Modernization of local public services in the Republic of Moldova

- Intervention area 2: Regional planning and programming -

Feasibility study

for the project 'Improving water supply and wastewater services in the town of Ungheni, localities of Zagarancea, Semeni and Petresti'

Final report

December 2015

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Acronyms and abbreviations

ADA	Austrian Development Agency
AMAC	Association “Moldova Apa-Canal”
ANRE	National Agency for Energy Regulation
ASAD	Active Sludge Aeration Tanks
ATU	Autonomous Territorial Unit
BAU	Business as Usual
BOD	Biochemical Oxygen Demand
CBA	Cost-Benefit Analysis
CCTV	Closed-circuit television
CNAS	National Social Insurance House (Casa Națională de Asigurări Sociale)
COD	Chemical Oxygen Demand
CzDA	Czech Development Agency
DMA	District Metering Area (zone for active leakage control)
DR	Development Region
DRC	Development Region Centre
DRN	Development Region North
DRS	Development Region South
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
EIM	Environmental Impact Assessment
ENPV	Economic Net Present Value
ERR	Economic Rate of Return
ESA	Environmental and Social Assessment
EU	European Union
EUR	Euro- official currency of the European Union's member states
FFE	Foreign Funded Enterprises
FIDIC	Fédération Internationale des Ingénieurs Conseils (frz.) - International Federation of Consulting Engineers (engl.)
FNPV(C)	Financial Net Present Value of the Investment
FNPV(K)	Financial Net Present Value of the Capital
FOPIP	Financial and Operational Performance Improvement Programme
FRR(C)	Financial Rate of Return of the Investment
FRR(K)	Financial Rate of Return of the Capital
FS	Feasibility Study
GD	Government Decision
GDP	Gross Domestic Product
GIZ	German Development Cooperation through Deutsche Gesellschaft für Internationale Zusammenarbeit
GPS	Global Positioning System
HDPE	High-density polyethylene
IFA	International Financing Agency
IFI	International Financial Institution
IFO	Institute of Financial Operations
IIC	International Insurance Company
IMF	International Monetary Fund
IPE	Individual Private Enterprise
IRR	Internal rate of return
IWA	International Water Association
JSC	Joint Stock Company
KfW	Kreditanstalt für Wiederaufbau (KfW German Bank for Development)

LGA	Local Government Association
LIP	Long-Term Investment Programme
LPA	Local Public Administration
LT	Long term
Ltd.	Limited Liability Company
MBBR	Moving Bed Biofilm Reactor
MDL	Moldovan Lei
ME	Municipal Enterprise
MLPS	Modernization of Local Public Services
MoE	Ministry of Environment
MRDC	Ministry of Regional Development and Construction
MT	Medium term
MWWPS	Main Waste Water Pumping Station
n/a	Not available
n/f	Not functional
NBS	National Bureau of Statistics
NDS	National Development Strategy
NEF	National Ecological Fund
NFRD	National Fund for Regional Development
NHIC	National Health Insurance Company
NIF	Neighbourhood Investment Fund
NIS	Network Information System
NP	Nominal Pressure
NPV	Net present value
NRW	Non-Revenue Water
OD	Outside Diameter (of pipe)
PAAS	Water Supply and Sanitation Plan
PAI	Project Area of Influence
PE	Population Equivalent
PE60	Population Equivalent based on 60 g BOD/capita/day
PH	Phase
PIP	Priority Investment Programme/Plan
PIU	Project Implementation Unit
PP	Poly-propylene
PPC	Possible Project Concept
PPP	Public-Private Partnerships
PS/WPS/WSPS	Water (Supply) Pumping Station
PVC	Polyvinyl chloride
PWG	Project Working Group
Qdmax	Maximum daily dry weather flow
QDWF	Maximum hourly dry weather flow
QSWF	Maximum hourly storm water flow
RDA	Regional Development Agency
RDS	Regional Development Strategy
RM	Republic of Moldova
ROA	Return on Assets
ROC	Regional Operating Company
ROE	Return on Equity
RPP	Regional Planning and Programming
RSP	Regional Sector Programme
RtG	”Ready-to-go” Project

SCADA	Supervisory Control and Data Acquisition
SDI	State Design Institute
SEE	State Ecological Expertise
SEI	State Ecological Inspectorate
SGAP	Social and Gender Action Plan
SN	Sewerage network
SNiP	Norms and Rules in Construction
SoE	State-owned Enterprise
ST	Short term
TA	Technical Assistance
TC	Trading company
TP/WTP	Water Treatment Plant
USAID	United States Agency for International Development
VAT	Value-Added Tax
VPC	Viable Project Concept
WB	Word Bank
WDS	Water distribution networks
WSS	Water Supply and Sanitation
WT	Water Tower
WWPS	Waste Water Pumping Station
WWTP	Waste Water Treatment Plant

Glossary

The main definitions used in this document are following:

Aquifer – underground layer of rock or other types of geological layers with a porosity and permeability able to allow a significant the flow of underground water or to capture significant quantities of underground water.

Water transmission main – a part of water supply system, comprising pipelines included between water intake and public transportation or distribution networks.

Agglomeration –an area where the population and/or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to an urban waste water treatment plant or to a final discharge point *(definition according to Directive 91/271/EEC)*.

Water supply – overall activities and works carried out with the aim to capture treat, transport, store and distribute drinking water to the final consumers.

Raw water – Intake water before any treatment or use.

Water sold – authorised water consumption which is billed and generate revenue (also known as revenue water). It is equal to billed and metered water consumption plus the billed unmetered water consumption.

Non-revenue water (NRW) – is the difference between the total system input volumes of water and the billed authorised water consumption. **Drinking water** –water intended for human consumption, to be used directly or indirectly, for a long period of time without affecting negatively the health, which is as follows:

- All water either in its original state or after treatment, intended for drinking, cooking, food preparation or other domestic purposes, regardless of its origin and whether it is supplied from a distribution network, from a tanker, or in bottles or containers;
- All water used in any food-production undertaking for the manufacture, processing, preservation or marketing of products or substances intended for human consumption, unless the Ministry of Health and Ministry of Agriculture and Food Industry approved the use of water for technological purposes, showing that water used do not affect the quality and wholesomeness of the food stuff in their ready to use condition/state;
- Water from local sources, such as wells, springs, etc., used for drinking, cooking meals or other domestic purposes.

Treated water – water that is intended for human consumption and use, considered to be free of toxic substances and pathogenic bacteria, cysts and viruses; good drinking water that has been or will be further treated in order to improve the aesthetic quality and/ or reducing the content of undesirable minerals and other substances known or unknown, by one or more water treatment processes on the site where it is used.

Surface water – still water and flow water having contact with the soil surface.

Storm water – is pure rainwater plus anything the rain carries along with it and snow melting.

Groundwater – waters below the soil surface, in the zone of saturation and in contact with the soil or the subsoil.

Industrial wastewater – any waste water which is discharged from premises used for carrying on any trade or industry, other than domestic wastewater and run-off rain water.

Domestic wastewater – waste water from residential settlements and services which originates predominantly from the human metabolism and from household activities (definition according to EU Directive 91/271/EEC).

Urban wastewater – means domestic waste water or the mixture of domestic waste water with industrial waste water and/or run-off rain water.

Wastewater –waters that come from domestic, social and economic activities, containing pollutants or residues, this water being adversely affected in quality by anthropogenic influence, the physical, chemical and bacteriological baseline being changed.

Water service connection – a segment of the public water supply network, which provide the link between the water distribution network and internal piping of the buildings.

Service connection – the realisation by the operator of public water supply and sewerage networks of a permanent connection of the consumer's water and / or sewage facility to public water supply and / or sewerage networks.

Water tower – an elevated structure supporting a water tank constructed at a height sufficient to pressurise a water supply system for the distribution of drinking water, and to provide emergency storage for fire protection. The water tower is composed of a metal, reinforced concrete or varied shape bricks reservoir (usual spherical one) and pillar for support.

Manhole – underground construction designed for the protection and access to the flow control valve for water, drain, ventilation, etc.

Concentration – mass-volume ratio of the total volume of wastewater discharged within a certain timeframe.

Pipeline – assembly of pipes, by means of which the water is transported.

Pressure pipe – rising pipe for transportation under pressure of water or wastewater.

P.E. (population equivalent) - means the organic biodegradable load having a five-day biochemical oxygen demand (BOD5) of 60 g of oxygen per day

Consumer – person or organisation that uses water supply and wastewater services or commodities according to a contract with the operator.

Biochemical oxygen demand (BOD) – is the amount of dissolved oxygen needed (i. e., demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period or the concentration of dissolved oxygen, in the given conditions (t days at 20 degrees Celsius with or without nitrification inhibition) by biological oxidation of organic material and / or inorganic water.

Chemical oxygen demand (COD) – the concentration of the oxygen required to oxidise soluble and particulate organic matter in water.

Water quality indicators –pollutants values, based on scientific researches, developed and updated by competent national authority. The concentration criteria and recommended values, or narrative descriptions that should not be exceeded for a water body to protect aquatic life or human health. **Volume of water/water flow rate** – is the volume of fluid which passes through cross-section pipe within a unit time.

Biological treatment – the biological treatment of wastewater using a biological process with a secondary settlement or another process, which complies with actual national standards.

Mechanical treatment – treatment of waste water by means of a physical process and/or chemical process, involving settlement of suspended solids or other processes in which the BOD_5 of the influent wastewater is reduced by at least 20%, and suspended solids at least 50%.

Tertiary treatment (advanced) – treatment process which results in a more advanced treatment than that obtained by mechanical and biological wastewater treatment or it is the additional process designed to improve the quality of purified water so that it can be discharged into the natural environment or re-used.

Septic tank – is an underground reservoir designed for wastewater obtained from a household. Bacteria from wastewater decompose organic waste and sludge deposits on the bottom of the tank. The effluent flows into the soil through the drainage channels.

Drinking water supplier – business entity, which supply drinking water to consumer on a centralised basis.

Spring – the place where the underground water, meeting the hydrogeological favourable conditions, is brought to the ground surface (if the water carrying permeable water bed which ends top-down at the ground level on an impermeable bed, the water bed can only reach the surface to form springs).

Underground dam – a watercourse (lake) embanked by a dam, levee, dam or other barrier. It is used for collecting and storing water to a future use.

Suspended solids (SS) – the concentration of solids in a liquid, usually determined by filtering or centrifuging and then drying under specified conditions.

Groundwater level – level under which the soil is saturated with water.

Real water consumption (specific water flow rate) – the volume of water consumed by one customer during 24 hours to meet the physiological and domestic needs under normal and exceptional operation conditions of the water supply system (l/c/d).

Sanitary and hygienic (quality) standards for drinking water – physical-chemical, microbiological and organoleptic indicators which drinking water must meet in order to endanger the health consumption; indicators are established in sanitations rules and standards approved by the Government.

Operator – a legal person operating and maintaining a public water supply and/or sanitation system providing the consumers with public water supply and/or wastewater services based on a direct contract.

Sludge - means residual sludge, whether treated or untreated, from urban waste water treatment plants.

Sludge dewatering - drying and sludge dewatering structure by removing water and evaporating it.

Apparent (water) losses/commercial losses - including all types of errors associated with consumer metering and data processing errors (meter reading and billing), plus unauthorised consumption (theft or illegal use).

Water loss - is a quantity of water, which leaks from installations or network because of poor tightness of pipe joints, emergencies and etc. Determinative factors are: pres-

sure, deteriorated conduits, low quality of pipes materials and execution, soil characteristics, traffic loads, corrosion of pipelines (due to vagabond electric current), grade and type of measurement.

Real (water) losses/physical losses - involving leaks and spills from tanks/reservoirs, losses related to pipe connections up to counter and water transport and distribution pipes leaking up to the consumer's meter.

Water supply and sanitation program (WSSP) - is a document planning investments for the long term development of the water supply and sanitation infrastructure, worked out for a specific region, rayon or locality (municipality, city, village, commune), so as to perfectly fit the existing systems as well as the funds and constraints related to the local water sources and the provisions of the law in force. **Water intake structure** - all construction structures and facilities which serve for the introduction of the necessary volume of water in the water transmission main (abstracted from a river, lake, reservoir, etc.) with the purpose of water supply or irrigation.

Sewer connections – sewer collector provides the connection between the indoor consumer sewer facility and public sewer collector.

Water resources - sources of water that are useful or potentially useful including surface waters, ground water and atmospheric precipitations/rainfall **Sewerage network** - a system of underground pipelines and additional structures collecting and transporting urban and/or industrial wastewater.

Water distribution network - created from pipelines, armature and other structures which supplies water to consumers. It is the most expensive facility/object, because of lengths, service works and water losses.

Underground water reservoir - storage of water volume needed to: compensate the consumption per hour, emergency reserves and reserves required for firefighting.

Water supply system – a set of constructions and sites, operating installations/facilities, and specific endowments, by which the water captured from a natural source is treated, transported, stored and distributed to the consumers based on a stable pressure, according to the quantity and qualify norms in force.

Wastewater system– a number of structures and facilities, networks, pumping stations, wastewater treatment plants etc. by which the evacuation, transportation, treatment and disinfection of wastewater and sludge management is carried out. Treated and disinfected wastewater is discharged into a water stream or other natural water body.

Drilled or shallow well - underground water intake construction/structure, which main dimension is developed by vertical line, aiming to reach the ground water resources; structure or installation/facility used with the purpose to obtain groundwater from an aquifer for an advantageous use.

Water quality standard - concentrations/ maximum admissible values recommended or mandatory for chemicals and microorganisms in drinking water. These amounts are established for the water used by municipalities (provided by public water supply systems), industrial and agricultural enterprises and entertainment areas.

Wastewater treatment plant - consisting of all wastewater treatment installations; their size and form varies according to the adopted methods of treatment; mechanical treatment consists in removing of suspended solids by physical processes from wastewater; the biological treatment uses the activities of microorganisms to oxidise and mineralise the organic substances in wastewater, which previously was subjected

to a mechanical treatment **Water pumping station** - to ensure on demand the required pressure in the distribution network.

Wastewater pumping stations –the pumping stations to be provided and designed in cases when configuration of the relief does not give possibility to collect and transport wastewater gravitationally. In such cases wastewater is pumped by pressure pipelines.

Water treatment plant - used for enhancing the quality of raw water from the river to the water quality criteria necessary for human consumption.

Water supply source - water natural resource (surface water, groundwater, etc.) to be used (or could be used) with the purpose to abstract water in the water supply system.

Sludge Treatment - all stages of transformation of sludge with the purpose to be used or disposed which could include thickening, stabilizing, conditioning, thermal hydrolysis, dewatering, drying, disinfection, sludge incineration.

Pipe – unit/piece in the cylindrical form, hollow in interior, made of metal, plastic, etc. and used for the distribution and transport of water and wastewater.

Sanitary protection area – unique territory, which includes water sources, constructions and water supply installations/facilities for water protection.

Executive summary

Since 2010, the Modernization of Local Public Services Project (MLPS), acting on mutual agreement between Moldovan and German governments, has supported Moldovan Local Public Authorities (LPAs) in extending and modernizing service provision in water supply and sanitation, solid waste management, regional and local roads, and energy efficiency of public buildings sectors.

The MLPS Project has the objective to improve the local public service delivery by local planning and programming, improving local public services infrastructure, capacity development of local public administration and local public service providers. As part of a major planning and programming program, MLPS committed to facilitate the development of pipeline of feasible, cost-effective investment projects in the aforementioned sectors.

This Feasibility Study (FS) Report proposes a structured phasing of the **Priority Investment Programme (PIP)** and creating necessary conditions for further implementation of the PIP in **Ungheni Rayon**. The FS particularly focuses on implementation of the first phase of the PIP, covering period of 2015-2018 and further named **the Project**.

The PIP covers the area of the town of Ungheni as well as the localities Zagarancea, Semeni and Petresti . The Project includes the town of Ungheni only.

Main beneficiaries of this study are the inhabitants from the above-mentioned localities, which will have access to improved Water Supply and Sanitation (WSS) services

Problem statement and Objective

The following major problems to be addressed in this feasibility study were identified during the preliminary project phases:

- Insufficient area coverage of the WSS services. While most of the town of Ungheni and localities benefit from water supply, the wastewater services are provided only to a limited urban area;
- Unsatisfactory levels of service, including:
    - Continuity of water and wastewater services. Although central part of Ungheni Town is continuously provided with water, some marginalized parts of the town have often interruptions supply due to bursts, leakages and insufficient network pressure. Certain parts of the town continuously suffer of sewer blockages.

As for the operational efficiency, the main problems encountered by the company are, as follows:

- High non-revenue water (NRW) ratio. Increased level of NRW results (around 37% in 2015) results in higher energy consumption for water pumping and consequently increased water tariffs;
- High staff efficiency ratio, as a result of inefficient operation of facilities and overstaffing of the utility;
- Poor asset management and lack of preventive maintenance, resulting in obsolete pipelines and facilities.

The **objective** of the present feasibility study is the development of an affordable, least-cost and cost-effective phased investment program for water and wastewater infrastructure to be rehabilitated and extended, as well as facilitation of regionalization of the WSS services.

The aim of the PIP is to extend the coverage and connection rates of the population connected to the regionalized water supply services by 14% from 86% to 100% of coverage rate and by 14% from 69% to 83% of connection rate, as well as increase of coverage and connection rates to wastewater services by 31% from 65% to 96% of coverage rate and by 19% from 44% to 63% of connection rate.

The aim of the first phase (the Project, 2015-2018) for the town of Ungheni is to extend the access of the population to the water supply services by 2% from 98% to 100% of coverage rate and by 2% from 79% to 81% of connection rate, as well as increase of coverage and connection rates to wastewater services by 4% from 78% to 82% of coverage rate and by 2% from 53% to 55% of connection rate.

Legal aspects

In the process of regulating and developing the water supply and wastewater services sector the competences belong to the central public authorities, while the establishment, organization and management of these services is the responsibility of local authorities and operators of public water supply and wastewater services.

The main sector policy document, Strategy for Water Supply and Sanitation (2014-2028) includes new approaches on structuring, financial planning and project identification, on which should be based sector development and institutional reforms in the sector in order to overcome excessive through regionalization.

"Regionalization" is the main aspect of the development policy of the water supply and wastewater services sector. This policy aims to improve sector performance through better management and professionalism, and benefiting from economies of scale as well.

Currently, the public water supply and wastewater services are organized and operated in the town of Ungheni by Municipal Enterprise ‘Apa – Canal’ Ungheni whose sole founder is Ungheni Local Council. The enterprise provides water supply and wastewater services within the town of Ungheni and within the localities of Semeni and Zagarancea from commune of Zagarancea as well. The Municipal Enterprise ‘Servicom – Petresti’, whose sole founder is Petresti Local Council, is the provider for water supply service within the commune of Petresti.

Taking into consideration the national WSS and the positive aspects of regionalization of WSS public services learnt from international experience, it is recommended to promote the joint operation of the service and development of the services and infrastructure projects. This policy was supported unanimously by the local authorities in all administrative units: Ungheni, Zagarancea and Petresti.

The institutional model of regionalization of water supply and wastewater public services in Ungheni Rayon, developed under the current legislation, comprises two key elements:

- Regional Operator;
- Delegated management contract which regulates the relationship between regional operator and local authorities.

Regionalization of water supply and wastewater services will involve the extension of service areas in all localities included in the feasibility study, initially in the urban areas, and afterwards in the rural areas. The establishment of the regional operator, through reorganization of the Municipal Enterprise 'Apa–Canal' Ungheni, will require significant changes in its organizational structure in order to cover the increasing demands of expanding service area.

Technical aspects and investment program

The Investment Program includes

- Short-term;
- Medium-term;
- Long-term measures.

The short-term measures are referred to as Priority Investment Measures and are again sub-divided into two sub-phases as follows:

- Phase 1 – priority measures to be implemented until 2018;
- Phase 2 – priority measures to be implemented between 2018 and 2021 (depending on the availability of funds and the capacity of the implementing and operating agency this period might be extended).

Priority investment measures retained in Phase 1 are referred to as "The Project" for which further assessments have been carried out in this study (Option Analysis, Financial Analysis, Environmental Assessment, etc.).

Investment framework

Water Supply:

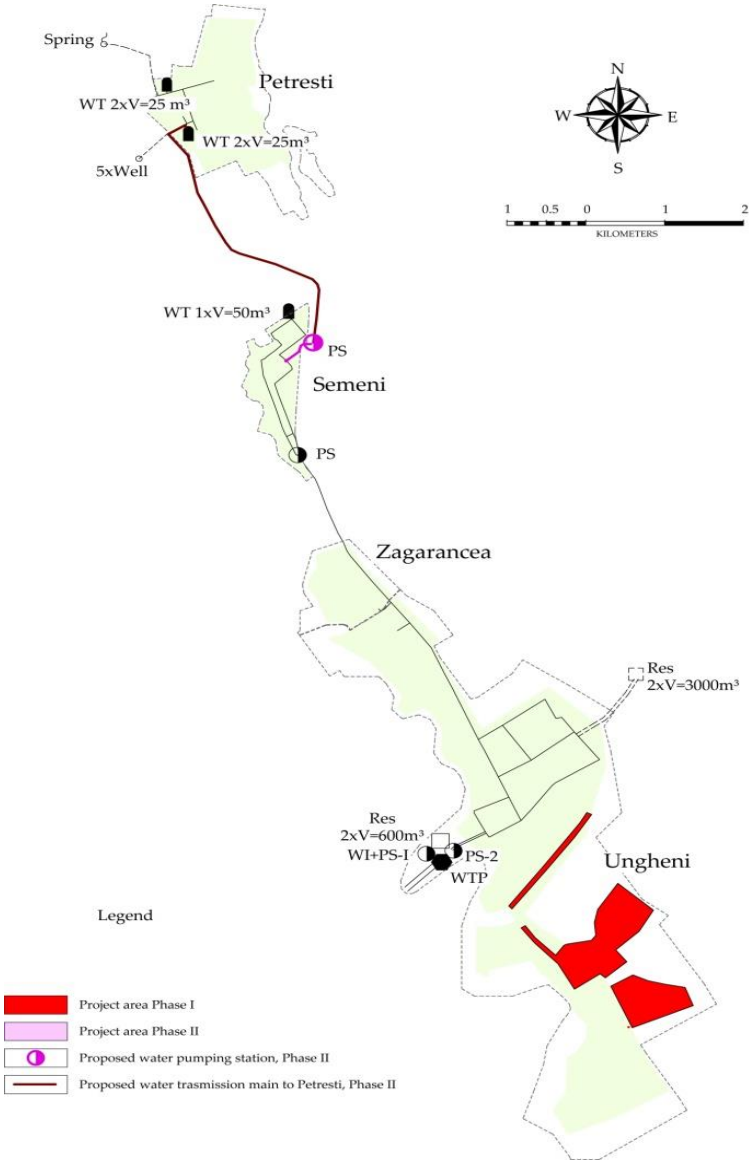
Currently there are 30,269 inhabitants (79% connection rate) in Ungheni Town and 1,614 people (83% connection rate) in the locality of Zagarancea are supplied with water from the existing water supply system of ME 'Apa-Canal' Ungheni.

Further, an extension of the water supply network of Ungheni Town to the locality of Semeni is in progress (ongoing construction works). The locality of Petresti (2,411 consumers in 2014, 63% connection rate) is currently not connected to the water supply system of Ungheni Town but supplied through its own water source (well and spring). Currently there is no supply shortage in the service area of ME 'Apa-Canal' Ungheni but the water supply network is in poor condition and its rehabilitation is urgently needed. The water quality in Petresti Locality is not compliant with the national standards (high nitrate concentration) and therefore it is proposed to connect this locality to the water supply system of Ungheni Town, which has sufficient capacities to provide water with compliant quality.

The investment measures proposed within the framework of this study include inter alia the rehabilitation and extension of the distribution network in Ungheni Town and connection of the water supply system of Petresti to the water supply system in Ungheni Town (transmission main and pumping station). These measures are consistent with the long-term infrastructure development plans ("no-regret measures"). The proposed measures would increase the water supply connection rate in Ungheni Town from currently 79% (population of 30,269) to 81% (population of 31,005) in 2018 (after imple-

mentation of Phase 1) and to 85% (population of 32,937) in 2021 (after implementation of Phase 2)[1].

Figure 0-1: Scheme of proposed extensions of the water supply system in the town of Ungheni and the localities of Zagarancea, Semeni and Petresti



Source: GIZ/MLPS

Wastewater:

Currently only Ungheni Town is partly endowed with an existing wastewater system, while in the other three localities no wastewater system exists. In Ungheni Town, about 20,433 people (53% connection rate) are currently connected to the sewerage network. The localities of Zagarancea (1,956 inhabitants in 2014), Semeni (1,986 inhabitants in

[1] The coverage rate would be 100% in 2018 but it is assumed that only part of the customers will connect immediately after project implementation while the connection rate will gradually increase until the end of the planning horizon.

2014) and Petresti (3,855 inhabitants in 2014) are planned to be connected to the wastewater system of Ungheni Town.

In Ungheni Town an extension of the sewerage network of about 46.5 km[2] is proposed in order to increase the coverage rate from currently 78% to 99% and the connection rate from 53% to 66% until the year 2021[3]. Further, rehabilitation of about 20 km sewerage network is proposed due to the frequent emergency cases in the existing sewerage network. Additionally, the pressure mains between the main wastewater pumping station (MWWPS) in the town centre and the existing WWTP in Valea Mare have to be replaced (20.4 km). In the three localities of Zagarancea, Semeni and Petresti an extension of the sewerage network of about 45.3 km[4] is proposed to increase the sewer connection rate to 49% in average.

Wastewater load generated in Ungheni Town and the three localities in the vicinity of the town is projected to increase from currently 23,086 P.E. to 47,229 P.E. in 2045. A preliminary analysis reveals that connection of all three localities to the WWTP in Ungheni Town would be the least cost option. The existing WWTP shall be abandoned and a new WWTP with a capacity of 43,661 P.E[5]. would be necessary to treat wastewater volume projected for Ungheni Town and the three localities in the year 2030. In order to avoid overcapacities, a staged approach for developing the capacities of the WWTP in Ungheni is recommended. A thorough agglomeration study (proposed to be included in Phase 1 of this project) has to be carried out for the entire rayon in order to assess which localities should be connected to the WWTP in the rayon town in the future.

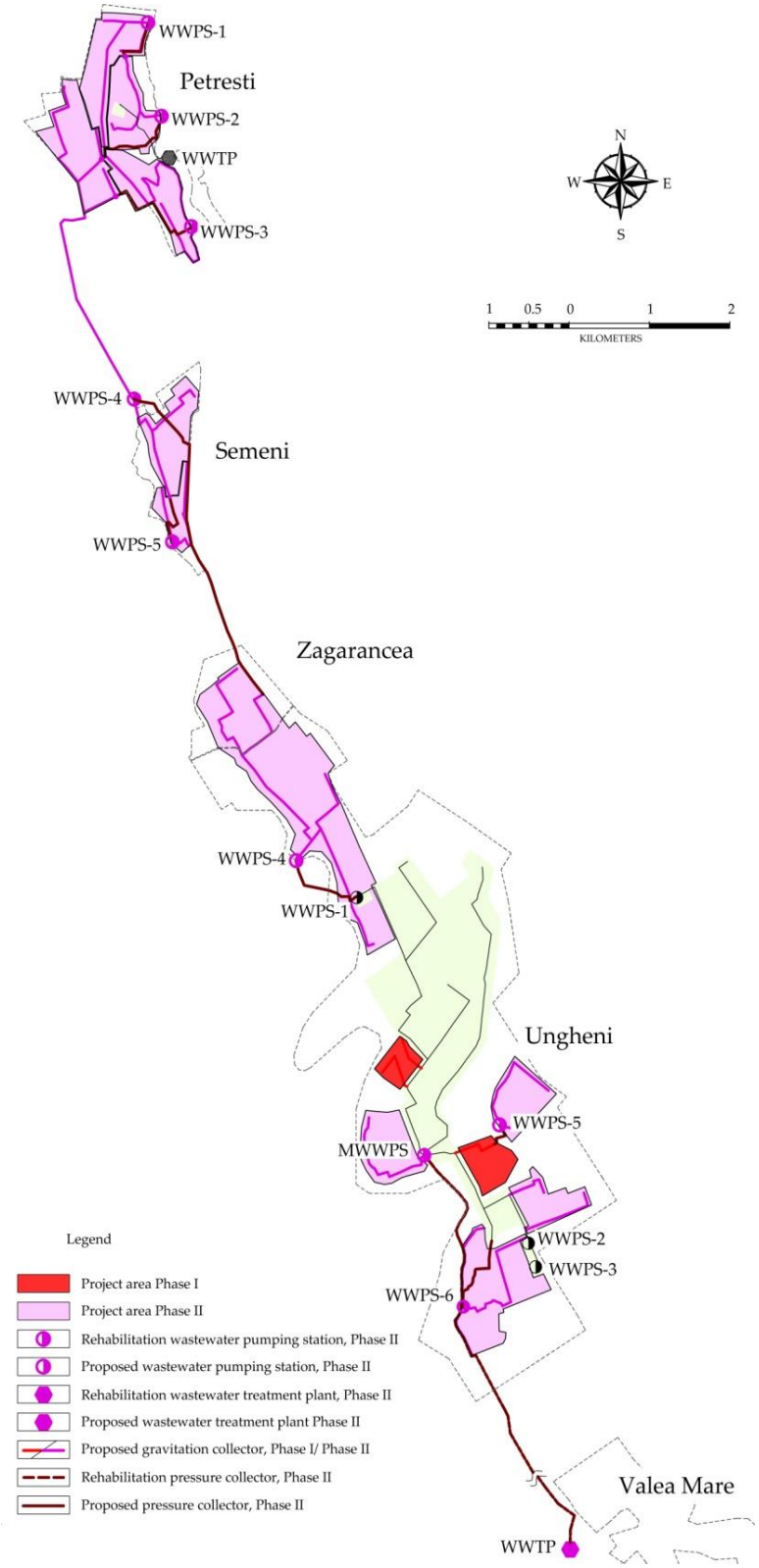
[2] Including pressure sewers

[3] After implementation of Phase 2 of the proposed project measures

[4] Including pressure sewers

[5] Tentative estimation capacity for the purpose of cost estimation.

Figure 0-2: Scheme of proposed extensions of the wastewater system in the town of Ungheni and the localities of Zagarancea, Semeni and Petresti



Source: GIZ/MLPS

Priority Investment Plan:

The proposed Priority Investment Plan for Phase 1 and Phase 2 including capital investments, equipment and technical assistance as well as the benefit of the proposed measures is presented in the table below. The total cost for the measures in Phase 1 ("The Project") amount to about 3.75 MEUR and 38,494 people will benefit from the proposed measures. The total costs for measures proposed in Phase 2 amount to about 42.96 MEUR and 46,178 people will benefit from the measures. The total costs for Phase 1 and Phase 2 amount to 46.7 MEUR.

Table 0-1: Proposed investment measures Phase 1 ("The Project")

N°	Measures	Costs [€]	Benefit from project measures
1	Capital investment		
1.1	Extension of the water distribution network in Ungheni Town by 5.4 km	393,876	Water supply coverage rate increased from 98% to 100% (755 additional people served)
1.2	Rehabilitation of 12.2 km water distribution network in Ungheni Town	971,260	Level of service and efficiency improvement for all people covered with water supply (38,494 people in 2018)
1.3	Extension of the sewerage network in Ungheni Town by 5.6 km	1,211,483	Wastewater coverage rate increased from 78% to 82% in Ungheni Town (1,527 additional people served);
1.4	Equipment and tools	200,000	Level of service and efficiency improvement for all people connected to the water supply and wastewater system (38,494 people in 2018)
ST-1	Sub-Total capital investment	2,178,000	
2	Technical assistance	633,194	Level of service and efficiency improvement for all people connected to the water supply and wastewater system (38,494 people in 2018)
3	Contingencies (10%)	340,981	
GT-1	Total costs for Phase 1	3,750,795	Additional 755 people will be served with water supply and 1,527 people with wastewater. In total 38,494 people will benefit from the water supply and wastewater measures.

Source: GIZ/MLPS

Table 0-2: Proposed investment measures Phase 2

N°	Measure	Costs [€]	Benefit
1	Capital Investment		
1.1	Extension of the sewerage network in the town of Ungheni by 41 km and rehabilitation of 20.4 km sewerage network and 19.3 km pressure main to the wastewater treatment plant (WWTP) including re-/construction of wastewater pumping stations (WWPS)	15,084,875	• Wastewater coverage rate increased from 82% to 99% in Ungheni Town (6,846 additional people served); • Level of service and efficiency improvement for all people covered with sanitation (38,281 people in 2021).
1.2	Construction of (WWTP) with a capacity of 43,661 P.E.	10,478,640	Improved environmental performance; compliance with effluent standards for a wastewater volume of 6,471 m³/day
1.3	Construction of wastewater system in the localities of Za-	8,968,699	Wastewater coverage rate increased from 0% to 82% in the rural localities (6,272 additional peo-

N°	Measure	Costs [€]	Benefit
	ragarancea, Semeni and Petresti incl. 45.4 km sewerage network and 5 WWPS		ple served).
1.4	Transmission main for connection of the locality of Petresti to the water supply system of Ungheni Town	338,400	Water quality in Petresti Locality (3,721 people in 2021) (compliance with national standards) and supply security improved (second supply source).
ST-1	Sub-Total capital investment	34,870,614	
2	Technical Assistance	4,184,474	Level of service and efficiency improvement for all people connected to the water supply and wastewater system (46,178 people in 2021)
3	Contingencies (10%)	3,905,509	
GT-2	Total Costs for Phase 2	42,960,597	Additional 13,118 people will be provided with wastewater services (incl. adequate treatment) in Ungheni Town and the three localities. Drinking water quality and public health for the population of Petresti Locality (3,721 people) will be improved. In total 46,178 people will benefit from the water supply and wastewater measures.

Source: GIZ/MLPS

Table 0-3: Summary of investment costs Phase 1 and 2

N°	Component	Costs Phase 1	Costs Phase 2	Costs Phase 1 & 2
		EUR	EUR	EUR
1	Water supply and wastewater, capital investments			
1.1	Water supply	1,365,136	338,400	1,703,536
1.2	Wastewater	1,211,483	34,532,214	35,743,698
1.3	Equipment and tools	200,000		
ST-1	Sub-total capital investments water supply and wastewater	2,776,619	34,870,614	37,647,234
2	Technical assistance	633,194	4,184,474	4,817,668
3	Contingencies	340,981	3,905,509	4,246,490
Total	**Total costs Phase 1 & 2**	**3,750,795**	**42,960,597**	**46,711,392**

Source: GIZ/MLPS

Financial aspects

The financial and economic analysis was developed using the incremental analysis, which considers the differences in the costs and benefits between two alternatives. It compares the project scenario with the baseline scenario without the project or Business as Usual (BAU) scenario, which means ‘do-nothing’.

The financial and economic analysis is developed based on the macroeconomic assumptions which include the forecast of the principal macroeconomic figures such as: GDP per capita, the Real Wages increase, evolution of Electricity Prices etc.

In the last three years the ME ‘Apa-Canal’ Ungheni generated losses from operating activities between MDL 0.98 million to MDL 1.5 million, which reveals that the company encountered cash liquidity difficulties. In present the operator used the cash generated

from depreciation to pay current liabilities, and no cash flow remains for investment purposes to rehabilitate and replace the fixed assets. As well, this means that the ME 'Apa-Canal' Ungheni has no creditworthiness capacity at the moment.

The investment costs of the project are estimated to amount of MDL 77.94 million or EUR 3.75 million. It is planned that the project will be implemented during a period of 3 years. In the first year it is planned that the project will be implemented in proportion of 10%, in the second year it is foreseen 50% to be covered and in third year - 40%. The Summary of the investment costs are presented in the table below.

Table 0-1: Summary of the investment cost (million MDL)

Project investment outlays	2015 (MDL mil.)	2016 (MDL mil.)	2017 (MDL mil.)	Total (MDL mil.)
	10%	50%	40%	
Rehabilitation of water network	2.02	10.09	8.07	20.18
Extension of water network	0.82	4.09	3.27	8.19
Extension of sewerage network	2.52	12.59	10.07	25.18
Equipment and Tools	0.42	2.08	1.66	4.16
Detailed design and procurement	0.69	3.46	2.77	6.92
Technical assistance, supervision and capacity development	0.62	3.12	2.49	6.23
Contingency	0.71	3.54	2.83	7.09
Total	**7.79**	**38.97**	**31.18**	**77.94**

Source: GIZ/MLPS

The total investment outlays will be financed by: domestic and international donors; national sources (national development funds, local and central budgets, water operator sources) and citizens contribution.

The donor contribution was estimated to be approximately 65.5% of the total investment costs that constitutes about EUR 2.46MEUR, while the local sources' contribution is 34.5%, which is about EUR 1.29 MEUR.

In the development of the financial forecast of the project was used the weighted average tariff for providing services. The proposed tariffs take into account the cost coverage principle and the tariff affordability level. The cost coverage principle means that the tariff should cover the operational costs and capital costs.

The weighted average tariff for delivering water services is proposed to get increased slowly in time, beginning from the actual tariff of 9.00 MDL/m^3 to approximately 19.00 MDL/m^3 in 2045. During the implementation period of the investment project, when capital costs increase significantly and water sale is limited, it is proposed that the depreciation cost do not be included in the tariff. The total costs (the operational costs and depreciation cost) will be covered by the mentioned tariff beginning with the year 2021.

The weighted tariff for wastewater services is estimated to growth up gradually from actual tariff of 8.50 MDL/m^3 to approximately 12.8 MDL/m^3 at the end of projected period. As well, the tariff for wastewater services will not include the full depreciation cost in the period 2016-2020, because of high depreciation cost of new assets realised due to the implementation of investment project. The total costs (the operational costs and depreciation cost) will be covered by the tariff beginning with the year 2021.

The tariff affordability rate in the whole projected period will be about 2.5%, which indicates that it is within the limits of accepted affordability threshold of 4%.

The cash flow projections for the entire reference period (30 years) reveal that the cumulative cash flow at the end of each year is positive. This is the basic financial figure that indicates that the project is **financially sustainable**. During the period of 30 years the ME 'Apa-Canal' Ungheni will be able to generate cumulative cash flow amounted to MDL 129.39 million, which could be used for investments purposes.

The net present value (NPV) of the investment project calculated at a 5% discount rate for a 30-years operating period is negative (MDL – 45.66 million), which emphasise that the project does not generate a return and is financially unprofitable. The economic net present value (ENPV) of the investment project calculated at a 5% discount rate is MDL 110.47 million. Such as, the value of ENPV is higher than zero this indicates that from a public perspective the investment project should be implemented.

Procurement Plan

In line with Moldova's policies and rules, the required public sector services and works contracts shall be awarded on the basis of open competitive tendering, which should assure a maximum of competition and transparency. The proposed procurement plan is presented in the table below.

Table 0-2: Procurement plan

N°	Description	Estimated contract value[6], EUR	Contract type	Procurement method
1	Design, engineering and supervision for Phase 1 investments	366,514	Consulting services	Competitive
2	Construction works: Extension of sewerage network for the town of Ungheni	2,834,281	Works	Open
3	Supply of equipment for operational performance improvement	220,000	Supply of goods	Shopping
4	Technical assistance: Corporate Development Programme, Stakeholder Participation Programme, Water Supply Network Analysis and Water Loss Reduction Programme, Medium to Long-term Sanitation Study	330,000	Consulting services	Competitive
GT	**Total amount**	**3,750,795**		

Source: GIZ/MLPS

Project implementation plan:

The implementation steps are based on having the funding arrangement concluded by end of 2015. The table below gives the project implementation plan for the proposed measures.

Table 0-3: Project implementation plan – Milestones

No	Item	Date
1	Contract award for consulting services	30.05.2016
2	Completion of consulting services	09.06.2019
3	Contract award for works contracts	31.03.2017
4	Completion of works contract	31.12.2017
5	End of defects liability period	31.12.2018

Source: GIZ/MLPS

[6] Including Contingencies

Environmental and social aspects

An Environmental Assessment (EA) was prepared in order to facilitate the implementation of the Project and to ensure that the envisaged Project objectives will comply with Moldova's environmental and social legislation, procedures and policies and international and EU conventions. In addition the EA Report addresses the environmental and social impacts, mitigation measures and management issues associated with the proposed objectives of the project.

According to the new law on environmental assessment (Law No. 86/29.05.2014 on Environmental Impact Assessment which is in force from beginning January 4, 2015) **none of the WSS objectives of the Project is subject to full scale EIA** on the national level.

For acquiring the environmental and construction permission it is required to prepare the documents for the State Ecological Expertise (SEE). This needs to be done in the design stage of the Project.

An assessment of the social and gender aspects was undertaken for Straseni feasibility study in May 2015 and its findings were integrated in the respective report. Given the scope of the proposed study ("no regrets" measures to improve service provision as part of a medium-term programme) and taking into account that social and gender needs and characteristics do not differ much from a town/study to another, the conclusions reached during the field visit in Straseni are also applied to Ungheni project. The tools applied in the field visit to Straseni were interviews with key stakeholders and focus groups disaggregated by gender with potential beneficiaries. Based on its findings a social and gender action plan was developed. The assessment of beneficiaries' needs and priorities by gender shows that the men and women have different needs and patterns in using the water and sanitation facilities. Therefore, these discrepancies and gaps need to be taken into consideration in the development and implementation of the Project.

1 Introduction

1.1 Preliminary and background

Since 2010, the Modernization of Local Public Services (MLPS) Project, acting on mutual agreement between Moldovan and German governments, has supported Moldovan Local Public Administrations (LPAs) in extending and modernising service provision in water supply and sanitation, solid waste management, regional and local roads, and energy efficiency of public buildings sectors.

The MLPS Project has the objective to improve the local public service delivery through local sector planning and programming, improving local public services infrastructure, and capacity development of Local Public Administration and public service providers. As part of a major planning and programming effort, MLPS has assisted Moldovan partners to develop a pipeline of feasible, cost-effective investment projects in the aforementioned sectors.

Currently, the Water Supply and Sanitation (WSS) sector is characterised by an inadequate mid-term financial planning and a lack of a coordinated systemic approach to the development of a pipeline of priority projects. In typical practice in Moldova, investment projects are often developed based on insufficient grounds, which leads to an increased risk to project sustainability. In order to address this situation, a Water Supply and Sanitation Regional Sector Programme (WSS RSP) was developed considering all relevant international, national and sector policy documents, with the intention of contributing to the implementation of the national Water Supply and Sanitation Strategy (2014-2028). The WSS RSP includes an analysis of the current situation in the sector in the development region, a set of sectorial targets to be achieved over the medium to long-term, an action plan that identifies barriers that must be addressed in the sector in order for the investments to have their full impact and for conditions to improve in the sector, and the process, methods and criteria for identification of priority investment projects that contribute to change in the sector and the achievement of sectorial targets.

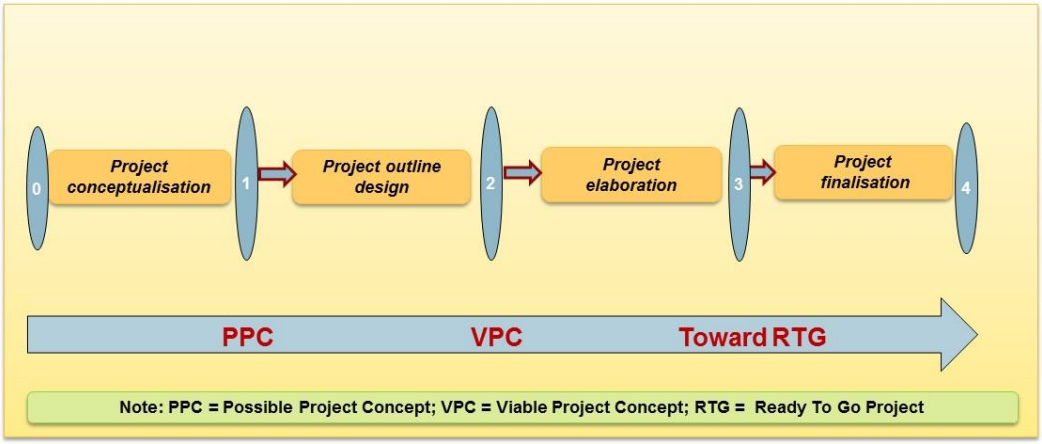
Based on the WSS sector development directions and criteria defined in the WSS RSP, a list of possible project concepts was defined for further project development.

1.2 Project Development Pathway

This feasibility study is an integral part of a comprehensive and systematic project identification and development process, defined and promoted by the Ministry of Regional Development and Construction (MRDC) as the Project Development Pathway (PDP). The Pathway Approach is the framework for implementation of the project pipeline, which, in turn, is the instrument used to carry out the investment component of the WSS Regional Sector Programmes.

The **project pipeline is developed over five stages**. If and when financing is identified, the project can be finalised and become ready for implementation (“Ready-to-Go”).

Figure 1-1: Project pipeline process in overview



Source: GIZ/MLPS

More specifically, the five stages of project development in MLPS are as follows:

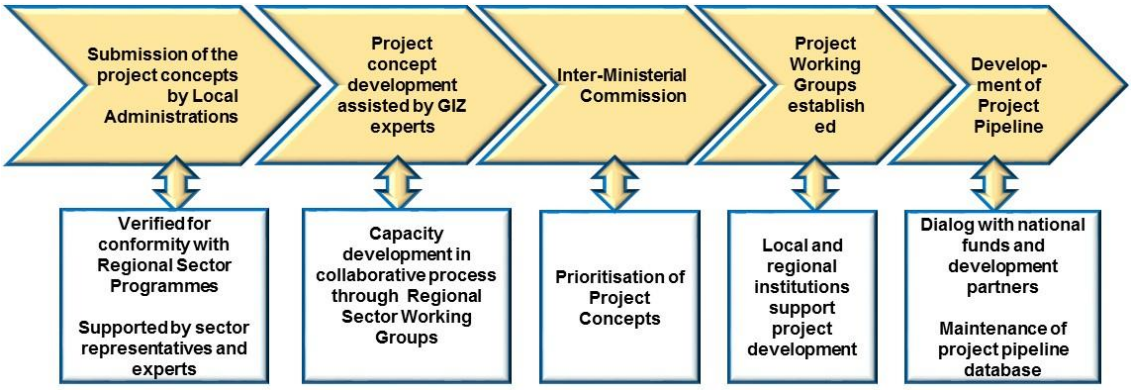
- **Stage 0 – Development of Regional Sector Programmes – Identification of Project Idea**
  In each RSP, specific process, methods, and criteria by which possible projects are identified for their contribution to the targets set out in the RSP for the sector;
- **Stage 1 – Conceptualisation (Possible Project Concept – PPC)**
  Possible project concepts are collected and screened for their compliance with and contribution to the targets of the RSP. Projects in this stage are termed "**Possible Project Concepts**";
- **Stage 2 – Project Outline Design (PPC to Viable Project Concept – VPC)**
  Project ideas that respond to a specific problem or set of problems are developed into possible project concepts and presented in brief reports outlining the objectives to be achieved by each project. Initial estimates for investment and operating costs are provided. Any potential barriers and risks to the development of the project are identified and assessed.
  Projects at the end of this stage are considered "Viable Project Concepts" and can be submitted to national and/or international agencies for further development and possible financing;
- **Stage 3 – Project Elaboration**
  Subject to availability of financial resources for further development, projects that contribute to the achievement of sectoral targets are further developed with a feasibility study, conceptual design, and EIA, as appropriate.
  Projects at the end of this stage are termed "Viable Project Concepts at Pre-final Stage" and can be submitted to national and/or international agencies for finalisation and possible financing;
- **Stage 4 – Project Finalisation**
  For the projects that have some financing commitment in place, the remaining tasks related to preparation of tender dossier, including final technical design, can be completed. All issues related to permitting, land ownership/access must be concluded during this stage. The future organisational and institutional set-ups must be clear and agreed so that they are ready for implementation during the investment period.

Projects at the end of this stage are ready for implementation.

These stages are somewhat fluid and vary from sector to sector. During the first PDP stages, RDAs along with the WSS sector working group identified 45 ideas for possible project concepts, out of which 31 PPCs have been identified as responsive to the WSS Sector policy documents. Further on, due diligence studies were conducted for the identified PPCs, and Inter-ministerial Commission identified 12 projects as most compliant to commonly agreed WSS sector development criteria, as project economic efficiency, contribution to achievement of sector goals, scale of regionalisation etc. A preliminary **Priority Investment Programme** (*further PIP, Programme*), covering period of 2015-2021, for each PPC was approved by the Inter-Ministerial Committee and was further developed in the feasibility study phase (Stage 3).

This collaborative process through which projects are developed is conceptualised in the following figure.

Figure 1-2: Project development and implementation



Source: GIZ/MLPS

This Feasibility Study (FS) Report constitutes the main output of Stage 3 of the PDP, proposing a structured phasing of the **Priority Investment Programme (PIP)** and creating necessary conditions for further implementation of the PIP in Ungheni Rayon. The FS particularly focuses on implementation of the first phase of the PIP, covering period of 2015-2018 and further named *the Project*.

A Project Working Group (PWG), established by decision of the Rayonal Council and comprising members from the Regional Development Agency Centre (RDA Centre), the Ungheni Local Public Administration (LPA) and GIZ/MLPS experts, was instituted to facilitate and coordinate the process of preparation and agreeing this feasibility study, in particular the scope of the proposed project. The same PWG will endorse the study for approval by the Ungheni Rayon council.

1.3 PIP Service Area

The programme area was defined using, but not limited to, the following key sector development criteria set in the WSS RSP:

- **Regionalisation and scale of the project** – Only rayon capitals with associated localities, as well as urban/rural agglomerations over 10,000 people were considered. The integrated approach to WSS services development requires development of both water and wastewater services. As part of the EU-Moldova Association Agreement, the Government of Moldova is committed to harmonise National legislation and implement the provisions of the EU Directives, including the

Council Directive 91/271/EEC concerning urban wastewater treatment, requiring implementation of wastewater collection and treatment in the first place in localities over 15,000 people (10,000 in sensitive areas). Applying the logic of the integrated service, this condition for wastewater systems is extended over the water supply service as well;

- **Presence of source of treatable drinking water, including abstraction and treatment facilities**. Water quality is essential to consumers. Supplying customers with treated surface water is the prioritised strategic approach;
- **Presence of functioning wastewater collection systems with wastewater treatment facilities**. As stated, the requirement of the UWWT Directive shall be considered and the proposed PIP shall tend to contribution to (at least) partial achievement of the requirements;
- **Agreement between beneficiaries and a sustainable WSS operator**. The inter-municipal cooperation between the potential project beneficiaries is a key to successful regionalisation of services. The current legal framework enforces the local public administrations to adopt the most appropriate way of provision of WSS service in their respective localities, and therefore a strong willingness of the LPAs is required to organise a regionalised WSS service.

Also, one of the major WSS services development constraints identified in the WSS RSP is poor and inadequate operational capacity of the existing WSS companies. Taking into consideration current institutional and operational arrangements, the RSP recommended that strengthening of the ME 'Apa-Canal' Ungheni's capacities within the existing service area shall be supported in the first place, and in the in short- term followed by extension of services, not exceeding double the size of the utilities' existing service area. This was considered to prevent water operating companies from financial/ operational/ institutional collapse and set reasonable geographic boundaries for short-term regionalisation of the WSS services.

In Ungheni Rayon, a human agglomeration satisfying the WSS development criteria was identified in the area of the Rayon centre, **the Town of Ungheni**, with the following Local Public Administrations, which expressed their willingness to cooperate and benefit from regional WSS services under the PIP:

- Locality of **Zagarancea**;
- Locality of **Semeni**;
- Locality of **Petresti**.

The above mentioned localities form the PIP service area for development of the regionalised WSS services in the Rayon of Ungheni, which is expected to be gradually implemented in accordance with the proposed phasing of infrastructure investments during 2015-2021.

The first phase of the PIP (the Project) includes improvement of WSS services in **the town of Ungheni**.

This FS Report covers the entire PIP area, having particular attention on the first phase investment Project area. In the longer term, the project service area is to be extended, with flexibility to include additional localities from the Ungheni Rayon and other neighbouring areas, where deemed technically and economically feasible.

1.4 Identified problems

The following major problems to be addressed in this feasibility study were identified during the preliminary project stages:

- Insufficient area coverage of the WSS services. While most of the town of Ungheni and villages benefit from water supply, the wastewater services are provided only to a limited urban area;
- Unsatisfactory levels of service, including:
  - Continuity of water and wastewater services. Although central part of Ungheni Town is continuously provided with water, some marginalised parts of the town have often interruptions supply due to bursts, leakages and insufficient network pressure. Certain parts of the town continuously suffer of sewer blockages.

As for the operational efficiency, the main problems encountered by the company are, as follows:

- High non-revenue water (NRW) ratio. Increased level of NRW results (around 37% in 2015) results in higher energy consumption for water pumping and consequently increased water tariffs;
- High staff efficiency ratio, as a result of inefficient operation of facilities and overstaffing of the utility;
- Poor asset management and lack of preventive maintenance, resulting in obsolete pipelines and facilities.

Further sections of the feasibility study address the major problems identified in the preliminary stages and provide appropriate measures split into implementation phases.

1.5 Study objective

The objective of the present Feasibility Study is the development of an affordable, least-cost and cost-effective phased investment programme for water and wastewater infrastructure to be rehabilitated and extended, as well as facilitation of regionalisation of the WSS services and inter-municipal cooperation with strong social and environmental benefits, as part of the implementation of the provisions of the WSS Regional Sector Programme and Water Supply and Sanitation Strategy (2014-2028).

The proposed Priority Investment Programme (2015-2021) is expected to result in improved access to regional water supply and wastewater services for the Town of Ungheni, as well as the localities of Zagarancea, Semeni and Petresti, and to contribute to the achievement of the regional WSS sector development indicators on access to water supply and wastewater services. The aim of the PIP is to extend the coverage and connection rates of the population connected to the regionalised water supply services by 14% from 86% to 100% of coverage rate and by 14% from 69% to 83% of connection rate, as well as increase of coverage and connection rates to wastewater services by 31% from 65% to 96% of coverage rate and by 19% from 44% to 63% of connection rate. Also, other major effect of the PIP is the rehabilitation and improvement of existing water supply services for 9% of population connected and for 16% of population connected to wastewater services.

The aim of the first phase (the Project, 2015-2018) for the town of Ungheni is to extend the access of the population to the water supply services by 2% from 98% to 100% of

coverage rate and by 2% from 79% to 81% of connection rate, as well as increase of coverage and connection rates to wastewater services by 4% from 78% to 82% of coverage rate and by 2% from 53% to 55% of connection rate. Also, other major effect of phase 1 rehabilitation and improvement of existing water supply services for 9% of population connected.

Table 1-1: Main service indicators

Indicator	Current connection rate	The first phase Project (2015-2018)		The second phase (2018-2021)		Priority Investment Programme (2015-2021)	
		Rehabilitation	Extension	Rehabilitation	Extention	Improvement	After PIP
Share of population directly benefitted from the rehabilitated and extended water supply services							
Urban	79%	9%	2%	0%	0%	11%	81%
Rural	21%	0%	0%	0%	0%	0%	73%
Share of population directly benefitted from the rehabilitated and extended wastewater services							
Urban	53%	0%	2%	16%	11%	29%	66%
Rural	0%	0%	0%	0%	49%	49%	49%
Non-Revenue Water Ratio, %	37%					5%	32%
Continuity of water service (hours/day)	24					24	24
Number of beneficiary localities covered by regional WSS services (urban/rural)	0/0	1/0	1/0	1/3	1/3		
Number of sustainable regional WSS operators instituted	0	1	1	1	1		

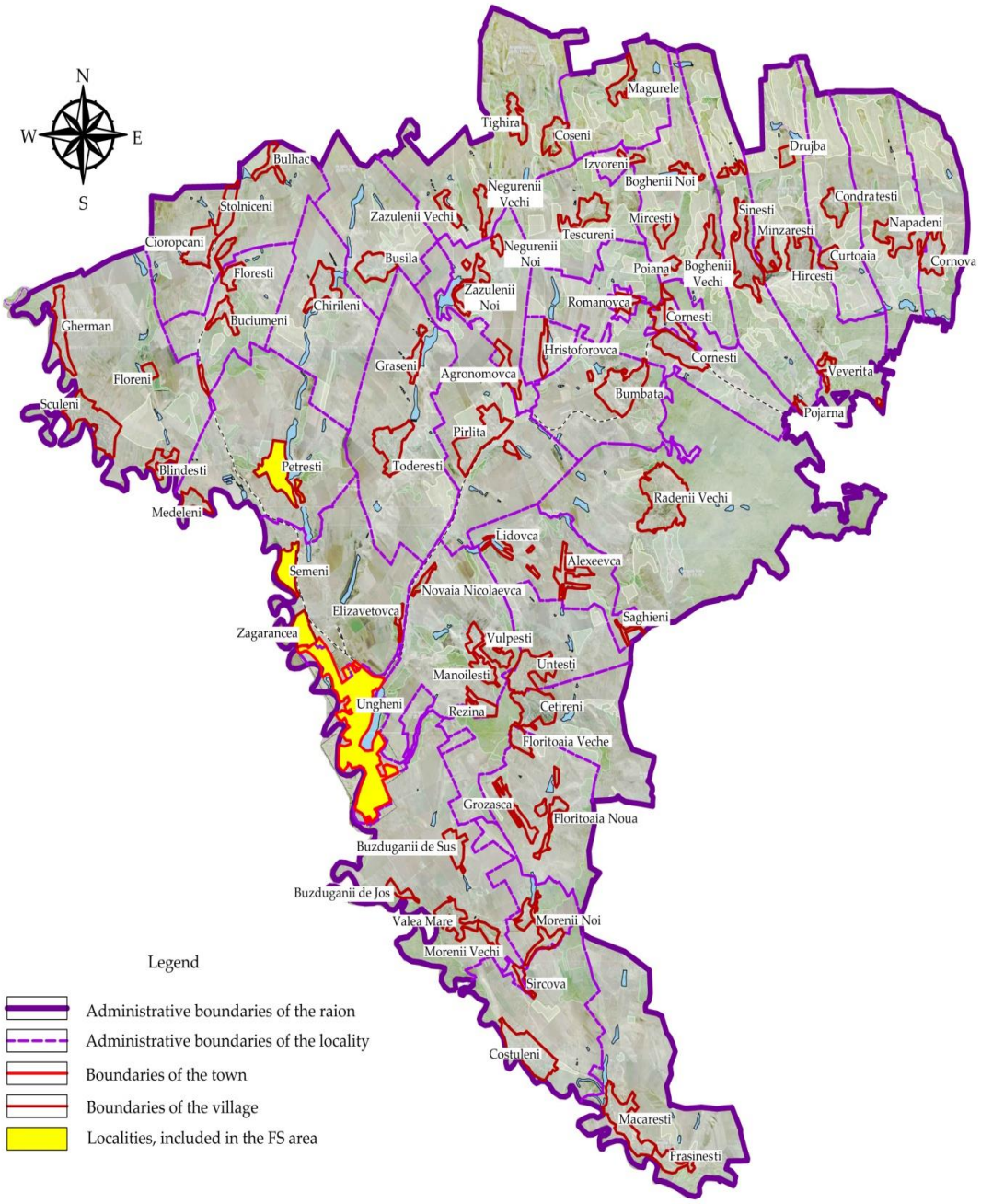
Source: GIZ/MLPS

2 Socio-economic aspects

2.1 Coverage area

The feasibility study covers the area that includes the territory of the town of Ungheni, commune of Zagarancea (the localities of Zagarancea and Semeni) and the locality of Petresti, as shown in the Figure 2-1.

Figure 2-1: Map of the FS localities



Source: www.google.com/maps/place

2.1.1 Geographical conditions in the coverage area

Ungheni Rayon is situated in the Western part of the Republic of Moldova, and also borders the following rayons of Falesti and Singerei to the North, Telenesti to the North-East, Calarasi to the East, Nisporeni to the South-East and Romania (member of EU) to the West. The rayon Centre is the town of Ungheni.

Table 2-1: Population and area of the localities covered in this feasibility study

N	Name of FS localities	Population	Area [km^2]
1	Ungheni	38,400	16.43
2	Petresti	3,855	2.63
3	Semeni	1,986	3.88
4	Zagarancea	1,956	12.17
	Total	**46,197**	**46.43**

Source: GIZ/MLPS

Ungheni Rayon covers an area of about 1,083 km^2.

Ungheni Rayon is composed of 74 localities, including two towns, 31 communes and 41 villages.

The town of Ungheni is situated in the west part of Ungheni Rayon, on the Eastern bank of the Prut River, at a distance of 105 km from the municipality of Chisinau, 85 km from the city of Balti and 45 km from the Romanian city of Iasi, it borders the Semeni, Zagarancea, Elizavetovca, Rezina, Floritoaia Veche, Grozoasca, Buzduganii de Jos, Buzduganii de Sus localities.

The area of the town of Ungheni is about 1,643 ha; this relatively small area is because the town lacks agricultural land. The mentioned surface includes two small rivers called Bailesti and Delia. Besides rivers in the town are three lakes with a total area of 125 ha: Delia, Ceachir and Beresti.

Commune of Zagarancea (the localities of Elizavetovca, Semeni and Zagarancea) is situated at a distance of 4 km from the town of Ungheni and 117 km from Chisinau, bordering the Petresti, Todiresti, Manoilesti and Ungheni localities. Zagarancea village has an area of about 12.17 km^2 with a perimeter of 19.31 km. Semeni village has an area of about 3.88 km^2, with a perimeter of 18.4 km.

Commune of Petresti (the localities of Petresti and Medeleni) is situated at a distance of 12 km north from the town of Ungheni, on the international highway Chisinau–Iasi, bordered with Semeni village. Commune of Petresti has an area of about 2.63 km^2, with a perimeter of 10.53 km.

2.2 Relief and climate conditions

The relief is specific for the Moldova Central Plateau and is characterized by areas of low hills and broad valleys and meadow of Middle Prut River. The average altitude reaches is about 65 meters above sea level.

The main soil types are Chernozem, grey type soil, forest and limestone. The prevailing soils are Chernozem - 75-80%. Average worthiness of agricultural land by soil structure is 61 points.

Reserves of humus in the soil layer have a thickness of 1 meter. From Ungheni Rayon are extracted raw building materials such clay, sand and gravel deposits, which are exploited in open quarries.

Hydrological network is 2,706 ha with the Prut River as a main constituent, which runs through the rayon on a length of 80.3 km, having 9 tributaries and 132 ponds. For rural areas, groundwater is the main source of water; which is extracted through 6,170 wells (70 artesian) and 67 springs.

The climate of Ungheni Rayon is temperate-continental. Summers are long and warm, while winter is mild, the average temperature over the year of about 8-9°C. Precipitation varies between 500 and 650 mm.

2.3 Socio-economic data

The total official number of inhabitants of Ungheni rayon is about 117,400 persons; including urban population of about 38.4 thousand persons and rural population of about 75.2 thousand. Accordingly, the population density is 102 inhabitants per 1 km^2.

The ethnical structure of population of Ungheni rayon is as follows: Moldovans – 97,805 people or 88.47%; Ukrainians - 7,743 persons or 7%; Russians – 2,766 persons or 2.5%; Bulgarians - 93 persons or 0.08%; Gagauzians – 90 persons or 0.08% and others.

The most recent vital statistics for the rayon are provided in the following table. The table exemplifies the slow growth occurring in the rayon, taking into account the birth and death rates.

Table 2-2: Vital Statistics of Ungheni rayon for 2014, persons

	Born	Deceased	Natural Growth
Ungheni Rayon	1,530	1,299	231
Ungheni Town	390	260	130
Cornesti town	19	30	-11
Rural Localities	1,121	939	182

Source: National Bureau of Statistics, 2015, www.statistica.md

The town of Ungheni is the administrative Centre of Ungheni rayon, with a total population number of 38,400 inhabitants, of which men – 17,856 people and women – 20,544 people.

Currently, about 1,250 economic agents are active in Ungheni town.

The educational system of town of Ungheni includes six lyceums, two secondary schools, two primary school, a boarding school with a capacity of 420 seats, five kindergartens counting about 1,500 children, two vocational schools, three colleges (medicine, agribusiness and border police), Moldovan State University subsidiary, two sports schools, a music school and a school of fine arts. In all educational institutions from town are involved 12,000 children.

Town of Ungheni includes the following cultural institutions: Palace of Culture, a music school, one arts school, a museum of history and ethnography, five libraries, two houses of culture and cinema with a capacity of 710 seats.

Health care system includes the rayon hospital with a capacity of 450 seats, Health Centre and one Centre for Family Physicians.

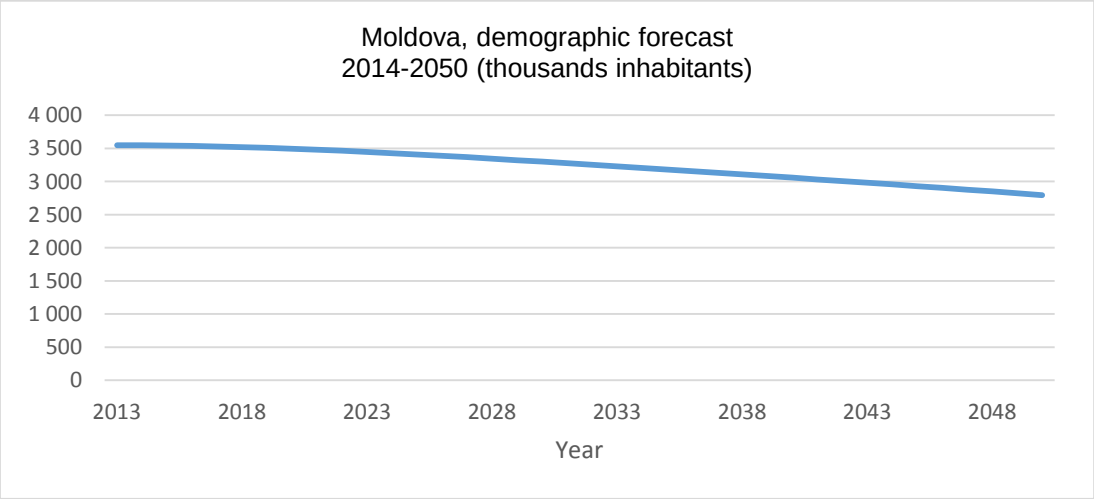
2.4 Population

Immediately upon gaining its independence in 1991, the Republic of Moldova faced economic hardships that severely affected demographic indicators. The main factors

affecting demography are outmigration for economic reasons and a decline in the birth rate. These trends began with the military conflict in Transnistria in 1992, which prompted a wave of emigration from Moldova toward Russia and Ukraine, followed by migration towards current European Union Member States (mainly Italy, Poland, and Romania). These trends were exacerbated during the Russian financial crisis in 1998. The total outflow of emigrants comprises 17.3% of the total population residing in Moldova in 1991, with some estimates reaching 25% (circa 1 million). For the purpose of this feasibility study, the authors considered as a baseline the prognosis of United Nations, which indicates a negative population growth as depicted in the figure below.

The scenario for demographic evolution is derived from the UNDP prognosis for the country up to the year of 2050.

Figure 2-2: United Nations Development Programme population forecast for Moldova



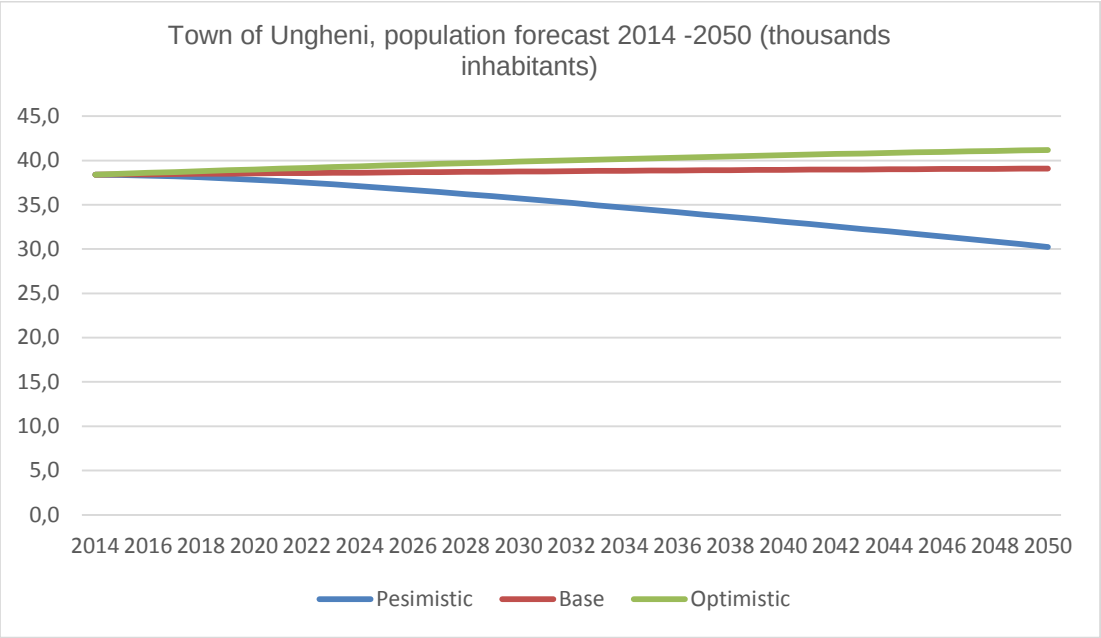
Source: UNDP, World Population prospects, 2013, internet: esa.un.org/wpp/

The Feasibility Study considers that the same national trend will apply uniformly to each rayon population.

Furthermore, the evolution of the demography for the rayons was compared to the evolution of the demography of the urban centers of the respective rayons for the last 10 years. Based on that, the internal migration rural-urban was calculated and three scenarios were derived:

- No internal migration: The rayon population and the rayon Centre population follow the same national demographic trend (pessimistic scenario);
- The average migration of the last 10 years for each respective rayon for rural-urban migration (base scenario);
- The maximum migration rate from all the past 10 years for each respective rayon (optimistic scenario).

Figure 2-3: Population forecast for town of Ungheni, 2014-2050

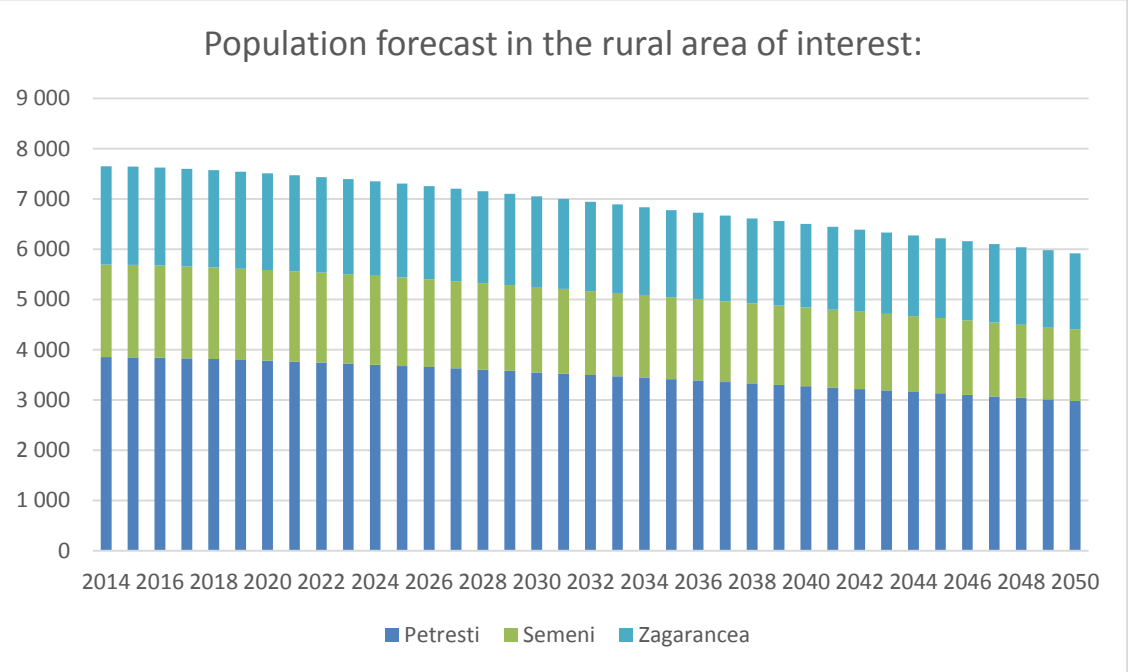


Source: GIZ/MLPS

Further in this feasibility study (year 2015, with the expectancy that the detailed design year will be executed in 2016), the population forecast uses the base scenario. In conclusion, it is expected that the population of town of Ungheni will slightly increase (from 38,400 inhabitants will increase to 39,094) despite the decrease of national population. The towns industry and its geographical position at the border with Romania, in close proximity to the city of Iasi, to which is directly connected by rail and road, offers sufficient employment and small trade opportunities, thus is contributing to the forecasted demographic scenario.

In regard to rural population, the population forecast to year 2050 reflects the national declining trend, as well as the rural-urban migration. The area of interest of the project includes three localities: Petresti (current population 3,855, forecasted to decrease to 2,982 inhabitants by 2050), Semeni (current population 1,986 forecasted to decrease to 1,536 inhabitants by 2050) and Zagarancea (current population 1,956 forecasted to decrease to 1,513 inhabitants by 2050). As it can be seen from the figure below, it is assumed that the rural population will decline at a steep rate.

Figure 2-4: Population forecast for rural areas covered by the FS, 2014-2050



Source: GIZ/MLPS

2.5 Employment

Ungheni is one of the most active towns in Moldova attracting financial resources from international projects, grants and investments for economic development and infrastructure. The town is located on the international transit routes to Central Europe, having excellent conditions for the development of various businesses and environment-friendly agriculture. One significant constrain of the region is the shortage of qualified personnel required in the newly developed market economy.

Currently in Ungheni there are about 1,250 registered companies, mostly active in trade - 179, also in other branches of the local economy such as industry - 38, agriculture - 29, construction – 16.

In 2002 in the town was established the Free Economic Zone / FEZ 'Ungheni-Business' with a planned lifetime of 25 years, on an area of 42.34 hectares, located in the industrial part of Ungheni with access to railroad which makes it possible to link with the north, centre and south regions of the Republic of Moldova and neighbouring countries. FEZ 'Ungheni-Business' is created on the basis of 13 companies from different economic sectors. The companies have access to all necessary infrastructures for business development (highways of local and international importance, access to European and Russian type railroads, water distribution system, sewerage, telecommunications, centralised heating, natural gas, electric power lines). The successful development of FEZ 'Ungheni-Business' is mainly due to the proximity to the border with the European Union. After the EU accession of Romania, several companies from Romania, other EU countries and Turkey located their business in Ungheni attracted by the existence of facilities and cheaper manpower.

So far, 34 residents were registered in FEZ, including companies with foreign capital from USA, Italy, Austria, Turkey, Romania, Belgium, etc. The number of employees is

about 1,800 people. The main kind of activity of residents is industrial production (92% of total sales). One of the largest resident is the American enterprise 'Lear – Corporation' Ltd. which produces seat covers and other textile articles for the automotive industry, being the most significant investor in FEZ 'Ungheni-Business'.

In general, the industry in the town is diverse, being well represented by enterprises from food and light industry, automotive industry, textile and building materials. The largest employer over the last years became 'Lear-Corporation' Ltd with circa 700 employees. Significant other ones are the carpet factory 'Covoare-Ungheni" JSC with its subsidiary 'Moldabela' Ltd., the clothing factory 'Pro Style' Ltd with 200 employees, the winery 'Ungheni-Vin" JSC and the canning factory 'Eco-Vit' JSC, which are in the top list of larger employers.

Despite the fact that in the last 20 years the town of Ungheni similar to all small and medium towns in Moldova suffered a downturn due to the shutdown of several factories, in the past 10 years the number of local businesses has a favorable dynamic, increasing constantly. The creation of modern enterprises with application of state of art technologies during last decade, especially with the foreign investments is a good incentive for others to invest in the town's economy and speed up the economic development of the town of Ungheni.

In general, the unemployment rate of Ungheni is 2.73% in 2014, lower than the average rate in Moldova (3.9% for 2014) and during 2011-2014 has been steadily decreasing.

Table 2-3: Unemployment rate in the town of Ungheni (%)

Year	2011	2012	2013	2014
Town of Ungheni	3.4	3.43	2.9	2.73

Source: Ungheni rayon statistical department

Table 2-4: Number of active population in the town of Ungheni

Year	2011	2012	2013	2014
Town of Ungheni	24,625	24,542	24,405	24,105

Source: Ungheni rayon statistical department

Table 2-5: Number of the unemployed persons in the town of Ungheni

Year	2011	2012	2013	2014
Town of Ungheni	962	878	811	760

Source: Ungheni rayon statistical department

The largest employers are presented in the table below.

Table 2-6: Main employers in the town of Ungheni

Company name	Company specialisation
'Ungheni Vin' JSC	Food industry
'Eco-Vit' JSC	Food industry
'Covoare-Ungheni" JSC	Textile industry
'Moldabela' Ltd	Textile industry

Company name	Company specialisation
'Covoare - Lux' Ltd	Textile industry
'Lear – Corporation' Ltd	Automotive industry
'Lones-Mol' Ltd	Shoe making industry
'Pro Style' Ltd	Light industry
'Filatura -Ungheni' Ltd	Textile industry
'BGK-Group' Ltd	Textile industry
'Hizmet' Ltd	Light industry
'BNV' Ltd	Construction materials industry
'EuroAtlant' Ltd	Furniture industry
'TDV-GROUP' Ltd	Construction materials industry

Source: Ungheni rayon statistical department

The increasing trend of the number of businesses with foreign capital in the last 5-8 years in the town of Ungheni gives hopes that reduction of unemployment and improvement of the investment climate is a steady process which will continue in the town of Ungheni.

2.6 Affordability

Affordability refers to the ability or willingness of household customers to pay for water supply and wastewater services. The typical measure of affordability is the ability to pay for services, as measured using a threshold percentage of household income devoted to paying for the cost of the water supply and wastewater services.

Therefore, the required information to estimate household affordability is disposable household income (typically, this is measured average household income; a better measure, however, is to examine various household income groups, such as in quintiles from lowest income to highest), average per capita water consumption, and unit cost per unit of consumption.

For the current analysis, average household income for Development Region Centre was used, based on available statistical data only (without taking into account additional income from the "grey economy" or remittances from abroad). The official income data for 2015 were adjusted according to the income forecasts of the Moldovan government.

The evolution of the average household disposable income is shown in the table below.

Table 2-7: Evolution of the average household disposable income[7]

Disposable income (MDL), forecast				
Region	**2012**	**2013**	**2014**	**2015**
North	1,412.60	1,572.60	1,653.56	1,738.69
Centre	1,317.20	1,437.90	1,511.93	1,589.76
South	1,247.20	1,419.10	1,492.16	1,568.98

Source: National Bureau of Statistics, 2015, www.statistica.md

After 2015, household income is assumed to growth by 4% per year in real terms.

[7] Per capita and per region (MDL)

According to the National Bureau of Statistics, the average household disposable income per capita in Moldova in 1st quarter was 1,768.23 MDL/person/month (Quarterly bulletin, I, 2015) while in the Center region it was 1,589.76 MDL/person/month.

The average bill for water and sewage, taking into account the average consumption of 60 litres per capita per day (lcd) and the current price in Ungheni of 11.42 MDL / m^3, can be estimated as follows:

- 0,060 m^3/d x 30 days x 11.42 MDL/m^3 = 20.56 MDL.

Comparing this figure to the average household's income of 1,589.76 MDL; the affordability ratio reaches 1.3%.The United Nations Development Programme has recommended a 3% affordability limit, the Organization for Economic Co-operation and Development (OECD) 4% for poor families in Eastern Europe, Caucasus, and Central Asian countries, and the Asian Development Bank 5%. Taking into account the mentioned above, it can be stated the population can support a further increase in tariff, as a result of the newly proposed infrastructure investments.

3 Legal and institutional framework

3.1 The legislative framework regulating water supply and wastewater services sector

3.1.1 European legislation on water supply and wastewater services

The water sector is one of the most regulated areas in the EU, in order to ensure the careful use of water resources and to minimise adverse impacts of water production and consumption on water quality.

Directive 2000/60/EC establishing a framework for Community action in the field of water is a keystone in the history of water policies in Europe. It establishes a common framework for sustainable and integrated management of all water bodies and requires that all impact factors and economic implications as well to be considered. Waters in the European Union are under increasing pressure, given the continued growth in demand for good quality water in sufficient quantities for a range of uses. The aim of this Directive is to protect and improve water quality by providing rules for stopping the deterioration of all water bodies in the European Union and achieve "good status" of rivers, lakes and groundwater in Europe.

Another regulation in the European Union, intended to protect human health by establishing strict standards for drinking water quality, is Directive 98/83/EC on the quality of water intended for human consumption, which amends Directive 80/778/EEC of 15 July 1980. The objectives of the Directive are to protect public health from the effects of any type of contamination of drinking water by ensuring quality. In order to ensure those the Directive requires the establishment of a program of measures to improve water quality. Member States have to monitor drinking water quality and take the necessary measures to ensure compliance with the standards.

In turn, the wastewater produced by the population and industry is an important source of pollution that can affect the quality of drinking and bathing waters, hampering the achievement of goals set out by Water Framework Directive.

Directive 91/271/EEC concerning urban wastewater treatment aims to protect surface waters, including those from the coastal territories, by regulating collection and treatment of urban wastewater and discharge of the biodegradable industrial wastewater (coming mainly from the agri-food industry). The Directive is often considered expensive, but proposes solutions to overcome these challenges that mean tremendous benefits for our health and the environment. Like other legislative acts of EU regarding water, the Directive provides clear and binding targets, while being very flexible in the means of achieving them. The Directive allows alternative solutions and encourages innovation, concerning both wastewater collection and treatment.

3.1.2 Transposition and implementation of the community environmental acquis

By signing the Association Agreement, the Republic of Moldova committed to implement the relevant environmental legislation of the European Union (including that regarding water quality and resources management) into its national legal system by adopting or changing national legislation, regulations and procedures.

The Republic of Moldova has to align national legislation with community environmental acquis in terms (3-8 years from the entry into force, starting September 1, 2014) and

conditions listed in Annex. XI Chapter 16 (Environment) of the Association Agreement Republic of Moldova - European Union[8].

Fulfilment of the assumed obligations started with the adoption of Government Decision no. 808 of 10.07.2014 regarding the approval of the National Action Plan for the implementation of the Association Agreement Moldova - European Union in 2014-2016.

These measures concern in particular the following tasks: completing the process of developing a mechanism to implement the Water Law; initiating assessment of the situation in the field of urban wastewater collection and treatment and identifying sensitive and less sensitive areas; drafting law on drinking water quality in accordance with Directive 98/83/EC on the quality of water intended for human consumption, as amended by Regulation (EC) no. 1882/2003; drafting Government Decision on the approval of sanitary regulations for small drinking water systems; and drafting Government Decision on the approval of sanitary regulations for drinking water quality monitoring.

Given these ambitious goals, Moldova has started to transpose and implement the Directives of the European Parliament and the European Council into Moldovan legislation by adopting the following legislation and regulations:

- Water Law no. 272 of 12.23.2011 is partially harmonised with Council Directive no. 91/271/ EEC of 21 May 1991 on urban wastewater treatment and no. 91/676 EEC of 12 December 1991 on waters protection against pollution caused by nitrates from agricultural sources, with European Parliament and Council Directives no. 2000/60/EC of 23 October 2000 on establishing a framework for the Community action in the field of water policy; no. 2006/7/EC of 15 February 2006 concerning the management of bathing water quality; no. 2007/60/EC of 23 October 2007 on the assessment and management of flood risks; no. 2008/105/EC of 16 December 2008 on environmental quality standards in the field of water, creates the legal framework, necessary for water management, protection and use;
- Regulations on requirements for wastewater collection, treatment and discharge into the sewage system and/or in water receiving bodies for urban and rural areas, approved by Government Decision no. 950 of 11.25.2013, partially transposes the provisions of Council Directive. 91/271/EEC of 21 May 1991 on urban wastewater treatment;
- Regulations on conditions for wastewater discharge into water receiving bodies, approved by Government Decision no. 802 of 10.09.2013, transposes art. 2 and 3 of Directive 2009/90/EC of Commission of 31 July 2009 on establishing, pursuant to Directive 2000/60/EC of the European Parliament and of the Council, technical specifications for chemical analysis and monitoring of water status; Annex III of Directive 91/271/EC of 21 May 1991 of Council regarding urban waste water treatment; Annex VIII of Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water.

3.1.3 National legislation for water supply and wastewater public services

The legal and normative framework in force which governs water supply and wastewater services sector, although harmonised only to a small extent with European

[8] www.parlament.md

legislation, represents the legal basis for the establishment, organisation, management, financing and monitoring of the functioning of these services.

The legal regulation of decentralised water supply and wastewater services is not a subject to a single legislative act, these being reflected in many laws and regulations, which are listed in Annex 3.

However, the framework act for this sector is the Law on water supply and wastewater public services no. 303 of December 13, 2013, which defines the legal framework for the establishment, organisation, management, regulation and monitoring of the functioning of the public service on raw and drinking water supply; public service on wastewater and industrial and domestic wastewater treatment in terms of accessibility, availability, reliability, continuity, competitiveness, transparency, compliance with quality, security and environmental protection.

The new law regulates public authorities (central and local public administrations) competences in water supply and wastewater services sector; the establishment of the National Agency for Energy Regulation as the regulator in water supply and wastewater services sector; service management, where local authorities can opt either for direct management or for delegated management; delegated management contract on water supply and wastewater services provision, as the only legal act that can establish rights and obligations of the parties; terms for delegating services provision based on public tender organised under the law; operator licensing under conditions of competition; endorsement and approval of tariffs for this service etc.

Adoption of Law 303 of 13 December 2013 started the process of amendment of the existing legislation, which is to be followed by putting into practice these regulations.

3.2 Administrative framework

3.2.1 At national level

The Ministry of Environment, Ministry of Regional Development and Construction, Ministry of Health and Ministry of Finance and State Chancellery with are competent authorities in the regulation and development of the water supply and wastewater services sector.

The Ministry of Environment is the main state institution, responsible for the development of national policies, legislative and regulatory framework and the subsequent implementation of the provisions of the policy documents, including the programming and implementation of investment needed in water supply and wastewater infrastructure. Additionally, the Ministry of Environment manages the National Ecological Fund.

The Ministry of Regional Development and Construction is responsible for the planning and development of water supply and wastewater at regional level and substantially involved in planning and infrastructure development through the three Regional Development Agencies. Additionally, the Ministry of Regional Development and Construction administers the National Fund for Regional Development. Together with the national Ecological Fund, these funds are the most important sources of national funding in the water supply and wastewater services sector.

The Ministry of Health oversees the population’s health and sets up priorities related to public health; promote provisions regarding health aspects into all public policies and supports their effective implementation in other sectors to maximise health gains. The Ministry of Health establishes and monitors all aspects of water quality in the field of water supply and wastewater services sector.

The Agency ‘Apele Moldovei’ under the Ministry of Environment is charged with implementing national policy in water management, hydro-reclamation and water supply and wastewater services sector.

The Agency for Geology and Mineral Resources under the Ministry of Environment is responsible for implementing state policy on geological research, and use and protection of soil and groundwater. Hydrogeological Expedition "EHGeoM" is under the Agency for Geology and Mineral Resources, providing services related to drilling artesian wells.

The National Agency for Energy Regulation is the regulator of water supply and wastewater services in terms of approving regulations and the tariffs for these services, giving licenses to the operators working in the field of energy supply and monitoring its activity.

At the national level, there are two main non-governmental associations, namely Water Operators Association of Republic of Moldova ‘Moldova Apa-Canal’ and the Congress of Local Authorities in Moldova.

Data on water supply and wastewater services sector are regularly collected and processed by the National Bureau of Statistics.

Moreover, it should be noted that besides the competent authorities indicated above, a series of other authorities play, directly or through their subsidiaries, more or less significant role in the monitoring and supervision of the water supply and wastewater services sector. These are, in particular:

3.2.2 At local level

In Republic of Moldova, the local government is organised on two levels: level 2 is the rayon public authorities, while the level1I is the public authorities in towns and villages. The water supply and wastewater public services are set up, organised and managed under the direction, coordination, supervision and responsibility of local public administrations of level 1, represented by local councils, as deliberative authorities, and mayors as executive authorities.

About 35 operators in Moldova provide water supply and wastewater services in urban areas, with the legal form of joint-stock companies or municipal enterprises. Of these, seven can be considered as regional operators, because they provide water supply and wastewater services in towns and neighbouring administrative-territorial units. In rural areas, services are provided either by local authorities, under the direct management or by sole proprietorships, limited liability companies or water user associations, under delegated management.

3.3 National policies in water supply and wastewater services sector

Up to 2013, there was essentially no planning in the WSS sector at national, regional and local level. Since then, a new sector strategy and regional sector programmes have been completed. Thus, the development of water supply and wastewater services sector is based on its principal document which is Water Supply and Sanitation Strategy (2014-2028) and other development policies of the Republic of Moldova, including the National Regional Development Strategy (2013-2015). This framework aims to improve national policies and harmonise the legal framework with the community acquis and European standards. The National Regional Development Strategy sets out a number of directions of water supply and wastewater services sector development, including national targets for achieving the Millennium Development Goals.

The Water Supply and Sanitation Strategy has new approaches for structuring, financial planning and project identification, on which sector development should be based.

The strategy proposed institutional reforms of the sector, including a new authority as sector regulator - the National Agency for Energy Regulation which would be responsible to develop pricing and regulating policy for operators based on performance indicators.

The strategy also states the need to develop inter-municipal cooperation in the development and provision of water supply and wastewater services by regional operators. Services provision can be ensured by means of public services delegated management contract concluded between local authorities and regional operator, before the implementation of investment projects in infrastructure.

'Regionalisation' is a key aspect of development policy in water supply and wastewater services sector. This policy aims to improve sector performance through better management and economies of scale.

Regionalisation of water supply and wastewater services, which intends to overcome excessive fragmentation of the sector, is aimed at concentrating water supply and wastewater services around strong regional operators, set up and developed by merging local operators.

Thus, it is foreseen that municipal enterprises will be reorganised into commercial companies and will extend the water supply and wastewater services area to other administrative-territorial units, with the aim of becoming economically viable regional operators.

The Strategy also places emphasis on the need to prepare Water Supply and Sanitation Development Plans (equivalent to so-called Master Plans) and feasibility studies in order to attract investments in the sector. Actions indicated in the Strategy will require a major financial commitment that goes beyond the national sources that are available.

In 2014, the Regional Development Councils from North, Centre and South approved Regional Sector Programmes (RSP) in the WSS sector. The RSP is an operational tool that links local and regional priorities with the national strategy within the WSS sector. Based on an analysis of the current situation in the respective region and national sector targets, the RSP provides the process, methods and criteria by which priority projects are identified for further development and implementation

3.4 Organisation of water supply and wastewater services in the administrative-territorial units covered in this study

3.4.1 Organisation and management of water supply and wastewater services

As stated, this study covers the town of Ungheni, the communes of Zagarancea with localities Zagarancea, Elizavetovca and Semeni; the commune of Petresti with localities Petresti and Medeleni.

To date, in the town of Ungheni has organised water supply and wastewater services, organised and managed under the leadership, coordination, control and responsibility of the Ungheni local public administrations, represented by the Ungheni Local Council as deliberative authority, and Ungheni mayor's office, as executive authority.

Municipal Eneterprise 'Apa-Canal' Ungheni, hereinafter ME 'Apa-Canal' Ungheni, is the sole operator of water supply and wastewater public services within the town of Ungheni. The company provides water supply and wastewater services for the town of

Ungheni and water supply services for localities Semeni and Zagarancea within the commune of Zagarancea as well.

In commune of Petresti, the water supply public service is provided by the Municipal Enterprise ‘Servicom-Petresti’, hereinafter ME ‘Servicom-Petresti’. The sole founder of the company is Petresti Local Council.

A management contract on regional water supply and wastewater services, concluded between the Ungheni Local Council and ME ‘Apa-Canal’ Ungheni, sets out the rights and responsibilities of the parties in the provision of these public services and the operation of the systems related to such services.

The tariffs for water supply and wastewater services are approved by the local council, in accordance with legislation in force.

3.4.2 Ownership

Public water and wastewater systems, including all technological and functional structures covering entire technologic cycle from raw water abstraction to discharge of treated wastewater into receiving body, are the property of Ungheni administrative-territorial unit.

The water supply and wastewater systems (propriety of the Ungheni administrative-territorial unit), as well as the water supply and wastewater systems in Semeni and Zagarancea villages have been transmitted to the ME ’Apa-Canal’ Ungheni, as the operator of public service in this locality.

As for the commune of Petresti, the local council has delegated the right of management and operation of public water supply systems to ME ‘Servicom-Petresti’ under a bailment contract for a period of 25 years.

There are no water supply systems owned by individuals or private legal entities.

3.5 Organisation and management of the ME ‘Apa-Canal’ Ungheni

ME ‘Apa-Canal’ Ungheni was established by decision of the local public administration and shall carry out activities for an unspecified period of time starting with the date of registration by State Registration Chamber.

The company has a Director, who is responsible for coordination of all company activities and conducting regular coordination with mayor’s office, being personally responsible to the company’s board for meeting the performance indicators.

Five subordinated specialists report directly to the director:

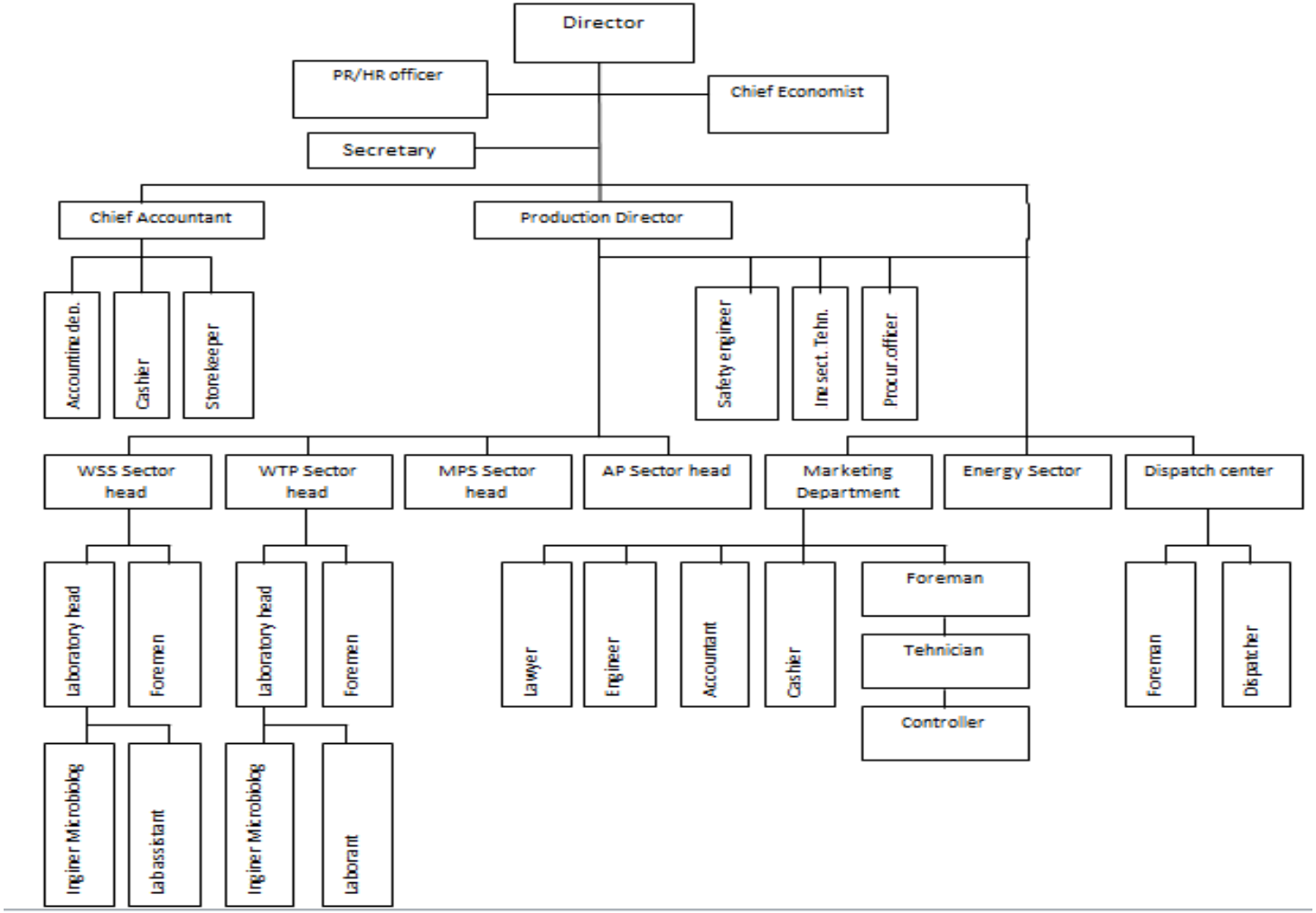
- Production director, responsible for the management of production sectors, elaboration of proposals for development, development of technical conditions for connection to water supply and wastewater network;
- Chief Accountant, responsible for accounting records management and working out of the accounting reports;
- Chief Economist, in charge with analysis of financial and economic situation, calculation of tariffs and development of production program;
- Human resources/public relations officer, in charge with staff tracks keeping and outreach communication;
- Secretary/assistant - responsible for correspondence keeping and informational support and logistics for director.

Heads of following seven units are subordinated to production director:

- WSS (Wastewater Treatment Plant) Sector;
- WTP (Water Treatment Plant) Sector;
- MPS (Main Pumping Station) Sector;
- Auto park (AP) Sector;
- Energy Sector;
- Dispatch Sector (emergency crew for water supply and wastewater systems);
- Marketing /sales Department.

The organisational structure of the ME ’Apa-Canal’ Ungheni is showed below:

Figure 3-1: ME 'Apa-Canal' Ungheni organisational chart



Source: ME "Apa-Canal" Ungheni

3.6 Company staff and training needs

The organisational structure of the company includes 160 positions (according to the staff list) and actual 155 employees. The actual number of employees within the company enables compliance with the actual schedule and workload.

Thus, the occupancy rate within the company is high at 97%, while the staff turnover rate ranged from 18% to about 21% over the past three years.

The years of service at the company of the technical financial staffs shows a stable situation. The overwhelming majority of staff members (151 or 97% of the total) have from 10 to 20 years of employment in the position, with an average of 13 years. Two key persons in the company (the company director and production director) have higher educations in water supply and wastewater, with work experience in the company of more than 30 years, and the relevant qualification for their duties. In general, 15% of the staff has a higher education, 19% - specialised secondary education; the rest have graduated from vocational schools.

Company management reports that it experiences difficulties in finding specialists and workers with the proper skills for the specificities of the WSS sector. This is due to the lack of skilled local labour in the town and neighbouring localities.

The ME ’Apa-Canal’ Ungheni conducts its activities according to an Action Plan. However, it does not include some trainings or measures designed to increase staff professional performance.

The table below lists the main topics that should be addressed in a human resources training programme, as identified during field visits to the utility and discussions with its management.

Table 3-1: ME ‘Apa-Canal’ Ungheni staff training needs

Training topic	Beneficiary
Strategic planning	Director; production director; economist
Investment planning and analysis of investment projects	Director; production director; heads of departments; economist; chief accountant
Human resources planning and development	Director; head of human resources department; economist
Performance indicators and staff motivation	Director; production director; heads of departments; head of human resources department
Customer service management, public relations	Marketing department employees
Tariffs and costs calculation	Economist; chief accountant; head of marketing department
Financial planning	Accounting department employees
Management and maintenance of equipment	Production director; heads of the related departments
Wastewater treatment and sludge management	Production director; heads of the related departments
Water supply and wastewater networks management	Production director; heads of the related departments
Energy management in water supply and wastewater systems operation	Production director; heads of relevant departments
Quality management in water supply and wastewater systems operation	Production director; heads of relevant departments
Meter checking and reading	Head of marketing department; controllers
Job retraining on ‘Operation of water supply and wastewater systems’, specialty ‘Intervention and reconstruction works’	Plumbers/operators
Project management	Director; production director
Legislative aspects and standards in water supply	Director; production director; lawyer

Training topic	Beneficiary
and wastewater	
Economic analysis in the field of water supply and wastewater	Economist; accounting department employees
Integrated accounting software use	Accounting department employees
Drawing up reports (statements) and annual financial statements regarding income tax	Economist
International Financial Reporting Standards	Economist
Cost management control and management reporting	Economist

Source: ME 'Apa-Canal' Ungheni

4 Technical aspects – existing situation

4.1 General information

The assessment of the existing water supply and wastewater situation in the town of Ungheni and localities (Zagarancea, Semeni and Petresti) has been conducted by the GIZ/MLPS experts in collaboration with members of Project Working Group (PWG, described in Chapter 1).

For assessment of existing situation, the necessary information was obtained from the following sources:

- Water supply and wastewater questionnaire prepared and distributed by GIZ/MLPS experts, and completed by local public administrations (LPAs) and the municipal services utilities;
- Project Working Group (PWG) meetings;
- Site visits conducted by GIZ/MLPS experts to verify the collected information and to inspect the existing water supply and wastewater facilities;
- Available pre-feasibility and feasibility studies, existing and implemented technical designs, topographic surveys (site plans) related to water supply and wastewater infrastructure indicating existing WSS facilities, as provided by the PWG.

4.2 Water supply and wastewater service area

Water supply and wastewater services in the town of Ungheni and locality Zagarancea are provided by a single operator - municipal enterprise (ME) “Apa-Canal” Ungheni.

In Semeni village, after the water supply system will be put into operation, the water supply service will be provided by the ME “Apa-Canal” Ungheni.

Water supply and wastewater services in Petresti village are provided by a single operator - municipal enterprise “Servicom-Petresti”.

General information about service areas in the feasibility study localities is provided in Table 4-1.

Table 4-1: General information about service area of FS localities.

No.	Locality	Population	Current situation and ongoing activities - water supply	Population served by centralised water supply service		Current situation and ongoing activities - wastewater	Population served by centralised wastewater service	
				Covered	Connected		Covered	Connected
1.	Ungheni	38,400	The coverage area of water supply system is about 98%. The connection rate is about 79%.	37,740	30,269	The coverage area of wastewater system is about 78%. The connection rate is about 53%.	29,908	20,433
2.	Zagarancea	1,956	The coverage area of water supply system is about 100%. The	1,956	1,614	No centralised wastewater system	0	0

No.	Locality	Population	Current situation and ongoing activities - water supply	Population served by centralised water supply service		Current situation and ongoing activities - wastewater	Population served by centralised wastewater service	
				Covered	Connected		Covered	Connected
			connection rate is about 82%.					
3.	Semeni	1,986	At the time of site visits conducted by GIZ/MLPS, construction works of the water distribution network has been carried out	0	0	No centralised wastewater system.	0	0
4.	Petresti	3,855	The coverage area of water supply system is about 100%. The connection rate is about 62%.	3,855	2,415	No centralised wastewater system	0	0

Source: LPA Ungheni, ME "Apa-Canal" Ungheni, LPA Zagarancea Commune, LPA Petresti Commune, municipal enterprise "Servicom-Petresti"

General information about public institutions in the town of Ungheni and feasibility study localities is provided in Table 4-2. Detailed information about public institutions in the town of Ungheni and feasibility study localities is provided in Annex 4.

Table 4-2: Public institutions in the feasibility study localities

N°	Locality/Public institution name	No. of institutions	Pupils/ children/ places/ beds	No. of employ ployees	Connected to water supply system	Connected to centralised wastewater system
1.	Ungheni					
	Kindergartens	6	2,012	273	yes	yes
	Schools	11	6,152	766	yes	yes
	Healthcare institutions	5	301	975	yes	yes
2.	Zagarancea	3	181	28	yes	no
3.	Semeni	3	213	33	n/a	n/a
4.	Petresti	3	593	94	n/a	n/a

Source: LPA Ungheni, ME "Apa-Canal" Ungheni, LPA Zagarancea Commune, LPA Petresti Commune

The business entities in the feasibility study localities are listed in Table below (Table 4-3). More detailed information is provided in Annex 4.

Table 4-3: Business entities in the feasibility study localities

No.	Locality/Type of business entity	No. of business entities	No. of employees	Connected to water supply system	Connected to centralised wastewater system
1.	Ungheni				
	Commerce	9	303	yes	yes
	Industry	2	183	yes	yes

No.	Locality/Type of business entity	No. of business entities	No. of employees	Connected to water supply system	Connected to centralised wastewater system
	Hotel	1	10	yes	yes
	Forestry	1	110	yes	yes
2.	Zagarancea	12	29	n/a	n/a
3.	Semeni	6	9	n/a	n/a
4.	Petresti	12	226	n/a	n/a

Source: LPA Ungheni, ME "Apa-Canal" Ungheni, LPA Zagarancea Commune, LPA Petresti Commune

4.3 Water supply system

4.3.1 Water supply system in the town of Ungheni

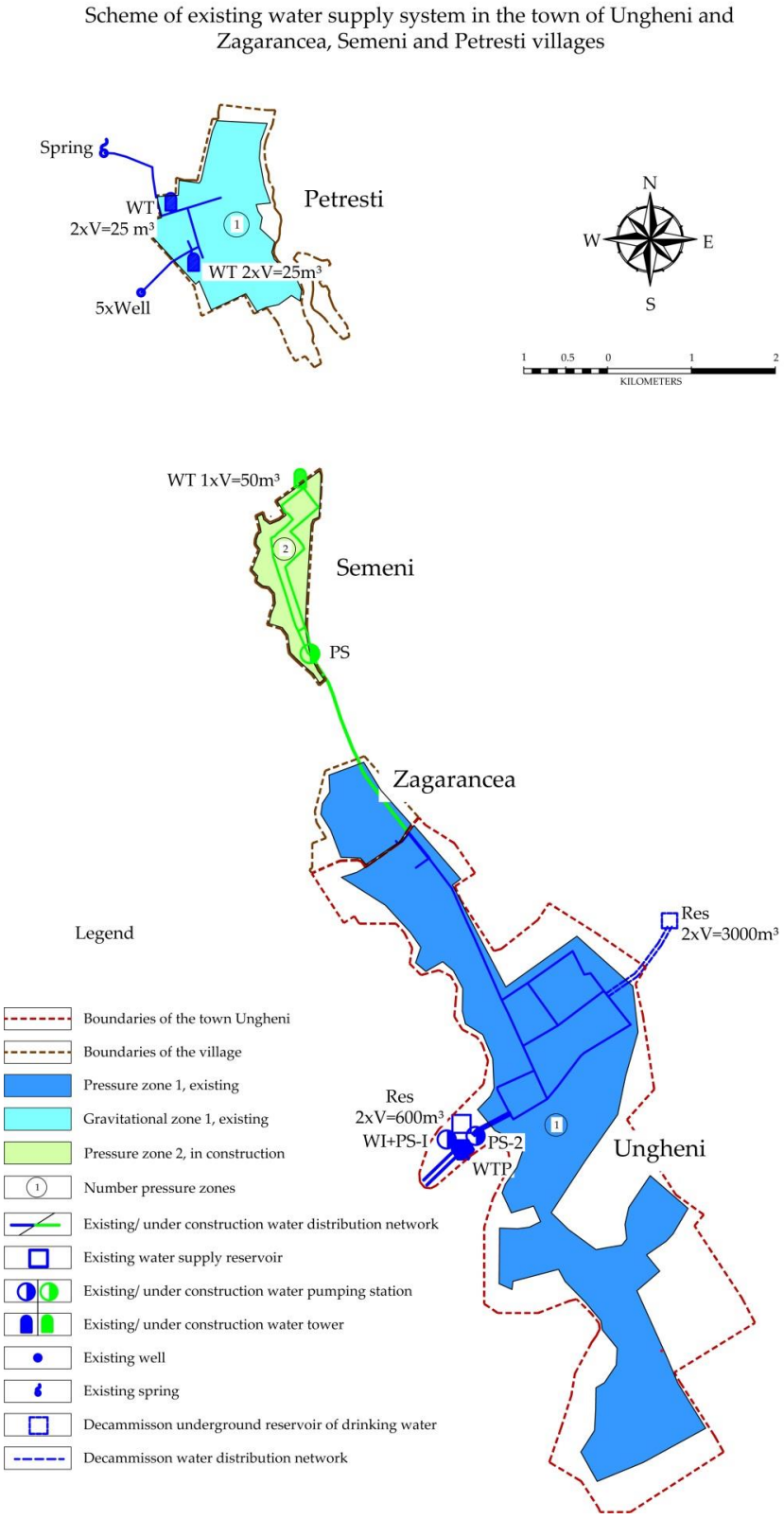
Water is supplied 24 hours/day in the town of Ungheni. Water supply services are provided to about 30,269 consumers (79%) out of 38,400 inhabitants.

The water supply system in the town of Ungheni represents a hydro technical system and comprises the following key components:

- Water source (water intake from the Prut River);
- First level pumping station (PS-1);
- Transportation of water, from water intake to the treatment plant and further from treatment plant to the distribution network (raw and drinking water transmission main);
- Water treatment plant to improve the water quality, so as to meet the consumer's requirements;
- Underground water reservoirs with the volume of 600 m^3 each, designed for the storage of a volume of water necessary in such cases as following: water reserve in case of network failure, compensation of hourly consumption and water reserve necessary for firefighting purposes;
- Second level pumping station (PS-2), to ensure the required pressure in the water distribution network;
- Looped water distribution network, combined with branched one;
- Booster pumping stations, for increasing the water pressure in the multi-storey apartment building;
- Underground service tank with a volume of 3,000 m^3 (out of operation).

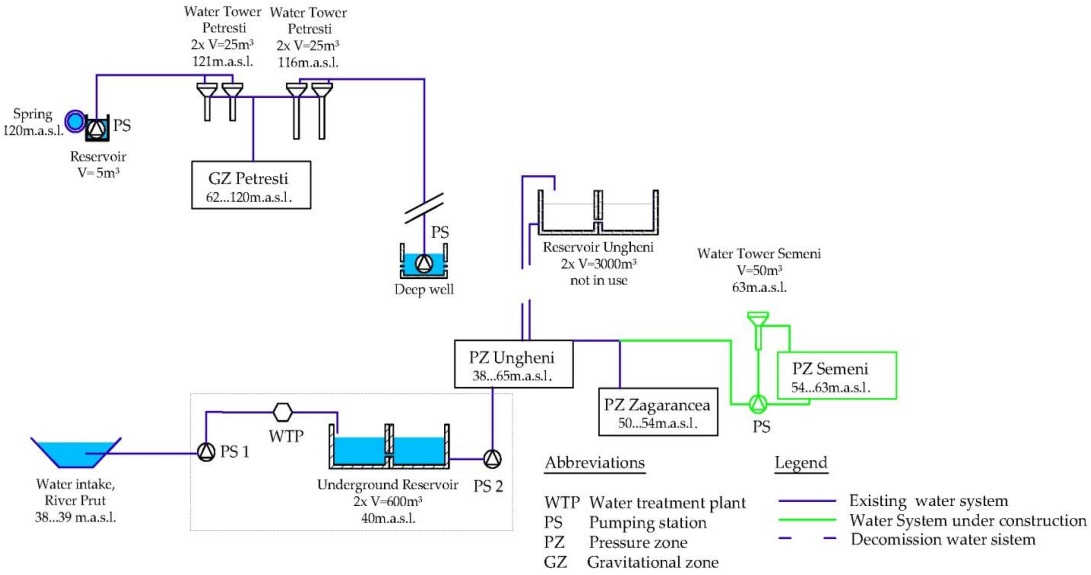
The water supply system in the town of Ungheni is represented in Figure 4-1. More detailed information about the water supply system in the town of Ungheni is provided in Annex 11.

Figure 4-1: Water supply scheme of the town of Ungheni and in the localities of Zagarancea, Semeni and Petresti



Source: GIZ/MLPS

Figure 4-2: Technological scheme of water supply system in the town of Ungheni and in the localities of Zagarancea, Semeni and Petresti



Source: GIZ/MLPS

4.3.1.1 Water source. Water abstraction

Water in the town of Ungheni is supplied from surface water – the Prut River. The well field was constructed in 1972, with a design capacity of 12,700 m^3/day.

According to the obtained data, the quality of the raw water (the Prut River) complies with the standards of the Republic of Moldova (Government Decision no. 934 of 15.08.2007 on the establishment of Automated Information System "State register of natural mineral water, drinking water and bottled non-alcoholic beverages"). The raw and drinking water quality indicators provided by ME “Apa-Canal” Ungheni, is presented in Table 4-4.

Table 4-4: Water quality indicators (August, 2015)

No.	Indicator	Unit	Max. concentration acc. to G.D. No 934 of 15.08.2007	Raw water concentration (Prut River)	Drinking water concentration (water treatment plant)
1.	Smell	degree	acceptable to consumers	0	acceptable to consumers
2.	Taste	degree	acceptable to consumers	0	acceptable to consumers
3.	Colour	degree	acceptable to consumers	17	acceptable to consumers
4.	Hydrogen Index pH		≥ 6.5 ≤9.5	7.85	7.23

No.	Indicator	Unit	Max. concentration acc. to G.D. No 934 of 15.08.2007	Raw water concentration (Prut River)	Drinking water concentration (water treatment plant)
5.	Turbidity	degree	5	45	0.50
6.	Temperature	°C		+18	+25
7.	Oxidbility	ml O_2/l	5	48.3	1.80
8.	Total alkalinity	moles/m^3	no standard	3.25	2.00
9.	Total hardness	degree	5 grade Germane	11.6	9.70
10.	Nitrates (NO_3)	mg/l	50		2.00
11.	Chlorine	mg/l	250		23.00
12.	Sulphates	mg/l	250		86.00
13.	Calcium	mg/l	no standard		54.00
14.	Magnesium	mg/l	no standard		18.50
15.	Aluminium	µg/l	200		80
16.	Manganese	µg/l	50		4.00

Source: ME "Apa-Canal" Ungheni

4.3.1.2 Water pumping station, first level (PS-1)

The raw water is pumped to the water treatment plant by the first level pumping station PS-1 via two (2) syphon pipes with a diameter of 500 mm each.

The main technical parameters of the first level pumping station (PS-1) are presented in Table 4-5. The main technical parameters of the raw water transmission main are provided in Table 4-6.

Table 4-5: Main technical parameters of the first level pumping station (PS-1)

N°	PS name	Year of installation	Year of rehabilitation	Pump type	Pump flow rate (m^3/h)	Head (m)	Pump power (kW)	Pump energy specific consumption [kwh/m³]
1.	PS-1	1972	2004	FA 15.84 DEMI-250/20 (2 pcs.)	250	20	18.5	0.078
2.				SEWATEC K200-4006-SEN 225M04 (1 pcs.)	553,25	20	38.39	0.069
3.				SD250/22.5 (1 pcs.)	250	22.5	37	0.146

Source: ME "Apa-Canal" Ungheni

Figure 4-3: Raw water abstraction facilities. Pump group SEWATEC K200-4006-SEN 225M04. Pump group FA 15.84 DEMI-250/20

Source: GIZ/MLPS

Table 4-6: Main technical parameters of the raw water transmission main

No.	Water transmission type	Pipeline material	Diameter (mm)	Length (m)
1.	Raw water transmission main – 2 pcs.	Steel	500	400
	Total			**800**

Source: ME "Apa-Canal" Ungheni

4.3.1.3 Water treatment facilities

The water treatment plant was brought into operation in 1972, with a design capacity of 12,700 m³/ day, in the present being about 7,000 – 10,000 m³/day. In 2012, the building and facilities of water treatment plant had been rehabilitated.

Water treatment process includes: coagulation, sedimentation of solids, filtration and disinfection.

The water treatment plant technological scheme includes the following components:

- Vertical truncated mixers (two (2) units);
- Longitudinal horizontal settlers (four (4) units);
- Fast filters (four (4) units);
- Chlorination plant;
- Reagent building;
- Two (2) drinking water underground reservoirs with a capacity of 600 m^3 each;
- Administrative building; boiler room; warehouse and workshop; auxiliary buildings and structures.

The water from surface sources is generally turbid due to high concentration of suspension solids and colloids. These substances have specific weight very close to weight of water and basically they remain suspended for a long period of time. In order to be supplied, it is necessary to clarify the water. For this purpose, while the water is not in motion or has a very low velocity, the natural settling mechanism of suspended solids is used. The settling of suspended solids is caused by gravity and the settling velocity is constant due to the viscosity of water.

In order to improve the settling process of surface water, the aluminium sulphate $Al_2(SO_4)_3$ is introduced as a coagulant, which allows fine-particles accumulate increasingly large flakes, which then settle by free-fall together with non-coagulated particles. The coagulation process considerably reduces the turbidity, suspended solids and water colour. Also, in the flakes accumulation and sedimentation phases, a partial involvement of organic compounds and bacteria contained in raw water.

The coagulant injection into the raw water is performed in the vertical truncated mixers (two (2) units), from which further the raw water mixed with reagent is transported by gravity in longitudinal horizontal settlers (four (4) units), which are concrete or reinforced concrete basins in which the water is moving horizontally with a small velocity and on the bottom of which the particles of suspended solids are settling as sludge.

During the settling process, a high clarification degree of water cannot be accomplished in order to meet required drinking water quality. To achieve a complete water clarification it is necessary to perform the water filtering through a filter layer, usually a sand layer.

The removal of suspensions through filter switch is classified according to the filtration velocity: slow filters, fast filters and ultra-fast filters.

Figure 4-4: Water Treatment Plant. Horizontal longitudinal clarifiers

Source: GIZ/MLPS

The water clarified in the above-mentioned settlers is transported through open fast filters (four (4) units) based on gravel and quartz sand.

The clarification of water through the settling and filtration processes reduces the bacterial concentration in water, but not sufficiently for consumption. An additional disinfection process is needed by use of ADVANCE facility in order to ensure its bacteriological quality. A chlorine solution is used for water disinfection, which mainly aims to ensure antibacterial protection in the water distribution network of the town of Ungheni up to the consumers as well as the oxidation of organic compounds and minerals in the water.

Figure 4-5: Water treatment plant. Open quick filter. Reagent building

Source: GIZ/MLPS

A chlorination unit is used for disinfection of water delivered to customers installed at the water treatment plant in the town of Ungheni.

In 2012, in the town of Ungheni, the technological equipment and the building of water treatment plant was upgraded.

Following disinfection, the treated water is stored in two (2) drinking water underground reservoirs with a capacity of 600 m^3 each. The main parameters of the existing drinking water underground reservoirs are provided in Table 4-9.

4.3.1.4 Drinking water transmission main

The drinking water stored in the drinking water underground reservoirs, installed on the water treatment plant area, is delivered directly into the water distribution network equipped with two (2) drinking water underground service tanks with a capacity of 3,000 m^3 each, currently out of operation, by the second level pumping station (PS-2), through two (2) water transmission pipelines of steel with a diameter of 400 mm,.

The main technical parameters of the drinking water transmission main are presented in Table 4-7.

Table 4-7: Technical parameters of drinking water transmission main

No.	Type of water transmission	Pipe material	Diameter (mm)	Length (m)
1.	Drinking water transmission main – 2 pcs.	Steel	400	1,000
	Total			**2,000**

Source: ME "Apa-Canal" Ungheni

4.3.1.5 Water pumping stations

Due to high-rise buildings in the town of Ungheni, the increasing of local pressure is required.

In the area of multi-storey apartment buildings the high pressure regime is ensured by eleven (11) water booster pumping stations. The nominal parameters of water booster pumping stations are presented in Table 4-8.

Table 4-8: Nominal parameters of water booster pumping stations

N°	PS name/ location	Year of installation/rehabilitation	Type	Flow rate (m^3/h)	Head (m)	Power (kW)	Energy specific consumption [kwh/m³]
1.	PS-2	1967/ 2012	CVE – 250 (2 pcs.)	250	65	75	0.375
2.			WILO type NP80/200 (5 pcs.)	162	60	37.1	0.229
3.			14NDN	1000	10	100	0.100
4.			16NDN	1500		160	0.107
5.	5, 7, Boico str.	2003	COR-1MVIE3202-GE	40	45	5.5	0.137
6.	5/7, Boico str.	2003	K 45/30	7		4.0	reserve
7.	66, Romana str.	2003	COR-1MHIE1602-2G-GE	13,5	19	2.2	0.162
8.	11, Cristiuc str.	2004	COR-4MHIE803-2G/VR-RBI	32	49	4x2.2	0.187
9.	11, Cristiuc str.	2004	K 90/35	60		15	
10.	26,Romana str.	2004	COR-1MVIE1604-6/CR-EB	23	52	2x2.2	0.174
11.	3, Porumbesc str.	2005	COR-1MHIE1602-2G-GE	13.5	19	2.2	0.162
12.	9, Ungureanu str.	2005	COR-1MHIE1602-2G-GE	13.5	19	2.2	0.162
13	43, Nationala str.	2005	PE DRLLO CP 25/160B	3	32.5	2x1.1=2.2	0.366
14.	33, Nationala str.	2005	PE DRLLO CP 25/160B	3	32.5	2x1.1=2.2	0.366
15.	48, N. Iorga str.	2011	Booster pump group PE DROL-LO	16-48	40	4x2.2	0.160

Source: ME "Apa-Canal" Ungheni

4.3.1.6 Water storage facilities

The main parameters of the existing underground reservoirs are provided in Table 4-9.

Table 4-9: Main technical parameters of the existing underground water reservoirs

No.	Location	Year of construction	Type of reservoir	Capacity (m^3)	Quantity/No. of chambers	Condition
1.	Water treatment plant area, Oranjerei str.	1972	Rectangular	600	2	Satisfactory
2.	Underground service tank, Elizavetovca village	1977	Rectangular	3,000	2	Satisfactory (out of operation)

Source: ME "Apa-Canal" Ungheni

4.3.1.7 Water distribution network

The water distribution network in the town of Ungheni consists of cast iron, asbestos-cement, steel, ceramic, high density polyethylene (HDPE) and reinforced concrete pipes with diameters of between 32 mm and 600 mm. The main technical parameters of water distribution network are provided in Tables 4-10, 4-11 and 4-12. The length of water distribution network for different diameters expressed as a percentage is provided in the Table 4-13.

Table 4-10: Main technical parameters of water distribution network

N°	Material	Length (m) / diameter (mm)							Length (m)	Pipe age (years)
		600	500	400	315	300	250	200		
1.	Cast iron		9,613	605		3,684	1,720	3,222	18,845	60
2.	Asbestos-cement							565	565	60
3.	Steel		2,683	19,226		1,488	325	1,162	24,884	45
4.	Ceramic						1,569	913	2,482	30
5.	HDPE				2,122			2,920	5,042	15
6.	Reinforced concrete	1,603	557	187					2,347	25

Source: ME "Apa-Canal" Ungheni

Table 4-11: Main technical parameters of water distribution network

N°	Material	Length (m) / diameter (mm)							Length (m)	Pipe age (years)
		160	150	110	100	90	80	75		
1.	Cast iron		11,401		21,252		575		33,228	60
2.	Asbes-tos-cement		2,368						2,368	60
3.	Steel		1,370		10,203		8,324		19,897	45
4.	Ceramic		470						470	30
5.	HDPE	2,963		2.683		2,134		1.945	9,725	15

Source: ME "Apa-Canal" Ungheni

Table 4-12: Main technical parameters of water distribution network

N°	Material	Length (m) / diameter (mm)					Length (m)	Pipe age (years)	Total length (m)
		65	63	50	40	32			
1.	Cast iron	45		430			475	60	135,475
2.	Asbestos-cement			405			405	60	
3.	Steel			11,670	1,019	302	12,991	45	
4.	HDPE		884		99	766	1,750	15	

Source: ME "Apa-Canal" Ungheni

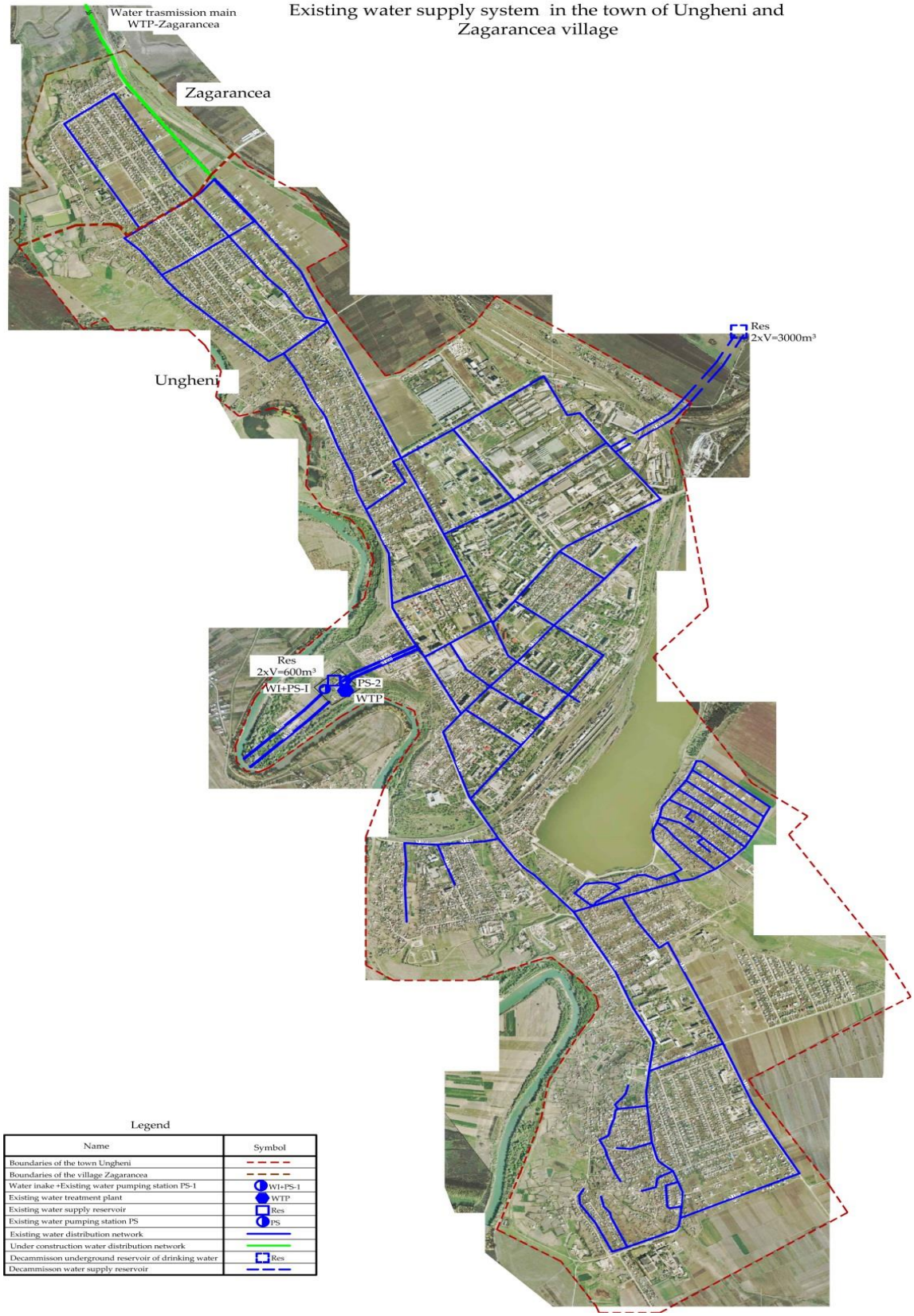
Table 4-13: Percentage of water distribution network by diameter size

N°	Material	Network length (m) by diameter size (mm)			Length (m)	Age (years)	Total (%)
		600 – 200 mm	160 – 75 mm	65 – 32 mm			
1	Cast iron	18,845	33,228	475	52,548	60	39
2	Asbestos-cement	565	2,368	405	3,338	60	2
3	Steel	24,884	19,897	12,991	57,772	45	42
4	Ceramic	2,482	470	1,750	4,702	30	3
5	HDPE	5,042	9,725	475	15,242	15	11
6	Reinforced concrete	2,347			2,347	25	2
	Total	**54,165**	**65,688**	**16,096**	**135,949**		**100**

Source: ME "Apa-Canal" Ungheni, GIZ/MLPS assessments

The water distribution network in the town of Ungheni is provided in Figure 4-6. More detailed information about water distribution network is provided in Annex 11.

Figure 4-6: Water distribution network in the town of Ungheni and Zagarancea locality



Source: www.geoportal.md, GIZ/MLPS

4.3.2 Water supply system in Zagarancea and Semeni localities

Water is supplied 24 hours/day in Zagarancea village.Water supply services are provided to about 1,614 consumers (82%) out of 1,956 inhabitants. Zagarancea village is supplied with water from the water supply system of the town of Ungheni by a water transmission main with a diameter of 160 mm. The coverage rate of water distribution network is 100% of locality area.

The scheme of water supply system in Zagarancea village is presented in the Figure 4-1. The water distribution network is presented in the Figure 4-6. More detailed information about water distribution network in Zagarancea village is provided in the Annex 11.

The Semeni village is foreseen to be supplied from the same water source, the water supply system of the town of Ungheni, by a water transmission main with a diameter of 110 mm. At the time of the site visits conducted by the GIZ/MLPS experts, the construction-installation works of the water distribution network had been carried out (100% coverage rate of locality area), financed by National Ecologic Fund. Water will be supplied 24 hours/day in Semeni village.

The scheme of water supply system in Semeni village is presented in Figure 4-1. Water distribution network is presented in Figure 4-7. More detailed information about water supply system and water distribution network in Semeni village is provided in Annex 11.

Figure 4-7: Water distribution network in Semeni locality

Source: www.geoportal.md, GIZ/MLPS

4.3.3 Water supply system in Petresti locality

Water is supplied 24 hours/day in Petresti locality. Water supply services are provided to about 2,415 consumers (62%) out of 3,855 inhabitants.

The scheme of water supply system in Petresti locality is represented in Figure 4-1. More detailed information about water supply system in Petresti locality is provided in the Annex 11.

In Petresti locality, the water abstraction is carried out in deep aquifers, and namely from five (5) wells in operation and from the spring. The raw water from wells is stored in two (2) water towers with a vat volume of 25 m^3 each, and further is delivered by gravity in the water distribution network. The groundwater, abstracted from the spring, is stored in one (1) collector tank with a volume of 5 m^3 and pumped in two (2) water towers with a vat volume of 25 m^3 each, and further distributed by gravity into water distribution network.

According to the obtained data, the quality of the raw water at the well /intake does not comply with the standards of the Republic of Moldova (Government Decision no. 934 of 15.08.2007 on the establishment of Automated Information System "State register of natural mineral water, drinking water and bottled non-alcoholic beverages") for following indicators: colour, turbidity, nitrates (NO3) and total hardness. The raw and drinking water quality indicators provided by municipal services utility “Servicom-Petresti”, is presented in Table 4-14.

Table 4-14: Water quality indicators (10 March, 2015)

No.	Indicator	Unit	Max. concentration acc. to G.D. No 934	Raw water concentration
1.	Smell	degree	acceptable to consumers	-
2.	Taste	degree	acceptable to consumers	-
3.	Colour	degree	acceptable to consumers	1.5
4.	Hydrogen Index pH		≥ 6.5 ≤9.5	7.6
5.	Turbidity	degree	5	0.8
6.	Ammonia NH_4	mg/l	0.5	<0.05
7.	Nitrites (NO_2)	mg/l	0.5	0.04
8.	Nitrates (NO_3)	mg/l	50	64.5
9.	Total hardness	degree	5 German degree	13.8
10.	Total soluble dry sediment	mg/l	1,500	844
11.	Chloride	mg/l	250	20.4
12.	Sulphates	mg/l	250	40.0
13.	Fluorides	mg/l	1.5	0.97
14.	Iron	mg/l	0.3	<0.1
15.	Copper	mg/l	1	<0.02

Source: Municipal Services Utility “Servicom-Petresti”

The main technical parameters on water towers are provided in the Table 4-15.

Table 4-15: Main technical parameters of water towers

No.	Year of construction	Volume (m^3)	Head (m)	Quantity	Condition
1.	1977	25	9	2	satisfactory
2.	1990	25	9	2	satisfactory

Source: Municipal Services Utility “Servicom-Petresti”

Figure 4-8: Water towers in Petresti locality

Source: GIZ/MLPS

The water distribution network is a single system and consists of high density polyethylene (HDPE) with the pipe age of eight (8) years and diameter of between 20 mm and 75 mm. Total length of water distribution network is about 22,930 m. The main technical parameters of water distribution network in Petresti locality are provided in Table 4-16.

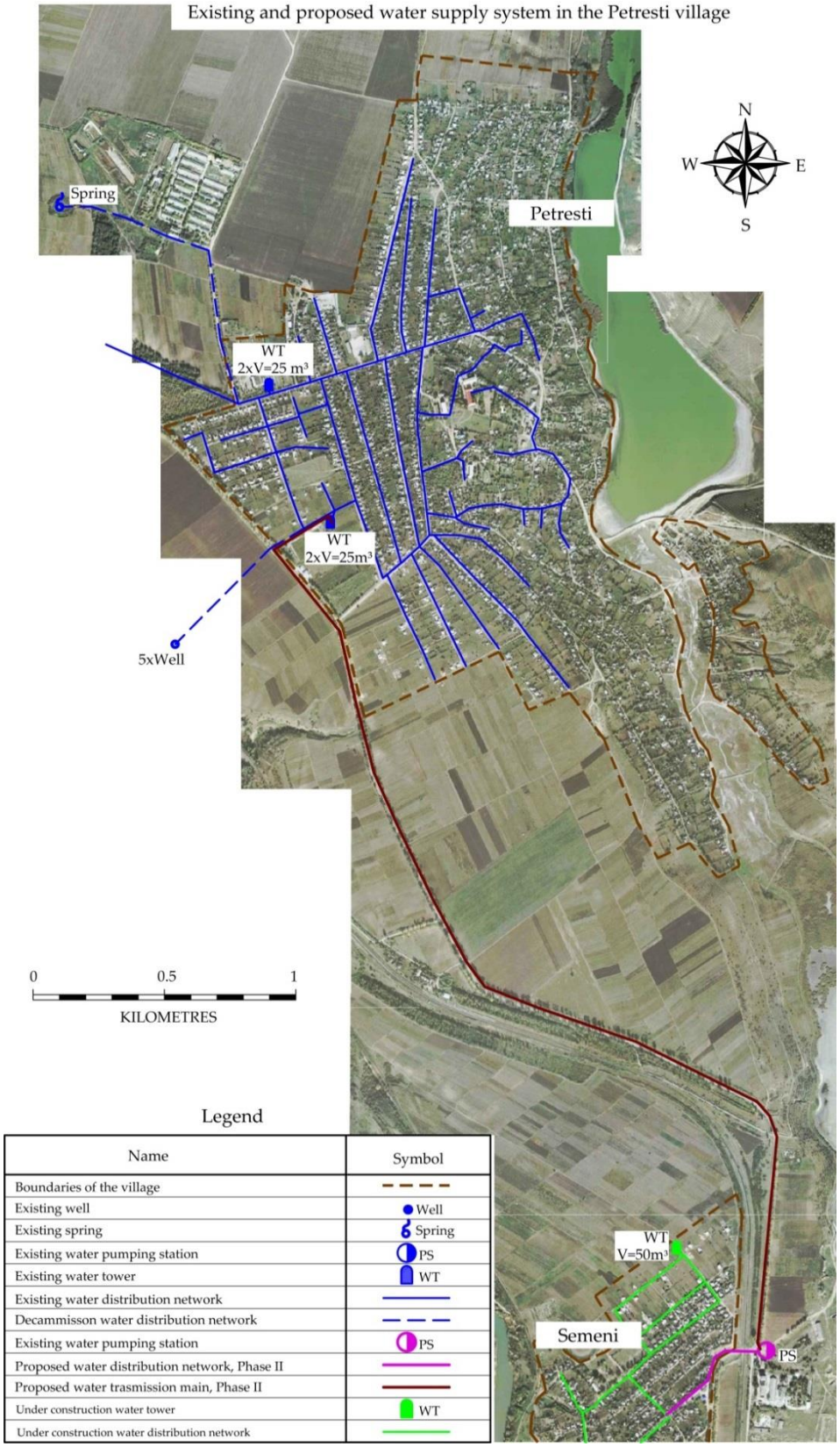
Table 4-16: Technical parameters of water distribution network in Petresti village

N°	Material	Length (m) / diameter (mm)							Pipe age (years)	Total length (m)
		75	63	50	40	32	25	20		
1.	HDPE	4,209	2,110	582	6,242	5,463	3,079	1,245	8	22,930

Source: Municipal Services Utility "Servicom-Petresti"

The water distribution network in Petresti locality is provided in Figure 4-9. More detailed information about water distribution network in Petresti locality is provided in Annex 11.

Figure 4-9: Water distribution network in Petresti locality



Source: www.geoportal.md, GIZ/MLPS

4.4 Water balance for water supply system in the town of Ungheni and Zagarancea locality

The data necessary for water balance calculation were provided by ME “Apa-Canal” Ungheni, and included the following details: monthly volume of the abstracted raw water, monthly volume of water sold to domestic customers, monthly volume of water sold to public institutions and business entities.

Following the real water consumption, the non-revenue water rate for water supply system of Ungheni was determined.

4.4.1 The monthly volume of the abstracted raw water

According to the information provided by ME “Apa-Canal” Ungheni, the monthly volume of the abstracted raw water is determined according to the pumping time of raw water, pump capacity installed at first level pumping station (PS-1) and the season of the year.

4.4.2 Water consumption

The water demand per month is the monthly volume of water sold to the domestic customers, to public institutions and business entities.

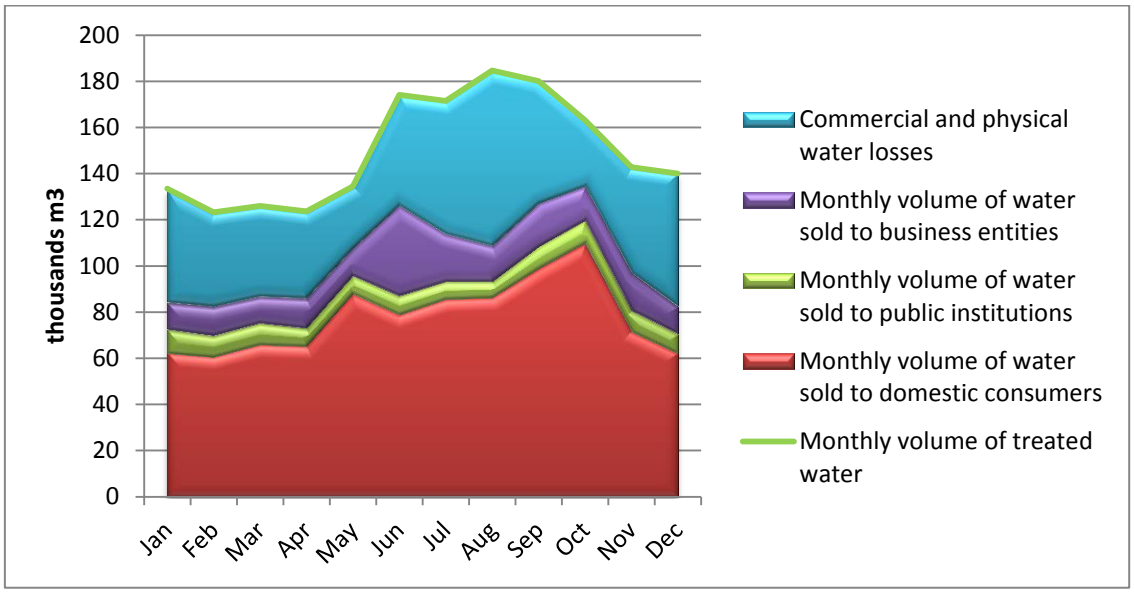
Operational indicators for 2014, presented by ME “Apa-Canal” Ungheni, are provided in the Table 4-17.

Table 4-17: Operational indicators for town of Ungheni and Zagarancea locality, 2014

No.	Month	Monthly volume of the abstracted raw water (m^3)	Monthly volume of raw water at the inlet of water treatment plant (m^3)	Monthly volume of treated water (m^3)	Monthly volume of water sold to		
					Domestic customers (m^3)	Public institutions (m^3)	Business entities (m^3)
1.	January	147,876	147,876	133,493	62,645	10,339	11,580
2.	February	137,565	137,565	123,182	60,937	9,372	12,362
3.	March	140,390	140,390	126,007	66,265	9,387	11,450
4.	April	138,809	138,809	123,706	65,530	7,954	12,724
5.	May	148,918	148,918	134,535	88,025	7,880	11,827
6.	June	188,534	188,534	174,151	78,965	8,343	38,864
7.	July	185,823	185,823	171,440	85,617	7,729	20,609
8.	August	199,062	199,062	184,679	86,384	7,061	15,320
9.	September	194,477	194,477	180,094	98,768	9,612	18,704
10.	October	177,622	177,622	163,239	109,690	9,885	14,854
11.	November	157,135	157,135	142,752	71,838	9,041	16,301
12.	December	154,471	154,471	140,084	62,372	8,516	11,743
	Total	**1,969,962**	**1,969,962**	**1,797,362**	**937,036**	**105,119**	**196,338**

Source: ME “Apa-Canal” Ungheni

Figure 4-10: Operational indicators



Source: ME "Apa-Canal" Ungheni

4.4.3 Real water consumption

The real water consumption is the volume of water consumed by one customer during 24 hours to meet the physiological and domestic needs under normal operation conditions of the water supply system (l/c/d). The real water consumption for customers is the ratio of daily water sold by the utility divided by the number of consumers (domestic, public institutions and business entities), as provided in Table 4-18.

Table 4-18: The real water consumption

No.	Indicator	Unit of measurement	Year		
			2012	2013	2014
1.	Number of domestic consumers	pers.	31,101	31,640	33,497
2.	Annual volume of abstracted raw water	m³	2,616,054	2,250,057	1,969,962
3.	Annual volume of treated water	m³	1,427,333	1,329,165	1,797,362
4.	Total water sold by the utility, of which: • Domestic consumers • Public institutions and business entities	m³ m³ m³	1,427,333 1,086,542 340,791	1,330,165 984,812 345,353	1,238,493 937,036 301,457
5.	Real water consumption (based on daily sold water)	l/c/d	126	115	101
6.	Real water consumption (based on daily water sold to domestic consumers)	l/c/d	96	85	77

Source: ME "Apa-Canal" Ungheni, GIZ/MLPS assessments

4.4.4 Non-revenue water (NRW)

Annual non- revenue water is the difference between the annual volume of abstracted raw water and annual water sold by utility to domestic consumers, public institutions and business entities.

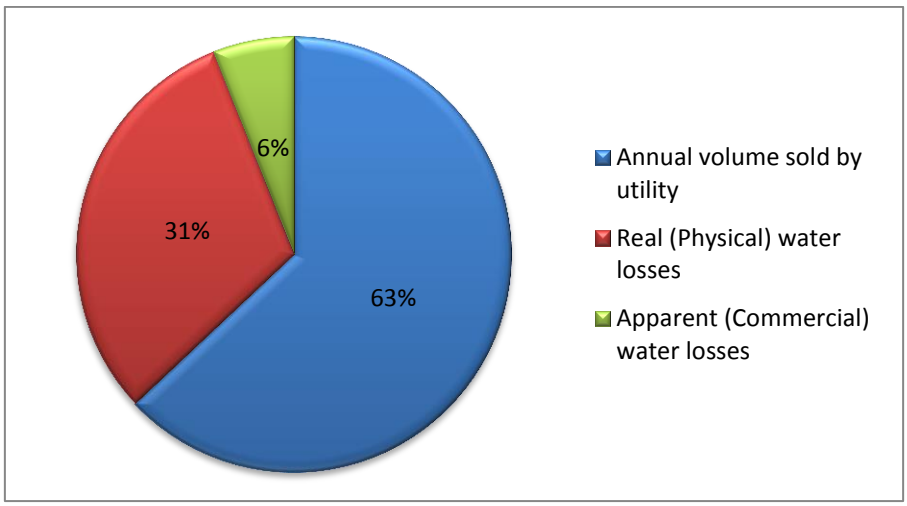
The water balance for water supply system in the town of Ungheni and Zagarancea village is provided in Table 4-19.

Table 4-19: Water balance

No.	Indicator	Unit of measurement		2014	
1.	Number of domestic consumers	pers.		33,497	
2.	Annual volume of abstracted raw water	m³		1,969,962	
3.	Annual volume of treated water	m³		1,797,362	
4.	Annual volume of invoiced/billed water	m³		1,238,493	
5.	The annual volume of NRW, including:	m³	%	731,469	37
	• Real (physical) water losses (84% of NRW)	m³	%	614,434	31
	• Apparent (commercial water losses (16% of NRW)	m³	%	117,035	6

Source: ME "Apa-Canal" Ungheni, GIZ/MLPS assessments

Figure 4-11: Water balance



Source: ME "Apa-Canal" Ungheni, GIZ/MLPS assessments

In order to reduce real (physical) losses of water it is recommended to:

- Identify the condition of pipes during operational or capital repairs (taking note of the material, interior and outer diameter, as well as interior and exterior condition);
- Identify the network sections with an advanced degree of wear or damage;
- Rapidly detect hidden water losses;
- Maintain records related to damages/ leaks and their quick remedy.

The measures related to apparent (commercial) water loss reduction can be identified by effective management of water supply system in town of Ungheni. With the purpose to reduce apparent water losses it is recommended to:

- Identify and replace defective water meters;
- Identify unauthorised connections of the water distribution network.

4.4.5 Water metering

During the period 2007-2012, in the town of Ungheni a water metering programme was implemented, resulting in a metering rate of about 98% of domestic customers, public institutions and business entities. At the time of implementation of World Bank-Financed Project, about 75% of water meters from customers in single-family dwellings were replaced.

4.4.6 Equipment and facilities

The ME "Apa-Canal" Ungheni, owns and operates the following equipment and facilities:

- Rescue trailer truck (one (1) unit);
- Caterpillar excavator (two(2) units);
- Trailer tractor (one (1) unit);
- Drainage truck (one (1) unit);
- Sewerage cleaning truck (one (1) unit);
- Water tank truck (one (1) unit);
- Ultrasonic water leak detector (one (1) unit);
- Portable ultrasonic flowmeter and manometers (with pressure transducers) (two(2) units);
- Manometers.

4.5 Technical and operational analysis of the water supply system

4.5.1 Non-revenue water (NRW)

Non-revenue water has a negative impact on operating costs (high level of electricity consumption for pumping, costs for current and capital repairs, etc.) and revenues (apparent losses). Both the operating costs and revenues are important factors for sustainable development in water supply sector.

At this time, the degree of wear of existing pipelines is very high, causing large leaks in the water supply system in the town of Ungheni. The statistics on damages and repairs in the period 1 January 2014 – 31 December 2014 are provided in Tables 4-20 and 4-21.

Table 4-20: Statistics on pipe damage, 01 January - 31 December, 2014, town of Ungheni

No.	Location	Pipeline breakdowns
1.	On water transmission main	2
2.	On distribution network, including:	459
	• Raptures	182
	• Cracks	94
	• Water blows	87
	• Valves damages	96

Source: ME "Apa-Canal" Ungheni

Table 4-21: Statistics on repairs accomplished in the period January 1, 2014 - December 31, 2014 in the town of Ungheni

No.	Type of repair	Repairs made
1.	Current repairs	280 units
2.	Capital repairs	179 units
3.	Water losses on water transmission main	558,869 m^3

Source: ME "Apa-Canal" Ungheni

4.6 Water balance for water supply system in Petresti locality

The data necessary for water balance calculation were provided by municipal services utility "Servicom-Petresti", and included the following details: monthly volume of the abstracted raw water, monthly volume of water sold to domestic customers, monthly volume of water sold to public institutions and business entities.

Following the real water consumption, the non-revenue water rate for water supply system in Petresti village was determined.

4.6.1 The monthly volume of the abstracted raw water

According to the information provided by municipal services utility "Servicom-Petresti", the monthly volume of the abstracted raw water is determined according to the pumping time of raw water, submersible pump capacity and the season of the year.

4.6.2 Water consumption

The water demand per month is the monthly volume of water sold to the domestic customers, to public institutions and business entities.

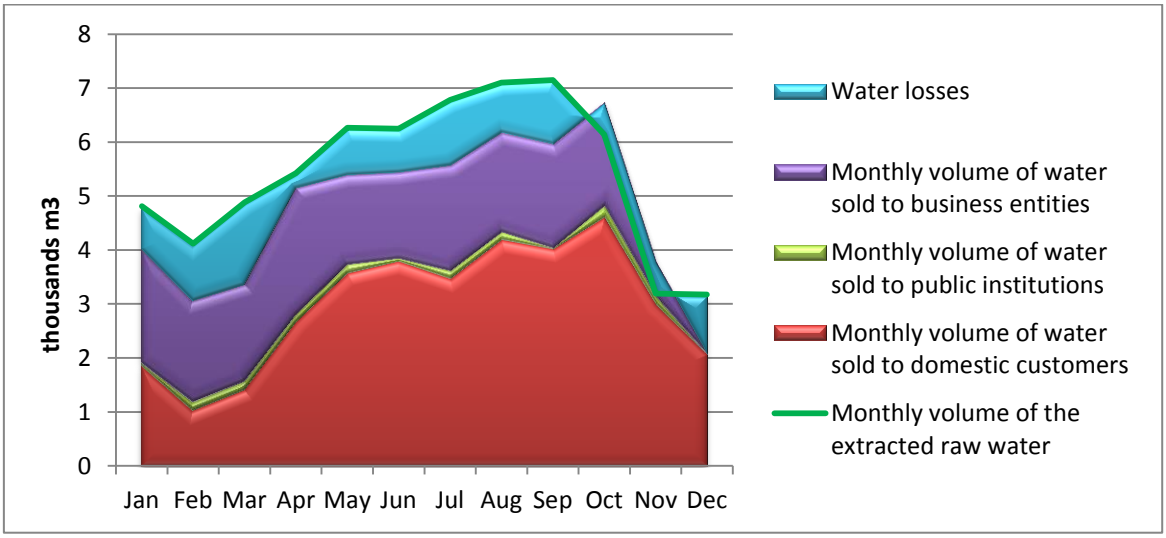
Operational indicators for 2014, presented by municipal services utility "Servicom-Petresti", are provided in Table 4-22.

Table 4-22: Operational indicators for 2014, Petresti village

N°	Month	Schedule of water supply (hours/ 24 hours)	Monthly volume of the abstracted raw water (m^3)	Monthly volume of water sold to domestic customers (m^3)	Monthly volume of water sold to public institutions (m^3)	Monthly volume of water sold to business entities (m^3)
1.	January	24	4,814	1,869	55	2,108
2.	February		4,117	1,039	162	1,876
3.	March		4,886	1,417	165	1,797
4.	April		5,422	2,662	148	2,345
5.	May		6,266	3,564	169	1,665
6.	June		6,249	3,788	58	1,600
7.	July		6,780	3,465	150	1,964
8.	August		7,101	4,186	147	1,850
9.	September		7,194	4,009	26	1,934
10.	October		6,140	4,600	220	1,905
11.	November		3,190	2,987	153	648
12.	December		3,173	2,064	0	25
	Total		**65,322**	**35,650**	**1,453**	**19,717**

Source: Municipal Services Utility "Servicom-Petresti"

Figure 4-12: Operational indicators



Source: Municipal services utility "Servicom-Petresti", GIZ/MLPS

Following analysis of operational indicators presented by municipal services utility "Servicom-Petresti", was concluded that in October and November 2014, the monthly volume of the abstracted raw water is smaller than the volume of water sold to domestic customers, public institutions and business entities. The municipal services utility "Servicom-Petresti" explained this by the fact that in this period of the year, the manholes for water meter nodes are covered and the water meter data collection is impossible, thus the volume of consumed water is determined according to the monthly average in the respective period.

4.6.3 Real water consumption

The real water consumption is the volume of water consumed by one customer during 24 hours to meet the physiological and domestic needs under normal operation conditions of the water supply system (l/c/d). The real water consumption for customers is the ratio of daily water sold by the utility divided by the number of consumers (domestic, public institutions and business entities), as provided in Table 4-23.

Table 4-23: The real water consumption, Petresti village

N°	Indicator	Unit of measurement	Year		
			2012	2013	2014
1.	Number of domestic customers	pers.	2,223	2,295	2,415
2.	The annual volume of abstracted raw water	m³/an	65,069	64,638	65,322
3.	Total water sold by the utility, of which: • Domestic consumers • Public institutions and business entities	m³/ year m³/ year m³/ year	53,298 32,571 20,727	57,465 32,183 25,282	56,820 35,650 21,170
4.	Real water consumption (based on annual billed water)	l/c/d	66	69	64
5.	Real water consumption (based on daily water sold to domestic consumers)	l/c/d	40	38	40

Source: Municipal Services Utility "Servicom-Petresti", GIZ/MLPS assessments

4.6.4 Non-revenue water (NRW)

Annual non- revenue water is the difference of the annual volume of abstracted raw water and annual water invoiced by the utility.

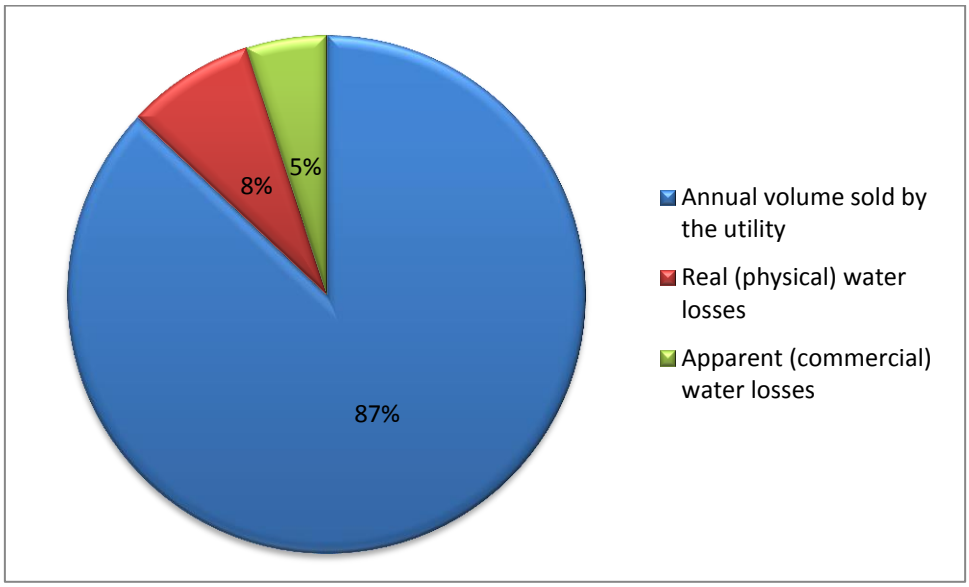
The water balance for water supply system in the town of Ungheni is provided in the Table 4-24.

Table 4-24: The water balance for water supply system in Petresti village

N°	Indicator	Unit of measurement		2014	
1.	Number of domestic consumers	pers.			2,415
2.	Annual volume of abstracted raw water	m³			65,322
3.	Annual volume of invoiced/billed water	m³			56,820
4.	The annual volume of NRW, including: • Real (physical) water losses (60% of NRW) • Apparent (commercial) water losses (40% of NRW)	m³ m³ m³	% % %	8,502 5,101 3,401	13 8 5

Source: Municipal Services Utility "Servicom-Petresti", GIZ/MLPS assessments

Figure 4-13: Water balance



Source: Municipal services utility "Servicom-Petresti", GIZ/MLPS assessments

In order to reduce real (physical) losses of water it is recommended to:

- Identify the condition of pipes during operational or capital repairs (taking note of the material, interior and outer diameter, as well as interior and exterior condition);
- Identify the network sections with an advanced degree of wear or damage;
- Rapidly detect hidden water losses;
- Maintain records related to damages/ leaks and their quick remedy.

The measures related to apparent (commercial) water loss reduction can be identified by effective management of water supply system in Petresti village. With the purpose to reduce apparent water losses it is recommended to:

- Install high precision water meters;
- Identify and replace defective water meters;
- Identify unauthorised connections of the water distribution network.

4.6.5 Water metering

During the period 2007-2014, a water metering programme was implemented, resulting in a metering rate of about 100% of domestic customers, public institutions and business entities in Petresti village. However, the water meter data contain a margin of error because the water meter nodes installed for customers are of class "A" (low precision class).

4.6.6 Equipment and facilities

The municipal services utility “Servicom-Petresti” do not own and operate equipment and facilities.

4.7 Technical and operational analysis of the water supply system in the Petresti locality

4.7.1 Non-revenue water (NRW)

Non-revenue water has a negative impact on operating costs (high level of electricity consumption of pumping, costs for current and capital repairs, etc.) and revenues (administrative /commercial losses). Both the operating costs and revenues are important factors for sustainable development in water supply sector.

The statistics on damages and repairs in the period 1 January 2014 – 31 December 2014 are provided in Tables 4-25 and 4-26.

Table 4-25: Statistics on pipe damage, 01 January - 31 December, 2014, Petresti locality

No.	Location	Pipeline breakdowns
1.	On distribution network	5

Source: Municipal Services Utility “Servicom-Petresti”

Table 4-26: Statistics on repairs made, 01 January - 31 December, Petresti locality

No.	Type of repair	Repairs made
1.	Current repairs	5

Source: Municipal Services Utility “Servicom-Petresti”

4.8 Wastewater system

4.8.1 Wastewater system in the town of Ungheni

About 20,433 domestic consumers out of 38,400 inhabitants from the town of Ungheni are connected to the centralised wastewater system, connection rate for wastewater services is about 53%.

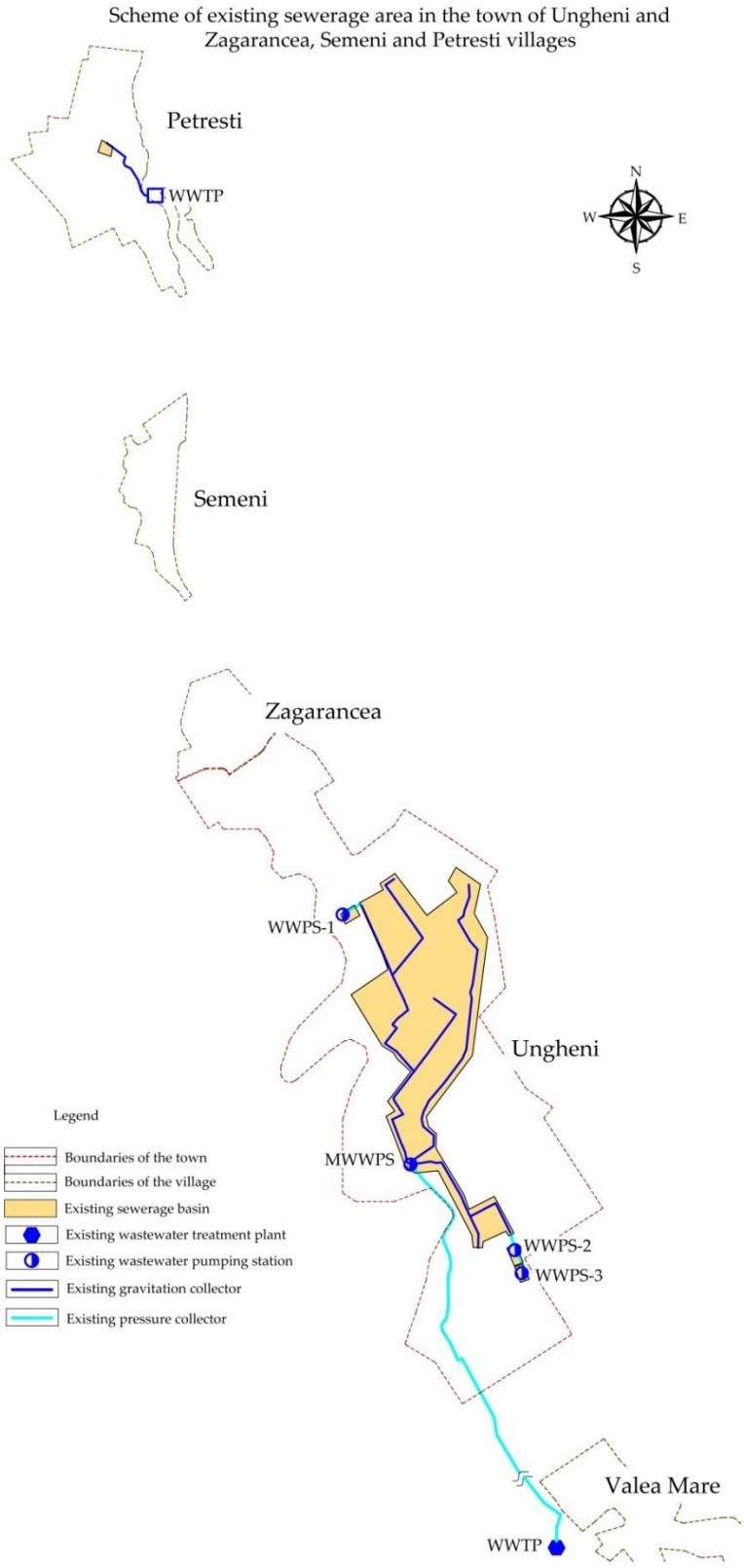
The wastewater system in the town of Ungheni, consists of separate sewerage network, that collects and disposes through at least two networks the domestic wastewater, industrial wastewater and storm water. The main facilities of the wastewater system in the town of Ungheni are the following:

- Gravity and pressure sewerage networks;
- One (1) main wastewater pumping station (MWWPS) and three (3) local wastewater pumping stations (WWPS) located in Caragiale, Ungureanu and Burebista streets;
- Wastewater treatment plant (WWTP).

Scheme of wastewater system in the town of Ungheni is represented in in Figure 4-14. More detailed information about wastewater system in the town Ungheni is provided in Annex 11.

The wastewater basin represents a defined territory, from which the wastewater is collected to a sewerage network.

Figure 4-14: Scheme of wastewater system in the town of Ungheni and Petresti village



Source: GIZ/MLPS

4.8.1.1 Sewerage network

The total length of gravity sewerage network is about 70,479 m. The main technical parameters of the gravity sewerage network are provided in Tables 4-27 and 4-28. The total length of pressure sewerage is about 20,200 m. The length of sewerage network for different diameters expressed as a percentage is provided in Table 4-29. The main technical parameters of the pressure sewerage network are provided in Table 4-30.

Table 4-27: Main technical parameters of gravity sewerage network

No	Material	Length (m) / diameter (mm)							Length (m)	Pipe age (years)
		800	700	600	500	400	300	250		
1.	Cast iron				500	14,739	706	417	16,362	47
2.	Ceramic					644	2,889	7,396	10,929	40
3.	Asbes-tos-cement					1,124	1,427	431	2,982	40
4.	Rein-forced concrete	13,712	1,327	1,603	825	187			17,654	40

Source: ME "Apa-Canal" Ungheni

Table 4-28: Main technical parameters of gravity sewerage network

No	Material	Length (m) / diameter (mm)						Lengt h (m)	Pipe age (years)	Total length (m)
		200	160	150	125	100	65			
1.	Cast iron	2,357		2,696		2,646	1,659	9,358	47	70.479
2.	Ceramic	5,120		3,102		615		8,837	40	
3.	Asbestos-cement	1,322		469		75		1,866	40	
4.	PVC		1,275		1,216			2,491	2	

Source: ME "Apa-Canal" Ungheni

Table 4-29: Percentage of sewerage network by diameter size

No.	Material	Sewerage network length (m) by diameter size (mm)		Length (m)	Age (years)	Total (%)
		800 – 250 mm	200 – 65 mm			
1	Cast iron	16,362	9,358	25,720	47	36
2	Ceramic	10,929	8,837	19,766	40	28
3	Asbestos-cement	2,982	1,866	4,848	40	7
4	Reinforced con-crete	17,654		17,654	40	25
5	PVC		2,491	2,491	2	4
	Total	**47,927**	**22,552**	**70,479**		**100**

Source: ME "Apa-Canal" Ungheni, GIZ/MLPS assessments

Table 4-30: Main technical parameters of pressure sewerage network

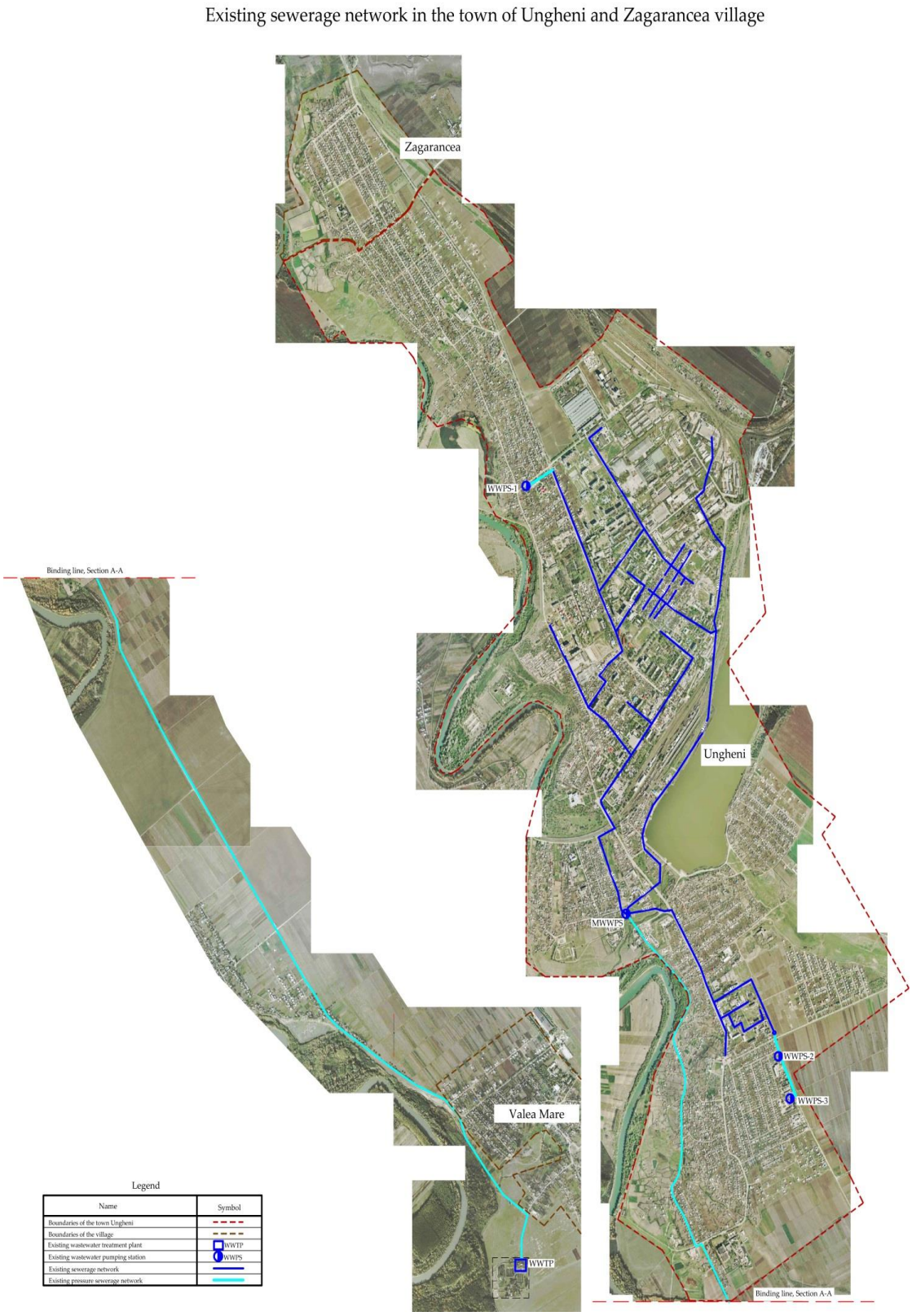
No	Material	Length (m) / diame-ter (mm)		Length (m)	Age	Total length (m)
1.	I – Cast iron collector D500mm	10,125	500	10,125	40	20,200

No	Material	Length (m) / diameter (mm)		Length (m)	Age	Total length (m)
2.	II – Steel collector D=500mm	2,225	500	2,225	37	
3.	II – Cast iron collector D=500mm	7,850	500	7,850	37	

Source: ME "Apa-Canal" Ungheni

The sewerage network in the town of Ungheni is provided in Figure 4-15. More detailed information is provided in Annex 11.

Figure 4-15: Sewerage network in the town of Ungheni



Source: www.geportal.md, GIZ/MLPS

4.8.1.2 Wastewater pumping stations

The wastewater from the existing wastewater basin is collected by gravity to the main wastewater pumping station (MWWPS) located in the locality's lower sector, and further pumped by pressure pipes to the wastewater treatment plant (WWTP) located in Valea Marea village.

The key issue of the main wastewater pumping station (MWWPS) is the contact chamber, which currently is clogged with sludge and makes difficult the access to the screens.

The nominal parameters of the wastewater pumping stations and pumps are presented in Table 4-31.

Table 4-31: Main nominal parameters of the pumping equipment

N°	PS name/ Location	Year of installation	Year of rehabilitation	Pump type	Pump flow rate (m^3/h)	Head (m)	Pump power (kW)	Pump energy specific consumption (kwh/m^3)
1.	MWWPS	1974		НГ.150.125.315/144 (2 pcs.)	144	48	22	0.153
2.				СД 450/56 1 unit (2 pcs.)	450	56	132	0.294
3.				НГ.150.125-229/4/double (2 pcs.)	140	48	22	0.158
4.			2005	WILO tip EMU FA10.94E-318-180 (2 pcs.)	181	23.4	20	0.111
5.				CM 100-65-250/4 (Drainage 1 pcs.)	50	20	7.5	0.150
6.	WWPS, Caragiale str.	2007		WILO-EMU FA05.32RFE	11.16	10.4	0.9	0.06
7.	WWPS, 15 Ungureanu str.	1985		CM100/65-250	120	7.2	20	0.065
8.	WWPS, 17,Burebista str.	2012		WILO-EMU FA05.32E-112	16	0.9	1.5	0.015

Source: ME "Apa-Canal" Ungheni

Figure 4-16: Main wastewater pumping station: Contact chamber. Engine room

Source: GIZ/MLPS

4.8.1.3 Wastewater treatment plant

The wastewater treatment plant (WWTP) is located in the southeast to Valea Marea village and was put into operation in 1975, with a design capacity of 15,000 m³/day. In the present, the wastewater flow rate collected to the wastewater treatment plant is about 3,000-4,000 m³/day.

Wastewater treatment plant includes the following processes: mechanical treatment, biological treatment, tertiary treatment and disinfection level.

The technological scheme of wastewater treatment includes the following facilities:

- Energy dissipater;
- Grit chambers (two (2) units);
- Sand beds (one (1) unit);
- Digester-settlers (eight (8) units);
- Active sludge aeration tanks (ASAT) (three (3) units);
- Secondary settlers (six (6) units);
- Sludge drying beds;
- Sludge pumping station and blower station;
- Chlorination plant; and
- Contact chambers (two (2) units).

The energy dissipater (or contact chamber) is designed to reduce the flow rate of pumped wastewater and the transition in gravity flow through open channels to treatment facilities.

The **mechanical treatment** or primary treatment is designed to remove suspended solids from wastewater by physical processes.

Gross solids and other constituents removal is carried out through screens as a mandatory operation to be performed at the inlet of the wastewater treatment plant. In Valea Marea village, gross solids and other constituents removal is carried out through screens installed in the grit chamber.

The grit chamber is designed for removal of mineral particles bigger than 0.2 mm from the wastewater, especially sand particles and particles considered non-decayed. The technological scheme includes two (2) grit chambers, of which only one is in operation.

The sand trapped sludge (dredged sludge) is non-decayed and it is subjected to de-watering on the sludge drying beds. The technological scheme includes one unit, which is out of operation.

The primary settlers are designed to gravity sedimentation of particles smaller than 0.2 mm, especially of organic suspended solids. The technological scheme includes two (2) digester-settlers, of which one is in operation only.

Figure 4-17: Wastewater treatment plant: Energy dissipater. Mechanical screens

Source: GIZ/MLPS

Biological treatment or secondary treatment uses the biological activity of microorganisms in order to oxidise and mineralise the organic matter from wastewater, which previously had been subjected to the primary treatment. The removal of organic matter dissolved in the wastewater is carried out by its absorption on the cell area, microorganisms, especially bacteria. As a result, the new bacteria cells and so-called metabolites (carbon dioxide, mineral salts) are formed. The technological scheme includes three (3) active sludge aeration tanks, which area out of operation.

Figure 4-18: Wastewater treatment plant: Digester-settler. Active sludge aeration tank[9]

Source: GIZ/MLPS

[9] ASAT

The secondary settlers are designed to remove the grown microorganisms from wastewater, (usually as a biological membrane) in the active sludge aeration tanks. Sedimented sludge is partially used for seeding aeration tanks with activated sludge, and the excess is stored on the sludge drying beds for dewatering, which aims to reduce humidity from 93-98% up to 70–80%. In Valea Marea village, the secondary settlers and sludge drying beds located at the wastewater treatment plant are out of operation.

The artificial biological treatment does not always ensure the elimination of all microbes, bacteria and pathogenic viruses. The disinfection level is foreseen to avoid the spread of infectious diseases at the wastewater discharge and it includes following units:

- Chlorination plant, where the chlorine solution is dosed and prepared;
- Mixing chamber of chlorine solution with treated wastewater;
- Contact chamber.

Figure 4-19: Wastewater treatment plant: Secondary settlers. Contact chamber

Source: GIZ/MLPS

In the town of Ungheni, the existing facilities and equipment for wastewater treatment have a high degree of wear and the wastewater treatment process includes only the mechanical treatment, the biological treatment being out of operation.

According to obtained data, the quality of effluent wastewater does not comply to the current standards of the Republic of Moldova (Government Decision no. 950 of 25.11.2013 on Approval of the Regulations on the conditions of collection, treatment and wastewater evacuation into sewage and /or water bodies for rural and urban localities), and corresponding treatment, for following indicators: suspended solids, five days biochemical oxygen demand (BOD_5), chemical oxygen demand (COD) and ammonia nitrogen (NH_4+). Quality indicators of influent and effluent wastewater were presented by ME “Apa-Canal” Ungheni, as provided in Table 4-32.

Table 4-32: Wastewater quality indicators

No.	Indicator	Unit	Influent concentration	Effluent concentration	Maximum allowed concentration acc. to GD nr.950
1.	Hydrogen ion concentration (pH)		8.1	7.5	6.5 – 8.5
2.	Suspended solids	mg/l	237.1	37.9	35.0

No.	Indicator	Unit	Influent con-centration	Effluent con-centration	Maximum allowed concentration acc. to GD nr.950
3.	Five days biochemical oxygen demand (BOD_5)	mgO_2/l	188.8	85.4	25.0
4.	Chemical oxygen de-mand (COD)	mgO_2/l	321	145	125.0
5.	Ammonia Nitrogen (NH_4+)	mg/l	31.8	30.6	2.0
6.	Total phosphorus (P)	mg/l	1.73	1.56	2.0
7.	Synthetical detergents biodegradable active an-ions	mg/l	0.97	0.86	0.5

Source: ME "Apa-Canal" Ungheni

Figure 4-20: Quality analysis of influent and effluent wastewater in the town of Ungheni

Source: GIZ/MLPS

The treated wastewater is discharged into Varsavca River – a tributary of the Prut River. The monthly volume of treated wastewater is provided in Table 4-33.

Table 4-33: Monthly volume of treated wastewater for 2014

Month	Monthly volume of treated wastewater (m^3)
January	67.515
February	65.696
March	62.743
April	56.614
May	62.582
June	82.050
July	71.766
August	66.238
September	74.852
October	76.228
November	74.030
December	63.477
Total	**823.791**

Source: ME "Apa-Canal" Ungheni

4.8.2 Wastewater system in Zagarancea and Semeni localities

There is no centralised wastewater system in the localities of Zagarancea and Semeni.

4.8.3 Wastewater system in Petresti locality

In Petresti village, the wastewater from the school and kindergarten is collected to the local wastewater treatment plant (TOPAZ-150), which was put into operation in 2006, with a design capacity about of 22 m³/day. In the present, the wastewater flow rate collected to the wastewater treatment plant is about 18 m³/day, as provided in Figure 4-21.

Figure 4-21: Sewerage network in Petresti locality

Source: www.geportal.md, GIZ/MLPS

The total length of gravity sewerage network in Petresti locality is about 1,357 m. The main technical parameters of gravity sewerage network are provided in the Table 4-34.

Table 4-34: Main technical parameters of gravity sewerage network in Petresti village

No.	Material	Length (m) / diameter (mm)			Length (m)	Pipe age (years)	Total length (m)
		150	200				
1.	Ceramica	927			927	28	1,357
2.	PVC		430		430	8	

Source: Municipal Services Utility "Servicom-Petresti"

According to obtained data, the quality of effluent wastewater complies to the current standards of the Republic of Moldova (Government Decision no.950 of 25.11.2013 on Approval of the Regulations on the conditions of collection, treatment and wastewater evacuation into sewage and /or water bodies for rural and urban localities), and corresponding treatment. Quality indicators of influent and effluent wastewater were presented by municipal services utility "Servicom-Petresti", as provided in Table 4-35.

Table 4-35: Wastewater quality indicators in Petresti village

No.	Indicator	Unit	Maximum allowed concentration acc. to GD no. 950	Effluent concentration
1.	Hydrogen ion concentration (pH)		6.5 – 8.5	7.9
2.	Suspended solids	mg/l	35.0	
3.	Five days biochemical oxygen demand (BOD_5)	mgO_2/l	25.0	32
4.	Chemical oxygen demand (COD)	mgO_2/l	125.0	120
5.	Ammonia Nitrogen (NH_4+)	mg/l	2.0	51
6.	Total phosphorus (P)	mg/l	2,0	
7.	Synthetical detergents biodegradable active anions	mg/l	0.5	

Source: Municipal Services Utility "Servicom-Petresti"

Figure 4-22: Wastewater treatment plant in Petresti village

Source: GIZ/MLPS

Monthly volume of treated wastewater is provided in Table 4-36.

Table 4-36: Monthly volume of treated wastewater for 2014

Month	Monthly volume of treated wastewater (m^3)
January	77
February	177
March	190
April	318
May	181
June	86
July	183
August	186
September	106
October	145
November	122
December	50
Total	**1,821**

Source: Municipal Services Utility "Servicom-Petresti"

4.9 Available pre-feasibility and feasibility studies and technical documentation

During the elaboration of this feasibility study; available studies, feasibility studies and existing technical designs have been consulted, as provided in Table 4-37.

Table 4-37: Available pre-feasibility and feasibility studies and technical documentation

No.	Project Name	Type of document	Financing Agency
1.	Water supply and sewerage feasibility studies, second design intended for small towns of the Republic of Moldova, Water and Sewerage Project Implementation Unit, SWECO INTERNATIONAL, 2007	Prefeasibility study	N/A
2.	Feasibility study for design of volumes collection and construction of water supply an sewerage in the sector which includes Burebista, Petru Rares, Cetireni, I.Neculce streets, microrayon of Danuteni, town of Ungheni, „ALTECINVEST" L.T.D., 2014	Feasibility Study	N/A
3.	Water supply and sewerage in the localities of Ungheni rayon, ACVAPROIECT,	Technical design	N/A
4.	Rehabilitation of water transmission main in Petresti village, rayon of Ungheni, "ECOPROIECT" L.T.D., 2006	Implemented technical design	N/A
5.	Water and sewerage networks in the Semeni village, rayon of Ungheni	Implemented technical design (water supply)	NEF
6.	Water and sewerage networks in the Zagarancea village, rayon of Ungheni	Implemented technical design (water supply)	NEF

Source: LPA Ungheni, LPA Zagarancea Commune, LPA Petresti Commune, http://mediu.gov.md/

The operational activity of municipal enterprise "Apa-Canal" Ungheni for 2014 includes the following:

- The water distribution network was rehabilitated in the streets of Martisor, Caragiale, Florilor, Zona Industriala Beresti, Mihai Eminescu, Vasile Alecsandri, Stefan cel Mare 257 (BIOVET), Barbu Lautaru, Constantin Stamati, Crestiuc 5-7, Romana (from Veronica Micle street untill Romana street, 5). The total length of water distribution network is about 2,209 m;
- The consumer's metering rate has been increased, reaching 86.10%;
- The number of customers connected to the drinking water supply system has been increased – 31,852 persons;
- Current repairs to the pump units No. 2, 4, 5 at Main Wastewater Pumping Station (MWWPS) has been performed;
- 30 m of pressure sewerage network has been rehabilitated;
- The booster pump group has been replaced at the water booster stations in the 3 Porumbescu, 11 Crestiuc and 26 Romana streets;
- A low level of water losses under indicated level of standards has been ensured;
- The reliability of the water supply and wastewater system, as well the quality of drinking water and wastewater, in the limits provided for by current standards have been ensured.

The objectives for 2015 are as follows:

- Installation of SCADA system (Supervisory Control And Data Acquisition) at booster pumping stations in the town of Ungheni;
- To increase the number of consumers;
- Construction of water distribution network in Sobolevschii street;
- Rehabilitation of water distribution network located in the Mihai Viteazu street from Ungureanu street up to Fintinilor street;
- Rehabilitation of water distribution network located in the Nationala street nearby Vasile Lupu street, Nationala street up to Solidaritatii street.

4.10 Conclusions

The identified issues of water supply and wastewater services in the feasibility study area are following:

- In the town of Ungheni, the water supply service area is about 98% and water supply connection rate is about 78%;
- High real (physical) and apparent (commercial) water losses (annual volume of NRW is about 37%);
- High degree of wear of existing pipelines (the pipe age exceeds years of useful life) causes leakages in the water supply system in some sectors of the town of Ungheni;
- In Zagarancea locality, the water supply service area is about 100% and water supply connection rate is about 82%.At the time of the site visits conducted by the GIZ/MLPS experts, in Semeni locality, the construction-installation works of the water distribution network had been carried out (100% coverage rate of locality area);
- In Petresti locality, the water supply service area is about 100% and water supply connection rate is about 62%;

- According to the obtained data, provided by municipal services utility “Servicom-Petresti”, the quality of the raw water at the well /intake does not comply with the standards of the Republic of Moldova (Government Decision no. 934 of 15.08.2007 on the establishment of Automated Information System "State register of natural mineral water, drinking water and bottled non-alcoholic beverages") for following indicators: colour, turbidity, nitrates (NO3) and total hardness;
- In the town of Ungheni, the wastewater coverage area is about 79% and wastewater connection rate is about 59%;
- High degree of wear of existing pipelines (the pipe age exceeds years of useful life) causes frequent sewerage blockages and emergency driven maintenance;
- According to obtained data, the quality of effluent wastewater does not comply to the current standards of the Republic of Moldova (Government Decision no. 950 of 25.11.2013 on Approval of the Regulations on the conditions of collection, treatment and wastewater evacuation into sewage and /or water bodies for rural and urban localities), and corresponding treatment, for following indicators: suspended solids, five days biochemical oxygen demand (BOD_5), chemical oxygen demand (COD) and ammonia nitrogen (NH_4+);
- There are no centralized wastewater systems in the neighbourhood localities (Zagarancea, Semeni and Petresti).

5 Investment Programme

5.1 General

The objective of this chapter is to prepare an Investment Programme to set the general direction for sector development in the study area and to identify the investment needs that will lead to increased coverage of population with water supply and wastewater services, improved service quality and efficiency improvements.

The subject of Investment Programme has been developed by MLPS experts in collaboration with local and regional partners[10] based on the following:

- Existing pre-feasibility, feasibility studies and detailed designs (see Chapter 4.9- Available pre-feasibility and feasibility studies and technical documentation);
- WSS Regional Sector Programme (RSP) and Possible Project Concept (PPC) for Ungheni developed in the framework of the project “Modernization of Local Public Services in the Republic of Moldova”;
- Analysis of the existing situation (see Chapter 4- Technical aspects-Existing situation);
- The comparison of results and assessment of initial conditions with the Regional Sector Programme for Development Region Centre and the National Water Supply and Sanitation Strategy 2014-2028 (GD nr.199 of 20.03.2014);
- Urban Development Plan of the town of Ungheni (see Chapter 4.1);
- Strategies, goals and priorities defined by the Mayor’s Office of the town of Ungheni and ME 'Apa -Canal' Ungheni (see Chapter 5.2 Development strategy for water supply and wastewater services);
- Identified problems and objectives based thereon;
- Water demand and wastewater flow projection (see Chapter 5.4).

The Investment Programme includes:

- Short-term;
- Medium-term;
- Long-term measures.

The short-term measures are referred to as Priority Investment Measures and are again sub-divided into two sub-phases as follows:

- Phase 1 – priority measures to be implemented until 2018;
- Phase 2 – priority measures to be implemented between 2018 and 2021 (depending on the availability of funds and the capacity of the implementing and operating agency this period might be extended).

[10] A Project Working Group (PWG), established by decision of the local council and comprising members from the Regional Development Agency Centre (RDA Centre), the Ungheni Local Public Administration (LPA) and GIZ/MLPS experts, was instituted to facilitate and coordinate the process of preparation and agreeing this feasibility study, in particular the scope of the proposed project. The same PWG will endorse the study for approval by the Ungheni local council.

The main reason for the sub-division of the short-term measures into two phases is that the capacity of the implementing and operating agencies should not be overloaded. Further, the objective is to identify “no-regret” measures which can be implemented immediately after completion of this feasibility study and which neither require further studies or investigations nor might it be in contradiction to other regional projects under development. Priority investment measures retained in Phase 1 are considered as “The Project” for which further assessments have been carried out (Option Analysis, Financial Analysis, Environmental Assessment, etc.) in this study.

The identified investment measures are presented in this chapter in the following sections:

- In Chapter 5.7 all identified measures have been described (irrespective of their phasing);
- In Chapter 5.8 the identified measures have been prioritised and phased (grouping into the above mentioned phases);
- In Chapter 5.9 an Option Analysis for the Priority Investment Measures retained for Phase 1 has been carried out;
- In Chapter 5.10 a Priority Investment Plan (PIP) including investment cost estimates for Phase 1 and Phase 2 measures has been presented.

5.2 Development strategy for water supply and wastewater services

In general, the main drivers for developing the Investment Programme in the water supply and wastewater sector are:

- Strategic Goal;
- Urban development;
- Service objectives;
- Water demand projection;
- Metering policy;
- Tariff policy.

Strategic goal

The general strategic goal of the Mayor Office and ME 'Apa-Canal' Ungheni is to achieve a viable and high quality management of the centralised water supply and wastewater systems. As for now, no specific policy and strategy for the Water Supply and Wastewater Sector has been developed for the town of Ungheni. The Mayor Office and ME 'Apa-Canal' Ungheni are well aware of the actual situation regarding to water supply and wastewater services and are willing to improve its quality. In order further to improve the efficiency of the services and utilise economies of scale, neighbouring localities should be integrated into the services area of ME 'Apa-Canal' Ungheni.

Urban development

According to the analysis of demographic development in recent years, the population of Ungheni Town can be expected to slightly increase throughout the period of analysis (see Chapter 2.4 - Population). More recently an extension of the town’s suburban areas was observed, especially along the road to Sculeni (road border cross to Romania). The town benefits from the proximity to the border points (both on road and rail), especially being very closely located to the Romanian city of Iasi (a major cultural and eco-

nomic centre). In recent years the town's local economy revitalised which reflected in construction of new high rise buildings (10 floor apartment buildings with commercial space on the first floors) and an increase of the economic activities. It is expected that the development of the town of Ungheni will exceed the national average.

Service objectives

The overall service objective is to provide the population with safe, reliable and continuous water supply and wastewater services. To achieve this, the Mayor Office and ME 'Apa-Canal' Ungheni should consider (see assumptions and targets presented in Chapter 5.3-Design parameters and assumptions) the following specific objectives:

- Provide water compliant with the national drinking water standards to all parts of the service area;
- Maintain the current level of service by providing water 24 hours per day;
- Provide water of sufficient quantity to all customers;
- Extend the water supply and wastewater service area in the town of Ungheni;
- Treat effluents from the wastewater system in compliance with the current nation legislation and in the future in compliance with the respective EU legislation (Urban Wastewater Treatment Directive);
- Reduce non-revenue water to an acceptable level of a maximum 25% by 2045;
- Improve efficiency of service provision by enhancing operation and maintenance practices for the Mayor Office and ME 'Apa-Canal' Ungheni;
- Reduce operating costs and provide sufficient funds for adequate maintenance, repair and capital renovation of the system in order to ensure sustainability of service provision;
- Improve environmental protection;
- Ensure affordability of the tariffs for water supply and wastewater services.

Water demand projection

Following a period of decrease due to the decline of the old industries, the town of Ungheni is experiencing a period of stable development in the last 10 years which reflected in an increase of water demand. Economically, the city benefits from the creation of the free economic zone. The proximity to the border with the European Union offers additional income opportunities which reflected in higher purchasing power for the residential users. Development of water demand including water losses and wastewater flow projection is presented in the following chapter. Overall, it can be expected that water demand for all customer categories (domestic and non-domestic) will increase during the period of analysis.

Metering policy

Ungheni Town

Water Production metering: ME 'Apa-Canal' Ungheni reported that two water meters at the outflow of the Water Treatment Plant (WTP) and at connection points to other localities (two water meters) were installed and are operational. There are no water meters installed at pumping stations and reservoirs.

Customer metering: In general the current status of water metering is at high level (about 96% of the customers are metered). About 87% of the individual households (private houses) and 100% of the apartments in multi-storey buildings are metered.

There are no master meters installed at the entrance of the multi-storey buildings. Further, ME 'Apa-Canal' Ungheni reported that the metering rate for non-domestic customers (institutional and commercial customers) reached 98%.

Most of the water meters in apartment buildings and individual households were replaced during implementation of a World Bank financed project some years ago and are therefore assumed to be operational. However, about 25% of the customer water meters still need to be replaced in the medium and long-term.

Locality of Petresti

Water Production metering: The water operator of Petresti (Municipal Enterprise "Servicom-Petresti") reported that water production is fully metered (One water meter at each of the two supply sources is installed and in operation).

Customer metering: "Servicom-Petresti" reported that all domestic and non-domestic consumers (private houses, enterprises, institutions) are endowed with water meters (100% metering rate). The meters are functional and were installed between 2007 and 2014, most of them being of "A" precision class (the lowest one).

Tariff policy

Water tariff policy and strategy (level of average tariff and tariff structure) has a significant impact on:

- Water consumption (demand elasticity results in reduction of consumption when tariffs increase);
- Revenue stream and consequently capacity of the operator to maintain the WSS system adequately (sustainability).

Capacity building measures should be foreseen to develop an appropriate tariff policy and to ensure sustainability of the proposed Priority Investment Plan. Reference is made to Chapter 6 – Financial and Economic analysis.

5.3 Design parameters and assumptions

The development of water demand is determined by the parameters and assumptions defined as follows:

5.3.1 Domestic water consumption and wastewater generation

- Population forecast and its assumptions as presented in Chapter 2.4;
- The development of the service connection rate (water and wastewater) for domestic customers considers the following:
  - Existing population connected;
  - Additional population connected due to on-going projects (completed before 2018);
  - Population connected due to network extension foreseen in Phase 1 by 2018;
  - Population connected due to network extension foreseen in Phase 2 by 2021;
  - Maximum target connection rate within the planning horizon is assumed to be reached in 2030 for urban localities and in 2045 for rural localities.
- It is further assumed that the coverage rate (population which can potentially be connected to the network) is different from the connection rate (population which actually is connected to the network) and the following applies: Data for the existing situation regarding coverage and connection rate are applied if available (see

chapter 4-Technical aspects-Existing situation); if data are not available it is assumed that the connection rate is 30% less than the coverage rate for water supply and 40% less than the coverage rate for wastewater. The difference between coverage rate and connection rate will then decrease linearly and will be zero in the year when the target connection rate is defined (e.g. water supply coverage rate for urban areas will reach 100% in 2030 and will be equal to the water supply connection rate in 2030). The respective targets are presented in the Table 5-1;

- **Per capita domestic water consumption** (volume of water sold) is currently very low as presented in Chapter 4.4 - Water balance, mainly due to two reasons (i) absence of part of the registered customers and (ii) apparent water losses (water theft, metering inaccuracy). Due to measures proposed in this feasibility study (Chapter 5.7.6 Technical Assistance) aimed at drastically reducing apparent (commercial) losses it is assumed that per capita water sales are projected to increase to the maximum of 110 l/c/d in urban areas and 80 l/c/d in rural areas due to economic development until the year 2045. It is noteworthy, that the demand projection model refers to "water sales" and not to "real water consumption[11]", which explains the difference to the suggested per capita consumption figures in the Regional Sector Programme (RSP);
- The **wastewater generation factor** (share of wastewater discharged to the wastewater system out of water consumed) for domestic customers is assumed to be 100% (factor of 1).

5.3.2 Non-domestic water consumption and wastewater flow

- **Industrial consumption**[12]: During the last decades, the economy in Ungheni Town has slowed down and many industries closed, which resulted in a steep decline in industrial water consumption. Recently, there have been signs for revitalisation of the town's economic activities. For the purpose of this study, it is assumed that industrial water consumption will slightly increase (from a very low level) linearly to 15 l/c/d until 2030, and will then remain constant until the end of the planning horizon. It is assumed that industrial consumption only applies to urban localities;
- **Institutional water consumption**: It is assumed that institutional water consumption will increase/decrease from current consumption level[13] linearly to 10 l/c/day until 2030 (in line with the National WSS Strategy) and will then remain constant until the end of the planning horizon. It is assumed that institutional consumption applies to urban and rural localities;
- The **wastewater generation factor** for non-domestic customers (share of wastewater discharged to the wastewater system out of water consumed) is assumed to be 100% for commercial and institutional customers (factor of 1);
- Industrial wastewater flow from customers not connected to the water supply system (own wells) but discharging to the wastewater system is unknown and cannot be determined based on the provided data). For future development of water demand it is assumed that this volume is insignificant and will not be taken into consideration for wastewater flow projection.

[11] The difference between water sales and real water consumption are the „apparent or commercial losses" due to meter under registration, meter tampering, etc. and partly also due to consumption from private individual wells.

[12] Including all commercial entities

[13] According to data from sales department of ME 'Apa-Canal' Ungheni

5.3.3 Extension of water supply system to localities in the neighbourhood of the town of Ungheni

ME 'Apa-Canal' Ungheni wishes to extend the services to the localities of Semeni, Petresti and Zagarancea in the vicinity of Ungheni Town. These localities are currently only partly endowed with a water supply network and not endowed with a sewerage network. Within this study it is assumed that all localities will be served with water supply and wastewater services from ME 'Apa-Canal' Ungheni by 2021 and respective investments have been included in this study.

5.3.4 Water losses

Currently non-revenue water (NRW) in the water supply system of the town of Ungheni is comparatively high. Reduction of NRW is therefore one of the main goals in order to increase efficiency of the WSS system. The following assumptions have been made with regard to reduction of NRW for the network.

- *Apparent Losses*[14] *(commercial losses)* are assumed to decrease linearly to 5% (unavoidable apparent losses) until the year 2045 due to technical assistance measures for reduction of commercial losses included in Phase 1;
- *Real losses (physical losses)* are assumed to decrease linearly to 20% until the end of the planning horizon in 2045. This target is assumed to be achieved by implementing (i) investment measures for renovation of the transmission main and (ii) Technical Assistance measures and equipment aiming at reducing water losses (including training in water loss reduction e.g. leakage detection and pressure management; improvement of revenue collection[15]) proposed in Phase 1. Further, in the long-term it is assumed that continuous renovation of the network[16] will further reduce real water losses;
- Overall, NRW is therefore assumed to decrease to 25% until the year 2045.

5.3.5 Sewerage infiltration rate

The sewerage infiltration rate (as % of total wastewater discharged to the wastewater system) is assumed to decrease if measures for rehabilitation of the sewerage network are foreseen. The development of this parameter is based on expert assessment, separate for each sewerage network, depending on

- The condition of the sewerage networks;
- The share of new and old sewerage network;
- The type of sewer (separate or combined system);
- Information about groundwater table if available;
- Data of wastewater concentration at the outflow of the wastewater system if available.

[14] Including unbilled authorised consumption

[15] Commercial improvements will result in availability of funds for regular renovation of the water network

[16] Financed from additional revenues generated by „Apa Canal“ as a result of technical assistance measures included in Phase 1.

There is no information on the current infiltration rate available for Ungheni sewerage network (see Chapter 4-Technical Aspects-Existing Situation) and therefore a typical[17] infiltration rate for the existing sewerage network in the region has been applied in the demand projection model (see Table 5-1). It is assumed that the infiltration rate will decrease after implementation of measures for rehabilitation of sewerage network or extension of the sewerage network in accordance with the ratio of "new sewerage network[18]" and "old sewerage network[19]" (see Table 5-1). Thereafter, it is assumed that the sewer infiltration rate will be maintained at constant level until the end of the planning horizon[20].

5.3.6 Wastewater flow and load

The following assumptions have been made regarding wastewater flow and load development:

- Specific domestic wastewater load: 60 gBOD_5/capita/day for design of WWTP;
- Specific non-domestic wastewater load: Wastewater flow at a max. admissible BOD_5 concentration of 225 mg/l to discharge into the sewerage network;
- Peak Storm Water Factor: 1.3 for allowance for storm water entering into the sewerage network from "inappropriate[21]" rainwater connections or rainwater entering into manholes during storm water run-off (applicable for separate systems).

All design parameters are in line with the national regulation and with international standards. The main design parameters are presented in the Table 5-1 (reference is made to explanations in the previous chapter).

Table 5-1: Design parameter

N°	Design Parameter	Unit	2014[22]	2018[23]	2021[24]	2030	2045
0	Service coverage rate for domestic customers, disaggregated for urban and rural localities						
0.1	Water - total	%	86	100	100	100	100
0.2	Wastewater - total	%	65	68	96	98	99
0.3	Water supply – urban	%	98	100	100	100	100
0.4	Water supply – rural	%	25	100	100	100	100
0.5	Wastewater - urban	%	78	82	99	100	100
0.6	Wastewater - rural	%	0	0	82	85	90
1	Service connection rate for domestic customers, disaggregated for urban and rural localities						
1.1	Water - total	%	69	79	83	97	100
1.2	Wastewater - total	%	44	46	63	86	94
1.3	Water supply – urban	%	79	81	85	100	100

[17] Outworn and obsolete wastewater system

[18] Infiltration rate of 10% is assumed for new sewerage networks

[19] An infiltration rate of 50% is assumed for old sewerage networks (e.g. above 30 years)

[20] It is assumed that without major investments after Phase 2 the infiltration rate cannot be further reduced. However, regular replacement of sewerage network by ME 'Apa-Canal' Ungheni will maintain the infiltration rate at constant level (increasing of the infiltration rate can be avoided by regular repairs and rehabilitation).

[21] It is best practice to avoid any connection from rainwater drains (e.g. from roofs or streets). However, practically a certain amount of rainwater entering the sewerage network cannot be avoided.

[22] Existing situation

[23] 1st year of operation Phase 1 investments

[24] 1st year of operation Phase 2 investments

N°	Design Parameter	Unit	2014[22]	2018[23]	2021[24]	2030	2045
1.4	Water supply – rural	%	21	70	73	83	100
1.5	Wastewater - urban	%	53	55	66	90	95
1.6	Wastewater - rural	%	0	0	49	65	90
2	Volume of water sold for domestic consumers						
2.1	In urban localities	l/c/d	83	86	89	97	110
2.2	In rural localities	l/c/d	40	40	44	56	80
3	Volume of water sold for non-domestic consumer (industry, commercial…), disagg. for urban and rural localities						
3.1	Ind. and commercial - urban	l/c/d	17.5	16.9	16.4	15.0	15.0
3.2	Ind. and commercial - rural	l/c/d	5.0	10.9	10.9	10.9	10.9
3.3	Institutional entities - urban	l/c/d	9.4	9.6	9.7	10.0	10.0
3.4	Institutional entities - rural	l/c/d	1.6	1.6	3.2	10.0	10.0
4	Wastewater generation as factor of water demand25						
4.1	Domestic customers	factor	1	1	1	1	1
4.2	Non-domestic customers	factor	1	1	1	1	1
5	Non-Revenue Water (NRW) as share from the water production						
5.1	Total NRW	%	37	32	32	30	25
5.2	Apparent losses	%	6	5	5	5	5
5.3	Real losses (physical losses)	%	32	27	26	25	20
6	Sewer Infiltration rate as share of total water discharged to the wastewater system						
6.1	Sewerage infiltration rate	%	50	45	30	30	30
7	Water demand variation factors (in compliance with SNIP)						
7.1	Daily variation factor	factor	1.1				
7.2	Hourly variation factor water supply	factor	1.5				
7.3	Hourly variation factor wastewater	factor	1.7				
7.4	Peak storm water factor	factor	1.3				
8	Wastewater flow and load parameters for domestic and non-domestic sources						
8.1	Specific Domestic wastewater Load	$gBOD_5$/c/d	60				
8.2	Specific Non-domestic Wastewater Load - maximum admissible BOD_5 concentration for sewer discharge	mg/l	225				

Source: GIZ/MLPS

The assumptions for water demand projection related to financial projections require differentiating between two scenarios: (1) Business as usual and (2) after project implementation (Phase 1 measures). The results of the financial projections are presented in Chapter 6 – Financial and Economic Analysis. While the assumptions presented in the Table 5-1 represent “Scenario 2 – With Project”, the main assumptions to differentiate between the two scenarios are presented as follows:

- Real (physical) water losses are assumed to remain constant without implementing the project measures in Phase 1 (reduction of water losses due to technical assistance measure (e.g. active leakage management, pressure management, etc.);

[25] A factor of 1 means that 100% of the water demand/consumption is discharged to the wastewater system.

- Apparent (commercial) water losses are assumed to remain constant without implementation of the technical assistance measures (Revenue and metering improvement programme).

5.4 Water demand and wastewater flow projection

The water demand projection (volume of water sold, non-revenue water and water production) is presented in the Table 5-2 (a detailed table is presented in Annex 5.1). As can be seen, the projected water production needs are highest in the year 2045, which will be the basis for design calculation.

Table 5-2: Water demand projection

N°	Parameter	Unit	2014[26]	2018[27]	2021[28]	2030	2045
1	Population in the study area served with water						
1.1	Total population serviced	N°	31,883	36,402	38,516	44,742	45,359
1.2	In urban localities	N°	30,269	31,005	32,937	38,757	39,023
1.3	In rural localities	N°	1,614	5,396	5,580	5,985	6,336
2	Volume of water sold in total and disaggregated for different consumers						
2.1	Total volume sold	m³/y	1,238,493	1,378,830	1,500,288	1,890,098	2,156,082
2.2	Domestic customers	m³/y	937,036	1,054,900	1,158,028	1,490,880	1,751,767
2.3	Industrial customers	m³/y	196,338	212,396	219,375	235,911	238,756
2.4	Institutional customers	m³/y	105,119	111,534	122,885	163,308	165,559
3	Total water sold disaggregated for urban and rural areas						
3.1	Urban localities	m³/y	1,211,040	1,274,926	1,381,763	1,722,762	1,922,835
3.2	Rural localities	m³/y	27,453	103,904	118,525	167,337	233,247
4	Non-Revenue Water (NRW) volume disaggregated for total NRW, apparent losses, and real losses						
4.1	Total NRW	m³/y	731,469	649,374	690,326	810,042	718,694
4.2	Apparent losses	m³/y	109,720	110,653	117,018	135,007	143,739
4.3	Real losses (physical losses)	m³/y	621,749	538,720	573,308	675,035	574,955
5	Water demand figures considering the demand variation factors						
5.1	Yearly water demand/production	m³/y	1,969,962	2,028,204	2,190,614	2,700,141	2,874,776
5.2	Average daily water demand	m³/d	5,397	5,557	6,002	7,398	7,876
5.3	Maximum daily water demand	m³/d	5,736	5,934	6,413	7,915	8,467
5.4	Average hourly water demand	m³/h	225	232	250	308	328
5.5	Maximum hourly water demand	m³/h	317	334	361	448	488

Source: GIZ/MLPS

Wastewater flow and load projections are presented in the Table 5-3 (a detailed table is presented in Annex 5.2). As can be seen, the highest wastewater flow and the highest wastewater load occur in the year 2045, which will be the basis for design calculation (design year) of sewerage network and wastewater treatment plant (if applicable).

[26] Existing situation

[27] 1st year of operation Phase 1 investments

[28] 1st year of operation Phase 2 investments

Table 5-3: Wastewater flow and load projection

N°	Parameter	Unit	2014[29]	2018[30]	2021[31]	2030	2045
1	Population in the study area served with sewerage						
1.1	Total population serviced	N°	20,433	21,355	29,231	39,525	42,774
1.2	In urban localities	N°	20,433	21,355	25,467	34,882	37,071
1.3	In rural localities	N°	0	0	3,763	4,644	5,702
2	Volume of wastewater charged in total and disaggregated for different customers						
2.1	Total volume	m³/y	823,791	884,069	1,154,892	1,687,027	2,088,592
2.2	By domestic customers	m³/y	565,532	625,429	837,223	1,284,474	1,654,928
2.3	By industrial customers	m³/y	155,030	150,751	184,605	209,378	225,563
2.4	by Institutional customers	m³/y	103,229	107,889	133,064	193,174	208,101
3	Total wastewater charged disaggregated for urban and rural areas						
3.1	In urban localities	m³/y	823,791	884,069	1,074,957	1,557,178	1,878,670
3.2	In rural localities	m³/y	0	0	79,935	129,848	209,923
4	Sewer infiltration water based on the determined infiltration rate						
4.1	Sewer Infiltration water	m³/y	411,896	397,831	346,468	506,108	626,578
5	Wastewater generation figures considering variation factors						
5.1	Average wastewater flow (dry weather)	m³/y	1,235,687	1,281,901	1,501,360	2,193,135	2,715,170
5.2	Maximum daily dry weather flow (Qdmax)	m³/d	3,611	3,754	4,430	6,471	8,011
5.3	Maximum hourly dry weather flow (QDWF)	m³/h	223	234	286	418	517
5.4	Maximum hourly storm water flow (QSWF)	m³/h	290	304	372	543	673
6	Population equivalents in total and disaggregated for different customers						
6.1	Total population equivalent	PE60	23,086	24,013	32,494	43,661	47,229
6.2	by domestic customers	PE60	20,433	21,355	29,231	39,525	42,774
6.3	by Industrial and institutional customers	PE60	2,653	2,657	3,264	4,136	4,455
7	Pollution load – BOD in total and disaggregated for different customers						
7.1	Total BOD_5 load	kg/d	1,385	1,441	1,950	2,620	2,834
7.2	by domestic customers	kg/d	1,226	1,281	1,754	2,372	2,566
7.3	by industrial and institutional customers	kg/d	159	159	196	248	267

Source: GIZ/MLPS

5.5 Water demand projection versus available water resources and production capacities

As presented in Chapter 4-Technical aspects-Existing situation, the available production capacities (water abstraction from river Prut and treatment plant) for Ungheni Town are 12,700 m^3/day.

The long term water demand projection for Ungheni Town (including all localities) shows an increase of the water demand with the peak water demand in the year 2045 (see Chapter 5.4 -Water demand and wastewater flow projection) up to a maximum of 8,467 m^3/day (Qdmax).

[29] Existing situation

[30] 1st year of operation Phase 1 investments

[31] 1st year of operation Phase 2 investments

Conclusively, the currently available water production and water treatment plant capacities are sufficient to cover the water demand until (and beyond) the year 2045. Therefore, no investments are necessary to increase the production capacities in Ungheni. The assessment shows that these capacities are not only sufficient to supply the currently connected localities (Ungheni Town, Zagarancea and Semeni[32]) but in the future also the locality of Petresti[33] with current water production of 179 m³/day.

Table 5-4: Water demand projection versus currently available production capacities

N°	Parameter	Unit	Quantity
1	Currently available water resources	m³/d	12,700
2	Peak water demand (Qdmax) in year 2045	m³/d	8,467
3	Additionally required water production capacities (2 – 1)	m³/d	- 4,233

Source: GIZ/MLPS

5.6 Unit costs

The prices are based on cost estimation from other studies, tendered projects which are implemented in Moldova and international experience.

5.6.1 Unit costs water supply

The Table 5-5 shows the unit costs for the relevant water supply components applied for the cost estimations for the investment measures proposed for the Phase 1 and Phase 2.

Table 5-5: Unit costs for water supply facilities

N°	Item	Dimension		Investment costs	
				Unit	Unit cost
1	Water network, distribution or transmission pipe, PE100, SDR17, PN10, Incl. all earth, works, installation works, pipes and fittings				
1.1	Pipe	OD	75	EUR/m	60
1.2	Pipe	OD	90	EUR/m	62
1.3	Pipe	OD	110	EUR/m	65
1.4	Pipe	OD	125	EUR/m	67
1.5	Pipe	OD	140	EUR/m	70
1.6	Pipe	OD	160	EUR/m	75
1.7	Pipe	OD	180	EUR/m	82
1.8	Pipe	OD	200	EUR/m	90
1.9	Pipe	OD	225	EUR/m	97
1.10	Pipe	OD	250	EUR/m	104
1.11	Pipe	OD	280	EUR/m	124
1.12	Pipe	OD	315	EUR/m	139
1.13	Pipe	OD	355	EUR/m	154
1.14	Pipe	OD	400	EUR/m	174
2	Manhole for distribution system, Incl. all earth works, installation works and fittings				
2.1	Manhole	Dia. mm	1,500	EUR/pc	423
3	House connection, Incl. all earth works, installation works, pipes and fittings				
3.1		pc	1	EUR/pc	250
4	Disinfection facility, Investment costs: incl. Container or small building, technical equipment, elec-				

[32] Ongoing project to connect the locality to the water supply system of Ungheni

[33] Currently supplied with its own water supply source (well and spring)

N°	Item	Dimension		Investment costs	
				Unit	Unit cost
	tric installations				
4.1	Device	m³/d	100	EUR	20,000
4.2	Device	m³/d	200	EUR	23,000
4.3	Device	m³/d	500	EUR	30,000
4.4	Device	m³/d	1,000	EUR	40,000
4.5	Device	m³/d	2,500	EUR	55,000
4.6	Device	m³/d	5,000	EUR	65,000
4.7	Device	m³/d	6,000	EUR	70,000
5	Submersible pumps, Pumps, technical equipment, electric installations, control system				
5.1	Submersible pump	l/s/ m	19.5/100	EUR	15,000
6	Water Supply Reservoirs				
6.1	Underground Reservoirs				
6.1.1	Reservoir Volume	m³	100	EUR	60,000
6.1.2	Reservoir Volume	m³	150	EUR	85,000
6.1.3	Reservoir Volume	m³	200	EUR	110,000
6.1.4	Reservoir Volume	m³	250	EUR	140,000
6.1.5	Reservoir Volume	m³	500	EUR	200,000
6.1.6	Reservoir Volume	m³	1,000	EUR	320,000
7	Pressure reducing valves (material incl. installations)				
7.1	For pipe diameter	OD	100	EUR/PC	3,500
7.2	For pipe diameter	OD	150	EUR/PC	5,300
7.3	For pipe diameter	OD	200	EUR/PC	6,830
7.4	For pipe diameter	OD	250	EUR/PC	8,770
7.5	For pipe diameter	OD	300	EUR/PC	10,670
7.6	For pipe diameter	OD	400	EUR/PC	18,295
7.7	For pipe diameter	OD	500	EUR/PC	26,020
7.8	For pipe diameter	OD	600	EUR/PC	37,440

Source: GIZ/MLPS

5.6.2 Unit costs wastewater

The Table 5-6 shows the unit costs for the relevant wastewater components applied for the cost estimations for the investment measures proposed for Phase 1 and Phase 2.

Table 5-6: Unit costs for wastewater facilities

N°	Item	Dimension		Investment costs	
				Unit	Unit cost
1	Sewerage network, collection pipe, PVC, Incl. all earth works, installation works, pipes and fittings				
1.1	Pipe	OD	110	EUR/m	88
1.2	Pipe	OD	125	EUR/m	92
1.3	Pipe	OD	160	EUR/m	140
1.4	Pipe	OD	200	EUR/m	150
1.5	Pipe	OD	250	EUR/m	165
1.6	Pipe	OD	315	EUR/m	185
2	Manhole for collection system, Incl. all earth works, installation works and fittings				
2.1	Manhole	dia. mm	1,000	EUR/pc	1,030
3	House Connection, Incl. all earth works, installation works, pipes and fittings				
3.1		pc	1	pc,	500
4	Wastewater pumping stations, Incl. all electro- mechanical equipment, pipes, fittings, housing and installation works				
4.1	Facility	N° of pop.	500	EUR	28,000

N°	Item	Dimension		Investment costs	
				Unit	Unit cost
4.2	Facility	N° of pop.	1,000	EUR	32,000
4.3	Facility	N° of pop.	2,000	EUR	40,000
4.4	Facility	N° of pop.	5,000	EUR	50,000
4.5	Facility	N° of pop.	10,000	EUR	63,000
4.6	Facility	N° of pop.	15,000	EUR	75,000
4.7	Facility	N° of pop.	20,000	EUR	83,000
5	Wastewater Treatment Plant, according to the EC Directive for urban wastewater treatment incl. primary treatment, secondary treatment (e.g. low load trickling filters, Low load activated sludge process, aerated pond system, constructed wetlands), all construction and installation works, electro- mechanical equipment.				
5.1	Plant	P.E.	1,000	EUR/P.E.	500
5.2	Plant	P.E.	2,500	EUR/P.E.	390
5.3	Plant	P.E.	5,000	EUR/P.E.	340
5.4	Plant	P.E.	10,000	EUR/P.E.	300
5.5	Plant	P.E.	20,000	EUR/P.E.	260
5.6	Plant	P.E.	30,000	EUR/P.E.	250
5.7	Plant	P.E.	35,000	EUR/P.E.	240

Source: GIZ/MLPS

5.7 Proposed investment measures

5.7.1 General

In order to meet the local development objectives and goals (see Chapter 5.2- Development strategy for water supply and wastewater services) as well as the targets in line with the Regional Sector Programme (RSP), a number of investment measures have been identified and are presented in this chapter. These measures are based on the measures identified in previous assessments ("Possible Project Concept" (PPC)) and the findings from this study (reference is made to Chapter 4 – Technical aspects - Existing situation and Chapter 5.4 - Water demand and wastewater flow projection).

This chapter contains:

- The main drivers for development of the investment framework;
- A detailed description of the proposed investment measures;
- Prioritisation and phasing of investment measures;
- An option analysis for priority investment measures Phase 1;
- The priority investment plan including cost estimates for each of the investment phases.

5.7.2 Investment framework

Based on the assessments within this study, the local WSS objectives and the RSP, the main drivers for development of the investment framework have been identified and are presented as follows:

Water Supply:

- Currently there are 30,269 inhabitants (79% connection rate) in Ungheni Town connected to the existing water supply system (see Table 5-7) and the locality of

Zagarancea (in the north-west part of the town) is supplied from Ungheni Town water supply network and has a connection rate of 83%;

- The water supply network of Ungheni Town is currently extended (ongoing construction) to the locality of Semeni located north-west of the town (additional connections of ongoing projects are included in the projection for the year 2018 but not in the current situation);
- The water supply network in Ungheni Town is in poor condition and about 87% of the pipes are older than 30 years, which causes frequent pipe bursts and supply interruptions as well as high water losses in part of the system. Therefore rehabilitation of part of the network will be of utmost importance;
- Currently there is no supply shortage for the service area of ME 'Apa-Canal' Ungheni. The current production capacity is sufficient to cover the water demand until (and beyond) the year 2045 (including all localities in the vicinity of Ungheni Town);
- The locality of Petresti is currently not connected to the water supply system of Ungheni Town but supplied through its own water source (well and spring). The connection rate for this locality is 63% (2,415 consumers)[34]. The water quality in Petresti Locality is not compliant with the national standards (high nitrate concentration). There are two strategic options to supply the service area in Petresti with water:
  - Construction of a Water Treatment Plant for nitrate removal;
  - Connection of Petresti Locality to the water supply system in Ungheni Town.
- As treatment of nitrate is very costly (high investment and O&M costs) this option is not recommended. Connection to the water supply system in Ungheni would certainly be the least cost technical solution to supply Petresti Locality with compliant water (short distance to Semeni water supply system). The existing supply sources in Petresti (wells and springs) can still be maintained as standby facilities (second supply source). However, this solution will need an institutional adjustment (agreement between the LPA of Petresti and Ungheni e.g. to integrate the network into the supply area of ME 'Apa-Canal' Ungheni or to supply Petresti with bulk water from Ungheni Town);
- Conclusively, the main strategy for development of the water supply system in the study area is to connect the locality of Petresti to the system of Ungheni which has sufficient capacities to provide water with compliant quality to all concerned localities in the vicinity of Ungheni Town;
- In the medium-term, it is recommended to optimize the network operation, based on the results of the detailed investment plan to be prepared in the frame of the Water Supply Network Analysis and Water Loss Reduction Programme included in the technical assistance measures in Phase 1 (reference is made to Chapter 5.7.6 - Technical Assistance). These measures might inter alia include:
  - Replacement of 30% of the water supply network older than 30 years in the medium-term;
  - Establishment of adequate system operation and control comprising pressure zoning, district metering and leakage monitoring with installation of permanent and temporary measure and control spots incl. chambers, measuring and control equipment, valves etc.;

[34] Petresti consumers have been taken into consideration in the water demand and financial calculation model starting 2018

- Installation of a SCADA system.

The table below shows the development of service connections for the water supply network (existing situation and additional connections for the year 2018 and 2021 as well as for 2030 and 2045). For more detailed projection tables reference is made to Annex 5.3 and Annex 5.4.

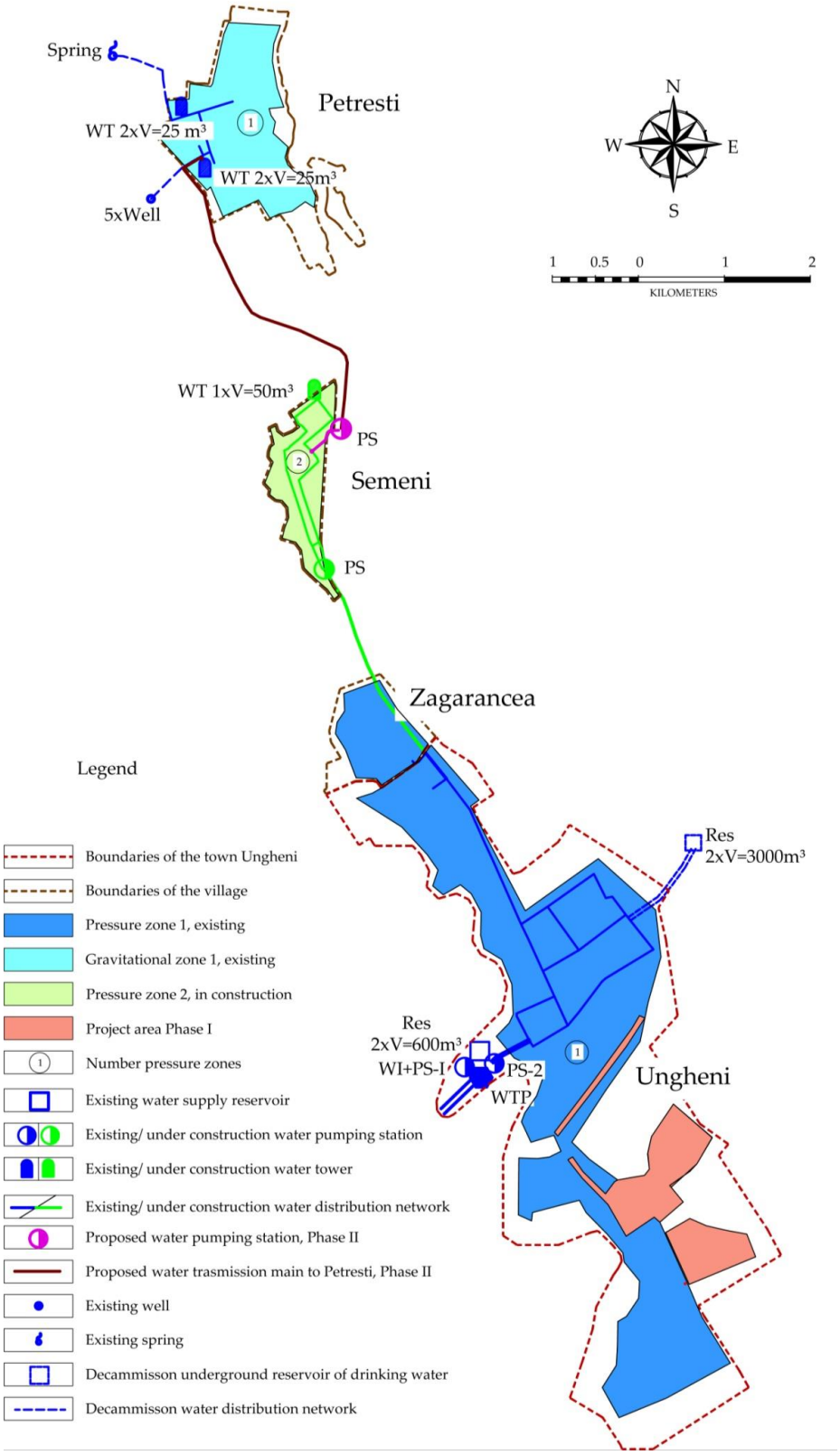
Table 5-7: Development of connection rates water supply

N°	Locality	Population connected to the water supply system									
		2014		2018		2021		2030		2045	
		n°	%	n°	%	n°	%	n°	%	n°	%
1	Ungheni	30,269	79	31,005	81	32,937	85	38,757	100	39,023	100
2	Petresti	0 (2,411)[35]	0 (63)	2,390	63	2,515	67	2,815	79	3,133	100
3	Semeni	0	0	1,376	70	1,422	73	1,525	83	1,614	100
4	Zagar-ancea	1,614	83	1,631	84	1,643	86	1,645	91	1,590	100
Total		**31,883**	**69**	**36,402**	**79**	**38,516**	**83**	**44,742**	**97**	**45,359**	**100**

Source: GIZ/MLPS

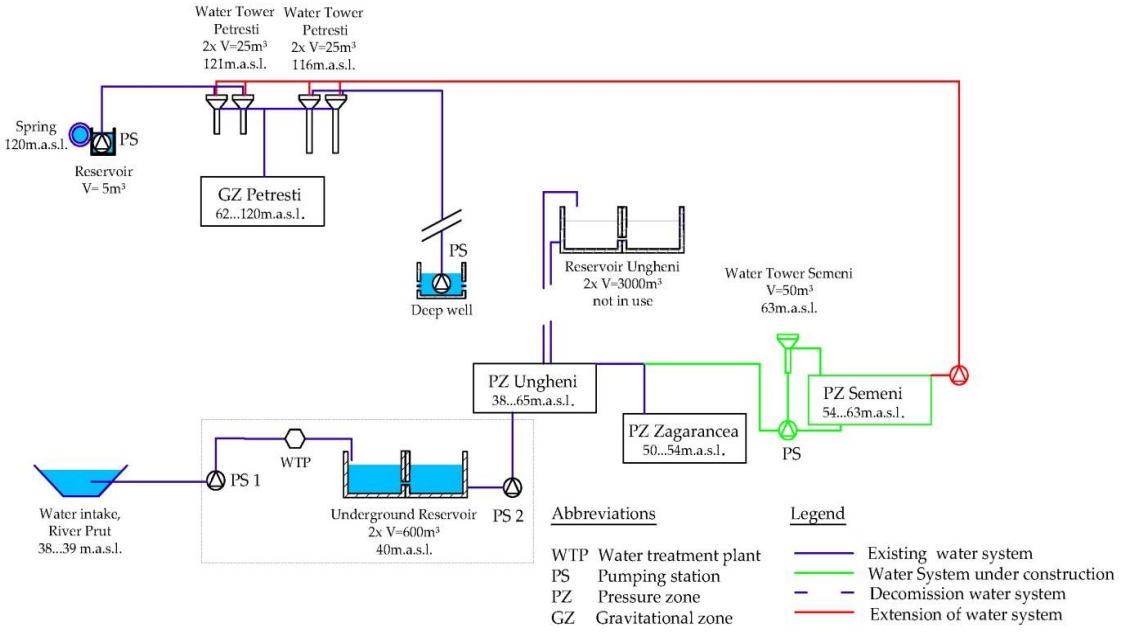
[35] The figures in brackets signify actual connection rate and number of people supplied; as Petresti is currently not supplied from ME 'Apa-Canal' Ungheni these consumers have not been taken into consideration in the water demand and financial calculation model

Figure 5-1: Scheme of existing and proposed extensions of the water supply system in the town of Ungheni and the localities of Zagarancea, Semeni and Petresti



Source: GIZ/MLPS

Figure 5-2: Hydraulic Scheme of existing and proposed extensions of the water supply system in the town of Ungheni the localities of Zagarancea, Semeni and Petresti



Source: GIZ/MLPS

Wastewater:

- Currently only Ungheni Town (except a very short network in Petresti for some public buildings) is partly endowed with an existing wastewater system (sewerage network and wastewater treatment plant are described in Chapter 4-Technical aspects-Existing situation of this report). About 53% of the population in Ungheni Town is currently connected to the sewerage network (see Table 5-8);
- Wastewater load generated in Ungheni Town and the three localities (Zagarancea, Semeni, Petresti) in the vicinity of Ungheni Town is projected to increase from currently 23,086 P.E. to 32,494 P.E. in 2021 and then to 47,229 P.E. in 2045 (see Chapter 5.4 Water demand and wastewater flow projection);
- In Ungheni Town the coverage rate is projected to increase from currently 78% to 99% and the connection rate from 53% to 66% until the year 2021[36];
- In order to develop the wastewater infrastructure in the rayon, agglomerations (as per EU-definition "an area where the population and/or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to an urban waste water treatment plant or to a final discharge point") have to be defined for the entire rayon. Further, an assessment (option analysis) will be necessary to decide which of these agglomerations should be grouped to be connected to a Wastewater Treatment Plant (WWTP). It is recommended to include this analysis in a technical assistance component to be implemented in Phase 1 (see Chapter 9 – Procurement strategy and implementation plan). The localities in the vicinity of Ungheni Town will be served in accordance with the results of the above mentioned agglomeration analysis and possibly in the future with the

[36] After implementation of Phase 2 of the proposed project measures

dates to be negotiated in the EU-accession treaty. Compliance of these localities with EU-environmental regulations (e.g. Urban Wastewater Treatment Directive 91/271/EEC) will require grouping the agglomerations into localities (i) below 2,000 P.E., (ii) between 2,000 P.E. and 10,000 P.E., and (iii) above 10,000 P.E. In the vicinity of Ungheni Town, there are several localities to be either endowed with a sewerage network and connected to a WWTP in the medium and long-term, or alternative wastewater systems (e.g. on-site sanitation) have to developed in order to ensure adequate wastewater treatment;

- Collection and treatment of wastewater in Ungheni Town (current population of 38,400) should be given highest priority (in line with priorities defined in the Urban Wastewater Treatment Directive 91/271/EEC);
- Zagarancea Locality (1,956 inhabitants in 2014), which is located west of Ungheni Town, is currently not endowed with a sewerage network. Due to the vicinity of the locality to the sewerage network of Ungheni Town, this locality can be connected at relatively low cost to Ungheni wastewater system and thus wastewater should be treated by the existing WWTP of Ungheni Town, located in the locality Valea Mare;
- For the localities of Semeni (1,986 inhabitants in 2014) and Petresti (3,855 inhabitants in 2014), located west of Ungheni Town, three options for wastewater treatment are possible:
  - Option 1 – 3 WWTPs: Separate WWTPs for each of the localities (1 WWTP in Petresti, 1 WWTP in Semeni, 1 WWTP for Ungheni/Zagarancea);
  - Option 2 – 2 WWTPs: 1 WWTP for the localities of Semeni and Petresti and 1 separate WWTP for Ungheni Town (including Zagarancea);
  - Option 3 - 1 WWTP: 1 WWTP in Ungheni Town treating wastewater for all localities.
- Within the framework of technical assistance measures proposed for Phase 1, a thorough assessment and option analysis should be carried out in order to identify the most appropriate solution. The assessment should take into consideration that in neighbouring EU-countries (Romania) many wastewater collection and treatment systems in small towns are currently not operational due to the high operation costs and the very low connection rates. Due to the small size of WWTPs in Option 1 and 2 (about 6,000 P.E. for the WWTP to treat wastewater from Semeni and Petresti) investment costs as well as operation and maintenance costs would be much higher than for Option 3. Therefore, Option 3 is proposed to be implemented. This option requires a wastewater pumping station (WWPS) west of Semeni Locality and a pressure main to discharge wastewater to the sewerage network in Ungheni Town;
- The capacities of the existing wastewater pumping stations are sufficient to cover the wastewater flow for the network extensions proposed in Phase 1 and Phase 2. However, the collection chamber in the Main Wastewater Pumping Station (MWWPS) is not functional and therefore a new chamber has to be constructed;
- The design capacity of the existing WWTP in Valea Mare (15,000 m³/day) would be sufficient to treat wastewater of Ungheni Town and all localities in the vicinity until 2045. However, the plant is outworn and should be replaced by a new WWTP. The design capacity of the new WWTP will depend on the above mentioned agglomeration analysis. Depending on the number of localities to be connected to the WWTP in Ungheni Town the design capacity could be from about 39,000 P.E. in 2030 (only for Ungheni Town) up to about 44,000 P.E.) if the three localities (Semeni, Petresti, Zagarancea) will be connected and could be even

much higher if additional localities, beyond the scope of this study but in the vicinity of Ungheni Town, would be connected to the WWTP. Therefore the design capacity can only be roughly estimated at this stage. Further planning shall be based on the results of the technical assistance study to be carried out in Phase 1. A staged approach is recommended in order to avoid over capacities. For the investment cost estimations a capacity of 43,661 P.E. for the WWTP in Ungheni Town has been used, assuming that all localities (Semeni, Petresti, Zagarancea) will be connected to the WWTP of Ungheni Town[37];

- According to the information provided by ME 'Apa-Canal' Ungheni, the reason for the long distance (about 10 km) between the town of Ungheni and the location of the existing WWTP is related to the water intake at Prut River for Iasi Town (Romania). The wastewater discharge point from the WWTP in Ungheni Town should be located downstream of the water intake for Iasi Town (to avoid health risk). The optimal location of the new WWTP should be assessed in course of the technical assistance study in Phase 1;
- The two pressure mains (2x DN 500 mm) between MWWPS and the existing WWTP in Valea Mare (see Figure 5-3) are in poor condition (more than 40 years old) and have to be replaced;
- Rehabilitation of the sewerage network in Ungheni Town with a length of about 20 km (out of 70 km total network length) is proposed due to the frequent emergency cases in the existing sewerage network;
- An extension of the sewerage network in Ungheni Town with a length of about 46.5 km (including pressure main) is required in order to increase the sewer coverage rate to from currently 78% to 99% and the connection rate from currently 53% to 66%. The main extension areas are located in the north-west (drainage area 1 and 7) and in the south-east (drainage area 5 and 2);
- Conclusively, the proposed measures will increase the connection rate in Ungheni Town to 66% and in the three localities Zagarancea, Petresti and Semeni) to 49% in average. The existing WWTP shall be abandoned and a new WWTP with a capacity of 43,661 P.E. will be necessary to treat wastewater volume projected for Ungheni Town and the three localities in the year 2030. Depending on the results of the technical assistance study to be carried out in Phase 1, the capacity has to be confirmed and a staged development approach of the WWTP has to be proposed.

The Table 5-8 shows the development of service connections for the wastewater network (existing situation and additional connections for the year 2018 and 2021 as well as for the years 2030 and 2045). For more detailed projection tables reference is made to Annex 5.5 and Annex 5.6.

Table 5-8: Development of connection rates wastewater

N°	Locality	Population connected to the wastewater system									
		2014		2018		2021		2030		2045	
		n°	%	n°	%	n°	%	n°	%	n°	%
1	Ungheni	20,433	53	21,355	55	25,467	66	34,882	90	37,071	95
2	Petresti	0	0	0	0	1,936	51	2,341	66	2,819	90

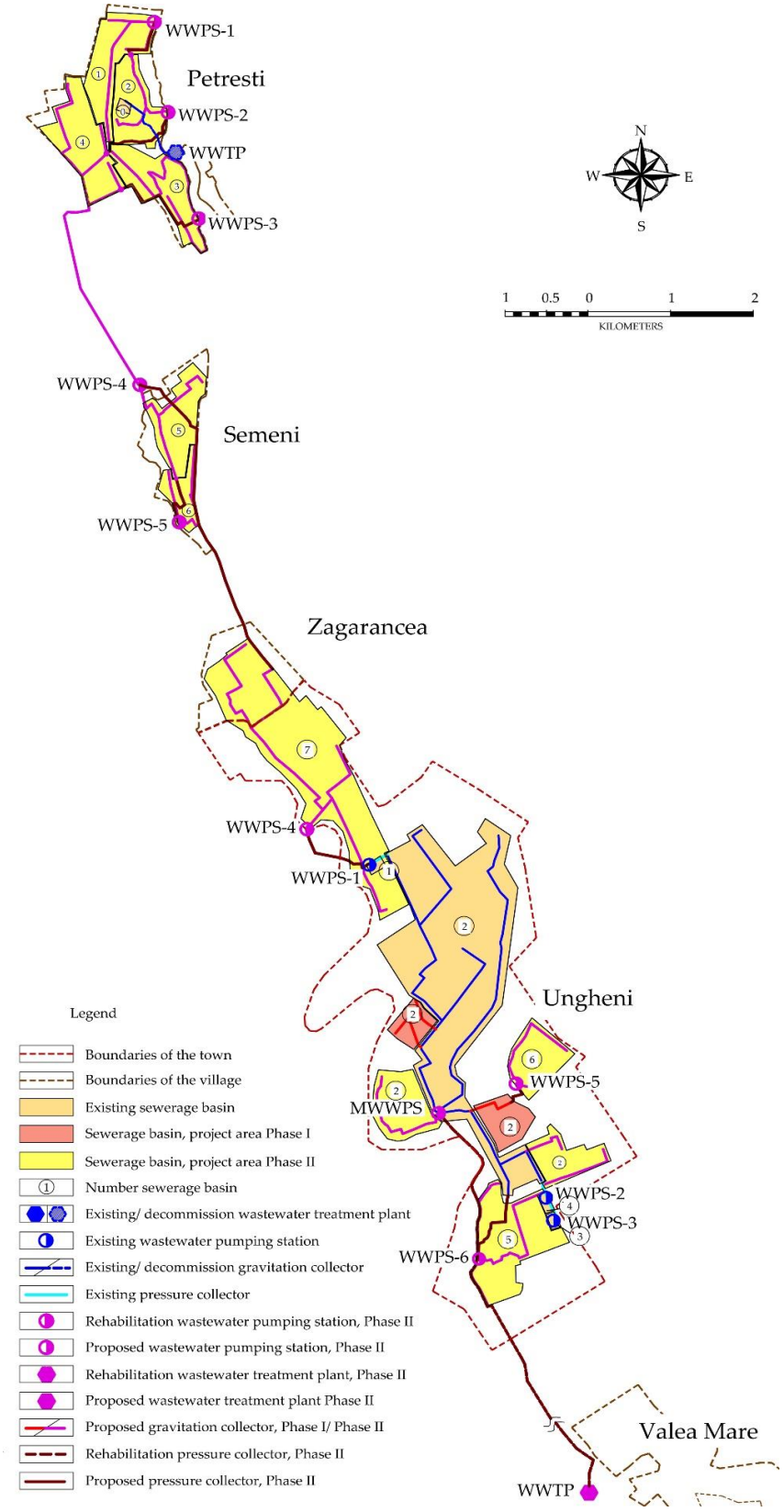
[37] The wastewater treatment concept and the capacity of the WWTPs will be determined in detail in the above mentioned sanitation study (incl. agglomeration analysis), which will be carried out in the technical assistance component in Phase 1.

N°	Locality	Population connected to the wastewater system									
		2014		2018		2021		2030		2045	
		n°	%	n°	%	n°	%	n°	%	n°	%
3	Semeni	0	0	0	0	1,028	53	1,224	67	1,452	90
4	Zagar-ancea	0	0	0	0	799	42	1,079	60	1,431	90
Total		**20,433**	**44**	**21,355**	**46**	**29,231**	**63**	**39,525**	**86**	**42,774**	**94**

Source: GIZ/MLPS

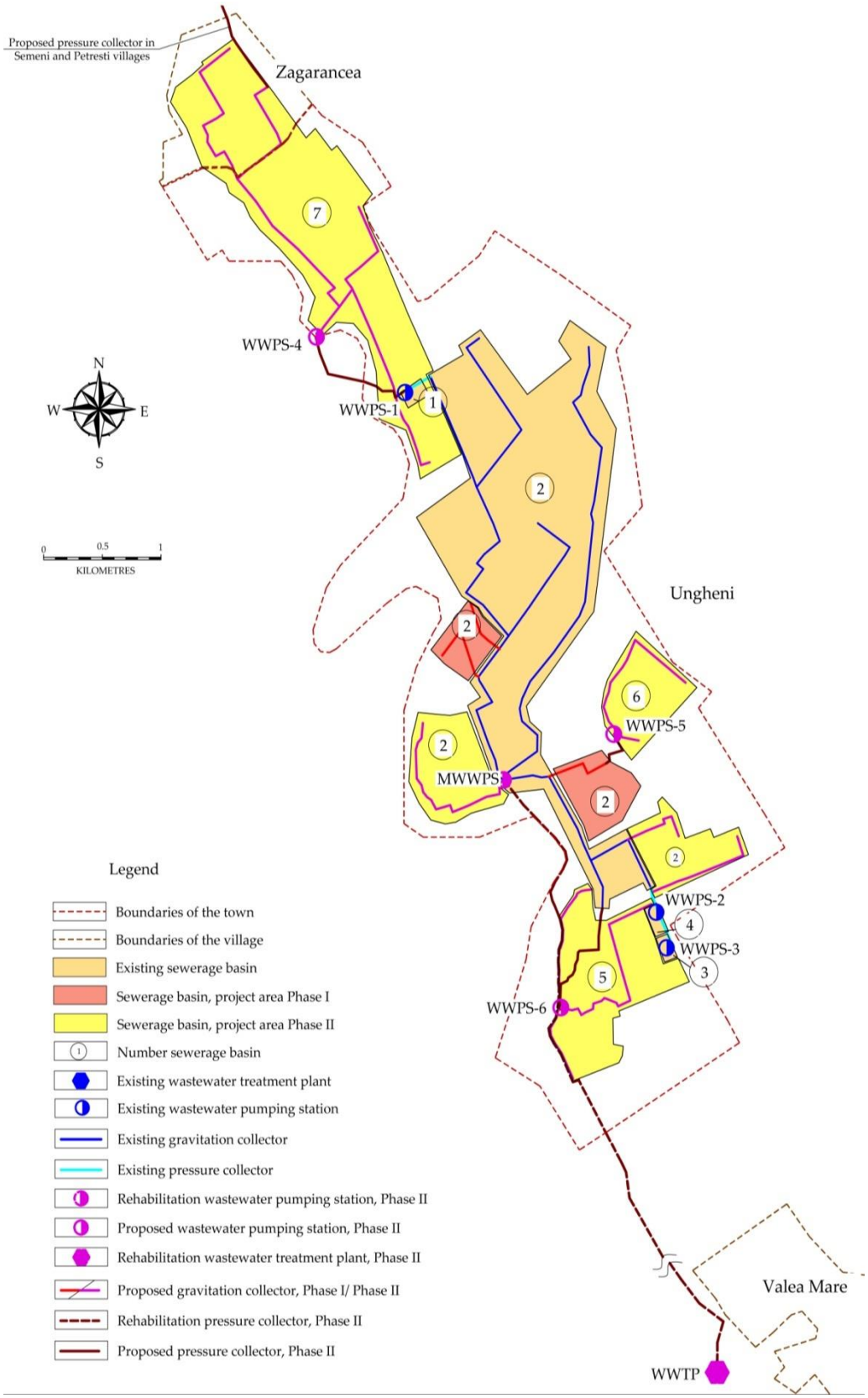
Schemes of existing and proposed extension of the wastewater system in the town of Ungheni and localities of Zagarancea, Semeni and Petresti are presented in Figures 5-3, 5-4, 5-5. More detailed information is presented in Annex 11.

Figure 5-3: Scheme of existing and proposed extension of the wastewater system in the localities of Zagarancea, Semeni and Petresti (overview)



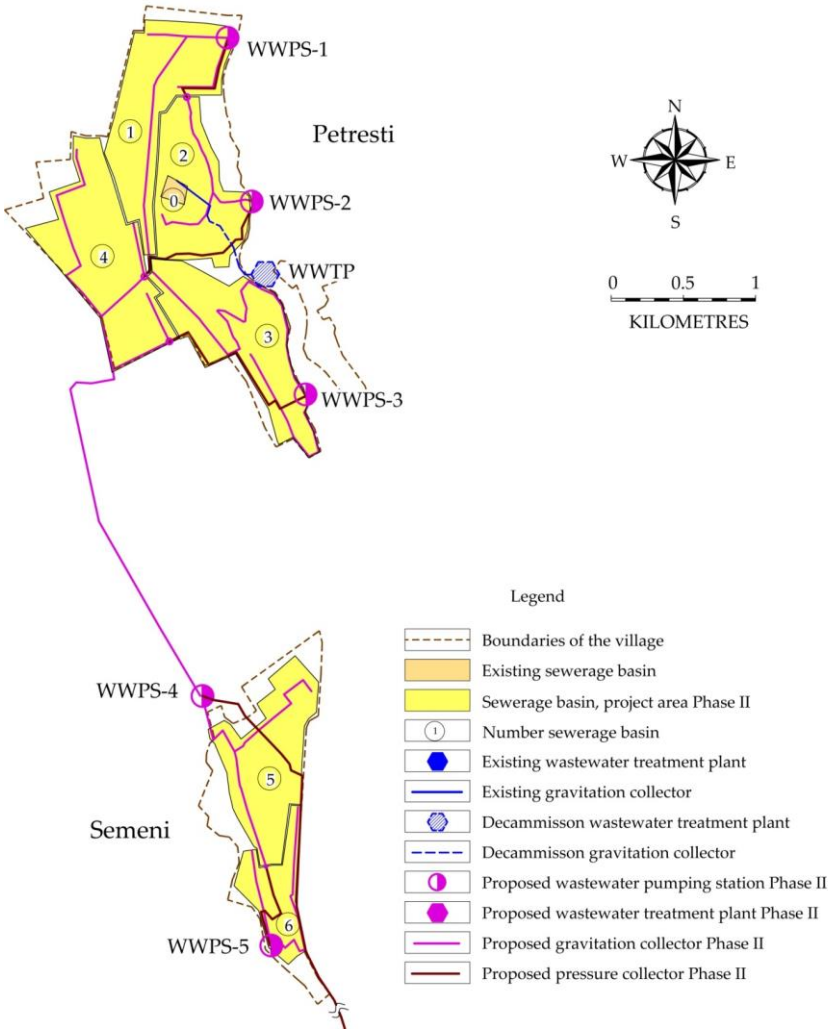
Source: GIZ/MLPS

Figure 5-4: Scheme of existing and proposed extension of the wastewater system in Ungheni Town and Zagarancea



Source: GIZ/MLPS

Figure 5-5: Scheme of existing and proposed extension of the wastewater system in the localities of Semeni and Petresti



Source: GIZ/MLPS

5.7.3 Investment measures - water supply system

5.7.3.1 General description of proposed system

The main deficiencies in the water supply system are as follows (see Chapter 4- Technical aspects –Existing situation):

- Low connection rate of about 79% in Ungheni Town;
- The water supply network in Ungheni Town is in poor condition and about 87% of the pipes are older[38] than 30 years;
- High real and apparent water losses (NRW of 37%);
- High number of pipe bursts due to old and obsolete water supply network;

[38] Or equal to

- The water quality in the locality of Petresti is not compliant with the national standards (high nitrate concentration).

In order to remediate the above mentioned deficiencies, the following improvements have been proposed in the water supply sector:

- Rehabilitation of the water distribution network in Ungheni Town;
- Extension of the water distribution network in Ungheni Town;
- Connection of the water supply system of Petresti to the water supply system in Ungheni Town (transmission main and pumping station);
- Water metering[39] and equipment for operational improvement (see Chapter 5.7.5 – Operational improvement).

5.7.3.2 Proposed investment measures

Rehabilitation of the water distribution network in Ungheni Town

Due to frequent pipe bursts in part of the distribution network the operation costs are high and supply security is low (frequent supply interruptions due to pipe repair). Further, total water losses (NRW) in Ungheni Town are estimated to be in the range of 37%. It is planned to replace 12,235 m of the pipe network (Diameter between 75 and 400 mm) in order to reduce the number of pipe bursts and water losses.

Extension of the water distribution network in Ungheni Town

It is planned to extend the existing water supply system in the south-east part of the town in order to reach full service coverage. The total network length for this extension area is 5,435 m and 235 households (736 consumers) will be connected to the water supply system by implementing this measure. The water supply connection rate will be increased from 79% to 81% by this measure.

Connection of the water supply system of Petresti to the water supply system in Ungheni Town

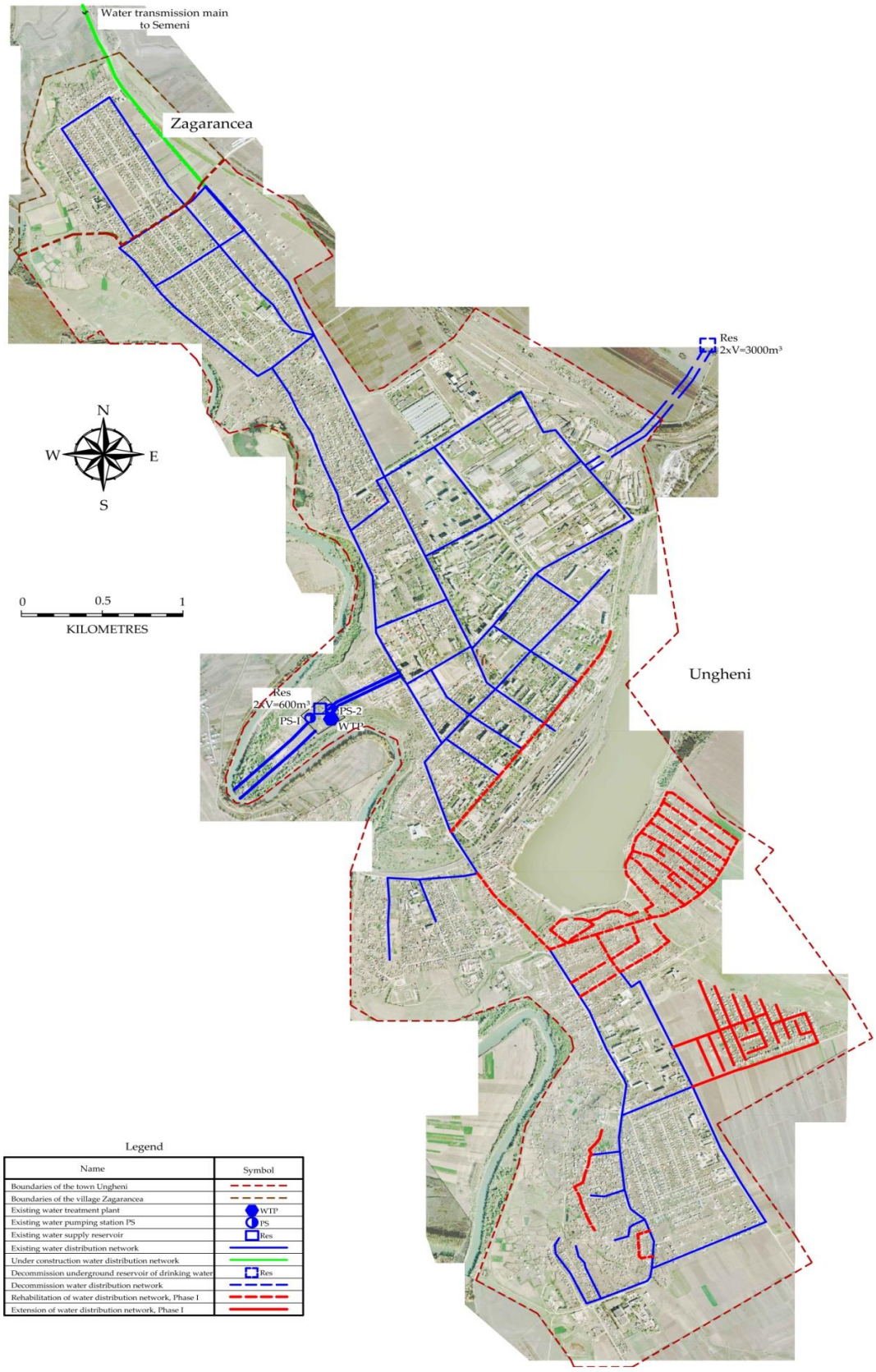
Petresti is currently supplied with groundwater from a well and a spring catchment. The water quality of the well does not comply with the national standards (high nitrate concentration). As mentioned above, nitrate treatment is not considered as an adequate option and therefore it is proposed to supply the locality of Petresti with water from Ungheni Town. The following investment measures are necessary (see Figure 5-6):

- One pumping station (PS) located in Semeni Locality;
- A transmission main along the main road from the PS in Semeni Locality to the Water Tower (WT) in Petresti with a length of 4,700 m HDPE OD 90 mm.

The existing and proposed water supply system in the town of Ungheni and Zagarance locality are presented in the Figure 5-6 and for the locality of Petresti is presented in the Figure 5-7. More detailed maps are provided in Annex 11.

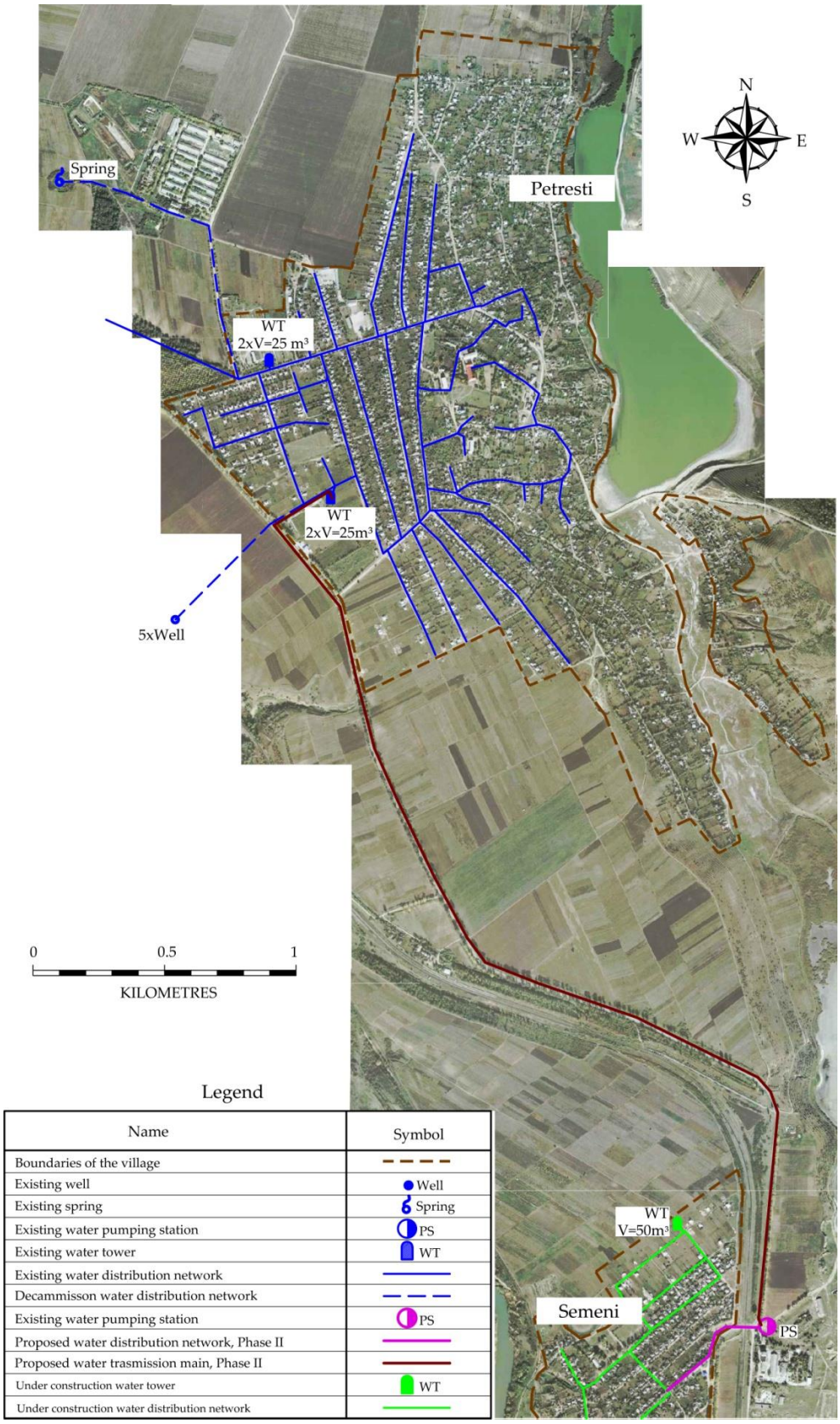
[39] Replacement of water meters

Figure 5-6: Existing and proposed water supply system in the town of Ungheni and the locality of Zagarancea



Source: GIZ/MLPS

Figure 5-7: Existing and proposed water supply system in the locality of Petresti



Legend

Name	Symbol
Boundaries of the village	
Existing well	Well
Existing spring	Spring
Existing water pumping station	PS
Existing water tower	WT
Existing water distribution network	
Decammisson water distribution network	
Existing water pumping station	PS
Proposed water distribution network, Phase II	
Proposed water trasmission main, Phase II	
Under construction water tower	WT
Under construction water distribution network	

Source: GIZ/MLPS

5.7.4 Investment measures - wastewater system

5.7.4.1 General description of proposed system

The main deficiencies in the wastewater system are as follows (see Chapter 4-Technical aspects –Existing situation):

- In Ungheni Town the coverage rate of wastewater services is about 78% and low connection rate of about 53%;
- There is no wastewater system in the localities of Zagarancea,Petresti and Semeni;
- The existing sewerage network is highly degraded (96% of the network is older[40] than 40 years) which leads to frequent sewer blockages and emergency driven maintenance;
- The sewer pressure main from the Main Wastewater Pumping Station (MWWPS) to the WWTP in Valea is in poor condition (about 40 years old);
- The existing WWTP for Ungheni Town (located in Valea Mare) is obsolete and has to be replaced;
- The collection chamber for the Main Wastewater Pumping Station (MWWPS) is not functional.

In order to remediate the above mentioned deficiencies, the following improvements have been proposed in the wastewater sector:

- Extension of the sewerage network in Ungheni Town;
- Rehabilitation of the sewerage network in Ungheni Town;
- Construction of a new WWTP in Ungheni Town (Valea Mare Locality);
- Extension of the sewerage network in the localities of Zagarancea, Semeni and Petresti.

Extension of the sewerage network in Ungheni Town:

In order to increase the service connection rate for Ungheni Town from currently 53% to 66% in 2021 (coverage rate from 78% to 99%) the sewerage network (separate system) has to be extended by about 46.5 km and 2,922 new service connections have to be constructed. The diameters of these sewer pipes vary between 200 mm and 250 mm. Due to the topography of the planning area, the wastewater system will be subdivided into the following wastewater collection areas (see the Figure 5.3 above and Figure 5.8 below):

- The wastewater from the north-western part of the town (drainage area n°7) will be discharged by gravity to the proposed wastewater pumping station n°4 (WWPS-4), which pumps wastewater through a proposed pressure main to the existing wastewater pumping station n°1 (WWPS-1) and from there through an existing pressure main into the existing main collector (DN 800 mm) which collects wastewater from drainage area n°2;
- The main collector discharges to the main wastewater pumping station (MWWPS) in the town centre;

[40] Or equal to

- There are two proposed extension areas (indicated in the Figure 5-8 with drainage area n°2 in yellow and red) in the north and two areas in the east of the MWWPS;
- In the north-east the proposed drainage area n°6 discharges to WWPS-6 and from there to the MWWPS;
- Wastewater from drainage area n°5 is discharging to WWPS-6 and from there it is pumped through a pressure sewer to a main collector (DN 500 mm) in drainage area n°2, which finally discharges to the MWWPS;
- The existing pumping stations n°2 and n°3 (WWPS-2 and WWPS-3) are not anymore functional;
- From the main wastewater pumping station (MWWPS) wastewater is pumped through the proposed (renovated) pressure sewer to the proposed (replaced) WWTP in Valea Mare Locality, located south-east of the town centre;
- The effluents from the WWTP discharge to the Prut River (recipient water).

Rehabilitation of the sewerage network in Ungheni Town:

The existing pressure sewer from the main wastewater pumping station (MWWPS) in Ungheni Town (cast iron and steel 2xOD 500 mm) to the WWTP in Valea Mare Locality is obsolete and should be replaced by a new pressure main (2xOD 315 mm, L=19,320 m). It is assumed that the new (proposed) WWTP will again be located in Valea Mare Locality (south-east of the town centre). In case that a new location of the WWTP will be identified (technical assistance Phase 1) the length of the pressure sewer will change.

As a second priority, it is recommended to conduct a CCTV inspection of the sewerage network in Phase 1 (see Chapter 5.7.6 Technical Assistance) and based on its result to identify the need for further rehabilitation of the sewerage network. For the purpose of cost estimation in this study, it was assumed that about 30% of the sewerage network older than 30 years (68 km) should be rehabilitated (20.5 km OD 200 – 250 mm).

Construction of a new WWTP of Ungheni Town (Valea Mare Locality):

The existing WWTP of Ungheni Town in the locality of Valea Mare (design capacity of 15,000 m³/day) is obsolete and has to be replaced by a new WWTP with a capacity of 43,661 P.E (for treatment of wastewater of Ungheni Town, Zagarancea, Petresti and Semeni localities until 2030). However, in order to cover future wastewater volume (long-term wastewater flow until 2045) development of an extension to about 47,500 P.E. (8,100 m³/day) will be necessary.

Extension of the sewerage network in the localities of Zagarancea, Semeni and Petresti:

- Wastewater from the extension area in the locality of Zagarancea (drainage area n°7 located north-west of Ungheni Town) will discharge to wastewater pumping station n°4 in Ungheni Town;
- The locality of Semeni and Petresti will discharge to the sewerage network in Ungheni Town (connection point to main collector in Zagarancea (drainage area n°7);
- Wastewater from Petresti Locality will be collected as follows:
  - The existing collector which collects wastewater from a school (drainage area n°0) and treats wastewater in an existing (small) WWTP discharges to a small lake. Due to the poor condition of the WWTP, the inadequate receiving water

and the high costs for operating a small system, it is proposed to abandon the existing WWTP and to connect the school to the sewerage network in drainage area n°2;
    - Wastewater from drainage area n°1 will discharge to WWPS-1 and from there through a pressure sewer to WWPS-2, which also collects wastewater from drainage area n°2;
    - From WWPS-2 wastewater is pumped through a pressure sewer to a connection point in the town centre;
    - Drainage area n°4 discharges by gravity to the above mentioned connection point;
    - Drainage area n°3 discharges to WWPS-3 and from there wastewater is pumped through a pressure sewer to a gravity main collector;
    - Wastewater is then discharging by gravity to the wastewater pumping station in Semeni Locality (WWPS-4).
- Wastewater in Semeni Locality will be collected as follows:
    - Wastewater from drainage area n°5 is discharging by gravity to WWPS-4 and drainage area n°6 to WWPS-5 and from there through a pressure main to a gravity collector discharging to WWPS-4;
    - WWPS-4 (which collects wastewater from Semeni and from Petresti localities) pumps wastewater through a pressure sewer to the wastewater system of Ungheni Town (connection point to main collector in Zagarancea).

5.7.4.2 Proposed investment measures

The wastewater investments proposed in this feasibility study are:

- Ungheni Town:
    - 1st priority extension of the existing sewerage network in Ungheni Town and construction of 5,589 m of PP/PVC[41] sewer collectors with diameters 200 mm (including 516 service connections) in the town centre (drainage area n°2);
    - 2nd priority extension of the existing sewerage network in Ungheni Town and construction of 38,282 m of PP/PVC[42] sewer collectors (2,406 service connections) with diameters between 200 mm and 250 mm in north-western and south-eastern part of the town (part of drainage area 2, as well as drainage area 5, 6 and 7);
    - Construction of 2,675 m pressure main PE OD 90-110 mm (drainage area 5,6 and 7);
    - Construction of three (3) Wastewater Pumping Stations (WWPS-4, WWPS-5, WWPS-6);
    - Rehabilitation of 20,396 m of the existing sewerage network (second priority rehabilitation);
    - Replacement of existing pressure main from MWWPS to WWTP by new pressure main (2xOD 315 mm, L=19,320 m);
    - Rehabilitation of discharge tank at Main Wastewater Pumping Station (MWWPS) station (V=2000 m³);

[41] Material to be defined in the detailed design phase.

[42] Material to be defined in the detailed design phase.

  - New Wastewater Treatment Plant (WWTP) with a capacity of 43,661 P.E.
- Zagarancea Locality:
  - Extension of the sewerage network in the locality of Zagarancea and construction of 5,930 m of PP/PVC[43] (370 service connections) sewer collectors with diameters between 200 mm and 250 mm (drainage area n°7).
- Semeni Locality:
  - Extension of the sewerage network in the locality of Semeni and construction of 9,965 m of PP/PVC[44] (620 service connections) sewer collectors with diameters between 200 mm and 250 mm (drainage area 5 and 6);
  - Construction of 770 m pressure sewer PE OD 90-110 mm (drainage area n°5 and 6);
  - Construction of two new Wastewater Pumping Station (WWPS-4 and WWPS-5).
- Petresti Locality:
  - Extension of the sewerage network in the locality of Petresti and construction of 25,612 m of PP/PVC[45] (1,200 service connections) sewer collectors with diameters between 200 mm and 250 mm (drainage area n°1, 2, 3 and 4);
  - Construction of 3,075 m pressure sewer PE OD 90-110 mm (drainage area n°1, 2 and 3);
  - Construction of three (3) new Wastewater Pumping Station (WWPS 1, 2 and 3).

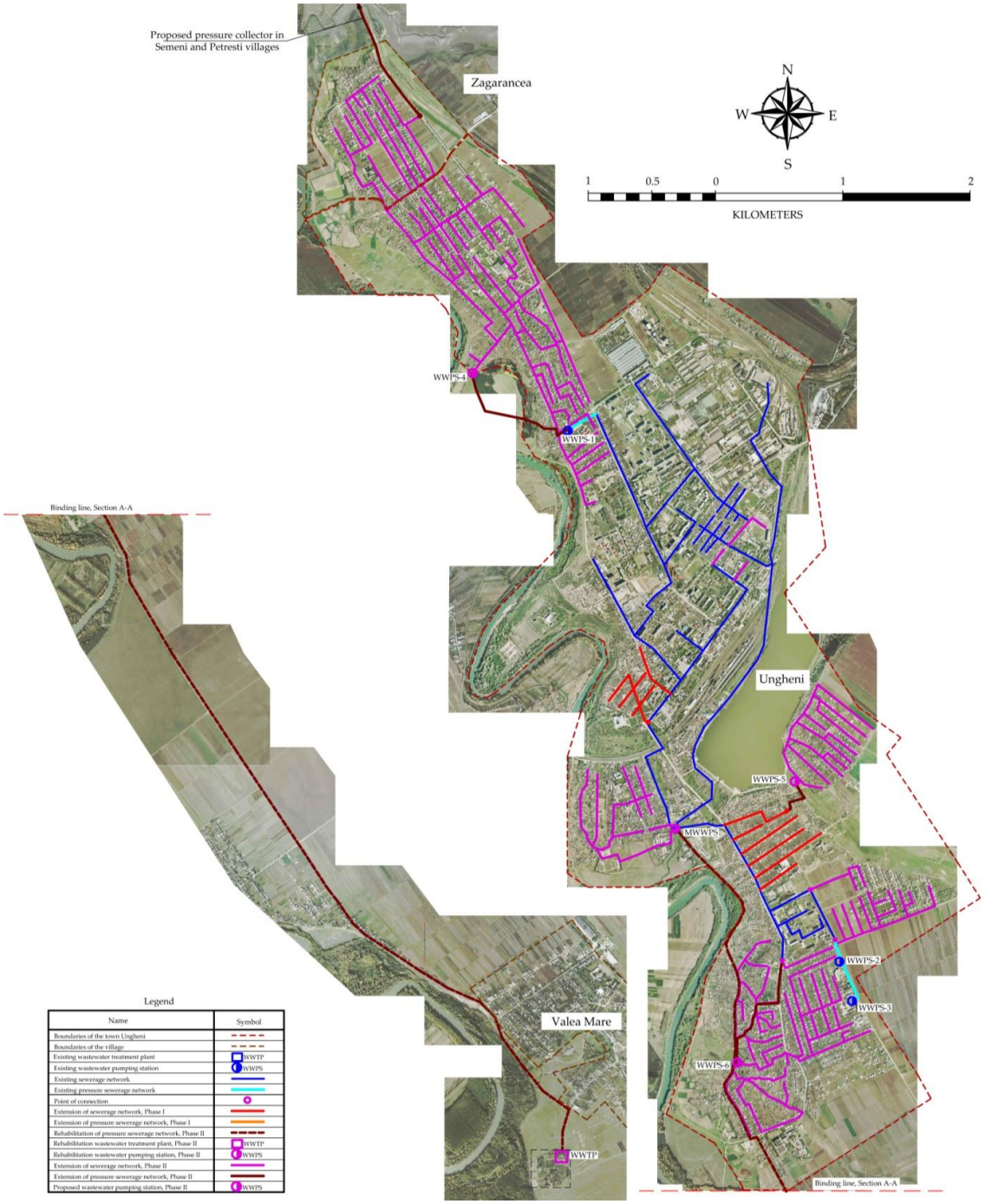
The existing and proposed wastewater system in the town of Ungheni and the localities of Zagarancea, Semeni and Petresti are presented in the figures 5-8, 5-9, 5-10 and 5-11. More detailed maps are provided in Annex 11.

[43] Material to be defined in the detailed design phase.

[44] Material to be defined in the detailed design phase.

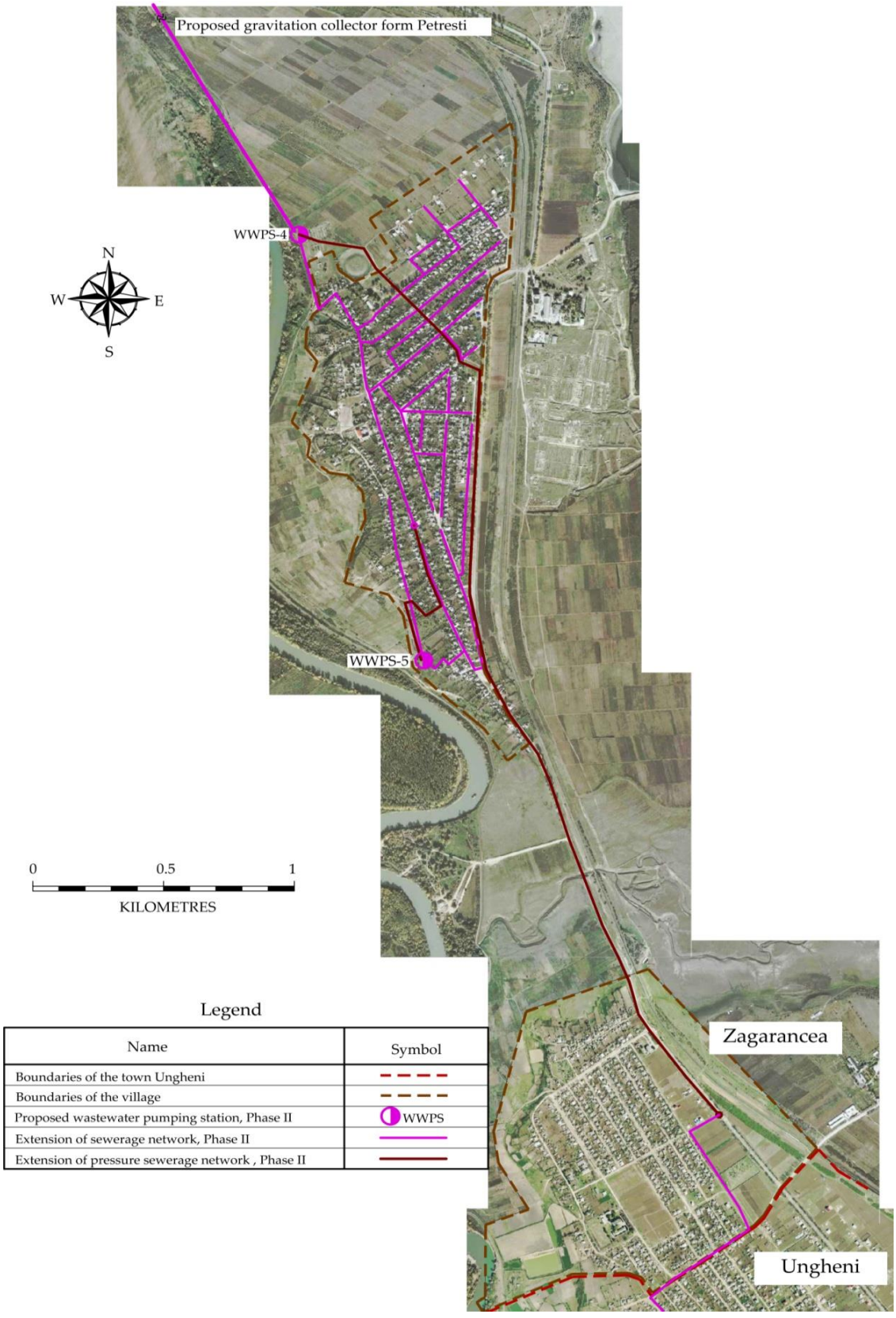
[45] Material to be defined in the detailed design phase.

Figure 5-8: Existing and proposed extension of the wastewater system in the town of Ungheni and the locality of Zagarancea



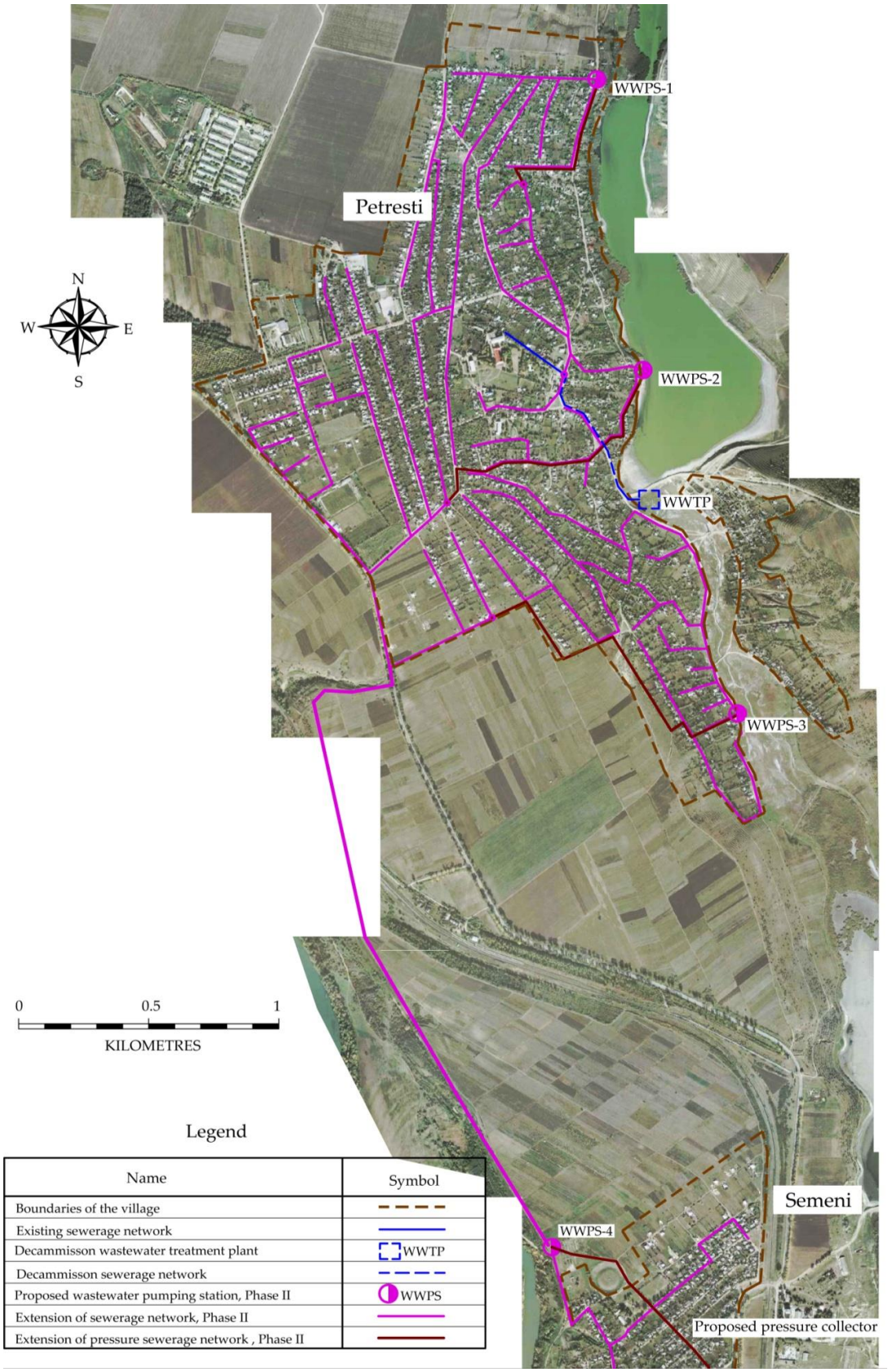
Source: GIZ/MLPS

Figure 5-9: Proposed extension of the wastewater system in the locality of Semeni



Source: GIZ/MLPS

Figure 5-10: Existing and proposed extension of the wastewater system in the locality of Petresti



Source: GIZ/MLPS

5.7.5 Operational improvement

5.7.5.1 Water supply (Water metering and equipment for operational improvement)

Customer water metering reached a high level in Ungheni Town, therefore no investments are foreseen in the short term (Phase 1 and 2 of this study). However, about 25% of the customer water meters (2,700 water meters) still need to be replaced in the medium and long-term. Water production is fully metered and therefore no investments are proposed. In the medium-term flow meters for all reservoirs and pumping stations are recommended.

In the medium term, a SCADA system with more advanced features for flow measuring and operation control will have to be installed. A tentative list of equipment is presented below (confirmation by ME 'Apa -Canal' Ungheni during the detailed design stage needed).

ME 'Apa-Canal' Ungheni is quite well endowed with operational equipment due to the participation in several international projects between 2006-2012. The available equipment includes inter alia the following items:

- Pressure loggers and manometer for pressure measurement in the network;
- Leak Detection Equipment including acoustic detection equipment and correlator;
- Metal pipe detection/localisation equipment;
- One emergency intervention truck;
- Two caterpillar excavators;
- One water tanker;
- Ultrasonic leak detection equipment;
- Two portable ultrasonic flow meters with manometers;
- Pressure Manometers;
- Laboratory equipment (modern equipment was procured under a World Bank financed project some years ago).

Note: Equipment is less than 5 years old, except the truck with water reservoir which is more than 25 years old and needs to be replaced.

According to ME 'Apa-Canal' Ungheni, the most urgent needs for improvements are:

- Portable ultrasonic flow meter (medium-term);
- Leak Detection Equipment;
- Water meter calibration unit;
- One truck with water reservoir;
- SCADA system;
- Other equipment needed may be specified during the detailed design study (e.g. hardware and software, maintenance tools, water meter calibration unit, etc.).

ME ‘Apa-Canal’ Petresti is not endowed with modern operation equipment and reported that the most important need will be a bucket excavator. The need for procurement of equipment for Petresti locality will depend on the intuitional solution to be agreed between the LPAs. As it is proposed that ME ‘Apa-Canal’ Ungheni will include the locality of Petresti in its service area, no additional equipment will be needed for this locality.

5.7.5.2 Wastewater

ME 'Apa-Canal' Ungheni is quite well endowed with equipment for wastewater operation and maintenance due to the participation in several international projects between 2006-2012 (see above). The available equipment includes inter alia the following items (other items listed above under water supply):

- One tractor with trailer;
- Laboratory equipment;
- One cesspool cleaning truck;
- One sewer cleaning (jetting) truck.

In order to ensure adequate Operation and Maintenance (O&M) for the wastewater system, procurement of the following equipment is proposed:

- Flow meter for measurement of wastewater flow (2 units);
- CCTV inspection equipment in order to assess in detail the condition of the sewerage network and based on these results to plan sewer rehabilitation works.

5.7.6 Technical assistance

Technical Assistance (TA) measures will be necessary aiming at:

- Improving operational performance in the water and wastewater sector;
- Assessing in detail the required investment in the wastewater sector (agglomeration analysis and option analysis);
- Assessing in detail the investment needs for sewerage network rehabilitation;
- Ensuring high quality standard for implementation of works (detailed designs[46], tender documents and supervision of works).

The scope of work for the Technical Assistance (TA) measures should include inter alia the following:

Table 5-9: Technical assistance

Component	Objectives	Measures
Design and Engineering for Phase 1 investments	To ensure high quality and timely implementation of works and technical assistance measures through support of the Project Implementing Agency[47] (i) in preparing all necessary documentation for tendering of the works for Phase 1 Investment measures, (ii) in tendering procedures, (iii) during the implementation period in project management, works su-	A) **Preparation of Detailed Design and Tender Documentation** for Phase 1 investment measures including (i) works contracts, (ii) equipment, (iii) design built contracts (if applicable), service contracts for follow-up TA measures. The services should also include (i) topographic survey and geotechnical investigations, (ii) all necessary measurements to prepare detailed designs and to confirm and justify the investment measures (e.g. flow measurements at transmission mains, water quality, etc.). The Consultant should further prepare all necessary documentation for obtaining required permits in accordance with the national

[46] In case of works contracts based on FIDIC Red-book.

[47] Reference is made to Chapter 9.3 – Project Implementation Plan (Set-up of a Project Implementation Structure)

Component	Objectives	Measures
	pervision and monitoring of technical assistance measures	legislation. B) Support during **tendering** of contracts including (i) preparation of reports and minutes of meetings (ii) communication, (iii) support in contract negotiations and preparation of contracts. C) Support of **Project Implementing Agency** in Project Management during contract implementation period (construction and defects liability period) including (i) establishment of adequate project management structures, (ii) preparation of detailed layout designs, construction designs (structural designs, shop drawings, etc.) and detailed pipeline routings, (iii) supervision of works, (iv) preparation of all necessary reports requested by the donor and the Project Implementing Agency (e.g. cash-flow reports, etc.), (v) training in project management and other areas identified as capacity weakness.
Corporate Development Programme	To improve the corporate planning capacity and to become a self-sustaining entity with commercially sustainable operations through improvement of the operational, financial and environmental performance of the operator.	• Corporate Development including improvements in (i) human resource development, (ii) service agreement with municipality and customers, (iii) strategy development, (iv) information system, (v) asset management; • Financial Performance Improvement including improvements in (i) accounting budgeting and cash management, (ii) billing system and revenue collection procedures, (iii) reporting procedures, (iv) reduction of apparent (commercial) water losses; • Operational Performance Improvement including (i) staff efficiency, (ii) water loss reduction, (iii) energy efficiency, (iv) operation and maintenance procedures; • Environmental Management including (i) preparation of Environmental and Social Action Plan and support in implementing the action plan (ii) improve overall environmental procedures; • Prepare a Capacity Building Programme for all areas of improvement.
Stakeholder Participation Programme	To ensure that all stakeholders are committed to the investment project and are involved during preparation and implementation phase. In particular the measures aims at enhancing public ownership by encouraging water conservation, increasing public participation in the provision of water services (service quality, rehabilitation activities, tariffs integrating poverty and social issues) and raising public awareness on issues related to the project implementation and water use	Raise customer awareness through education campaigns: • Identification of information needs; • Prepare Information campaign Plan and support the implementation. Facilitation of dialogue between clients and the Company: • Creation of and support to information exchange platform for customers; • Creation of an Advisory Committee comprising all major stakeholders; • Encourage transparency in decision-making; • Sustainability of dialogue.

Component	Objectives	Measures
Water Supply Network analysis and Water Loss reduction Programme	To improve the knowledge of water supply networks as a basis for preparation of a sound medium and long-term investment plan. To reduce water losses in the system through planning and implementing a comprehensive (i) strategy, (ii) action plan, (iii) capacity building programme.	A) **Network analysis**: Carry out comprehensive network analysis including (i) flow measurements at defined locations in the network (water intake, reservoirs, etc.), (ii) pressure measurements, (iii) analysis of system failures (pipe break data), (iv) analysis of pipe material, (v) preparation of Network Information System (NIS) including field data collection for mapping, (vi) hydraulic modelling and zoning, (vii) detailed investment plan for medium and long term development of the network (replacement, zoning, metering, etc.), (viii) training of operator's staff in applying the NIS and hydraulic modelling software tools. B) **Water loss reduction**: Prepare a water loss reduction strategy (in accordance with IWA best practice) including (i) recommendations for improvement of the organisation structure of the operator (e.g. set-up a water loss reduction department within the operator's organisation, recruitment of staff, etc.); (ii) prepare water balance (analyse components of the water balance in accordance with IWA standard procedures), (iii) recommend strategy and policy for reduction of water losses (e.g. pressure management, DMA/active leakage control, etc.), (iv) prepare detailed action plan for water loss reduction and leakage control including financial requirements, staff capacities required, time steps, methodology, etc.), (v) prepare a capacity building programme to support the operator in implementing the action plan.
Medium to Long-term Sanitation Study	To prepare a medium to long-term rayon investment plan for wastewater (Master Plan for Wastewater) and define number and capacity of WWTPs.	To assess in detail the required medium and long-term investment needs in the wastewater sector based on (i) detailed assessment of wastewater system including flow and load measurements for sewerage treatment and wastewater network analysis[48], (ii) definition of agglomeration borders in the rayon (as defined in EU Urban Wastewater Treatment Directive), (iii) preparation of option analysis for collection and treatment of wastewater (grouping of agglomerations to a wastewater treatment plan), (iv) preparation of strategy for localities not suitable for collection of wastewater (on-site sanitation, alternative systems, etc.), (v) preparation of wastewater treatment process options, (vi) preparation of a wastewater sludge management strategy and plan (vii) preparation of a medium to long-term investment plan for wastewater systems (collection, treatment and on-site sanitation), (viii) environmental and social impact assessment and (ix) economic and financial analysis. In particular the study should contain an option analysis for the localities of Semeni, Petresti and

[48] Procurement strategy for CCTV inspection of sewerage network should be prepared under this assignment including comparison of an option with procurement of own equipment and staffing and outsourcing of all works to the contractor. For the retained option a detailed action plan and draft specifications for a work contract should be prepared.

Component	Objectives	Measures
		Zagarancea (at least the following 3 options should be assessed (see Chapter 5.7.2 Investment framework): • Option 1 - Separate WWTPs for each of the localities (3 WWTPs); • Option 2 – One clustered agglomeration for Petresti and Semeni localities (2 WWTPs); • Option 3 – all localities discharge to the WWTP in Ungheni Town (1 WWTP). Further, the study should assess if other localities in the vicinity of Ungheni Town should be connected to the WWTP of Ungheni Town. Based on the above mentioned agglomeration analysis, the study should define the necessary capacity of the WWTP and propose a staged development (including the feasibility of an extension of the existing WWTP). Finally, the study should include a detailed assessment of options for the location of the WWTP (minimise distance to Ungheni Town in order to avoid the long pressure main.

Source: GIZ/MLPS

5.8 Prioritisation and phasing of investment measures

5.8.1 Criteria for phasing

The proposed investment measures described above in Chapter 5.7 have been grouped into:

- Short-term;
- Medium-term;
- Long-term measures.

The short-term measures are referred to as *Priority Investment Measures* and are again sub-divided into two sub-phases (Phase 1 and Phase 2).

The investment measures were phased according to the following criteria:

- Technical criteria (logical steps / order for implementation, robustness of investment measure (no-regret measures);
- Capacity of operator to implement and operate the system;
- Affordability;
- Available budget for investment expenditures;
- Contribution to health and environmental targets.

The main result of this phasing exercise is to identify priority measures which can be implemented immediately after completion of this feasibility study and which should be completed by end of 2017 (first year of operation in 2018). These measures are grouped in Phase 1 and constitute "*The Project*".

5.8.2 Justification for phasing

The following qualitative approach was used to apply the criteria presented in the previous section.

Table 5-10: Proposed investment measures and phasing

N°	Investment Measures	Proposed Phase[49]	Justification for phasing
1	Water supply	PH 1 and PH2	High priority due to all criteria: (i) Water supply has to be implemented before wastewater system[50] (ii) Capacity of operator sufficient (no complex systems); (iii) Affordability is ensured (comparatively low cost per capita); (iv) high contribution to public health improvement (water quality)
1.1	Rehabilitation of the water distribution network in the town of Ungheni	PH 1	About 56 km (41%) out of 136 km of the existing network is older than 60 years (87% older than 30 years) and is thus at the end of its service life. Hence there is an urgent need for network renovation in the short and medium term (see Chapter 4-Technical aspects-Existing situation). ME 'Apa-Canal' Ungheni has identified 12.2 km as highest priority. The measure will reduce the number of pipe bursts and water losses. Further, the service quality for the population will be improved (less supply interruptions).
1.2	Extension of the water distribution network in the town of Ungheni	PH 1	High priority is given to this measure in order to reach 100% coverage rate for the town.
1.3	Connection of the water supply system of Petresti to the water supply system in Ungheni Town	PH 2	Water quality in the locality of Petresti does not comply with national standards (high nitrate concentration). As treatment of nitrate would be too costly, it is proposed to supply the locality with water from Ungheni Town and connect it to the water network in Semeni locality. The measure is proposed to be implemented in Phase 2 as the intuitional restructuring process proposed in this project (incorporation of Petresti into the service area of Ungheni Town) will most likely not be completed in the short-term (there is an ongoing service contract with a private company for operation of the water supply system with a contract duration of 25 years).
1.4	Renovation of water supply network in Ungheni town	MT	It is recommended to optimise network operation, based on the results of the detailed investment plan to be prepared in the frame of the water Supply Network analysis and Water Loss reduction Programme included in the TA measures in Phase 1. These measures might inter alia include (i) Replacement of water supply network (30% of network older than 30 years), (ii) Establish adequate system operation and control, (iii) installation of SCADA. These measures require substantial input from the operator (high investment needs and complexity of measures). In order to avoid overloading of the operator during the relatively short project period, a gradual development in the medium term (stretched over several years) is proposed.
2.	Wastewater system	PH 1 and 2	Extension of sewerage network in Ungheni Town in

[49] PH 1: Phase 1, PH 2: Phase 2, MT: Medium Term, LT: Long-Term

[50] Without functioning water supply system the wastewater system cannot be functional

N°	Investment Measures	Proposed Phase[49]	Justification for phasing
			Phase 1&2 Rehabilitation of the existing sewerage network in Phase 2 New wastewater system for localities of Zagarancea, Semeni and Petresti in Phase 2. Construction of a new WWTP for Ungheni Town in Phase 2
2.1.a	Extension of sewerage network in Ungheni Town	PH 1	Due to the size of the agglomeration (above 10,000 P.E.) ME 'Apa-Canal' Ungheni gives priority to the extension of the sewerage network in Ungheni Town, while lower priority is given to the smaller localities in the vicinity of Ungheni Town. Highest priority is given to extension areas in the central part of the town (drainage area n° 2).
2.1.b	Extension of sewerage network in Ungheni Town	PH 2	In order to avoid overloading the capacities of the operator extensions in other drainage areas (drainage area n° 5, 6, 7 and parts of 2) are proposed to be implemented in Phase 2.
2.2	Rehabilitation of the existing sewerage network in Ungheni Town	PH 2	Replacement of the existing pressure sewer between the main wastewater pumping station (MWWPS) in Ungheni Town and the WWTP in Valea Mare Locality is proposed to be implemented in Phase 2 in parallel to the implementation of the WWTP. The pressure sewer cannot be implemented before identifying the location of the proposed WWTP (assessed in the detailed sanitation study in Phase 1). Rehabilitation of discharge tank at Main Wastewater Pumping Station (MWWPS) is related to the replacement of the existing pressure sewer and should therefore be carried out in (Phase 2). Based on the results of the CCTV inspection (to be carried out in Phase 1) rehabilitation of about 20.4 km sewerage network (30% of sewers older than 30 years) is proposed. In order to ensure functioning of the proposed WWTP (avoid operational problems due to highly diluted sewerage) this measure should be carried out in Phase 2.
2.3	Construction of a new WWTP for Ungheni Town	Ph 2	The existing WWTP of Ungheni Town in the Valea Mare Locality is obsolete and has to be replaced by a new WWTP. The measure should be implemented in Phase 2 for the following reasons (i) The location of the WWTP and its capacity (see Chapter 5.7.2 – Investment framework) can only be determined after completion of the sanitation study in Phase 1, (ii) in order to ensure compliance with national wastewater effluent quality standards (and in the future with EU-standards) for wastewater from Ungheni Towns and all localities proposed to be connected in Phase 2, the measure should not be carried out at a later stage then in Phase 2.
2.4	Extension of the sewerage network in the localities of Zagarancea, Semeni and Petresti	PH 2	The need for extensions and the optimal technical solutions in these localities should be assessed thoroughly in the proposed Sanitation Study (technical assistance in Phase 1). Therefore, the measure should be implemented in Phase 2 (based on the results of the Sanitation Study).

N°	Investment Measures	Proposed Phase[49]	Justification for phasing
3	Equipment for operational performance improvement	PH 1	Water Supply: High priority is given to the procurement of equipment (see Chapter 5.7.5-Operational Improvement) in order to improve operational efficiency (reduce real and commercial water losses). The equipment shall be procured in parallel to the implementation of TA measures in order to ensure its effectiveness. Wastewater: The procurement of equipment has high priority for operational performance improvement and preparation of long-term investment plan (technical assistance measure) and should be carried out in Phase 1 for the following reasons: • Procurement of equipment has high priority for operational performance improvement and preparation of the sanitation study (wastewater flow and load measurement should be available during the study in order to improve reliability of the applied design values for the WWTP); • CCTV inspection and sewer cleaning trucks have been identified as high priority equipment by ME 'Apa-Canal' Ungheni in order to improve operational performance and to prepare sewer rehabilitation programmes.
4.	Technical assistance		
4.1	Design and Engineering for Phase 1 investments	PH 1	Mandatory for implementation of works contracts for Phase 1.
4.2	Corporate Development Programme	PH 1	Should start as early as possible (in Phase 1) in order to increase the capacity of the operator and to generate additional revenues for implementing long-term investment measures (e.g. pipe replacements).
4.3	Stakeholder Participation Programme	PH 1	Should be implemented before and in parallel to the works contracts of Phase 1 (start as early as possible during design phase)
4.4	Water Supply Network Analysis and Water Loss Reduction Programme	PH 1 (PH 2)	Should be carried out in parallel to the design stage of Phase 1 investment measures in order to ensure that part of its results are available for designing Phase 1 investments. In case that insufficient budget is available, this measure could be split into two phases (follow up in Phase 2 in order to determine long-term network development needs).
4.5	Medium to Long-term Sanitation Study	PH 1	Should be implemented as soon as possible (in Phase 1) in order to ensure that all wastewater investment measures (in particular design and construction of WWTP) can be implemented in Phase 2.

Source: GIZ/MLPS

5.9 Option analysis for investment measures

Possible options for the priority investment measures proposed to be implemented in Phase 1 were identified and analysed, while for measures in Phase 2 the options have been identified but will be analysed in subsequent studies (see technical assistance measures above). Detailed options (such as pipe materials, type of pumps, zoning op-

tions, etc.) will be carried out in the subsequent detailed design stage (technical assistance measure 3.1. and 3.4).

Option analysis for Phase 1

The proposed investment measures for Phase 1 are:

- Extension of the water distribution network in the town of Ungheni;
- Rehabilitation of the water distribution network in the town of Ungheni;
- Extension of the sewerage network in the town of Ungheni;
- Equipment and Tools for operational performance improvement (water supply and wastewater).

Due to the nature of the proposed investment measures (network rehabilitation and extension) no options have been identified.

Identified options for Phase 2:

The identified options to be assessed by the future technical assistance consultant (see Chapter 5.7.6) for Phase 2 measures are described below:

Water Supply of the locality of Petresti through treatment of nitrate versus water supply from Ungheni Town:

Groundwater from the well in Petresti is contaminated with nitrates (see Chapter 4-Technical aspects. Existing situation) and therefore does not comply with national standards. There are two options to improve water quality:

- Option 1: Construction of a new water treatment plant (WTP);
- Option 2: Connection of the Petresti water supply system to the network of Semeni and supply with surface water from Ungheni Town.

Option 1: The costs (investment as well as operation and maintenance costs) for treatment of nitrate are very high. Additionally, the requirements for maintenance of the plant (complex system) would be high and it would be difficult for ME 'Apa-Canal' Petresti to operate the system.

Option 2: In order to supply Petresti with water from Ungheni a transmission main with a length of only 4.7 km and a pumping station would be needed. The investment costs for this option have been estimated at about 0.33 MEUR.

Conclusion: Due to the fact that both, investment as well as operation costs for the treatment plant are by far higher compared to a connection to Ungheni water supply system, it is obvious that Option 2 – connection to the water supply network in Semeni/ Ungheni is the preferred option and was thus retained for the purpose of cost estimation of Phase 2. The technical assistance consultant in Phase 1 should re-analyse the options and confirm the proposed solution (considering institutional arrangements).

Wastewater collection and treatment in Ungheni Town and the localities of Petresti and Semeni:

In order to define the required capacity of the WWTP an assessments of the agglomerations (localities in the vicinity of Ungheni Town) to be connected to the central WWTP in Ungheni Town has to be carried out. This assessment includes an option analysis comparing central versus decentralised options for each of the agglomerations / localities. Hence, for each agglomeration the assessment reveals if the preferred option will

be a connection to the WWTP in the town (centralised option) or if a decentralised solution is the least cost option (e.g. separate WWTP for each locality). Further, the agglomeration boarders have to be assessed, defining clearly which part of the service area should be connected to a centralised sewerage network and which part of the service area should better be served through on-site sanitation (e.g. septic tanks, etc.). This assessment should be carried out at least at rayon level (or even beyond administrative borders of the rayon) and should include ALL localities in a defined study area (approach as typically carried out at master plan level). As the scope of this feasibility study is limited to the preselected urban localities (towns) and localities in the immediate vicinity of this town, this study has to be carried out within the scope of the subsequent technical assistance measure in Phase 1 (see above in Chapter 5.7.6 Technical Assistance).

The subsequent Sanitation Study should in particular assess the following options (see Chapter 5.7.2 Investment framework and Chapter 5.7.4 - Investment measures – wastewater system):

For the localities of Semeni (1,986 inhabitants in 2014) and Petresti (3,855 inhabitants in 2014), located west of Ungheni Town, three options for wastewater treatment are possible:

- Option 1 – 3 WWTPs: Separate WWTPs for each of the localities (1 WWTP in Petresti, 1 WWTP in Semeni, 1 WWTP for Ungheni/Zagarancea);
- Option 2 – 2 WWTPs: 1 WWTP for the localities of Semeni and Petresti and 1 separate WWTP for Ungheni Town (including Zagarancea);
- Option 3 - 1 WWTP: 1 WWTP in Ungheni Town treating wastewater for all localities.

Within the framework of technical assistance measures proposed for Phase 1, a thorough assessment and option analysis should be carried out in order to identify the most appropriate solution. The assessment should take into consideration that in neighbouring EU-countries (Romania) many wastewater collection and treatment systems in small towns are currently not operational due to the high operation costs and the very low connection rates. Due to the small size of WWTPs in Option 1 and 2 (about 6,000 P.E. for the WWTP to treat wastewater from Semeni and Petresti Localities) investment costs as well as operation and maintenance costs would be much higher than for Option 3. Therefore, for cost estimation purposes Option 3 is proposed to be implemented (to be confirmed by the technical assistance consultant in Phase 1). This option requires a wastewater pumping station (WWPS) west of Semeni Locality and a pressure main to discharge wastewater to the sewerage network in Ungheni Town.

5.10 Proposed investment plan

The phased priority investment plan is presented in the tables 5-11. The total investment costs for Phase 1 have been estimated at 3.75 MEUR and for Phase 2 at 42.96 MEUR (see summary table below). The total costs for Phase 1 and Phase 2 amount to 46.7 MEUR.

Table 5-11: The investment plan for Phase 1

N°	Component	Units	Quantity	Unit costs	Total cost
				EUR	EUR
1.	Water supply				
1.1	Rehabilitation of the water distribution network in the town of Ungheni				
1.1.1	Water distribution network HDPE pipe OD 400 mm	m	1,700	174	295,800
1.1.2	Water distribution network HDPE pipe OD 315 mm	m	480	139	66,720
1.1.3	Water distribution network HDPE pipe OD 90 mm	m	2,720	62	168,640
1.1.4	Water distribution network HDPE pipe OD 75 mm	m	7,335	60	440,100
ST-1.1	Subtotal 1.1				971,260
1.2	Extension of the water distribution network in the town of Ungheni				
1.2.1	Water distribution network HDPE pipe OD 90 mm	m	1,975	62	122,450
1.2.2	Water distribution network HDPE pipe OD 75 mm	m	3,460	60	207,600
1.2.3	Manholes, ϕ 1,500	pcs	12	423	5,076
1.2.4	Service connections	pcs	235	250	58,750
ST-1.2	Subtotal 1.2				393,876
ST-1	Sub-total water supply (1.1+1.2)				1,365,136
2.	Wastewater				
2.1	Extension of the sewerage network in the town of Ungheni				
2.1.1	Sewerage network PP/PVC pipe DN 200	m	5,589	150	838,350
2.1.2	Manholes, ϕ 1,000	pcs	112	1030	115,133
2.1.4	Service connections	pcs	516	500	258,000
ST-2	Subtotal 2.1 Extension of the sewerage network				1,211,483
3	Equipment and tools for operational performance improvement (water supply and wastewater)	LS	1	200,000	200,000
ST-1&2&3	Sub-Total (1+2+3)				2,776,619
4	Technical assistance				
4.1	Design and engineering (12% of investment costs)				333,194
4.2	Technical assistance (Corporate Development Programme, Stakeholder Participation Programme, Water Supply Network Analysis and Water Loss Reduction Programme, Medium to Long-term Sanitation Study)	LS	1	300,000	300,000
ST-4	Sub-total technical assistance (4.1+4.2)				633,194
4	Contingencies (10% of 1+2+3)				340,981
GT	**Total costs for Ungheni Phase 1 (1+2+3+4)**				**3,750,795**

Source: GIZ/MLPS

Table 5-12: The investment plan for Phase 2

N°	Component	Units	Quantity	Unit costs	Total cost
				EUR	EUR
A	Ungheni Town				
1	Wastewater				
1.1	Rehabilitation of the sewerage network in the town of Ungheni				

N°	Component	Units	Quantity	Unit costs	Total cost
				EUR	EUR
1.1.1	Pressure main PE OD 315 mm (MWWPS to WWTP)	m	19,320	139	2,685,480
1.2.1	Rehabilitation of sewerage network in the town of Ungheni (OD 200-250 mm)	m	20,396	165	3,365,406
ST-1.1	Subtotal 1.1 Rehabilitation of the sewerage network				6,050,886
1.2	Extension of the sewerage network in the town of Ungheni				
1.2.1	Sewerage network PP/PVC pipe OD 200 -250 mm	m	38,282	165	6,316,530
1.2.2	Manholes, ϕ 1,000	pcs	766	1030	788,609
1.2.3	Pressure main PE OD 90-110 mm	m	2,675	62	165,850
1.2.4	Service connections	pcs	2,406	500	1,203,000
ST-1.2	Subtotal 1.2 Extension of the sewerage network				8,473,989
1.3	Wastewater pumping station				
1.3.1	Wastewater pumping station	LS	1	32,000	32,000
1.3.2	Wastewater pumping station	LS	1	40,000	40,000
1.3.3	Wastewater pumping station	LS	1	63,000	63,000
ST-1.3	Subtotal 1.3 Wastewater pumping station				135,000
1.4	Main wastewater pumping station				
1.4.1	Rehabilitation of discharge tank at Wastewater pumping station (V=2,000 m³)	LS	1	425,000	425,000
ST-1.4	Subtotal 1.4				425,000
1.5	Wastewater Treatment Plant				
1.5.1	Rehabilitation/Construction of Wastewater Treatment Plant	P.E	43,661	240	10,478,640
ST-1.5	Subtotal 1.5 Main wastewater pumping station				10,478,640
ST-1	Subtotal Wastewater (1.1+1.2+1.3+1.4+1.5)				25,563,515
B	Zagarancea Locality				
1	Wastewater				
1.1	Construction of the sewerage network the locality of Zagarancea				
1.1.1	Sewerage network PP/PVC pipe OD 200-250 mm	m	5,930	165	978,450
1.1.2	Manholes, ϕ 1,000	pcs	119	1,030	122,158
1.1.3	Service connections	pcs	370	500	185,000
ST-1	Subtotal 1.1 Construction of the sewerage network s				1,285,608
GT	Total Costs for Zagarancea locality Phase 2				1,285,608
C	Semeni Locality				
1	Wastewater				
1.1	Construction of the sewerage network in the locality of Semeni				
1.1.1	Sewerage network PP/PVC pipe OD 200-250 mm	m	9,965	165	1,644,225
1.1.2	Manholes, ϕ 1,000	pcs	199	1,030	205,279
1.1.3	Pressure main PE OD 90-110 mm	m	770	62	47,740
1.1.4	Service connections	pcs	620	500	310,000
ST-1.1	Subtotal 1.1 Construction of the sewerage network in the locality of Semeni				2,159,504
1.2	Wastewater pumping station				

N°	Component	Units	Quantity	Unit costs	Total cost
				EUR	EUR
1.2.1	Wastewater pumping station	LS	1	28,000	28,000
1.2.2	Wastewater pumping station	LS	1	50,000	50,000
ST-1.2	Subtotal 1.2 Wastewater pumping station				78,000
ST-1	TOTAL Wastewater (1.1+1.2)				2,237,504
GT	Total Costs for Semeni_Locality Phase 2				2,237,504
D	Petresti Locality				
1	Water supply				
1.1	Construction of water transmission main from WTP Ungheni till PS Petresti, HDPE pipe OD 90 mm	m	4,700	62	291,400
1.2	Construction of Water Pumping Station	LS	1	47,000	47,000
ST-1	Total Water (1.1+1.2)				338,400
2	Wastewater				
2.1	Extension of the sewerage network in the locality of Petresti				
2.1.1	Sewerage network PP/PVC pipe OD 200-250 mm	m	25,612	165	4,225,980
2.1.2	Manholes, ϕ 1,000	pcs	512	1,030	527,607
2.1.3	Pressure main PE OD 90-110 mm	m	3,075	62	190,650
2.1.4	Service connections	pcs	1,200	500	600,000
ST-1.1	Subtotal 1.1 Extension of the sewerage network				5,353,587
1.2	Wastewater pumping station				
1.2.1	Wastewater pumping station	LS	1	28,000	28,000
1.2.1	Wastewater pumping station	LS	2	32,000	64,000
ST-1.2	Subtotal 1.2				92,000
GT	Total Costs for Petresti Locality Phase 2				5,783,987
SUM	Summary for Total Investment Costs for all localities				
1	Ungheni Town				
1.1	Water Supply				-
1.2	Wastewater				25,563,515
ST-1	Sub-total capital investment costs Ungheni Town				25,563,515
2	Zagarancea Locality				
2.1	Wastewater				1,285,608
ST-2	Sub-total capital investment costs Zagarancea Locality				1,285,608
3	Semeni Locality				
3.1	Wastewater				2,237,504
ST-3	Sub-total capital investment costs Semeni Locality				2,237,504
4	Petresti Locality				
4.1	Water supply				338,400
4.2	Wastewater				5,445,587
ST-4	Sub-total capital investment costs Petresti Locality				6,122,387
TOT	Total capital Investment cost all localities (1+2+3+4)				34,870,614
T1	Water Supply				338,400
T2	Wastewater				34,532,214
TOT	Total capital Investment cost all localities				34,870,614

N°	Component	Units	Quantity	Unit costs	Total cost
				EUR	EUR
TA	Technical assistance				
DE	Design and engineering (12% of investment costs)				4,184,474
CON	Contingencies (10% of Investment costs and TA)				3,905,509
GT II	**Grand TOTAL for Phase 2 (Investment costs + TA + Contingencies)**				**42,960,597**

Source: GIZ/MLPS

Table 5-13: Summary of the investment plan for Phase 1 and Phase 2

N°	Component	Costs Phase 1	Costs Phase 2	Costs Phase 1 &2
		EUR	EUR	EUR
1	Water supply and wastewater, capital investments			
1.1	Water supply	1,365,136	338,400	1,703,536
1.2	Wastewater	1,211,483	34,532,214	35,743,698
1.3	Equipment and tools	200,000		
ST-1	Sub-total capital investments water supply and wastewater	2,776,619	34,870,614	37,647,234
2	Technical assistance	633,194	4,184,474	4,817,668
3	Contingencies	340,981	3,905,509	4,246,490
Tot	**Total costs Phase 1 & 2**	**3,750,795**	**42,960,597**	**46,711,392**

Source: GIZ/MLPS

6 Financial and economic analysis

6.1 Assumptions for financial and economic analysis

The financial model is structured in nominal Moldovan lei (MDL), the base year is 2014 and forecast begins in 2015.

The financial and economic analysis was based on macroeconomic assumptions on a forecast of GDP per capita, wages increase and electricity prices described below (Macroeconomic forecast).

The financial and economic analysis was prepared using incremental analysis, which considers the differences in the costs and benefits between the 'do something' alternative(s) and a single counterfactual without the project, that is, in principle, the BAU[51] scenario[52], in reference to the EU Guide to Cost-Benefit Analysis (further EU guide) of investment projects.

The project was prepared using following assumptions:

- The water supply service are will be extended with 235 households in Ungheni in 'with project' scenario and no extension of the service area is forecasted for BAU scenario;
- The wastewater service area will be extended with 516 households according 'with project' scenario and no extension of the service area is forecasted for BAU scenario;
- The connection rate increases in the existing service area to 100% as the targets was set by 2030 and for the new area (new connected localities) to the 100% in 2045;
- Apparent losses (Commercial losses) will decrease down to the target set of 5% until 2030;
- Physical losses will decrease down to the target set 25% until 2030 and down to 20% in 2045;
- Fixed costs and depreciation do not change, except increases in salaries as described in the macroeconomic forecast;
- Variable costs are proportional to the unit water consumption.

The details of the financial and economic analysis are presented in Annex 6, Tables 1-26 as follows:

- Table 1. Macroeconomic forecast;
- Table 2. Investment costs for water supply;
- Table 3. Investment costs for wastewater;
- Table 4a. Depreciation rates for water supply;
- Table 4b. Depreciation rates for wastewater;
- Table 5a. Summary of investment costs for water supply;

[51] Business as Usual

[52] In fact, the BAU scenario is an adjusted "do-minimum" scenario used as the reference solution. This is because in some cases, the BAU (do-nothing) scenario cannot be considered acceptable because it produces catastrophic effects.

- Table 5b. Summary of investment costs for wastewater;
- Table 6a. Depreciation for water supply;
- Table 6b. Depreciation for wastewater;
- Table 7a. Gross value of new assets for water supply;
- Table 7a. Gross value of new assets for wastewater;
- Table 8a. Net assets for water supply;
- Table 8b. Net assets for wastewater;
- Table 9a. Depreciation costs for water supply;
- Table 9b. Depreciation costs for wastewater;
- Table 10. Variable costs – summary;
- Table 11. Fixed costs;
- Table 12. Total costs;
- Table 13. Calculation of the water and wastewater tariff;
- Table 14. Tariff affordability;
- Table 15. Profits and losses - with project;
- Table 16. Profits and losses - without project;
- Table 17. Working Capital - with project;
- Table 18. Working Capital - without project;
- Table 19. Balance sheet - with project;
- Table 20. Balance sheet - without project;
- Table 21. Cash flow - with project;
- Table 22. Cash flow - without project;
- Table 23. Financial analysis on profitability of the investment;
- Table 24. Calculation of NPV on own capital;
- Table 25. Economic analysis;
- Table 26. Sensitivity analysis.

The financial analysis was prepared in an annual presentation and covers a time horizon of 30 years. Calculation of NPV was conducted for a 30-year reference period as the most appropriate infrastructure investments in the WSS sector and also advised by EU guide for water and environment (Table 2.2 of the guide which provides reference time horizon in years).

Historical financial data for 2012, 2013 and 2014 are used as the basis for the financial model. Data from 2014 is used as basis for the current costs structure.

The exchange rate used for the analysis represents the average exchange rate for the 2015 (the period from 1 January to 1 November) and is 1 EUR = 20.78 MDL. (Source: (https://www.bnm.md/en/content/official-exchange-rates).)

6.1.1 Macroeconomic forecast

Gross domestic product (GDP) is the monetary value of all the finished goods and services produced within a country's borders in a specific time period. GDP is usually cal-

culated on an annual basis. The major source for the GDP forecast is the Poverty Reduction Strategy[53].

The National Development Strategy (NDS)—known as 'Moldova 2020'—was approved by the Parliament of the Republic of Moldova on July 11, 2012 and officially published on November 30, 2012. The Strategy is not only a policy guide for the Government of Moldova but also the base for relations with IMF and other IFOs. The Strategy sets the priorities for country development for the time horizon 2012-2020. At the same time the Strategy assumes two development scenarios: base case scenario and scenario Moldova 2020.

The base case scenario, which regards a continuation of trends of the last decade, assumes that Moldova will develop as it has done to date, with the same economic, social, political phenomena, with rising remittances and the same pace of reforms. The base case scenario estimates an average annual GDP growth of 4.7% during 2012-2020.

The implementation of the Strategy's priorities, considering the direct and quantifiable effects of each priority, supplements this annual growth rate by more than 1.2% annually, thus forming the alternative scenario Moldova 2020, which in this study is called the optimistic scenario. The annual supplement to the additional GDP growth will emerge gradually, but will accelerate rapidly and sustainably, from 1.1% (2015) to 2.1% (by 2020), continuing beyond the analysis horizon used in this study. The difference is small at first glance, but in developed economies an annual GDP growth difference of 2% is sometimes the difference between stagnation and growth, or the difference between normal growth and economic boom. Hence, the alternative scenario assumes that, due to effects only, in 2020 the GDP will be 12% higher compared to the base case scenario and, with each year beyond 2020, this difference will grow significantly. Along with the implementation of these priorities, the annual income per capita by 2020 will be on average 12% higher compared to the base case scenario and 79% higher compared to 2011.

Taking into account that the National Development Strategy 2012-2020 also serves as the Poverty Reduction Strategy (PRS) and is the official basis for internal programming and for bilateral relations between the Government of the Republic of Moldova and the IMF and other international financial institutions, it may be concluded that the annual percentage changes in GDP presented in the Strategy can serve as a reference for the feasibility study projections.

Table 6-1: Gross Domestic Product annual percentage of change based on the information provided by Poverty Reduction Strategy (%)

Scenario/ Years	2015	2016	2017	2018	2019	2020
Base case scenario, %	4.70	4.60	4.65	4.70	4.65	4.70
Moldova 2020 scenario (optimistic), %	5.80	5.90	6.40	6.50	6.40	6.70
Pessimistic, %	1.10	1.30	1.75	1.80	1.75	2.00

Source: GIZ/MLPS

The base case scenario in the Poverty Reduction Strategy assumes that in the period 2012 – 2020, the annual GDP growth rate will be on average 4.70%. The Moldova 2020 scenario assumes that GDP will be higher than in the base case scenario in 2015 by 1.10% and in 2020 by 2.10%. Table 6-1 presents GDP growth estimates from 2015-

[53] http://www.imf.org/external/pubs/cat/longres.aspx?sk=40895.0

2020 based on the assumptions and figures provided in the PRS. This study includes also a third scenario, pessimistic, where growth is half of that in the base scenario.

During the development of this feasibility study, the World Bank and IMF changed their GDP forecasts for the Republic of Moldova, due to social and political events that recently took place in region and the country itself. In this context, the World Bank has revised its GDP forecast downward, as shown in the following table.

Table 6-2: Gross Domestic Product projection by World Bank (%)

Scenario/ Years	2015	2016	2017
Base case scenario, %	-2.0	1.5	4.00

Source: http://www.worldbank.org/content/dam/Worldbank/GEP/GEP2015b/Global-Economic-Prospects-June-2015-Europe-and-Central-Asia-analysis.pdf

Applying the same methodology used in the Poverty Reduction Strategy, the GDP growth for all three scenarios has been estimated and is presented in the table below.

Table 6-3: GDP annual percentage of change in the feasibility study (%)

Scenario/ Years	2015	2016	2017	2018	2019	2020
Base case scenario, %	-2.0	1.5	4.0	4.0	4.0	4.0
Optimistic scenario, %	-2.0	3.00	4.5	5.0	5.0	5.0
Pessimistic scenario, %	-2.0	0.8	2.0	2.0	2.0	2.0

Source: GIZ/MLPS

Extending the GDP projections beyond 2020, it is assumed that the high growth of 4% annually will continue until 2035 as a result of structural reforms. However, in the later years the GDP growth will gradually slow, achieving the growth of 3% in the period of 2035-2044. The GDP growth forecasts for the period 2025-2045, estimated according to the above assumptions are presented in Table 6-4. In the optimistic scenario, the GDP growth will remain higher, while in the pessimistic scenario there will be stagnation.

Table 6-4: GDP annual percentage of change projection 2025-2045 (%)

Scenario/ Years	2025	2030	2035	2040	2045
Base case scenario, %	4.0	4.0	3.0	3.0	3.0
Optimistic scenario, %	5.0	5.0	5.0	5.0	5.0
Pessimistic scenario, %	2.0	2.0	1.5	1.5	1.5

Source: GIZ/MLPS

The base case scenario was used further in the financial analysis and financial calculations.

6.1.2 Wages forecast

According to the National Bureau of Statistics of the Republic of Moldova, the gross average monthly salary was MDL 4,172.0 in 2014, which was higher by 10.8% compared to the gross average salary in 2013. For the period 2009-2014, the average salary growth rate was 8.7%. The table below presents the gross average salaries and the salary growth rate for the period 2005 – 2014.

Table 6-5: Gross average monthly salary (MDL)

Indicator / Years	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Gross average monthly salary, MDL	1,319	1,697	2,065	2,530	2,748	2,972	3,194	3,478	3,765	4,172
Salary growth rate, %	19.5	28.7	21.7	22.5	8.6	8.2	7.5	8.9	8.3	10.8

Source: (http://statbank.statistica.md/pxweb/Dialog/varval.asp?ma=SAL0108_en&ti=Gross+average+monthly+salary+by+economic+activities+and+sectors%2C+2004-2010&path=../Database/EN/03%20SAL/SAL01/serii%20anuale/&lang=3)

The gross average salary for the next four years (2015-2018) is described on the macro economic forecast of the Moldovan Ministry of Economy. The table below presents the gross average salaries and the salary growth rate for 2015 – 2018.

Table 6-6: The forecast of gross average monthly salary for the next years (MDL)

Indicator / Years	2015	2016	2017	2018
Gross average monthly salary, MDL	4,500	4,925	5,400	5,900
Nominal growth rate, %	7.9	9.4	9.6	9.3

Source: (http://www.mec.gov.md/ro/documents-terms/situatia-macroeconomica-prognozare-macroeconomica)

The base case scenario, which regards a continuation of trends of the last decade, assumes that Moldova will develop as it has done to date, with the same economic, social, political phenomena.

The base case scenario estimates an average monthly salary growth of 9.0% during 2012-2020.The optimistic scenario (Moldova 2020) assumes that gross monthly salary will be higher than in the base case scenario in 2015 - 2020 by 2.0%. The pessimistic scenario assumes that the salary growth will be half of the provided by base scenario.

Table 6-7 presents gross monthly salary growth estimates for the period 2015-2020 based on the assumptions and figures provided by the Moldovan Ministry of Economy.

Table 6-7: The forecast of gross average monthly salary growth for the next years (%)

Scenario/Years	2015	2016	2017	2018	2019	2020
Base Case scenario, %	7.9	9.4	9.6	9.3	9.3	8.5
Pessimistic scenario, %	3.95	4.70	4.80	4.65	4.66	4.26
Optimistic scenario, %	9.9	11.4	11.6	11.3	11.3	10.5

Source: GIZ/MLPS

Extending the projections of gross average monthly wages beyond 2020, it is assumed that the high growth of about 6.3% annually will continue until 2025 as a result of structural reforms and the growth of the economy. For the period 2025-2035, the growth will slow down up to approximately 4.3% annually. In later years, it is estimated that growth will gradually slow, achieving the rate of 3% in the period of 2035-2044.

The gross average monthly salary forecast for the period 2020-2045 is presented in the table below.

Table 6-8: The forecast of gross average monthly salary growth, 2020-2045 (%)

Scenario/Years	2020	2025	2030	2035	2040	2045
Base Case scenario, %	8.5	5.6	4.3	3.6	3.0	2.7
Pessimistic scenario, %	4.26	2.78	2.17	1.79	1.52	1.35
Optimistic scenario, %	10.5	7.6	6.3	5.6	5.0	4.7

Source: GIZ/MLPS

The base case scenario was used in this feasibility study.

6.1.3 Household income forecast

According to National Bureau of Statistics of the Republic of Moldova the disposable household income was (in 2014), in person per month: MDL 2,292.6 in Chisinau, MDL 1,697.2 in the North, MDL 1,564.3 in the Centre and MDL 1,526.6 in the South Region[54].

In 2014 the disposable household income was MDL 1,767.5 on average at national level, MDL 2,111.1 in urban and MDL 1,505.7 in rural areas.

The forecast for disposable household income was estimated based on disposable household income per capita per month from 2014 and increased according to the assumptions for the annual real wage growth. The following tables present the forecast for disposable household income for the period 2015-2020 and 2020-2045.

Table 6-9: Forecast of disposable household income, 2015-2020[55]

Scenario/Years	2015	2016	2017	2018	2019	2020
Base Case scenario, MDL	1,730	1,781	1,863	1,944	2,021	2,102
Pessimistic scenario, MDL	1,730	1,756	1,796	1,835	1,871	2,066
Optimistic scenario, MDL	1,730	1,816	1,936	2,058	2,161	2,837

Source: GIZ/MLPS

Table 6-10: Forecast of disposable household income, 2020-2045[56]

Scenario/Years	2020	2025	2030	2035	2040	2045
Base Case scenario, MDL	2,102	2,558	3,112	3,786	4,389	4,940
Pessimistic scenario, MDL	1,909	2,107	2,327	2,569	2,767	2,937
Optimistic scenario, MDL	2,269	3,008	3,838	4,899	6,252	7,600

Source: GIZ/MLPS

6.1.4 Electricity prices forecast

Electricity prices have a significant influence on costs of providing services and therefore on the tariffs that customers should pay.

[54] http://statbank.statistica.md/pxweb/Dialog/view.asp?ma=NIV0103_EN_t&ti=Disposble+incomes+average+monthly+per+capita+by+Years%2C+Sources+of+income%2C+Unit+and+Zones&path=./quicktables/EN/04%20NIV/NIV01/&lang=3

[55] Per capita per month (MDL)

[56] Per capita per month (MDL)

While electricity prices in Moldova are below the European average, they are among the highest when compared to disposable household income. Thus, the following factors will affect electricity prices:

- Regulation and government policy keeping prices low;
- Regional price of gas as a major fossil fuel used in the power generation in Moldova;
- Demand for the electricity in the region;
- Situation in Transnistria, from where Moldova imports electricity at a low price due to subsidised gas prices in Transnistria;
- Development of grid connections to Romania and Ukraine;
- General growth of the country's GDP and increase in disposable household income, which may provide the government with the possibility of relaxing control on electricity prices.

Based on these factors, the feasibility study makes following assumptions:

- By 2020, the real increase in electricity prices will be limited to 1% annually, with the exception of 2016, when according to Administrative Board Decision of National Agency for Energy Regulation of the Republic of Moldova no. 153 of July 18, 2015, the electricity price was increased by 37%;
- In years 2020-2030, it will be proportional to the half of GDP increase;
- After 2030, it will be proportional to the GDP increase;
- In the pessimistic scenario, it will be proportional to half of GDP increase by 2020 and then it will be proportional to the GDP increase;
- In the optimistic scenario, there will be annual real growth of 1%.

The following table summarises the assumed future electricity price increases:

Table 6-11: Increase of electrify prices (%)

Scenario/ Years	2015	2016	2017	2018	2019	2020	2030	2040
Base case scenario, %	0.0	37.0	1.0	1.0	1.0	1.0	2.5	4.0
Pessimistic scenario, %	0.0	37.0	2.3	2.4	2.3	2.4	5.0	4.0
Optimistic scenario, %	0.0	37.0	1.0	1.0	1.0	1.0	1.0	1.0

Source: GIZ/MLPS

The base case scenario is used in the feasibility study and further in the financial analysis and financial calculations.

6.2 Evaluation of the financial capacity of the Operator

6.2.1 Analysis of the current financial situation of the Operator

6.2.1.1 Analysis of the Balance Sheet

The WSS operator's Balance Sheet reveals an increase of the fixed assets (see Table 6-12).

Table 6-12: Balance Sheet of ME 'Apa-Canal' Ungheni

Balance Sheet	Row Code	2012 (MDL)	2013 (MDL)	2014 (MDL)
ASSETS				
LONG-TERM FIXED ASSETS				
Intangible assets	010	27,500	31,425	40,245
Accumulated Depreciation-Intangible Assets	020	-4,563	-10,781	-21,256
Intangible assets' book cost	030	22,937	20,644	18,989
Incomplete fixed assets	040	2,554,441	248,325	270,625
Fixed Assets	060	75,359,733	81,039,579	83,248,741
Depreciation and depletion of long-term fixed assets	080	-45,604,670	-47,275,548	-51,126,607
Long-term fixed assets' book cost	090	32,309,504	34,012,356	32,392,759
Total Non-Current Assets	180	32,332,441	34,033,000	32,411,748
CURRENT ASSETS				
Stocks of goods and materials				
Raw materials	190	309,129	400,746	618,010
Inventory	210	46,399	37,256	28,270
Goods for sale	240	1,287,213	567,070	314,794
Stocks of goods and materials	250	1,642,741	1,005,072	961,074
Short-term receivables				
Trade accounts receivables	260	3,481,701	4,203,114	4,791,560
Adjustments on doubtful debts	270	-342,739	178,812	86,768
Receivables related to budget	300	0	5,133	4,575
Receivables from staff	320	29,104	34,491	35,917
Other short-term receivables	340	25,611	66,075	457
Short-term receivables	350	3,193,677	4,130,001	4,745,741
Cash				
Settlement Account	400	8	2	1
Cash	410	664,778	1,289,329	1,066,500
Cash and equivalents	440	664,786	1,289,331	4,066,501
Other current assets	450	3,342	2,606	4,972
Total Current Assets	460	5,504,546	6,427,010	6,778,288
TOTAL - ASSETS	**470**	**37,836,987**	**40,460,010**	**39,190,036**
LIABILITIES AND OWN EQUITY				
EQUITY				
Share capital and capital surplus				
Share capital	480	25,167,813	25,167,813	25,167,813
Share capital and capital surplus	520	25,167,813	25,167,813	25,167,813
Correction of previous periods' results	570	0	104,847	103,734
Retained profit (uncovered loss) of previous years	580	-8,833,337	-10,176,399	-12,744,583
Net income (loss) of the reporting period	590	-1,343,062	-2,673,031	-6,400,473
Retained earnings (uncovered loss)	610	-10,176,399	-12,744,583	-19,041,322
Subsidies	630	526,488	451,909	390,284
Non capital assets	640	526,488	451,909	390,284
Total Equity	650	15,517,902	12,875,139	6,516,775
LONG-TERM LIABILITIES				
Long term loans	670	20,647,958	25,698,566	30,866,534
Total Long Term Liabilities	770	20,647,958	25,698,566	30,866,534
SHORT-TERM LIABILITIES				
Other short-term financial liabilities	810	36,395	51,212	55,784
Short-term accounts payables				
Commercial account payables	830	362,732	433,219	303,382
Short-term accounts payables	860	362,732	433,219	303,382
Wages owed	870	505,803	574,147	598,761

Balance Sheet	Row Code	2012 (MDL)	2013 (MDL)	2014 (MDL)
Other employee liabilities	880	13,667	11,047	21,218
Insurance	890	144,457	145,571	223,290
Insurance	900	227,127	216,558	161,719
Value Added Tax and excises to be paid	910	16,977	19,880	20,810
Reserves	940	363,969	434,671	421,763
Short-term accrues liabilities	960	1,272,000	1,401,874	1,447,561
Total Short Term Liabilities	970	1,671,127	1,886,305	1,806,727
TOTAL – EQUITY and LIABILITIES	**980**	**37,836,987**	**40,460,010**	**39,190,036**

Source: ME 'Apa-Canal' Ungheni

The following conclusions results from the Balance Sheet analysis:

- The largest assets category is long-term assets, which constituted 82.7% of the total in 2014. It should be mentioned that the operator's assets increased from MDL 37.8 million in 2012 to MDL 39.2 million in 2014;
- Liabilities show that the operator is financed mainly from permanent capital where an increase in long-term loans that were offered to rehabilitate the water and wastewater systems;
- The share of short-term debts in 2014 is 4.6% from the total liabilities. The operator honours its current and long-term liabilities in due time.

6.2.1.2 Analysis of the Profit and Losses Statement

The Profit and Losses Statement for the period 2012-2014 is shown in the following Table 6-13.

Table 6-13: Profit and Losses Statement of ME 'Apa-Canal' Ungheni

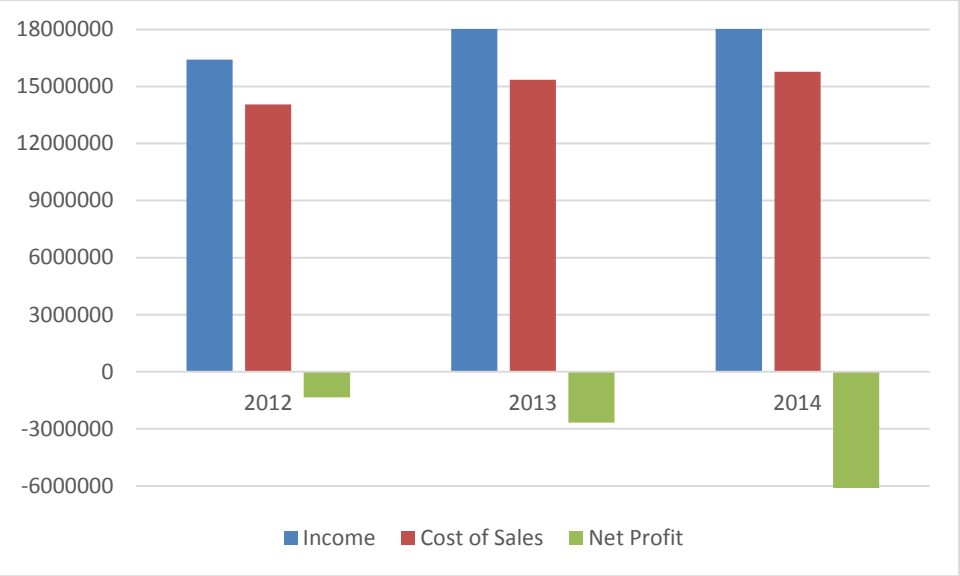
Income Statement	Row Code	2012 (MDL)	2013 (MDL)	2014 (MDL)
Income from sales	010	16,418,005	18,439,783	18,265,189
Cost of sales	020	14,049,647	15,345,950	15,771,565
Gross profit (gross loss)	030	2,368,358	3,093,833	2,493,624
Other operating income	040	1,950,487	1,880,074	1,490,302
Commercial expenses	050	0	0	0
General and administrative expenses	060	3,349,199	3,865,568	3,507,619
Other operating expenses	070	2,007,019	2,084,671	1,954,318
Result from operating activities: profit (loss)	080	-1,037,373	-976,332	-1,478,011
Result from investing activities: profit (loss)	090	-39,010	3,523	15,714
Result from financial activities: profit (loss)	100	-262,104	-1,700,222	-4,938,176
Result from financial and economic activities: profit (loss)	110	-1,338,487	-2,673,031	-6,400,473
Extraordinary result: profit (loss)	120			
Profit (loss) before tax	130	-1,338,487	-2,673,031	-6,400,473
Income tax	140	-4,575		
Net profit (net loss)	150	-1,343,062	-2,673,031	-6,400,473

Source: ME 'Apa-Canal' Ungheni

The operator has losses from operating activities in 2012-2014, which had a negative effect in the accumulation of reserves.

The evolution of the operator's income, cost of sales and net profit for the period of 2012-2014 is presented in the Figure 6-1.

Figure 6-1: Operator's income cost of sales and net profit (MDL)



Source: GIZ/MLPS

6.2.1.3 Cash flow analysis

The Cash Flow Statement for the period 2012-2014 is shown in Table 6-14.

Table 6-14: Cash Flow Statement of ME 'Apa-Canal' Ungheni

Cash Flow Statement	Row Code	2012 (MDL)	2013 (MDL)	2014 (MDL)
Operating activities				
Cash inflows from sales	010	18,086,301	20,501,620	20,183,182
Cash paid to suppliers and contractors	020	8,070,078	8,341,363	7,218,942
Cash payments to employees and social security contributions	030	8,326,667	9,359,505	10,057,268
Interest payments	040	216,391	334,448	422,197
Income tax payments	050			
Other cash receipts	060	727,370	649,459	356,692
Other cash payments	070	2,195,537	2,110,037	2,237,695
Net cash flow from operating activities	080	4,998	1,005,726	603,772
Investing activities				
Cash payments to acquire long-term assets	100		381,181	826,602
Net cash flow from investing activities	140		-381,181	-826,602
Financing activities				
Other cash receipts (payments)	200	70,000		
Net cash flow from financial activity	210	70,000		
Net cash flow before extraordinary items	220	74,998	624,545	-222,830
Cash proceeds (payments) from extraordinary items	230			
Net cash flow	240	74,998	624,545	-222,830
Positive (negative) foreign exchange differences	250			

Cash Flow Statement	Row Code	2012 (MDL)	2013 (MDL)	2014 (MDL)
Cash balance at the beginning of the year	260	589,788	664,786	1,289,331
Cash balance at the end of the reporting period	270	664,786	1,289,331	1,066,501

Source: ME 'Apa-Canal' Ungheni

6.2.1.4 Financial Indicators

A series of indicators derived from the financial statements were calculated based on the data collected (see Table 6-15).

Table 6-15: Financial Indicators

N°	Financial Indicators	2012	2013	2014	Indicators limits
1	Current Liquidity Ratio	3.29	3.41	3.75	1.0 – 2.0
2	ROE, %	-8.7	-20.8	-98.2	
3	ROA, %	-3.5	-6.6	-16.3	
4	Operating Profitability, %	-6.3	-5.3	-8.1	> 0
5	Debts Service Converge Ratio	0.41	0.32	0.16	<1.2
6	Financial Ratio	0.59	0.68	0.84	
7	Accounts Receivable Turnover, days	83	72	88	< 30
8	Accounts Payable Turnover, days	9	10	9	< 30

Source: GIZ/MLPS

- The profitability indicators (2, 3, 4) have oscillating values, but are generally negative for 2012-2014. This means that operator covers its current costs partially;
- Debt ratio indicators (5,6) show an increasing weight of debt;
- Liquidity indicator (1) shows a constant capacity of paying in the short-term period;
- The collection of receivables shows an increase in the collection period from 83 days in 2012 to 88 days in 2014. The accounts payable period did not change.

6.2.1.5 Revenue analysis

The revenues from the provision of water and wastewater services are presented in Table 6-16.

Table 6-16: Revenues from water supply/wastewater services, ME 'AC' Ungheni, 2014

Consumers	Revenues		Volumes	
	(MDL)	(%)	(m^3)	(%)
WATER SUPPLY	11,260,688	100.0	1,238,493	100.0
Population	5,472,244	48.6	937,036	75.7
Budgetary Consumers	1,461,154	13.0	105,119	8.5
Private Entities	4,327,290	38.4	196,338	15.9
WASTEWATER SERVICES	7,004,500	100.0	823,791	100.0
Population	3,155,681	45.1	565,532	68.6
Budgetary Consumers	1,335,783	19.1	103,229	12.5
Private Entities	2,513,036	35.9	155,030	18.8

Source: ME 'Apa-Canal' Ungheni

The operator differentiates tariffs by customer groups and tariffs are approved by the Local Council (see Table 6-17).The tariffs are indicated without VAT.

Table 6-17: Evolution of tariffs, 2013-2015

Tariffs for consumers	2013 (MDL / 1m^3)	2014 (MDL / 1m^3)	2015 (MDL / 1m^3)
Budgetary Consumers	23.00	26.84	26.84
• Water supply	11.00	13.90	13.90
• Wastewater services	12.00	12.94	12.94
Private Entities	32.98	38.25	38.25
• Water supply	19.00	22.00	22.00
• Wastewater services	13.98	16.21	16.21
Population	9.88	11.42	11.42
• Water supply	5.00	5.84	5.84
• Wastewater services	4.88	5.58	5.58
Weighted average		23.91	
• Water supply		13.11	
• Wastewater services		10.80	

Source: ME 'Apa-Canal' Ungheni

In the period of 2014 - 2015, the tariffs for WSS services did not change. This fact demonstrates that the operator's activity is not based on the principle of cost recovery. Also, in accordance with the operator's data the weighted average tariffs were calculated.

6.2.1.6 Detailed cost structure

The operator's detailed cost structure for water and wastewater services is shown in Table 6-18. It can be noticed that the majority of the costs are for salaries and electricity.

Table 6-18: Detailed cost structure for 2014 of ME 'Apa-Canal' Ungheni

Cost category	Amount (MDL)	Percentage (%)
WATER SUPPLY	10,925,005	100.0
Electricity (for pumping)	2,131,635	19.5
• For pumping	2,111,639	-
• For water treatment	3,533	-
• For office, heating and other purposes	16,463	-
Chemicals for water treatment	928,477	8.5
Fuel for transport for water supply	34,353	0.3
Salaries of employees working at water supply	3,356,078	30.7
• Number of employees (pers.)	76	-
• Average monthly salary per employee	3,680	-
Social benefits (pension fund/insurance)	901,259	8.2
Depreciation	1,186,441	10.9
Maintenance costs for water supply	793,033	7.3
External services for water supply	132,340	1.2
Tax for water capturing	278,342	2.5
Other costs	553,047	5.1
WASTEWATER SERVICES	5,528,139	100.0
Electricity (for wastewater treatment)	541,751	9.8
• For pumping	456,208	-
• For wastewater treatment	69,080	-
• For office, other purposes	16,463	-

Cost category	Amount (MDL)	Percentage (%)
Chemicals for wastewater treatment	6,742	0.1
Fuel for transport for wastewater services	38,806	0.7
Salaries of employees working in wastewater services	2,707,766	49.0
• Number of employees (pers.)	49	-
• Average monthly salary per employee	4,605	-
Social benefits (pension fund/insurance)	726,206	13.1
Depreciation	732,303	13.2
Maintenance costs for wastewater services	588,722	10.7
External services for wastewater services	127,854	2.3
Fees paid for wastewater services	15,708	0.3
Other costs	42,281	0.8
OTHER SERVICES	1,272,739	100.0
Electricity	21,032	1.7
Salaries of employees working at other services	935,045	73.5
• Number of employees (pers.)	17	-
• Average monthly salary per employee	4,584	-
Social benefits (pension fund/insurance)	249,820	19.6
Maintenance costs for other services	58,856	4.6
External services for other services	7,986	0.6
ADMINISTRATION AND OVERHEAD	3,507,619	100.0
Salaries of employees working in administration	1,138,117	32.4
• Number of employees (pers.)	16	-
• Average monthly salary per employee	5,579	-
Social benefits (pension fund/insurance)	308,952	8.8
Maintenance costs for administration	76,559	2.2
Fuel for transport for administration	29,034	0.8
Other travel services	6,033	0.2
Insurance costs	29,079	0.8
External services	233,143	6.6
Other overhead costs	1,259,902	35.9
Financial costs	426,800	12.2

Source: ME 'Apa-Canal' Ungheni

6.2.1.7 Investments

The operator obtained co-financing for external sources for investments and capacity development as follows (see Table 6-19).

Table 6-19: Investments

Investments	Source	Period	Amount (MDL)
Total			24,000,000
Rehabilitation of the Water Treatment Plant, procure-ment of the equipment, procurement of the laboratory equipment	World Bank	2009-2013	24,000,000

Source: ME 'Apa-Canal' Ungheni

6.2.2 Information on existing loans (if any)

The operator benefits of the long-term loan in 2014 in the amount of USD 1.977 million. The interest rate for the loan is 1.5% per year with a 6 years of grace period and the loan should be repaid till 2039.

6.2.3 Creditworthiness capacity of the operator

Capacity to repay a loan is the most important criterion used to assess the operator's creditworthiness. The loan repayment shall be less than the net profit and depreciation if there are no investment and financial activities. Unfortunately, the operator uses cash surpluses generated from depreciation to decrease working capital. In conclusion, the operator presently has no creditworthiness capacity.

6.3 Financial analysis

6.3.1 Investment costs

The total investment outlays amount to MDL 77.94 million (EUR 3.75 million). The outlays include:

- Rehabilitation of the water distribution network in the town of Ungheni – 12.2 km;
- Extension of the water distribution network in the town of Ungheni – 5.4 km;
- Extension of the sewerage network in the town of Ungheni – 5.6 km;
- Equipment and tools;
- Detailed design and procurement;
- Technical assistance, supervision and capacity development;
- Contingencies.

The presented construction costs were prepared using conceptual design estimates. Using the information obtained, the costs were estimated based on expert experience from many years of design works, tenders and investment supervision in water management. Also, in preparation of investment plan was taking into consideration the priority objectives regarding the development of water supply system and wastewater system established by Local Public Administration and WSS operator. In the calculations, the experts took into account the different investment conditions. The costs are inclusive of VAT.

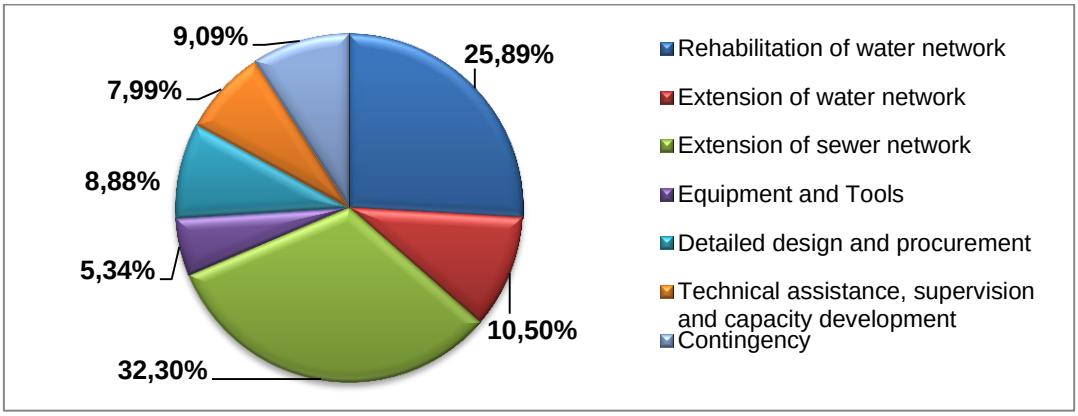
Table 6-20: Summary of the investment costs (MDL mil.)

Project investment outlays	Amount (MDL mil.)	Percentage (%)
Rehabilitation of water network	20.18	25.89
Extension of water network	8.19	10.50
Extension of sewerage network	25.18	32.30
Equipment and Tools	4.16	5.34
Detailed design and procurement	6.92	8.88
Technical assistance, supervision and capacity development	6.23	7.99
Contingency	7.09	9.09
Total	**77.94**	**100.00**

Source: GIZ/MLPS

The main part of investment costs about 36.4% will be for the rehabilitation and extension of water distribution network of the town Ungheni. Another 32.3% will be for the rehabilitation of wastewater network of the town Ungheni. Capacity development and technical assistance will be around 17% of the total investment cost. Also, in the project are provided various and unforeseen expenditures in the amount of 9% of investment costs.

Figure 6-2: Structure of the project investment costs



Source: GIZ/MLPS

6.3.2 Financing of the project and assessing the need for additional funding

6.3.2.1 Additional sources of income

There are two additional sources of project financing: 'local contribution' and tariffs. Local contributions – co-financing of capital investment projects by citizens – are widely used in Moldova. The possible local contributions were proposed based on the experience in Moldova in implementing other investment projects. Accordingly, the estimated contribution of citizens is MDL 1,000 MDL per household connected to the system[57].

These funds will be spent on the local wastewater network, thus households already connected to the local wastewater system will not contribute because usually they already had been contributing to the construction of the network. Thus only households not connected to sanitation system were taken into account.

It is estimated that 235 households will be connected to the water supply system and 310 households will be connected to the wastewater system in the first year of the project realisation. The estimation of the citizens contribution is amounted to MDL 0.55 million.

Tariffs could be a source of financing of the WSS capital project, in particular to help repay existing and future loans. On the other hand, if the development of water and wastewater systems will be realised through loans, than the tariffs calculated, will exceed the affordable constrains. In addition, currently ME 'Apa-Canal' Ungheni has no creditworthiness capacity. Therefore, for this project the tariff will not be used to contribute to project financing.

As indicated when calculating the financial gap (see Chapter 6.3.7 'Financial performance of the project - NPV and IRR calculation'), project is not profitable (FNPV(K)~=0) when own contribution achieve MDL 27.11 million. This means that apart from citizen contributions of MDL 0.55 million, the additional MDL 26.56 million needs to be provided from other sources.

[57] This is not the total household spending capacity, as the connection to the water supply system also has to be financed.

6.3.2.2 Financial plan

The total investment outlays will be financed by:

- Domestic and international donors;
- Citizens providing local contribution;
- National sources (national development funds. local and central budgets. water operator).

The following methods for assessing the amount to be financed from each source of financing were used:

Table 6-21: Methods used for assessing the amount to be financed from each source of financing

Source of financing	Method used to estimate share in project financing
Citizens providing local contribution	The practice of 'local contribution' – co-financing of capital investment projects, including water supply, by citizens – is widely used in Moldova. The estimate was based on experience from other projects in Moldova. The estimated contribution of citizens is MDL 1,000 per household which will be connected to the wastewater system.
Domestic and international donors	The assumption is that remaining part of the investment costs will be financed by donors. Donors may not spend more than the estimated 'financing gap'[58]. The calculation of the required donor contribution takes into account that the project should not lead to financial losses for residents and communes. The social discount rate of 5% is used to determine the financial net present value (FNPV(K)) of the project. The donor contribution is then determined at the level at which FNPV(K) is equal to zero.
Water utility	The water utility may co-finance the project from tariffs. As the level of tariff is above affordability level, it means that currently the water utility will have no capacity to co-finance the project from tariffs. Also, currently 'Apa-Canal' Ungheni has no creditworthiness capacity.

Source: GIZ/MLPS

The following table presents the investment outlays and their financing:

Table 6-22: Summary of the financing sources (MDL mil.)

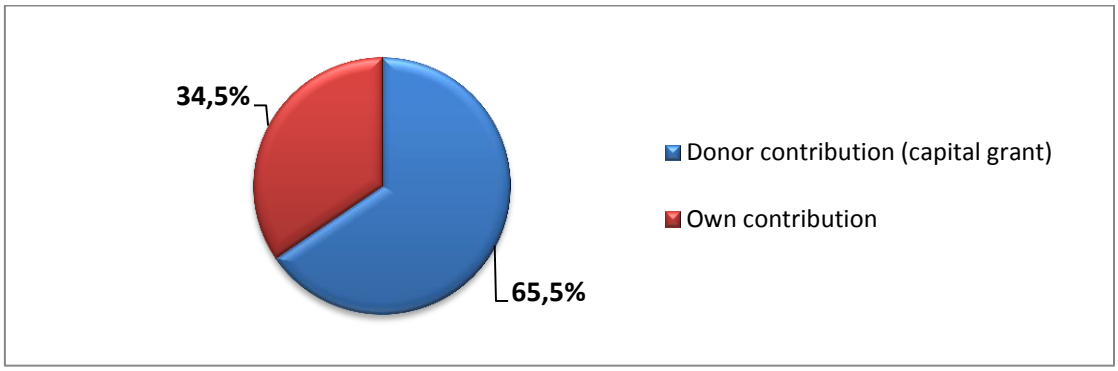
Project financing sources	Amount (MDL mil.)	Percentage (%)
Citizens providing local contribution	0.55	0.70
Domestic and International donors	51.05	65.50
Other domestic sources	26.34	33.80
Water utility	0.00	0.00
Total	**77.94**	**100.00**

Source: GIZ/MLPS

The donor contribution was estimated as 65.5% of the total investment costs, while the local sources' contribution is 34.5%.

[58] This is not an EU financing gap calculation, however, it is based on a similar assump-tions.

Figure 6-3: Structure of project financing (%)



Source: GIZ/MLPS

The project will be implemented during the period of three years and the implementation schedule is as indicated in the following table. For the first year, it is assumed that the project will be implemented in 10%, for the second year is foreseen 50% and for the third year 40%.

Table 6-23: Summary of the investment implementation schedule (MDL mil.)

Project investment outlays	2015 (MDL mil.)	2016 (MDL mil.)	2017 (MDL mil.)	Total (MDL mil.)
	10%	50%	40%	
Rehabilitation of water network	2.02	10.09	8.07	20.18
Extension of water network	0.82	4.09	3.27	8.19
Extension of sewerage network	2.52	12.59	10.07	25.18
Equipment and Tools	0.42	2.08	1.66	4.16
Detailed design and procurement	0.69	3.46	2.77	6.92
Technical assistance, supervision and capacity development	0.62	3.12	2.49	6.23
Contingency	0.71	3.54	2.83	7.09
Total	**7.79**	**38.97**	**31.18**	**77.94**

Source: GIZ/MLPS

6.3.3 Forecast of operating costs

A detailed cost structure of ME 'Apa-Canal' Ungheni for the year 2014 was presented in section 6.6.2.1.6 (Detailed cost structure). The cost structure was used as a basis for the expenditure forecast with and without the project.

The following assumptions were used for the expenditure forecast:

- **Direct costs for labour – salaries and benefits**. In the project the labour cost is calculated based on forecasted enterprise staff number (Description of enterprise staff is provided in Subchapter 7.6 'Corporate development of the operator'). For both options (BAU and with project) it have been used an average real growth rate equal to the wages increase forecast. Three scenarios of wages increase were prepared (see Chapter 6.1.2 'Wages forecast'), but for the financial forecast the base case scenario is presented;

- **Direct costs (chemicals for treatment and water abstraction fee)**. Currently, the costs are estimated at 0.61 MDL/m^3 of water treated. No real increase is forecasted;
- **Direct costs (electricity)**. The following assumptions were used for unit consumption:
  - **For pumping stations (PS1 and PS2)**. The electricity consumption for the pumping station SP1 is estimated to be 0.1383 kWh/m^3 and for pumping station PS2 is estimated to be 0.352 kWh/m^3;
  - **For water treatment plant**. The electricity consumption of water treatment plant is estimated to be 0.1895 kWh/m^3;
  - **For wastewater treatment plant**. The electricity consumption for the treatment plant is estimated to be 0.0356 kWh/m^3;
  - **For wastewater pumping station**. The electricity consumption for the wastewater pumping station is estimated to be 0.2350 kWh/m^3.

Electricity costs are estimated taking into account the electricity prices and the electricity consumption. Price of energy[59] for the reference period is adjusted by forecast of real changes of electricity prices. Electricity consumption is calculated resulting from electricity consumption based on unit of water/wastewater (1 m^3 of water/wastewater) multiplied by total volume of water/wastewater production:

- **General administration costs**. General administration costs are currently MDL 3.5 million annually. For the expenditure forecast, due to limited expansion of the service area, it is assumed that the costs will increase with the GDP growth rate forecasted for both scenarios (BAU and with project). The GDP growth forecast is presented in the macroeconomic forecasts, where was developed three scenarios of GDP growth (base case, optimistic and pessimistic). The base case scenario was used in the financial forecast;
- **Depreciation**. Currently, the depreciation is at level of MDL 2.55 million annually. However, depreciation costs will increase to about MDL 4.59 million annually, after the investments in new assets have been implemented, beginning with the year 2018.

The depreciation costs are taken into account for project sustainability analysis, and are taken into account in the tariff policy discussion.

Details on depreciation forecast are presented in Annex 6, Tables 4a-9b, which also include calculation of net assets that is further used for the balance sheet forecast.

The operational costs forecasts are presented in the following table.

Table 6-24: Summary of the operational costs projections (MDL mil.)

Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Variable costs water	MDL mil.	1.81	3.35	4.16	4.22	4.29	4.34	5.38	7.99	11.25
Electricity for pumping	MDL mil.	1.53	2.13	2.94	2.99	3.04	3.09	3.95	6.34	9.55
Water treatment	MDL	0.28	1.22	1.22	1.23	1.24	1.25	1.43	1.65	1.70

[59] It has to be noted that current electricity price for all pumping station is 1.57 MDL/kWh.

Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
costs	mil.									
Fixed costs water	MDL mil.	9.77	9.77	10.11	11.35	14.58	14.91	16.94	21.55	27.00
Salaries and related costs	MDL mil.	4.26	4.26	4.39	4.59	4.97	5.17	6.45	9.54	12.95
Maintenance - old assets	MDL mil.	0.00	0.00	0.00	0.00	2.00	2.04	2.25	2.75	3.20
Maintenance - new assets	MDL mil.	0.00	0.00	0.05	0.28	0.47	0.47	0.47	0.47	0.47
Fuel	MDL mil.	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Depreciation of fixed assets	MDL mil.	1.82	1.82	1.96	2.67	3.23	3.23	3.23	2.82	2.82
General and administrative expenditures	MDL mil.	2.16	2.16	2.19	2.28	2.37	2.47	3.00	4.45	6.03
Other costs	MDL mil.	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49
Total costs for water	MDL M	11.57	13.11	14.28	15.57	18.86	19.26	22.31	29.54	38.25
Wastewater service	**Unit**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2024**	**2034**	**2044**
Variable costs wastewater	MDL mil.	0.56	0.55	0.74	0.75	0.78	0.77	1.17	2.01	3.31
Electricity for pumping	MDL mil.	0.54	0.52	0.72	0.72	0.76	0.75	1.14	1.97	3.26
Wastewater treatment costs	MDL mil.	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.04	0.04
Fixed costs water	MDL mil.	6.33	6.33	6.54	7.22	8.57	8.80	11.20	15.24	19.67
Salaries and related costs	MDL mil.	3.43	3.43	3.54	3.70	4.12	4.28	6.29	9.32	12.64
Maintenance - old assets	MDL mil.	0.00	0.00	0.00	0.00	0.50	0.51	0.56	0.69	0.80
Maintenance - new assets	MDL mil.	0.00	0.00	0.03	0.19	0.31	0.31	0.31	0.31	0.31
Fuel	MDL mil.	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Depreciation of fixed assets	MDL mil.	0.73	0.73	0.79	1.10	1.35	1.35	1.35	1.35	1.35
General and administrative expenditures	MDL mil.	1.35	1.35	1.37	1.42	1.48	1.54	1.87	2.77	3.75
Other costs	MDL mil.	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Total costs for wastewater	MDL mil.	6.89	6.87	7.28	7.97	9.35	9.57	12.37	17.25	22.98
TOTAL COSTS	**MDL mil.**	**18.46**	**19.98**	**21.56**	**23.54**	**28.22**	**28.83**	**34.68**	**46.79**	**61.23**

Source: GIZ/MLPS

The summary of the variable costs forecast are provided in Annex 6, Table 10. The fixed costs are presented in Annex 6, Table 11 and total (fixed and variable) in Table 12.

6.3.4 Revenue forecast (including the calculation of tariffs)

6.3.4.1 Forecast of the tariff

To estimate revenues for the water supply service in the future, the average tariff for the service is calculated. This is done by taking into account:

- Operating and maintenance cost of the system, including: direct costs of labour, electricity costs, chemicals, fuel, maintenance costs, financial and administrative costs;
- Application of polluter-pays principle and full cost recovery tariff (including depreciation) in the long run;
- Need to generate positive cumulative cash flow of the operator to maintain sustainable operations. This requires that the tariff calculation includes reserves for irregular receivables.

The Table 13 in the Annex 6 contains a calculation of the tariff with and without depreciation. The proposed tariff takes into account the full cost recovery principle and affordability. The full cost recovery principle means that the operational costs and capital costs should be covered by the tariff. If the tariff with depreciation exceeds the assumed affordability limit, a lower tariff needs to be proposed, albeit one that fully covers operating costs.

Based on the foregoing the future tariff is proposed as illustrated in the following table.

Table 6-25: Tariff calculation for the option 'with project' (MDL mil.)

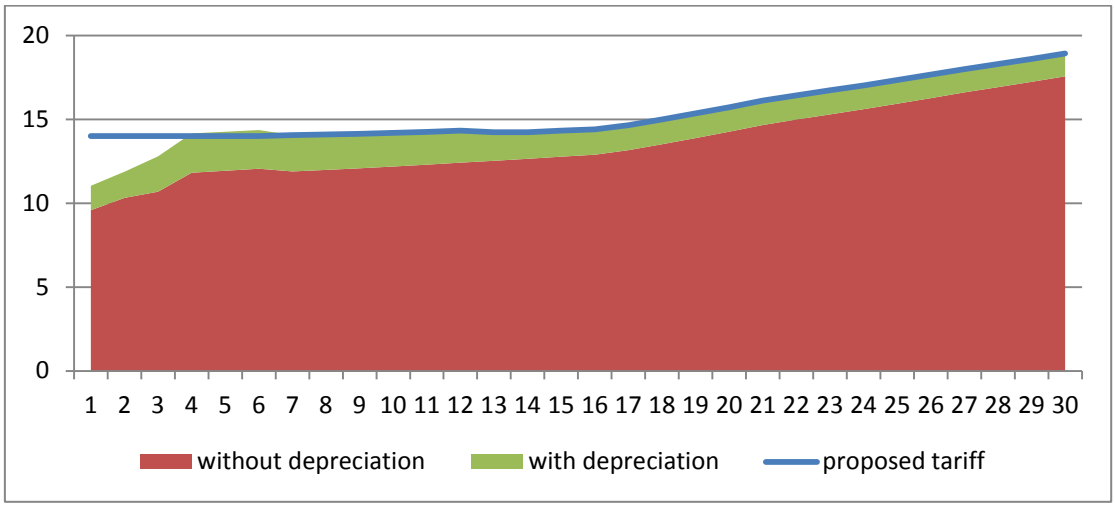
Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Variable and fixed costs	MDL mil.	11.27	11.30	12.32	12.90	15.63	16.02	19.08	26.72	35.43
Depreciation	MDL mil.	1.82	1.82	1.96	2.67	3.23	3.23	3.23	2.82	2.82
Interest and financial costs	MDL mil.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reserve for irregular receivables	MDL mil.	0.00	0.66	0.64	0.62	0.66	0.58	0.56	0.74	0.96
Sale of water	ths m^3	1,238	1,248	1,257	1,266	1,379	1,391	1,612	1,926	2,072
Tariff without depreciation	MDL/m^3	9.10	9.58	10.31	10.68	11.81	11.93	12.18	14.26	17.56
Tariff with depreciation	MDL/m^3	10.57	11.04	11.87	12.79	14.16	14.26	14.19	15.72	18.92
Proposed average tariff	MDL/m^3	9.09	14.00	14.00	14.00	14.00	14.00	14.19	15.72	18.92
Wastewater service	**Unit**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2024**	**2034**	**2044**
Variable and fixed costs	MDL mil.	6.14	6.14	6.49	6.87	8.00	8.22	11.02	15.90	21.63
Depreciation	MDL mil.	0.73	0.73	0.79	1.10	1.35	1.35	1.35	1.35	1.35
Interest and financial costs	MDL mil.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reserve for irregular receivables	MDL mil.	0.00	0.34	0.33	0.32	0.33	0.29	0.31	0.43	0.57
Sale of wastewater	ths m^3	824	830	836	842	884	890	1,306	1,628	1,843
Tariff without depreciation	MDL/m^3	7.45	7.81	8.15	8.53	9.42	9.56	8.67	10.03	12.05
Tariff with de-	MDL/m^3	8.34	8.70	9.10	9.85	10.95	11.08	9.71	10.86	12.78

Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
preciation										
Proposed average tariff	MDL/m^3	8.50	9.00	9.00	9.00	9.00	9.00	9.71	10.86	12.78

Source: GIZ/MLPS

The following Figure 6-4 illustrates the evolution of the proposed tariffs. During the construction period when the capital costs will increase significantly and water sales are limited approximately to the same level, it is proposed that tariff does not contain depreciation costs. This would stimulate the water consumption and will keep the tariffs below affordability constraints. After the project is completed, the water consumption will increase because of new consumers connecting to the system; when possible, the tariff should include depreciation. The estimation shows that full cost recovery tariff can be applied starting with year 7 of the forecast for water supply service and in year 10 for wastewater system.

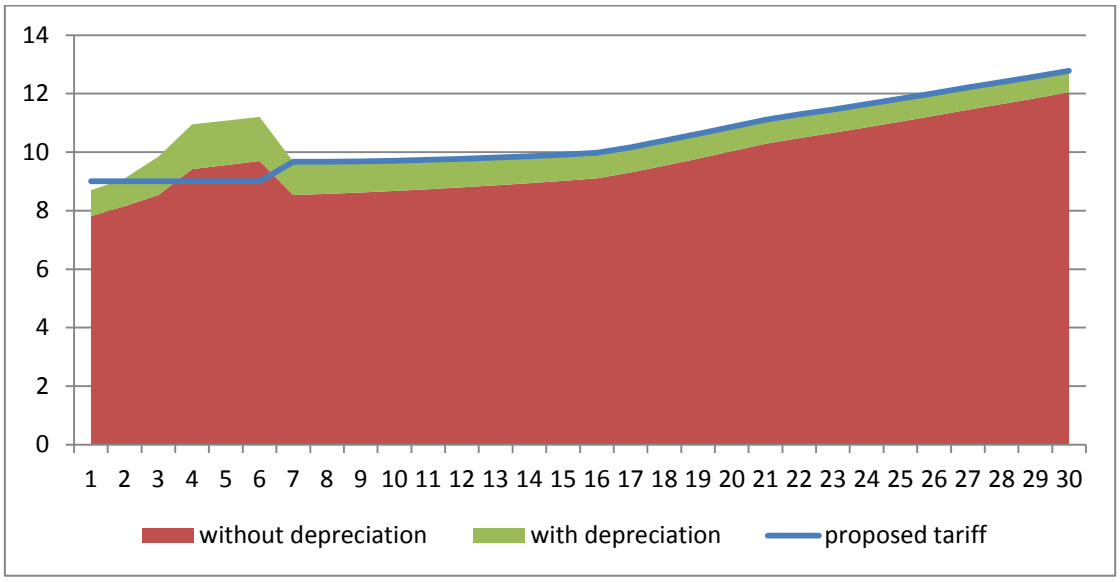
Figure 6-4: Forecast of the tariff for water (MDL/m^3)



Source: GIZ/MLPS

The tariff of water is forecasted to be about MDL 15.40 per m^3 on average for the entire forecast period. The financial projections, however, do not take into account the effect of inflation. As a result, the real decrease or increase of tariffs will depend of the development of costs and their variation.

Figure 6-5: Forecast of the tariff for wastewater (MDL/m^3)



Source: GIZ/MLPS

The tariff for wastewater is forecasted to be about MDL 10.40 per m^3 on average for the whole projected period. Also, the financial projections do not consider the effect of inflation, but the real decrease or increase of tariff will depend on how costs develop and fluctuate.

6.3.4.2 Tariff affordability

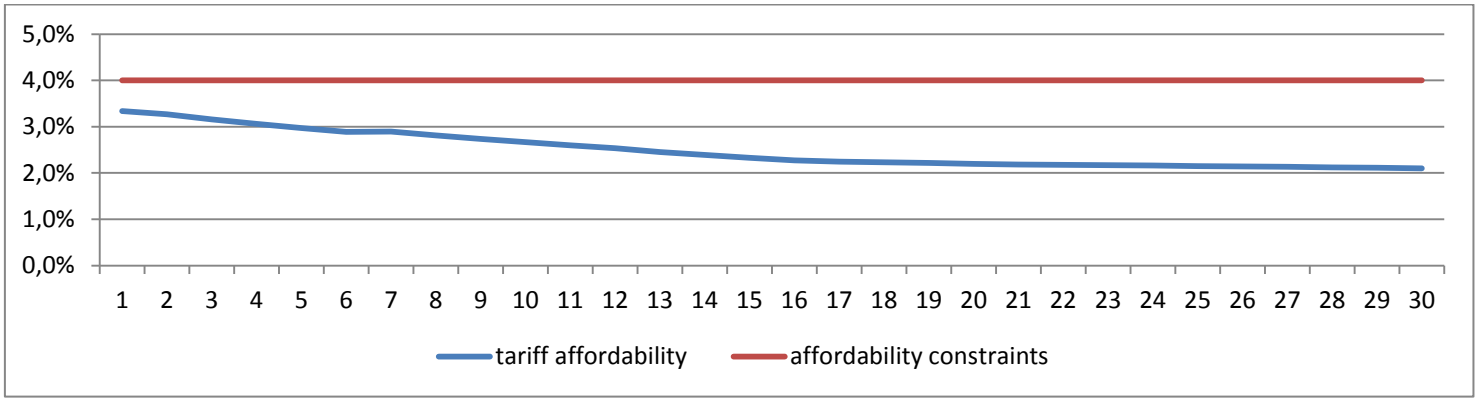
The affordability of tariffs, expressed as the ability of households to pay for services, is estimated as the household expenditures on water and wastewater services expressed as a percentage of disposable household income. For Eastern Europe countries, a common benchmark figure for the affordability threshold for water and wastewater services is 4%. As discussed, the tariff should cover at least operating and maintenance costs and should not exceed a level covering these costs together with capital costs (depreciation). In the event the calculated tariff is higher than the affordable tariff, a subsidy to the price from the LPA should be proposed. Tariff affordability, based on household bills for WSS services as a percentage of disposable household income, is presented in Table 14 in Annex 6.

During the entire period of the financial projections, the average tariff will constitute about 2.5% of average disposable household income, which means that it is within the limits of the affordability threshold of 4%.

For the first years of the project implementation, it is proposed that tariff does not contain the capital cost component (depreciation). Otherwise, the proposed tariff would be too high and the affordability constraint would lead to a further decrease of water consumption. The average bill in these years does not exceed 4% of average disposable household income.

The proposed bill for water as a percentage of disposable household income is presented by Figure 6-6.

Figure 6-6: Proposed tariff and tariff affordability (MDL/m^3)



Source: GIZ/MLPS

6.3.4.3 Revenue forecast

The calculation of revenues was based on the demand analysis taking into account water demand and the proposed tariff for water and wastewater services. The revenues forecast for each service is presented in the Table 6-26.

Table 6-26: Revenues forecast for the option 'with project' (MDL mil.)

Water supply service	**Unit**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2024**	**2034**	**2044**
Sale of water	ths m^3	1,238.5	1,247.6	1,256.7	1,265.8	1,378.8	1,391.3	1,612.0	1,926.0	2,072.3
The weighted average tariff for water	MDL/ m^3	9.09	14.00	14.00	14.00	14.00	14.00	14.19	15.72	18.92
Revenues from water service	MDL mil.	11.26	17.47	17.59	17.72	19.30	19.48	22.87	30.28	39.21
Wastewater service	**Unit**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2024**	**2034**	**2044**
Sale of wastewater	ths m^3	823.8	829.8	835.9	841.9	884.1	890.4	1,305.8	1,628.2	1,842.8
The weighted average tariff for wastewater	MDL/ m^3	8.50	9.00	9.00	9.00	9.00	9.00	9.71	10.86	12.78
Revenues from wastewater service	MDL mil.	7.00	7.47	7.52	7.58	7.96	8.01	12.68	17.68	23.55
Total Revenues	**MDL mil.**	**18.27**	**24.93**	**25.12**	**25.30**	**27.26**	**27.49**	**35.55**	**47.96**	**62.76**

Source: GIZ/MLPS

The water demand will increase from 1.24 million m^3 per year to 2.07 million m^3 per year at the end of projection period. This increase is determined by the growth of water consumption per capita from 82.7 l/c/d to 110 l/c/d in 2045 and the increase of consumers by 13,476.

The wastewater inflow is calculating based on the wastewater generation per capita and the number of consumers. It is assumed that the number of consumers will grow from actual number of 20,433 to 42,774 persons and the wastewater generation will increase from the current 75.8 l/c/d up to 110 l/c/d in 2045.

The tariff for water services will increase slowly from 9.00 MDL/m^3 to approximately 19.00 MDL/m^3 at the end of projection period.

For the wastewater services the tariff is estimated to growth slowly from 8.50 MDL/m^3 to approximately 12.80 MDL/m^3 in 2045.

6.3.5 Income statement and Balance sheet forecast

6.3.5.1 Income statement

The profit and loss (income) statement illustrates the financial performance of the operator in each year of the reference period. It should be noted, however, that financial statements are more relevant instruments to assess the financial situation of business entities/commercial companies. The negative values of net profit are acceptable and do not mean that the operator will face cash flow problems during the implementation phase. In the long-term, however, financial losses mean that the revenue from tariffs do not cover O&M and capital costs.

The financial results from the provision of water supply services will be positive for entire period of reference. The average annual profit is expected to be about MDL 0.92 million. For the wastewater services, the financial results will be positive, with exception of period 2018-2020 when the financial results will be negative. Beginning with 2021 the average annual profit for the wastewater service will be about MDL 0.42 million. The cumulated net profit for the projected period will be positive with a value of MDL 28.94 million.

The calculation of net profit for each service in the 'with project' option is presented in Table 6-27.

Table 6-27: Net profit forecast for the 'with project' scenario (MDL mil.)

Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Sale of water	MDL mil.	11.26	17.47	17.59	17.72	19.30	19.48	22.87	30.28	39.21
Costs of water services	MDL mil.	13.09	13.11	14.28	15.57	18.86	19.26	22.31	29.54	38.25
Gross profit from water services	MDL mil.	-1.83	4.35	3.32	2.15	0.44	0.22	0.56	0.74	0.96
Wastewater service	**Unit**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2024**	**2034**	**2044**
Sale of wastewater	MDL mil.	7.00	7.47	7.52	7.58	7.96	8.01	12.68	17.68	23.55
Costs of wastewater services	MDL mil.	6.87	6.87	7.28	7.97	9.35	9.57	12.37	17.25	22.98
Gross profit from wastewater services	MDL mil.	0.13	0.60	0.24	-0.39	-1.40	-1.56	0.31	0.43	0.57
Total gross profit	MDL	-1.70	4.95	3.56	1.76	-0.96	-1.34	0.87	1.17	1.53

Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
	mil.									
Income tax	MDL mil.	0.00	0.59	0.43	0.21	0.00	0.00	0.10	0.14	0.18
Net profit	MDL mil.	-1.70	4.36	3.13	1.55	-0.96	-1.34	0.76	1.03	1.35
Cumulated net profit	MDL mil.		4.36	7.49	9.04	8.08	6.74	7.92	16.91	28.94

Source: GIZ/MLPS

The forecast of income statement for ‘with project’ and BAU scenarios, is presented in Annex 6, Tables 15 and 16.

6.3.5.2 Balance sheet

The balance sheet illustrates the 'net worth' of the company. It reveals the company's assets, liabilities and owner's equity at certain point of time (e.g. end of the year). The balance sheet forecast is presented in Annex 6, Tables 19, 20 for with project and BAU scenario.

6.3.6 Cash flow and financial indicators forecast

6.3.6.1 Working capital

The working capital sheet illustrates the current assets and current liabilities of the company and is use to estimate balance sheet and cash flow. The following assumptions were made in the calculation of working capital (see Table 6-28):

Table 6-28: Assumption for calculation of working capital

Current assets or liabilities	Average payment period
Inventory	30 days
Short-term receivables	30 days
Accounts payable to suppliers	30 days
Accounts payable to employees	30 days

Source: GIZ/MLPS

The forecast of working capital is presented in the Annex 6, Tables 17 and 18 for the ’with project’ and BAU scenarios.

6.3.6.2 Cash flow and financial sustainability

A cash flow analysis was carried out for the project. The cash flow statement is a basic instrument used to assess the financial sustainability of the project of improving the operator’s infrastructure. The purpose of carrying out a cash flow analysis is to verify whether the project operator faces of cash flow constraints. The projections were made for the entire reference period, i.e. 30 years. As cumulative cash flow is positive in each year of project analysis, the project is considered financially sustainable. The cash flow is presented in the Table 6-29:

Table 6-29: Cash flow forecast for the 'with project' scenario (MDL mil.)

Indicator	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Financial inflows	MDL mil.	0.00	33.04	64.22	56.58	27.64	27.57	35.67	48.15	62.95
Donor contribution (capital grant)	MDL mil.	0.00	5.11	25.53	20.42	0.00	0.00	0.00	0.00	0.00
Own contribution	MDL mil.	0.00	2.69	13.44	10.76	0.00	0.00	0.00	0.00	0.00
Revenues from sale	MDL mil.	0.00	24.93	25.12	25.30	27.26	27.49	35.55	47.96	62.76
Increase in current liabilities	MDL mil.	0.00	0.31	0.13	0.11	0.38	0.08	0.13	0.18	0.19
Financial outflows	MDL mil.	0.00	27.61	63.37	56.34	29.12	29.42	30.30	42.91	57.39
Investment costs	MDL mil.	0.00	7.79	38.97	31.18	0.00	0.00	0.00	0.00	0.00
Costs of providing services	MDL mil.	0.00	17.44	18.81	19.77	23.63	24.24	30.10	42.62	57.06
Increase in current assets	MDL mil.	0.00	-3.36	0.02	0.04	0.35	0.03	0.10	0.15	0.15
Income tax	MDL mil.	0.00	0.59	0.43	0.21	0.00	0.00	0.10	0.14	0.18
Net cash flow (inflow - outflow)	MDL mil.	0.00	5.43	0.85	0.25	-1.48	-1.84	5.38	5.24	5.56
Cumulated cash	MDL mil.	1.07	6.50	7.35	7.60	6.12	4.27	23.28	75.29	129.39

Source: GIZ/MLPS

The detailed cash flow analysis is presented in Annex 6, Tables 21 and 22 for 'with project' and BAU scenarios.

The amount of the financial surplus is not sufficient to repay a new loan to finance the investment costs of MDL 77.94 million. In the first years of the project, the net cash flow is insignificant, and is increasing in value in the latest years. During the 30-year period of analysis, the project is expected to generate a MDL 129.39 million cumulative cash flow, which can be used for capital investments to reduce water losses and expand services, as required.

It has to be emphasised that Table 21 in Annex 6 – as its major purpose is to present project sustainability – does not present incremental values but values for the 'with project' scenario.

6.3.7 Financial performance of the project - NPV and IRR calculation

The analysis of NPV was based on discounting the incremental cash flows (operating surpluses) generated by WSS operator. The nominal discount rate used for the financial analysis was 5% over the entire forecast period.

In estimating NPV, no re-investment rate was assumed and thus it was assumed that the generated funds (available funds at the end of each year) are not re-invested (e.g. paid into term deposit accounts or put into treasury bills). This assumption avoids distortions in the NPV due to differences in the price of capital because usually the present reinvestment rate differs from the price of capital (in the present case the discount rate).

A key element in determining the NPV of a project is the residual value of assets, defined at the end of the forecast period. The residual value was defined at a level equal to the net present value of the fixed assets at the end of the forecast period.

The NPV analysis was conducted using an incremental cash flow model. This means that the financial projections were constructed in such a manner so as to identify additional cash flows attributable to the project.

Table 23 in Annex 6 presents the incremental cash flows used to calculate the FNPV(C) of the project. FNPV(C) means that financial net present value of the investment is calculated. This indicator and FRR(C) - Financial Rate of Return of the Investment – illustrate the profitability of the investment project. Inflows include the increase in revenues associated with increasing the volume of water and wastewater services provided. On the expenditures side, investment outlays and changes in operating costs were taken into account.

It is important to point out that the project involves an increase in the amount of water delivered and volume of wastewater discharged. For this reason, the return on the investment should be viewed from the social rather than financial perspective.

The calculated NPV at a 5% discount rate for a 30-year operating period is negative. This attests to the fact that the project does not generate a return and is financially unprofitable.

This is a typical result for a project in which costs are incurred (capital and operating) but revenues do not significantly increase. Public sector investments often generate similar results.

Negative financial indicators (rate of return) for a project cannot serve as the sole basis for determining whether a project should be pursued. These results, however, serve as the basis for estimating the social benefits associated with the project.

FNPV (C)=	-45.66	MDL million
FRR (C)=	-1%	

Source: GIZ/MLPS

The financial analysis on profitability of the own capital contribution was also conducted. The analysis is similar to that presented above, but takes into account the capital contribution to the project only and does not count grant (donor) contribution to the project.

Table 24 in Annex 6 presents the incremental cash flows used to calculate the financial net present value of own capital of the project - FNPV(K). Financial Rate of Return of the own capital (FRR(K)) indicates the profitability of the own capital invested in the project and is equal to 5%.

The results are close to 0, what is according to the assumption that external co-financing should not lead to profitability of own funds used.

FNPV (K) =	0.0	MDL million
FRR (K) =	5%	

Source: GIZ/MLPS

6.3.8 Sensitivity analysis

A sensitivity analysis was conducted to analyse the forecast in the event of changes in the following variables:

- **Investments costs**. The sensitivity was conducted for investments costs varying from 100% to 125% of the calculated values;
- **Real wage increase**. The real wage increase indicator is used in the financial model to determine the costs of employment and also to determine the increase in disposable household income. The sensitivity analysis was done not by changing a single indicator on annual real wage increase, but rather switching the entire forecast for the entire time horizon of the project. Thus, three forecasts of real wage increase were prepared (as described in the section on macroeconomic assumptions):
  - Base case;
  - Half base case;
  - Pessimistic.
- **Real GDP growth**. Similarly to real wage increase, three forecasts of real GDP growth were prepared. The real GDP growth is used in the financial model to forecast increase in water demand from industry and institutions. The proposed forecasts are: base case, optimistic, pessimistic;
- **Costs of electricity**. The financial analysis assumed an increase in the costs of electricity. As electricity costs are a large component of total costs, the sensitivity analysis also covers these costs. Similarly to real GDP growth, three forecasts of real increase of electricity prices were prepared.

For each variable, the sensitivity analysis provides results for:

- FNPV(C);
- FRR(C);
- FNPV(K);
- FRR(K);
- Financial sustainability (TRUE/FALSE – indicating whether the cumulated cash flow is positive during the entire time horizon of the analysis).

The results of sensitivity analysis are presented in Annex 6, Table 26.

The analysis shows that project is sensitive an increase in investment costs. The influence of investment costs, however, is limited due to the fact that majority of investments costs are assumed to be co-financed by donors.

Nevertheless, in none of the cases did the project lose financial sustainability (cumulated cash flow less than zero).

6.3.9 Cost-benefit analysis / economic analysis

Preparing an economic analysis (Cost-Benefit Analysis, or CBA) is important for infrastructure projects; especially those co-financed using international donor aid.

The objective of a CBA is to analyse a measure's impact on society's well-being in the region (or country) in which the project is implemented. This approach is what makes a CBA different from a financial analysis, which only takes into account the costs and

benefits that accrue to the investor as a result of the measure. A CBA should include the total costs and benefits from the perspective of the public that benefits from the project. The fundamental rule in selecting projects holds that benefits from the measure should exceed its costs. In essence, for a CBA this means that the measure should generate a positive economic net present value (ENPV).

In describing the economic effectiveness of the project, the CBA includes the following indicators:

- ENPV;
- ERR.

The starting point for calculation of these indicators is the financial cash flows from the financial analysis.

Many methods exist to estimate the social costs and benefits for CBA purposes. The general rule holds that outlays on the project should be described in terms of their opportunity cost, while the benefits (effects) of the measure should be measured by the society's willingness to pay to obtain a given effect. Often the benefits transfer technique is used, which involves extrapolating results from studies from sectors and projects similar to the analysed project.

6.3.9.1 Analysis of socio-economic costs

Price distortions on means of production

Shadow prices arise when distortions occur in a given market, which lead to the costs of a factor of production to differ from the cost that society incurs. Market distortions may be caused by the existence of a monopoly, quotas and price regulation.

Due to the competitive market for factors of production, no price distortions on factors of production were considered. Only electricity prices – which are regulated – differ from market values and appropriate corrections have been made.

Wage distortions

The scale of the project is low and given the unemployment rate in Moldova, it is not expected to distort wages.

Tax aspects

The project does not involve negative tax aspects.

External costs

Investments in wastewater networks involve external costs generated due to the temporary exclusion of land and streets from use; yet, these costs are taken into account in investment outlays (possible damages/compensation, repairs of the road). Moreover, the project has a positive impact on the natural environment and no other external costs are expected.

A CBA should take into account social costs that are not compensated and that have a significant impact for the wider public apart from those that refer directly to the project.

The decline in the value of land in the vicinity of the wastewater treatment plant, wastewater reservoirs and pumping stations – these types of objects do not motivate buyers, which means that land in the vicinity will have a lower value – could be an external cost. Yet, the facilities' location was selected outside built-up areas, close to the

existing water production facilities and will not be significant or will have minimal impact.

Non-financial costs

It is not expected that the project will involve non-financial costs.

Social costs resulting from additional employment

Additional employment is not required for the project operation. It is required for the project implementation but will not distort the labour market and thus social costs do not arise due to the investment.

6.3.9.2 Analysis of socio-economic benefits

Price distortions on the means of production

The effect of engaging unemployed persons during construction was taken into account. This aspect is described in the section on social benefits from additional employment.

Tax aspects

Transfers include all taxes, fees, financial costs and subsidies. These should be excluded from a CBA because they do not constitute a cost to society but rather a transfer of income (a tool for the redistribution of income). They do not contribute to an increase or decline in social welfare.

Value Added Tax

The VAT contained in investment outlays is a transfer and the cash flows used to calculate ENPV have been corrected by the amount of this tax.

External benefits

The concept of external effect is associated with the imperfections of the functioning of the market. An external effect occurs when the actions of one economic actor cause a change in the welfare of another economic actor and this change is not compensated. In other words the external effect occurs if the utility function or production function of entity ‘A’ contain real (that is. monetary) variables, the value of which were determined by other entities (person, company, government) without their taking into account the impact on the level of welfare of actor ‘A’.

In the present project, a number of external benefits arise due to implementation. Among the main external effects the following should be mentioned:

- Health effects due to reduction of pollution in the water;
- Social effects due to uninterrupted water supply;
- Economic development effects.

Health benefits

The approach to estimating benefits from improvement of the wastewater system programme involves determining the positive health effects that will result from the programme and assigning a monetary value to them. Although the proposed project programme is related to extension of wastewater infrastructure, increase volume of treated wastewater will have effect on cleaner environment in general, including safer water supply.

The approach for determining positive health effects, however, requires precise study of the relationships between pollution in the environment and a response (e.g., improvement of health, reduction in morbidity). This relationship is described in a dose-response function. While these studies have been conducted in EU countries for various pollutants, their application in sewerage improvement programmes have many limitations.

The economic valuation of the benefits from implementing a wastewater infrastructure extension programme, which cause environment and water quality improvement, is difficult due to the low number of studies conducted on this issue as well as the need to determine precisely the physical effects of these programmes (knowledge of the dose-response relationship is essential).

Evaluating the benefits based on data from studies conducted in other countries does not yield authoritative results due to the differences in the conditions that prevail in project impact area. Further limitations in evaluating programme benefits are due to the inability of estimating some benefits in monetary terms. The literature indicates that these results should be viewed in the context of many assumptions, limitations and uncertainties in evaluating benefits. Limitations include, inter alia, lack of available data on illnesses caused by wastewater pollution; underestimation of economic costs of wastewater pollution, etc., P. Faircloth[60] describes four types of benefits of implementing water quality improvement programmes:

- Health benefits;
- Amenity benefits;
- Non-use benefits;
- Benefits for water users – agriculture, households.

Another problem is that, although, it is obvious that the amount of pollution in water will be reduced quantitative data on nitrates and other pollutions differs from commune to commune and are not available. However, there are studies that estimate, especially health benefits. ECOTEC report[61] provides estimation of benefits of avoided water-related diseases. Per capita value for Romania (good proxy for Moldova) is EUR 27 per capita and this value was used for the estimation.

New business enterprises

Demand analysis uses the annual increase in businesses proportional to the GDP increase. Currently, the sewage system is not able to collect wastewater for new businesses. This situation is due to lack of wastewater network in the Ungheni and in other localities. The situation reduces the possibilities of business development or the business will have to find other ways to discharge wastewater - this may cause very high social costs if the project is not implemented (or high social benefits for the project implementation). Having in mind, limitations in valuation of the social benefits from establishing new businesses, shadow prices for discharge wastewater from new business were used. The shadow price was estimated at 30 MDL/m^3, as equal to the costs of discharge a wastewater by septic trucks. The shadow price was applied to the demand from business.

[60] Peter Faircloth (Cranford Economics) and others “Approximation of Environmental legislation A Study of the Benefits of Compliance with the EU Environmental Acquis”

[61] The benefits of compliance with the environmental acquis for the candidate countries

Non-financial benefits

Apart from those described elsewhere in this chapter no non-financial benefits in this project were identified.

Social benefits resulting from additional employment

In a CBA, additional employment is a cost because the project is using labour resources that become unavailable for alternative social purposes.

Two separate methods exist of estimating the social benefits of additional employment:

- Using accounting wages below the current wages in the project;
- Estimating the income multiplier of investment revenues on the social income resulting from the project that will be higher than the income for private investors.

Both methods have disadvantages and limitations. In this CBA results are corrected so that the cost of employing persons from the ranks of unemployed is equal to zero.

The following social effects from additional employment were taken into account in the analysis:

- Increase in the number of jobs during investment implementation (temporary effect);
- New jobs resulting from the economic development made possible due to investment implementation.

The first effect was estimated and described in detail below, while the second effect is not quantified.

Increase in jobs during investment implementation

Project implementation results in additional employment. This will be a temporary effect from the infrastructure investments, in which a significant portion of the investment outlays is associated with labour. Full automation is not possible during construction of the water and sewerage networks, especially in excavation works, and thus the required labour includes a significant portion of low qualified workers from the ranks of the unemployed. Due to the lack of detailed data on outlays, typical cost estimates of similar project scopes were analysed in order to determine the share of wages for low qualified labour in total outlays. Based on this analysis, a share of 30% of such labour in outlays was assumed and in the CBA this result was adjusted so that the cost of employing these persons was equal to zero.

Reducing developmental disparities among regions

The project's impact on reducing developmental disparities among regions results foremost from the expansion of access to technical infrastructure. Tasks completed under the project have a positive impact on increasing investment also in the entire region.

Two aspects are of key importance for reducing the level of development between regions:

- Expansion of infrastructure is the basic element of development in the region and is viewed by residents as a requirement. A lack of infrastructure leads to a degradation in the region and an outflow of persons toward areas that are better developed;

- The second element in reducing developmental disparities between regions is linked to the strict relationship between the expansion of communal infrastructure – including water– and economic development. The project provides not only for constructing water pipes but also gives the possibility for business development in commercial and service (agriculture) areas. The lack of a water capacity is a large barrier to development of these areas because transporting water by cisterns is much more expensive. This discourages potential investors from developing activities in the area that is lacking basic infrastructure.

6.3.9.3 Economic rate of return (ERR) and economic net present value (ENPV)

Table 25 in Annex 6 contains a calculation of the economic rate of return (ERR) and the economic net present value (ENPV).

This table includes the results of the financial analysis that were corrected for transfers external effects and price distortions on factors of production.

The net cash flow balance was corrected for the social costs and benefits described earlier:

- Fiscal corrections:
  - VAT.
- Price distortions:
  - Engaging unemployed persons during construction;
  - Price distortions for electricity prices.
- External effects:
  - Shadow prices related to business development;
  - Benefits of avoided water-related diseases.

The calculation does not take into account the grant because it is a transfer.

After making the above corrections, the surplus after corrections was calculated; this in turn was the basis for calculating the economic rate of return (ERR) and the economic net present value (ENPV).

The calculated ERR is 22% while the ENPV is MDL 110.47 million at a discount rate of 5%.

The CBA lists many factors that were not expressed in monetary terms. If it were possible to estimate them, the value of ERR would be considerably higher. The positive result of the economic analysis (ENPV greater than zero) indicates that from a public perspective, the project should be implemented.

7 Institutional development

7.1 Potential for WSS area extension

With respect to the regionalisation of water supply and wastewater services in administrative-territorial units of the project, the parties have expressed a consensus of opinion. Ungheni Municipal Services Utility has stated that extension of water supply and wastewater services area to other administrative units is one of the company's strategic development activities.

Representatives of local public administrations of the town of Ungheni, commune of Zagarancea and Petresti have agreed to appoint Municipal Enterprise ‘Apa - Canal’ Ungheni, hereinafter ME ‘Apa - Canal’ Ungheni, as regional operator, to whom they intend to delegate the management of water supply and wastewater services.

Opinions of the local authorities/operator on the regionalisation of WWS services in the Ungheni Rayon were received following discussions at meetings of the project working groups and from questionnaires completed by each administrative-territorial unit.

7.2 Competence of local public administration and inter-municipal cooperation

The Constitution of the Republic of Moldova (RM) states in Article 109 that the public administration in administrative-territorial units is based on the principles of local autonomy, decentralisation of public services, eligibility of authorities of local public administration and consultations with citizens on local problems of major interest. Thus, Moldova returned to the principle of autonomy through decentralisation and transfer of major responsibilities to local administration.

The deliberative authorities of administrative-territorial units have the exclusive competence on the set-up, organisation, coordination, monitoring and control of water supply and wastewater services. They have also the competence of management and operation of the public goods which make up the administrative-territorial units’ public infrastructure associated with those services.

According to the Law no. 303 on water supply and wastewater public service dated December 13, 2013, the local councils have the competence to:

- Draw up and implement own business operations and development plan on water supply and wastewater public services for short/mid/long term;
- Approve tariffs of water supply and wastewater public services;
- Manage water supply and sewerage public systems as the integrated components of the administrative-territorial units’ infrastructure;
- Approve the regulations and specifications of the service;
- Select the method of management and approve the documentation on organisation and conducting of procedures regarding management delegation;
- Approve the performance indicators of the services.

The management of services concerns the organisation, operation and control of water supply and wastewater services under the conditions laid down by local public administrations.

Management of water supply and wastewater services can be organised in two ways, the choice being left to the discretion of local public administrations:

- Direct management through specialised structures (divisions, departments) organised within the local public administrations;
- Delegated management, defined as a type of management through which the local authorities assign one or more operators to manage directly this service, namely the management and operation of water supply and wastewater systems, under a contract of management delegation. Delegated management is performed via a management delegation contract between one or more administrative-territorial units, as granting authority, and an operator as a delegate. The basis for awarding such a contract of management delegation is the public tendering in compliance with the applicable procedures.

The form of management is determined by the decisions of the deliberative authorities of the administrative-territorial units, depending on the nature and status of the service, the need to ensure the best price / quality ratio, present and future interests of administrative-territorial units, and size and complexity of public utility systems.

The legal basis for local public administration cooperation on water supply and wastewater services development is mentioned in law no. 303[62], local public administration level 1 (LPA 1):

- Decide on administrative-territorial units association for the purpose of setting up, organising and encouraging investments in the relevant systems of water supply and wastewater services;
- Use own financial resources/or goods to increase the operator's assets to provide water supply and wastewater services.

The development of water supply and wastewater services requires a level of investment in infrastructure that far exceeds the financial capacities of most local authorities. In addition, localities lack staff specialised in service provision as well as experience in the preparation and implementation of projects.

Thus, the recommended solution to address the lack of sufficient financial and human resources capacity is to organise and operate the services at the regional level, in order to ensure sustainable development and efficiency of activities through achieving economies of scale.

7.3 Institutional model for regionalisation

From the institutional point of view, regionalisation is achieved by reorganisation of existing public services owned by local authorities. For the current project, regionalisation is achieved through two institutional elements:

- Regional operator, a public equity company founded by one or more administrative-territorial units, to which water supply and wastewater services are delegated through delegated management contract;
- Contract on delegated management services. The administrative-territorial units through local authorities delegate the management of water supply and

[62] Art. 8 of Law no. 303 on water supply and sanitation public service dated December 12, 2013

wastewater services to the regional operator through a single delegated management contract.

The relationship between these institutions will be regulated by constitutive act of the regional operator and by delegated management contract.

7.3.1 Regional operator

A regional operator can be considered the operator organised as a business enterprise with public equity owned by one or more administrative-territorial units. It provides water supply and wastewater public services within the area of several administrative-territorial units, ensuring management and operation of the systems related to these public services.

The main activities of the regional operator will be abstraction/intake, treatment and distribution of drinking water; wastewater collection and treatment; performing other activities as well in accordance with the legislation in force, necessary to achieve the goal of activity established by constituent act.

The regional operator is responsible for provision of water supply and wastewater public services within the area of administrative-territorial units that have delegated the management of the service. The operator also bears responsibility for the management, operation, maintenance, renewal and extension, where appropriate, of all fixed assets (systems) subject to the contract.

All administrative-territorial units take charge of the activities carried out by regional operator activities under the provisions specified in the constitutive act.

The regional operator can be set up on the basis of the existing operator following one of two ways:

- Reorganisation of the ME ‘Apa–Canal’ Ungheni.
  Reorganisation through transformation of the legal person, applicable in this case, means the continuity of legal person’s activity, having the same rights of property and corresponding liabilities, ensuring uninterrupted operation of the assets and continuous production of benefits.
  The process of transformation does not imply the transfer of rights and obligations from one legal person to the other because it does not disappear, but continues its existence in a different legal form;
- Setting up of a new business enterprise with wholly public equity, whose founders are administrative-territorial units only in the area where regional operator will provide the service.
  In this case the ME ‘Apa – Canal’ Ungheni will not stop the work and will provide other municipal public services.

Another important point is to identify the organisational-legal form of a new regional operator, in accordance with legislation in force and specificity of the public service.

Given the subject of activity, namely the provision of the water supply and wastewater services and legal provisions in force as well, the following are the organisational-legal forms that can be taken in the future: the municipal enterprise with more founders, limited liability company, and joint stock company.

Table 7-1: Comparative analysis of the organisational-legal forms

	Municipal enterprise (inter-municipal)	Limited liability company	Joint-stock company
Regulatory framework	• Government Decision no. 387 of 06.06.1994 regarding the approval of regulations' model of Municipal Enterprise; • Civil Code (Law no. 1107-XV of June 6, 2002); • Law on entrepreneurship and enterprises no. 845-XII from 01.03.1992; • Law on State Registration of Legal Entities and Individual Entrepreneurs No. 220-XVI from 10.19.2007	• Law on Limited Liability Companies no. 135-XVI of 06.14.2007; • Civil Code (Law no. 1107-XV of June 6, 2002); • Law on entrepreneurship and enterprises no. 845-XII from 01.03.1992; • Law on State Registration of Legal Entities and Individual Entrepreneurs No. 220-XVI from 10.19.2007.	• Law on Joint Stock Companies no.1134-XIII of 04.02.1997; • Civil Code (Law no. 1107-XV of June 6, 2002); • Law on entrepreneurship and enterprises no. 845-XII from 01.03.1992; • Law on State Registration of Legal Entities and Individual Entrepreneurs No. 220-XVI from 10.19.2007.
Governing bodies	• The head (director); • Boards of directors (if needed).	• General meeting of shareholders; • The council of enterprise; • Enterprise's manager; • Auditor.	• General meeting of shareholders; • The council of enterprise; • Executive body; • Auditing committee.
Responsibilities of governing bodies	The director manages the daily operations of enterprise; its responsibilities are set out in the employment contract concluded between the founder and head of the company.	• General meeting of shareholders is the supreme body of the enterprise (art. 48-61 of Law no. 135-XVI dated 06.14.2007)); if enterprise has only one shareholder, the rights and liabilities of general meeting are taken over by the latter (art. 62 of Law no. 135-XVI dated 06.14.2007); • Council of the enterprise (at least 3 people) is its executive body (art. 64-68 of Law no. 135-XVI dated 06.14.2007 and constituent act); • The company may have one or more managers (art. 69-76 of Law no. 135-XVI dated 06.14.2007); • Auditor is enterprise's supervisory body; the general meeting may appoint one or more auditors; the enterprise may instead appoint an independent audit censor (art. 77-79 of Law no. 135-XVI dated 05.14.2007).	• Shareholders general meeting is the supreme leading body (art. 50-64 of Law no. 1134-XIII dated 04.02.1997); • Council of the enterprise performs general management and control over enterprise's activities (art. 65-68 of Law no. 1134-XIII dated 04.02.1997); • The executive body carries out the management of enterprise's current activities (art. 69-70 of Law no. 1134-XIII dated 04.02.1997); • Auditing Committee exercises control over financial and economic activity of enterprise (art. 71-72 of Law no. 1134-XIII dated 04.02.1997).
Legal liability	• The enterprise is liable for the obliga-	• The company is liable for its obligations	• The enterprise is liable for its obligations by

	Municipal enterprise (inter-municipal)	Limited liability company	Joint-stock company
	tions assumed by entire property it owns under ownership right; • The administrative-territorial units are not responsible for the obligations of municipal enterprises; • Municipal enterprises are not responsible for the obligations of administrative-territorial units.	with all its assets; • Shareholders are not liable for enterprise's obligations; they bear the risk of losses resulting from the enterprise's activity within their participation in the share capital.	entire property it owns under ownership right; • The enterprise is not liable for obligations of its shareholders; • Shareholders are not liable for enterprise's obligations and bear the risk of losses within the value of shares belonging to them.
Setting up conditions	Setting up decision and enterprise charter is adopted by founder (local council). Incorporation from the moment of registration by State Registration Chamber.	• Enterprise can be set up by one or more natural and/or juridical persons; • Number of associates shall not be more than 50; • Founding agreement is signed by all founders and notarised; charter is approved by single founder; • It is registered by State Registration Chamber.	• Enterprise can be set up by one or more persons; • Both natural and juridical persons can be founders of enterprise; • Shareholders can be natural and juridical persons from Republic of Moldova, other countries, stateless citizens, foreign countries and international organisations; • Contract conclusion (decision taken on enterprise setting up); founders subscription to shares and constituent assembly holding; enterprise contract (statement on enterprise setting up) loses its force since enterprise is registered; charter approval by founding members; • Incorporation from the moment of registration by State Registration Chamber.
Constituent acts	Local council decision on enterprise setting up and its charter	Founding agreement or enterprise charter (art.12 of Law no.135-XVI of 06.14.2007)	Founding agreement (or founding statement) and enterprise charter (art.32 of Law no.1134-XIII of 04.02.1997)
Initial equity	Not regulated	Equity capital shall not be less than 5,400 MDL (art. 21 para 2 of Law no. 135-XVI of 06.14.2007)	Equity capital shall not be less than 20,000 MDL (art. 40 of Law no. 1134-XIII of 04.02.1997)
New members acceptance	No members	Allowed in accordance with charter provisions	Allowed in accordance with charter provisions
Strengths	• The best known organisational-legal form for public services provision; • A separate legal entity having own property and budget; • The loans taken are guaranteed by the Local Public Administration;	• The most applicable organisational-legal form for delegated public services in the rural area; • More mobility and capacity to respond to the economic and financial changes; • Possibility to access loans for investments;	• Possibility to attract investments for development; • More mobility and capacity to respond to the economic and financial changes; • More profitable services when provided on larger area (regional or rayon level);

	Municipal enterprise (inter-municipal)	Limited liability company	Joint-stock company
	• Subsidies from Local Public Administrations.	• Independence from Local Public Administrations; • More simple procedure on setting up and registration.	• Higher transparency of activity and management of public goods.
Weaknesses	• Outdated legal regulations in this sector; • Limited possibility for investments; • Dependence on founding Local Public Administrations; • High probability on budgeting dependence and political influence on tariffs level.	• It is subject to all risks of market economy; • It is seen through concern for personal benefits to the detriment of the public interest.	• It is subject to all risks of market economy; • More complex registration procedures; • More complex structure and operating mode; • Not practical for rural areas.

Source: GIZ/MLPS

Taking into account all mentioned above and considering the regionalisation policy for water supply and wastewater sector by creating stronger operators, it is proposed that the optimal legal form for conversion of the existing operator is joint-stock company.

Setting up of the regional operator will be made in compliance with Civil Code, Law on entrepreneurship and enterprises no. 845-XII of 01.03.1992, Law on Joint Stock Companies no. 1134-XIII of 04.02.1997, Law on State Registration of Legal Entities and Individual Entrepreneurs no. 220-XVI of 10.19.2007.

7.3.2 Delegated management contract

Under a delegated management contract, an LPA as delegator assigns to a licensed operator as a delegatee, acting on own risk and responsibility, the rights and obligations to provide full water supply and wastewater services for a specified period of time. Alternatively, only some specific activities may be delegated to the operator, including the rights and obligations to manage and operate the technical infrastructure associated with services provided, in return for a management fee.

The delegated management contract establishes specific rights and obligations of each party on the provision of water supply and wastewater services, development of investment programs, and achievement of the certain performance levels. The provisions of the delegated management contract are stipulated in Law no. 303[63].

In this way, the regional operator bears responsibility for the management, operation, maintenance, renovation and expansion of fixed assets, pursuant to the contract.

In the regionalisation process, a delegated management contract for water supply and wastewater services is an agreement between regional operator (delegate), on the one hand, and the local authority (delegator) on the other.

One approach would be to draw up a single contract for the entire project area (town of Ungheni; commune of Zagarancea, commune of Petresti), signed by each administrative-territorial unit separately, corresponding to the jurisdiction of all administrative-territorial units that delegate water supply and wastewater services to the operator.

The following addendums are mandatory to be attached to the delegated management contract:

- Technical specifications regarding provision of service;
- Regulations on provision of service;
- Inventory of movable and immovable assets, which are associated with the service provided, including public or private property;
- Protocols on the take-over assets listed in 3rd subparagraph.

Regardless of the stipulations in the contract, the ownership of public assets and the responsibility for providing water supply and wastewater services at affordable prices remains with the local public administrations. Since the assets remain under public ownership, they need to be reclaimed by their owner (administrative-territorial units) upon termination of the contract.

The delegated management contract is typically concluded for a long period of time. The tariff policy aims at full cost recovery and is applied by the regional operator in accordance with the applicable regulations issued by ANRE, under the control and with

[63] Art. 13, par. 8 of Law no. 303

the approval of the administrative-territorial unit. The financing and commercial risk is assumed by reorganised operator.

Delegating management is made by direct award, as stipulated in Law no. 303[64].

7.4 Steps to implement institutional framework

7.4.1 Selecting the management model of water supply and wastewater public services

At this stage, local public administrations (town of Ungheni; commune of Zagarancea, commune of Petresti) should decide on the management model for water supply and wastewater services, specifically direct management or delegated management.

Under Law no. 303[65], this phase begins with the preparation by local authorities of a study to substantiate and identify optimal solutions for water supply and wastewater services delegation.

Based on the study findings and proposed solutions, local councils then adopt decisions on the management model. A decision on delegation of service management to a single / regional operator provides the grounds for taking the next step.

As for commune of Petresti, this stage includes also a decision making on the further activity of the Municipal Enterprise 'Servicom – Petresti', which is the sole operator of water supply service in this community.

7.4.2 Regional operator

The starting point is the local council decisions approving studies, which substantiate this regionalisation and identification of the optimal institutional model regarding regionalisation in Ungheni Rayon.

Establishment of a working group to identify the fastest and most viable solution for the regional operator setting up. This activity has the character of a recommendation, but creates prerequisites for a detailed analysis of the future operator.

Adoption of the decision on reorganisation through transformation of the ME "Apa - Canal" Ungheni or decision on new business enterprise setting up.

Establishing new operator will be subject to the provisions of the Civil Code, Law on entrepreneurship and enterprises no. 845-XII from 01.03.1992, the Law on joint stock companies no. 1134-XIII of 04.02.1997, the Law on state registration of legal entities and individual entrepreneurs no. 220-XVI from 10.19.2007, and it is recommended to be organised as a joint stock company.

This stage ends with acquiring legal personality of the new operator by registering at the State Registration Chamber.

7.4.3 Delegation of water supply and wastewater services

The activities necessary for the delegation of water supply and wastewater public services to regional operator are under competence of deliberative authorities from administrative-territorial units. Thus, local councils of the town of Ungheni, communes of Zagarancea and Petresti are responsible for:

[64] Art.13, par. 12 of Law no. 303

[65] Art. 13, par. 14 of Law no. 303

- Drawing up and approving the delegated management contract and assign this contract directly to the regional operator;
- Defining and elaborating performance indicators of water supply and wastewater services provided to consumers;
- Elaborating and approving the regulations and the specifications of water supply and wastewater services;
- Ensuring the signature of the contract by executive authorities, for and on behalf of administrative-territorial units.

7.5 Timeframe for regionalisation process of water supply and wastewater services

The regionalisation of the water supply and wastewater services needs time because the legislation is quite rigid regarding deadlines that must be followed and the required activities are complex and time-consuming. In addition, local authorities in Moldova point to the lack of legal and regulatory framework that would guide the entire regionalisation process.

Given the steps needed to introduce regionalisation of services, as well as time limits imposed by legislation, an outline time schedule with approximate limits is as follows:

Table 7-2: Time schedule of regionalisation of the services

No.	Method chosen for setting up the regional operator	Steps	Time
a)	Reorganisation of ME "Apa – Canal' Ungheni	• Reorganisation of the ME "Apa - Canal' Ungheni into Joint Stock Company with Ungheni Town Council as a sole shareholder; • Increase of the authorised capital stock through acceptance of the new shareholders, in person of administrative-territorial units Zagarancea and Petresti; • Delegation of the management of the water supply and wastewater services to the new set up operator.	5-7 months 5-7 months 3 months
b)	Setting up of a new business enterprise	• Setting up of the Joint Stock Company, whose founders (shareholders) are Ungheni Town Council; Zagarancea Local Council and Petresti Local Council; • Delegation of the management of the water supply and wastewater services to the new set up operator.	6-9 months 3 months

Source: GIZ/MLPS

Given the fact that at the present time there is water supply and wastewater services operator in the town of Ungheni, it is recommended the reorganisation of the ME 'Apa – Canal' Ungheni into Joint Stock Company (regional operator) as an optimal solution.

Following the deadlines foreseen by legislation in force and taking into account the practical aspects of regionalisation of water supply and wastewater services, it can be stated that the whole process will coincide with Phase 1 of the feasibility study implementation (the Project). Afterwards, once the Phase 2 starts, the full regionalisation of water supply and wastewater services within the localities of the Ungheni Rayon will be competed.

7.6 Corporate human resources development of the operator

The existing institutional setup of the ME 'Apa – Canal' Ungheni will require considerable changes, in order to meet the increasing demands of the expanding service area.

In general, ME 'Apa – Canal' Ungheni is currently overstaffed, as the staff efficiency indicator is 6.33 (both water and wastewater) per total (water and wastewater) connections, while an average value for Moldova is 5.51.

At this point, it is rather difficult to propose an efficient institutional model, as the beneficiary localities have to decide first on the legal form of company (e.g. joint-stock company, municipal company etc.) and ways of service management (e.g. delegated to the Company, certain activities outsourced to third-parties etc.). This may have an impact over the number of staff and internal procedures.

The following factors are expected to improve the institutional and operational capacity of the company:

- Increased level of automation. Introduction of automated systems for the existing water production, pumping and distribution facilities, as well as wastewater pumping, will have a positive impact on the reduction of the number of technicians and operating staff. Introduction of a SCADA system will improve data management and will require less administrative effort;
- Introduction of Management Information System. This is expected to reduce the burden over the accounting, economic, human resources and customer service departments and may contribute to the optimisation of administration;
- Implementation of a dispatch centre. Regular monitoring and control of all service localities will help determine if customer service targets are being met. A mobile emergency team may replace local operating staff;
- Outsourcing of activities. Outsourcing may be suggested for billing system or specialised services (e.g. heavy equipment works).

Most of the mentioned activities shall be further developed under the corporate development programme proposed as part of the technical assistance in the first phase of implementation of the priority investment programme (i.e., the Project). This corporate development programme should also provide a general direction for institutional development, in close relation to the phasing of infrastructure investments.

For the Project (first phase of investments until 2018), no significant extension of water supply services over the rural localities is planned, while most of investments will be spent on rehabilitation and extension of the existing water supply network in the town of Ungheni. However, an increase of 14% in total number of water consumers is foreseen by 2018 on account of the rural population from the localities of Semeni and Petresti who are going to be connected to the Ungheni water supply network. A small extension of wastewater services within the town of Ungheni with 4.5% will have no considerable impact on increase of the number of consumers.

This means that the proposed investments for Phase 1 do not require increase of the Operator staffing. Therefore, the company needs to improve its staff efficiency to be able to operate WSS in a sustainable manner.

It is projected that the utility will tend to reach an average staff efficiency indicator for Moldovan utilities of 5.5 water and wastewater staff per 1,000 total connections, with the first benchmark of 6.0 staff persons per 1,000 water and wastewater connections in 2018. Basing on the projected number of future water and wastewater consumers, this

would result in total need of 142 staff persons in 2018. In absolute values this means an increase by 6 persons only, as compared to the current situation.

As for the second phase (2018-2021), an extension of both water and wastewater service areas is foreseen in urban and rural communities. This will require increase in water and wastewater (W&WW) staff. It is estimated that the Operator shall tend to keep the same staff optimisation pace, as in the first phase (2015-2018), and will achieve the staff efficiency indicator of 5.5 W&WW staff per 1,000 W&WW connections by 2021. It is expected that that number of water and wastewater staff will be increased for the new rural members, having representatives in each rural locality. The reduced staff from the first phase can be hired for the new positions in the second phase. In order to avoid interruptions in the staff activities, a smooth HR strategy shall be foreseen, which will link improvement of operational efficiency and reallocation/optimisation of staffing.

In the meantime, continuous slow reduction of administration and support staff is foreseen. The staff projections are provided in the Table below:

Table 7-3: Staff projections

Indicator	Unit	Current Situation, as of 2015	Projected Situation for 2018	Projected Situation for 2021
Number of water staff	people	77	81	83
Number of wastewater staff	people	45	49	58
Number of administrative and other W&WW staff	people	16	14	14
Total Number of staff	people	138	144	155
Number of water connections	conn.	13,285	15,168	16,048
Number of wastewater connections	conn.	8,514	8,898	12,180
Water & related admin staff per 1,000 W connections	pers./1,000 conn.	6.55	5.93	5.67
WW & related admin staff per 1,000 WW connections	pers./1,000 conn.	5.99	6.07	5.25
Total staff per 1,000 W&WW connections	pers./1,000 conn.	6.33	6.00	5.50

Source: GIZ/MLPS

In order to facilitate further institutional development of the Operator, the Phase 1 investments foresee a Technical Assistance for Corporate Development (see Chapter 5).

7.7 FOPIP

Because the process of regionalisation of water supply and wastewaters services requires a relatively long period of time comprising several stages that have to be completed in order to implement the institutional framework, active support of the national / local authorities is absolutely necessary to complete this process successfully.

Also, given the need for sequencing in the process of establishment of the regional operator, based on the existing services operator ME ‘Apa – Canal’ Ungheni, it is the priority and extremely important to develop its capacity to take over some administrative units, whose operational and financial results are reduced or even non-performing.

Based on mentioned above, a Financial and Operational Performance Improvement Program (FOPIP) for the regional operator is necessary to elaborate for the benefit of all administrative-territorial units involved in the project.

The program of improving financial and operational performances should have the objective to provide assistance in/for:

- Compliance with legal provisions in the water and wastewater sector;
- The process of regionalisation;
- Regional operator to become sustainable and able to implement investment projects etc.

In this regard, the main activities will comprise support for institutional reorganisation; improving staff performance and efficiency; support for improving operational and technical performance; and financial and business performance improvement, among others.

8 Environmental assessment for the Feasibility Study

8.1 Executive summary and conclusions

It is proposed to rehabilitate and extend the water supply and wastewater system in Ungheni town and the localities of Zagarancea, Petresti and Semeni.

The Feasibility Study (FS) for Ungheni town and Zagarancea, Petresti and Semeni villages has been developed in the WSS sector by the Project "Modernisation of Local Public Services" (MLPS-Project, intervention area 2) and it refers to the following components:

Water Supply System:

- Rehabilitation of the water distribution network in the town of Ungheni–12,235 m;
- Extension of the water distribution network in the town of Ungheni- 3,460 m;
- Construction of water transmission main from Semeni locality to the existing water towers of Petresti locality – 4,700 m;
- Construction of Water Pumping Station in the Petresti locality (located in the Semeni village) – 1 unit.

Wastewater System:

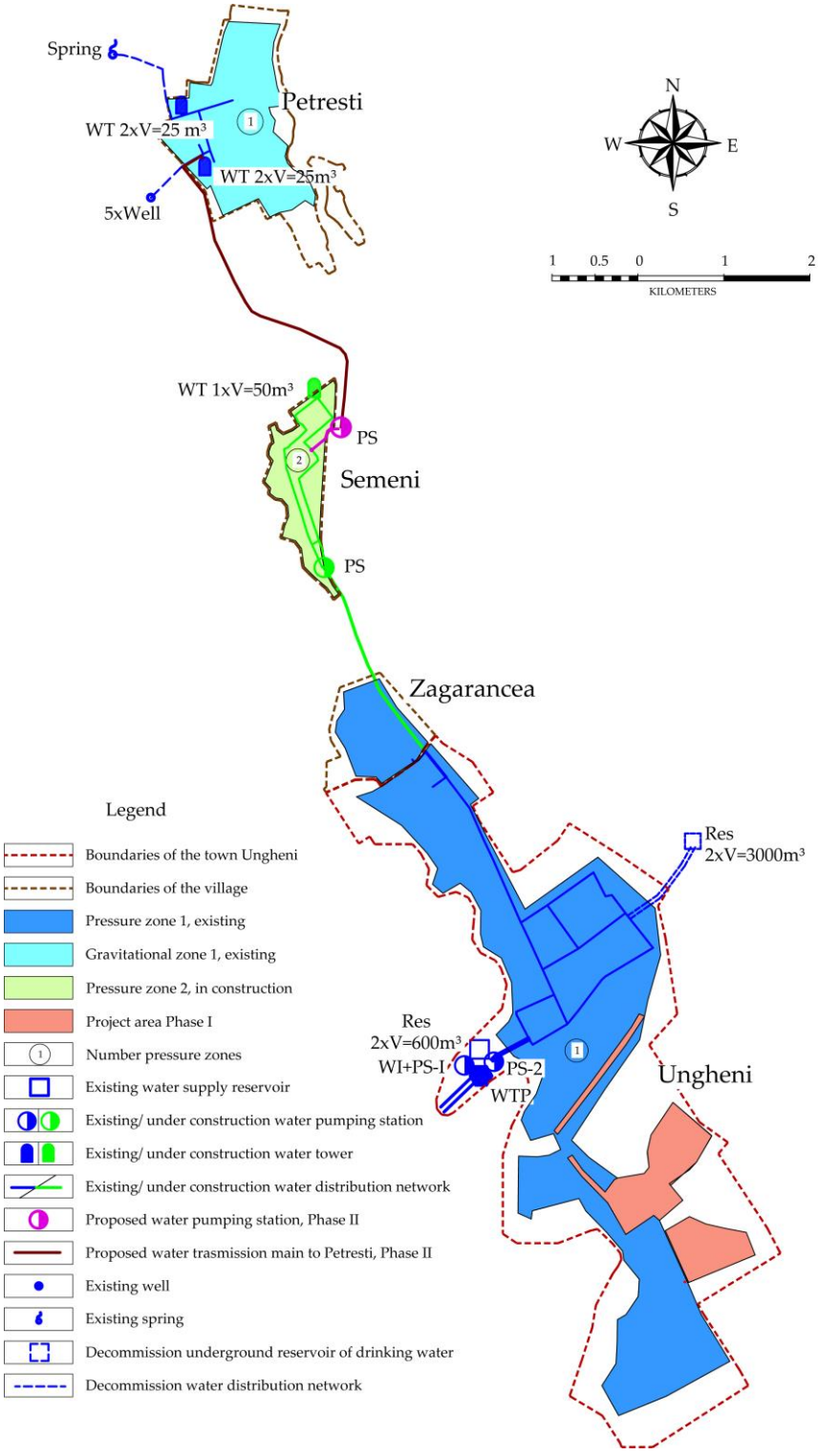
- Rehabilitation of the sewerage network in the town of Ungheni – 39,797 m;
- Extension of the sewerage network in the town of Ungheni – 46,546 m;
- Construction of wastewater pumping stations in Ungheni – 3 units;
- Rehabilitation of main WWPS in Ungheni – 1 unit;
- Rehabilitation/Construction of Wastewater Treatment Plant in Ungheni – 1 unit;
- Construction of the sewerage network in the Zagarancea locality - 5,930 m;
- Construction of the sewerage network in the of Semeni locality– 10,735 m;
- Construction of wastewater pumping station in the Semeni locality– 2 units;
- Extension of the sewerage network in the Petresti locality – 28,687 m;
- Construction of wastewater pumping station in the Petresti locality – 3 units.

The investment programme includes short, medium and long term measures designed for a planning horizon until the year 2045. The priority short-term measures divided into two phases as follows:

- Phase 1 – priority measures to be implemented until 2018, which in the context of this FS is considered the " The Project";
- Phase 2 – priority measures to be implemented between 2018 and 2021 (the period might be extended depending on the availability of funds and the capacity of the operator or implementing agency).

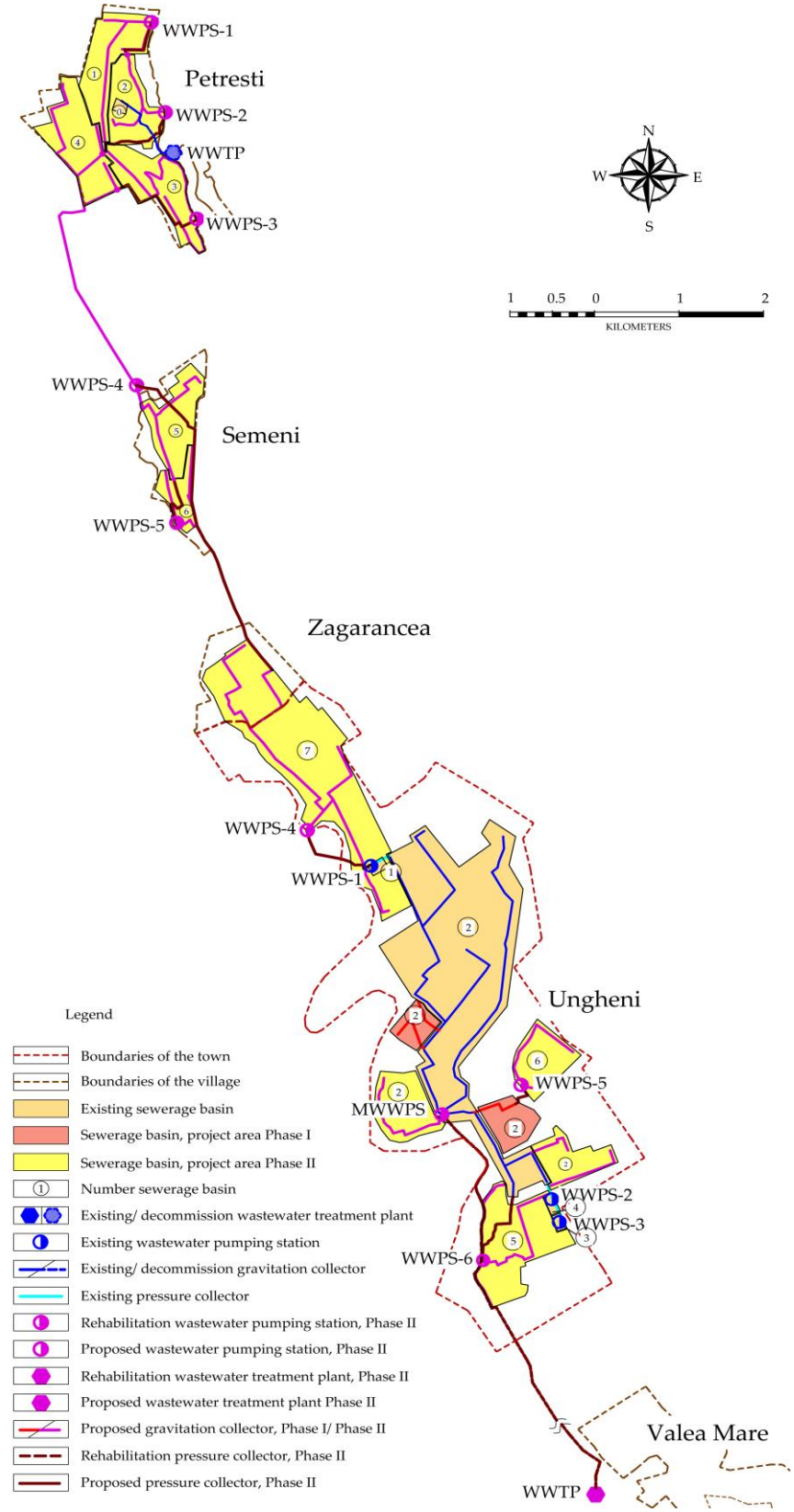
Priority Investment Plan (PIP) including investment cost estimates for Phase 1 and Phase 2 measures. Schemes of existing and proposed water supply system and wastewater systems in the town of Ungheni and Zagarancea, Petresti and Semeni localities are presented in the Figure 8-1 and 8-2.

Figure 8-1: Scheme of existing and proposed water supply system in the town of Ungheni and Zagarancea, Petresti and Semeni localities



Source: GIZ/ MLPS

Figure 8-2: Scheme of existing and proposed wastewater system in the town of Ungheni and Zagarancea, Petresti and Semeni localities



Source: GIZ/ MLPS

An Environmental and Social Assessment (ESA) was prepared in order to facilitate the implementation of the Project and to ensure that the envisaged Project objectives will comply with Moldova's environmental and social legislation, procedures and policies and international and EU conventions. In addition this ESA addresses the environmental and social impacts, mitigation measures and management issues associated with the proposed objectives of the project.

According to the new law on environmental assessment (Law No. 86/29.05.2014 on Environmental Impact Assessment which is in force from beginning January 4, 2015) none of the WSS objectives of the Project is subject to full scale EIA on the national level.

For acquiring the environmental and construction permission it is required to prepare the documents for the State Ecological Expertise (SEE). This needs to be done in the detailed design stage of the Project.

The environmental impacts of the measures proposed in this FS have been assessed in this Environmental and Social Assessment. The results of analysing the environmental impacts and mitigation measures are presented below "Environmental Impacts and Mitigation measures". Potential environmental impacts arising from the designed project along with a set of the mitigation measures to reduce the impacts to acceptable levels is provided.

The analysis reveals that the environmental impacts associated with the implementation of the Project are site specific, small scale and mostly limited to the construction stage. Therefore the overall conclusion of the assessment is that provided the mitigation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of location, design, construction or operation of the various objectives of the Project. There should in fact be positive benefits through major improvements in quality of life and individual and public health once the scheme is in operation. The implementation of the Project will stimulate economic growth and generate new job opportunities.

Individual and public health standards will improve as a result of the project.

8.2 Introduction

This document presents the Environmental and Social Assessment (ESA) for the phase 1 of the feasibility study (the Project). The Environmental and Social Assessment is part of this feasibility study.

8.2.1 Objective of the Environmental and Social Assessment

The objective of the ESA is to facilitate the implementation and to ensure that the envisaged Project objectives will comply with Moldova's environmental and social legislation, procedures and policies and international and EU conventions. In addition the ESA Report addresses the environmental and social impacts, mitigation measures and management issues associated with the proposed objectives of the Project.

8.2.2 Methodology

The methodology used for the preparation of this Environmental and Social Assessment Report was based upon the review of the FS documents that were so far prepared in the lead up to this FS, particularly the Regional Sector Programme in the WSS sector for the Development Region Centre (DRC) and the documents prepared in the PPC (Possible Project Concept) stage of the Project Development Pathway.

In addition the existing Moldovan environmental and social legislation and the pertinent safeguard requirements of International Financing Agencies (IFA) were respected.

8.2.3 Study area

The Project Area of Influence (PAI) comprises the territory of the town of Ungheni. The area that is foreseen for water supply rehabilitation and extension and the proposed sewerage area for extension is shown in the figures in Chapter 8.4 Project Description and Location.

8.3 Legislation and legal approval procedure

According to the new law on environmental assessment (Law No. 86/29.05.2014 on Environmental Impact Assessment which is in force from beginning January 4, 2015) none of the WSS components of the FS is subject to EIA on the large scale on national level.

For acquiring the environmental and construction permission it is required to prepare the documents for the SEE. This needs to be done in the detailed design stage of the Project.

A separate annex has been prepared on the legal approval procedure. The Annex 8 describes in detail the legal framework conditions and the SEE approval process.

8.4 Project description and location

The FS involves the new construction and rehabilitation of various components in the WSS systems. It is designed to improve the service standards of the WSS system in the town of Ungheni as follows:

Water supply system:

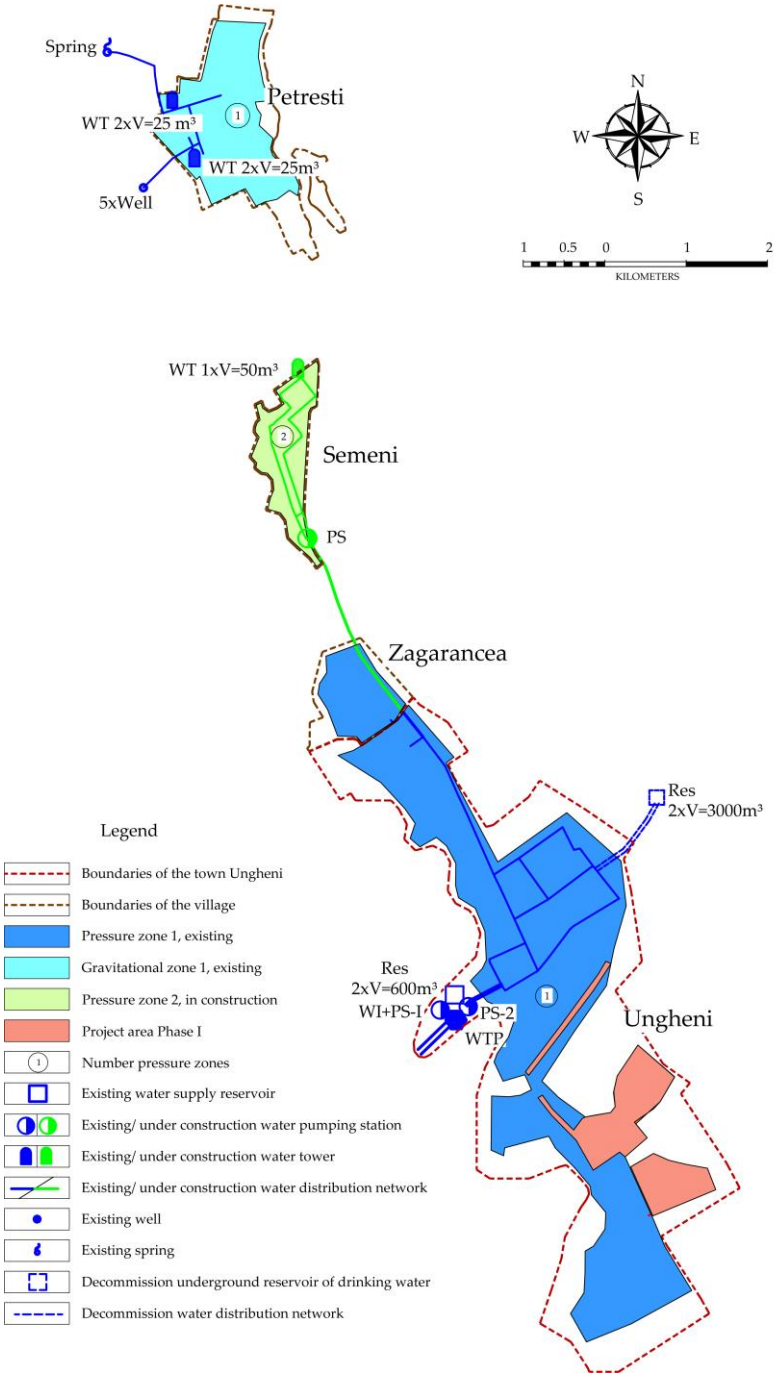
- Rehabilitation of the water distribution network in the town of Ungheni–12,235 m;
- Extension of the water distribution network in the town of Ungheni - 5,435 m.

Wastewater system:

- Extension of the sewerage network in the town of Ungheni – 5,589 m.

The scheme of existing and proposed water supply system in the town of Ungheni Zagarancea, Semeni and Petresti localities (Phase 1) and is presented in the Figure 8-3.

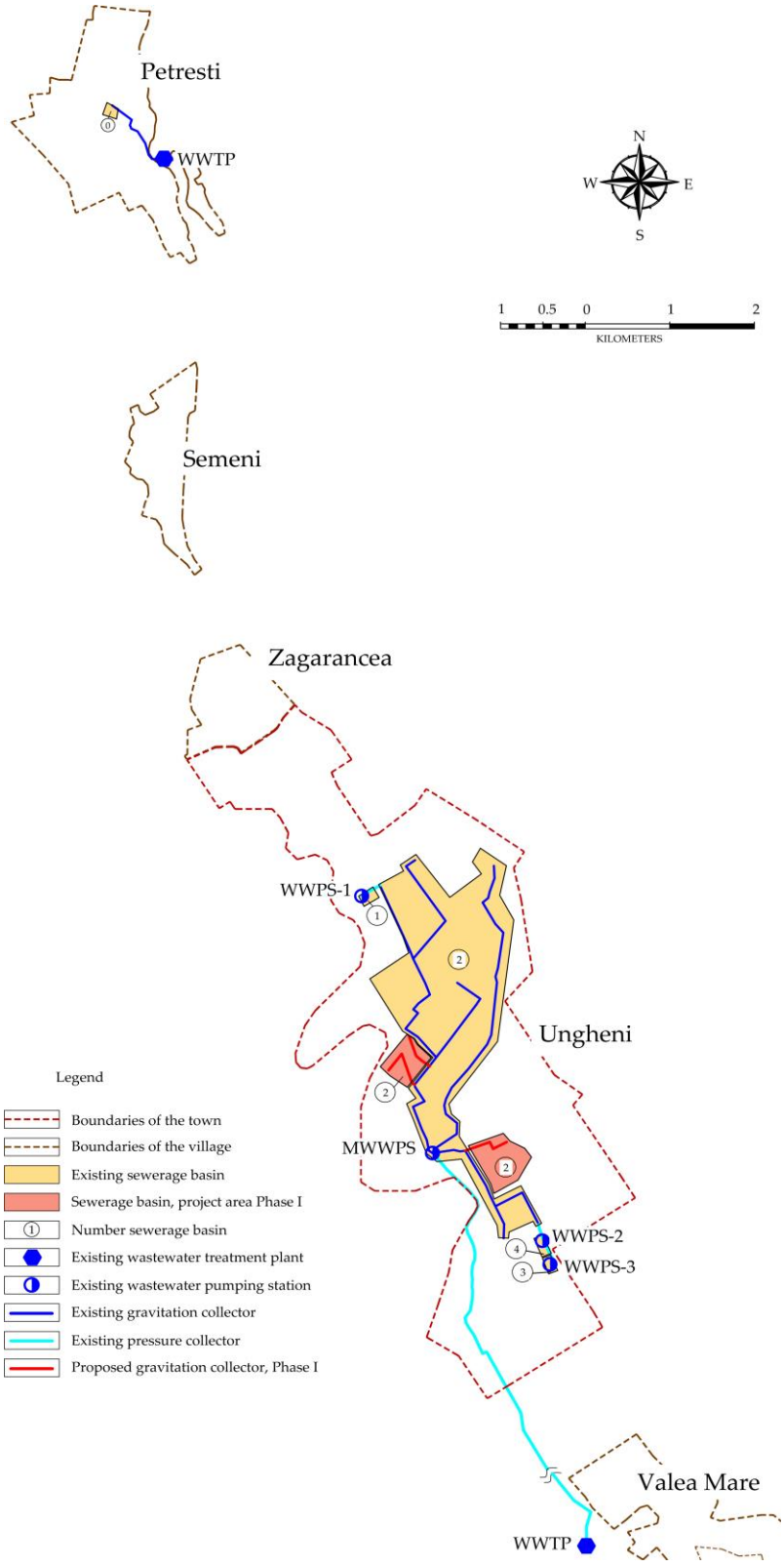
Figure 8-3: Scheme of existing and proposed water supply system in the town of Ungheni and Zagarancea, Semeni and Petresti villages (Phase 1)



Source: GIZ/MLPS

Scheme of existing and proposed wastewater system in the town of Ungheni and Zagarancea, Semeni and Petresti localities (Phase 1) is presented in the Figure 8-4:

Figure 8-4: Scheme of existing and proposed wastewater system in the town of Ungheni[66]



Source: GIZ/MLPS

[66] (Phase 1)

8.5 Project implementation stages

With regard to potential environmental impacts it needs to be distinguished between the construction stage and the operational stage of the new WSS system. In the following the required activities for these stages are described under Environmental considerations.

8.5.1 Construction stage

In the Water Supply System the following main elements are planned:

Water supply system:

- Rehabilitation of water distribution network in the town of Ungheni – 12,235 m;
- Extension of water distribution network in the town of Ungheni – 5,435 m.

Water Supply Sector:

- Rehabilitation of the water distribution network in the town of Ungheni–12,235 m;
- Extension of the water distribution network in the town of Ungheni- 3,460 m.

The new pipes for installing will be polyethylene. Pipes of smaller diameter will be laid for rehabilitation and extension of the distribution network in the Ungheni town. The pipes will be will be laid along existing streets, lanes or other linear structures, thus keeping the involved environmental impacts and land acquisition requirements to a minimum.

The typically depth of trench will be 1.5–2.5 m depending on topographical conditions. The width of the trench in average will vary between 0.6 and 1.0 m depending on the pipe's outside diameter, type of soil and groundwater level. After construction part of trench will be occupied by pipe and sand layer, and trench is refilled with the excavated material.

In the wastewater system the following main elements are planned:

- Extension of the sewerage network in the town of Ungheni – 5,589 m.

Construction practices for these works are described in the following.

The sewer pipes will be laid along existing streets, lanes or other linear structures, thus keeping the involved environmental impacts and land acquisition requirements to a minimum. The typically depth of the trench will be between 1.5–4.0m depending on topographical conditions. The width of the trench will be 0.8–3.0m. Excavated soil will be placed alongside the open trenches, and the pipes will be placed in the trench. Pipes will be joined, after which excavated soil will then be replaced on beneath and sides. The trench will be refilled with excavated soil and sand and compacted manually.

Water needed for civil works comprises of potable water and construction (technical) water: potable water shall comply with the national quality standards and shall not compete with the needs of the local population. Construction water and water to be used for dust suppression measures may be taken from the Prut River or other surface waters in the vicinity of construction site.

Transportation routes: construction site is accessible via the European Road E58 and regional/local roads.

For mitigation measures please refer to subsequent chapters.

8.5.2 Operation stage

Water supply infrastructure will require repair and maintenance activities like detection and repair of leaks. Since good quality pipes are being used breaks are very rare, and leaks will be mainly limited to joints between pipes. Repair work will be conducted in the same way the pipe was laid, after locating the leaking section.

The sewerage infrastructure will require repair and maintenance activities including cleaning and regular inspection. Since good quality pipes are being used sedimentation on the pipes will be very rare, the repair work will be conducted in the same way the pipe was laid. The extension of the wastewater system will improve the environmental situation in the respective area allowing to increase in the collected wastewater flow.

No significant environmental impacts are associated with the operation of the new water supply and wastewater system.

8.6 Environmental and social baseline conditions

8.6.1 Physical environment

The project area is located on the old platform of the Central Moldovan Plateau. This territory forms the southern part of the Middle Prut river lowland (valley). The study area is entirely located in the basin of River Prut. Quaternary, alluvial deposits are exposed in the floodplain of Prut River near Ungheni. The surface layer is represented by water saturated silty sands with limestone fragments and broken seashell. Sand deposits reach a thickness of 7 - 8m.

The lands in the environs are characterised by naturally productive chernozems which support substantial and diverse agricultural production.

The lower reaches of the Prut River valleys have saline and marshland soils. The excessive use of chemical fertilizers, pesticides and herbicides during the Soviet period has generally resulted in significant contamination of the soil and groundwater.

The region has a temperately continental climate with an average temperature in summer (21-21.5°C) and winter (- 4.5-5°C) and characterised by erratic rain-fall and extended droughts. Mean annual rainfall is in the order of 550 to 625 mm. Most of that precipitation occurs during the warmer summer months. Heavy showers coupled with irregular surface often cause erosion problems and siltation of river Prut.

Winds tend to mainly come from northwest or southeast.

8.6.2 Biological environment

Geographically the Project is located within the floodplain of the River Prut. Most of the area is built up but there are also sections with river meadows and agricultural use alongside the Project area. The banks of Prut River are usually bordered by willows (Salix spec.). On some of the surrounding pastures along the project area and agricultural land can still be found specific grass species, such as Wolga Vescu (Festuca valesiaca) and different species of grass (Stipa capillata, lessingiana S. and S. pulcherima).

The Prut River floodplain is a habitat for a diverse fauna. It is of special significance for birds, amphibians and reptiles.

Mammal species that *potentially occur in the wider vicinity of the study area include the red deer (Cervus cervus), the fox* (*Vulpes vulpes*), the wild boar (*Sus scrofa*), the beech

marten (*Martes foina*), and the roe deer (*Capreolus capreolus*). Within the shore-line of the river Prut Amphibians and Reptiles are expected to occur including the common spadefoot (*Pelobates fuscus*), the green toad (*Bufo viridis*), the crested newt (*Triturus cristatus*), the tree frog (*Hyla arborea*) and the grass snake (*Natrix natrix*).

8.7 Environmental impacts and mitigation measures

In the below table the environmental impacts that are associated with the Project implementation are described together with the identified mitigation measures that need to be implemented for reducing the impacts to acceptable levels. The environmental impacts and mitigation measures are described for the 3 different phases of Project implementation, the pre-construction, construction phase and the operation phase.

Ultimately, all proposed measures for impact avoidance or mitigation that relate to construction need to be incorporated into the bidding or contract documents thereby becoming binding elements of the construction and construction supervision contracts.

Table 8-1: Environmental impacts and mitigation measures

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
Pre-Construction				
Possible removal of terrestrial habitat. Loss of vegetation and top soil	Construction site rehabilitation by contractor after finalisation of construction activities. Vegetation planting and stabilisation of site, including replacement of any native plant species that were removed during construction activities.	Construction Contractor	Construction and labour camp, storage area. trench for pipes	Part of construction cost
Construction				
Ambient Air and Local Dust	• Cover or damp down by water spray on the excavated mounds of soil to control dust generation; • Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process; • Bring the material (aggregate and sand) as and when required; • Ensure speedy completion of work and proper site clearance after completion; • Damp down unsatisfied /bad condition roads to avoid dust generation while using for transport of waste/material; • Use tarpaulins to cover loose material that is transported to and from the site by truck; • Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside barricaded area; • Clean wheels and undercarriage of haul trucks prior to leaving construction site; • Don't allow access in the work area except workers to limit soil disturbance and prevent access by fencing.	Construction Company	Excavation areas for trenches in the town of Ungheni	Part of construction cost
	The Contractor shall coordinate with local Traffic Management Department to minimise construction traffic impact in the following topics: • Temporary parking restrictions; • Pedestrian and cyclist diversion routes where construction prevents access; • Temporary traffic signals; • One way scheme; • Maintaining local residential access at all times; • General traffic diversion routes where roads are closed; • Sound barriers should be erected at schools and hospitals if the distance to the construction site is less than 50 m.	Contractor	Transportation routes of construction material	Part of construction cost
Noise Pollution	• Maintain machinery and vehicle silencer units to minimise noise;	Construction	Excavation areas	Part of con-

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
	• Keep noise generating activities associated with construction activities to a minimum and within working hours; • Notify the residents close to the Project area prior to commencement of the construction phase; • Vehicles and machinery that are used intermittently should not be left idling condition for long period of time; • Equipment used on site will be quietest reasonably available; • Haul routes for construction traffic entering and leaving the site will be selected to ensure noise levels at noise sensitive receptors are kept at a minimum.	Contractor	for trenches in the town of Ungheni in Ungheni	struction cost
Impact on surface water bodies due to construction	• In case of heavy rain, protect open trenches from entry of rain water by raising earthen bunds with excavated soil; • Confine construction area including the material storage (sand and aggregate) so that runoff from upland areas will not enter the site; • Ensure that drains are not blocked with excavated soil.	Construction Contractor	Project area	Part of construction cost
Soil Contamination	• The contractors will be required to instruct and train their workforce in the storage and handling of materials and chemicals that can potentially cause soil contamination; • Solid waste generated during construction and at campsites will be properly treated and safely disposed of only in demarcated waste disposal sites; • Construction chemicals will be managed property; • Clearly labelling all dangerous products; • Fuel tanks (diesel or oil) should be placed in a concrete pool with perimeter walls that are at least 1.0 m high; • A proper floor drain should be installed on the slab of the concrete pool for safely discharging the leakages.	Construction Contractor	Construction site, Camp	Part of construction cost
Impact on Flora and Fauna	• Avoid tree cutting; • In unavoidable cases, plant two trees of same species for each tree that is cut for construction; • The trench shall not be kept open in the night/after working hours. This will avoid any safety risk to people, domesticated, stray or wild animals; • The Contractor shall ensure that the work site be kept clean, tidy and free of rubbish that would attract animals.	Construction Contractor	Construction site in Ungheni town	Part of construction cost
Impact on Traffic	• Inform all residents and businesses about the nature and duration of any work well in advance so that they can make necessary preparations if necessary;	Construction Contractor	Construction site, Access Roads	Part of construction cost

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
	• Provide wooden walkways/planks across trenches for pedestrians and metal sheets where vehicle access is required; • Increasing workforce to complete the work in minimum time in these stretches; • Initial situation of private properties has to be re-established after construction.			
Hazardous Materials	• Comply with all national, regional and local legislation with regard to the storage, transport, use and disposal of petroleum, chemical, harmful and hazardous substances and materials; • Establish an emergency procedure for dealing with spills or releases of petroleum; • Storage of all hazardous material to be safe, tamper proof and under strict control; • Petroleum, chemical, harmful and hazardous waste throughout the site must be stored in appropriate, well maintained containers; • Any accidental chemical / fuel spills need to be corrected immediately.	Construction Contractor	Construction site Storage Area	Part of construction cost
Solid Waste	• Place for disposal of waste must be demarcated; • The waste may not be stored nearby drainage structures; • Waste has to be immediately removed from the working sites; • Waste has to be placed in secondary protective basins; • Waste may only be transferred to a certified contractor. The personnel involved in the handling of hazardous and non-hazardous waste will undergo specific training in: • Waste handling; • Waste treatment; and • Waste storage.	Construction Contractor	Construction site, waste storage area, camp site	Part of construction cost
Loss of top soil	Top soil of about 0.3 m shall be removed and stored separately during excavation work, and after pipeline construction the same soil shall be replaced on the top.	Construction Contractor	Construction site	Part of construction cost
Erosion due to excavation/refilling	Ensure proper compaction of refilled soil. There shall not be any loose soil particles on the top; the material shall be refilled in layers and compacted properly layer by layer.	Construction Contractor	Construction site	Part of construction cost
Impact on air quality due to emissions from construction equipment/vehicles	Ensure that all equipment & vehicles used for construction activity are in good condition and are well maintained. Ensure that all equipment & vehicles confirm to emission and noise norms.	Construction site in the town of Ungheni and access roads	Ungheni town	Part of construction cost
Socio-economic benefits from	To the extent possible labour force should be drawn from the local com-	Construction	All construction	Part of con-

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
employing local people in construction work	munity	Contractor	sites	struction cost
Safety risk – public and worker	• Follow standard and safe procedures for all activities – such as provision of shoring up deep trenches (>2 m); • Exclude public from the site – enclose construction area, provide warning and sign boards, security personnel; • Provide adequate lighting to avoid accidents; • Ensure that all workers are provided with and use appropriate Personal Protective Equipment - helmets, hand gloves, boots, masks, safety belts (while working at heights etc.); • Maintain accidents records and report regularly; • Trench construction shall be taken up in small segments, so that work (excavation, pipe laying and refilling) in each segment is completed in a day. No trenches shall be kept open in the night/after work hours.	Construction Contractor	All construction sites	Part of construction cost
Historical, archaeological chance finds during excavation	• Contractor shall put in place a protocol for conducting any excavation work, to ensure that any chance finds are recognised and measures are taken to ensure they are protected and conserved. This should involve: • Having excavation observed by a person with archaeological field training; • Stopping work immediately to allow further investigation if any finds are suspected; • Calling in the state archaeological authority if a find is suspected, and taking any action they require to ensure its removal or protection in situ.	Construction Contractor	All construction sites	Part of construction cost
Operation Phase				
Potential waste water discharges	Regular monitoring and control of pipe system regarding leakages	State Environmental Inspection of the Ministry of Environment		
Risk of delivery of unsafe water to consumers	• Conduct regular water quality monitoring; • Develop & implement water quality monitoring program for distribution system; • Establish a water quality laboratory as part of the project, with adequate building, equipment and trained personnel.	State Environmental Inspection of the Ministry of Environment and Center of Public Health	Water intake, transmission main, distribution network	Part of operation cost

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
		of the Ministry of Health		
Disturbance/ nuisance/ noise due to operation activity including haulage of waste, dewatered sludge	• Plan transportation routes in consultation with Municipality and Police; • Schedule transportation activities by avoiding peak traffic periods; • Use tarpaulins to cover loose material that is transported to and from the site by truck; • Educate drivers: limit speed between 20-25 km/h and avoid use of horn in the town; • Provide prior information to local people about work.	ME “Apa - Canal”	WWTP, access roads	
Influx of insects, rodents	Regular waste and sludge disposal on landfill	State Environmental Inspection of the Ministry of Environment and Centre of Public Health of the Minis-try of Health	Sewerage network and WWTP	Part of construction costs

8.8 Social and gender assessment of WSS project in Ungheni

8.8.1 Social and gender issues in Moldova and in WSS project area

The main gender characteristics for the Republic of Moldova, including for the Project area, are as follow:

- **The population of the Republic of Moldova has decreased in recent years**. As of 1 January 2015, the official population of the Republic of Moldova was 3,555,159 persons, with 4,382 persons less than 2012. The population decrease is determined by the negative natural growth rate and the on-going out-migration processes. Nonetheless, in Ungheni rayon the population grew by 164 persons: from 117,222 in 2012 to 117,386 persons in 2014.[67] The population of Ungheni town was 38,400 in 2014, which represented 32.7% of the total population of Ungheni rayon and 1.07% of the total population of the Republic of Moldova;
- **Women are predominant in both the general population and the population of the Project area**. The gender distribution of the population in the country has been practically the same for a long period of time, with small deviations: around 52% of women and 48% of men. In 2014 in the Republic of Moldova the break-down of the population by gender was: 51.9% women and 48.1% men. In Ungheni rayon, the gender distribution was the following: women – 52% and men – 48%.[68] In Ungheni town women constituted 53.5% and men 46.5% in 2013;
- **On average, at the national level women have higher life expectancy at birth than men by 7.9 years in 2014**.[69] In 2014 the average life expectancy at birth was 67.5 years for men and 75.4 years for women. Because of the differentiated level of mortality, the average duration of life of inhabitants at birth in the urban areas is higher than in rural areas, respectively by 4.6 years for men and 3.5 years for women. In Ungheni rayon, the average duration of life is similar to the average per country (men – 66.9 years, women – 75.8 years);[70]
- **In 2015, the average age of women (39.1 years) was higher than the average age of men (35.8 years).** The average age at the national level increased from 36.7 years in 2012 to 37.5 years in 2015. In Ungheni rayon the average age increased from 35.4 years in 2012 to 35.8 years in 2014 while for the town the figures are 35.8 in 2012 and 36.6 in 2014. The average age by gender for the Project area is lower than that at national level: men – 34.6 years, women – 38.3 years;[71]
- **The employment rate among women is lower** (37.4%) **compared to that for men** (42.1%) in 2014. For the Centre Statistical Region the employment rate for men was 38.8% while for women – 34.9%. Women with higher levels of education are more likely to participate in the labour market. Therefore, the employment rate is greater among women with higher education (53%), followed by those with specialised secondary education (48%), secondary professional education (43%) secondary school (33%) and gymnasium (27%).[72] The analysis of

[67] Statistica teritoriala, 2014; Statistical databank, NBS website.

[68] Statistica teritoriala, 2014.

[69] http://www.statistica.md/newsview.php?l=ro&id=3814&idc=168

[70] Statistica teritoriala, 2014.

[71] Ibid.

[72] Statistical databank, NBS website.

statistical data also shows that the female employment rate depends on various factors, including whether they have children under 16. The employment rate of women with children gradually decreases depending on the number of children: from 52.2% for women with one child up to 43.9% for women with three or more children. This rate of employed women also depends on the children' age, the biggest differences being registered to persons with children up to two years old, the employment rate being 15.3% for women compared to 53% for men;[73]

- **There are significant discrepancies in the employment of women and men in different spheres**.
  There is a larger share of women employed in the service sector (60% compared to 40% of men) but they are less in the agricultural (44%), industry (44%) and constructions (9%) sectors. Women are predominant in economic activities like hotels and restaurants (73.7%), education (81.5%), health protection (81.3%) and trade (56.6%);[74]
- **Women are mostly employed in low-paying jobs and occupy lower positions in the job hierarchy where they are employed**.[75] The statistical data shows that women are dominant in the group of specialists with higher levels of qualification (65% women and 35% men), in administrative officials (83% women and 17% men) and in workers in services and trade (77% women and 23% men). However, men constitute 56% of the total managers of all levels. The gender differences for the top leaders of economic and social units are even more pronounced. The gender ratio among employers is one woman to four men regardless of ownership of the unit they lead;[76]
- **Unemployment affects men more than women**. The unemployment rate at the country level was 3.9% in 2014, compared to 5.6% in 2012[77], the rate among unemployed men being higher (4.6%) compared to women (3.1%). In 2014, in Ungheni town the unemployment rate was 2.73% compared to 3.9% at the national level;
- **At the national level, the average salary for women is 11.6% less than the average salary for men**. Discrepancies between the salaries of women and men decreased in the period 2003-2013; however, this trend has slightly reversed since then. Thus, the monthly average earnings for women amount to 88.4% of the average salary for men in 2013; in monetary terms, the discrepancy constituted 454 MDL on average (according to NBS). This gap persists because women, most often, either work in lower-paid sectors – education, healthcare or services – or occupy lower-paid positions. For Ungheni rayon the gender pay gap was 95.1% or a difference of 152 MDL between the salary of men and women;[78]
- **Women spend more time on unremunerated household work than men**. According to statistical data, unremunerated work in Moldova constitutes on average 3.9 hours per day per person (in urban areas – 3.8 hours, in rural areas – 4.9 hours). Women spend on average 4.9 hours per day (in rural areas – 5.9 hours

[73] Statistica Moldovei, 2014. Portretul statistic al barbatilor si femeilor in Republica Moldova.

[74] Ibid.

[75] http://www.undp.md/mdg/MDG3/gender.shtml

[76] Statistica Moldovei, 2014. Portretul statistic al barbatilor si femeilor in Republica Moldova.

[77] Statistical databank, NBS website.

[78] Promote gender equality and empower women, UNDP Moldova; Statistica teritoriala 2014.

and in urban areas – 4.4 hours) and men – 2.8 hours per day (in rural areas – 3.9 hours and in urban areas – 2.7 hours);[79]

- **The average size of female pensions is less than the average size for men**. The discrepancies in the remuneration of men and women influence also the size of pensions for statutory retirement. In 2013, the average woman's pension was 16% lower than the average man's pension. Furthermore, the average pension for employees in the non-agricultural sector is higher compared to agricultural sector: in the case of women, the difference is 20.7% while for men the gap is higher – 45.7%;[80]
- **The average nominal monthly earning per employee** in Ungheni in 2013 was 3,046 MDL (compared to 3,765.1 MDL in the country overall), with 444 MDL more than in 2011; this constitutes 82.9% of the average salary in the country overall. According to the deprivation index of the small areas calculated in 2012, out of 35 LPAs of 2nd level, Ungheni rayon is ranked seventh for the index of multiple deprivation and seventh in income deprivation specifically;[81]
- **More women than men are enrolled in the higher education system**. In 2014, from the total number of graduates from higher education institutions, women represented about 60.5% compared to 39.5% of men (statistical databank). There are gender discrepancies at the level of specialities with a significant share of women in the teaching staff (over 80%). The almost exclusive domination of primary education by women confirms that there are stereotypes according to which women are those who must educate and take care of children. The poor remuneration in education and the exodus of teachers abroad are also worth mentioning;[82]
- **Domestic violence and human trafficking have gender dimensions and remain among the largest problems for women in Moldova**. According to data from the Ministry of Internal Affairs on combating human trafficking, during 2012 the following was recorded: 151 criminal cases for human trafficking offences, with 266 identified victims out of which about 65% are women and 35% are men. The purpose of trafficking varied as following: a) 126 victims were sexually exploited (100% women); b) 126 victims were exploited in labour (37 women, 89 men); and, c) 13 victims were exploited in begging (6 women, 7 men);[83]
- **Women in Moldova are less represented in politics than men**, constituting 19.8% of the members of Parliament, 18.6% of councillors in rayonal councils, 29.9% in local councils, and 20.5% of the mayors. After the local elections in June 2015, the Ungheni Rayon Council comprised 35 councillors, of whom eight (23%) are women.[84] Regarding the local council of Ungheni town, of 27 councillors four (22%) are women;[85]

[79] Biroul National de Statistica, Chisinau 2013. Utilizarea timpului in Republica Moldova. Sinteza.

[80] Statistica Moldovei, 2014. Portretul statistic al barbatilor si femeilor in Republica Moldova.

[81] In order to establish the deprivation level of the locality in a certain field, the city halls were arranged in the order of rank obtained: first rank indicates the most deprived community (the poorest, lacking certain services), rank 35 – the lowest deprivation (the wealthiest).

[82] Government decision no.933 from 31.12.2009 on approval of the National Programme on ensuring gender equality in the Republic of Moldova during the period 2009-2015.

[83] CEDAW. Replies of Moldova to the list of issues.

[84] Web page of the Rayonal Council Ungheni: http://www.crungheni.md/Consiliu

[85] Web page of the Town Hall Ungheni: http://ungheni.md/category/lista-membrilor/

- **Poverty in Moldova continues to affect vulnerable population categories: traditional families who depend on farming, older people, people without education and professional skills, and households consisting of several children**. Although the poverty rate in Moldova decreased from 26.4% in 2008 to 12.7% in 2013, it continued to be high in rural areas (18.8%), in households with three and more children (34.6%), in households with the head aged over 65 (18%), in households where the head has low level of education (no education – 40.8%; primary/gymnasium education - 24.1%), among agricultural workers (31.3%), self-employed (21.7%) and retired persons (14.7%). The proportion of the poor population that lives in rural areas increased from 75.6% in 2006 to 84% in 2013.[86] In Ungheni town, the vulnerable families constituted 4% of the total families in 2012 and included 150 families with persons with disabilities, 465 families – with one parent, 56 families – with three and more children, 97 families –that have children under the tutorship (IDAM, 2012);[87]
- **The high poverty level limits the access of vulnerable groups to goods and services for a decent standard of living**. Expenditure for the purchase of food and communal services' payments absorb approximately 73% of the budget of poor families, a fact which limits their access to other goods and services necessary for a decent living. According to the Household Budget Survey (2013), in the 1st quintile, only 35.5% of population have access to water supply services, only 7.33% of the population have access to a centralised sewage system, and only 7.4% of the population have access to the toilet inside their houses. The poor, in comparison with the wealthy group of population spend 20 times less for education, 11 times less for leisure activities, six times less for clothes and shoes and five times less for health services.[88]

Based on the analysis of social and gender dimensions in the Republic of Moldova and in the Project area, the conclusion is that, despite the adoption of the legal and regulatory framework on ensuring gender equality, and the relatively high ranking of Moldova in the Global Gender GAP Index 2015 (26)[89] there are still many problems faced within its practical implementation in the country, including in the Project area, including among others:

- Employment inequalities;
- Under-representation of women in decision-making positions;
- Salary and pension disparity between women and men;
- Engagement of women in unremunerated household work etc.

Poverty in Moldova still affects the most vulnerable groups of population (families who depend on farming, older people, people without education and professional skills, households consisting of three and more children) and limits their access to goods and services, like water supply and wastewater, centralised heating systems, education and health. Given this situation, social and gender mainstreaming is an essential component of the implementation of WSS project in Ungheni town. The methodological approach and the description of the pilot gender study (performed for the town of Straseni and considered to apply also for the FS of Ungheni) are presented in Annex 8.2.

[86] Raport privind saracia in Republica Moldova, 2014.

[87] Ministry of Economy, National Bureau of Statistics.

[88] Raport privind saracia in Republica Moldova, 2014.

[89] World Economic Forum. The Global Gender GAP Report, 2015 http://reports.weforum.org/global-gender-gap-report-2015/economies/#economy=MDA

9 Procurement strategy and implementation plan

9.1 General

The following chapter describes all actions for the procurement of services and works for a successful and efficient project implementation including an envisaged time schedule. The project measures for Ungheni in Phase 1 comprise capital investments and technical assistance that need to be procured and implemented.

The works and services to be procured for the implementation of Phase 1 measures are as follows:

Technical assistance components:

- Design, engineering and supervision for Phase 1 investments;
- Corporate Development Programme;
- Stakeholder Participation Programme;
- Water Supply Network Analysis and Water Loss Reduction Programme;
- Medium to Long-term Sanitation Study.

Capital investments and goods:

- Rehabilitation of 12.2 km water distribution network in the town of Ungheni;
- Extension of 5.4 km water distribution network in the town of Ungheni;
- Extension of 5.6 km sewerage network in the town of Ungheni;
- Equipment and tools for operational performance improvement (water supply and wastewater).

9.2 Procurement plan

In line with Moldova's policies and rules, the required public sector services and works contracts shall be awarded on the basis of open competitive tendering, which should assure a maximum of competition and transparency.

The fundamental requirements of open competitive tendering are:

- Be open to all qualified and interested bidders;
- Be advertised locally (and internationally, when required);
- Have objective qualification criteria;
- Have neutral and clear technical specifications;
- Have clear and objective evaluation criteria;
- Be awarded to the least-cost provider, without contract negotiations.

9.2.1 Procurement strategy

It is proposed to arrange procurement into four different contracts:

- Design & Engineering Contract;
- Works Contract;

- Supply Contract;
- Technical Assistance.

9.2.1.1 Design & engineering contract / technical assistance

Design and Engineering is proposed to be procured separately from the remaining Technical Assistance Tasks (Corporate Development Programme, Stakeholder Participation Programme, Water Supply Network Analysis and Water Loss Reduction Programme, Medium to Long-term Sanitation Study) as the requirements for the consulting company are different.

9.2.1.2 Capital investment and goods

The strategy is to keep contract values at a size to attract international contractors as well as local contractors. Due to the similarity of the works (mainly network rehabilitation and extension; investment amount of chlorination equipment will be too small to be procured in a separate contract) and the relatively small total investment value it is proposed to combine all capital investment measures in one contract. The Conditions of Contracts for the works contracts should be based on “FIDIC Conditions of Contract for Construction for Building and Engineering Works Designed by the Employer (FIDIC Red Book)”.

Although the contract value will be relatively small, the equipment for operation and maintenance improvement is proposed to be procured under a supply contract (shopping).

The summary of cost breakdown per contract and the procurement plan below, lists the different contracts to be procured during the entire project including, project component, costs and financing, type of contract and the procurement method.

Table 9-1: Summary cost breakdown per contract

N°	Component	Total project costs	Design & Engineering	Construction works	Supply contract	Technical assistance
1	Water supply					
1.1	Rehabilitation of the water distribution network in the town of Ungheni	971,260		971,260		
1.2	Extension of the water distribution network in the town of Ungheni	393,876		393,876		
2	Wastewater					
2.1	Extension of the sewerage network in the town of Ungheni	1,211,483		1,211,483		
3	Equipment and tools for operational performance improvement (water supply and wastewater)	200,000			200,000	
4	Technical assistance					
4.1	Design, engineering and supervision for Phase 1 investments (12% of investment costs)	333,194	333,194			
4.2	Technical assistance (Corporate Development Programme, Stakeholder Participation Programme, Water Supply Network Analysis and Water Loss Reduction Programme, Medium to Long-term Sanitation Study)	300,000				300,000
5	Contingencies (10% of 1+2+3+4)	340,981	33,319	257,662	20,000	30,000
GT	**Total costs for per contract**	**3,750,795**	**366,514**	**2,834,281**	**220,000**	**330,000**

Table 9-2: Procurement plan

N°	Description	Estimated contract value[90], EUR	Contract type	Procurement method
1	Design, engineering and supervision for Phase 1 investments	366,514	Consulting services	Competitive
2	Construction works: Rehabilitation and extension of water supply network and sewerage network in Ungheni Town	2,834,281	Works	Open
3	Supply of equipment for Operational performance improvement	220,000	Supply of goods	Shopping
4	Technical assistance: Corporate Development Programme, Stakeholder Participation Programme, Water Supply Network Analysis and Water Loss Reduction Programme, Medium to Long-term Sanitation Study	330,000	Consulting services	Competitive
GT	**Total Amount**	**3,750,795**		

Source: GIZ/MLPS

9.3 Project implementation plan

9.3.1 Key steps of project implementation

Key steps in project implementation will be the following:

9.3.1.1 Concluding of funding arrangements

In order to conclude on the funding arrangements the following will be necessary:

- Agreement of all relevant stakeholders (i.e. local authorities, ministries, relevant funding institutions) on project volume, funding sources, financing plan;
- Conclusion of funding agreements as basis for project start.

9.3.1.2 Setting-up of project implementation structures

In order to establish a sound and efficient project steering and project management a proper project implementation structure shall be established by the client of the project (the Employer). The client will either[91] be the LPA Ungheni, which is the owner of the assets or ME 'Apa -Canal' Ungheni, which manages and operates these assets. Further, relevant stakeholders shall be involved in the project implementation structure in order to have coordinated decisions and processes.

The project implementation shall be managed by a Project Manager (PM), appointed by the Employer.

The main tasks of a project implementation structure are:

- Establish adequate conditions for operation, location, and endowment;
- Selection of a qualified staff;
- Develop implementation plan for the project;
- Tendering process for services and works contracts;

[90] Including Contingencies

[91] Depending on the funding arrangement (donor and type of contract)

- Monitor the implementation of the service and works contracts;
- Organise in due time all required licenses, permits and conclusions;
- Financial management and reporting;
- Maintain records for all the documents and communications;
- Monitor of disbursements and reporting to the funding institution.

9.3.1.3 Procurement and implementation of consulting services

The first key activity directly related with project implementation will be the timely and successful procurement of the required consulting services for detailed design, tendering and construction supervision of the identified rehabilitation works, supplies and their installation.

The steps in regard to procurement and implementation of the consulting services (the Engineer) will be:

- Issuing the Request for Proposal;
- Technical and financial evaluation of the received proposals;
- Recommendation for consultant selection;
- Contract award for consulting services;
- Implementation of consulting services.

9.3.1.4 Procurement and implementation of works and supplies contracts

In cooperation with the Engineer the Employer (project implementation structure) will hold responsible for the procurement process for the works contracts comprising following steps:

- Invitation for tendering and issuing of tender documents;
- Tender period;
- Receiving of bids;
- Bid Evaluation and preparation of evaluation report;
- Contract award for work contracts;
- Implementation of works contract;
- Defects liability period.

9.3.1.5 Project monitoring and evaluation

Project monitoring during implementation of the project and internal as well as external evaluation at the end of the project implementation period shall be carried out:

- Monitoring is an instrument for systematic collection of data on specific indicators to provide the management and the main stakeholder relevant information on the project progress and the achievement of objectives;
- Evaluation is the systematic and objective assessment of the on-going or completed project, its design, implementation and results. The aim is to determine the relevance and fulfilment of objectives, development efficiency, effectiveness, impact and sustainability.

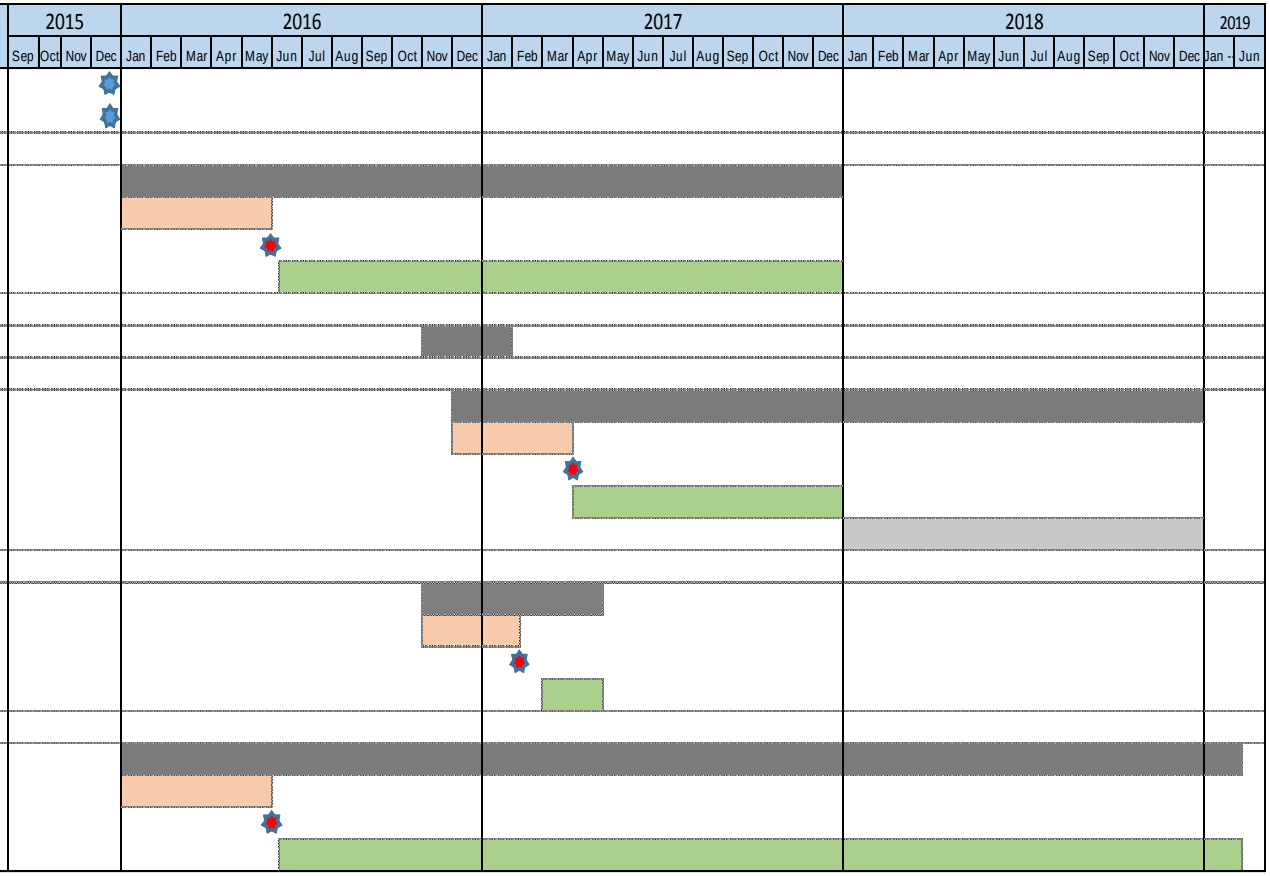
For both instruments the setting of targets and indicators as well as the methodology and administration of data collection need to be organised.

9.3.2 Project implementation plan

All key data for the above mentioned implementation steps are based on having the funding arrangement concluded by end of 2015. The table below gives the project implementation plan for the proposed measures.

Table 9-3: Project implementation plan

No	Item	start date	end date
1	Concluding of funding arrangements*	31.12.2015	
2	Setting-up of project implementation structures	31.12.2015	
3	Design and engineering	01.01.2016	01.12.2017
3.1	Procurement of consulting services	01.01.2016	30.05.2016
3.2	Contract award for consulting services	30.05.2016	
3.3	Implementation of consulting services	09.06.2016	01.12.2017
4	Obtaining required conclusions and permits	01.11.2016	30.01.2017
5	Works contracts	01.12.2016	31.12.2018
5.1	Procurement of works	01.12.2016	31.03.2017
5.2	Contract award for works contracts	31.03.2017	
5.3	Implementation of works contract	31.03.2017	31.12.2017
5.4	Defects liability period	01.01.2018	31.12.2018
6	Supply contracts	01.11.2016	30.04.2017
6.1	Procurement of equipment and tools	01.11.2016	31.01.2017
6.2	Contract award for the supply contracts	31.01.2017	
6.3	Delivery of goods	01.03.2017	30.04.2017
7	Other technical assistance components	01.01.2016	09.06.2019
7.1	Procurement of consulting services	01.01.2016	30.05.2016
7.2	Contract award for consulting services	30.05.2016	
7.3	Implementation of consulting services	09.06.2016	09.06.2019



* In case the conclusion of funding arrangements and/or the setting up of the project implementation structures are delayed all following activities will be postponed accordingly

Source: GIZ/MLPS

10 Risk analysis

10.1 General

The following chapter applies and adapts the methodology for qualitative risk analysis in the new guide to cost-benefit analysis published by the European Commission[92].

According to the Guide, a qualitative risk analysis includes the following elements:

- "A list of adverse events to which the project is exposed;
- A risk matrix for each adverse event indicating:
  - The possible causes of occurrence;
  - The link with the sensitivity analysis, where applicable;
  - The negative effects generated on the project;
  - The (ranked) levels of probability of occurrence and of the severity of impact;
  - The risk level.
- An interpretation of the risk matrix including the assessment of acceptable levels of risk;
- A description of mitigation and/or prevention measures for the main risks, indicating who is responsible for the applicable measures to reduce risk exposure, when they are considered necessary[93]."

Further, the Guide continues that "according to the CBA methodology, as described in Annex III to the Implementing Regulation on application form and CBA methodology, the probabilistic risk analysis is required where the residual risk exposure is still significant. In other cases it may be carried out where appropriate, depending on project size and data availability[94]". Given that the project at hand entails "no regrets" measures in the first phase of a short-term priority investment programme (PIP), which in turn is part of a long-term investment plan, the residual risk exposure is not expected to be significant. Further, the project size, while above the threshold of a typical water and wastewater sector project in the Republic of Moldova, is below any objective measure of a major project. Therefore, a qualitative risk analysis is deemed sufficient for the present study.

10.2 Assumptions

A number of assumptions related to the project are important to its success. These assumptions serve to acknowledge the dependencies, potential points of weakness, and risks associated with the project:

- The per capita water consumption will increase, as provided in Chapter 5-4 Water demand and wastewater flow projection;
- The connection rate to the water systems will increase as a result of the investments and technical assistance;
- The operators will implement unified tariffs for the entire area of their operations;

[92] European Commission, Guide to Cost-Benefit Analysis of Investment Projects, Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

[93] Ibid, p 69

[94] Ibid, p. 71

- As a target for the tariff strategy, we have considered that the affordability ratio should be somewhere between 3% and 3.5% of average household income.

It is also assumed that the local authorities, as owners of the assets operated by the target water utility will commit themselves to support the implementation of the Project and the Priority Investment Programme.

It is finally assumed that the sensitivity analysis covers overall changes in investment costs, operating costs and revenues, and the overall impacts of these changes on project effectiveness. Specific aspects of risk are covered in the following risk matrix.

10.3 Identification of adverse events and risks

As an input to the risk matrix, a list of adverse events to which the project is exposed needs to be developed. The following list is offered, together with a brief description of each risk:

- Political and policy risks, including:
  - Political risk from national and local elections – possibly delaying key decisions and policy changes;
  - Political risk from interference in day-to-day operations – causing both instability and delay in implementing day to day operational decisions;
  - Financial crisis at national level – limiting domestic financing sources;
  - Legal and regulatory framework – sectoral policy: delays in establishment of new tariff policy for the regional and local water companies by the National Agency for Energy Regulation (ANRE);
  - Legal and regulatory framework – sectoral policy: Lack of regulation regarding the elaboration of PAAS (Water Supply and Sanitation plans);
  - Legal and regulatory framework – sectoral policy: Lack of legal framework on ownership of land and public infrastructure at the regional level.
- Institutional risks, including:
  - Limited understanding of functioning of commercial companies – raising risk that the water utility will not make necessary improvements to improve and expand its services;
  - Operator size – operators are rather small in Moldova, making regionalisation of services difficult;
  - Institutional capacity – weak institutional capacity on the operational level in WSS, including financial weaknesses of the institutions to attract investments, manage investments, as well as provide quality services to the population;
  - Institutional capacity – ongoing and delayed decentralisation process which leads to uncertainty in WSS sector and artificial fragmentation of the areas managed by the specialised institutions;
  - Institutional capacity – financial weakness of the institutions which increases the perceived risks of making investments in WSS.
- Operational risks, including:
  - Insufficient number of customers when networks extended – raising the risks that forecasted revenues will not be realised;
  - Lack of reliable data collection and recording on the part of the operator – increasing the number of assumptions required in any study, thus raising the

uncertainty, as well as reducing the likelihood that project impacts will be properly tracked in the future;
    - Delay in obtaining the construction permits due to delay in submission or approval by the local authorities.
- Financial risks, including:
    - Low financial absorption capacity at national and local level;
    - Lack of expressed co-financing commitment from donors for priority projects;
    - Lower number of actual consumers than estimated after the investment implementation;
    - Political interference in tariff adjustments.
- Project implementation and management risks, including:
    - Insufficient technical expertise at local level that creates serious difficulties in supplementing project teams with qualified staff;
    - Insufficient project management and implementation experience at local level;
    - Construction delays;
    - Cost overruns;
    - Outdated construction standards of materials and technologies applied for design and project implementation.

10.3.1 Risk matrix

The risk matrix is presented in the following tables.

Key:

Probability of occurrence: A. Very unlikely (0–10% probability); B. Unlikely (10–33% probability); C. About as likely as not (33–66% probability); D. Likely (66–90% probability); E. Very likely (90–100% probability).

Severity of impact: I – No relevant effect on social welfare, even without remedial actions.; II – Minor loss of the social welfare generated by the project, minimally affecting the project long run effects- However, remedial or corrective actions are needed.; III – Moderate: social welfare loss generated by the project, mostly financial damage, even in the medium-long run. Remedial actions may correct the problem; IV – Critical: High social welfare loss generated by the project; the occurrence of the risk causes a loss of the primary function(s) of the project. Remedial actions, even large in scope, are not enough to avoid serious damage; V Catastrophic: Project failure that may result in serious or even total loss of the project functions.

Table 10-1: Risk matrix, political and policy risks

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
Delay in key decisions and policy changes	n/a	National and/or local elections	Reduced project efficiency	Medium	Delay in establishing positive cash flow	D	III	High	Intensify work within partner systems to ensure policy decisions are taken in a timely manner and followed by subsequent regimes	High, but cannot be modelled
Instability and delay in implementing day to day operational decisions	Operating costs	Political interference in day-to-day operations	Reduced project efficiency	Medium	Negative	C	III	Moderate	Corporate development programme as part of technical assistance	Low to moderate
Limited availability of domestic financing sources	n/a	Financial crisis at national level	Delay in project start	Short	Delay in establishing positive cash flow and benefits to public	E	IV	Very high	Policy recommendations at national level to consolidate funding sources. Supporting unified policy to external donors	Moderate
Unclear tariff regime	Operating revenues	Delays in establishment of new tariff policy for the regional and local water companies	Reduced project efficiency and financial stability of operator	Medium	Negative	C	III	Moderate	Policy recommendations at national level; Corporate development programme as part of technical assistance	Low to moderate
Planning uncertainty	n/a	Lack of regulation regarding the elaboration of PAAS (Water Supply and Sanitation	Reduced project efficiency; project not meeting local	Medium to long-term	Negative	C	III	Moderate	Regional sector programmes; intensive cooperation with local partners to identify needs; Corporate development programme	Low

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
		plans)	needs						as part of technical assistance	
Uncertainty in ownership of assets at regional operator	n/a	Lack of legal framework on ownership of land and public infrastructure at the regional level	Reduced project efficiency and financial stability of operator	Medium to long-term	Negative	B	III	Moderate	Corporate development programme as part of technical assistance; Road map for establishment of regional operator	Low

Table 10-2: Risk matrix, institutional risks

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
operator will not make necessary improvements to improve and expand its services	Operating revenues	Limited understanding of functioning of commercial companies	Reduced operator efficiency; delays in provision of improved services	Medium to long-term	Negative	C	III	Moderate	Corporate development programme as part of technical assistance; Road map for establishment of regional operator	Low to moderate
Regionalisation of services will not be achieved	Operating revenues	Small existing operators; lack of national level policy guidance	Reduced operator efficiency; delays in provision of improved services	Medium to long-term	Negative	C	III	Moderate	Corporate development programme as part of technical assistance; Road map for es-	Low to moderate

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
									tablishment of regional operator; National level policy advise	
Expansion of higher quality services is delayed	n/a	Weak institutional capacity on the operational level in WSS, including financial weaknesses of the institutions to attract investments, manage investments, as well as provide quality services to the population	Delay in project start	Short	Delay in establishing positive cash flow and benefits to public	E	IV	Very high	Policy recommendations at national level to consolidate funding sources. Supporting unified policy to external donors	Moderate
Unclear tariff regime On-going and delayed decentralisation process which leads to uncertainty in WSS sector and artificial fragmentation of the areas managed by the specialised insti-	Operating revenues	Delays in establishment of new tariff policy for the regional and local water companies On-going and delayed decentralisation process which leads to uncertainty in WSS sector and artifi-	Reduced project efficiency and financial stability of operator	Medium	Negative	C	III	Moderate	Policy recommendations at national level; Corporate development programme as part of technical assistance	Low to moderate

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
tutions		cial fragmentation of the areas managed by the specialised institutions								
Planning uncertainty financial weakness of the institutions which increases the perceived risks of making investments in WSS	n/a	financial weakness of the institutions which increases the perceived risks of making investments in WSS	Reduced project efficiency; project not meeting needs	Medium and long-term	Negative	C	III	Moderate	Regional sector programmes; intensive cooperation with local partners to identify needs; Corporate development programme as part of technical assistance	Low
Uncertainty in ownership of assets at regional operator	n/a	Lack of legal framework on ownership of land and public infrastructure at the regional level	Delays in implementation; depreciation not calculated in tariff	Short to medium-term	Negative	B	III	Moderate	Corporate development programme as part of technical assistance	Low

Table 10-3: Risk matrix, financial risks

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
Delay in project implementation	n/a	Low financial absorption capacity at national and local level	Delay in project start	Short to medium	Delay in establishing positive cash flow	D	II	Moderate	Capacity development within partner systems	Moderate
Delay in project approval and implementation	n/a	Lack of expressed co-financing commitment from donors for priority projects	Delay in project start	Short to medium	Delay in establishing positive cash flow	C	III	Moderate	Corporate development programme as part of technical assistance	Low to moderate
Project indicators and cash flow forecast not met	Operating revenues	Lower number of actual consumers than estimated after the investment implementation	Reduced project efficiency and financial stability of operator	Medium	Negative	D	III	High	Corporate development programme – revenue enhancement activities, as part of technical assistance; public information campaign	Moderate
Unclear tariff regime	Operating revenues	Political interference in tariff adjustments	Reduced project efficiency and financial stability of operator	Short to medium	Negative	C	III	Moderate	Policy recommendations at national level; Corporate development programme as part of technical assistance	Low to moderate

Table 10-4: Risk matrix, project implementation and management risks

Adverse event	Variable	Causes	Effect	Timing (short, medium, long-term)	Effect on cash flows	Probability	Severity	Risk level	Prevention and/or mitigation measures	Residual risk
Difficulties in supplementing project teams with qualified staff	n/a	Insufficient technical expertise at local level	Reduced project efficiency	Medium	Delay in establishing positive cash flow	C	III	High	Corporate development programme as part of technical assistance; establishment of Project Implementation Unit (PIU)	Moderate
Difficulties in supplementing project teams with qualified staff	n/a	Insufficient project management and implementation experience at local level	Reduced project efficiency	Medium	Delay in establishing positive cash flow	C	III	High	Corporate development programme as part of technical assistance; establishment of PIU	Moderate
Construction delays	n/a	Insufficient project management and implementation experience at local level	Reduced project efficiency	Short to medium	Delay in benefits to public	C	II	Moderate	Corporate development programme and technical supervision as part of technical assistance; assistance to PIU	Moderate
Cost overruns in excess of contingencies	n/a	Insufficient project management and implementation experience at local level	Reduced project efficiency	Short to medium	Negative	C	III	Moderate	Corporate development programme and technical supervision as part of technical assistance; assistance to PIU	Low to moderate
Project targets not met	n/a	Outdated construction standards of materials and technologies applied for design and project implementation	Project not meeting local needs	Medium to long-term	Delay in benefits to public	C	III	Moderate	Lobbying within partner systems; Technical supervision as part of technical assistance; assistance to PIU	Moderate

Table 10-5: Risk level

Severity/Probability	I none	II minor	III moderate	IV critical	V catastrophic
A. Very unlikely (0-10% probability)	Low	Low	Low	Low	Moderate
B. Unlikely (10–33% probability)	Low	Low	Moderate	Moderate	High
C. About as likely as not (33–66% probability)	Low	Low	Moderate	High	High
D. Likely (66–90% probability)	Low	Moderate	High	Very high	Very high
E. Very likely (90–100% probability)	Moderate	High	Very high	Very high	Very high

10.3.2 Interpretation of risk matrix

Adverse events for which the residual risk is higher than “moderate” should be modelled in a probabilistic risk analysis. It is assumed that all risk resulting from the adverse events will be mitigated down to at least “moderate” level through the measures indicated, with the exception of the political risk from elections and the winding up of various governments. This risk, in turn, cannot be adequately modelled in a probabilistic risk analysis.

The main mitigation measures are related to lobbying within partner systems (work with line ministries), establishment and assistance to a Project Implementation Unit, and technical assistance to the WSS operator through a corporate development programme. The corporate development programme is described in Chapter 5.7.6 – Technical Assistance.

Annexes

Annex 3	Legal and regulatory framework
Annex 4	General information on consumers
Annex 5	Investment Programme
Annex 6	Financial and economic analysis
Annex 8	Environmental impact assessment and gender aspects
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Annex 3

Legal and regulatory framework

Annex 3: Legal and regulatory framework

International regulations:

- Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991), ratified by Parliament Decision No. 1546-XII dated 23 June, 1993. It was applied in construction impact assessment of a larger number of facilities, including Giurgiulesti terminal on Prut - Danube Rivers;
- Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992), ratified by Republic of Moldova Parliament Decision no. 1546 -XII dated 23 June 1993. Institutional cooperation entities in transboundary watercourses management were established based on bilateral cooperation agreements with Ukraine (11.23.1994) and Romania (08.28.2010);
- Convention on the Transboundary Effects of Industrial Accidents (Helsinki, 1992), ratified by Parliament Decision no. 1546-XII dated 23 June, 1993;
- Convention on cooperation and protection and sustainable use of the Danube River (Sofia, 1994) created the general legal instrument for cooperation in transboundary watercourse management in Danube River basin. The Convention was ratified by Republic of Moldova Parliament Decision no. 323-XIV of 17 March 1999, respectively that is a part of the management committee of Danube river basin;
- Convention on Access to Environmental Information, Public Participation in Environmental Decision-making and Access to Justice in environmental matters (The Aarhus Convention) was signed on 25 June 1998 and entered into force on 30 October 2001. The Aarhus Convention was ratified by Republic of Moldova Parliament Decision o. n46-XIV dated 07 April 1999 and the National Action Plan for implementing the Aarhus Convention in Moldova was approved by Government Decision no. 471 dated 28 June 2011;
- The Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes EEC UNO / WHO-EURO, adopted in London on 17 June 1999 entered into force on 4 August 2005. Republic of Moldova ratified the Protocol on Water and Health based on Law No. 207 dated 29 July 2005.

National Regulations:

- Law on local public administration no. 436 dated 12.28.2006, published in Monitorul Oficial, Republic of Moldova no. 32-35 dated 03.09.2007;
- Law on administrative decentralisation no. 435-XVI dated 12.28.2006, published in Monitorul Oficial, Republic of Moldova no. 29-31/91 dated 03.02.2007;
- Law on Local Public Finances No. 397-XV of 10.16.2003, published in Monitorul Oficial of Republic of Moldova no. 248/253 dated 10.16.2003;
- Law on public utility services no. 1402-XV of 10.24.2002, published in Monitorul Oficial, Republic of Moldova no.14-17/49 dated 02.07.2003;
- Law on Water Supply and Sanitation Public Services no. 303 dated 13 December 2013, published in Monitorul Oficial, Republic of Moldova no. 60-65 dated 03.14.2014;

- Water Law no. 272 of 23 December 2011, published in Monitorul Oficial al Republicii Moldova no. 81 dated 04.26.2012;
- Law on drinking water no. 272-XIVof 02.10.1999, published in Monitorul Oficial, Republic of Moldova no. 39-41 dated 22 April 1999;
- Law on state supervision of public health no. 10-XVI dated 02.03.2009, published in Monitorul Oficial, Republic of Moldova No. 67/183 dated 04.03.2009;
- Law on Public - Private Partnership no. 179-XVI of 07.10.2008, published in Monitorul Oficial, Republic of Moldova no. 165-166/605 dated 09.02.2008;
- Law on Concessions no. 534-XIII of 07.13.95, published in Monitorul Oficial, Republis of Moldova no. 67/752 dated 11.30.1995;
- Law on protection areas and protection strips of river waters and water basins no. 440-XIII of 27 Aprilie 1995, published in Monitorul Oficial, Republic of Moldova no. 43/482 dated 08.03.1995;
- Law on irrigation water users associations no. 171 of 07.09.2010, published in Monitorul Oficial, Republic of Moldova no. 160-162 dated 09.07.2010;
- Civil Code of Republic of Moldova no. 1107-XV of 6 June 2002, published in Monitorul Oficial, Republic of Moldova no. 82-86 dated 06.22.2002;
- Law on entrepreneurship and enterprises no. 845-XII of 01.03.1992, published in Monitorul Oficial, Republic of Moldova no. 2 dated 02.28.1994;
- Law on Joint Stock Companies no.1134-XIII of 04.02.1997, published in Monitorul Oficial, Republic of Moldova no. 38-39 dated 06.12.1997;
- Law on Limited Liability Companies no. 135 of 06.14.2007, published in Monitorul Oficial, Republic of Moldova no. 127-130 dated 08.17.2007;
- The law on state registration of legal entities and individual entrepreneurs no. 220-XVI of 10.19.2007, published in Monitorul Oficial, Republic of Moldova no. 184-187 dated 11.30.2007;
- Government Decision of Republic of Moldova no. 685 dated September 4 2013 on the National Strategy for Regional Development for the period 2013-2015, published in Monitorul Oficial, Republic of Moldova no. 198-204 dated 09.13.2013;
- Government Decision of Republic of Moldova on approval of Water Supply and Sanitation Strategy (2014-2028) no. 199 dated 20 March 2014, published in Monitorul Oficial, Republicof Moldova no. 72-77 dated 03.28.2014;
- Government Decision of Republic of Moldova no. 802 dated 10.09.2013 for approving the Regulation on conditions for waste water discharge into water bodies, published in Monitorul Oficial, Republic of Moldova no. 243-247 dated 11.01.2013;
- Government Decision of Republic of Moldova no. 950 of 25 November 2013 approving the Regulation on requirements for collection, treatment and discharge of wastewater into the sewerage system and / or water bodies for urban and rural areas, published in Monitorul Oficial, Republic of Moldova no. 284-289 dated 12.06.2013;

- Government Decision of Republic of Moldova no. 387 of 06.06.1994 on the approval of the Model Regulation for Municipal enterprises, published in Monitorul Oficial, Republic of Moldova no. 2 dated 09.02.1994;
- Government Decision of Republic of Moldova no. 1006 of 09.13.2004 on the approval of the Regulation on public utility service concession, published in Monitorul Oficial, Republic of Moldova no. 171 dated 09.17.2004;
- Government Decision of Republic of Moldova no. 656 of 05.27.2002 on the approval of the Regulation Framework on the use of municipal water supply and sewerage system, published in Monitorul Oficial, Republic of Moldova no. 71-73 dated 06.06.2002;
- Government Decision of Republic of Moldova no. 1228 dated 11.13.2007 approving the Regulation on the acquisition, designing, installation, reception and operation of the equipment for recording water consumption, published in Monitorul Oficial, Republic of Moldova no. 180-183 dated 11.23.2007;
- Government Decision of Republic of Moldova no. 1188 dated in 11.02.2004 on the Action Plan related to the operation of the 'Soroca - Balti' water main and the water supply of some areas of the country, published in Monitorul Oficial, Republic of Moldova no. 199-204 of 11.05.2004;
- Government Decision of Republic of Moldova no. 619 dated 08.16.1994 on the regulation of links in the field of water management and rational use of water resources in Republic of Moldova, published in Monitorul Oficial, Republic of Moldova no. 3 dated 09.08.1994;
- Decision of the National Agency for Energy Regulation no. 741 of 12.18.2014 on approving the Methodology for determination, approval and application of tariffs for public water supply, sanitation and wastewater treatment services, published in Monitorul Oficial, Republic of Moldova no. 33-38 dated 02.13.2015;
- Decision of the Ministry of Regional Development, Construction, Housing and Communal Services on the approval of the Strategy for modernization and development of municipal water supply and sewerage systems no. 7/1 dated 05.14.99, published in Monitorul Oficial, Republic of Moldova no. 130-133/238 of 11.25.1999;
- Order of the Ministry of Environment and Ministry of Health on approving the list of target indicators for implementation of the Protocol on Water and Health no. 91 / 704 of 20 October 2010.

Standards for the design and construction of infrastructure in the field of water supply and sanitation are:

- Construction Standard of Moldova / CSM L.01.07: 2005 The structure of the bill of quantity in construction;
- CSM A.07.03: 2014 Procedure on development, notification and approval of special technical conditions regarding project documentation of building projects (this one is valid);
- CSM G.03.01: 2012 Small capacity wastewater treatment plants;
- Practice Code / PC G.03.02-2006 Design and installation of water supply and sewerage systems made of polymer materials;

- PC G.03.06-2011 Design and installation of sewage underground pipes made of glass fiber reinforced plastics;
- SNiP 2.04.01-85 Internal water supply and sewerage systems;
- SNiP 2.04.02-84 Water supply. External networks and installations;
- SNiP 2.04.03-85 Sewerage. External networks and installations;
- SNiP 3.05.04-85 Water supply and sewerage external networks and installations;
- GOST 12.3.006-75* Safety standards system. Operation of the water supply and sewage facilities and networks. General safety requirements;
- Guideline to SNiP 2.04.02 Design of installations for surface water catchment;
- Guideline to SNiP 2.04.02-84 Design of installations for water treatment;
- Guideline to SNiP 2.04.03-85 Design of installations for wastewater treatment;
- Guideline to SNiP 2.04.02-84 Guideline on the volume and content of the project documentation for external water supply and sewerage systems;
- Guideline to SNiP 3.05.04-85 Guideline on laying and installation of cast iron, concrete and asbestos-cement pipelines of water supply and sewerage systems.

Annex 4

General information on consumers

Annex 4: General information on consumers

Table 4-1: General information about public institutions in the town of Ungheni

N°	Public institution name	No. of pupils/children/ places/beds	Employee's number	Connected to water supply system	Connected to centralized sewer system
1.	Theoretical Lyceum „Mihai Eminescu"	1,130	107	Yes	Yes
2.	Primary school "Spiridon Vangheli"	328	32	Yes	Yes
3.	Theoretical Lyceum „Vasile Alecsandri"	630	61	Yes	Yes
4.	Theoretical Lyceum „Alexandru Puskin"	926	103	Yes	Yes
5.	Lyceum "Gheorghe Asachi"	818	101	Yes	Yes
6.	Lyceum "Ion Creanga"	723	76	Yes	Yes
7.	Gymnasium Zagarancea	129	24	Yes	
8.	Rehabilitation Centre	51	19	Yes	Yes
9.	Kindergarten no. 2	350	50	Yes	Yes
10.	Kindergarten no. 3	350	50	Yes	Yes
11.	Kindergarten no. 9	395	49	Yes	Yes
12.	Kindergarten no. 10	378	42	Yes	Yes
13.	Kindergarten no. 11	372	57	Yes	Yes
14.	Kindergarten no. 47	167	25	Yes	Yes
15.	Centre of Family Physicians		170	Yes	Yes
16.	Public Health Centre		62	Yes	Yes
17.	Raion Hospital	250	361	Yes	Yes
18.	Social Assistance Directorate		30	Yes	Yes
19.	Kindergarten Zagarancea	52	12	Yes	
20.	Technical college	387	73	Yes	Yes
21.	Military Centre		62	Yes	
22.	Medical College	447	71	Yes	Yes
23.	Educational Department	350	50	Yes	Yes
24.	Agro industrial College	453	99	Yes	Yes
25.	Healthcare Centre Danuteni		62	Yes	Yes
26.	Centre "Faclia"	170	8	Yes	Yes
27.	Music School	140	36	Yes	Yes
28.	Tourist Base	230	10	Yes	
29.	Fine Art Schools	170	7	Yes	Yes
30.	Viitorul Incepe Azi JSC	12	11	Yes	Yes
31.	Casa pentru Toti	70	25	Yes	Yes

Source: LPA Ungheni, Municipal Enterprise "Apa-Canal" Ungheni

Table 4-2: General information about public institutions in Zagarancea, Semeni and Petresti villages

No.	Type of public institution	Denumirea localității					
		Zagarancea		Semeni		Petresti	
		No. of pupils/ children/ places/ beds	Employee's number	No. of pupils/ children/ /places/ beds	Employee's number	No. of pupils/ children/ /places/ beds	Employee's number
1.	School	135	16	148	18	426	56
2.	Kindergarten	45/45	9	64/64	12	167	22
3.	Hospital	1	3	1	3		16

Source: LPA Zagarancea Tonwship, LPA Petresti Township

Table 4-3: General information about business entities in the town of Ungheni

No.	Business entity	Employee's number	Field	Type of property	Connected to water supply system	Connected to centralized sewer system
1.	Arus Ltd.	18	commerce	private	yes	yes
2.	Ambulatorul Liniar	12	medical assistance	state	yes	yes
3.	ASITO JSC	15	insurance	private	yes	yes
4.	Acortamex Ltd.	16	supply of services	private	yes	yes
5.	Banca de Economii JSC	21	commerce	private	yes	yes
6.	BNV Ltd.	40	commerce	private	yes	yes
7.	Banca Finante si Comert JSC	13	commerce	private	yes	yes
8.	Cereale Prut JSC	33	industry	private	yes	yes
9.	Codreanca JSC	40	production	private	yes	
10.	Casa Antreprenoriatului	50	institution	state	yes	
11.	Cosinzeana JSC	90	commerce	private	yes	yes
12.	Com Gaz Plus JSC	41	supply of services	state	yes	
13.	Ecovit Ltd.	150	industry	private	yes	yes
14.	Euro Credit Bank JSC	11	Commercial bank	private	yes	yes
15.	EnergBank JSC	15	Commercial bank	private	yes	yes
16.	Euro Atlant Ltd. ZEL	120	production	private	yes	yes
17.	Euro Yarns Ltd.	30	production	private	yes	yes
18.	Grafica Tipar JSC	20	supply of services	private	yes	yes
19.	Gara Feroviara Ungheni	40	transport	state	yes	yes
20.	Hotelul Dacia JSC	10	hotel services	private	yes	yes
21.	Lones Mol Ltd.	60	production	private	yes	yes
22.	Lear Corporation Ltd.	1,400	production	private	yes	yes
23.	Moldtelecom JSC	51	supply of services	private	yes	yes
24.	Plumcom VM Ltd.	30	production	private	yes	yes
25.	Paza de Stat	25	supply of services	private	yes	yes

No.	Business entity	Employee's number	Field	Type of property	Connected to water supply system	Connected to centralized sewer system
26.	Pitulicea Ltd.	26	commerce	private	yes	yes
27.	Paranacom Ltd.	40	commerce	private	yes	yes
28.	Red Nord JSC	126	supply of services	private	yes	yes
29.	Rincor Prim Ltd.	74	supply of services	private	yes	
30.	Railways Maintenance Department	72	transport	state	yes	yes
31.	Municipal facilities	70	supply of services	private	yes	
32.	Silva Centru	110	forestry	private	yes	yes
33.	Speranța JSC	20	supply of services	private	yes	yes
34.	Soclemo Ltd.	20	production	private	yes	yes
35.	Statia Zonala AMU centru	40	medical assistance	private	yes	yes
36.	Soldi Ltd.	15	construction	private	yes	
37.	Sampdoria Ltd.	20	production	private	yes	
38.	Scopos Ltd.	12	production	private	yes	
39.	Struguras Prut JSC	20	production	private	yes	yes
40.	Tirex Petrol JSC	15	commerce	private	yes	yes
41.	Trasis Lux Ltd.	46	supply of services	private	yes	yes
42.	Ungheni Vin JSC	27	production	private	yes	yes
43.	Ungheni Gaz Ltd.	100	supply of services	private	yes	yes
44.	Unconsalex Ltd.	40	commerce	private	yes	yes
45.	Victoria Banc JSC	22	commercial bank	private	yes	yes
46.	M.E. Apa-Canal Ungheni	159	supply of services	state	yes	yes
47.	S.E. Posta Moldovei	45	supply of services	state	yes	yes
48.	Excel-Manifacturing Ltd.	80	production	private	yes	yes

Source: LPA Ungheni, Municipal Enterprise "Apa-Canal" Ungheni

Annex 5

Investment Programme

Annex 5: Investment Programme

Annex 5.1: Water Demand Projection

N°	Parameter	Unit	2014*	2015	2016	2017	2018**	2019	2020	2021***	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
1	**Population in the project area served with water**																																	
1.1	Total population serviced	N°	31,883	31,899	31,914	31,928	36,402	36,398	36,393	38,516	39,210	39,902	40,595	41,287	41,979	42,670	43,361	44,052	44,742	44,792	44,840	44,888	44,934	44,979	45,023	45,065	45,106	45,146	45,184	45,222	45,258	45,293	45,326	45,359
1.2	In urban settlements	N°	30,269	30,288	30,306	30,325	31,005	31,024	31,043	32,937	33,581	34,225	34,871	35,517	36,163	36,811	37,459	38,108	38,757	38,775	38,793	38,810	38,828	38,846	38,863	38,881	38,899	38,916	38,934	38,952	38,969	38,987	39,005	39,023
1.3	In rural settlements	N°	1,614	1,612	1,608	1,603	5,396	5,374	5,351	5,580	5,629	5,677	5,724	5,770	5,815	5,859	5,902	5,944	5,985	6,017	6,048	6,078	6,106	6,133	6,159	6,184	6,207	6,229	6,250	6,270	6,288	6,306	6,321	6,336
2	**Volume of water sold in total and disaggr. for different consumers**																																	
2.1	Total volume sold	m^3/y	1,238,493	1,247,609	1,256,710	1,265,797	1,378,830	1,391,342	1,403,801	1,500,288	1,541,398	1,582,937	1,624,903	1,667,294	1,710,109	1,753,346	1,797,003	1,841,080	1,890,098	1,907,092	1,924,092	1,941,095	1,958,099	1,975,104	1,992,107	2,009,106	2,026,100	2,043,087	2,060,065	2,077,033	2,093,988	2,110,929	2,127,854	2,156,082
2.2	Domestic customers	m^3/y	937,036	947,310	957,574	967,829	1,054,900	1,067,671	1,080,408	1,158,028	1,193,157	1,228,752	1,264,811	1,301,334	1,338,320	1,375,769	1,413,679	1,452,050	1,490,880	1,507,467	1,524,069	1,540,684	1,557,311	1,573,947	1,590,591	1,607,241	1,623,895	1,640,552	1,657,210	1,673,866	1,690,520	1,707,169	1,723,811	1,751,767
2.3	Industrial customers	m^3/y	196,338	194,723	193,103	191,478	212,396	210,650	208,897	219,375	221,508	223,568	225,553	227,465	229,303	231,066	232,756	234,371	235,911	236,135	236,355	236,570	236,779	236,984	237,184	237,378	237,568	237,753	237,932	238,107	238,277	238,442	238,601	238,756
2.4	Institutional customers	m^3/y	105,119	105,576	106,033	106,490	111,534	113,020	114,496	122,885	126,733	130,618	134,539	138,495	142,485	146,510	150,569	154,660	163,308	163,490	163,668	163,841	164,009	164,173	164,332	164,487	164,637	164,782	164,923	165,060	165,191	165,318	165,441	165,559
3	**Total water sold disaggr. for urban and rural areas**																																	
3.1	Urban Settlements	m^3/y	1,211,040	1,220,197	1,229,361	1,238,531	1,274,926	1,284,306	1,293,690	1,381,763	1,418,098	1,454,820	1,491,929	1,529,427	1,567,314	1,605,590	1,644,257	1,683,314	1,722,762	1,736,020	1,749,290	1,762,571	1,775,864	1,789,168	1,802,484	1,815,810	1,829,149	1,842,498	1,855,859	1,869,232	1,882,615	1,896,010	1,909,417	1,922,835
3.2	Rural settlements	m^3/y	27,453	27,412	27,350	27,267	103,904	107,036	110,111	118,525	123,301	128,118	132,974	137,867	142,794	147,755	152,747	157,767	167,337	171,072	174,802	178,523	182,235	185,936	189,623	193,296	196,952	200,589	204,206	207,801	211,373	214,918	218,437	233,247
4	**Non-Revenue Water (NRW) volume dissagregated for total NRW, apparent losses, and real losses**																																	
4.1	Total NRW	m^3/y	731,469	736,853	741,021	745,166	649,374	650,218	650,973	690,326	703,731	717,065	730,322	743,501	756,598	769,610	782,533	795,366	810,042	804,413	798,680	792,841	786,900	780,855	774,708	768,460	762,111	755,662	749,115	742,469	735,725	728,886	721,950	718,694
4.2	Apparent losses	m^3/y	109,720	110,528	110,508	110,477	110,653	110,607	110,542	117,018	119,078	121,115	123,128	125,118	127,083	129,022	130,936	132,824	135,007	135,575	136,139	136,697	137,250	137,798	138,341	138,878	139,411	139,937	140,459	140,975	141,486	141,991	142,490	143,739
4.3	Real losses (physical losses)	m^3/y	621,749	626,325	630,513	634,689	538,720	539,611	540,430	573,308	584,654	595,950	607,194	618,384	629,515	640,588	651,597	662,542	675,035	668,838	662,541	656,145	649,650	643,057	636,367	629,582	622,701	615,725	608,656	601,494	594,240	586,895	579,460	574,955
5	**The water demand figures considering the demand variation factors**																																	
5.1	Yearly water demand/production	m^3/y	1,969,962	1,984,462	1,997,732	2,010,963	2,028,204	2,041,560	2,054,774	2,190,614	2,245,130	2,300,002	2,355,225	2,410,795	2,466,707	2,522,955	2,579,537	2,636,446	2,700,141	2,711,506	2,722,771	2,733,936	2,744,999	2,755,959	2,766,815	2,777,566	2,788,211	2,798,750	2,809,180	2,819,502	2,829,713	2,839,814	2,849,804	2,874,776
5.2	Average daily water demand	m^3/d	5,397	5,437	5,473	5,509	5,557	5,593	5,630	6,002	6,151	6,301	6,453	6,605	6,758	6,912	7,067	7,223	7,398	7,429	7,460	7,490	7,521	7,551	7,580	7,610	7,639	7,668	7,696	7,725	7,753	7,780	7,808	7,876
5.3	Maximum daily water demand	m^3/d	5,736	5,779	5,818	5,856	5,934	5,975	6,014	6,413	6,573	6,735	6,898	7,062	7,227	7,393	7,560	7,728	7,915	7,951	7,987	8,022	8,057	8,092	8,126	8,160	8,194	8,228	8,261	8,294	8,326	8,359	8,391	8,467
5.4	Average hourly water demand	m^3/h	225	227	228	230	232	233	235	250	256	263	269	275	282	288	294	301	308	310	311	312	313	315	316	317	318	319	321	322	323	324	325	328
5.5	Max. hourly water demand	m^3/h	316	318	321	323	333	335	338	360	370	379	388	398	407	417	427	436	447	450	452	455	457	460	462	465	467	470	472	475	477	479	482	487

*existing situation

**1st year of operation phase 1 investments

*** 1st year of operation phase 2 investments

Annex 5.2: Wastewater Flow and Load Projection

N°	Parameter	Unit	2014*	2015	2016	2017	2018**	2019	2020	2021***	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
1	**Population in the project area served with sewerage**																																	
1.1	Total population serviced	N°	20,433	20,446	20,458	20,471	21,355	21,368	21,381	29,231	30,366	31,503	32,642	33,784	34,928	36,074	37,222	38,373	39,525	39,748	39,969	40,190	40,409	40,628	40,847	41,064	41,281	41,496	41,711	41,925	42,139	42,351	42,563	42,774
1.2	In urban settlements	N°	20,433	20,446	20,458	20,471	21,355	21,368	21,381	25,467	26,502	27,540	28,581	29,624	30,670	31,719	32,770	33,824	34,882	35,027	35,172	35,317	35,463	35,609	35,754	35,900	36,046	36,192	36,338	36,485	36,631	36,778	36,925	37,071
1.3	In rural settlements	N°	0	0	0	0	0	0	0	3,763	3,863	3,963	4,061	4,160	4,258	4,355	4,452	4,548	4,644	4,721	4,797	4,872	4,947	5,020	5,092	5,164	5,234	5,304	5,373	5,441	5,507	5,573	5,638	5,702
2	**Volume of wastewater charged in total and disaggr. for different customers**																																	
2.1	Total volume of wastewater gen,	m^3/y	823,791	829,828	835,870	841,916	884,069	890,379	896,692	1,154,892	1,210,425	1,266,756	1,323,886	1,381,816	1,440,549	1,500,083	1,560,422	1,621,566	1,687,027	1,711,978	1,737,098	1,762,385	1,787,837	1,813,453	1,839,233	1,865,175	1,891,278	1,917,540	1,943,961	1,970,539	1,997,274	2,024,163	2,051,207	2,088,592
2.2	by domestic customers	m^3/y	565,532	574,108	582,694	591,287	625,429	634,404	643,386	837,223	882,876	929,534	977,198	1,025,872	1,075,558	1,126,259	1,177,977	1,230,714	1,284,474	1,307,311	1,330,322	1,353,505	1,376,860	1,400,385	1,424,078	1,447,940	1,471,969	1,496,163	1,520,521	1,545,043	1,569,727	1,594,572	1,619,576	1,654,928
2.3	by industrial customers	m^3/y	155,030	152,427	149,820	147,209	150,751	148,021	145,287	184,605	188,399	191,935	195,212	198,229	200,985	203,479	205,710	207,677	209,378	210,479	211,576	212,670	213,761	214,849	215,934	217,016	218,095	219,171	220,244	221,314	222,381	223,444	224,505	225,563
2.4	by Institutional customers	m^3/y	103,229	103,293	103,357	103,420	107,889	107,954	108,018	133,064	139,150	145,288	151,476	157,715	164,005	170,345	176,735	183,175	193,174	194,189	195,201	196,210	197,216	198,220	199,220	200,218	201,214	202,206	203,195	204,182	205,166	206,147	207,126	208,101
3	**Total wastewater charged disaggr, for urban and rural areas**																																	
3.1	in urban Settlements	m^3/y	823,791	829,828	835,870	841,916	884,069	890,379	896,692	1,074,957	1,125,806	1,177,333	1,229,539	1,282,428	1,336,001	1,390,260	1,445,208	1,500,847	1,557,178	1,577,752	1,598,447	1,619,265	1,640,205	1,661,268	1,682,453	1,703,762	1,725,193	1,746,748	1,768,426	1,790,227	1,812,152	1,834,201	1,856,373	1,878,670
3.2	in rural settlements	m^3/y	0	0	0	0	0	0	0	79,935	84,619	89,423	94,347	99,388	104,548	109,823	115,214	120,720	129,848	134,227	138,651	143,120	147,632	152,186	156,780	161,413	166,084	170,792	175,535	180,312	185,122	189,963	194,834	209,923
4	**The sewer infiltration water based on the determined infiltration rate**																																	
4.1	**Sewer Infiltration water**	m^3/y	411,896	404,541	397,038	389,386	397,831	356,152	313,842	346,468	363,127	380,027	397,166	414,545	432,165	450,025	468,127	486,470	506,108	513,594	521,129	528,715	536,351	544,036	551,770	559,552	567,383	575,262	583,188	591,162	599,182	607,249	615,362	626,578
5	**The wastewater generation figures considering the variation factors**																																	
5.1	Avg, wastewater flow (dry weather)	m^3/y	1,235,687	1,234,369	1,232,909	1,231,302	1,281,901	1,246,531	1,210,534	1,501,360	1,573,552	1,646,783	1,721,052	1,796,361	1,872,713	1,950,108	2,028,549	2,108,036	2,193,135	2,225,572	2,258,228	2,291,100	2,324,188	2,357,489	2,391,003	2,424,727	2,458,661	2,492,802	2,527,149	2,561,701	2,596,456	2,631,412	2,666,569	2,715,170
5.2	Max, daily dry weather flow (Qdmax)	m^3/d	3,611	3,609	3,607	3,604	3,754	3,659	3,562	4,430	4,643	4,859	5,078	5,300	5,525	5,754	5,985	6,220	6,471	6,566	6,663	6,760	6,857	6,956	7,055	7,154	7,254	7,355	7,456	7,558	7,661	7,764	7,868	8,011
5.3	Max, hourly dry weather flow (QDWF)	m^3/h	223	223	224	224	234	231	227	286	300	314	328	342	357	372	387	402	418	424	430	437	443	449	456	462	469	475	482	488	495	501	508	517
5.4	Max, hourly Storm Water Flow (QSWF)	m^3/h	290	290	291	291	304	300	295	372	390	408	426	445	464	483	503	522	543	551	559	568	576	584	592	601	609	618	626	635	643	652	661	673
6	**Population equivalents in total and disaggr, for different customers**																																	
6.1	Total population equivalent	PE_{60}	23,086	23,073	23,059	23,046	24,013	23,998	23,983	32,494	33,731	34,967	36,204	37,441	38,678	39,914	41,151	42,388	43,661	43,905	44,148	44,390	44,632	44,872	45,112	45,351	45,589	45,826	46,062	46,297	46,531	46,765	46,998	47,229
6.2	by domestic customers	PE_{60}	20,433	20,446	20,458	20,471	21,355	21,368	21,381	29,231	30,366	31,503	32,642	33,784	34,928	36,074	37,222	38,373	39,525	39,748	39,969	40,190	40,409	40,628	40,847	41,064	41,281	41,496	41,711	41,925	42,139	42,351	42,563	42,774
6.3	by Industrial and instit, customers	PE_{60}	2,653	2,627	2,601	2,575	2,657	2,630	2,602	3,264	3,365	3,465	3,562	3,657	3,750	3,841	3,929	4,016	4,136	4,158	4,179	4,201	4,222	4,244	4,265	4,287	4,308	4,329	4,350	4,372	4,393	4,414	4,435	4,455
7	**Pollution load – BOD in total and disaggr, for different customers**																																	
7.1	The total BOD_5 load	kg/d	1,385	1,384	1,384	1,383	1,441	1,440	1,439	1,950	2,024	2,098	2,172	2,246	2,321	2,395	2,469	2,543	2,620	2,634	2,649	2,663	2,678	2,692	2,707	2,721	2,735	2,750	2,764	2,778	2,792	2,806	2,820	2,834
7.2	by domestic customers	kg/d	1,226	1,227	1,227	1,228	1,281	1,282	1,283	1,754	1,822	1,890	1,959	2,027	2,096	2,164	2,233	2,302	2,372	2,385	2,398	2,411	2,425	2,438	2,451	2,464	2,477	2,490	2,503	2,516	2,528	2,541	2,554	2,566
7.3	by industrial and instit, customers	kg/d	159	158	156	154	159	158	156	196	202	208	214	219	225	230	236	241	248	249	251	252	253	255	256	257	258	260	261	262	264	265	266	267

*existing situation

**1st year of operation phase 1 investments)

*** 1st year of operation phase 2 investments)

Annex 5.3: Development of connection rates water supply

N°	Settlement	2014*	2015	2016	2017	2018**	2019	2020	2021***	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
1	Ungheni	79%	79%	79%	79%	81%	81%	81%	85%	87%	89%	90%	92%	94%	95%	97%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2	Petresti	0%	0%	0%	0%	63%	63%	63%	67%	68%	69%	71%	72%	74%	75%	76%	78%	79%	81%	82%	83%	85%	86%	87%	89%	90%	92%	93%	94%	96%	97%	99%	100%
3	Semeni	0%	0%	0%	0%	70%	70%	70%	73%	74%	75%	76%	78%	79%	80%	81%	82%	83%	84%	86%	87%	88%	89%	90%	91%	92%	93%	94%	95%	97%	98%	99%	100%
4	Zagarancea	83%	83%	83%	83%	84%	84%	84%	86%	86%	87%	88%	88%	89%	89%	90%	91%	91%	92%	92%	93%	94%	94%	95%	95%	96%	96%	97%	98%	98%	99%	99%	100%
TOT	**Total**	**69%**	**69%**	**69%**	**69%**	**79%**	**79%**	**79%**	**83%**	**85%**	**86%**	**88%**	**90%**	**91%**	**93%**	**94%**	**96%**	**97%**	**98%**	**98%**	**98%**	**98%**	**98%**	**98%**	**99%**	**99%**	**99%**	**99%**	**99%**	**99%**	**100%**	**100%**	**100%**

Annex 5.4: Development of connected population water supply

N°	Settlement	2014*	2015	2016	2017	2018**	2019	2020	2021***	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
1	Ungheni	30,269	30,288	30,306	30,325	31,005	31,024	31,043	32,937	33,581	34,225	34,871	35,517	36,163	36,811	37,459	38,108	38,757	38,775	38,793	38,810	38,828	38,846	38,863	38,881	38,899	38,916	38,934	38,952	38,969	38,987	39,005	39,023
2	Petresti	0	0	0	0	2,390	2,380	2,369	2,515	2,551	2,586	2,621	2,655	2,688	2,721	2,753	2,784	2,815	2,842	2,867	2,892	2,917	2,940	2,963	2,985	3,006	3,026	3,046	3,065	3,083	3,100	3,117	3,133
3	Semeni	0	0	0	0	1,376	1,370	1,364	1,422	1,435	1,447	1,459	1,471	1,482	1,493	1,504	1,515	1,525	1,533	1,541	1,548	1,556	1,563	1,569	1,575	1,581	1,587	1,592	1,597	1,602	1,606	1,610	1,614
4	Zagarancea	1,614	1,612	1,608	1,603	1,631	1,624	1,617	1,643	1,644	1,644	1,645	1,645	1,645	1,645	1,645	1,645	1,645	1,642	1,640	1,637	1,634	1,630	1,627	1,624	1,620	1,616	1,612	1,608	1,604	1,599	1,594	1,590
TOT	**Total**	**31,883**	**31,899**	**31,914**	**31,928**	**36,402**	**36,398**	**36,393**	**38,516**	**39,210**	**39,902**	**40,595**	**41,287**	**41,979**	**42,670**	**43,361**	**44,052**	**44,742**	**44,792**	**44,840**	**44,888**	**44,934**	**44,979**	**45,023**	**45,065**	**45,106**	**45,146**	**45,184**	**45,222**	**45,258**	**45,293**	**45,326**	**45,359**

Annex 5.5: Development of connection rates wastewater

N°	Settlement	2014*	2015	2016	2017	2018**	2019	2020	2021***	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
1	Ungheni	53	53	53	53	55	55	55	66	69	71	74	77	79	82	85	87	90	90	91	91	91	92	92	92	93	93	93	94	94	94	95	95
2	Petresti	0	0	0	0	0	0	0	51	53	54	56	58	59	61	63	64	66	67	69	71	72	74	75	77	78	80	82	83	85	87	88	90
3	Semeni	0	0	0	0	0	0	0	53	54	56	57	59	61	62	64	65	67	68	70	71	73	74	76	78	79	81	82	84	85	87	88	90
4	Zagarancea	0	0	0	0	0	0	0	42	44	45	47	49	51	53	55	58	60	62	63	65	67	69	71	73	75	77	79	81	83	85	88	90
TOT	**Total**	**44**	**44**	**44**	**44**	**46**	**46**	**46**	**63**	**66**	**68**	**71**	**73**	**76**	**78**	**81**	**83**	**86**	**87**	**87**	**88**	**88**	**89**	**89**	**90**	**90**	**91**	**92**	**92**	**93**	**93**	**94**	**94**

Annex 5.6: Development of connected population wastewater

N°	Settlement	2014*	2015	2016	2017	2018**	2019	2020	2021***	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
1	Ungheni	20,433	20,446	20,458	20,471	21,355	21,368	21,381	25,467	26,502	27,540	28,581	29,624	30,670	31,719	32,770	33,824	34,882	35,027	35,172	35,317	35,463	35,609	35,754	35,900	36,046	36,192	36,338	36,485	36,631	36,778	36,925	37,071
2	Petresti	0	0	0	0	0	0	0	1,936	1,983	2,030	2,075	2,121	2,166	2,210	2,254	2,298	2,341	2,377	2,413	2,448	2,482	2,516	2,549	2,581	2,613	2,645	2,675	2,705	2,735	2,764	2,792	2,819
3	Semeni	0	0	0	0	0	0	0	1,028	1,051	1,074	1,096	1,118	1,140	1,161	1,183	1,203	1,224	1,242	1,259	1,277	1,293	1,310	1,326	1,341	1,357	1,372	1,386	1,400	1,414	1,427	1,440	1,452
4	Zagarancea	0	0	0	0	0	0	0	799	829	859	890	921	952	983	1,015	1,047	1,079	1,102	1,125	1,148	1,171	1,194	1,218	1,241	1,265	1,288	1,312	1,335	1,359	1,383	1,407	1,431
TOT	**Total**	**20,433**	**20,446**	**20,458**	**20,471**	**21,355**	**21,368**	**21,381**	**29,231**	**30,366**	**31,503**	**32,642**	**33,784**	**34,928**	**36,074**	**37,222**	**38,373**	**39,525**	**39,748**	**39,969**	**40,190**	**40,409**	**40,628**	**40,847**	**41,064**	**41,281**	**41,496**	**41,711**	**41,925**	**42,139**	**42,351**	**42,563**	**42,774**

Annex 6

Financial and economic analysis

Annex 6: Financial and economic analysis

Table 6-1: Macroeconomic forecast

Indicator	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Real Wage Increase	1.50%	3.00%	4.60%	4.30%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Base Case	1.50%	3.00%	4.60%	4.30%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Pessimistic	0.75%	1.50%	2.30%	2.15%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Optimistic	3.50%	5.00%	6.60%	6.30%	5.00%	5.00%	5.00%	6.00%	6.00%	6.00%	6.00%	5.00%	5.00%	5.00%	5.00%
Real GDP growth	-2.00%	1.50%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Base Case	-2.00%	1.50%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Pessimistic	-2.00%	0.75%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Optimistic	-2.00%	3.00%	4.50%	5.00%	5.00%	5.00%	5.00%	6.00%	6.00%	6.00%	6.00%	5.00%	5.00%	5.00%	5.00%
Costs of electricity	0.0%	37.0%	1.0%	1.0%	1.0%	1.0%	1.0%	3.0%	3.0%	3.0%	3.0%	3.0%	2.5%	2.5%	2.5%
Base Case	0.0%	37.0%	1.0%	1.0%	1.0%	1.0%	1.0%	3.0%	3.0%	3.0%	3.0%	3.0%	2.5%	2.5%	2.5%
Pessimistic	0.0%	37.0%	2.3%	2.4%	2.3%	2.4%	2.4%	6.0%	6.0%	6.0%	6.0%	6.0%	5.0%	5.0%	5.0%
Optimistic	0.0%	37.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%

Indicator	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Real Wage Increase	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Base Case	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Pessimistic	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
Optimistic	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Real GDP growth	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Base Case	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Pessimistic	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
Optimistic	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Costs of electricity	2.5%	2.5%	5.0%	5.0%	5.0%	5.0%	5.0%	4.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%
Base Case	2.5%	2.5%	5.0%	5.0%	5.0%	5.0%	5.0%	4.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%
Pessimistic	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	4.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%
Optimistic	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%

Table 6-2: Investment costs for water supply

		TOTAL	1	2	3	4	5
Equipment and tools	MDL M	4.16	0.42	2.08	1.66		
Pipelines	MDL M	28.37	2.84	14.18	11.35		
Water towers	MDL M						
Reservoirs	MDL M						
Pumping stations	MDL M						
Water treatment plant	MDL M						
TOTAL Construction and installation costs	**MDL M**	**32.52**	**3.25**	**16.26**	**13.01**	**0.00**	**0.00**
Design and engineering	MDL M	3.90	0.39	1.95	1.56	0.00	0.00
Technical assistance	MDL M	6.23	0.62	3.12	2.49	0.00	0.00
Contingencies	MDL M	4.27	0.43	2.13	1.71	0.00	0.00
TOTAL Investment Costs	**MDL M**	**46.93**	**4.69**	**23.46**	**18.77**	**0.00**	**0.00**

Table 6-3: Investment costs for wastewater

		TOTAL	1	2	3	4	5
Equipment and tools	MDL M	0.00	0.00	0.00	0.00		
Sewage network	MDL M	25.17	2.52	12.59	10.07		
Pumping stations	MDL M						
Wastewater treatment plant	MDL M						
TOTAL Construction and installation costs	**MDL M**	**25.17**	**2.52**	**12.59**	**10.07**	**0.00**	**0.00**
Design and engineering	MDL M	3.02	0.30	1.51	1.21	0.00	0.00
Technical assistance	MDL M	0.00	0.00	0.00	0.00	0.00	0.00
Contingencies	MDL M	2.82	0.28	1.41	1.13	0.00	0.00
TOTAL Investment Costs	**MDL M**	**31.02**	**3.10**	**15.51**	**12.41**	**0.00**	**0.00**

Table 6-4a: Depreciation rates for water supply

		years	%
1	Pipelines	50	2.0%
2	Water towers	16	6.3%
3	Reservoirs	20	5.0%
4	Pumping stations	20	5.0%
5	Equipment and tools	10	10.0%
6	Water treatment plant	35	2.9%
7	Land acquisition	99999999	0.0%
8	Technical assistance	50	2.0%
9	Contingency	50	2.0%

Table 6-4b: Depreciation rates for wastewater

		years	%
1	Sewage network	50	2.0%
2	Pumping stations	20	5.0%
3	Equipment and tools	10	10.0%
4	Wastewater treatment plant	35	2.9%
5	Land acquisition	99999999	0.0%
6	Technical assistance	50	2.0%
7	Contingency	50	2.0%

Table 6-5a: Summary of investment costs for water supply

			TOTAL	1	2	3	4	5	6
1	Pipelines	MDL M	28.4	2.8	14.2	11.3	0.0	0.0	0.0
2	Water towers	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Reservoirs	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	Pumping stations	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Equipment and tools	MDL M	4.2	0.4	2.1	1.7	0.0	0.0	0.0
6	Water treatment plant	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	Land acquisition	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	Technical assistance	MDL M	10.1	1.0	5.1	4.1	0.0	0.0	0.0
9	Contingency	MDL M	4.3	0.4	2.1	1.7	0.0	0.0	0.0
	TOTAL	**MDL M**	**46.9**	**4.7**	**23.5**	**18.8**	**0.0**	**0.0**	**0.0**

Table 6-5b: Summary of investment costs for wastewater

		TOTAL	1	2	3	4	5	6
1	Sewage network	25.2	2.5	12.6	10.1	0.0	0.0	0.0
2	Pumping stations	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Equipment and tools	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	Wastewater treatment plant	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Land acquisition	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	Technical assistance	3.0	0.3	1.5	1.2	0.0	0.0	0.0
7	Contingency	2.8	0.3	1.4	1.1	0.0	0.0	0.0
	TOTAL	**31.0**	**3.1**	**15.5**	**12.4**	**0.0**	**0.0**	**0.0**

Table 6-6a: Depreciation for water supply

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Pipelines	MDL M		0.1	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
5	Equipment and tools	MDL M		0.0	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
8	Technical assistance	MDL M		0.0	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
9	Contingency	MDL M		0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	TOTAL	**MDL M**	**0.0**	**0.1**	**0.9**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Pipelines	MDL M	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
5	Equipment and tools	MDL M	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
8	Technical assistance	MDL M	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
9	Contingency	MDL M	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	TOTAL	**MDL M**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**

Table 6-6b: Depreciation for wastewater

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Sewage network	MDL M		0.1	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
6	Technical assistance	MDL M		0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
7	Contingency	MDL M		0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	TOTAL Depreciation costs	MDL M	**0.0**	**0.1**	**0.4**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sewage network	MDL M	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
6	Technical assistance	MDL M	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
7	Contingency	MDL M	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	TOTAL Depreciation costs	MDL M	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**

Table 6-7a: Gross value of new assets for water supply

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Pipelines	MDL M	2.8	17.0	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4
5	Equipment and tools	MDL M	0.4	2.5	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
8	Technical assistance	MDL M	1.0	6.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
9	Contingency	MDL M	0.4	2.6	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
	TOTAL	MDL M	**4.7**	**28.2**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Pipelines	MDL M	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4
5	Equipment and tools	MDL M	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
8	Technical assistance	MDL M	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
9	Contingency	MDL M	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
	TOTAL	MDL M	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**	**46.9**

Table 6-7b: Gross value of new assets for wastewater

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Sewage network	MDL M	2.5	15.1	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2
6	Technical assistance	MDL M	0.3	1.8	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
7	Contingency	MDL M	0.3	1.7	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
	TOTAL	MDL M	**3.1**	**18.6**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sewage network	MDL M	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2
6	Technical assistance	MDL M	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
7	Contingency	MDL M	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
	TOTAL	MDL M	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**	**31.0**

Table 6-8a: Net assets for water supply

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Pipelines	MDL M	2.8	17.0	28.0	27.4	26.8	26.3	25.7	25.1	24.6	24.0	23.4	22.9	22.3	21.7	21.2
8	Technical assistance	MDL M	1.0	6.1	9.9	9.6	9.3	9.0	8.7	8.4	8.1	7.8	7.5	7.2	6.9	6.6	6.2
9	Contingency	MDL M	0.4	2.5	4.2	4.0	3.9	3.8	3.7	3.5	3.4	3.3	3.1	3.0	2.9	2.8	2.6
	TOTAL	MDL M	**4.7**	**28.0**	**45.9**	**44.5**	**43.1**	**41.7**	**40.3**	**38.8**	**37.4**	**36.0**	**34.6**	**33.2**	**32.0**	**31.0**	**30.0**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Pipelines	MDL M	20.6	20.0	19.5	18.9	18.3	17.8	17.2	16.6	16.1	15.5	14.9	14.4	13.8	13.2	12.7
8	Technical assistance	MDL M	5.9	5.6	5.3	5.0	4.7	4.4	4.1	3.8	3.5	3.2	2.9	2.6	2.3	2.0	1.7
9	Contingency	MDL M	2.5	2.4	2.2	2.1	2.0	1.9	1.7	1.6	1.5	1.3	1.2	1.1	1.0	0.8	0.7
	TOTAL	MDL M	**29.0**	**28.0**	**27.0**	**26.0**	**25.0**	**24.0**	**23.0**	**22.0**	**21.0**	**20.0**	**19.0**	**18.0**	**17.0**	**16.0**	**15.0**

Table 6-8b: Net assets for wastewater

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Sewage network	MDL M	2.5	15.1	24.8	24.3	23.8	23.3	22.8	22.3	21.8	21.3	20.8	20.3	19.8	19.3	18.8
6	Technical assistance	MDL M	0.3	1.8	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4	2.4	2.3	2.3
7	Contingency	MDL M	0.3	1.7	2.8	2.7	2.7	2.6	2.6	2.5	2.4	2.4	2.3	2.3	2.2	2.2	2.1
	TOTAL	MDL M	**3.1**	**18.5**	**30.6**	**30.0**	**29.3**	**28.7**	**28.1**	**27.5**	**26.9**	**26.2**	**25.6**	**25.0**	**24.4**	**23.8**	**23.1**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sewage network	MDL M	18.3	17.8	17.3	16.8	16.3	15.8	15.3	14.8	14.2	13.7	13.2	12.7	12.2	11.7	11.2
6	Technical assistance	MDL M	2.2	2.1	2.1	2.0	2.0	1.9	1.8	1.8	1.7	1.6	1.6	1.5	1.5	1.4	1.3
7	Contingency	MDL M	2.0	2.0	1.9	1.9	1.8	1.8	1.7	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3
	TOTAL	MDL M	**22.5**	**21.9**	**21.3**	**20.7**	**20.0**	**19.4**	**18.8**	**18.2**	**17.6**	**16.9**	**16.3**	**15.7**	**15.1**	**14.5**	**13.8**

Table 6-9a: Depreciation costs for water supply

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Pipelines	MDL M		0.1	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
8	Technical assistance	MDL M		0.0	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
9	Contingency	MDL M		0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	TOTAL	**MDL M**		**0.1**	**0.9**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.1**	**1.0**	**1.0**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Pipelines	MDL M	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
8	Technical assistance	MDL M	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
9	Contingency	MDL M	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	TOTAL	**MDL M**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**

Table 6-9b: Depreciation costs for wastewater

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Sewage network	MDL M		0.1	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
6	Technical assistance	MDL M		0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
7	Contingency	MDL M		0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	TOTAL	MDL M		**0.1**	**0.4**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sewage network	MDL M	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
6	Technical assistance	MDL M	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
7	Contingency	MDL M	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	TOTAL	MDL M	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**

Table 6-10: Variable costs – summary

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Water supply																
1	Electricity for pumping	MDL M	2.13	2.94	2.99	3.04	3.09	3.15	3.37	3.55	3.75	3.95	4.16	4.38	4.59	4.81	5.03
2	Water treatment costs	MDL M	1.22	1.22	1.23	1.24	1.25	1.26	1.33	1.37	1.40	1.43	1.46	1.50	1.53	1.56	1.60
	TOTAL variable costs for water	MDL M	3.346	4.162	4.220	4.286	4.345	4.404	4.701	4.918	5.144	5.379	5.623	5.877	6.119	6.369	6.627
	Wastewater																
1	Electricity for pumping	MDL M	0.525	0.718	0.724	0.762	0.748	0.734	0.948	1.007	1.070	1.135	1.204	1.277	1.346	1.419	1.495
2	Wastewater treatment costs	MDL M	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04
	TOTAL variable costs for water		0.547	0.740	0.747	0.785	0.771	0.756	0.976	1.036	1.100	1.166	1.236	1.309	1.380	1.454	1.530

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Water supply																
1	Electricity for pumping	MDL M	5.28	5.42	5.71	6.02	6.34	6.67	7.03	7.33	7.65	7.97	8.32	8.67	8.95	9.25	9.55
2	Water treatment costs	MDL M	1.63	1.64	1.64	1.65	1.65	1.66	1.66	1.67	1.67	1.68	1.68	1.69	1.69	1.70	1.70
	TOTAL variable costs for water	MDL M	6.910	7.064	7.358	7.667	7.992	8.333	8.692	8.999	9.319	9.651	9.998	10.358	10.646	10.943	11.250
	Wastewater																
1	Electricity for pumping	MDL M	1.574	1.635	1.739	1.850	1.967	2.092	2.225	2.343	2.467	2.598	2.736	2.880	3.003	3.130	3.263
2	Wastewater treatment costs	MDL M	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
	TOTAL variable costs for water		1.610	1.672	1.776	1.888	2.006	2.131	2.264	2.383	2.508	2.639	2.777	2.922	3.045	3.173	3.307

Table 6-11: Fixed costs

	Water		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Maintenance - old assets	MDL M	0.00	0.00	0.00	2.00	2.04	2.08	2.12	2.16	2.21	2.25	2.30	2.34	2.39	2.44	2.49
2	Maintenance - new assets	MDL M	0.00	0.05	0.28	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
3	Salaries and related costs	MDL M	4.26	4.39	4.59	4.97	5.17	5.38	5.73	5.96	6.20	6.45	6.70	6.97	7.25	7.54	7.84
4	Fuel	MDL M	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
5	General and administrative expenditures	MDL M	2.16	2.19	2.28	2.37	2.47	2.57	2.67	2.78	2.89	3.00	3.12	3.25	3.38	3.51	3.65
6	Other costs	MDL M	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49
	TOTAL fixed costs for water		7.949	8.156	8.680	11.343	11.677	12.023	12.522	12.901	13.293	13.701	14.124	14.563	15.019	15.492	15.983
	Wastewater																
1	Maintenance - old assets	MDL M	0.00	0.00	0.00	0.50	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.59	0.60	0.61	0.62
2	Maintenance - new assets	MDL M	0.03	0.03	0.19	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
3	Salaries and related costs	MDL M	3.43	3.54	3.70	4.12	4.28	4.45	5.59	5.82	6.05	6.29	6.54	6.81	7.08	7.36	7.66
4	Fuel	MDL M	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
5	General and administrative expenditures	MDL M	1.35	1.37	1.42	1.48	1.54	1.60	1.66	1.73	1.80	1.87	1.94	2.02	2.10	2.19	2.27
6	Other costs	MDL M	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
	TOTAL fixed costs for wastewater	MDL M	5.623	5.747	6.120	7.217	7.451	7.694	8.911	9.211	9.524	9.849	10.187	10.538	10.903	11.282	11.676

	Water		16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Maintenance - old assets	MDL M	2.54	2.59	2.64	2.69	2.75	2.80	2.84	2.89	2.93	2.97	3.02	3.06	3.11	3.15	3.20
2	Maintenance - new assets	MDL M	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
3	Salaries and related costs	MDL M	8.16	8.48	8.82	9.18	9.54	9.92	10.22	10.53	10.84	11.17	11.50	11.85	12.21	12.57	12.95
4	Fuel	MDL M	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
5	General and administrative expenditures	MDL M	3.80	3.95	4.11	4.28	4.45	4.62	4.76	4.91	5.05	5.20	5.36	5.52	5.69	5.86	6.03
6	Other costs	MDL M	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49
	TOTAL fixed costs for water		16.493	17.022	17.571	18.141	18.733	19.347	19.826	20.318	20.824	21.345	21.881	22.432	22.999	23.583	24.183
	Wastewater																
1	Maintenance - old assets	MDL M	0.63	0.65	0.66	0.67	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.77	0.78	0.79	0.80
2	Maintenance - new assets	MDL M	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
3	Salaries and related costs	MDL M	7.96	8.28	8.61	8.96	9.32	9.69	9.98	10.28	10.59	10.90	11.23	11.57	11.91	12.27	12.64
4	Fuel	MDL M	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
5	General and administrative expenditures	MDL M	2.36	2.46	2.56	2.66	2.77	2.88	2.96	3.05	3.14	3.24	3.33	3.43	3.54	3.64	3.75
6	Other costs	MDL M	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
	TOTAL fixed costs for wastewater	MDL M	12.085	12.511	12.954	13.414	13.892	14.389	14.776	15.175	15.586	16.009	16.444	16.892	17.354	17.829	18.319

Table 6-12: Total costs

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Variable costs	MDL M	3.89	4.90	4.97	5.07	5.12	5.16	5.68	5.95	6.24	6.54	6.86	7.19	7.50	7.82	8.16
2	Fixed costs	MDL M	13.57	13.90	14.80	18.56	19.13	19.72	21.43	22.11	22.82	23.55	24.31	25.10	25.92	26.77	27.66
3	Depreciation	MDL M	2.55	2.75	3.77	4.59	4.59	4.59	4.59	4.59	4.59	4.59	4.59	4.59	1.75	1.62	1.62
	TOTAL costs	MDL M	20.015	21.559	23.538	28.218	28.830	29.464	31.697	32.654	33.648	34.682	35.757	36.875	35.168	36.219	37.440

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Variable costs	MDL M	8.52	8.74	9.13	9.55	10.00	10.46	10.96	11.38	11.83	12.29	12.77	13.28	13.69	14.12	14.56
2	Fixed costs	MDL M	28.58	29.53	30.52	31.55	32.62	33.74	34.60	35.49	36.41	37.35	38.32	39.32	40.35	41.41	42.50
3	Depreciation	MDL M	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62
	TOTAL costs	MDL M	38.721	39.891	41.282	42.732	44.245	45.823	47.181	48.498	49.860	51.267	52.723	54.227	55.668	57.151	58.681

Table 6-13: Calculation of the water and wastewater tariff

	Water Supply		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1	Variable and fixed costs	MDL M	11.27	11.30	12.32	12.90	15.63	16.02	16.43	17.22	17.82	18.44	19.08	19.75	20.44	21.14	21.86	22.61
2	Depreciation	MDL M	1.82	1.82	1.96	2.67	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23	2.94	2.82	2.82
3	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Reserve for irregular receivables	MDL M	0.00	0.66	0.64	0.62	0.66	0.58	0.49	0.51	0.53	0.54	0.56	0.57	0.59	0.60	0.62	0.64
5	Sale of water	m3	1,238,493	1,247,609	1,256,710	1,265,797	1,378,830	1,391,342	1,403,801	1,491,465	1,531,290	1,571,475	1,612,020	1,652,928	1,694,196	1,735,827	1,777,820	1,820,175
6	Tariff without depreciation	MDL M/m3	9.10	9.58	10.31	10.68	11.81	11.93	12.05	11.89	11.98	12.08	12.18	12.29	12.41	12.52	12.64	12.77
7	Tariff with depreciation	MDL M/m3	10.57	11.04	11.87	12.79	14.16	14.26	14.36	14.06	14.09	14.14	14.19	14.25	14.32	14.22	14.23	14.32
8	**Proposed avarage tariff**	**MDL/m3**	**9.09**	**14.00**	**14.00**	**14.00**	**14.00**	**14.00**	**14.00**	**14.06**	**14.09**	**14.14**	**14.19**	**14.25**	**14.32**	**14.22**	**14.23**	**14.32**
	Wastewater Services																	
1	Variable and fixed costs	MDL M	6.14	6.17	6.49	6.87	8.00	8.22	8.45	9.89	10.25	10.62	11.02	11.42	11.85	12.28	12.74	13.21
2	Depreciation	MDL M	0.73	0.73	0.79	1.10	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
3	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Reserve for irregular receivables	MDL M	0.00	0.35	0.33	0.32	0.33	0.29	0.25	0.28	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36
5	Sale of wastewater	m3	823,791	829,828	835,870	841,916	884,069	890,379	896,692	1,191,492	1,229,189	1,267,302	1,305,831	1,344,777	1,384,141	1,423,923	1,464,123	1,504,743
6	Tariff without depreciation	MDL M/m3	7.45	7.85	8.15	8.53	9.42	9.56	9.70	8.53	8.57	8.62	8.67	8.73	8.80	8.87	8.94	9.02
7	Tariff with depreciation	MDL M/m3	8.34	8.73	9.10	9.85	10.95	11.08	11.20	9.67	9.67	9.69	9.71	9.74	9.77	9.82	9.86	9.92
8	**Proposed avarage tariff**	**MDL/m3**	**8.50**	**9.00**	**9.00**	**9.00**	**9.00**	**9.00**	**9.00**	**9.67**	**9.67**	**9.69**	**9.71**	**9.74**	**9.77**	**9.82**	**9.86**	**9.92**
	Dynamic prime costs for water	**MDL/m3**		**14.27**														
	Dynamic prime costs for wastewater	**MDL/m3**		**10.62**														

	Water Supply		**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	Variable and fixed costs	MDL M	23.40	24.09	24.93	25.81	26.72	27.68	28.52	29.32	30.14	31.00	31.88	32.79	33.65	34.53	35.43
2	Depreciation	MDL M	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82
3	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Reserve for irregular receivables	MDL M	0.66	0.67	0.69	0.72	0.74	0.76	0.78	0.80	0.82	0.85	0.87	0.89	0.91	0.93	0.96
5	Sale of water	m3	1,866,787	1,881,615	1,896,422	1,911,206	1,925,968	1,940,708	1,955,424	1,970,118	1,984,789	1,999,436	2,014,060	2,028,660	2,043,236	2,057,787	2,072,314
6	Tariff without depreciation	MDL M/m3	12.89	13.16	13.51	13.88	14.26	14.66	14.98	15.29	15.60	15.93	16.26	16.60	16.91	17.23	17.56
7	Tariff with depreciation	MDL M/m3	14.40	14.66	15.00	15.35	15.72	16.11	16.43	16.72	17.02	17.34	17.66	17.99	18.29	18.60	18.92
8	**Proposed avarage tariff**	**MDL/m3**	**14.40**	**14.66**	**15.00**	**15.35**	**15.72**	**16.11**	**16.43**	**16.72**	**17.02**	**17.34**	**17.66**	**17.99**	**18.29**	**18.60**	**18.92**
	Wastewater Services																
1	Variable and fixed costs	MDL M	13.70	14.18	14.73	15.30	15.90	16.52	17.04	17.56	18.09	18.65	19.22	19.81	20.40	21.00	21.63
2	Depreciation	MDL M	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
3	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Reserve for irregular receivables	MDL M	0.38	0.39	0.40	0.42	0.43	0.45	0.46	0.47	0.49	0.50	0.51	0.53	0.54	0.56	0.57
5	Sale of wastewater	m3	1,545,783	1,566,206	1,586,750	1,607,415	1,628,202	1,649,111	1,670,142	1,691,294	1,712,569	1,733,966	1,755,485	1,777,127	1,798,891	1,820,778	1,842,789
6	Tariff without depreciation	MDL M/m3	9.10	9.30	9.54	9.78	10.03	10.29	10.48	10.66	10.85	11.04	11.24	11.45	11.64	11.84	12.05
7	Tariff with depreciation	MDL M/m3	9.98	10.17	10.39	10.62	10.86	11.11	11.29	11.46	11.64	11.82	12.01	12.21	12.39	12.58	12.78
8	**Proposed avarage tariff**	**MDL/m3**	**9.98**	**10.17**	**10.39**	**10.62**	**10.86**	**11.11**	**11.29**	**11.46**	**11.64**	**11.82**	**12.01**	**12.21**	**12.39**	**12.58**	**12.78**

Table 6-14: Tariff affordability

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Avarage bill for water (per person)	MDL/month	35.10	35.47	35.84	36.21	36.58	36.95	37.48	37.94	38.43	38.94	39.49	40.07	40.16	40.56	41.20
2	Avarage bill for wastewater (per person)	MDL/month	22.56	22.80	23.04	23.28	23.51	23.75	25.77	26.04	26.33	26.65	26.99	27.35	27.72	28.11	28.53
3	Avarage bill for water and wastewater (per person)	MDL/month	57.66	58.27	58.87	59.48	60.09	60.70	63.25	63.98	64.76	65.59	66.48	67.42	67.88	68.67	69.73
4	Disposable households income	MDL/month	1729.57	1781.46	1863.41	1943.53	2021.27	2102.12	2186.21	2273.66	2364.60	2459.19	2557.56	2659.86	2766.25	2876.90	2991.98
5	Tariff affordability	%	3.3%	3.3%	3.2%	3.1%	3.0%	2.9%	2.9%	2.8%	2.7%	2.7%	2.6%	2.5%	2.5%	2.4%	2.3%
6	Affordability constrains	%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Avarage bill for water (per person)	MDL/month	41.80	42.94	44.34	45.79	47.31	48.90	50.30	51.64	53.02	54.46	55.94	57.47	58.91	60.40	61.93
2	Avarage bill for wastewater (per person)	MDL/month	28.97	29.79	30.71	31.68	32.68	33.72	34.56	35.40	36.25	37.14	38.05	39.00	39.92	40.86	41.84
3	Avarage bill for water and wastewater (per person)	MDL/month	70.77	72.73	75.05	77.47	79.99	82.62	84.86	87.03	89.28	91.60	93.99	96.47	98.83	101.27	103.77
4	Disposable households income	MDL/month	3111.66	3236.12	3365.57	3500.19	3640.20	3785.81	3899.38	4016.36	4136.85	4260.96	4388.79	4520.45	4656.07	4795.75	4939.62
5	Tariff affordability	%	2.3%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
6	Affordability constrains	%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%

Table 6-15: Profits and losses - with project

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Sale of water	MDL M	17.47	17.59	17.72	19.30	19.48	19.65	20.97	21.58	22.21	22.87	23.56	24.27	24.68	25.30	26.07
2	Sale of wastewater	MDL M	7.47	7.52	7.58	7.96	8.01	8.07	11.52	11.89	12.28	12.68	13.09	13.53	13.98	14.44	14.92
3	Other revenues	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	**Total revenues**	**MDL M**	**24.93**	**25.12**	**25.30**	**27.26**	**27.49**	**27.72**	**32.49**	**33.47**	**34.49**	**35.55**	**36.65**	**37.80**	**38.66**	**39.74**	**40.99**
5	Costs of water services	MDL M	13.11	14.28	15.57	18.86	19.26	19.66	20.46	21.05	21.67	22.31	22.98	23.67	24.08	24.68	25.43
	variable costs	MDL M	3.35	4.16	4.22	4.29	4.34	4.40	4.70	4.92	5.14	5.38	5.62	5.88	6.12	6.37	6.63
	fixed costs	MDL M	7.95	8.16	8.68	11.34	11.68	12.02	12.52	12.90	13.29	13.70	14.12	14.56	15.02	15.49	15.98
	depreciation	MDL M	1.82	1.96	2.67	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23	2.94	2.82	2.82
6	Costs of wastewater services	MDL M	6.90	7.28	7.97	9.35	9.57	9.80	11.24	11.60	11.98	12.37	12.78	13.20	13.64	14.09	14.56
	variable costs	MDL M	0.55	0.74	0.75	0.78	0.77	0.76	0.98	1.04	1.10	1.17	1.24	1.31	1.38	1.45	1.53
	fixed costs	MDL M	5.62	5.75	6.12	7.22	7.45	7.69	8.91	9.21	9.52	9.85	10.19	10.54	10.90	11.28	11.68
	depreciation	MDL M	0.73	0.79	1.10	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
7	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Costs of other services and general costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	**Total costs**	**MDL M**	**20.01**	**21.56**	**23.54**	**28.22**	**28.83**	**29.46**	**31.70**	**32.65**	**33.65**	**34.68**	**35.76**	**36.87**	**37.72**	**38.77**	**39.99**
10	**Gross profit**	**MDL M**	4.92	3.56	1.76	-0.96	-1.34	-1.74	0.79	0.82	0.84	0.87	0.89	0.92	0.94	0.97	1.00
11	**Income tax**	MDL M	0.6	0.4	0.2	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
12	**Net profit**	**MDL M**	4.33	3.13	1.55	-0.96	-1.34	-1.74	0.70	0.72	0.74	0.76	0.79	0.81	0.83	0.85	0.88

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sale of water	MDL M	26.88	27.58	28.44	29.34	30.28	31.26	32.12	32.94	33.79	34.66	35.56	36.50	37.38	38.28	39.21
2	Sale of wastewater	MDL M	15.42	15.92	16.48	17.07	17.68	18.32	18.85	19.38	19.93	20.50	21.09	21.70	22.30	22.91	23.55
3	Other revenues	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	**Total revenues**	**MDL M**	**42.30**	**43.50**	**44.93**	**46.41**	**47.96**	**49.58**	**50.97**	**52.32**	**53.72**	**55.16**	**56.65**	**58.20**	**59.67**	**61.19**	**62.76**
5	Costs of water services	MDL M	26.22	26.90	27.75	28.63	29.54	30.50	31.34	32.14	32.96	33.82	34.70	35.61	36.46	37.34	38.25
	variable costs	MDL M	6.91	7.06	7.36	7.67	7.99	8.33	8.69	9.00	9.32	9.65	10.00	10.36	10.65	10.94	11.25
	fixed costs	MDL M	16.49	17.02	17.57	18.14	18.73	19.35	19.83	20.32	20.82	21.35	21.88	22.43	23.00	23.58	24.18
	depreciation	MDL M	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82
6	Costs of wastewater services	MDL M	15.05	15.54	16.08	16.65	17.25	17.87	18.39	18.91	19.45	20.00	20.57	21.17	21.75	22.36	22.98
	variable costs	MDL M	1.61	1.67	1.78	1.89	2.01	2.13	2.26	2.38	2.51	2.64	2.78	2.92	3.05	3.17	3.31
	fixed costs	MDL M	12.09	12.51	12.95	13.41	13.89	14.39	14.78	15.18	15.59	16.01	16.44	16.89	17.35	17.83	18.32
	depreciation	MDL M	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
7	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Costs of other services and general costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	**Total costs**	**MDL M**	**41.27**	**42.44**	**43.83**	**45.28**	**46.79**	**48.37**	**49.73**	**51.05**	**52.41**	**53.82**	**55.27**	**56.78**	**58.22**	**59.70**	**61.23**
10	**Gross profit**	**MDL M**	1.03	1.06	1.10	1.13	1.17	1.21	1.24	1.28	1.31	1.35	1.38	1.42	1.46	1.49	1.53
11	**Income tax**	MDL M	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
12	**Net profit**	**MDL M**	0.91	0.93	0.96	1.00	1.03	1.06	1.09	1.12	1.15	1.18	1.22	1.25	1.28	1.31	1.35

Table 6-16: Profits and losses - without project

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Sale of water	MDL M	17.47	17.59	17.72	17.91	18.05	18.19	16.93	17.51	18.12	18.75	19.41	20.10	20.79	21.51	22.25
2	Sale of wastewater	MDL M	7.47	7.52	7.58	7.63	7.69	7.74	9.93	10.28	10.65	11.03	11.43	11.85	12.28	12.72	13.18
3	Other revenues	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	**Total revenues**	**MDL M**	**24.93**	**25.12**	**25.30**	**25.54**	**25.74**	**25.93**	**26.86**	**27.79**	**28.77**	**29.78**	**30.84**	**31.95**	**33.06**	**34.23**	**35.43**
5	Costs of water services	MDL M	13.11	14.09	14.44	14.99	15.35	15.72	16.52	17.08	17.68	18.29	18.94	19.61	20.28	20.98	21.71
	variable costs	MDL M	3.35	4.16	4.22	4.30	4.36	4.43	4.77	5.00	5.24	5.50	5.76	6.04	6.30	6.58	6.87
	fixed costs	MDL M	7.95	8.11	8.40	8.87	9.17	9.47	9.93	10.27	10.62	10.98	11.36	11.75	12.16	12.58	13.03
	depreciation	MDL M	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82
6	Costs of wastewater services	MDL M	6.88	7.20	7.43	7.92	8.15	8.40	9.69	10.03	10.39	10.76	11.15	11.56	11.98	12.41	12.86
	variable costs	MDL M	0.55	0.75	0.77	0.78	0.79	0.81	0.88	0.94	1.00	1.06	1.12	1.19	1.25	1.32	1.39
	fixed costs	MDL M	5.59	5.72	5.93	6.41	6.63	6.86	8.07	8.36	8.66	8.98	9.30	9.64	9.99	10.36	10.74
	depreciation	MDL M	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
7	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Costs of other services and general costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	**Total costs**	**MDL M**	**19.99**	**21.29**	**21.87**	**22.91**	**23.50**	**24.12**	**26.20**	**27.12**	**28.07**	**29.06**	**30.09**	**31.17**	**32.26**	**33.39**	**34.57**
10	**Gross profit**	**MDL M**	4.95	3.82	3.43	2.63	2.23	1.81	0.66	0.68	0.70	0.73	0.75	0.78	0.81	0.83	0.86
11	**Income tax**	MDL M	0.6	0.5	0.4	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
12	**Net profit**	**MDL M**	4.35	3.37	3.02	2.32	1.96	1.59	0.58	0.60	0.62	0.64	0.66	0.69	0.71	0.73	0.76

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sale of water	MDL M	23.03	23.72	24.58	25.48	26.43	27.41	28.29	29.14	30.01	30.92	31.85	32.83	33.74	34.68	35.65
2	Sale of wastewater	MDL M	13.66	14.14	14.68	15.24	15.83	16.44	16.95	17.46	17.98	18.53	19.09	19.67	20.25	20.84	21.46
3	Other revenues	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	**Total revenues**	**MDL M**	**36.70**	**37.87**	**39.27**	**40.73**	**42.26**	**43.85**	**45.24**	**46.60**	**47.99**	**49.44**	**50.95**	**52.50**	**53.99**	**55.52**	**57.11**
5	Costs of water services	MDL M	22.47	23.14	23.98	24.86	25.78	26.74	27.60	28.43	29.28	30.16	31.08	32.03	32.92	33.83	34.78
	variable costs	MDL M	7.17	7.36	7.70	8.07	8.45	8.85	9.27	9.65	10.03	10.44	10.87	11.31	11.68	12.06	12.45
	fixed costs	MDL M	13.49	13.97	14.46	14.98	15.52	16.08	16.51	16.96	17.43	17.90	18.39	18.90	19.42	19.96	20.51
	depreciation	MDL M	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82
6	Costs of wastewater services	MDL M	13.33	13.80	14.32	14.87	15.44	16.04	16.54	17.03	17.55	18.08	18.63	19.19	19.76	20.34	20.93
	variable costs	MDL M	1.46	1.51	1.61	1.71	1.82	1.93	2.05	2.16	2.27	2.39	2.51	2.65	2.76	2.87	2.99
	fixed costs	MDL M	11.14	11.55	11.98	12.43	12.90	13.38	13.76	14.14	14.54	14.96	15.38	15.82	16.27	16.73	17.21
	depreciation	MDL M	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
7	Interest and financial costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Costs of other services and general costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	**Total costs**	**MDL M**	**35.80**	**36.94**	**38.31**	**39.73**	**41.22**	**42.78**	**44.14**	**45.46**	**46.82**	**48.24**	**49.70**	**51.22**	**52.67**	**54.17**	**55.72**
10	**Gross profit**	**MDL M**	0.90	0.92	0.96	0.99	1.03	1.07	1.10	1.14	1.17	1.21	1.24	1.28	1.32	1.35	1.39
11	**Income tax**	MDL M	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
12	**Net profit**	**MDL M**	0.79	0.81	0.84	0.87	0.91	0.94	0.97	1.00	1.03	1.06	1.09	1.13	1.16	1.19	1.23

Table 6-17: Working Capital - with project

			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Current assets**	**MDL M**	**5.71**	**2.35**	**2.37**	**2.41**	**2.76**	**2.79**	**2.82**	**3.23**	**3.32**	**3.42**	**3.52**	**3.62**	**3.73**	**3.81**	**3.92**	**4.04**
1	Inventories	MDL M	0.96	0.30	0.31	0.33	0.52	0.53	0.54	0.56	0.57	0.58	0.59	0.61	0.62	0.64	0.65	0.67
2	Accounts receivable	MDL M	4.75	2.05	2.06	2.08	2.24	2.26	2.28	2.67	2.75	2.83	2.92	3.01	3.11	3.18	3.27	3.37
	Increase in current assets	MDL M		-3.36	0.02	0.04	0.35	0.03	0.03	0.40	0.09	0.10	0.10	0.10	0.11	0.09	0.10	0.12
B	**Current liabilities**	**MDL M**	**1.75**	**2.07**	**2.20**	**2.31**	**2.69**	**2.77**	**2.85**	**3.16**	**3.27**	**3.40**	**3.52**	**3.65**	**3.79**	**3.92**	**4.07**	**4.22**
1	Liabilities to suppliers	MDL M	0.30	1.44	1.55	1.62	1.94	1.99	2.04	2.23	2.31	2.39	2.47	2.56	2.65	2.75	2.84	2.94
2	Liabilities to employees	MDL M	1.45	0.63	0.65	0.68	0.75	0.78	0.81	0.93	0.97	1.01	1.05	1.09	1.13	1.18	1.22	1.27
3	Increase in current liabilities	MDL M		0.32	0.13	0.11	0.38	0.08	0.08	0.31	0.12	0.12	0.13	0.13	0.14	0.14	0.14	0.15

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Current assets**	**MDL M**	**4.16**	**4.27**	**4.41**	**4.55**	**4.69**	**4.85**	**4.98**	**5.10**	**5.23**	**5.37**	**5.51**	**5.65**	**5.79**	**5.93**	**6.08**
1	Inventories	MDL M	0.68	0.70	0.72	0.73	0.75	0.77	0.79	0.80	0.82	0.83	0.85	0.87	0.88	0.90	0.92
2	Accounts receivable	MDL M	3.48	3.58	3.69	3.81	3.94	4.08	4.19	4.30	4.42	4.53	4.66	4.78	4.90	5.03	5.16
	Increase in current assets	MDL M	0.12	0.12	0.13	0.14	0.15	0.15	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.15
B	**Current liabilities**	**MDL M**	**4.37**	**4.52**	**4.69**	**4.87**	**5.05**	**5.24**	**5.40**	**5.56**	**5.73**	**5.89**	**6.07**	**6.25**	**6.42**	**6.61**	**6.79**
1	Liabilities to suppliers	MDL M	3.05	3.15	3.26	3.38	3.50	3.63	3.74	3.85	3.96	4.08	4.20	4.32	4.44	4.56	4.69
2	Liabilities to employees	MDL M	1.32	1.38	1.43	1.49	1.55	1.61	1.66	1.71	1.76	1.81	1.87	1.92	1.98	2.04	2.10
3	Increase in current liabilities	MDL M	0.16	0.15	0.17	0.18	0.18	0.19	0.16	0.16	0.16	0.17	0.17	0.18	0.18	0.18	0.19

Table 6-18: Working Capital - without project

			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Current assets**	**MDL M**	**5.71**	**2.35**	**2.37**	**2.39**	**2.42**	**2.44**	**2.47**	**2.55**	**2.64**	**2.72**	**2.82**	**2.91**	**3.02**	**3.12**	**3.22**	**3.34**
1	Inventories	MDL M	0.96	0.30	0.30	0.31	0.32	0.33	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.41	0.42
2	Accounts receivable	MDL M	4.75	2.05	2.06	2.08	2.10	2.12	2.13	2.21	2.28	2.36	2.45	2.54	2.63	2.72	2.81	2.91
	Increase in current assets	MDL M		-3.36	0.02	0.02	0.03	0.02	0.02	0.08	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.11
B	**Current liabilities**	**MDL M**	**1.75**	**2.07**	**2.19**	**2.27**	**2.42**	**2.50**	**2.58**	**2.87**	**2.99**	**3.10**	**3.23**	**3.35**	**3.48**	**3.62**	**3.76**	**3.91**
1	Liabilities to suppliers	MDL M	0.30	1.43	1.54	1.59	1.67	1.72	1.77	1.94	2.02	2.10	2.18	2.26	2.35	2.44	2.54	2.63
2	Liabilities to employees	MDL M	1.45	0.63	0.65	0.68	0.75	0.78	0.81	0.93	0.97	1.01	1.05	1.09	1.13	1.18	1.22	1.27
3	Increase in current liabilities	MDL M		0.31	0.13	0.08	0.15	0.08	0.08	0.29	0.11	0.12	0.12	0.13	0.13	0.13	0.14	0.15

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Current assets**	**MDL M**	**3.45**	**3.56**	**3.69**	**3.82**	**3.96**	**4.11**	**4.23**	**4.36**	**4.48**	**4.61**	**4.75**	**4.89**	**5.03**	**5.17**	**5.31**
1	Inventories	MDL M	0.44	0.45	0.46	0.47	0.49	0.50	0.51	0.53	0.54	0.55	0.56	0.58	0.59	0.60	0.62
2	Accounts receivable	MDL M	3.02	3.11	3.23	3.35	3.47	3.60	3.72	3.83	3.94	4.06	4.19	4.32	4.44	4.56	4.69
	Increase in current assets	MDL M	0.12	0.11	0.13	0.13	0.14	0.15	0.13	0.12	0.13	0.13	0.14	0.14	0.14	0.14	0.14
B	**Current liabilities**	**MDL M**	**4.06**	**4.20**	**4.37**	**4.55**	**4.73**	**4.92**	**5.08**	**5.24**	**5.40**	**5.57**	**5.74**	**5.93**	**6.10**	**6.28**	**6.47**
1	Liabilities to suppliers	MDL M	2.73	2.83	2.94	3.06	3.18	3.31	3.42	3.53	3.64	3.76	3.88	4.00	4.12	4.24	4.37
2	Liabilities to employees	MDL M	1.32	1.38	1.43	1.49	1.55	1.61	1.66	1.71	1.76	1.81	1.87	1.92	1.98	2.04	2.10
3	Increase in current liabilities	MDL M	0.15	0.15	0.17	0.17	0.18	0.19	0.16	0.16	0.16	0.17	0.17	0.18	0.18	0.18	0.19

Table 6-19: Balance sheet - with project

			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Assets**	**MDL M**	**39.19**	**46.49**	**83.58**	**111.27**	**105.55**	**99.15**	**92.35**	**93.35**	**94.19**	**95.05**	**95.94**	**96.85**	**97.80**	**98.77**	**99.77**	**100.80**
1	Fixed assets	MDL M	32.41	37.66	73.88	101.28	96.69	92.11	87.52	82.93	78.34	73.76	69.17	64.58	59.99	55.70	51.53	47.35
2	Current assets	MDL M	6.78	8.83	9.70	9.99	8.86	7.04	4.83	10.42	15.85	21.29	26.77	32.27	37.81	43.07	48.24	53.44
3	Inventories	MDL M	0.96	0.30	0.31	0.33	0.52	0.53	0.54	0.56	0.57	0.58	0.59	0.61	0.62	0.64	0.65	0.67
4	Short-term receivables	MDL M	4.75	2.05	2.06	2.08	2.24	2.26	2.28	2.67	2.75	2.83	2.92	3.01	3.11	3.18	3.27	3.37
5	Cash and other financial assets	MDL M	1.07	6.48	7.32	7.57	6.09	4.25	2.01	7.19	12.52	17.87	23.25	28.65	34.07	39.25	44.32	49.40
6	Other current assets	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B	**Liabilities**	**MDL M**	**39.19**	**46.49**	**83.58**	**111.27**	**105.55**	**99.15**	**92.35**	**93.35**	**94.19**	**95.05**	**95.94**	**96.85**	**97.80**	**98.77**	**99.77**	**100.80**
1	Equity capital	MDL M	6.52	10.85	13.98	15.53	14.57	13.23	11.49	12.19	12.91	13.65	14.41	15.20	16.01	16.84	17.69	18.57
2	Long-term liabilities	MDL M	30.87	25.72	20.58	15.44	10.30	5.15	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
3	Long-term loan	MDL M	0.00	-5.14	-5.14	-5.14	-5.14	-5.14	-5.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Short-term liabilities	MDL M	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
5	Short-term loan	MDL M	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
6	Current liabilities to suppliers	MDL M	0.30	1.44	1.55	1.62	1.94	1.99	2.04	2.23	2.31	2.39	2.47	2.56	2.65	2.75	2.84	2.94
7	Current liabilities	MDL M	1.45	0.63	0.65	0.68	0.75	0.78	0.81	0.93	0.97	1.01	1.05	1.09	1.13	1.18	1.22	1.27
8	Accruals	MDL M	0.00	7.79	46.76	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Assets**	**MDL M**	**101.86**	**102.94**	**104.08**	**105.25**	**106.46**	**107.72**	**108.97**	**110.25**	**111.57**	**112.92**	**114.31**	**115.74**	**117.20**	**118.69**	**120.23**
1	Fixed assets	MDL M	43.18	39.01	34.84	30.67	26.50	22.32	18.15	13.98	9.81	5.64	1.47	-2.71	-6.88	-11.05	-15.22
2	Current assets	MDL M	58.68	63.93	69.24	74.58	79.97	85.39	90.82	96.27	101.76	107.28	112.85	118.45	124.07	129.74	135.45
3	Inventories	MDL M	0.68	0.70	0.72	0.73	0.75	0.77	0.79	0.80	0.82	0.83	0.85	0.87	0.88	0.90	0.92
4	Short-term receivables	MDL M	3.48	3.58	3.69	3.81	3.94	4.08	4.19	4.30	4.42	4.53	4.66	4.78	4.90	5.03	5.16
5	Cash and other financial assets	MDL M	54.51	59.65	64.82	70.03	75.27	80.54	85.84	91.16	96.52	101.91	107.33	112.79	118.28	123.80	129.36
6	Other current assets	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B	**Liabilities**	**MDL M**	**101.86**	**102.94**	**104.08**	**105.25**	**106.46**	**107.72**	**108.97**	**110.25**	**111.57**	**112.92**	**114.31**	**115.74**	**117.20**	**118.69**	**120.23**
1	Equity capital	MDL M	19.48	20.41	21.38	22.37	23.40	24.47	25.56	26.68	27.84	29.02	30.24	31.48	32.77	34.08	35.43
2	Long-term liabilities	MDL M	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
3	Long-term loan	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Short-term liabilities	MDL M	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
5	Short-term loan	MDL M	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
6	Current liabilities to suppliers	MDL M	3.05	3.15	3.26	3.38	3.50	3.63	3.74	3.85	3.96	4.08	4.20	4.32	4.44	4.56	4.69
7	Current liabilities	MDL M	1.32	1.38	1.43	1.49	1.55	1.61	1.66	1.71	1.76	1.81	1.87	1.92	1.98	2.04	2.10
8	Accruals	MDL M	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94	77.94

Table 6-20: Balance sheet - without project

			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Assets**	**MDL M**	**39.19**	**38.71**	**37.06**	**35.01**	**32.34**	**29.24**	**25.77**	**26.64**	**27.35**	**28.09**	**28.85**	**29.64**	**30.45**	**31.30**	**32.17**	**33.08**
1	Fixed assets	MDL M	32.41	29.86	27.31	24.77	22.22	19.67	17.12	14.57	12.02	9.47	6.92	4.38	1.83	-0.72	-3.27	-5.82
2	Current assets	MDL M	6.78	8.85	9.75	10.25	10.12	9.57	8.65	12.07	15.33	18.61	21.92	25.26	28.63	32.02	35.44	38.90
3	Inventories	MDL M	0.96	0.30	0.30	0.31	0.32	0.33	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.41	0.42
4	Short-term receivables	MDL M	4.75	2.05	2.06	2.08	2.10	2.12	2.13	2.21	2.28	2.36	2.45	2.54	2.63	2.72	2.81	2.91
5	Cash and other financial assets	MDL M	1.07	6.50	7.38	7.85	7.70	7.12	6.18	9.52	12.69	15.88	19.10	22.34	25.61	28.90	32.21	35.56
6	Other current assets	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B	**Liabilities**	**MDL M**	**39.19**	**38.71**	**37.06**	**35.01**	**32.34**	**29.24**	**25.77**	**26.64**	**27.35**	**28.09**	**28.85**	**29.64**	**30.45**	**31.30**	**32.17**	**33.08**
1	Equity capital	MDL M	6.52	10.87	14.23	17.25	19.57	21.53	23.13	23.70	24.30	24.92	25.55	26.22	26.90	27.61	28.35	29.11
2	Long-term liabilities	MDL M	30.87	25.72	20.58	15.44	10.30	5.15	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
3	Long-term loan	MDL M	0.00	-5.14	-5.14	-5.14	-5.14	-5.14	-5.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Short-term liabilities	MDL M	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
5	Short-term loan	MDL M	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
6	Current liabilities to suppliers	MDL M	0.30	1.43	1.54	1.59	1.67	1.72	1.77	1.94	2.02	2.10	2.18	2.26	2.35	2.44	2.54	2.63
7	Current liabilities	MDL M	1.45	0.63	0.65	0.68	0.75	0.78	0.81	0.93	0.97	1.01	1.05	1.09	1.13	1.18	1.22	1.27
8	Accruals	MDL M	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Assets**	**MDL M**	**34.02**	**34.98**	**35.99**	**37.04**	**38.13**	**39.26**	**40.39**	**41.55**	**42.74**	**43.97**	**45.24**	**46.55**	**47.88**	**49.26**	**50.67**
1	Fixed assets	MDL M	-8.37	-10.92	-13.47	-16.01	-18.56	-21.11	-23.66	-26.21	-28.76	-31.31	-33.86	-36.40	-38.95	-41.50	-44.05
2	Current assets	MDL M	42.39	45.90	49.45	53.05	56.69	60.37	64.05	67.76	71.50	75.28	79.09	82.95	86.84	90.76	94.72
3	Inventories	MDL M	0.44	0.45	0.46	0.47	0.49	0.50	0.51	0.53	0.54	0.55	0.56	0.58	0.59	0.60	0.62
4	Short-term receivables	MDL M	3.02	3.11	3.23	3.35	3.47	3.60	3.72	3.83	3.94	4.06	4.19	4.32	4.44	4.56	4.69
5	Cash and other financial assets	MDL M	38.93	42.33	45.76	49.22	52.72	56.26	59.81	63.40	67.01	70.66	74.34	78.05	81.80	85.59	89.40
6	Other current assets	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B	**Liabilities**	**MDL M**	**34.02**	**34.98**	**35.99**	**37.04**	**38.13**	**39.26**	**40.39**	**41.55**	**42.74**	**43.97**	**45.24**	**46.55**	**47.88**	**49.26**	**50.67**
1	Equity capital	MDL M	29.89	30.71	31.55	32.42	33.33	34.27	35.24	36.24	37.27	38.34	39.43	40.56	41.71	42.91	44.13
2	Long-term liabilities	MDL M	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
3	Long-term loan	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Short-term liabilities	MDL M	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
5	Short-term loan	MDL M	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
6	Current liabilities to suppliers	MDL M	2.73	2.83	2.94	3.06	3.18	3.31	3.42	3.53	3.64	3.76	3.88	4.00	4.12	4.24	4.37
7	Current liabilities	MDL M	1.32	1.38	1.43	1.49	1.55	1.61	1.66	1.71	1.76	1.81	1.87	1.92	1.98	2.04	2.10
8	Accruals	MDL M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6-21: Cash flow - with project

			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Financial inflows**	**MDL M**		**33.05**	**64.22**	**56.58**	**27.64**	**27.57**	**27.81**	**32.80**	**33.59**	**34.61**	**35.67**	**36.78**	**37.93**	**38.80**	**39.88**	**41.14**
1	Loan disbursement	MDL M		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Donor contribution (capital grant)	MDL M		5.11	25.53	20.42	0.00	0.00										
3	Own contribution	MDL M		2.69	13.44	10.76	0.00	0.00										
4	Revenues from sale	MDL M		24.93	25.12	25.30	27.26	27.49	27.72	32.49	33.47	34.49	35.55	36.65	37.80	38.66	39.74	40.99
5	Increase in current liabilities	MDL M		0.32	0.13	0.11	0.38	0.08	0.08	0.31	0.12	0.12	0.13	0.13	0.14	0.14	0.14	0.15
B	**Financial outflows**	**MDL M**		**27.64**	**63.37**	**56.34**	**29.12**	**29.42**	**30.05**	**27.61**	**28.26**	**29.26**	**30.30**	**31.38**	**32.51**	**33.62**	**34.82**	**36.05**
1	Investment costs	MDL M		7.79	38.97	31.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Costs of providing services	MDL M		17.47	18.81	19.77	23.63	24.24	24.88	27.11	28.07	29.06	30.10	31.17	32.29	33.42	34.60	35.82
3	Long term loan repayment	MDL M		5.14	5.14	5.14	5.14	5.14	5.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Increase in current assets	MDL M		-3.36	0.02	0.04	0.35	0.03	0.03	0.40	0.09	0.10	0.10	0.10	0.11	0.09	0.10	0.12
5	Income tax	MDL M		0.59	0.43	0.21	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.12
C	Net cash flow (inflow - outflow)	**MDL M**		5.41	0.85	0.25	-1.48	-1.84	-2.24	5.19	5.33	5.35	5.38	5.40	5.43	5.18	5.06	5.08
D	Cumulated cash	**MDL M**	1.07	6.48	7.32	7.57	6.09	4.25	2.01	7.19	12.52	17.87	23.25	28.65	34.07	39.25	44.32	49.40

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Financial inflows**	**MDL M**	**42.46**	**43.65**	**45.10**	**46.59**	**48.15**	**49.77**	**51.13**	**52.48**	**53.88**	**55.33**	**56.83**	**58.38**	**59.85**	**61.37**	**62.95**
1	Loan disbursement	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Donor contribution (capital grant)	MDL M															
3	Own contribution	MDL M															
4	Revenues from sale	MDL M	42.30	43.50	44.93	46.41	47.96	49.58	50.97	52.32	53.72	55.16	56.65	58.20	59.67	61.19	62.76
5	Increase in current liabilities	MDL M	0.16	0.15	0.17	0.18	0.18	0.19	0.16	0.16	0.16	0.17	0.17	0.18	0.18	0.18	0.19
B	**Financial outflows**	**MDL M**	**37.35**	**38.51**	**39.92**	**41.39**	**42.91**	**44.50**	**45.84**	**47.15**	**48.52**	**49.94**	**51.40**	**52.92**	**54.36**	**55.85**	**57.39**
1	Investment costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Costs of providing services	MDL M	37.10	38.27	39.66	41.11	42.62	44.20	45.56	46.88	48.24	49.64	51.10	52.60	54.04	55.53	57.06
3	Long term loan repayment	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Increase in current assets	MDL M	0.12	0.12	0.13	0.14	0.15	0.15	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.15
5	Income tax	MDL M	0.12	0.13	0.13	0.14	0.14	0.15	0.15	0.15	0.16	0.16	0.17	0.17	0.17	0.18	0.18
C	Net cash flow (inflow - outflow)	**MDL M**	5.11	5.14	5.17	5.20	5.24	5.28	5.30	5.33	5.36	5.39	5.42	5.46	5.49	5.52	5.56
D	Cumulated cash	**MDL M**	54.51	59.65	64.82	70.03	75.27	80.54	85.84	91.16	96.52	101.91	107.33	112.79	118.28	123.80	129.36

Table 6-22: Cash flow - without project

			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Financial inflows**	**MDL M**		**25.25**	**25.24**	**25.38**	**25.69**	**25.81**	**26.01**	**27.15**	**27.91**	**28.89**	**29.91**	**30.97**	**32.08**	**33.20**	**34.37**	**35.58**
1	Loan disbursement	MDL M		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Donor contribution (capital grant)	MDL M		0.00	0.00	0.00	0.00	0.00										
3	Own contribution	MDL M		0.00	0.00	0.00	0.00	0.00										
4	Revenues from sale	MDL M		24.93	25.12	25.30	25.54	25.74	25.93	26.86	27.79	28.77	29.78	30.84	31.95	33.06	34.23	35.43
5	Increase in current liabilities	MDL M		0.31	0.13	0.08	0.15	0.08	0.08	0.29	0.11	0.12	0.12	0.13	0.13	0.13	0.14	0.15
B	**Financial outflows**	**MDL M**		**19.82**	**24.36**	**24.90**	**25.84**	**26.39**	**26.96**	**23.82**	**24.73**	**25.69**	**26.69**	**27.73**	**28.81**	**29.91**	**31.05**	**32.24**
1	Investment costs	MDL M		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Costs of providing services	MDL M		17.44	18.74	19.32	20.36	20.95	21.57	23.65	24.57	25.52	26.51	27.54	28.62	29.71	30.84	32.02
3	Long term loan repayment	MDL M		5.14	5.14	5.14	5.14	5.14	5.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Increase in current assets	MDL M		-3.36	0.02	0.02	0.03	0.02	0.02	0.08	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.11
				0.59	0.46	0.41	0.32	0.27	0.22	0.08	0.08	0.08	0.09	0.09	0.09	0.10	0.10	0.10
C	**Net cash flow (inflow - outflow)**	**MDL M**		5.43	0.88	0.48	-0.15	-0.57	-0.94	3.33	3.17	3.19	3.22	3.24	3.27	3.29	3.32	3.34
D	**Cumulated cash**	**MDL M**	1.07	6.50	7.38	7.85	7.70	7.12	6.18	9.52	12.69	15.88	19.10	22.34	25.61	28.90	32.21	35.56

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Financial inflows**	**MDL M**	**36.85**	**38.01**	**39.43**	**40.90**	**42.44**	**44.04**	**45.40**	**46.75**	**48.16**	**49.61**	**51.12**	**52.68**	**54.17**	**55.71**	**57.30**
1	Loan disbursement	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Donor contribution (capital grant)	MDL M															
3	Own contribution	MDL M															
4	Revenues from sale	MDL M	36.70	37.87	39.27	40.73	42.26	43.85	45.24	46.60	47.99	49.44	50.95	52.50	53.99	55.52	57.11
5	Increase in current liabilities	MDL M	0.15	0.15	0.17	0.17	0.18	0.19	0.16	0.16	0.16	0.17	0.17	0.18	0.18	0.18	0.19
B	**Financial outflows**	**MDL M**	**33.48**	**34.61**	**36.00**	**37.44**	**38.94**	**40.51**	**41.85**	**43.17**	**44.54**	**45.97**	**47.44**	**48.97**	**50.42**	**51.92**	**53.48**
1	Investment costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Costs of providing services	MDL M	33.25	34.39	35.76	37.19	38.68	40.23	41.59	42.91	44.28	45.69	47.15	48.67	50.12	51.62	53.17
3	Long term loan repayment	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Increase in current assets	MDL M	0.12	0.11	0.13	0.13	0.14	0.15	0.13	0.12	0.13	0.13	0.14	0.14	0.14	0.14	0.14
			0.11	0.11	0.11	0.12	0.12	0.13	0.13	0.14	0.14	0.14	0.15	0.15	0.16	0.16	0.17
C	**Net cash flow (inflow - outflow)**	**MDL M**	3.37	3.40	3.43	3.46	3.50	3.53	3.55	3.58	3.62	3.65	3.68	3.72	3.75	3.78	3.82
D	**Cumulated cash**	**MDL M**	38.93	42.33	45.76	49.22	52.72	56.26	59.81	63.40	67.01	70.66	74.34	78.05	81.80	85.59	89.40

Table 6-23: Financial analysis on profitability of the investment

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Financial inflows**	**MDL M**	**0.00**	**0.00**	**0.03**	**1.95**	**1.76**	**1.79**	**5.65**	**5.68**	**5.72**	**5.77**	**5.81**	**5.85**	**5.60**	**5.51**	**5.56**
1	Incremental revenues from sales	MDL M	0.00	0.00	0.00	1.72	1.76	1.79	5.63	5.68	5.72	5.76	5.81	5.85	5.60	5.51	5.55
2	Incremental increase in current liabilities	MDL M	0.00	0.00	0.03	0.23	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Residual value	MDL M															
B	**Financial outflows**	**MDL M**	**4.46**	**39.06**	**31.66**	**3.62**	**3.32**	**3.34**	**3.86**	**3.59**	**3.64**	**3.69**	**3.73**	**3.78**	**3.80**	**3.86**	**3.91**
1	Investment costs	MDL M	7.79	38.97	31.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Incremental operational costs of providing services	MDL M	0.03	0.06	0.44	3.27	3.29	3.31	3.46	3.50	3.54	3.59	3.63	3.67	3.71	3.75	3.79
3	Incremental increase in current assets	MDL M	-3.36	0.02	0.04	0.35	0.03	0.03	0.40	0.09	0.10	0.10	0.10	0.11	0.09	0.10	0.12
C	Net cash flow (inflow - outflow)	**MDL M**	-4.46	-39.05	-31.63	-1.67	-1.56	-1.54	1.78	2.09	2.09	2.08	2.08	2.08	1.80	1.66	1.64
D	FNPV(C)	**MDL M**	**-45.68**														
E	FRR(C) - Financial Rate of Return of the Investment	%	**-1%**														

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Financial inflows**	**MDL M**	**5.61**	**5.64**	**5.66**	**5.69**	**5.71**	**5.73**	**5.73**	**5.73**	**5.72**	**5.72**	**5.71**	**5.69**	**5.68**	**5.67**	**34.48**
1	Incremental revenues from sales	MDL M	5.60	5.63	5.66	5.69	5.71	5.73	5.73	5.73	5.72	5.72	5.71	5.69	5.68	5.67	5.65
2	Incremental increase in current liabilities	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Residual value	MDL M															28.83
B	**Financial outflows**	**MDL M**	**3.97**	**3.99**	**4.03**	**4.06**	**4.09**	**4.12**	**4.10**	**4.09**	**4.09**	**4.09**	**4.08**	**4.08**	**4.06**	**4.05**	**4.04**
1	Investment costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Incremental operational costs of providing services	MDL M	3.84	3.87	3.90	3.92	3.95	3.97	3.97	3.97	3.96	3.95	3.95	3.93	3.92	3.91	3.89
3	Incremental increase in current assets	MDL M	0.12	0.12	0.13	0.14	0.15	0.15	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.15
C	Net cash flow (inflow - outflow)	**MDL M**	1.64	1.65	1.63	1.62	1.62	1.61	1.63	1.64	1.63	1.63	1.62	1.62	1.62	1.62	30.44

Table 6-24: Calculation of NPV on own capital

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Financial inflows**	**MDL M**	**5.11**	**25.53**	**20.45**	**1.95**	**1.76**	**1.79**	**5.65**	**5.68**	**5.72**	**5.77**	**5.81**	**5.85**	**5.60**	**5.51**	**5.56**
1	Incremental revenues from sales	MDL M	0.00	0.00	0.00	1.72	1.76	1.79	5.63	5.68	5.72	5.76	5.81	5.85	5.60	5.51	5.55
2	Incremental increase in current liabilities	MDL M	0.00	0.00	0.03	0.23	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Donor contribution (capital grant)	MDL M	5.11	25.53	20.42	0.00	0.00										
4	Residual value	MDL M															
B	**Financial outflows**	**MDL M**	**4.46**	**39.06**	**31.66**	**3.62**	**3.32**	**3.34**	**3.86**	**3.59**	**3.64**	**3.69**	**3.73**	**3.78**	**3.80**	**3.86**	**3.91**
1	Investment costs	MDL M	7.79	38.97	31.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Incremental operational costs of providing services	MDL M	0.03	0.06	0.44	3.27	3.29	3.31	3.46	3.50	3.54	3.59	3.63	3.67	3.71	3.75	3.79
3	Incremental increase in current assets	MDL M	-3.36	0.02	0.04	0.35	0.03	0.03	0.40	0.09	0.10	0.10	0.10	0.11	0.09	0.10	0.12
C	**Net cash flow (inflow - outflow)**	**MDL M**	0.64	-13.53	-11.21	-1.67	-1.56	-1.54	1.78	2.09	2.09	2.08	2.08	2.08	1.80	1.66	1.64
D	**FNPV(K) - Financial Net Present value of the Capit**	**MDL M**	**-0.03**														
E	**FRR(K)- Financial Rate of Return of Capital**	%	**5%**														

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Financial inflows**	**MDL M**	**5.61**	**5.64**	**5.66**	**5.69**	**5.71**	**5.73**	**5.73**	**5.73**	**5.72**	**5.72**	**5.71**	**5.69**	**5.68**	**5.67**	**34.48**
1	Incremental revenues from sales	MDL M	5.60	5.63	5.66	5.69	5.71	5.73	5.73	5.73	5.72	5.72	5.71	5.69	5.68	5.67	5.65
2	Incremental increase in current liabilities	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Donor contribution (capital grant)	MDL M															
4	Residual value	MDL M															28.83
B	**Financial outflows**	**MDL M**	**3.97**	**3.99**	**4.03**	**4.06**	**4.09**	**4.12**	**4.10**	**4.09**	**4.09**	**4.09**	**4.08**	**4.08**	**4.06**	**4.05**	**4.04**
1	Investment costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Incremental operational costs of providing services	MDL M	3.84	3.87	3.90	3.92	3.95	3.97	3.97	3.97	3.96	3.95	3.95	3.93	3.92	3.91	3.89
3	Incremental increase in current assets	MDL M	0.12	0.12	0.13	0.14	0.15	0.15	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.15
C	**Net cash flow (inflow - outflow)**	**MDL M**	1.64	1.65	1.63	1.62	1.62	1.61	1.63	1.64	1.63	1.63	1.62	1.62	1.62	1.62	30.44

Table 6-25: Economic analysis

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**Net cash flow (inflow - outflow)**	**MDL M**	**-4.46**	**-39.05**	**-31.63**	**-1.67**	**-1.56**	**-1.54**	**1.78**	**2.09**	**2.09**	**2.08**	**2.08**	**2.08**	**1.80**	**1.66**	**1.64**
1	Social costs	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02
2	Shadow prices - electricity	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02
B	**Social benefits**	**MDL M**	**3.51**	**17.54**	**14.03**	**9.02**	**9.01**	**9.01**	**10.02**	**10.03**	**10.03**	**10.03**	**10.03**	**10.03**	**10.03**	**10.03**	**10.02**
1	Tax correction - VAT	MDL M	1.56	7.79	6.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Social benefits resulting from additional employment	MDL M	1.95	9.74	7.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Shadow price - business	MDL M	0.00	0.00	0.00	0.75	0.75	0.74	1.76	1.76	1.77	1.77	1.77	1.77	1.76	1.76	1.76
4	Benefits of avoiding water related disease	MDL M	0.00	0.00	0.00	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26
C	**Net cash flow (inflow - outflow)**	**MDL M**	-0.95	-21.51	-17.60	7.35	7.45	7.47	11.81	12.12	12.12	12.12	12.12	12.12	11.85	11.70	11.68
D	**ENPV**	**MDL M**	**110.44**														
E	**ERR**	%	**22%**														

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Net cash flow (inflow - outflow)**	**MDL M**	**1.64**	**1.65**	**1.63**	**1.62**	**1.62**	**1.61**	**1.63**	**1.64**	**1.63**	**1.63**	**1.62**	**1.62**	**1.62**	**1.62**	**30.44**
1	Social costs	MDL M	-0.02	-0.02	-0.03	-0.03	-0.04	-0.04	-0.05	-0.05	-0.06	-0.06	-0.07	-0.08	-0.08	-0.09	-0.10
2	Shadow prices - electricity	MDL M	-0.02	-0.02	-0.03	-0.03	-0.04	-0.04	-0.05	-0.05	-0.06	-0.06	-0.07	-0.08	-0.08	-0.09	-0.10
B	**Social benefits**	**MDL M**	**10.02**	**10.02**	**10.02**	**10.02**	**10.02**	**10.02**	**10.03**	**10.03**	**10.03**	**10.03**	**10.03**	**10.04**	**10.04**	**10.04**	**10.04**
1	Tax correction - VAT	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Social benefits resulting from additional employment	MDL M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Shadow price - business	MDL M	1.75	1.75	1.76	1.76	1.76	1.76	1.76	1.76	1.77	1.77	1.77	1.77	1.77	1.78	1.78
4	Benefits of avoiding water related disease	MDL M	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26	8.26
C	**Net cash flow (inflow - outflow)**	**MDL M**	11.68	11.69	11.68	11.68	11.68	11.68	11.71	11.72	11.72	11.72	11.73	11.73	11.74	11.75	40.58

Table 6-26: Sensitivity analysis

A	**Investment Costs**	**%**	100%	105%	110.00%	115.00%	120.00%	125.00%
1	FNPV(C)	MDL M	-45.68	-35.41	-37.09	-38.76	-40.44	-42.11
2	FRR(C)	%	-0.6%	0.3%	0.3%	0.2%	0.2%	0.2%
3	FNPV(K)	MDL M	-0.03	-0.14	-0.28	-0.41	-0.55	-0.69
4	FRR(K)	%	5.0%	5.0%	4.9%	4.9%	4.9%	4.9%
5	Financially sustainable		True	True	True	True	True	True

B	**Real Wage Increase**		Base Case	Base Case	Pessimistic	Optimistic
			1	1	2	3
1	FNPV(C)	MDL M	-45.68	-33.73	-33.73	-33.73
2	FRR(C)	%	-0.6%	0.27%	0.27%	0.27%
3	FNPV(K)	MDL M	-0.03	0.00	0.00	0.00
4	FRR(K)	%	5.0%	5.0%	5.0%	5.0%
5	Financially sustainable		True	True	True	True

C	**Real GDP growth**		Base Case	Base Case	Pessimistic	Optimistic
			1	1	2	3
1	FNPV(C)	MDL M	-45.68	-33.73	-34.09	-33.42
2	FRR(C)	%	-0.6%	0.27%	0.19%	0.33%
3	FNPV(K)	MDL M	-0.03	0.00	-0.36	0.31
4	FRR(K)	%	5.0%	5.0%	4.9%	5.1%
5	Financially sustainable		True	True	True	True

D	**Costs of electricity**		Base Case	Base Case	Pessimistic	Optimistic
			1	1	2	3
1	FNPV(C)	MDL M	-45.68	-33.73	-33.12	-34.15
2	FRR(C)	%	-0.6%	0.27%	0.39%	0.17%
3	FNPV(K)	MDL M	-0.03	0.00	0.62	-0.42
4	FRR(K)	%	5.0%	5.0%	5.2%	4.9%
5	Financially sustainable		True	True	True	True

Annex 8

Environmental impact assessment and gender aspects

Annex 8: Environmental impact assessment and gender aspects

8.1 Summary for legal framework on SEE and EIA in WSS sector

The Moldovan legal basis for environmental assessment is covered by three main laws. During the process of approximation of Moldovan legislation to the EU acquis, these laws are to be amended and/or adjusted in the near future as follow:

- Law on Environmental Protection with subsequent amendments;
- Law on Ecological Expertise with subsequent amendments;
- Law on Environmental Impact Assessment.

The Law on Environment Protection[1] represents the main legal framework for development of special normative acts and instructions in the field of environment protection in order to ensure a healthy living environment, conservation of the natural environment, ecosystem restoration etc.

The Law on Ecological Expertise[2] describes the concept of the State Ecological Expertise (SEE) which precedes decision-making on activities that may have an adverse impact on the environment. It is compulsory for all economic activities that might have negative impact on environment regardless of their destination, ownership, investments, location, source of financing, etc.

The Law on Environmental Impact Assessment[3] describes procedures and requirements for Environmental Impact Assessment (EIA) on the national level.

As result of feasibility studies, technical designs will be developed, which in the regional and local planning process in the WSS (Water Supply and Sanitation) sector will be subject to SEE and the corresponding documents shall be prepared and submitted to the responsible authorities together with the technical project documentation.

The national authority responsible for SEE in Republic of Moldova is the State Ecological Inspectorate (SIE), which is a subdivision of the Ministry of the Environment (MoE). All legal procedures on State Ecological Expertise System are described in the Chapter II of the Law on Ecological Expertise, while the organization of the SEE is detailed in the Chapter V.

In relation to the national environmental permitting procedure of various project-types and activities, there are the SEE and the EIA. The procedures, requirements and entire EIA process are detailed in the new Law on Environmental Impact Assessment.

In addition, the procedures for conducting SEE are included in the Guidelines on Performing SEE (2002). They define in detail the goals, objectives and principles of the SEE and specify the procedures for submitting project documentation, as well as reviewing procedures.

[1] Law No. 1515 of 16.06.1993 on Environment Protection, published in ”Monitorul Parlamentului” No. 10 of 01.10.1993, Art. 283, last amended by the Parliament Law No. 153 of 30.07.2015.

[2] Law No. 851 of 29.05.1996 on Ecologic Expertise and Environment Impact Assessment, published in ”Monitorul Oficial” No. 52-53 of 08.08.1996, Art. 494, last amended by the Parliament Law No. 153 of 30.07.2015.

[3] Law No. 86 of 29.05.2014 on Environment Impact Assessment, published in ”Monitorul Oficial” No. 174-177 of 04.07.2014, Art. 393. Date of entry into force: 04.01.2015.

Therefore, two project categories can be distinguished on the national level:

- Projects requiring SEE only;
- Projects requiring SEE and EIA.

In conclusion, for all selected CPV (Viable Project Concept) set-up projects as a part of the RSP (Regional Sector Program) in WSS sector, the SEE shall be conducted.

In relation to the national environmental permitting procedure of various project-types and activities, there are the SEE and the EIA. The procedures, requirements and entire EIA process for WSS project activities are detailed in the new Law on Environmental Impact Assessment.

Further, the following categories of planned activities are to be subjected of full scale EIA and for which is needed the environmental impact assessment in WSS sector.

According to the new Law No. 86 on EIA the following water supply facilities are subject to full scale EIA:

- Groundwater abstraction activities or artificial groundwater recharge schemes where the annual volume of water to be abstracted or recharged amounts to 10 million cubic metres or more;
- Deep drilling for water supply drilling (5,000 cubic metres per day and more).

And included in Annex 2:

- Installations of long-distance aqueducts (thoroughfares 5 km long and more);
- Groundwater abstraction and artificial groundwater recharge schemes (not included in Appendix no 1, with an abstraction or recharge capacity of 1 million cubic metres per year and more).

In addition waste-water treatment plants with a capacity exceeding the 150,000 population equivalent are subject to full scale EIA (Annex 1 of the New EIA Law No. 86).

Waste-water treatment plants (not included in Annex no. 1, with a capacity ranging from 50,000 to 150,000 population equivalent) are listed in Annex 2 of the new Law No. 86 and require the identification of the need for the conduct of the environmental impact assessment.

All selected VPCs in the WSS sector need only improvements of existing facilities like network repair and rehabilitation. These types of Projects do not fall into the categories that require the conduct of a full scale EIA according to national Moldovan Legislation. Consequently, this project is not subject to the new Law No. 86 and not requires an EIA evaluation.

In conclusion, the financing of programs and projects is allowed only after a positive SEE decision has been issued and following the IFI / international donor’s requirements.

8.2 Social and gender assessment in Straseni

8.2.1 Methodological approach

The main scope of the study was to assess the social and gender dimensions of the WSS project from the Centre Development Region. The objectives of the study were to

analyse the social and gender situation in Moldova and in the project zone and to develop recommendations for the action plan related to these aspects.

The **main tools** used for the assessment were both qualitative and quantitative data. A desk-based review was used to collect secondary data on various aspects on men and women features at the country as well as at the project area level. Most of the collected data[4] was based on the National Bureau of Statistics and Ministry of Economy documents; administrative data from local public administration from the first and second level, as well as studies and reports written by international organisations.

The approach applied for the current project was developed and tested in a pilot study in the town of Straseni in May 2015 where an assessment of the social and gender aspects was undertaken. Its findings were integrated in the feasibility study of the respective project. Given the scope of the proposed project ("no regrets" measures to improve service provision as part of a medium-term programme) and taking into account that social and gender needs and characteristics do not differ much from a town/project to another, the conclusions reached during the field visit in Straseni are also applied to projects of other rayons/towns of Moldova. The tools applied in the field visit to Straseni were interviews with key stakeholders and focus groups disaggregated by gender with potential beneficiaries. Based on its findings a social and gender action plan was developed.

Focus group participants were selected using the following criteria: gender dimension (men/women), education status (high/low), welfare status (low, medium to high), type of dwelling (individual/apartment), and connection to the water supply system. In the end, four focus groups discussions were conducted: 1) a focus group with women with low welfare status (women with disabilities, unemployed, retired); 2) a focus group with men with low welfare status (men with disabilities, unemployed, retired); 3) a focus group with women with medium to high welfare status; 4) a focus group with men with medium to high welfare status. In total, 28 persons (18 women and 10 men) participated in the focus group discussions.

The key stakeholders who were interviewed were selected based on groups interested in the implementation of the project. In total, seven key stakeholders were interviewed, including: the vice-mayor of Straseni, the town architect of Straseni, the person in charge of attracting investments in Straseni, the director of the district hospital, one businesswoman, the director of the district environmental inspection, and the director of the municipal enterprise, Apa-Canal Straseni.

8.2.2 Beneficiaries, needs and priorities by gender

During the focus group meetings and discussions held in Straseni, it was shown that women and men use water in different ways and for different needs. The use of water depends on the distribution of roles of men and women within households. From the table below, it can be seen that the distribution of household activities (where the water is used) between men and women in the Project area is unequal, as extrapolated from the findings from the focus group meetings.

Table 8-1: Water use by men and women

Household activities where the water is used	Men	Women	Children
Cooking		X	
Washing clothes		X	

[4] All presented data at the national level do not include the rayons from the left side of Dniester River and Bender municipality.

Household activities where the water is used	Men	Women	Children
Washing dishes		X	X
Washing children		X	
Watering crops	X	X	
Cleaning the house		X	X
Watering flowers		X	
Bathing (shower or bath)	X	X	X
Cleaning garden	X	X	
Planting garden	X	X	
Washing car	X		
Washing carpets		X	
Cleaning cesspit	X		
Cleaning animal cages	X	X	
Watering domestic animals		X	X

Thus, from the list of activities shared with the participants in focus group discussions, only a few activities are done mostly by men – washing car and, cleaning the cesspit. More than half of activities are done mostly by women, sometimes with small support from children. Those activities are the following: preparation of meals, washing clothes, washing dishes, washing children, watering flowers, cleaning the house, washing carpets, watering domestic animals. Some of the activities, like watering the crops, cleaning the garden, cleaning the animal cages, planting the garden are shared among men and women. In the households connected to the centralised water system, women are mainly those who clean the water and sanitation facilities. In the households with the outdoor sanitation facilities, roles between men and women are shared. Women usually do the daily cleaning and maintenance of the facilities and the men are responsible for the evacuation of the contents of the septic tank/collectors or of the traditional toilet.

The assessment of beneficiaries' needs and priorities by gender shows that the men and women have different needs and patterns in using the water and sanitation facilities. Therefore, these discrepancies and gaps need to be taken into consideration in the development and implementation of the Project.

The perceptions of men and women regarding the impact of the future project. Both men and women consider that as a result of Project implementation the whole population of the town will benefit. At the local level, the view is that the positive impact of the Project will result in the following:

- More business enterprises will be developed and subsequently more jobs will be created;
- The quality of water and afterwards, people's health will improve;
- The ecological situation will be improved;
- There will be more transparency in the use of water;
- The water and sanitation management will improve;
- The women will have more time to spend with their children and for their personal needs;
- Men will have more time to support their wives in household activities;
- Children will have more time for homework, reading, watching TV, playing games etc.;

- More women will use automatic washing machines and will save their time for other activities.

However, men and women consider that the implementation of the project might cause social problems and social conflicts in communities, like the following:

- Vulnerable groups of the population (pensioners, single women, households with many children, households with persons with disabilities) will still have limited access to water and sanitation system because of lack of money for an individual connection and for paying for services;
- The beneficiaries will not be willing to pay an increased tariff for WSS as they do not understand well the content of the tariff, or the factors that influence the tariff calculations;
- Many households will refuse to be connected to the sanitation system because of the need to pay more for the WSS and of lack of information regarding the positive impact of this project on their health;
- Some of the households will use in parallel the wells and will pay less for sanitation;
- The connection of some enterprises to the sanitation system will raise the cost of final products;
- The treatment plants can be located close to households and the population can suffer from bad smells;
- The streets where mostly the vulnerable groups of population live can be excluded from the project;
- Conflict of interests can arise between the city hall and the construction company, which will cause a substantial increase of the cost of the project;
- The companies will have limited interest in employing local persons during the implementation of the project;
- The staff selection for new WSS management unit could be done in a non-competitive way and qualified persons will have limited opportunities to be employed.

That is why in the elaboration and implementation project process is necessary to take into account the issues mentioned by participants and avoid or prevent the emergence of social disputes.

8.2.3 Social and Gender Action Plan

The Social and Gender Action Plan (SGAP) is based on the summary of findings during the social and gender assessment of the WSS project and provides measures that aim to increase equality in the participation of men and women during all project phases. The following activities are required for the plan:

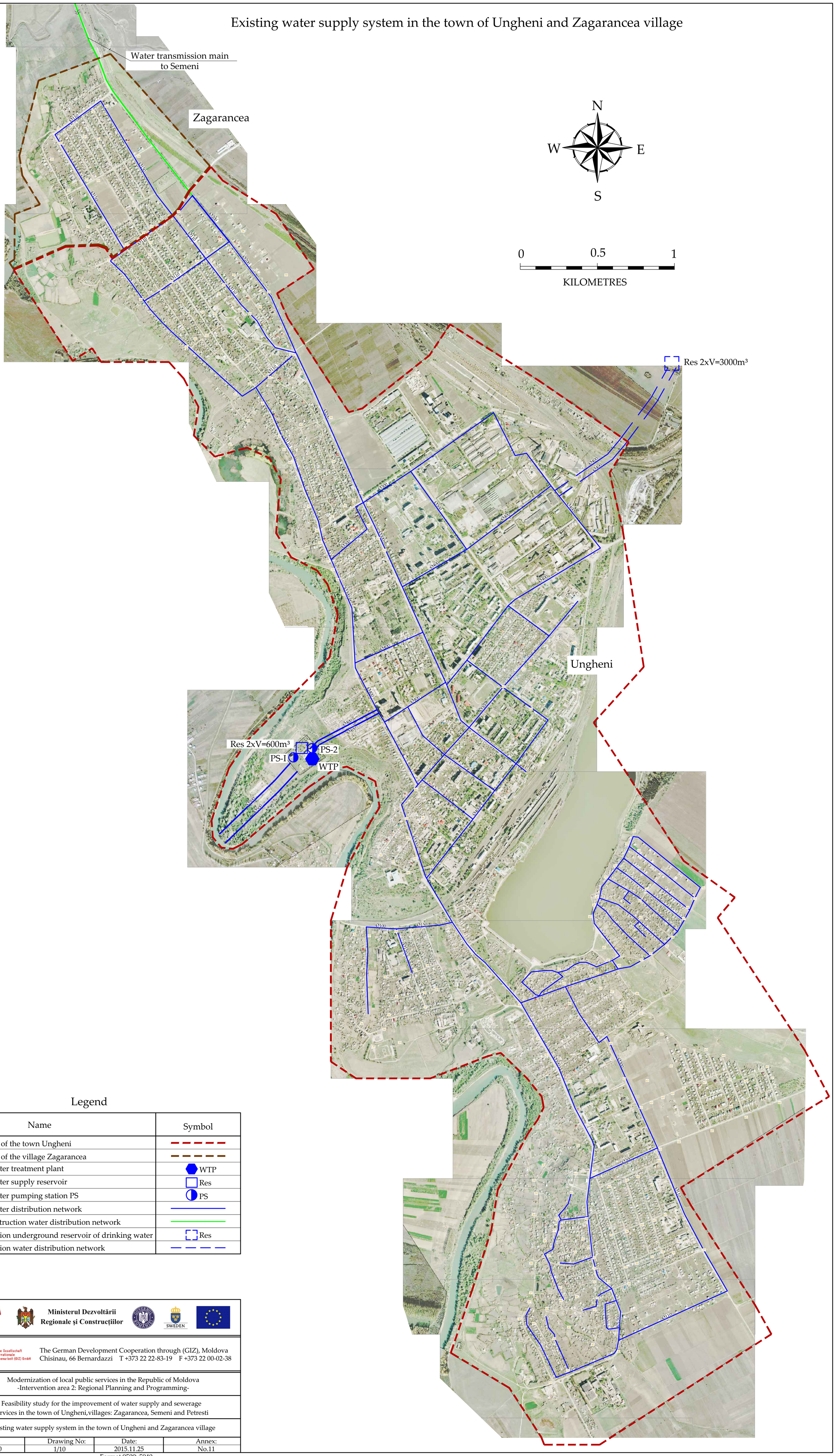
- Information of RDA staff on findings of social and gender assessment and their incorporation in the RDA plan of activities;
- Appointment of a gender focal point at the respective RDA;

- Strengthening the capacities of the RDA staff on integration of social and gender dimensions into the WSS project;
- Incorporation of the findings and recommendations of the social and gender assessment in the ToR of the company performing the detailed designs;
- Consultation of the WSS project technical design separately with women and men, according to their income, disability and age. Women will constitute at least 40% of participants at consultations. Strengthening the capacities of LPAs (rayon councils and local city halls) on the following issues: gender equity, integration of gender dimensions into the project cycle, building an accountable, affordable and qualitative WSS system and communication/information;
- Establishing monitoring committees at the local level and strengthening their capacities in social and gender issues and communication/information. At least 40% of committee members shall be women;
- Provision of information campaigns at the communities' level regarding the WSS project, including the information on SGAP that will be targeted to men/women/persons with disabilities/poor persons. 40% of participants in different communication campaigns will be women;
- Increase the access of vulnerable groups of population to WSS through their involvement at different levels of project preparation and implementation, mobilisation of community support and direct financial support;
- Change the attitudes and behaviours of population regarding the following issues: use of drinkable water for irrigation, using of permeable collectors for wastewater, sustainability of WSS services, etc. At least 40% of participants at those activities must be women.

Annex 11

Conceptual drawings

Existing water supply system in the town of Ungheni and Zagarancea village



Legend

Name	Symbol
Boundaries of the town Ungheni	
Boundaries of the village Zagarancea	
Existing water treatment plant	WTP
Existing water supply reservoir	Res
Existing water pumping station PS	PS
Existing water distribution network	
Under construction water distribution network	
Decommission underground reservoir of drinking water	Res
Decommission water distribution network	

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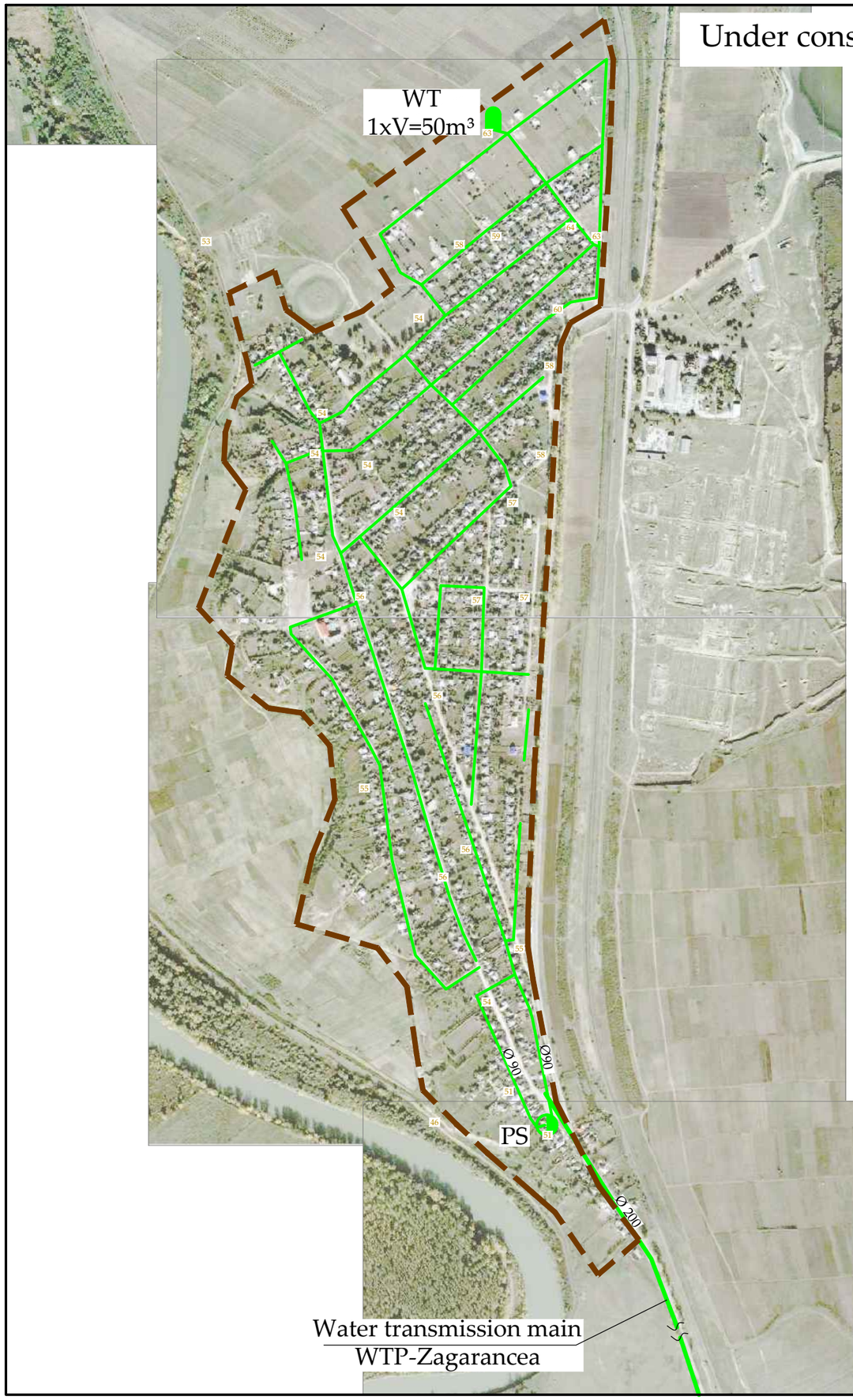
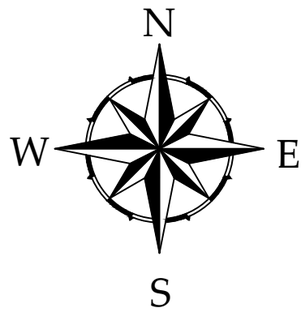
Existing water supply system in the town of Ungheni and Zagarancea village

Scale:	Drawing No:	Date:	Annex:
1:10 000	1/10	2015.11.25	No.11

Format 9500x5940

Under construction water supply system in the Semeni village





Legend

Name	Symbol
Boundaries of the village	
Under construction water pumping station	PS
Under construction water tower	WT
Under construction water distribution network	

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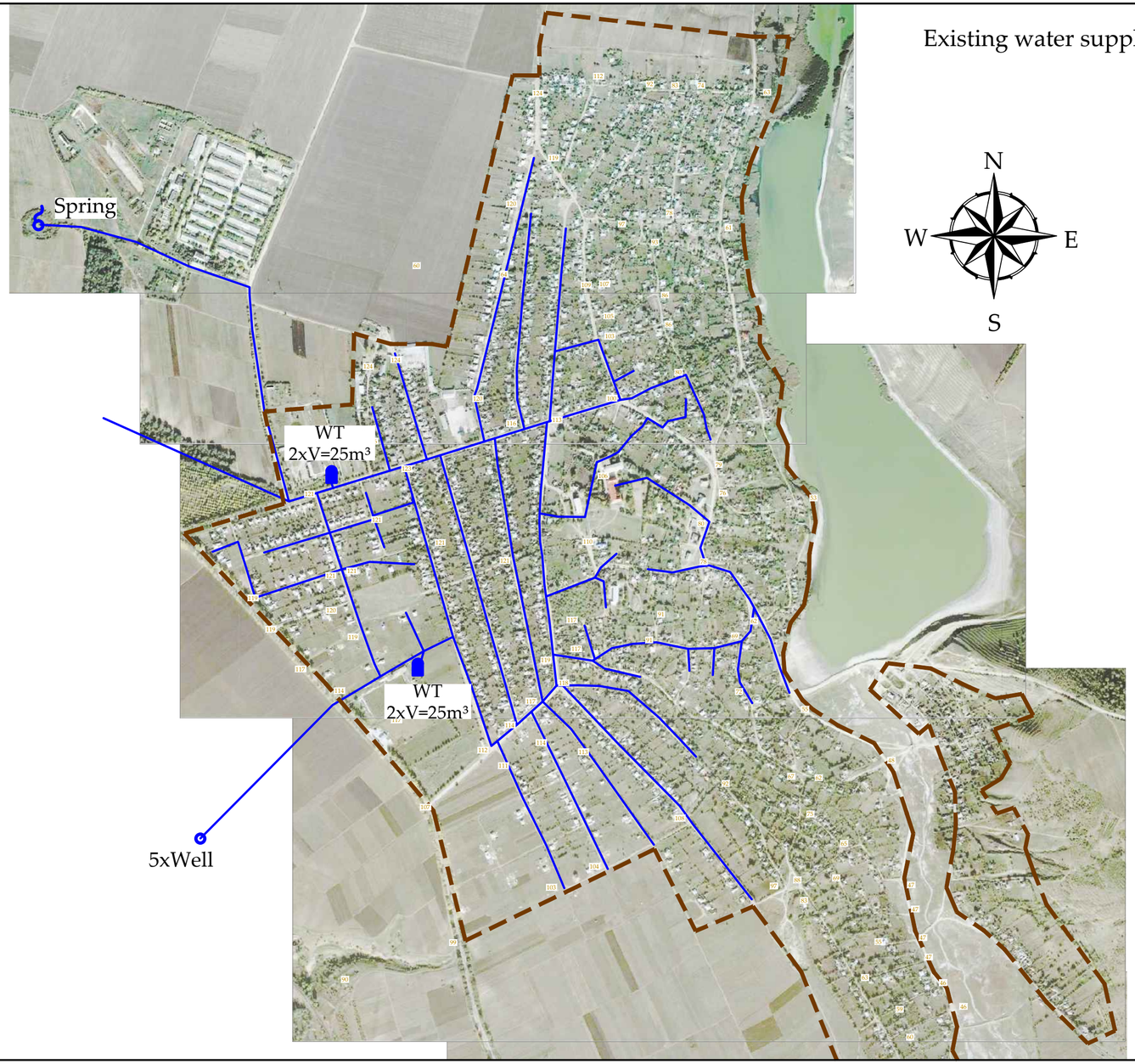
Under construction water supply system in the Semeni village

Scale:	Drawing No:	Date:	Annex:
1:10 000	2/10	2015.11.25	No.11

Format A3

Existing water supply system in the Petresti village



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Legend

Name	Symbol
Boundaries of the village	
Existing well	Well
Existing spring	Spring
Existing water pumping station	PS
Existing water tower	WT
Existing water distribution network	

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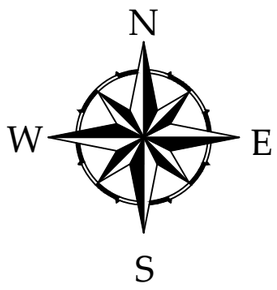
Existing water supply system in the Petresti village

Scale:	Drawing No:	Date:	Annex:
1:10 000	3/10	2015.11.25	No.11

Format 2970x5940 (A3+A4)

Existing sewerage system in the town of Ungheni and Zagarancea village



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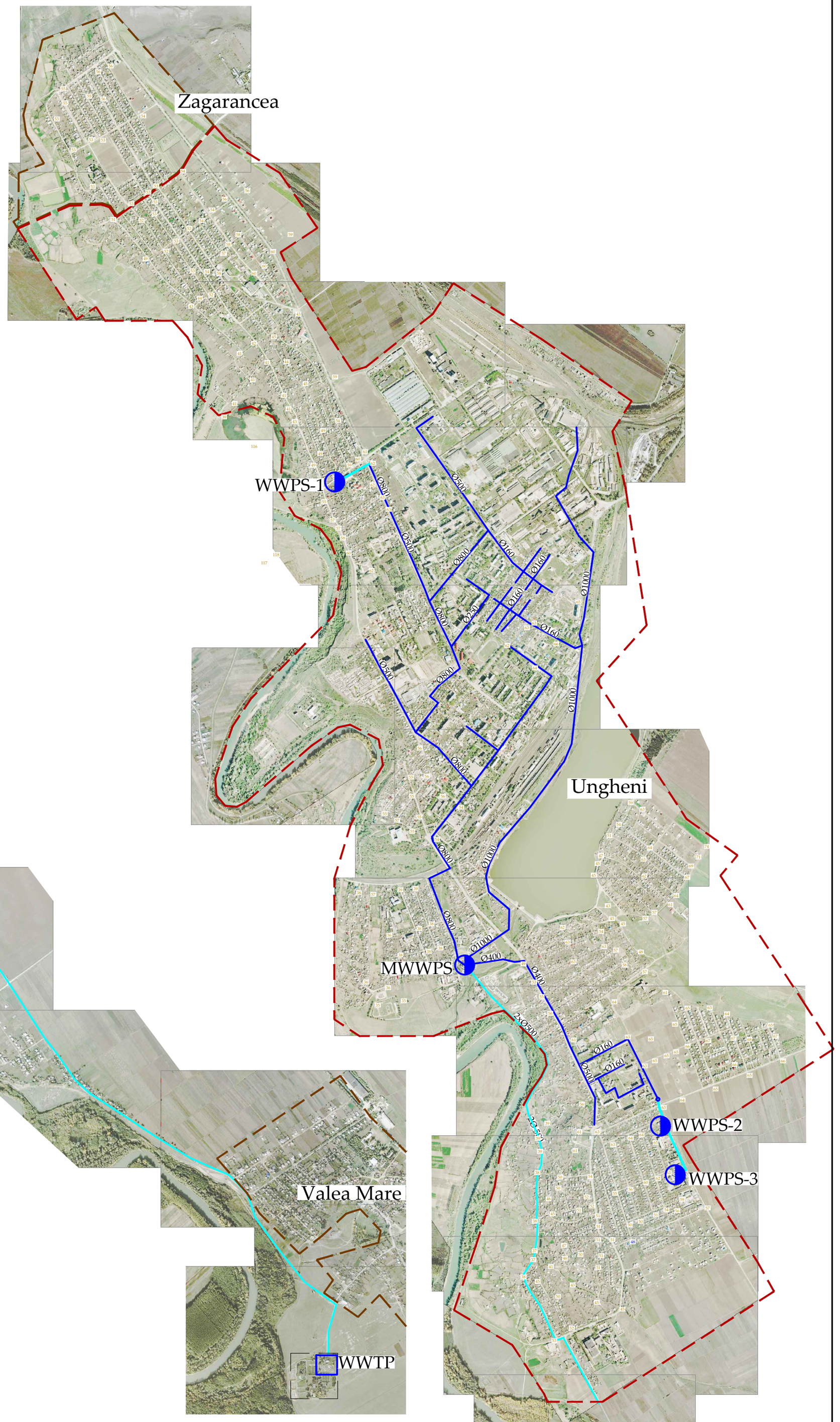
Binding line, Section A-A



Legend

Name	Symbol
Boundaries of the town Ungheni	
Boundaries of the village	
Existing wastewater treatment plant	WWTP
Existing wastewater pumping station	WWPS
Existing sewerage network	
Existing pressure sewerage network	

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Existing sewerage system in the town of Ungheni and Zagarancea village

Scale:	Drawing No:	Date:	Annex:
1:20 000	4/10	2015.11.25	No.11

Format A2

Existing sewerage system in the Petresti village

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Legend

Name	Symbol
Boundaries of the village	
Existing wastewater treatment plant	WWTP
Existing sewerage network	

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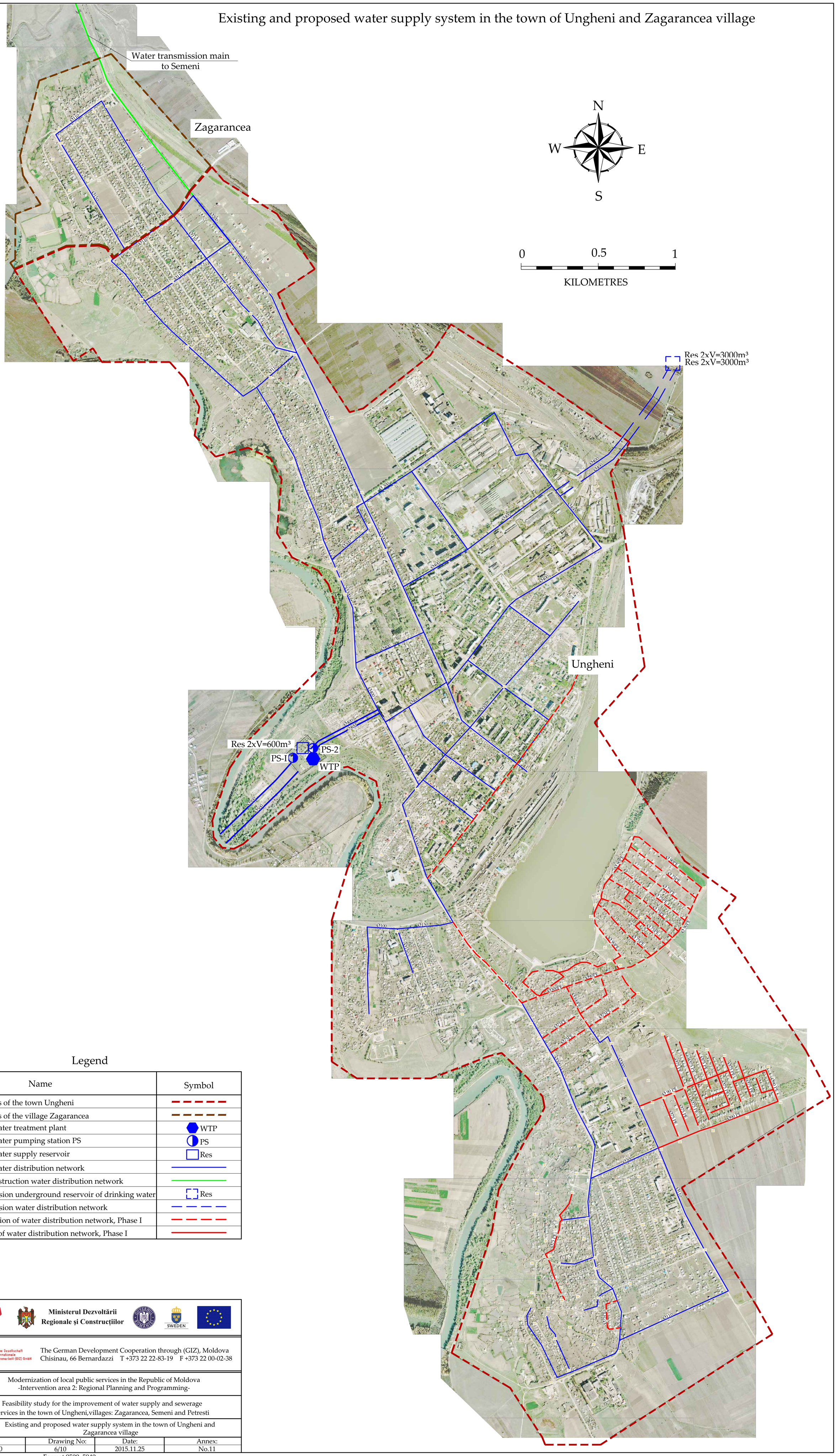
Existing sewerage system in the Petresti village

Scale:	Drawing No:	Date:	Annex:
1:10 000	5/10	2015.11.25	Nr.11

Format 2970x5940

Existing and proposed water supply system in the town of Ungheni and Zagarancea village



Legend

Name	Symbol
Boundaries of the town Ungheni	
Boundaries of the village Zagarancea	
Existing water treatment plant	WTP
Existing water pumping station PS	PS
Existing water supply reservoir	Res
Existing water distribution network	
Under construction water distribution network	
Decommission underground reservoir of drinking water	Res
Decommission water distribution network	
Rehabilitation of water distribution network, Phase I	
Extension of water distribution network, Phase I	

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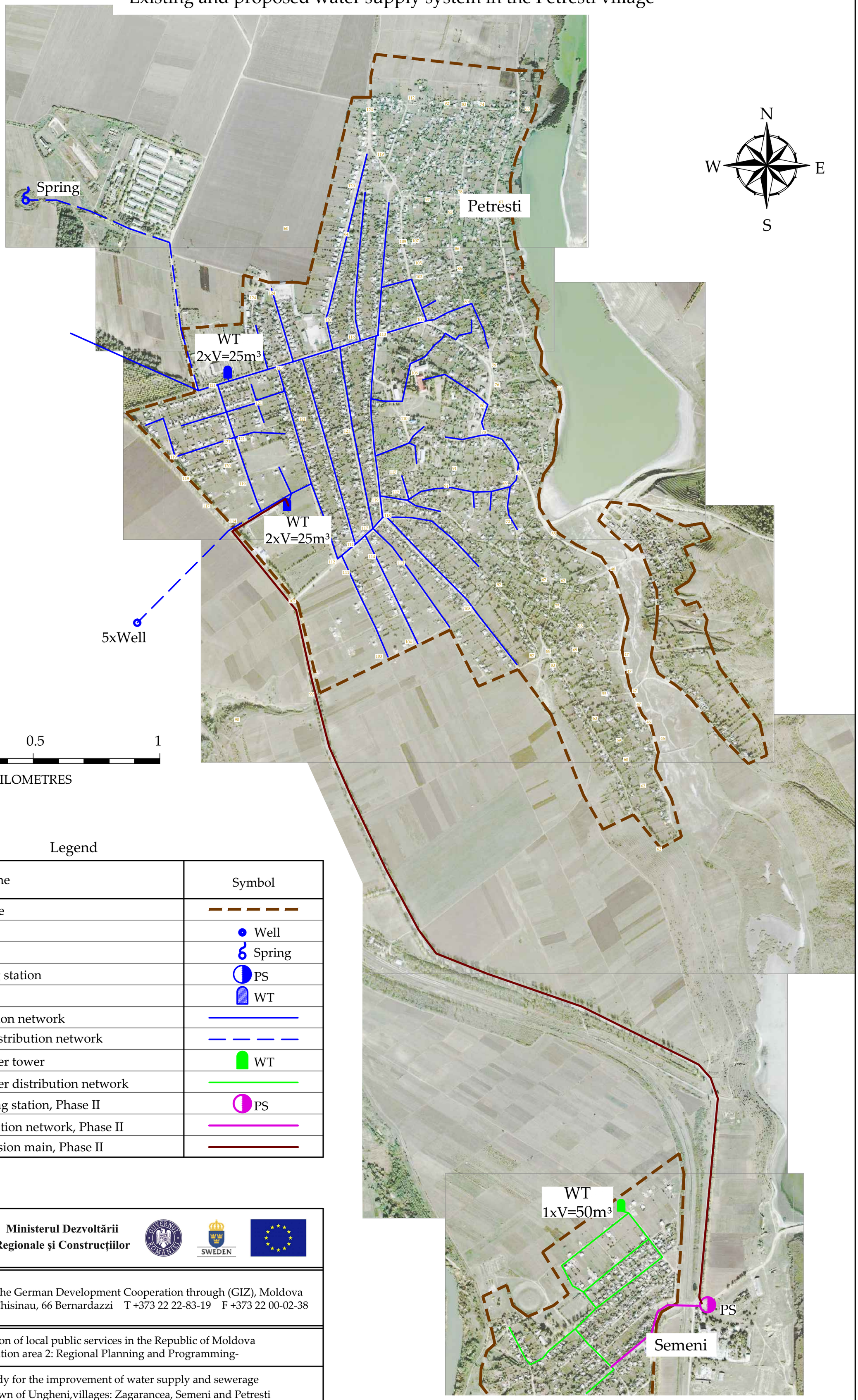
Existing and proposed water supply system in the town of Ungheni and Zagarancea village

Scale:	Drawing No:	Date:	Annex:
1:10 000	6/10	2015.11.25	No.11

Format 9500x5940

Existing and proposed water supply system in the Petresti village



Legend

Name	Symbol
Boundaries of the village	
Existing well	Well
Existing spring	Spring
Existing water pumping station	PS
Existing water tower	WT
Existing water distribution network	
Decommission water distribution network	
Under construction water tower	WT
Under construction water distribution network	
Proposed water pumping station, Phase II	PS
Proposed water distribution network, Phase II	
Proposed water trasmission main, Phase II	

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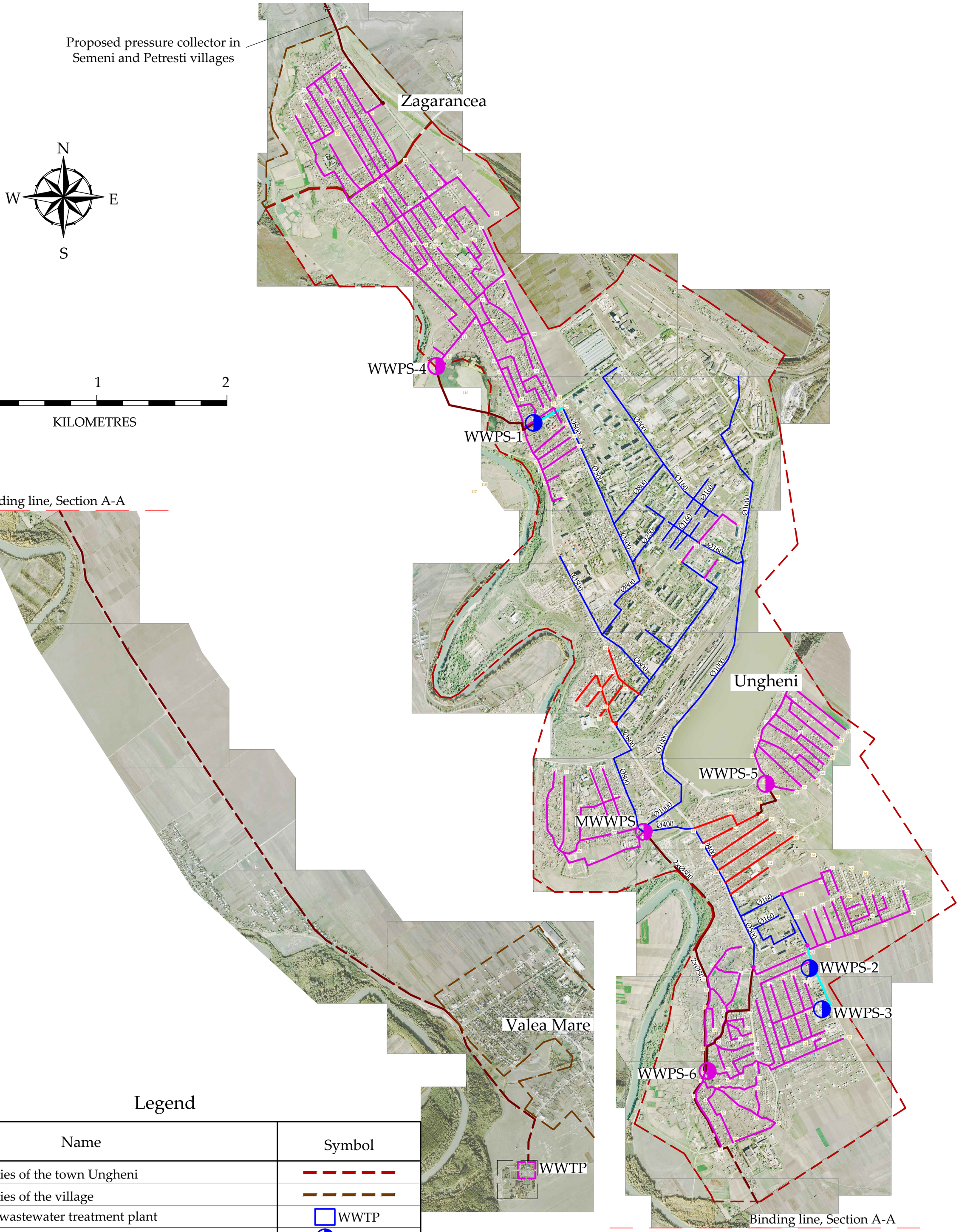
Existing and proposed water supply system in the Petresti village

Scale:	Drawing No:	Date:	Annex:
1:10 000	7/10	2015.11.25	No.11

Format A2

Existing and proposed sewerage system in the town of Ungheni and Zagarancea village



Legend

Name	Symbol
Boundaries of the town Ungheni	
Boundaries of the village	
Existing wastewater treatment plant	WWTP
Existing wastewater pumping station	WWPS
Existing sewerage network	
Existing pressure sewerage network	
Point of connection	
Extension of sewerage network, Phase I	
Extension of pressure sewerage network, Phase I	
Rehabilitation of pressure sewerage network, Phase II	
Rehabilitation wastewater treatment plant, Phase II	WWTP
Rehabilitation wastewater pumping station, Phase II	WWPS
Extension of sewerage network, Phase II	
Extension of pressure sewerage network, Phase II	
Proposed wastewater pumping station, Phase II	WWPS

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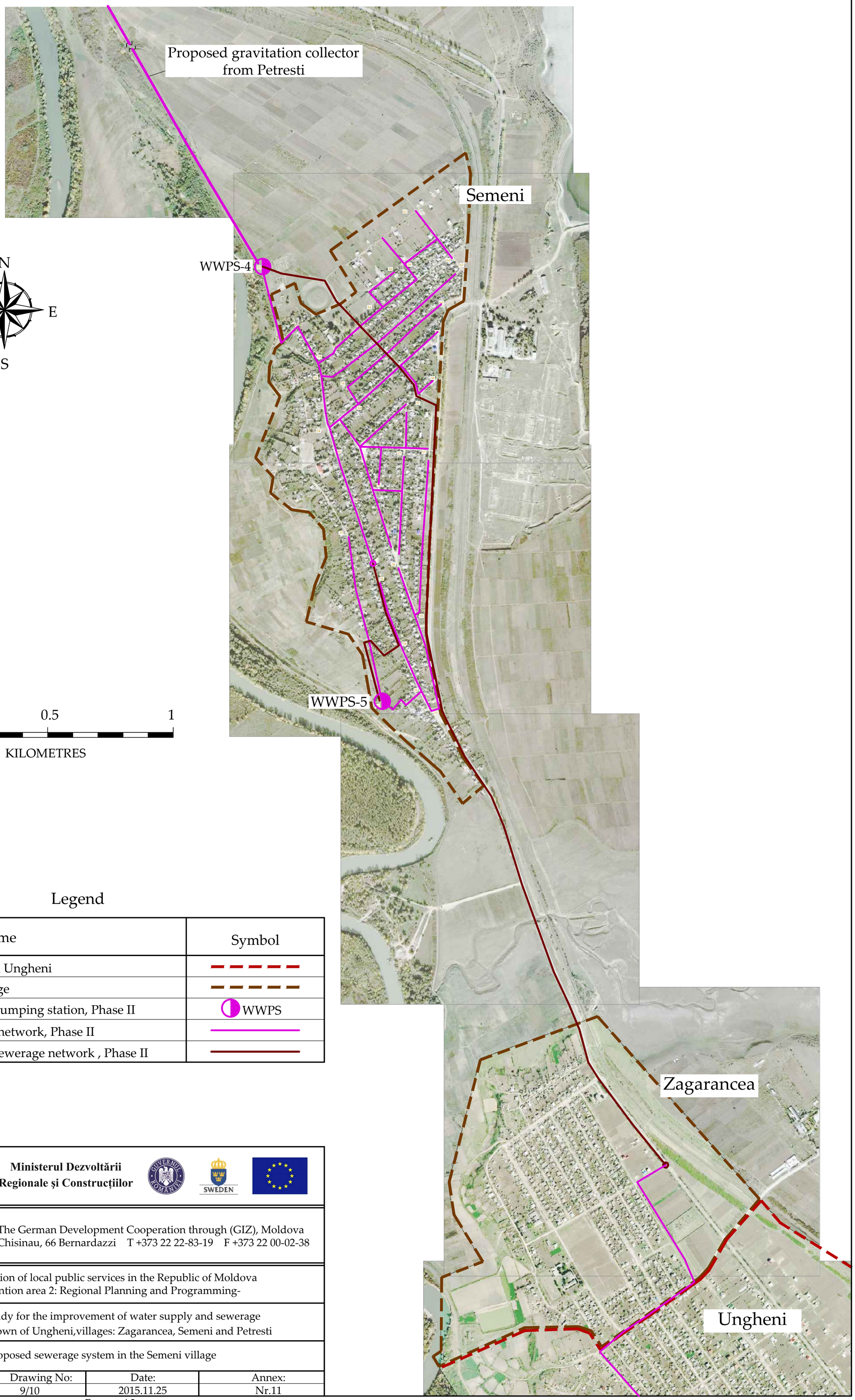
Existing and proposed sewerage system in the town of Ungheni and Zagarancea village

Scale:	Drawing No:	Date:	Annex:
1:20 000	8/10	2015.11.25	No.11

Format A2

Proposed sewerage system in the Semeni village



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KILOMETRES

Legend

Name	Symbol
Boundaries of the town Ungheni	
Boundaries of the village	
Proposed wastewater pumping station, Phase II	WWPS
Extension of sewerage network, Phase II	
Extension of pressure sewerage network , Phase II	

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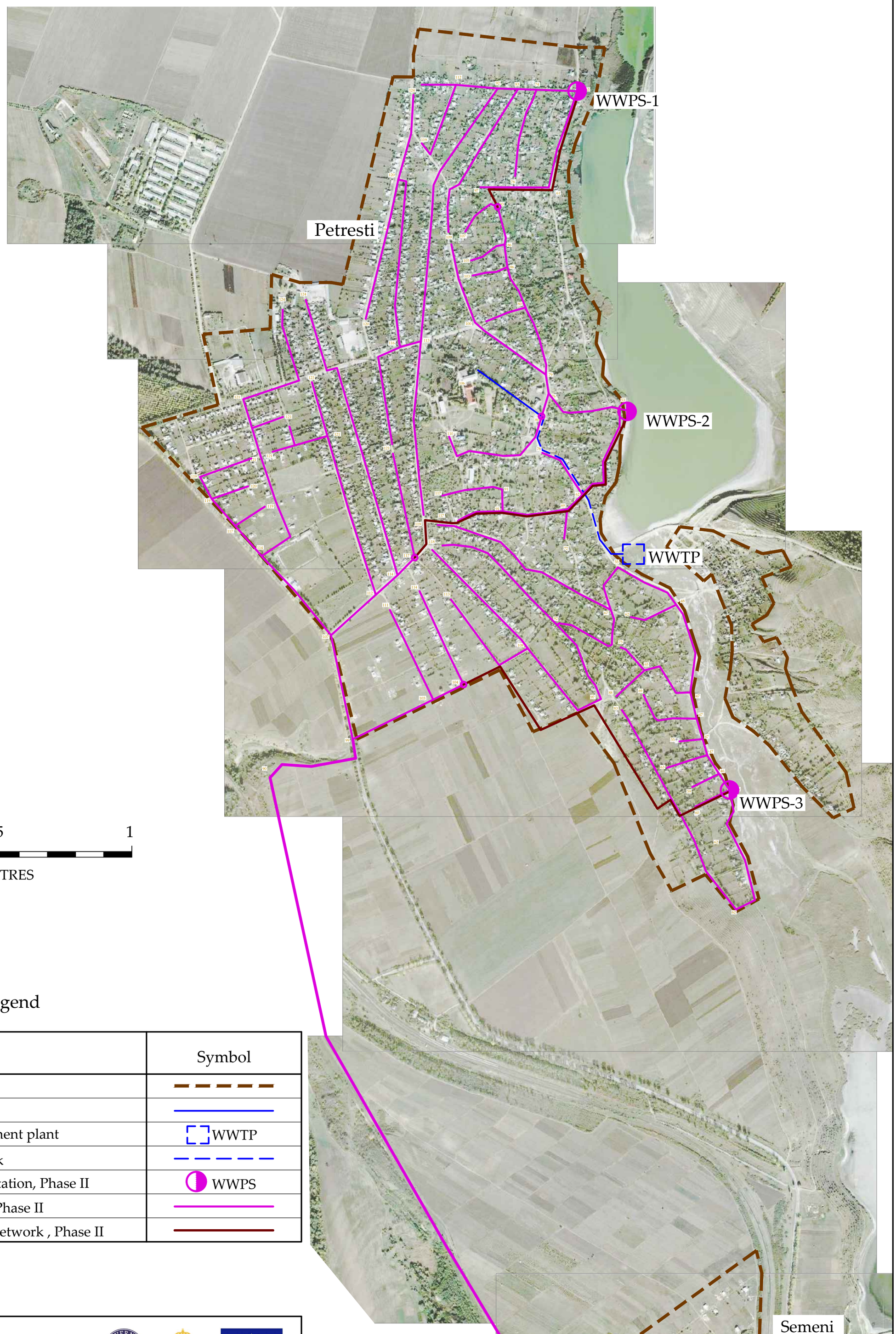
Proposed sewerage system in the Semeni village

Scale:	Drawing No:	Date:	Annex:
1:10 000	9/10	2015.11.25	Nr.11

Format A2

Existing and proposed sewerage system in the Petresti village



N

W E

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0 0.5 1

KILOMETRES

Legend

Name	Symbol
Boundaries of the village	
Existing sewerage network	
Decommission wastewater treatment plant	WWTP
Decommission sewerage network	
Proposed wastewater pumping station, Phase II	WWPS
Extension of sewerage network, Phase II	
Extension of pressure sewerage network , Phase II	

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Existing and proposed sewerage system in the Petresti village

Scale:	Drawing No:	Date:	Annex:
1:10 000	10/10	2015.11.25	Nr.11

Format A2