decisions in tariff calculation;
- Based on a "cost+fee" mechanism, the Methodology does not allow any revolving remuneration of the Company or stakeholders for savings achieved; it does not stimulate the improvement of company efficiency through incentive, just through arbitrary constraints regarding some lines of the budget;
- One of the weaknesses of the tariff setting method currently in use comes from its inability to incorporate investment financing on a long-term forecast. Indeed, this yearly-oriented mechanism prevents ACC from considering future increases of costs beyond the next year, even if these costs are already identified, which may generate obstacles to smooth tariff increases over years;
- The current methodology for calculating tariffs does not permit ACC to include some necessary costs in the water and sewerage charges such as the cost of fixing meters, for example;
- Constraints created by agreements with IFIs, and especially the covenants of loans, can generate distortions in the implementation of Tariff Setting regulations, and potential defaults of compliance with Moldovan legislation and rules.

4.1.6 Tariff setting process

The current tariff setting process is unclear and highly political. It involves many players: ACC, the Municipal Council of Chişinau, the Municipal Commissions, the Specialized Commissions and ANRE, which is the National Energy Regulation Agency (ANRE has written the methodology used for water tariffs setting).

In such a context, it is worth pointing out that discussions are being held to transfer the responsibility on tariff from the City Council to ANRE. This is mainly motivated by the fact that today the tariff level is highly dependent on the political environment.

The main risk with tariff setting is not the methodology itself but the non- application of the methodology for the annual revision of tariff levels.

4.2 IMPLEMENTATION OF GEOGRAPHICAL INFORMATION SYSTEM

4.2.1 Objectives

As the existing information available in ACC regarding the water and wastewater systems were incomplete and not updated, a GIS has been built.

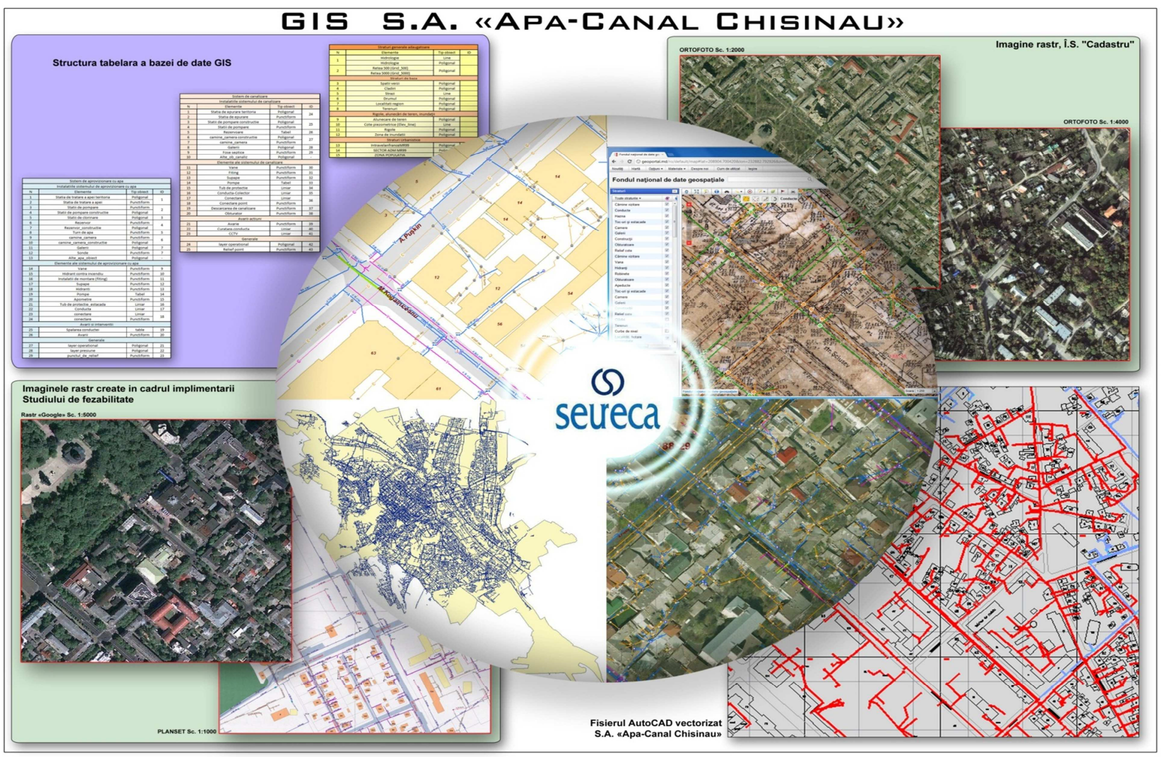


Figure 20: ACC GIS

A GIS is an operating tool that will mainly help ACC to:

- Have more accurate knowledge of the networks;
- Improve the operation by reporting and analysing key parameters;
- Anticipate problems;
- Schedule programme for maintenance, etc;

- Value the assets.

The following table summarizes the main objectives of a GIS.

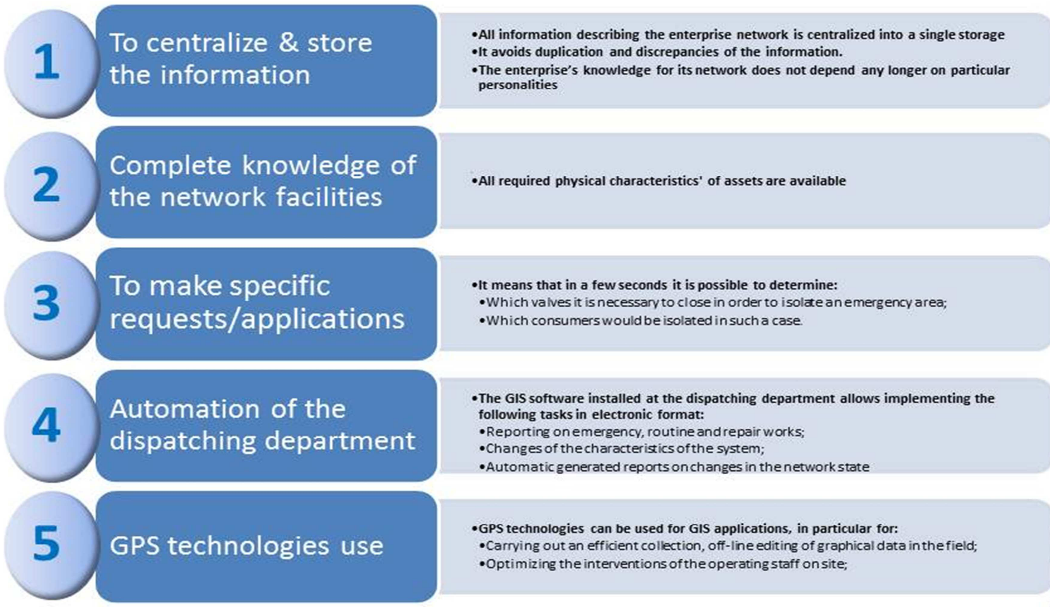


Figure 21: GIS Objectives

Actually, the Project carried out by Seureca shall be seen as the first step of a long horizon strategy, as shown on the following figure.

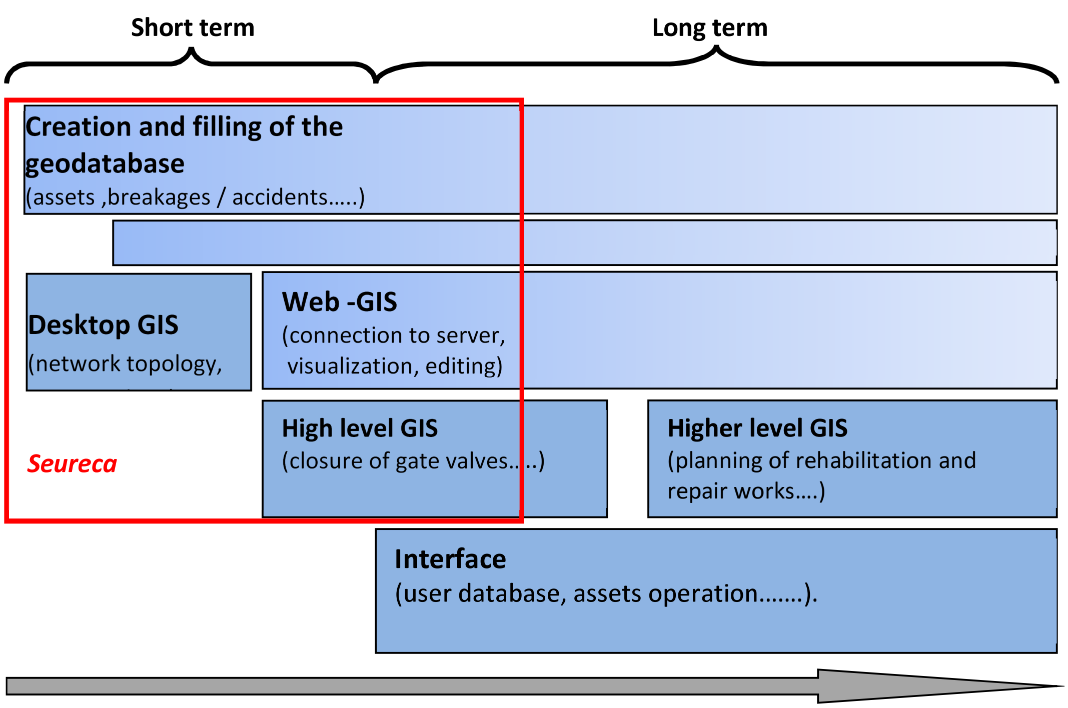


Figure 22: Seureca scope of work related to GIS

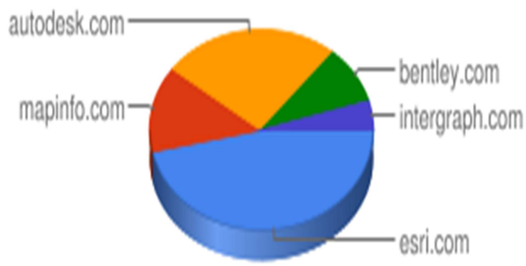
4.2.2 Purchase of equipment

In the frame of the Project the following equipment (total budget about EUR 53,000) has been purchased and transmitted to ACC.

Software/licenses purchased

- ArcGis Editor 10 – 2 licenses, (floating license);
- ArcGis Server 10 – 1 license;
- MS–Windows7 Professional – 8 licenses;
- Windows Svr Std 2008 R2 w/SP1 x64 English 1pk DSP OEI DVD, 5 Clt. – 1 license

It is worth pointing out that ESRI company, the developer of ArcGis software, has an extensive experience in providing support for worldwide companies.



Hardware/other equipment purchased:

- 8 Working GIS stations (computers)
- 1 physical server
- 1 Scanner A1
- 1 GPS recorder Leica Viva ZENO 15 3G

Figure 23: GPS Leica

4.2.3 Digitization of ACC networks & construction of a Geodatabase

A GIS geodatbase has been defined in close collaboration with ACC then constructed.

As shown in the following table about 5,000 km of pipes have been digitized; i.e. kms of pipes input are in excess of the lengths stated in ACC balance (+ 100%).

Table 6: Digitization of water supply system

Name element	Unit	Total
Manholes	unit	47,624
Hydrants	unit	380
Networks	km	3,444

Table 7: Digitization of wastewater system

Name element	Unit	Total
Manholes	unit	71,891
Networks	km	1,810

Now that the GIS has been built and is running, it is very easy for ACC to make some data analysis (see example in the next page).

It is also possible to make some specific requests; for example to identify which valves shall be closed to isolate an emergency area.

Analysis of data obtained from the digitization of cartographic material National geospatial data fund of Moldova, Chisinau.As of 31.03.2012

Moldova: Chisinau Water Supply & Sewage Treatment - Feasibility Study.GIS

seureca

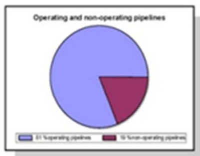
Water supply system

Water supply			
№	Name element	unit	Total
1	Manhole	pcs	39742
2	Hidrant	pcs	361
3	Point elevation	pcs	19839
4	Valves	pcs	1942
5	Camera	pcs	2314
6	Facilitis	pcs	841
7	Network water supply	km	2632,44

System of sewerage

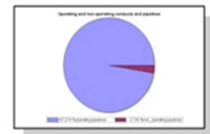
Severage			
№	Name element	unit	Total
1	Manhole	pcs	60729
2	Point elevation	pcs	526
3	Facilitis	pcs	250
4	Cesspool	pcs	2487
5	Camera	pcs	456
6	Network sewerage	km	1510,97

Operating and non-operating pipelines

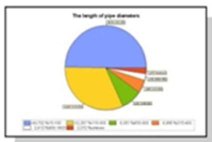


Category	Percent	Length,km
operating pipelines	81	2142,347
non-operating pipelines	19	490,094

Category	Percent	Length,km
operating pipelines	97,27	1469,78
non-operating pipelines	2,73	41,2

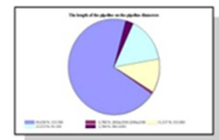


Length of pipe diameters



Category	Percent	Length,km
15-100	49,7	1308,4
110-300	32,3	849,9
315-400	5,0	130,7
450-800	8,4	220,1
900-1400	2,4	63,5
unknow	2,3	59,8

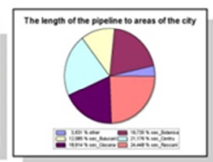
Diametr	Percent	Length,km
50-100	15,3	231,4
110-300	69,6	1052,2
315-800	11,5	174,0
900-2000	2,7	41,5
2000x1500-2000x2500	0,8	11,9



Length of the pipeline to district of the city

District	Percent	Length,km
sec_Rascani	20,5	540,1
sec_Ciocana	17,5	459,5
sec_Centru	19,0	501,2
sec_Buiucan	17,9	470,2
sec_Botanica	17,4	456,8
other	7,8	204,7

District	Percent	Length,km
sec_Botanica	19,7	298,2
sec_Buiucani	12,1	182,6
sec_Centru	21,2	320,0
sec_Ciocana	18,9	285,8
sec_Rascani	24,4	369,4
other	3,6	54,9

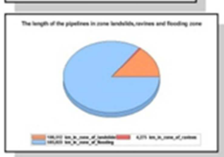


Length of pipe material

Material	Percent	Length,km
asbest	0,4	11,5
concrete	0,8	20,1
cast iron	20,8	548,7
steel	61,9	1630,3
pe	15,2	400,9
unknown	0,8	21,0

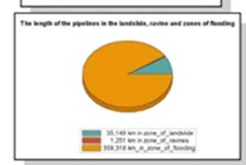
Material	Percent	Length,km
asbest	18,476	279,2
concrete	8,560	129,3
beton	0,651	9,8
ceramica	39,599	598,3
cast iron	16,437	248,4
stell	3,824	57,8
pe	0,187	2,8
pvc	12,248	185,1
unknow	0,017	0,3

Length of the pipelines in zone landslids,ravines and flooding zone



Categoria	Length,km
zone_of_landslide	100,5
zone_of_ravines	4,3
zone_of_flooding	583,6
Total	688,4

Categoria	Length,km
zone_of_landslide	35,1
zone_of_ravines	1,3
zone_of_flooding	359,3
Total	395,7



4.2.4 ACC GIS Web Interface

As per the Contract, a web interface for “ACC GIS” has been built. This shall enable the users to perform the following tasks:

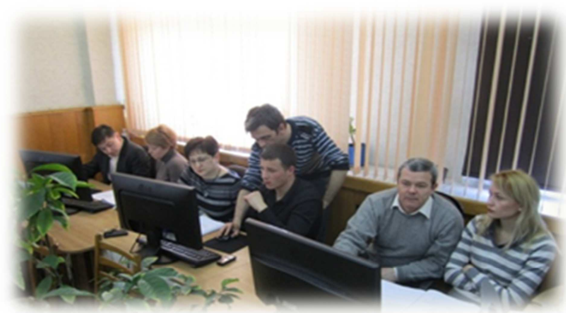
- Visualization of all ACC GIS GDB elements;
- Editing Water Supply and Wastewater systems breakage.

This request comes from the Technical Department of ACC, which wanted that the field operators could report, via internet, the leaks observed on site and the repairs done.

The Web interface was developed with the help of Flex API based on ArcGis Viewer for Flex which has the following possibilities:

- Maps visualization & navigation;
- Perform the address and name based searching (through ArcGis Server or ArcGis Online);
- Perform the GIS analysis (through geo-processing services);
- Etc.

4.2.5 Training



Training on ArcGIS 10 has been performed for:

- 10 GIS users;
- 2 GIS administrators.

The following courses, based on “ESRI” Company Official Training Program, have been conducted:

- ArcGIS Desktop I: The beginning of the work on GIS;
- ArcGIS Desktop II: Instruments and functionality;
- An introductory course for GIS administrators (performed during the rolling out of the ACC geodatabase on ACC server, by “Trimetrica” company specialist).

4.2.6 Recommendations

It is crucial to create a GIS department directly subordinated to the Technical Direction to:

- Develop the GIS built by Seureca;
- Update the information;
- Use it for operational purposes.

4.3 IMPLEMENTATION OF MEASUREMENT CAMPAIGNS

4.3.1 Analytical survey at WWTP

An analytical survey has been made of the wastewater incoming flow at the WWTP. It mainly aimed to gain a detailed insight into the characterization of the raw wastewater as well as a better knowledge of the performances of the plant from a process point of view.

Fifteen daily samples have been collected in the period ranging from April 25th 2011 to May 19th 2011 by the two automatic samplers that were installed at the inlet of the WWTP and at the outlet. In addition to the analyses performed on the samples provided by the automatic samplers, Seureca has monitored the mixed liquor in the biological tanks by analysing a few samples for TS, TSS, VS and DO. These analyses can then be compared to the routine analysis performed by ACC.

The analysis of inflows and outflows complemented by the collection of important operating parameters of the WWTP allowed i) to assess the characteristics of the inflows (raw wastewater) and of the outflows (treated wastewater) and ii) to provide complementary operating results to be compared with ACC analyses.

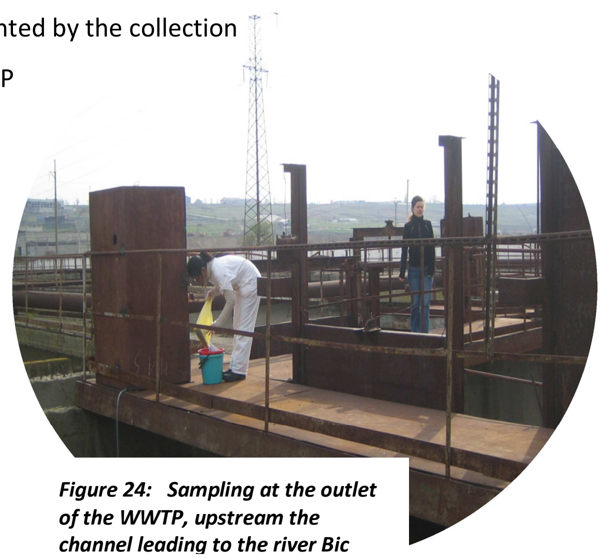


Figure 24: Sampling at the outlet of the WWTP, upstream the channel leading to the river Bic

The main results are the following:

- The effluent is very septic, featuring very low ORP values and high sulphide concentrations.
- The effluent is a typical diluted municipal wastewater.

This survey also highlighted some significant discrepancies between the measurements performed by the ACC lab and by Seureca. This suggests that samples as collected and analysed by ACC are not the most representative of the inlet and outlet flows, which should also be taken into account when evaluating the performances of the plant.

4.3.2 Measurements at both water and wastewater networks for the models calibration

Two measurement campaigns have been performed: one for potable water and the second for wastewater.

Water Measurement campaign

The measurement campaign was performed between the 25th May and 7th September, 2011. Each of the six separate campaigns was of seven days duration.

Each campaign comprised the collection of pumping station pump delivery pressures and the inlet and outlet flows at the stations within a zone; water service reservoir levels and flows and pressures at strategic points in the distribution network. The data was collected from permanent ACC pressure and flow recorders or from temporary equipment provided by Seureca for the purposes of the measurement campaign.

The objectives of the campaign were to:

- Enable the calibration of the strategic network model;
- Provide information upon current customer demand and patterns of demand;
- Ascertain physical water losses from the network, and
- Provide ACC with a prioritised non-revenue water detection programme.

In particular, the campaign enabled the following key determinations for each zone, and collectively for the distribution network of ACC:

- The annual average and peak day “water into supply” from the sources;
- Annual average customer demand, including operational water used by ACC;
- Performance Indictors of Linear Leakage Index and Network Efficiency, and
- Hydraulic energy supplied to each zone from which a prioritised leak detection programme based upon the cost of energy was produced.

The Indicators derived for the whole supply area are shown in the following table:

Table 8: Network Performance Indicators for ACC Area of Supply

Item	Chişinau	Suburbs	Whole Area of Supply
Network Efficiency	63%	50%	61%
Linear Leakage Index (m3/km/day)	48	22	42

An output of the measurement campaign is the energy cost per cubic meter required to pump water into supply and around the different supply zones, enabling prioritisation of the leak detection programme.

The measurement campaign data permitted:

- The efficiency of the pumping stations to be computed, and
- The energy dissipated across flow control valves.

The determination of energy losses across flow control valves shows the locations where there could advantageously be investment to avoid the energy.

Wastewater Measurement campaign

Hydraulic measurements were made on the ACC network from mid-June 2011 to mid-October 2011, ensuring the availability of a high number of dry weather days.

The campaign objectives were, under dry weather conditions:

- The assessment of wastewater volumes within each sub-catchment;
- The definition of the daily wastewater discharge profiles;
- Determination of peak flow coefficients;
- The assessment of permanent ingress to the sewer network;
- The collection of data for the hydraulic model's calibration process, and
- The gathering of data for pump efficiency assessments.

While the main purpose of the campaign was to gather all the above data during dry weather days, a certain number of rainy days occurred during the campaign which allowed an assessment to be made of stormwater flows that entered the system.

From mid-October to early November, instantaneous flow, pressure and electrical measurements were recorded in twelve wastewater pumping stations accounting for 90% of the electrical power consumption, excluding the wastewater treatment plant inlet pumping station. The main objective of which was to assess pumping efficiency.

The hydraulic measurements campaign was conducted jointly with ACC operational staff.

4.3.3 Metering survey

On-site metering campaigns were performed to assess metering under-registration, with two different methodologies depending on the type of customers (domestic and non-domestics).

Metering under-registration is related to many technical issues:

- Improper meter type and sizing;
- Incorrect meter installation;
- Meter encrustation and deterioration with age;
- Flowrates lower than the minimal flowrate the meter can reliably register;
- Insufficient maintenance/replacement;
- Frequency of calibration;
- Inability to obtain meter indexes and influence of meter reading cycles.

Domestic customers

A sample of 50 customers (25 individual houses and 25 individual apartments) was equipped with new water meters (oscillating piston type) imported from France.

Figure 25 : Example of metering point during the study

For each household, it is estimated that 14 cubic metres per year are not metered by current water meters' models in the service area.

Considering a tariff of 9.2 MDL per cubic metre[3] (0.58€ at an exchange rate of 1 € = 16 MDL), it means that a total of 128.8 MDL is not invoiced by ACC each year per household (total of 8.1€).

It implies the following losses for the categories of domestic customers having direct contracts with ACC:

- 562,620 m^3/year for individual houses, equivalent to 326 k€/year;
- 79,230 m^3/year for individual apartments[4], equivalent to 46 k€/year.

The most common model in the service area, the MADDALENA CD-ONE TRP, which is recommended by ACC, is quite suited to the current situation due to its low price and the low water tariffs. However, its aging within the service area supply conditions strongly affects the metrological performances.

[3] Water Supply and Wastewater

[4] The apartments considered here are only the customers having a direct contract with ACC, as the customers having a contract with a condominium are billed based on the block water meters, that were not tested in this study.

Non-domestic customers

The results of the campaigns performed on water meters of non-domestic customers are summarized in the table below:

Table 9: Summary for non-domestic customers

Name of the industrial customer	% of under-registration assessed	Comments
EFES Vitanta	86%	Water Meter oversized and hydraulic conditions unfavorable (90° elbow)
Hydraulic conditions unfavorable (90° elbow)	15%	Water Meter oversized and hydraulic conditions unfavorable (90° elbow)
Bucuria	26%	Water Meter oversized and hydraulic conditions unfavorable (90° elbow)
Hydraulic conditions unfavorable (90° elbow)	50%	Water Meter oversized and hydraulic conditions unfavorable (90° elbow)
Spitalul Clinic Republican	6%	Water Meter oversized
Hydraulic conditions unfavorable (90° elbow)	72%	Hydraulic conditions unfavorable (90° elbow)
Spitalul din urgenţa	17%	Water Meter oversized and hydraulic conditions unfavorable (check valve)

Figure 26: Portable ultrasonic flowmeter installed in S.A. BUCURIA

Many issues have been observed thanks to the site visits and the preliminary results:

- Water meters are quite often oversized when compared to the customers' preferential flowrates on their water consumption patterns.
- For large users, horizontal helix Woltmann type units are preferred but are usually installed incorrectly, very often just after a 90° elbow with high risks of turbulent flow.

4.4 SURVEY ON THE POPULATION OF CHIŞINAU ABOUT QUALITY OF SERVICE

In the frame of a global socio-economic analysis a household Ssrvey was held during March and April 2011. The objective was to understand domestic water usage within different socio-economic groups; gain knowledge of (i) customer satisfaction with ACC service and (ii) the issues seen as important to them, and their affordability and willingness to pay ACC charges. The survey also included for wastewater disposal facilities.

A total of 1,038 households were surveyed with 631 in Chişinau city, 125 in each of five districts, and 407 outside of the city.

When asked about their satisfaction with the service provided to them by ACC, the highest dissatisfaction was recorded for the cost (72%). This is of little consequence as customers gave little importance to the cost – see Figure below. Dissatisfaction with cost might not necessarily be dissatisfaction with the cost per see, but the consequence of other dissatisfactions.

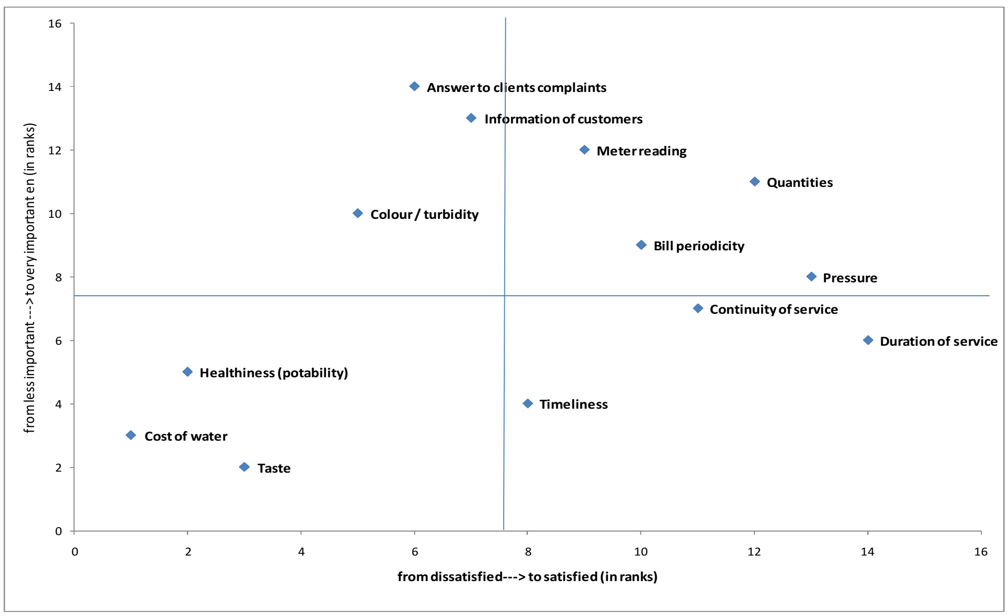


Figure 27: Customer Dissatisfaction and Importance

Within Chişinau City, dissatisfaction with taste (63%), colour (55%) and smell (61%) featured higher than the less tangible aspects of customer service (30%), meter reading and billing (17%). These high levels of dissatisfaction with the water quality tie in with the 75% of households who consider that ACC water involves a health risk. Outside of the City, dissatisfaction with taste and smell etc was much less at around 40%.

Within Chişinau City, dissatisfaction with pressure, duration and continuity of service were much lower at around 14%.

When dissatisfaction criteria is plotted against importance, encouraging for ACC, the company's response to customer complaints and colour/turbidity have both low levels of dissatisfaction, but are considered of importance to customers.

Customer service featured as being of high importance and came midway in the satisfaction levels. Clearly as far as the perception of ACC service is concerned, on-going importance needs to be given to customer service.

4.5 TRAINING OF ACC STAFF

4.5.1 Hydraulic model

A water network and a wastewater computer models have been constructed based on the data collected during the measurement campaign. Basically, after the calibration stage, the model has been used to:

- Analyse the current condition of the network and to propose a diagnostic of the network operation;
- Design the future extensions of the network and to design the pipes which are to be rehabilitated;
- Simulate different configurations considered for the future operation of the system related to the emergency use of the ground water wells;
- Simulate the quality of the water in the network and the residence time in the reservoirs;
- Model the emergency response scenarios created by the unavailability of a water source, a pipe, a pumping station, and
- Optimize the investments and the operational costs.

Hydraulic modelling is a very efficient operating tool for planning & emergency response.

Therefore, a training of ACC staff has been performed on the use of EPANET, which is a public domain software and freely available to ACC after the completion of the project. To remain of benefit to ACC, it will be necessary for ACC to "own" and continually update the model to ensure its currency.

4.5.2 Leak detection

The measurement campaign performed on the water supply network showed that the ACC has a higher-than-acceptable level of physical losses from its network that requires to be tackled.

During the period July 2011 and September-December 2011, a Pilot Leakage Study was made over 300kms of ACC network.

The main objectives of the Study were:

- Familiarisation of ACC staff with acoustic correlation and acoustic ground listening for leak detection and location;
- Interaction of ACC staff with our experienced staff for all aspects of NRW activities in order to introduce best practise into ACC;
- Analysis of the Study results as indicators for an NRW reduction programme across the whole of the ACC service area, and
- To determine the most suitable organisational unit within ACC for NRW management.

Figure 28: Observed leaks during the training on leak detection

The training aspect of the Study was particularly successful with the trained ACC staff able to perform unaided a proactive leak detection and location programme in Vadul-lui-Voda. For the purposes of the Study, acoustic leak detection and location equipment was brought to Chişinau and made available to ACC technicians. Special equipment to detect and locate metallic mains and accessories was also purchased.

The team inspected 418km of network (23% of the whole system), and found 339 hidden leaks during the 5 months of the Study. The ratios that can be deducted from these primary results are:

- 0.8 hidden leaks per kilometre were detected and located by the team;
- 5.2 kilometres of network per day were inspected by a team, and
- An average of 4 leaks per day was found by the team.

The percentage of detected and located leaks on valves is very high; higher when combined with those from fire hydrants. Both are in a poor condition, old and with high levels of corrosion. As a consequence they are very vulnerable to leakage and many cannot be operated, itself a network management concern.

From the Study, the number and location of leaks detected is as shown below.

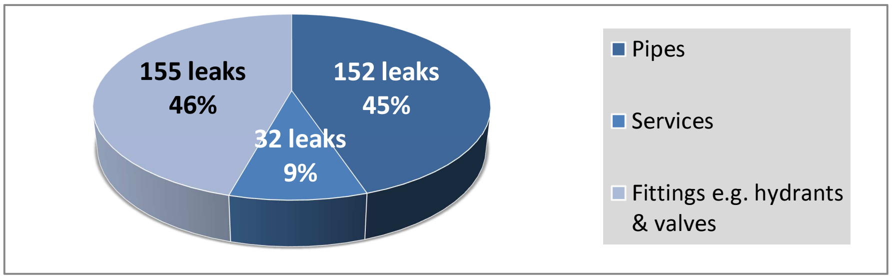


Figure 29: Number and Location of Leaks Detected within the Pilot leakage Study

4.5.3 GPS use

At the request of ACC, ACC staff has been trained on the use of GPS, which has been purchased in the frame of the Project. The GPS will be used to complete the GIS based on field investigations and to report all the events observed on site (leaks, burst, repairs, …).

4.6 OTHER GENERAL RECOMMENDATIONS

4.6.1 Human Resources & Organization

We recommend that ACC considers an organisation structure similar to that shown below, which is typical of that found in many modern water service providers.

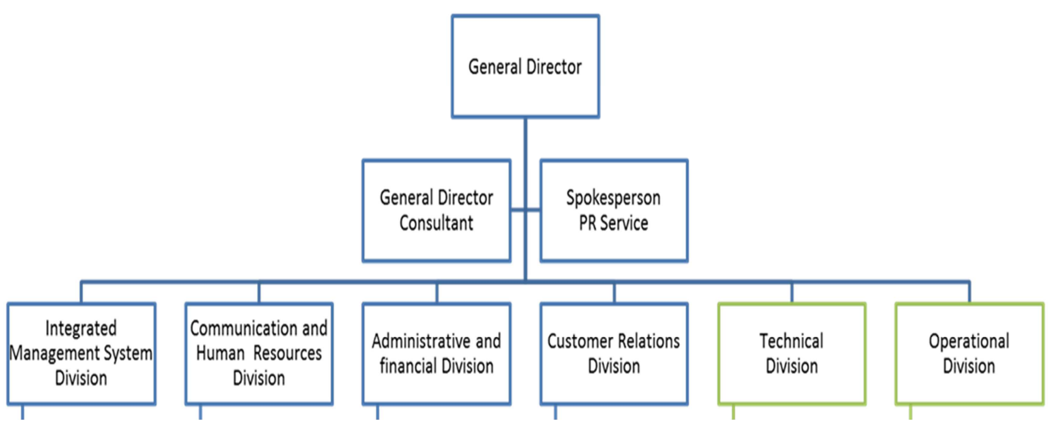


Figure 30: Proposed Organisational Structure

The main features of the organisation are:

- A limit number of Directors under the General Director, performing as an executive committee of a size to facilitate rapid decision-making;
- Divisions focused upon strategic business units, with clear areas of responsibility;
- A separate division for all customer service activities, and
- A clear separation between asset owner and asset operator activities lending itself to outsourcing and, if found necessary, to a Service Agreement between asset owner and asset operator units.

Moldovan economic environment and of the staff employment laws and policies must be respected and we have tried to formulate our proposals sensitive to the difficulties that would befall any ACC employee who is made redundant in Chişinau.

Before there can be any major reduction in the staff establishment, the reasons for the high staffing levels needs to be tackled. Without investment in the infrastructure assets and business systems, it is unrealistic to expect ACC significantly reduce staff numbers; yet still provide the required level of customer service. The only exception could be outsourcing.

Though staff reductions cannot commence yet, a long-term Action Plan that will be required to reduce the establishment to a number more comparable with other utilities has been set out. A long-term target was suggested of 1.5 employees/per 1,000 customers and a 5:1 operational to administrative ratio.

The changes proposed in the Project are at a "conceptual" stage and will need to be supported and further developed within a strategic Human Resources Plan prepared by ACC staff, as set out below.

The key tasks to be performed within an Action Plan would be:

Year 1

- Senior managers prepare a strategy for a reduced establishment identifying areas where the workforce could be reduced and where additional resources will be required, based upon the "Human Resources Report – Good Practices and Recommendations", prepared within this Feasibility Study;
- ACC appoint a Change Manager as a senior manager reporting directly to the Director General;
- Discussions are held with employee representatives at the earliest opportunity to encourage their acceptance of the strategy;
- Employee workshops are held at which the proposals are openly discussed with emphasis upon the safeguards to be provided, and

- Employees are canvassed to see who would be prepared to leave early with appropriate compensation.

Year 2

- ACC explores the opportunities for outsourcing and, if considered adequate, outsource activities, and
- A training provider is procured who assists with the preparation of appraisal and training procedures, and trains.

Year 3 onwards

Implement reduction in the establishment within a time-frame dependent upon investments made; the ability to introduce re-training and the introduction of improved business procedures and processes.

4.6.2 MIS

Most computer systems used in ACC are developed internally within the IT Department. The systems have been developed directly in Oracle or are older systems of MS DOS type which are difficult to use and do not meet the business needs of ACC.

There is no integrated MIS and the existing applications have been developed at the request of certain departments or services. Commonly, applications deal only with the activities in the department that requested the application. Consequently, there is no “total picture” of a process or activity across all ACC departments.

The preparation of management reports is difficult, particularly when information has to be correlated from various applications.

Our main recommendation is for the implementation of an integrated ERP system that will include:

- The CRM component for managing customer-related activities;
- Stock and procurement management;
- Financial and accounting flows, and
- Network computerized management, through the GIS system.

For an MIS to be effective, it is essential that good quality data is entered for which there quality control is required.

4.7 FURTHER POTENTIAL INSTITUTIONAL DEVELOPMENT

Following this Feasibility Study, several leads for institutional strengthening and development could be envisaged, such as:

- Transfer of regulatory responsibility over tariffs to ANRE;
- Develop a Pilot Project for sludge use in agriculture, especially regarding administrative authorisations;
- Transformation of ACC into a Regional Operating Company with an opening of Capital to surrounding municipalities;
- Development of Public-Private Partnership to increase the investment capacity and transform ACC into an efficient and customer oriented entity;
- Developing commercial services (pipe works for example) for third-parties (private customers, villages outside ACC service area, …).

5 CONCLUSION

In the framework of the EU Neighbourhood Initiative, EBRD and its co-funders consider to support ACC in its efforts to improve its operations through a large scale phased investment Programme, estimated around EUR 60m.

In order to prepare the Programme, ACC has appointed Seureca and its partners as Consultant to prepare a Feasibility Study, which started on December 2010, and ended on December 2012.

Based on a detailed technical assessment including in particular the implementation of measurements campaigns and the construction of hydraulic models, investment plans have been defined for different horizons.

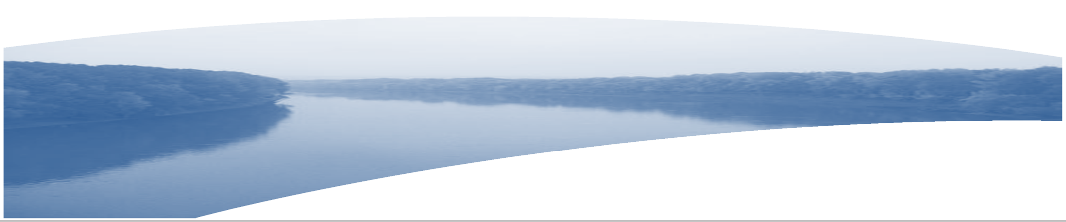
A Priority Investment Programme (PIP) has then been selected using a multi criteria analysis. The PIP (EUR 60m) has been tailored to mainly solve the issue of sludge disposal at WWTP site and to make significant energy savings. Its financial feasibility has been demonstrated (construction of a financial model).

In addition to these technical and financial aspects, the Project also included an institutional assessment of the Company and the evaluation of environmental and social impacts and issues.

During all the development of the Project, the Municipality of Chisinau has been kept informed and involved in the main strategic choices.

It is worth pointing out that in the frame of the Project several operating tools have been developed and ACC staff trained to their use (GIS, leak detection, …).

Finally, Seureca would like to thank ACC and its staff for the hospitality shown; as well as the Municipality of Chisinau, EBRD and its co-funders for their support. Without such a collaboration and support, this Project would not have been successfully implemented.



APPENDICES

Appendix. 1. Procurement Plan

Various kinds of works and supply are included in the PIP. A packaging in several projects is proposed hereafter. This proposal has been defined according to the following principles:

- Propose large enough packages in terms of amount in order to interest international companies;
- Respect technical consistency of each package.

Standard models of contract have been prepared by the FIDIC (Fédération Internationale des Ingénieurs Conseil – Swiss), based on past experience of projects. These standards can be easily adapted to each particular project. The EBRD recommends using such kind of standards, or equivalent.

In the current case, two models of contracts are relevant:

- Design and Built contract (known as “FIDIC Yellow book”);
- Work contract (known as “ FIDIC Red Book”).

We propose 15 packages with amounts ranging between EUR 150,000 and EUR 25.3m.

The biggest package concerns the first phase of upgrading the WWTP (package 1). It has to be noted that two types of procurement process are proposed for this package: “Design & Build” for the new facilities to be constructed (pretreatment, digesters, …) and “Work Contract” for the facilities to be rehabilitated (primary settling, biological tanks, …).

As shown on the followings graphs, different types of procurements are proposed.

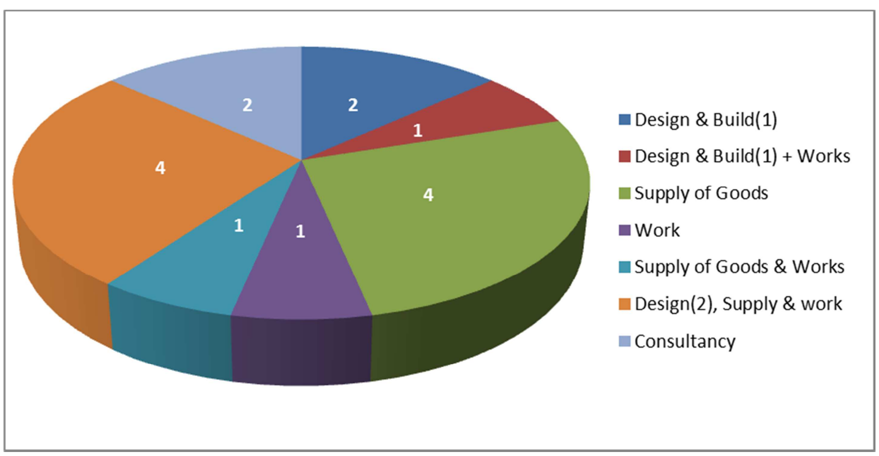


Figure 31: PIP - Number of Packages & Type of Procurement Process

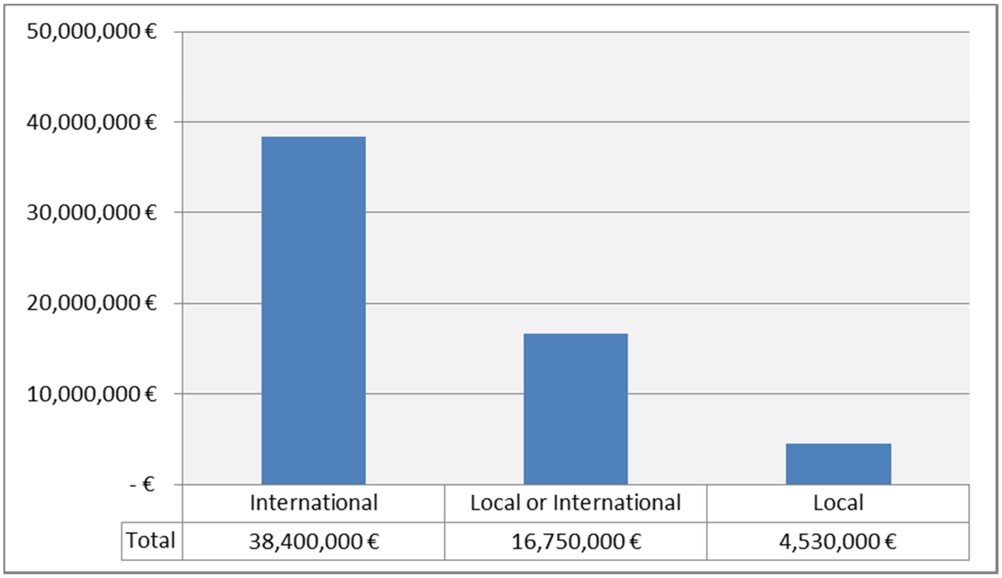


Figure 32: PIP - Type of Procurement

A preliminary procurement plan with definition of each package with their own type of contract is displayed in table hereafter.

Table 1: List of Packages with their description

Package #	Name of the package	Procurement Process	International / local	Description	Estimated cost	Party in charge of the detailed Design	Implementation period (in months)
1	First phase of upgrading the WWTP for Chişinau	Design & Build[5] + Works	International	D&B: New pretreatment facilities including PS Separated thickeners for biological excess sludge Digesters for anaerobic digestion with energy generation Centrifuges for sludge dewatering Works: Light rehabilitation of primary settling Light rehabilitation of biological tanks Light rehabilitation of secondary clarification Electrical work	25,310,000 €	D&B: Contract based on the FIDIC Yellow Book Works: Contract based on detailed design & BoQ made by the Consusltant	24
2	New Water Treatment Plants for well fields	Design & Build[1]	International	Treatment of the water produced from Ialoveni, Petrucani, Ghidighici and Baliveskii well fields	1,260,000€	Contractor based on the FIDIC Yellow Book	12
3	New Electrochlorination Plant	Design & Build[1]	International	Implementation (equipment & civil works) of an Electroclorination Plant at the WTP STA	820,000 €	Contract based on the FIDIC Yellow Book	12
4	Rehabilitation and construction of wells	Design[6], Supply & work	International	Rehabilitation of the wells for the Emergency Plan: Ialoveni (21 wells), Ghidighici (11 wells), Petricani (9 wells), Balisevsc (6 wells) Construction of one new well field (15 wells)	2,410,000 €	Contract based on intermediary design prepared by the Consultant	12
5	Civil works for some water supply and production facilities	Work	Local	Civil Work for the implementation of a new Pumping Station at Tohatin Rehabilitation of some civil works at STA Rehabilitation of the tank n°5 in the Water Treatment Plant and 4 other tanks at STA Rehabilitation of 16 existing tanks	3,980,000 €	Contract based on detailed design & BoQ prepared by the Consultant	12
6	Rehabilitation of the drinking water and wastewater networks	Design[2], Supply & work	Local or International	Design, supply of sewers and pipeworks including trenches, laying of sewers, construction of manholes for urgent renewal of sewers (15 km) Design, supply of water pipes and pipeworks including trenches, laying of pipes, installation of valves and fittings, construction of manholes (190 km of drinking water network rehabilitation+New pipes to be laid for the Emergency Plan+new pipes & fittings for the adaptation of the water distribution system to the new production scheme) Supply of hydraulic fittings for the repairs	12,820,000 €	Contract based on intermediary design prepared by the Consultant	36
7	Rehabilitation of connections	Design[2], Supply & work	international	Procurement of fittings and installation/replacement of 3,270 steel connections for buildings (blocks)	2,130,000 €	Contract based on intermediary design prepared by the Consultant	24
8	O&M equipment[7]	Supply of Goods	Local or International	Equipment for operating both water supply and wastewater networks including vehicles, public works machinery, leak detection equipment, CCTV, safety equipment, automated tools, …	3,360,000 €	Technical specifications based on performance requirements prepared by the Consultant	6
9	Pressure reduction on the network	Design[2], Supply & work	Local or International	Implementation of pressure reducers, flowmeter, pressure sensors, boosters	300,000 €	Technical specifications based on performance requirements prepared by ACC	12
10	Pumping Stations for both drinking water and sewerage systems	Supply of Goods	International	New pumps for the water PS (Tohatin, Buiucani Z3 PS, Buiucani Z4 PS, Independenta Z3 PS, Independenta Z4 PS & Treapta II a raw water) New pumps for the wastewater PS (Vatra 1, Vatra 2, Codru 2, Codru 1 & 3, Vieru 1 & 2, V.Lupu 1 and Vatra 3 + PS where odour problems are observed) Pumps for the Emergency Plan	1,980,000 €	Technical specifications based on performance requirements prepared by the Consultant	12
11	Water treatment equipment	Supply of Goods	Local or International	Chlorination system at the PS: Telecentru, Tohatin, Valea Dicescu, Buiucani,Ciocana, Schinoasa, Airport, Codru MDK, Colonita, Independenta, Singera and Stauceni	120,000 €	Technical specifications based on performance requirements prepared	3

[5] D&B includes procurement of equipment's & goods

[6] The detailed design will be made by the contractor in charge of the work, based on preliminary BoQ determined by the Consultant

[7] International bidders must have a local branch in Moldova

Package #	Name of the package	Procurement Process	International / local	Description	Estimated cost	Party in charge of the detailed Design	Implementation period (in months)
						by the Consultant	
12	Instrumentation and control Equipment	Supply of Goods	International	MIS: Implementation of a full ERP system SCADA: Upgrading or renewal of the existing equipment[8]	1,480,000 €	Technical specifications based on performance requirements prepared by the Consultant	12
13	Enhancement of the existing SCADA	Consultancy	Local or International	Data Storage: i) redirect data arriving on the LOVATI server and on the Russian server and on the Termocom server to a server computer service; ii) transfer selected data from the WTP to a server computer service (50 days) Development of a specific tool or adaptation of an existing tool for data processing (100 days)	150,000 €	ToR to be prepared by the Consultant (see package 16)	12
14	Electrical works	Supply of Goods & Works	Local	Supply and installation of new electrical panels in PS Replacement of the electrical lines in STA, SAN, SESE, SSP	550,000 €	Technical specifications based on performance requirements prepared by the Consultant	24
15	Consultancy	Consultancy	International	Detailed design[9] Intermediary design with preparation of BoQ[10] Preparation of performance requirements for all equipment & goods to be purchased Preparation of ToR for the SCADA Consultancy Project (package 14) Preparation of tender documents for all packages (1 to 15) Supervision of all the works (packages 1 to 15)	3,010,000 €		36
					59,680,000 €		

[8] Installation of equipment to be done by ACC

[9] It includes: the rehabilitation works at the WWTP (package 1), the rehabilitation of the reservoirs (package 5), the pumping stations (package 5) and the electrical works (package 15)

[10] Detailed design will be made by the contractors. However an intermediary design with preliminary BoQ are required for the evaluation of the bids. It includes the rehabilitation of wells (package 4), water pipes (package 6), sewers (package 7), connections (package 8), implementation of hydraulic fittings (package 10)

Appendix. 2. Description of the LTIP irrespective financing capacity of ACC[11]

[11] It differs from the CAPEX introduce in the financial model where only a part of the LTIP has been considered, which is economically sustainable for the own revenues of ACC

LONG TERM INVESTMENT PROGRAMME - LTIP											
No.	**Colonne1**	**Field**	**Sub-Cat**	**Type of operation**	**Quantity**	**Unit**	**Unit Cost**	**Cost**	**Rank**	**PIP or LTIP**	**Description**
1	WW-P-01	Wastewater	Pumping	Renewal of pumps	1	u	400,000 €	400,000 €	26	PIP	Renewal of the pumps at the inlet f the WWTP: 4 pumping groups
2	WW-P-02	Wastewater	Pumping	Other	1	ls	204,000 €	204,000 €	7	PIP	Installation of electrical panel plexiglas in the big PS+ Installation of electrical panel plexiglas in the small PS + New electrical panels in big PS + New electrical panels in small PS
3	WW-P-03	Wastewater	Pumping	Renewal of pumps	1	ls	847,000 €	847,000 €	17	PIP	Rehabilitation of PS where odour issues are obsrevedReplacement of the pumps of Vatra 1, Vatra 2 and Codru 2 + Replacement of the pumps of Codru 1 & 3, Vieru 1 & 2, V.Lupu 1 and Vatra 3
4	WW-P-04	Wastewater	Pumping	Renewal of pumps	1	ls	630,000 €	630,000 €	42	LTIP	Renewal of pump (5 pumps per year)
5	WW-N-01	Wastewater	Network	Renewal of sewers	4,800	m	202 €	968,000 €	19	PIP	Urgent pipe rehabilitation defined by ACC
6	WW-N-02	Wastewater	Network	Renewal of sewers	9,600	m	202 €	1,935,000 €	30	PIP	Rehabilitation of the 2nd priority pipes selected by ACC
7	WW-N-03	Wastewater	Network	Renewal of sewers	141,900	m	252 €	35,758,800 €	39	LTIP	Rehabilitation of the pipes selected by ACC
8	WW-N-04	Wastewater	Network	Renewal of sewers	57,300	m	189 €	10,829,700 €	38	LTIP	Renewal of the sewerage network based on 1% after the completion of the rehabilitation programme
9	WW-OM-01	Wastewater	O&M	Equipment	1	ls	1,683,000 €	1,683,000 €	16	PIP	Hydrocleaning trucks + Jet units on trailer + CCTV Equipment + Quick View equipment for sewers inspection: 5 equipment for 5 teams + Safety Equipment (gaz detector, scale, harness, protection clothes, safety signs, road signalisation, …) + General intervention equipment + Smoke generator + "basa de produtie" ?A CONFIRMER AVEC CAMILLE
10	DW-OM-01	Drinking Water	O&M	Equipment	2	ls	41,000 €	82,000 €	4	PIP	Necessary equipment for 2 leak detection teams, inlcuding 2 light commercial vehicles

LONG TERM INVESTMENT PROGRAMME - LTIP

No.	Colonne1	Field	Sub-Cat	Type of operation	Quantity	Unit	Unit Cost	Cost	Rank	PIP or LTIP	Description
11	DW-OM-02	Drinking Water	O&M	Equipment	19	ls	34,000 €	646,000 €	10	PIP	Vehicles for the transport of team: 19 Small Truck 5-10T and 19 Trailer for mini excavator
12	DW-OM-03	Drinking Water	O&M	Equipment	19	ls	31,000 €	589,000 €	21	PIP	Public works machinery and equipment (Mini-excavator 3T, Generator, Compressor and Ram down machinery)
13	DW-OM-04	Drinking Water	O&M	Equipment	1	ls	101,000 €	101,000 €	2	PIP	Automated tools (Sawing machinery, Jack hammer, Drill, …) + Manual tools (General tool box, Specific spanners and tools for cleaning, Specific tools to work on HDPE pipes, Wheel barrow, shovel, pickaxe, hammer, broom, …) + Safety Equipment (gaz detector, individual and collective, …)
14	DW-OM-05	Drinking Water	O&M	Equipment	1	ls	260,000 €	260,000 €	15	PIP	JCB (backhoe loader) + Excavator on wheel 14T + Dump truck 4X6 26T
15	DW-N-01	Drinking Water	Network	Replacement of connections	1,000	u	700 €	700,000 €	14	PIP	Replacement of steel connections (for blocks) when replacing pipes during the PIP
16	DW-N-02	Drinking Water	Network	Replacement of connections	2,270	u	700 €	1,589,000 €	9	PIP	Rehabilitation of steel connections (blocks) in line with the percentage of pipes replaced
17	DW-N-03	Drinking Water	Network	Replacement of connections	49,017	u	700 €	34,312,103 €	40	LTIP	Rehabilitation of steel connections in line with the percentage of pipes replaced
18	DW-N-04	Drinking Water	Network	Other	1	ls	303,000 €	303,000 €	6	PIP	Pressure reduction on the network:Pressure reduction on Zone 1 + Pressure reduction on Zone 2 in Botanica + Pressure reduction on Zone 2 in Ciocana + Pressure reduction on Zone 2 Doina + Pressure reduction on Zone 2 Oţel + Pressure reduction on Zone 3 Valea Dicescu + Pressure reduction on Zone 3 Ciocana + Pressure reduction on Zone 4 Ciocana + Pressure reduction on Zone 4A Schinoasa + Critical points on the network
19	DW-O-01	Drinking Water	Other	Supply and installation of water meters	2,717	u	400 €	1,086,667 €	34	LTIP	1st renewal of block waters for domestic customers (1/3 of the existing stock)
20	DW-O-02	Drinking Water	Other	Supply and installation of water meters	2,717	u	400 €	1,086,667 €	34	LTIP	2nd renewal of block waters for domestic customers (2/3 of the existing stock)

LONG TERM INVESTMENT PROGRAMME - LTIP											
No.	**Colonne1**	**Field**	**Sub-Cat**	**Type of operation**	**Quantity**	**Unit**	**Unit Cost**	**Cost**	**Rank**	**PIP or LTIP**	**Description**
21	DW-O-03	Drinking Water	Other	Supply and installation of water meters	2,717	u	400 €	1,086,667 €	34	LTIP	3rd renewal of block waters for domestic customers (3/3 of the existing stock)
22	DW-N-05	Drinking Water	Network	Renewal of water pipes	1	ls	2,232,000 €	2,232,000 €	29	PIP	Rehabilitation of the current network: 1 - Priority programme (ND150 existing steel pipes=17800m & ND200 existing steel pipes=12200m)
23	DW-N-06	Drinking Water	Network	Renewal of water pipes	1	ls	7,747,000 €	7,747,000 €	22	PIP	42% of Rehabilitation of the current network: 2 - Steel Pipes ND 100 to 200 (ND100 existing steel pipes=290500m & ND150 existing steel pipes=54600m & ND200 existing steel pipes=37300m)
24	DW-N-07	Drinking Water	Network	Renewal of water pipes	1	ls	10,749,000 €	10,749,000 €	37	LTIP	68% of Rehabilitation of the current network: 2 - Steel Pipes ND 100 to 200 (ND100 existing steel pipes=290500m & ND150 existing steel pipes=54600m & ND200 existing steel pipes=37300m)
25	DW-N-08	Drinking Water	Network	Renewal of water pipes	1	ls	16,409,000 €	16,409,000 €	42	LTIP	Rehabilitation of the current network: 3 - Steel Pipes ND 250 to 400 (ND250 existing steel pipes=26600m & ND300 existing steel pipes=64000m & ND350 existing steel pipes=3800m & ND400 existing steel pipes=27400m
26	DW-N-09	Drinking Water	Network	Renewal of water pipes	1	ls	17,435,000 €	17,435,000 €	42	LTIP	Rehabilitation of the current network: 4 - Iron Pipes ND 100 to 200 (ND100 existing cast iron pipes=126300m & ND150 existing cast iron pipes=89900m & ND200 existing cast iron pipes=73400m
27	DW-N-10	Drinking Water	Network	Renewal of water pipes	1	ls	14,114,000 €	14,114,000 €	42	LTIP	Rehabilitation of the current network: 5 - ACC's programme not included in the four categories above (Existing pipes with diameter between 100 and 1200 mm=35800m)
28	DW-N-11	Drinking Water	Network	Renewal of water pipes	1	ls	24,642,000 €	24,642,000 €	42	LTIP	Rehabilitation of the current network: 6 - Strategic pipes to be defined (Existing pipes with diameter between 100 and 1200 mm=62500m)
29	O-OM-03	Other	O&M	Other	1	ls	389,000 €	389,000 €	13	PIP	Replacement of the electrical lines in STA, SAN, SESE, SSP
30	DW-N-12	Drinking Water	Network	Equipment	1	ls	200,000 €	200,000 €	25	PIP	Hydraulic fittings for the repairs (stainless steel pipe repair clamps, couplings large tolerance, other fittings, …)
31	DW-P-01	Drinking Water	Pumping	Renewal of pumps	1	ls	825,000 €	825,000 €	20	PIP	Rehabilitation of the existing pumps (Emergency Plan)Buiucani Z3 PS + Buiucani Z4 PS + Independenta Z3 PS + Independenta Z4 PS + Treapta II a raw water

LONG TERM INVESTMENT PROGRAMME - LTIP

No.	Colonne1	Field	Sub-Cat	Type of operation	Quantity	Unit	Unit Cost	Cost	Rank	PIP or LTIP	Description
32	DW-P-02	Drinking Water	Pumping	Renewal of pumps	1	ls	1,904,000 €	1,904,000 €	41	LTIP	Rehabilitation of the existing pumps (stage 1):Ialoveni PS to Ialoveni City + U. Agrara PS + Valea Dicescu PS + Botanica PS + Telecentru Z4 PS + Telecentru Z4a PS + Schinoasa PS + STA Z3 PS + STA Z4 PS + Tohatin PS to Tohatin + Tohatin PS to Colonita + Aeroport PS + Singera PS + Stauceni PS + Treapta I raw water + Treapta II raw water
33	DW-P-03	Drinking Water	Pumping	Renewal of pumps	1	ls	297,000 €	297,000 €	42	LTIP	Rehabilitation of the existing pumps (stage 2):Ialoveni PS to Ialoveni City + Buiucani Z3 PS + Buiucani Z4 PS + U. Agrara PS + Independenta Z3 PS + Independenta Z4 PS + Botanica PS + Telecentru Z4 PS + Telecentru Z4a PS + Schinoasa PS + Tohatin PS to Tohatin + Tohatin PS to Colonita + Aeroport PS + Singera PS + Stauceni PS
34	DW-P-04	Drinking Water	Pumping	Renewal of pumps	1	ls	35,000 €	35,000 €	42	LTIP	Rehabilitation of the existing pumps (stage 3):Buiucani Z3 PS + Telecentru Z4 PS + Schinoasa PS
35	DW-T-01	Drinking Water	Treatment	Rehabilitation of the existing plant	1	ls	3,000,000 €	3,000,000 €	27	PIP	Urgent rehabilitation works including Electrochlorination plant
36	DW-T-02	Drinking Water	Treatment	Rehabilitation of the existing plant	1	ls	10,157,000 €	10,157,000 €	31	LTIP	Rehabilitation of STA: overhauling of coagulation, retroffiting of settlers, overhauling of filters and chemical plant
37	DW-T-03	Drinking Water	Treatment	Construction of new treatment facilities	1	ls	548,000 €	548,000 €	5	PIP	Treatment of the water produced from Ialoveni well field
38	DW-O-04	Drinking Water	Other	Construction of new treatment facilities	1	ls	764,000 €	764,000 €	8	PIP	Emergency Plan: Treatment of the water produced from the wells: Petrucani, Ghidighici and Baliveskii
39	DW-O-05	Drinking Water	Other	Rehabilitation/construction of well	1	ls	2,592,000 €	2,592,000 €	23	PIP	Rehabilitation of the wells for the Emergency Plan: Ialoveni(Rehab 21 wells), Ghidighici(Rehab 11 wells), Petricani(Réhab 9 wells), Balisevsc(Réhab 6 wells), New wells field(Realization 15 wells)
40	DW-O-06	Drinking Water	Other	Other	1	ls	888,000 €	888,000 €	11	PIP	Emergency plan: distribution of the water produced from the wells: Petricani PS to Zone 1 + Petricani PS to Zone 2 + Ghidighici PS + Balsevsc PS + Buiucani Z4 PS from Buiucani tanks + Ialoveni PS to Chişinau + Schinoasa PS to Z4a Telecentru + Connection Petricani PS to Transfer pipe of Doina (Zone 2)
41	DW-N-13	Drinking Water	Network	Other	1	ls	108,000 €	108,000 €	1	PIP	Adaptation of the water distribution system to the new production scheme: By-pass of SAN facilitiesNew PS from Zone 2 to TohatinNew PS from Tohatin tanks to VdVGhidighici dilution
42	DW-N-14	Drinking Water	Network	Rehabilitation of reservoir	1	ls	840,000 €	840,000 €	12	PIP	Rehabilitation of the tanks of STA Chişinau

LONG TERM INVESTMENT PROGRAMME - LTIP

No.	Colonne1	Field	Sub-Cat	Type of operation	Quantity	Unit	Unit Cost	Cost	Rank	PIP or LTIP	Description
43	DW-N-15	Drinking Water	Network	Rehabilitation of reservoir	1	ls	1,416,000 €	1,416,000 €	18	PIP	Rehabilitation of the tanks of Ialoveni + Rehabilitation of the tanks of Tohatin + Rehabilitation of the tanks of Valea Dicescu + Rehabilitation of the tanks of Ghidighici + Rehabilitation of the tanks of Telecentru + Rehabilitation of the tanks of Buiucani + Rehabilitation of the tanks of Ciocana + Rehabilitation of the tanks of Schinoasa + Rehabilitation of the tanks of Airport + Rehabilitation of the tanks of Balsevsc + Rehabilitation of the tanks of Petricani + Rehabilitation of the tanks of Codru MDK + Rehabilitation of the tanks of Colonita + Rehabilitation of the tanks of Independenta + Rehabilitation of the tanks of Sîngera + Rehabilitation of the tanks of Stauceni
44	WW-T-01	Wastewater	Treatment	Construction of new treatment facilities	1	ls	26,195,000 €	26,195,000 €	28	PIP	First phase of upgrading the WWTP for Chişinau (New pretreatment, light rehabilitation of primary settling, biological tanks and secondary clarification, separated thickening for biological excess sludge, anaerobic digestion with energy generation, sludge dewatering)
45	WW-T-02	Wastewater	Treatment	Construction of new treatment facilities	1	ls	24,046,000 €	24,046,000 €	33	LTIP	Second phase of the new WWTP for Chişinau (Biological tanks+Secondary clarifiers+Thickeners+Electrical works+Administrative building and miscellaneous works)
46	WW-T-03	Wastewater	Treatment	Construction of new treatment facilities	1	ls	16,201,000 €	16,201,000 €	32	LTIP	Third phase of the new WWTP for Chişinau (Pretreatment+Biological tanks+Secondary clarifiers+Thickeners+Sludge dewatering facility+Electrical works)
47	O-OM-01	Other	O&M	Equipment	1	ls	1,300,000 €	1,300,000 €	24	PIP	Puchase of MIS equipment
48	O-OM-02	Other	O&M	Equipment	1	ls	325,000 €	325,000 €	3	PIP	SCADA: Upgrading or renewal of the equipment for wastewater PS + SADA: Data Storage + SCADA: Implement a unique tool for data processing (Development of a specific tool or adaptation of an existing tool)
Total								**280,455,603 €**			**48**

Appendix. 3. Description & justification of the PIP

The LTIP has been prioritised into a PIP that would fit an assumed level of funding, here about EUR 60m.

The most urgent needs both within water supply and wastewater have been addressed in the PIP. The overall short-term strategy is detailed hereafter.

WATER PRODUCTION

Decommissioning of SAN

The two existing plants (SAN & STA) treating the water from the Nistru River (97% of the current productions) are globally in poor condition. No significant investment has been made on the two plants since the construction of the third phase of the main plant (STA), with the consequence that the two plants should be completely rehabilitated or reconstructed.

The first step we propose to consider in the PIP is the decommissioning of SAN. Indeed, maintaining in operation the 2 sites (SAN & STA) has two drawbacks:

- It does not secure the supply since both plants treat the water coming from the same source, the Nistru River. SAN cannot be considered as a backup facility in case of accidental pollution;
- It is more expensive than operating 1 solely site.

Furthermore, the water produced at SAN and supplied to Chişinau is as expensive as the water produced at STA (electricity and chemical expenditures are more or less equivalent for 1 cubic metre of water produced).

Regarding the CAPEX, rehabilitating two plants is also much more expensive that focusing the investment on one site only.

It is worth noticing that the whole area supplied by SAN is already connected to the main network and the hydraulic system can easily be adapted. Only the raw water pumping station located at SAN, and feeding STA, will be kept in operation.

The full rehabilitation of STA is planned in the LTIP. Within the PIP we propose to limit the investments to perform:

- Some urgent general rehabilitation works in the WTP (rehabilitation of the building where are located the filters, renewal of some hydraulic fittings, …);

- Construction of an electro-chlorination Plant to produce sodium hypochlorite used for the water disinfection. Bulk supply of sodium hypochlorite is the current method. Producing on site hypochlorite production by electrolysis will reduce the operating costs and secure the treatment.

<u>Rehabilitation of the well fields</u>

As already stressed several times in the frame of this Study, the security of supply within Chişinau is very vulnerable since the main and almost solely source of water for Chişinau is the River Nistru.

As detailed in a specific report on the water resources, mobilizing underground water resources appears to be a reliable alternative to mitigate the risk of pollution or flooding. It implies to:

- Rehabilitate the existing well fields of Ialoveni, Ghidighici, Petricani and Balisevsc;
- Create a new well field near STA.

The cumulated estimated capacity production is expected to be about 63,600m3/d. This will provides adequate water to supply Chişinau and meet about 34% of the current volume into supply and 50% of the estimated volume into supply in 2035 thanks to a reduction of water losses and a decrease of the demand.

Given the poor quality of the ground water in most of the wells fields, the production of drinking water from these sources will require the implementation of treatment facilities.

DRINKING WATER NETWORK

All the population living in the Study Area is not fully supplied with potable water. However the extension of the drinking water network operated by ACC is not included in the PIP because such investments are not the responsibility of ACC. Investing into new facilities (treatment works, pipes, PS, reservoirs) to connect new areas should be supported directly by local authorities.

<u>Adaptation to the new scheme of production</u>

The new production scheme with the decommissioning of SAN and the mobilization of underground water resources imply some modifications in the existing water supply system.

New pumps have to be installed in existing facilities (Tohatin for example) and new pipes must be laid. These investments are mainly due to:

- the water distribution between Vadul Lui Voda and Tohatin has to be adapted: by-pass of SAN, new pumping stations;
- The dilution in the reservoirs of Petricani and Ghidighici: underground water produced from Balişevschi, Ghidighici and Petricani well fields must be diluted with the water produced at STA in the storage tanks before being supplied to customers.

Pipes

Although the current network efficiency is acceptable (about 60%), taking into consideration the present economical conditions of ACC, the estimated volume of NRW represents still 89,000 m3/d, i.e. 32.5 Mm3/year. This must be improved. Furthermore, as already stressed in the assessment of the current network, the LLI is around 47m3/day/km and the mean LRI about 8repair/km/year. Those values are very high and evidence the poor condition of the network. In Western Europe, Veolia ranks urban network within the "Very Poor" category when the linear leakage index is higher than 16m3/day/km and in Bucharest the LRI observed is 5.2repair/km/year.

A programme of pipe and HSC renewals is required in order to achieve sustainable leakage reduction and to alleviate service problems for customers.

The targeted programme of pipe rehabilitation we propose to include in the PIP is based on pipe bursts analysis. Renewal usually takes precedence over repair when it represents the least cost option assessed on the whole lifespan. Our analysis shows that the most brittle pipes are: i) pipes made of steel with a Nominal Diameter between 100 and 400 mm (especially ND150 and ND200); and ii) pipes made of iron with a Nominal Diameter between 100 and 200 mm (around 17% of total length and of total repairs).

In order to significantly and quickly reduce the physical losses, we propose an ambitious programme, particularly during the next five years, with the replacement of 190 km of pipes (mainly steel pipes with ND between 100 and 200). The exact location of the pipes to be replaced will be based on the statistical analysis of the georeferenced leakages, using the GIS.

It has to be noted that the programme should be adapted taking into consideration other parameters, as the programme of road rehabilitation undertaken by the Municipality. When renovating a road, it might be interesting to replace the pipes as well. Strategic pipes might be also added to our programme because of the consequences a burst may cause.

When renewing the pipe, we propose to rehabilitate also the HSC. We include about 3,270 connections in the PIP, which correspond to the connections for blocks. HSC for individual houses or industrials should be replaced at the same time but it will be charged to the customer as those connections are not ACC property.

The implementation of this PIP will result in a drop of the number of intervention, from 14,000 to 8,600 (-39%). The volume of water wasted by losses will also decrease by 30%.

In addition, we expect energy savings (less water to pump) and also an improvement of the water quality (the risk of contamination will be reduced).

Pressure reduction

Another mean to reduce the physical water losses is to optimize the management of the pressure. By reducing the pressure, the water lost for each existing leak is reduced, and the number of new leaks drops. Several solutions have been studied:

- Change the pressure set at the outlet of the pumping stations;
- Isolate a part of the network and supply it by a pressure Zone with a lower piezometry;
- Isolate a part of the network and install a pressure reducer.

The implementation of a EUR 302,000 capital investment programme, mainly consisting in installing some pressure reducers, new valves, pressure sensors, flow meters and boosters, will reduce the physical losses by 10%.

Reservoirs

We assessed the cumulated storage capacity of the existing reservoirs sufficient to secure the supply against emergency situation. It represents about 168,000 m3; i.e. 70% of the daily peak water demand.

Although there is no need to increase this storage capacity by constructing new service reservoirs, some of the existing reservoirs must be rehabilitated within the PIP because of their poor structural condition. It concerns 17 sites.

In addition, we propose also to decommission 3 reservoirs (cumulated capacity ~8,000 m3). They are too expensive to rehabilitate and do not contribute to the objective: maintaining a storage capacity higher than 50% of the peak demand over the next 25 years per hydraulic entity.

Operating mode of reservoirs must be optimized (flow balancing) to take into account the new tariff structure for electricity, which should result in energy savings.

Pumping Stations

The current pumping stations are rather well operated by ACC, but some of them are proposed to be rehabilitated. New pumps with better efficiency will lead to significant energy savings.

The first step of our analysis consisted in identifying the PS worth rehabilitating.

Then we have looked which PS should be shutdown to fit with the new production scheme (decommission of STA, …).

The PS proposed to be rehabilitated within the PIP are listed in the table below.

Table 10: Water Pumping Stations to be Rehabilitated

Pumping Station	% of the total current consumption of energy	Energy savings per year	Estimated savings per year
Treapta II a raw water	20.0 %	1,021,343 kWh/y	1,370,000 MDL
Buiucani Z3 & Z4 PS	2.6 %	615,622 kWh/y	822,000 MDL
Independenta Z3 & Z4 PS	4.4 %	640,964 kWh/y	856,000 MDL
Total	**27.0%**	**2,277,929 kWh/y**	**3,048,000 MDL**

As shown on the above table, these subprojects result not only in operational expenditures savings for ACC but also in reduction of energy consumption, which is in benefit to the Environment.

Telemetry System and Control

Introducing a phased programme for telemetry monitoring and control is part of the PIP.

The existing SCADA systems used by ACC are operational and work properly. We recommend to develop it. ACC should pursue their investments for the equipment of remote transmission.

To significantly improve the current situation, we advise ACC to choose a unique tool for data processing.

WASTEWATER COLLECTION NETWORK

In the wastewater field, sewage collection is only available in parts of the study area.

However, extension of the wastewater collection network is not included in the PIP for the following reasons:

- Investing into new facilities to connect new areas are not under the direct responsibility of ACC, but should be supported by local authorities;
- Inside Chişinau city, some areas are missing the wastewater collection system, but these areas will be known only once the GIS is finished.

The investment considered in the PIP are the ones that

- Improve the operational efficiency of ACC, and guaranty the safety of the workers;
- With a small investment have a high return rate and lead to energy savings;
- Channel the pollution to the WWTP.

Sewers

The wastewater collection system is known to be in a poor condition with blockages, broken pipe and other deficiencies. However, over the past few years, a very few rehabilitation works have been done as no substantial funding has been available for their launch.

But the need for rehabilitation and/or replacement is evident. It will improve the structural stability of the network and limit the risks of breakage or collapse.

While the overall requirements exceed the financing of the first phase, an allocation is essential to initiate improvements in the most pressing sections of the network. In close collaboration with the operation sectors chiefs a list of “urgent rehabilitation” has been defined. ACC staff had chosen the pipes to be rehabilitated based on their detailed knowledge and expertise only (no thorough CCTV inspection has been performed). However, ACC has a very good empirical knowledge of its system. Many operational and structural reasons confirm the rehabilitation choices.

In the PIP, replacement of about 15 km of sewers is considered.

Pumping Stations

The investments for the WW PS we propose within the PIP aim to reduce the energy consumption, therefore realise savings by replacing some existing pumps.

The 9 pumps concerned are listed in the table below.

Table 11: Wastewater Pumping Stations for Rehabilitation

Pumping Station	Pump No.	Estimated energy savings	Estimated savings per year
Vatra	1	52,993 kWh/y	70,967 MDL
Vatra	2	40,259 kWh/y	53,914 MDL
Codru	2	29,935 kWh/y	40,088 MDL
Codru	1	21,413 kWh/y	28,675 MDL
Codru	3	21,413 kWh/y	28,675 MDL
Vieru	2	32,991 kWh/y	44,181 MDL
Vieru	1	26,381 kWh/y	35,329 MDL
V. Lupu	1	13,816 kWh/y	18,502 MDL
Vatra	3	23,832 kWh/y	31,915 MDL
Total		**263,033 kWh/y**	**352,246 MDL**

In addition to the above stations that are installed on the sewerage network, we also propose to include in the PIP the replacement of the pumps installed at the inlet pumping station of the WWTP. They are oversized and should be replaced by equipment adapted to the actual needs. It is worth reminding that these pumps consume about 70% of the total consumption of the wastewater collection system. The saving expected is about 3.5 MLeu/year (218,000€/year) and the consumption of electricity should decrease by 60%. The time of return on investment is lower than 2 years, which is very low considering the forecasted lifetime of this type of equipment (20-30 years).

Telemetry System and Control

Proposals for WW PS are the same as for the drinking water: development of the remote control system (SCADA) and upgrade of data storage and processing, utilizing the same system for both DW and WW.

WASTEWATER TREATMENT AND SLUDGE MANAGEMENT

Chişinau WWTP suffers from the lack of investment over the past decades. The major issue at the works is the odour that emanates from the site, due mainly to poor sludge management. In addition to this odours issue, the structural condition of the plant is very poor and the process performance and quality of the final effluent should be improved.

The full rehabilitation of the existing structures of Chişinau WWTP is not a good option either economically or technically due to the advanced damage of the works and to the future treatment requirements (compliance with the EU standards on N<10 mg/L and P<1 mg/L for a sensitive receiving body as the Bic River and expected increase of the load received in the future).

Therefore a new plant will have to be built. But this requires massive investments (more than 50 M€). This cannot be included in the PIP but will be considered in the long-term strategy for wastewater treatment and sludge disposal.

However solutions must be found in order to secure the good operation of the existing WWTP in the medium term horizon until the construction of the new WWTP. Particular efforts should be made to reduce odours.

The new facilities we propose to construct during the PIP must be designed in such a way that they can be easily integrated into the future WWTP. Actually, the PIP component for the WWTP constitutes the first step of the long-term implementation. It includes the following:

- Construction of new pre-treatment facilities:
    - New pump building (inlet chamber, by-pass, coarse screens, pumps);
    - Fine screens;
    - Sand and grease removal tanks.
- Light rehabilitation of primary settling, biological tanks and secondary clarification;
- Implementation of separated thickening for biological excess sludge;
- Implementation of sludge dewatering: installation of centrifuges;
- Construction of digesters for an anaerobic digestion with energy generation;
- Upgrading of the electrical works.

Optimizing the pre-treatment, dewatering and anaerobic digestion of the sludge are efficient solutions to reduce significantly the unacceptable odour emanating from the site.

Dewatering and digesting the sludge will allow to: i) achieve higher reduction in sludge volume by eliminating 1/3 of the dry solids; ii) stabilize the sludge (today the sludge are not stabilized which is one of the source of odour); iii) to produce biogas that would cover more than 50% of the energy production of the WWTP (inclusive of the upstream pumping station).

Before implementing a long-term and sustainable sludge disposal strategy (agriculture use or landfilling), we propose to continue to store dehydrated sludge in the recently built dumping site nearby the plant. It is worth pointing out that installing centrifuges will extend its lifetime from 4 years to 6 years.

INVESTMENTS AIMED AT IMPROVING OPERATION PERFORMANCE

It is important, with the improvement of the water supply and wastewater systems, to consider appropriate investments aimed at improving the ACC operational performance.

Together with the introduction within ACC of best practices for network operation, investments for the modernization of the O&M equipment should be done. Currently, ACC is poorly equipped: the overall fleet of vehicles is old and not very efficient. Their productivity is low compared with modern vehicles. Their maintenance costs are high due in particular to a very high consumption of fuel.

The provision of operation and maintenance equipment provides vital support to the company in undertaking maintenance and repair work and must be included in the PIP. The needs have been identified jointly with ACC.

O&M investments for drinking water supply system:

Considering the age of the current equipment within ACC, and their inadequacy to a performing service, we recommend a massive investment in new equipment including small Truck 5-10T, public works machinery and equipment, safety equipment, excavators, trucks and leak detection equipment for 2 teams.

O&M investments for wastewater collection system:

We propose to equip ACC with operating equipment for preventive actions in order to reduce significantly the number of interventions. Today, there are about 30interventions/km/year. In comparison this KPI is about 7int/km/y today in Bucharest.

It will also make the daily intervention on the network simpler and safer.

Our proposal includes vehicles, 2 big hydro-cleaning trucks and 5 small jet units on trailer (1 per team), 1 CCTV truck and 5 quick view, 1 smoke generator and general intervention equipment.

O&M investments for the improvement of ACC operational staff safety

By international standards, there are some aspects within ACC that should be improved regarding the safety issues. That is considered as a top priority.

Therefore, the PIP we propose includes some measures aiming to improve security for ACC staff:

- Installation of Plexiglas protection in front of the electrical panel of all WW PS;
- Electrical optimization : installation of new electrical panels for all the WW PS;
- Purchase safety equipment.