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 rayon of Calarasi (town of Calarasi, villages of Novaci, Niscani, Paulesti)"

Final report

December 2015

Ministerul Dezvoltării Regionale şi Construcţiilor
cooperare germană DEUTSCHE ZUSAMMENARBEIT
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
SWEDEN

Published by:
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

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Prepared for:
Project “Modernization of local public services in the Republic of Moldova”, implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of Federal Ministry for Economic Cooperation and Development (BMZ) and with support of Romanian Government, Swedish International Development Cooperation Agency (Sida) and European Union

Project partners:
Ministry of Regional Development and Construction of the Republic of Moldova
Ministry of Environment of the Republic of Moldova
Agencies for Regional Development

Chisinau, 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 Authority
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 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 authorized 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 provides 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 wastewater facility to public water supply and / or sewerage networks.

Water tower – an elevated structure supporting a water tank constructed at a height sufficient to pressurize 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 organization 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 rec-

ommended 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 sanitation 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 unauthorized 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: pressure, 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 which fell on the territory of the Republic of Moldova.

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 quality 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 oxidize and mineralize 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 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 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 programme, 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 **Calarasi 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 Calarasi as well as the localities of Niscani, Novaci and Paulesti. The Project includes the town of Calarasi 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;
- Unsatisfactory levels of service, including:
  - Continuity of service;
  - Water quality.
- As for the operational efficiency, the main problems encountered by the company are as follows:
  - High non-revenue water (NRW) ratio (around 51% in 2015);
  - High staff efficiency ratio;
  - Poor asset management and lack of preventive maintenance.

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.

The aim of the PIP is to extend the coverage and connection rates of the population connected to the regionalised water supply services by 22% from 78% to 100% of coverage rate and by 19% from 65 % to 84% of connection rate, as well as increase of coverage and connection rates to wastewater services by 52% from 42% to 94% of coverage rate and by 31% from 40% to 71% of connection rate. Also, other major effect of the PIP is the rehabilitation and improvement of existing water supply and

wastewater services for 34% of population covered with water supply services and for 22% of population covered with wastewater services.

The aim of the first phase -Project (2015-2018) is to extend the access of the population to the water by 3% from 97% to 100% of coverage rate and by 2% from 80% to 82% of connection rate and to rehabilitate and improve existing water supply and wastewater services for 34% of population covered with water supply services and for 22% of population covered with wastewater services.

Legal aspects

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

"*Regionalisation*" 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 services (and wastewater in the town of Calarasi only) are organised and operated exclusively in the town of Calarasi and commune of Tuzara (Selistea Noua village). The management of water supply and wastewater public services is ensured by municipal services utility I. M. “Gospodaria Comunal-Locativa” Calarasi, which is organised and operates based on self-financing and financial autonomy principles. In the localities of Paulesti and Niscani the centralised water supply service is not organised.

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

The institutional model of regionalisation of water supply and wastewater public services in Calarasi 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.

Regionalisation 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. Creating a regional operator (through reorganisation of Calarasi municipal services utility) will require considerable changes in the organisational structure in order to cover the increasing demands of expanding service area.

Technical aspects and investment programme

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 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 (Option Analysis, Financial Analysis, Environmental Assessment, etc.) in this study.

Investment framework

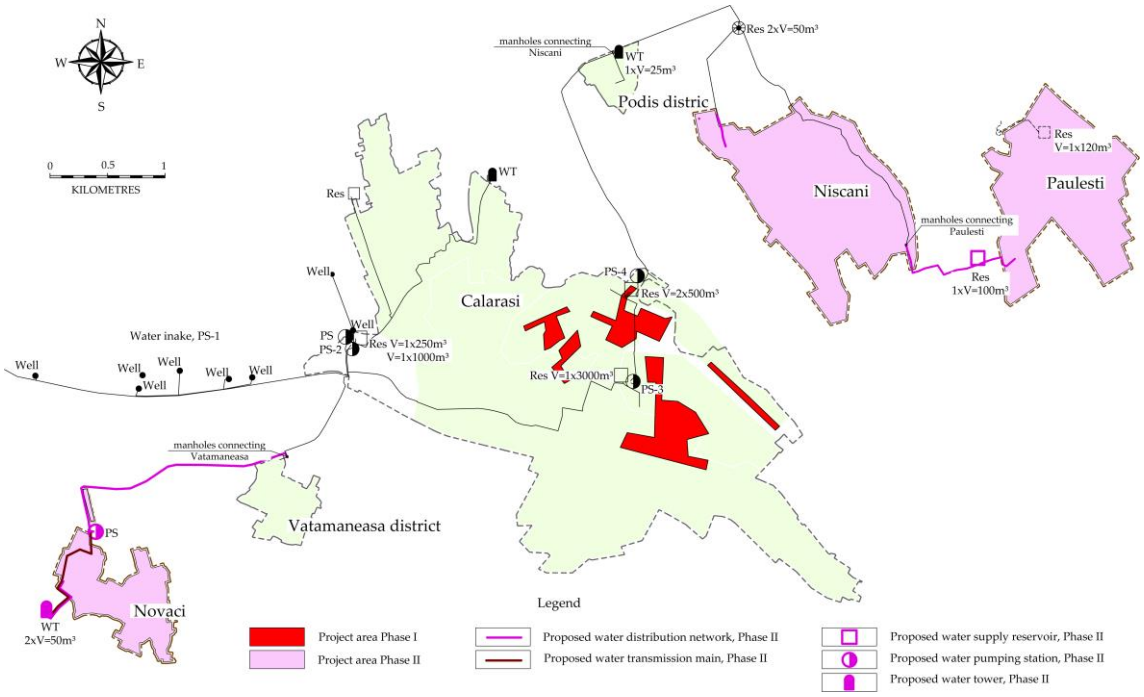
Water Supply:

Currently there are 13,213 inhabitants in Calarasi Town connected to the existing water supply system (80% connection rate). The localities of Niscani, Paulesti and Novaci in the vicinity of Calarasi Town are not connected to the water supply system of Calarasi Town but the Municipal Services Utility envisages connecting these localities in the near future. Due to the extensions of the service area in Calarasi Town and the localities in the vicinity of the town as well as the assumed increase of per capita water consumption, it is projected that water demand (including water losses) will almost triple until the year 2045. Currently there is no supply shortage in the service area of the Municipal Services Utility, but in the medium and long-term additional capacities of about 1,145 m^3/day have to be developed either through construction of additional wells or connection to the regional transmission main from Chisinau to Calarasi.

The water quality for the service area does not comply with the national standards for drinking water quality (exceedance of fluorine concentration). As treatment of fluorine is very costly there is no immediate solution which can be proposed within the framework of this study. Therefore, it is assumed that the water quality and also water quantity constraints will be solved by connecting Calarasi water supply system to the regional transmission main (Chisinau to Calarasi). The investment measures proposed within the framework of this project include inter alia the rehabilitation and extension of the distribution network in Calarasi Town and the neighbouring localities as well as disinfection of water. These measures will be necessary irrespective of the future development of the regional transmission main (Chisinau – Calarasi) and are therefore consistent with the long term infrastructure development plans (“no-regret measures”). The proposed measures would increase the water supply connection rate in Calarasi Town from currently 80% (population of 13,213) to 82% (population of 13,589) in 2018 (after implementation of Phase 1) and to 87% (population of 14,317) in 2021 (after implemen-

tation of Phase 2)[1]. Further, the proposed investment measures include extension of the urban water supply network to the localities of Niscani, Paulesti and Novaci in Phase 2 (additional population of 2,665 connected and 3,807 covered).

Figure 0-1: Scheme of proposed extensions of the water supply system in the town of Calarasi and the localities of Novaci, Niscani and Paulesti



Source: GIZ/MLPS

Wastewater:

Currently only Calarasi Town is partly endowed with an existing wastewater system. About 49% of the population is currently connected to the sewerage network. The locality of Novaci (935 inhabitants in 2014), is planned to be connected to the wastewater system of Calarasi Town. For the localities of Niscani (1,952 inhabitants in 2014) and Paulesti (997 inhabitants in 2014), separate wastewater systems are planned.

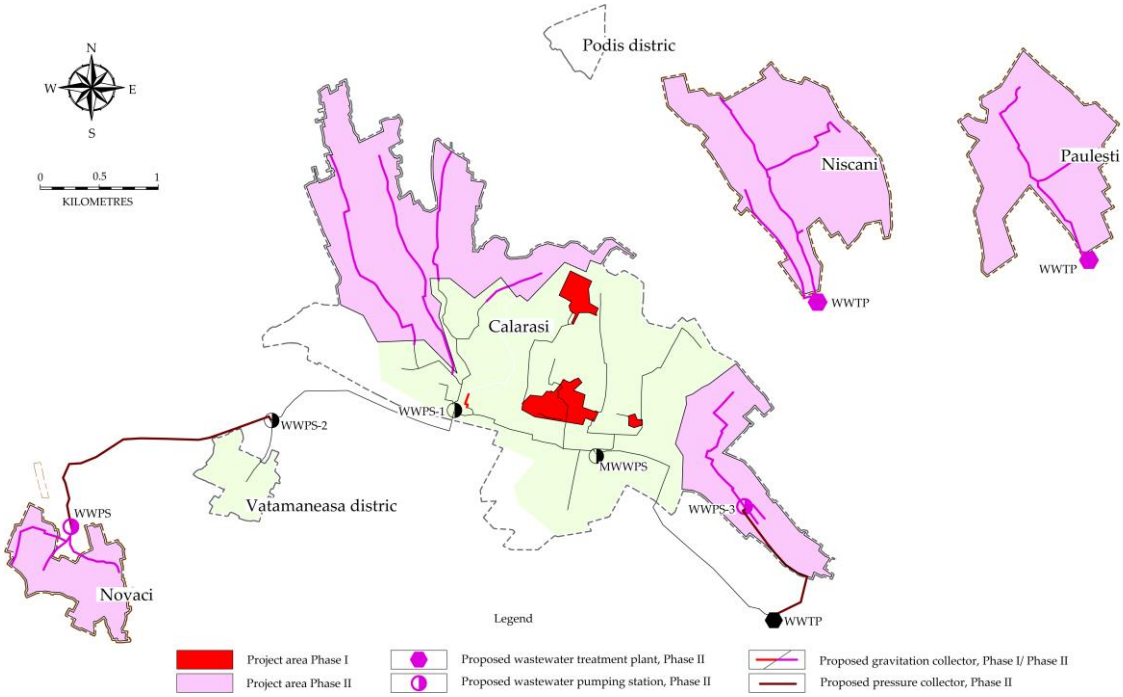
Wastewater load generated in Calarasi Town and the three localities in the vicinity of the town is projected to increase from currently 8,709 P.E. to 15,453 P.E. in 2021 and to 20,142 P.E. in 2045. In Calarasi Town the coverage rate is projected to increase from currently 52% to 95% and the connection rate from 49% to 75% until the year 2021[2]. The extension of the sewer network in Calarasi Town to 75% sewer connection rate until 2021 and the connection of Novaci locality will require an extension of the existing (recently constructed) WWTP to a capacity of at least 2,000 m^3/day (17,000 P.E.) in order to treat wastewater volume projected until the year 2030. In order to avoid overcapacities, a staged approach for developing the capacities of the WWTP in Calarasi is recommended. A thorough agglomeration study (proposed to be included 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.

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

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.

Figure 0-2: Scheme of proposed extensions of the wastewater system in the town of Calarasi and the localities of Novaci, Niscani and Paulesti



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 3.0 MEUR and 16,500 people will benefit from the proposed measures. The total costs for measures proposed in Phase 2 amount to about 22.7 MEUR and 20,307 people will benefit from the measures. The total costs for Phase 1 and Phase 2 amount to 25.7 MEUR.

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

No	Measure	Costs [€]	Benefit from project measures
1	Capital Investment		
1.1	Extension of the water distribution network in Calarasi Town by 3,900 m	305,875	Water supply coverage rate increased from 97% to 100% (538 additional people served)
1.2	Rehabilitation of 12 km water distribution network in Calarasi Town	975,700	Level of service and efficiency improvement for all people covered with water supply (16,500 people in 2018)
1.3	Construction of a new chlorination plant in Calarasi Town	55,000	Improved bacteriological safety (water quality) for all people covered with water supply (16,500 people in 2018)
1.4	Rehabilitation of the sewer network in the town of Calarasi	641,425	Level of service and efficiency improvement for all people covered with sanitation (8,575 people in 2018)

No	Measure	Costs [€]	Benefit from project measures
1.5	Equipment and tools	200,000	Level of service and efficiency improvement for all people connected to the water supply and wastewater system (16,500 people in 2018)
ST-1	Sub-Total Capital Investment	2,178,000	
2	Technical Assistance	561,360	Level of service and efficiency improvement for all people connected to the water supply and wastewater system (16,500 people in 2018)
3	Contingencies (10%)	273,936	
GT-1	Total Costs for Phase 1	3,013,296	Additional 538 people will be served with water supply. In total 16,500 people will benefit from the water supply and wastewater measures.

Source: GIZ/MLPS

Table 0-2: Proposed investment measures Phase 2

No	Measure	Costs [€]	Benefit
1	Capital Investment		
1.1	Extension of the sewer network in the town of Calarasi by 26.7 km incl. WWPS and WWTP (8,000 P.E.) and Rehabilitation of the sewer network by 4.3 km	9,360,641	Wastewater coverage rate increased from 52% to 95% in Calarasi Town (7,175 additional people served); Level of service and efficiency improvement for all people covered with sanitation (19,035 people in 2021); Improved environmental performance; compliance with effluent standards.
1.2	Water supply system in the localities of Novaci, Paulesti, Niscani incl. 31 km distribution network	2,504,925	Water supply coverage rate increased from 0% to 100% in the rural localities (3,807 additional people served)
1.3	Wastewater system in the localities of Novaci, Paulesti, Niscani incl. 28 km sewer network, 1 WWPS and 2 WWTPs (1,828 P.E.)	6,536,605	Wastewater coverage rate increased from 0% to 86 % in the rural localities (3,285 additional people served)
ST-1	Sub-Total Capital Investment	18,402,171	
2	Technical Assistance	2,208,261	Level of service and efficiency improvement for all people connected to the water supply and wastewater system (20,307 people in 2021)
3	Contingencies (10%)	2,061,043	
GT-2	Total Costs for Phase 2	22,671,475	Additional 3,807 people will be served with water supply and 10,460 people with sanitation. In total 20,307 people will benefit from the water supply and wastewater measures.

Source: GIZ/MLPS

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

No	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	1,336,575	2,504,925	3,841,500
1.2	Wastewater	641,425	15,897,246	16,538,671
1.3	Equipment and Tools	200,000		
ST-1	Sub-total capital investments Water Supply and Wastewater	2,178,000	18,402,171	20,580,171
2	Technical Assistance	561,360	2,208,261	2,769,621
3	Contingencies	273,936	2,061,043	2,334,979
Total	**Total Costs Phase 1 & 2**	**3,013,296**	**22,671,475**	**25,684,771**

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 period 2012-2014 *Calarasi Municipal Service Utility* generated losses from operating activities in two of the last three years, which reveals that the company encountered some cash liquidity difficulties. Thus, in 2012 the losses amounted to MDL 448.0 thousand and in 2014 – MDL 1.16 million. This reflects that 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 reflects that *Calarasi Municipal Service Utility* has no creditworthiness capacity at the moment.

The investment costs of the project are estimated to amount of MDL 62.62 million or EUR 3.01 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 0-4: Summary of the investment cost (million MDL)

Project investment outlays	2015	2016	2017	Total
	10%	50%	40%	
Rehabilitation of water distribution network	2.03	10.14	8.11	20.28
Extension of water distribution network	0.64	3.18	2.54	6.36
New chlorination unit	0.11	0.57	0.46	1.14
Rehabilitation of sewer network	1.33	6.67	5.33	13.33
Equipment and Tools	0.42	2.08	1.66	4.16
Detailed design and procurement	0.54	2.72	2.17	5.43
Technical assistance, supervision and capacity development	0.62	3.12	2.49	6.23
Contingency	0.57	2.85	2.28	5.69
Total	**6.26**	**31.31**	**25.05**	**62.62**

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 81.1% of the total investment costs, that constitutes about 2.44 MEUR, while the local sources' contribution is 18.9%, which is about 0.57 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 actual medium tariff which is approximately 19.00 MDL/m^3 and is projected to reach the value of about 25.00 MDL/m^3 in 2045. During the construction period, when capital costs increase significantly and water sale is limited, it is proposed that tariff does not include depreciation costs. The total costs (the operational costs and depreciation cost) will be covered by the mentioned tariff beginning with the year 2027.

The weighted tariff for rendering sanitation services will increase during the project implementation period from actual value of 14.64 MDL/m^3 to 16.50 MDL/m^3, and after that will decrease to approximately 12.50 MDL/m^3, due to increase of volume of wastewater inflows. As well, the tariff for wastewater services will not include the full depreciation cost in the construction period (2017-2020). 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 period of the financial projections will be about 2.6%, 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 Calarasi Municipal Service Utility will be able to generate cumulative cash flow amounted to MDL 57.89 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 - 45.43 million), which emphasize 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 18.21 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 0-5: Procurement plan

N°	Description	Estimated contract value[3], EUR	Contract type	Procurement method
1	Design and Engineering for Phase 1 investments	287,496	Consulting services	Competitive
2	Construction works: Rehabilitation and extension of water supply network and sewer network in Calarasi Town	2,175,800	Works	Open
3	Supply of equipment for operational performance improvement	220,000	Supply of goods	Shopping
4	Technical assistance: Corporate Development Program, Stakeholder Participation Program, Water Supply Network Analysis and Water Loss Reduction Programme, Medium to Long-term Sanitation Study	330,000	Consulting services	Competitive
GT	**Total Amount**	**3,013,296**		

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 0-6: 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

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.

[3] Including Contingencies

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 regret" measures to improve service provision) 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 Calarasi 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 public services infrastructure, and capacity development of local public administration and local 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.

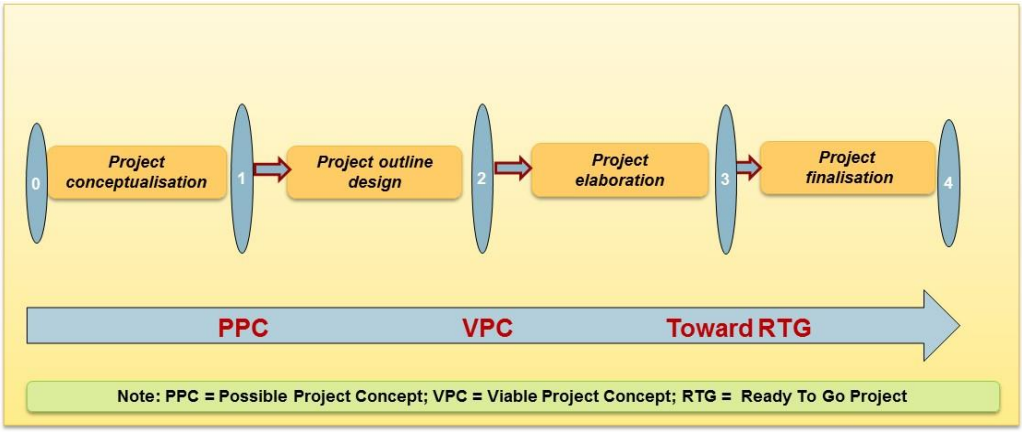
Based on the WSS sector development directions and criteria defined in the WSS RSP, a list of possible project concepts was defined for further project development.

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 finalized 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:

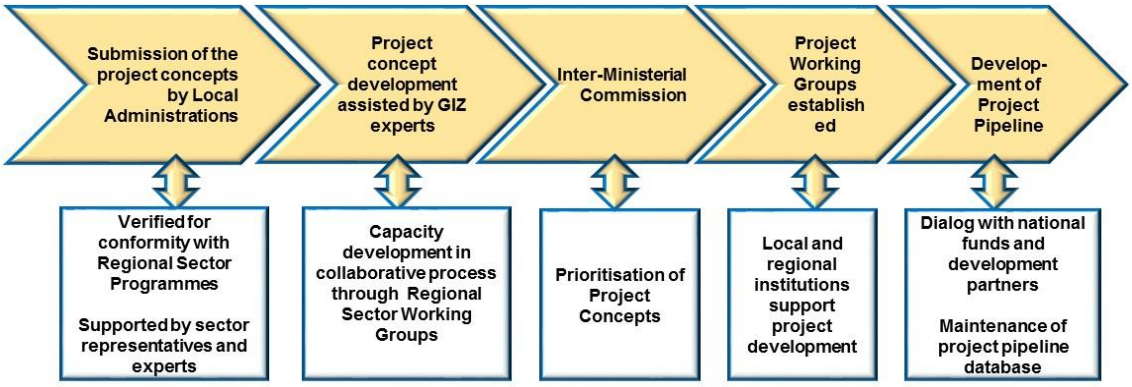
- **Stage 0 – Development of Regional Sector Programmes – Identification of Project Idea**.
  In each RSP, specific process, methods, and criteria by which possible projects are identified for their contribution to the targets set out in the RSP for the sector;
- **Stage 1 – Conceptualization (Possible 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 finalization 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 organizational 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 conceptualized 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 **Calarasi 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 Calarasi Local Public Authority (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 Calarasi 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 harmonize 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;

- **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.

Criteria related to availability of water sources and wastewater treatment facilities were taken into consideration.

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 Calarasi Municipal Service Utility's capacities within the existing service area shall be supported in the first place, and in the short term followed by extension of services, not exceeding double the size of the water utility's existing service area. This was considered to prevent water operating companies from financial/operational/institutional collapse and set reasonable geographic boundaries for short-term regionalization of the WSS services.

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

- Locality of **Niscani**;
- Locality of **Paulesti**;
- Locality of **Novaci**.

The above mentioned localities form the PIP service area for development of the regionalised WSS services in the Rayon of Calarasi, 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 Calarasi**.

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 Calarasi 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. Only part of the town of Calarasi and villages benefit from the water supply, while wastewater services are provided in a limited urban area;

- Unsatisfactory levels of service, including:
  - Continuity of service. Although central part of Calarasi Town is continuously provided with water, some marginalized parts of the town have often interruptions supply due to bursts, leakages and insufficient network pressure;
  - Currently, groundwater quality is not compliant with the National Standards. This Feasibility Study does not address this issue directly, while it is assumed that surface water of drinking quality will be provided from Chisinau-Straseni-Calarasi pipeline in the foreseeable future.

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 51% 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, 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 sanitation services for the Town of Calarasi, as well as for the localities of Niscani, Novaci and Paulesti, 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 22% from 78% to 100% of coverage rate and by 19% from 65% to 84% of connection rate, as well as increase of coverage and connection rates to wastewater services by 52% from 42% to 94% of coverage rate and by 31% from 40% to 71% of connection rate. Also, other major effect of the PIP is the rehabilitation and improvement of existing water supply services for 34% of population connected and for 37% of population connected to wastewater services.

The aim of the first phase (the Project, 2015-2018) for the town of Calarasi is to extend access of the population to water supply services by 3% from 97% to 100% of coverage rate and by 2% from 80% to 82% of connection rate and to rehabilitate and improve existing water supply and wastewater services for 34% of population connected to water supply services and for 22% of population connected to wastewater services.

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	Extension	Improve-provement	After PIP
Share of population directly benefitted from the rehabilitated and extended water supply services							
Urban	80%	34%	2%	0%	0%	36%	82%
Rural	0%	0%	0%	0%	70%	70%	70%
Share of population directly benefitted from the rehabilitated and extended wastewater supply services							
Urban	49%	22%	0%	15%	26%	63%	75%
Rural	0%	0%	0%	0%	52%	52%	52%
Non-Revenue Water Ratio, %	51%					8%	43%
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		

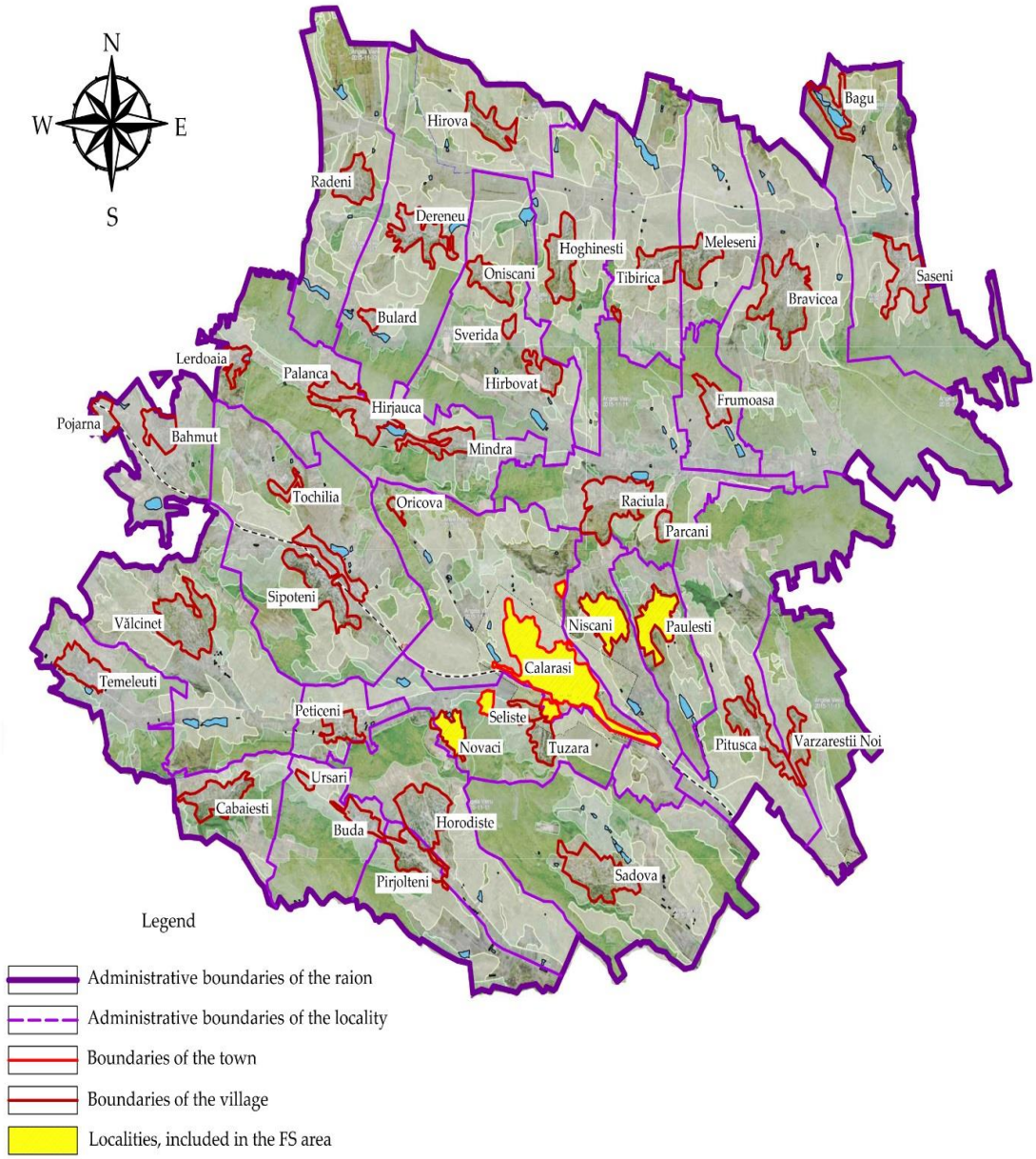
Source: GIZ/MLPS

2 Socio-economic aspects

2.1 Coverage area

This feasibility study covers the area that includes the territory of the town of Calarasi and the localities of Niscani, Paulesti and Novaci (Commune Tuzara), as shown in Figure 2-1.

Figure 2-1: Map of the FS localities



Source: www.google.com/maps/place

2.1.1 Geographical conditions of the coverage area

Calarasi Rayon is situated in the western part of the Republic of Moldova, and also borders the following rayons of Nisporeni to the southwest, Orhei to the East, Ungheni and Telenesti to the West, and Straseni to the Southeast. The rayon centre is the town of Calarasi.

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

N	Name of FS localities	Population	Area [km^2]
1	Calarasi	16,500	42.33
2	Niscani	1,952	2.16
3	Paulesti	997	1.26
4	Novaci	935	0.68
	Total	**20,384**	**46.43**

Source: GIZ/MLPS

Calarasi Rayon covers an area of about 753.54 km^2.

Calarasi Rayon comprises 44 localities, including one town, 27 communes and 14 localities.

The **town of Calarasi** is situated in the central part of the Republic of Moldova, on both banks of the Bic River, a tributary of the Dniester River, at a distance of about 54 km from the munincipality of Chisinau and about 59 km from the town of Ungheni, it borders with Pitusca, Varzarestii Noi, Tuzara, Paulesti, Niscani and Sipoteni localities.

The area of the town of Calarasi is about 4,233 ha, of which 2,279 ha is agricultural land, including:

- Arable lands – 885 ha;
- Multi-annual crops – 881 ha, of which vineyards – 476 ha and orchards– 404 ha;
- Pastures – 485 ha.

Surface covered by water is 433 ha, of which swamps – 128 ha and lakes – 39 ha.

Niscani locality is situated at a distance of about 4 km from the town of Calarasi and about 63 km from Chisinau; it borders with Calarasi, Paulesti and Raciula localities. Niscani locality has an area of about 2.16 km^2, with a perimeter of 7.51 km.

Paulesti locality is situated at a distance of about 11 km from the town of Calarasi and about 54 km from Chisinau; it borders Calarasi, Niscani, Pitusca and Varzarestii Noi localities. Paulesti locality has an area of about 1.26 km^2, with a perimeter of 6.18 km.

Novaci locality (Tuzara Commune) is situated at a distance of about 6 km from the town of Calarasi and 56 km from Chisinau, it borders with Calarasi, Tuzara, Selistea Noua, Horodiste and Peticeni localities. Novaci locality (Tuzara Commune) has an area of about 0.68 km^2, with a perimeter of 3.72 km.

2.2 Relief and climate conditions

Calarasi Rayon is characterised by a hilly relief and crossed by the valleys of the Bic, the Ichel, the Cula and the Racatau Rivers. The territory is quite variable, crossed by slopes of various inclination degrees and plateaus, and is situated in the Central Moldovan Plateau in Codri area, which reaches a height of 400 meters above sea level.

Mineral deposits such as sand and clay can be found on the territory of Calarasi Rayon. Generally, prevailing soils are Chernozem – 15,256 ha and alfisols – 13,151 ha.

Soil freezing depth is 0.8 m and seismicity is 7-8 degrees.

Groundwater is found at an average depth of 150-300m in a calcareous Sarmatic Age bed, characterized by increased content of fluorides and ammonia.

The climate of Calarasi Rayon is temperate continental. Summers are long and warm, with an average temperature of July of 22°C. Winters are mild, with average temperature in January of about -7°C. Precipitation varies between 550 and 625 mm.

2.3 Socio-economic data

The total number of inhabitants of Calarasi Rayon is about 78,100; of which an urban population of about 16.5 thousand and rural population of about 61.6 thousand. Accordingly, the population density is 105 inhabitants per 1 km^2.

The ethnical structure of Calarasi Rayon is as follows: Moldovans – 70,680 people or 94.15%; Ukrainians - 2,799 persons or 3.73%; Russians - 947 persons or 1.26%; Gagauzians - 54 persons or 0.07% and others.

The most recent vital statistics for the rayon are provided in the following table. The table exemplifies the slow decline occurring in the rayon, taking into account the birth and death rates. As discussed in the next section, however, outmigration is accentuating the overall population decline.

Table 2-2: Vital Statistics of Calarasi Rayon for 2014, pers.

No.	Name	Born	Deceased	Natural Growth
1.	Calarasi Rayon	907	1,030	-123
2.	Calarasi Town	173	167	6
3.	Rural Localities	734	863	-129

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

The **Town of Calarasi** is the administrative Centre of Calarasi rayon, with a total population number of 16,500, of which men – 7,885 persons and women – 8,6154 persons.

Currently, about 285 economic agents are active in Calarasi town.

The educational system of town of Calarasi includes three pre-schools, an elementary school, two secondary schools, gymnasium “Ion Creanga”, theoretical lyceum “Mihail Sadoveanu”, pedagogical college "Alexandru cel Bun" with a capacity of 517 seats, auxiliary school with a capacity of 84 seats, a Centre for children with physical disabilities with a capacity of 12 seats and a technical school with a capacity of 308 seats.

Town of Calarasi includes the following cultural institutions: House of Culture, Arts School, a public library with two subsidiaries, seven school libraries and a cinema. In the town functions a sports school.

Health care system includes the rayon hospital, a clinic, and a Centre of Family Physicians.

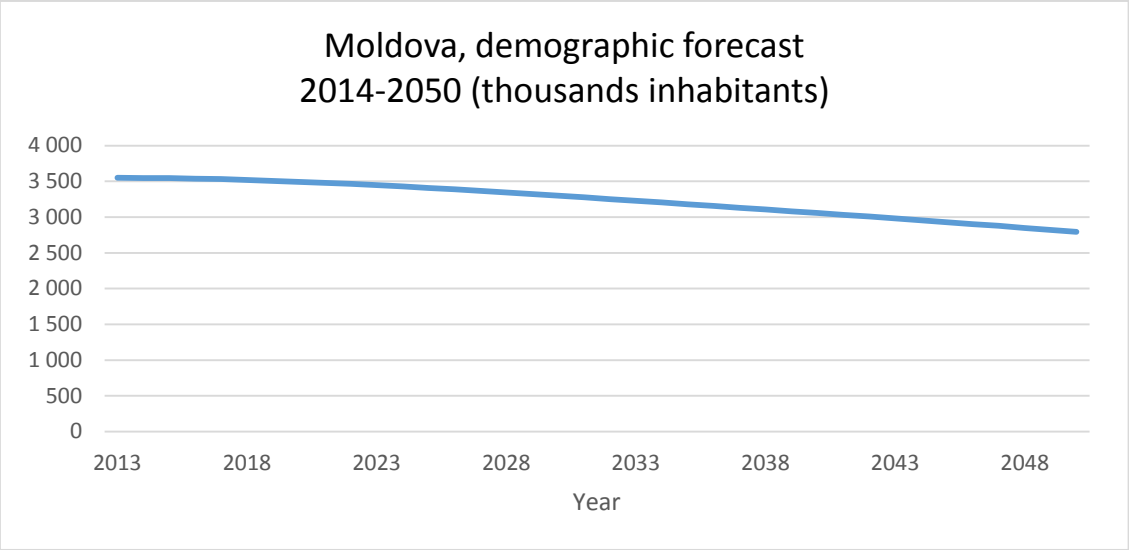
[4] Source: Calarasi Municipal Services Utility, Calarasi Mayor’s Office

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



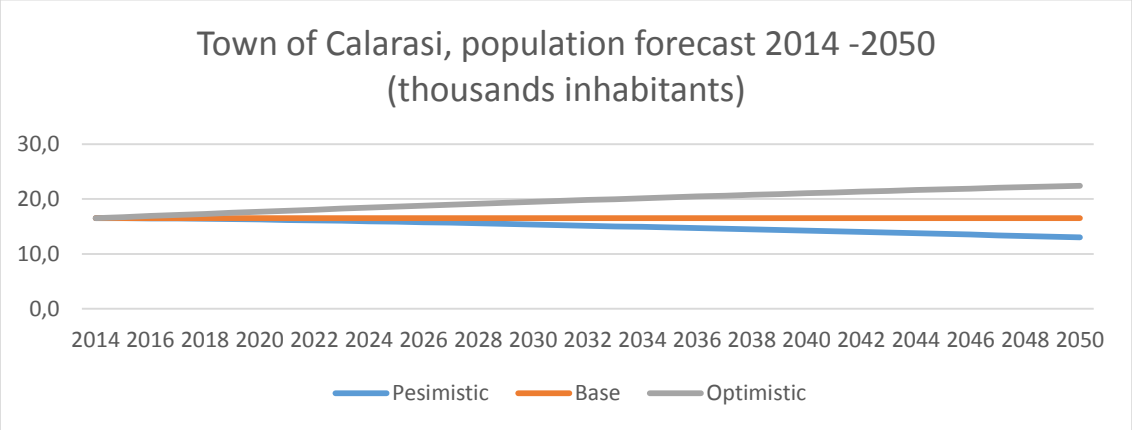
Source: UNDP, World Population prospects, 2013, internet: esa.un.org/wpp/

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 centres 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 Calarasi, 2014-2050

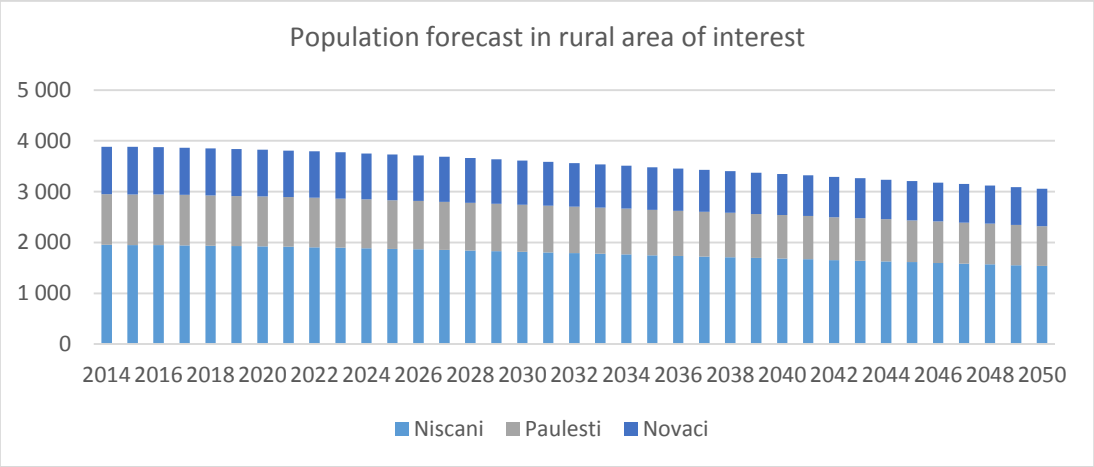


Source: GIZ/MLPS

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 the town of Calarasi will remain constant (16,500 inhabitants) despite the decrease of national population. Its geographical location, located about mid-way from the city of Chisinau to the border city of Ungheni, supports such trend, and the economic development plans (free economic zones) for both Straseni and Ungheni will contribute positively to the estimated demographic forecast. The direct access to major railway and highway and also supports this 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: Niscani (current population 1,952, forecasted to decrease to 1,537 inhabitants by 2050), Paulesti (current population 997, forecasted to decrease to 785 by 2050) and Novaci (current population 935, forecasted to decrease to 736 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

About 285 businesses operate in the town of Calarasi, of which eight are production companies, in particular in the food processing and construction industries. Thus, industry accounts for just under 3% of the total number of economic agents operating in the town. "Palplast" Ltd, representing the chemical industry, manufactures pipes for water supply networks, sewerage and irrigation and is one of the largest employers in the town.

In the past 10 years, the number of local businesses has exhibited a constant, upward trend. The prevalent economic activity is trade, the average share of which during 2006-2014 was about 75%. However, businesses in the food industry, such as the winery 'Calarasi Divin', dairy 'Lapmol' JSC and 'Calarasi Cannery', JSC 'Codreanca' JSC and 'Instacon' Ltd in the textile industry, and 'Palplast' Ltd provide most of the jobs in the town of Calarasi.

In the last 20 years, the town of Calarasi – just as the rest of the small and medium towns in Moldova – suffered a downturn due to the closing of several industrial enterprises. In the present, however, the town of Calarasi is in the process of implementing a socio-economic strategy for 2012-2016, that is aimed at facilitating the creation of modern enterprises with application of the state of art technologies.

In general, the unemployment rate in the town of Calarasi of 1.9% in 2014 is lower than average rate in Moldova (3.9% for 2014) and during 2011 – 2014, the unemployment rate has steadily decreased.

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

Year	2011	2012	2013	2014
Town of Calarasi	1.4	1.5	2.3	1.9

Source: Calarasi rayon statistical department

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

Year	2011	2012	2013	2014
Town of Calarasi	10,986	10,776	10,706	10,628

Source: Calarasi rayon statistical department

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

Year	2011	2012	2013	2014
Town of Calarasi	154	157	248	205

Source: Calarasi rayon statistical department

The largest employers are presented in the table below.

Table 2-6: The main employers in the town of Calarasi

Company name	Company specialization
'Calarasi Divin' JSC	Food industry
'Lapmol' JSC	Food industry
'Calarasi cannery' JSC	Food industry
'Palplast' Ltd	Chemical industry

Company name	Company specialization
Calarasi Municipal Services Utility	Water supply and sanitation services
'Codreanca' JSC	Textile industry
'Asicon' Ltd	Construction industry
UCOOP 'Calarasi'	Trade
'Ghiocel' Ltd	Trade
'Lantav Prim' Ltd	Trade
'Nirom Roz' Ltd	Construction industry
'Instacon' Ltd	Textile industry

Source: Calarasi rayon statistical department

The location of the town of Calarasi between Straseni and Ungheni towns – which in contrast to Calarasi have free economic zones in their territory – would appear to put Calarasi at a disadvantage compared to its neighbouring towns. On the other hand, in the past five years the number of enterprises with foreign capital has increased, which suggests an improving investment climate overall.

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 sanitation 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 per capita/month by region

Disposable income (MDL), forecast				
Region	**2012**	**2013**	**2014**	**2015**
Nord	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.

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 Centre region it was 1,589.76 MDL/person/month.

The average bill for water and wastewater, taking into account the average consumption of 60 litres per capita per day (lcd), and the current price in Calarasi of 26.50 MDL / m^3, can be estimated as follows:

- 0.060 m^3/d x 30 days x 26.50 MDL / m^3 = 47.7 MDL;
  Comparing this figure to the average household's income of 1,589.76 MDL-the affordability ratio reaches 3%. 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 that the population can support a slight increase in tariffs of the 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 agro-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[5].

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 sewerage 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 harmonized only to a small extent with European

[5] www.parlament.md

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

The legal regulation of decentralized 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, organization, 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 authorities) 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 Construction and Regional Development 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 maximize 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 level 1 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 authorities 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 harmonize 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 the feasibility study

3.4.1 Organisation and management of water supply and wastewater services

As stated, this study covers the town of Calarasi; commune of Tuzara with its localities Tuzara, Selistea Noua and Novaci and localities of Niscani and Paulesti.

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

The water utility - Calarasi Municipal Services Utility is the sole operator of water supply and wastewater public services within the town of Calarasi. The company provides water supply and wastewater services for the town of Calarasi and water supply services for the locality of Selistea Noua from commune of Tuzara.

The localities of Niscani, Novaci and Paulesti do not have centralised water supply systems.

In general, operator provides different municipal services, including water supply, wastewater collection and treatment, heating, town cleaning and development etc.

A management contract on regional water supply and wastewater services, concluded between the Calarasi Local Council and Calarasi Municipal Services Utility 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 Calarasi administrative-territorial unit.

The town of Calarasi has delegated the management and operation rights of the water supply and wastewater systems to the Calarasi Municipal Services Utility. The locality of Selistea Noua from the commune of Tuzara also has delegated the management an operation rights of the water supply system to the Calarasi Municipal Services Utility, as the operator of public service in these localities.

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

3.5 Organisation and management of Calarasi Municipal Services Utility

Calarasi Municipal Services Utility was established by decision of the local public authority 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.

Seven subordinated specialists report directly to the director:

- Chief engineer, responsible for the management of production sectors, elaboration of proposals for development, development of technical conditions for connection to water supply and wastewater networks;
- Chief accountant, responsible for accounting records management and working out of the accounting reports;
- Economist, in charge with analysis of financial and economic situation, calculation of tariffs and development of production program;
- Head of marketing department - responsible for sales, control and accounting of the consumers' payments and keeping their records;
- Safety engineer, in charge with accidents prevention within the company;
- Human resources officer, in charge with development of job descriptions, keeping staff tracks and promote staff policy;
- Lawyer, responsible for ensuring compliance with legislation and contracts concluding.

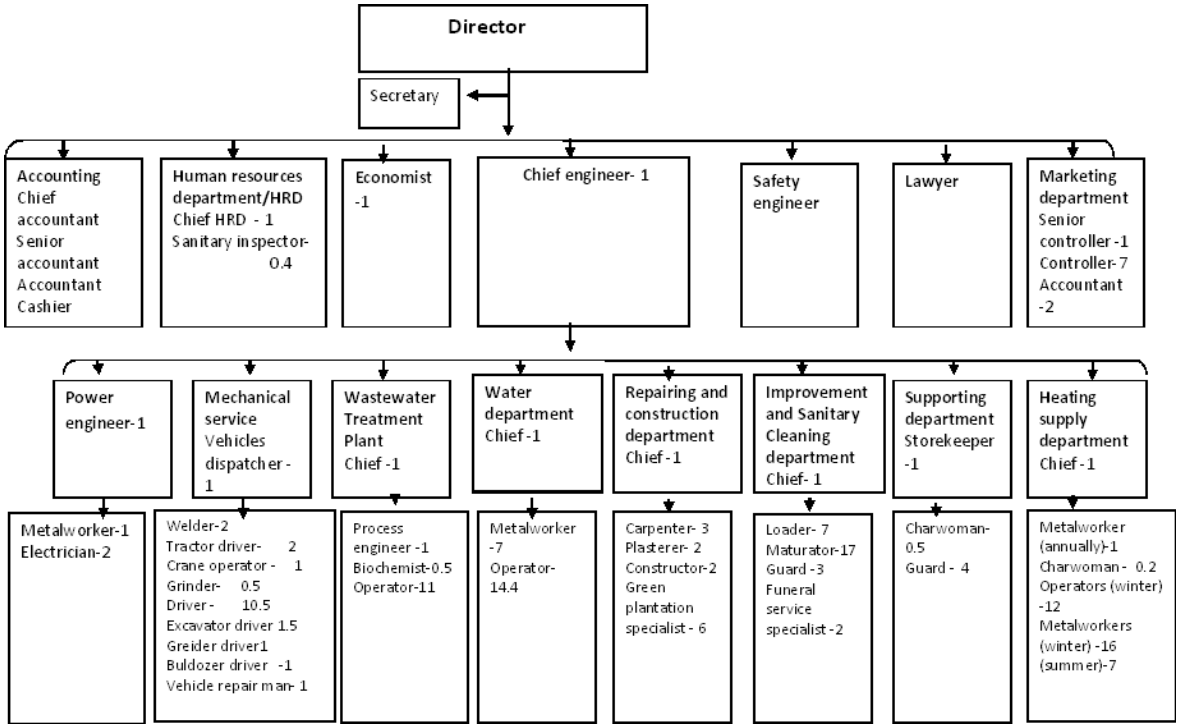
Heads of following eight units are subordinated to chief engineer, who is the manager for technical teams:

- Head of Water Department;
- Head of Wastewater Treatment Plant;
- Head of Repairing and Construction Department;
- Head of Improvement and Sanitary Cleaning Department;
- Head of Heating Supply Department;
- Head of Supporting Department;
- Head of Mechanical Service / vehicles dispatch centre;
- Power engineer.

The structure of the company is adequate for the objectives and the activities carried out.

The organisational structure of the Calarasi Municipal Services Utility is showed below:

Figure 3-1: Calarasi Municipal Services Utility Organisation chart



Source: LPA Calarasi, Calarasi Municipal Services Utility

3.6 Company staff and training needs

The organisational structure of the company includes 143.5 positions (according to the staff list) and actual 130 employees. Number of employees increases during the winter when several stokers are hired within Heating Supply Department. 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 91%, while the staff turnover rate remaining at 20% over the past three years.

Currently, only 52 out of 130 staff members are dedicated to water and wastewater operations, while 19 persons deal with the other services and 59 persons provide support and administrative services to all activities of the Calarasi Municipal Services Utility.

The years of service at the company of the technical and financial staff shows a stable situation. The overwhelming majority of staff members (90 or 70% of the total) have more than 15 years of employment in the position, with an average of 25 years. Three key persons in the company (chief engineer, head of Repairing and Construction Department and Marketing Department) 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, 9% of the staff has higher education, 41% - 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.

Calarasi Municipal Services Utility has an Activities Improvement Plan which includes a set of 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: Calarasi Municipal Services Utility staff training needs

Training topic	Beneficiary
Strategic planning	Director; chief engineer; economist
Investment planning and analysis of investment projects	Director; chief engineer; heads of departments; economist; chief accountant
Human resources planning and development	Director; human resources officer; economist
Performance indicators and staff motivation	Director; chief engineer; heads of departments; human resources officer
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	Chief engineer; heads of the related departments
Wastewater treatment and sludge management	Chief engineer; heads of the related departments
Water supply and wastewater networks management	Chief engineer; heads of the related departments
Energy management in water supply and wastewater systems operation	Chief engineer; heads of relevant departments
Quality management in water supply and wastewater systems operation	Chief engineer; 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; chief engineer
Legislative aspects and standards in water supply and wastewater	Director; chief engineer; lawyer
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

4 Technical aspects - existing situation

4.1 General information

The assessment of the existing water supply and wastewater situation in the town of Calarasi and localities in its vicinity (Niscani, Paulesti and Novaci (Tuzara Commune)) has been conducted by the GIZ/MLPS experts in collaboration with members of Project Working Group (PWG).

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 Authorities (LPAs) and the Municipal Services Utility;
- 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 sewerage facilities;
- Available pre-feasibility and feasibility studies, existing and implemented technical design project, topographic surveys (site plans) related to water supply and sewerage 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 Calarasi are provided by a single operator - Calarasi Municipal Services Utility.

There are no centralised water supply and wastewater systems in the localities of Niscani, Paulesti and Novaci (Tuzara Commune).

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

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

No.	Locality	Population	Current situation and on-going activities - water supply	Population served by centralised water supply service		Current situation and on-going activities - wastewater	Population served by centralised wastewater service	
				Covered	Connected		Covered	Connected
1.	Calarasi	16,500	The coverage area of water supply system is about 97%. The connection rate is about 80%	15,963	13,213	The coverage area of wastewater system is about 52%. The connection rate is about 49%.	8,575	8,145
2.	Niscani	1,952	No centralised water supply system in operation	0	0	No centralised wastewater system	0	0
3.	Paulesti	997	No centralised	0	0	No central-	0	0

No.	Locality	Population	Current situation and on-going activities - water supply	Population served by centralised water supply service		Current situation and on-going activities - wastewater	Population served by centralised wastewater service	
				Covered	Connected		Covered	Connected
			water supply system in operation			ised wastewater system		
4.	Novaci	935	No centralised water supply system	0	0	No centralised wastewater system	0	0

Source: LPA Calarasi, Calarasi Municipal Services Utility, LPA Tuzara Commune, LPA Niscani and LPA Paulesti

General information about public institutions in the town of Calarasi and FS localities is provided in Table 4-2. More detailed information is provided in Annex 4.

Table 4-2: Public institutions in the town of Calarasi and FS localities

No.	Locality/Public institution name	No. of institutions	Pupils/ children / places/ beds	Employees	Connected to water supply system	Connected to centralised wastewater system
1.	Calarasi					
	Kindergarten	3	620	84	yes	yes
	Schools	8	2,312	351	yes	yes
	Healthcare institutions	3	7,253	456	yes	yes
2.	Niscani	3	171	38	n/a	n/a
3.	Paulesti	2	20	14	n/a	n/a
4.	Novaci	2	30	17	n/a	n/a

Source:LPA Calarasi, Calarasi Municipal Services Utility, LPA Tuzara Commune, LPA Niscani and LPA Paulesti

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

Table 4-3: Business entities in the FS localities

No.	Locality/Type of business entity	No. of business entities	Employees	Connected to water supply system	Connected to centralised wastewater system
1.	Calarasi				
	Commerce	13	n/a	yes	yes
2.	Niscani	16	112	n/a	n/a
3.	Paulesti	4	20	n/a	n/a
4.	Novaci	2	5	n/a	n/a

Source: LPA Calarasi, Calarasi Municipal Services Utility, LPA Tuzara, LPA Niscani and LPA Paulesti

4.3 Water supply system

4.3.1 Water supply system in the town of Calarasi

Water is supplied to the town of Calarasi 24 hours/day. Water supply services are provided to about 13,213 consumers out of 16,500 inhabitants, water supply connection rate being of 80%.

The water supply system in the town of Calarasi consists of following key components:

- Water source (Sipoteni water intake and individual deep wells) and first level pumping station (PS-I);
- Transportation of water, from water intake to the underground reservoirs and further from reservoirs to the distribution network (raw and drinking water transmission main);
- Underground water reservoir with a volume of 1,000 m^3, designed for the storage of a volume of water necessary in such cases as following: water reserve in case of network failure, compensation of uneven hourly consumption and water reserve necessary for fire fighting purposes;
- Second level pumping station (PS-II) and booster pumping stations (PS-3 and PS-4), to ensure the required pressure in the water distribution network;
- Looped water distribution network, combined with branched one;
- Underground service tank with a volume of 3,000 m^3;
- Underground water reservoir with a volume of 500 m^3.

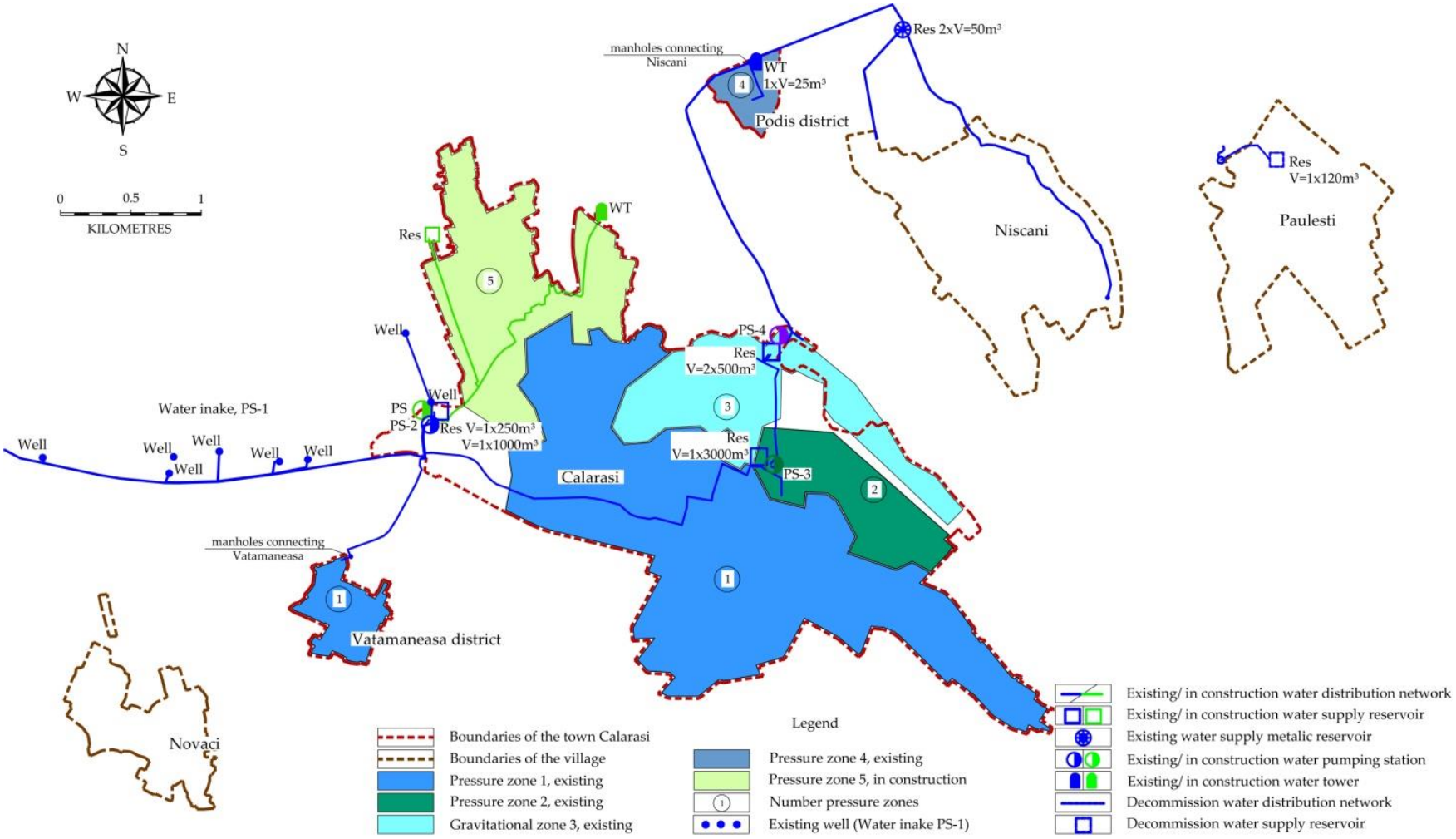
The raw water from deep wells located in Sipoteni locality and two (2) deep wells, located in the town of Calarasi, is pumped and stored into one (1) underground water reservoir with a volume of 1,000 m^3. From this underground water reservoir, the water is further pumped through the second level pumping station (PS-2) into the distribution network (pressure zone 1) and stored in an underground service tank with a volume of 3,000 m^3 installed at the third level pumping station PS-3 located in Biruinta street.

For the Rayon Hospital and a few streets of the Carabliu district, the water from service tank located in Biruinta Street is pumped through third level pumping station PS-3 into water distribution network (pressure zone 2) and stored into two (2) underground water reservoirs with a volume of 500 m^3 each in Stefan cel Mare Street. Further on, the water from underground reservoirs is distributed by gravity for the Bojole district and the upper side of the Carabliu district (pressure zone 3).

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

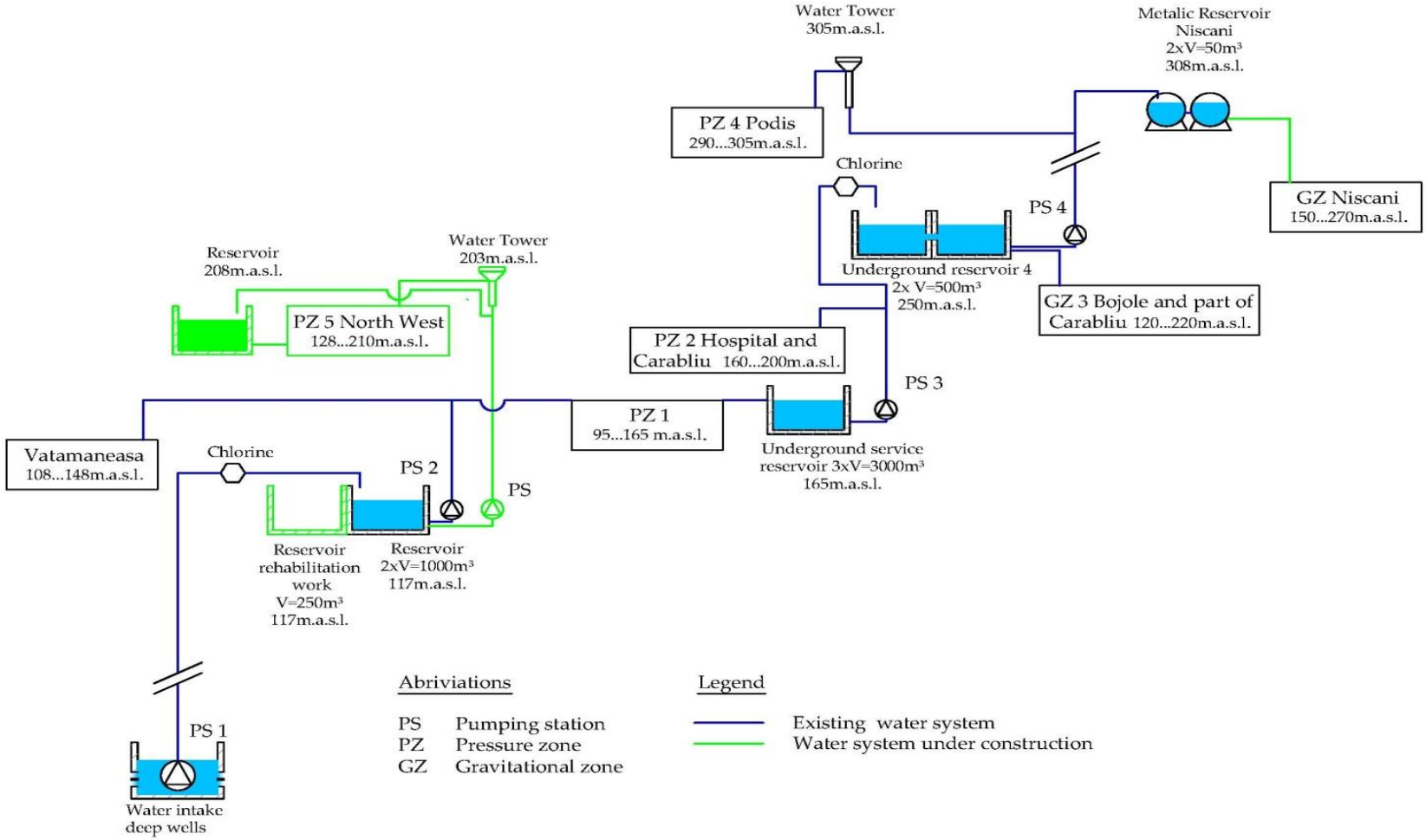
At the time of sites visit conducted by the GIZ/MLPS experts, the construction works of the water distribution network in the Northwest district (pressure zone 5) were underway, as a part of the “Construction of water supply and sewerage networks in the Northwest part of the town of Calarasi” project, financed by National Ecological Fund.

Figure 4-1: Scheme of water supply system in the town of Calarasi



Source: Calarasi Municipal Services Utility, GIZ/MLPS

Figure 4-2: Technological scheme of water supply system in the town of Calarasi



Source: GIZ/MLPS

4.3.1.1 Water source

In the town of Calarasi, the well field - Sipoteni water intake, includes seven (7) deep wells in operation (Sipoteni water intake), and six (6) individual deep wells situated on the town's territory, of which only five (5) are in operation, the others being reserve.

The main technical data on the functioning and reserved deep wells are presented in the Table 4-4.

Table 4-4: Available water sources at the existing well field

No.	Year of installation	Well no. in technical passport/location	Well depth (m)	Hydrostatic water level (m)	Hydrodynamic water level (m)	Yield capacity (l/s)	Condition
1.	1969	2824(5) (Sipoteni)	173	74	94	2.78	functional
2.	1975	3564(8) (Sipoteni)	190	110	125	2.78	functional
3.	1973	3471(9) (Sipoteni)	200	108	140	2.78	functional
4.	1987	4672(9a)(Sipoteni)	205	141	165	2.22	functional
5.	1991	4936(10)(Sipoteni)	190	127	161	2.78	functional
6.	1975	3578(11)(Sipoteni)	175	121	141	2.78	functional
7.	1981	4220(12)(Sipoteni)	200	115	135	2.78	functional
8.	1981	4221(3), PS-II	210	126	146	2.78	functional
9.	1963	4222 PS-III	235	190	208	1.94	functional
10.	1981	1360 (farm)	210	90	96	2.78	functional
11.	1981	4236 (hospital)	250	183	193		non-functional
12.	2010	10/10 (Bojole)	275	212	213	2.78	functional
13.	1987	1863 (bus station)	175	120	143	2.78	functional

Source: Calarasi Municipal Services Utility

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, ammonia NH4, fluorides. The raw water quality indicators provided by Calarasi Municipal Services Utility, are presented in the Table 4-5.

Table 4-5: Water quality indicators (17 June, 2015)

No.	Indicator	Unit	Max. concentration acc. to G.D. No 934	Raw water concentration (deep well no. 9a)
1.	Smell	Degree	acceptable for consumers	2
2.	Taste	Degree	acceptable for consumers	-
3.	Colour	Degree	acceptable for consumers	52
4.	Hydrogen Index pH		≥ 6.5 ≤9.5	8.9
5.	Turbidity	degree	5	7.3
6.	Ammonia NH_4	mg/l	0.5	4.6
7.	Nitrites (NO_2)	mg/l	0.5	0.003
8.	Nitrates (NO_3)	mg/l	50	0.2
9.	Total hardness	degree	5 German degree	1.1
10.	Total dissolved solids	mg/l	1,500	1,100
11.	Chlorine	mg/l	250	38.5
12.	Sulphates	mg/l	250	279.8
13.	Fluorides	mg/l	1.5	3.3

No.	Indicator	Unit	Max. concentration acc. to G.D. No 934	Raw water concentration (deep well no. 9a)
14.	Iron	mg/l	0.3	0.13
15.	Copper	mg/l	1	0.05

Source: Calarasi Municipal Services Utility

4.3.1.2 Water abstraction facilities

Water abstraction facilities comprise of:

- Deep wells and first level pumping station (PS-1);
- Water storage reservoirs.

The raw water from seven (7) deep wells (Sipoteni water intake) and from two (2) individual deep wells (4221(3) and 1360) is pumped through submersible pumps (first level pumping station (PS-1)) and stored in one (1) underground water reservoir with a volume of 1,000 m^3 installed on the territory of the second level pumping station (PS-2). During elaboration of the feasibility study, in period of the site visits conducted by GIZ/MLPS experts, rehabilitation works of underground reservoir with a volume of 250 m^3 were being carried out.

The raw water from deep well 4222 is pumped through submersible pumps (first level pumping station (PS-1)) and stored in one (1) underground water reservoir with a volume of 3,000 m^3 installed on the territory of the pumping station (PS-3).

The raw water from deep well 1010 is pumped through submersible pumps (first level pumping station (PS-1)) and stored in two (2) underground water reservoir with a volume of 500 m^3 installed on the territory of the pumping station (PS-4).

The raw water from deep well 1863 is pumped through submersible pumps (first level pumping station (PS-1)) and stored in one (1) steel tank with a volume of 50 m^3 located in area of the railway station.

The main technical data of the existing submersible pumps are provided in the Table 4-6.

Table 4-6: The main parameters of the submersible pumps in operation

No.	Year of installation	No. in technical passport /location	Pump type	Pump flow rate (m^3/h)	Head (m)	Pump power (kW)	Pump energy specific consumption [kwh/m³]	Condition
1.	1969	2824(5)(Sipoteni)	ECV 6-10-185	10	185	8,00	1,10	in operation
2.	1975	3564(8) (Sipoteni)	ECV 6-10-185	10	185	8,00	1,00	in operation
3.	1973	3471(9) (Sipoteni)	ECV 6-10-185	10	185	8,00	1,12	in operation
4.	1987	4672(9a)(Sipoten)	4SP8 - 44	7	185	5.5	0.78	in operation
5.	1991	4936(10)(Sipoteni)	GRUNDFOS	10	170	7,50	0,75	in operation
6.	1975	3578(11)(Sipoteni)	ECV 6-10-235	10	235	11,00	1,15	in operation

No.	Year of installation	No. in technical passport /location	Pump type	Pump flow rate (m^3/h)	Head (m)	Pump power (kW)	Pump energy specific consumption [kwh/m³]	Condition
7.	1981	4220(12)(Sipoteni)	ECV 6-10-235	10	235	11,00	1,16	in operation
8.	1981	4221(3), PS-II	GRUNDFOS	10	150	7,50	0,75	in operation
9.	1963	4222 PS-III	ECV 6-6,3-225	6,3	225	8,00	1,33	in operation
10.	1981	1360 (farm)	ECV 6-10-185	10	185	8,00	1,00	in operation
11.	1981	4236 (hospital)						not in operation
12.	2010	10/10(Bojole district)	ECV 6-6,3-300	6,3	300	11,00	1,74	in operation
13.	1987	1863 (bus station)	ECV 6-10-185	10	185	8	1	in operation

Source: Calarasi Municipal Services Utility

Figure 4-3: Deep well no. 4672 (9a). Water meter node

Source: GIZ/MLPS

Main technical data on the existing underground reservoirs with a volume of 1,000 m^3 and 250 m^3 (under rehabilitation) are provided in the Table 4-7.

Table 4-7: Main technical data on existing underground reservoirs

No.	Location	Year of construction	Type of reservoir	Capacity (m^3)	Quantity, no. of chambers	Condition
1.	PS2	1970	Rectangular	1,000	1	satisfactory
2.		1960	Cylindrical	250	1	unsatisfactory

Source: Calarasi Municipal Services Utility

Figure 4-4: Water underground reservoirs with a volume of 1,000 m^3 and 250 m^3 (under rehabilitation) - territory of the second level pumping station PS-2

Source: GIZ/MLPS

4.3.1.3 Water pumping stations

The water is delivered directly to the water distribution network in the town of Calarasi, by the second level pumping station, by use of an (1) underground service tank with a capacity of 3,000 m^3 installed at the third level pumping station PS-3 located in Biruinta street.

Due to area's relief in the town of Calarasi, the water distribution network is designed with an underground service tank. During the maximum hourly water consumption, the water distribution network is supplied with water from the second level pumping station (PS-II) and from the service tank, while during the hourly minimum water consumption; it is supplied from the second level pumping station (PS-II) only. Taking into account the fact that the pump's flow rate is higher than the water consumption of the populated area, the excess water is stored in an underground service tank.

For the Rayon Hospital and few streets from the Carabliu district, water is pumped into water distribution network by the third level pumping station PS-3 and is stored in two (2) water underground reservoirs with a volume of 500 m^3 each, located in Stefan cel Mare Street, and further distributed by gravity to Bojole district and upper side of Carabliu district. In the elaboration period of the feasibility study, during the site visits conducted by GIZ/MLPS experts, a submersible pump (PS-4) was installed in the above mentioned reservoirs to provide water to Podis district of the town of Calarasi (pressure zone 4) and further to Niscani locality.

The main technical parameters of pumping stations are presented in Table 4-8.

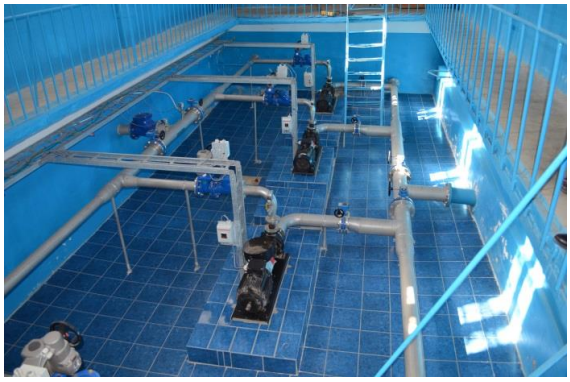
Table 4-8: Main technical parameters of pumping stations

No.	PS name	Year of installation	Year of rehabilitation	Pump type	Pump flow rate (m3/h)	Head (m)	Pump power (kW)	Pump energy specific consumption [kwh/m^3]
1.	PS2	1960	2004	GRUNDFOS NK50-200 (4 pcs.)	60	57	18.5	0.31
2.	PS3	1960	2004	GRUNDFOS CR 16-80 (3 pcs.)	16.1	97	7.5	0.47
3.	PS4	1960	2004	ЭЦВ 6-10-185	10	185	8.0	0.83

Source: Calarasi Municipal Services Utility

The pumping stations are in a good condition. At the moment of elaboration of FS rehabilitation/ replacement is not required.

Figure 4-5: Second level pumping station PS2. Third level pumping station PS3




Source: GIZ/MLPS

4.3.1.4 Water disinfection

The raw water is disinfected only by injecting sodium hypochlorite solution (NaOCl) in the underground reservoir with a volume of 1,000 m^3 installed at the second level pumping station (PS-2) and in two (2) underground reservoirs with a volume of 500 m^3 each, installed at the fourth level pumping station (PS-4).

Figure 4-6: Sodium hypochlorite dosing station (the 2nd pumping station PS-2 area)

Source: GIZ/MLPS

4.3.1.5 Water storage facilities

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

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

No.	Location	Year of construction	Type of reservoir	Capacity (m^3)	Quantity/No. of chambers	Condition
1	Underground service tank, PS3	1960	rectangular	3,000	1	satisfactory
2	Underground water reservoir, PS4	1960	rectangular	500	2	satisfactory

Source: Calarasi Municipal Services Utility

Figure 4-7: Underground service tank with a volume of 3,000 m^3 (PS-3) and underground reservoir with a volume of 500 m^3 (PS-4)

Source: GIZ/MLPS

4.3.1.6 Water distribution network

The water distribution network in the town of Calarasi consists of cast iron, steel and high density polyethylene (HDPE) pipes with diameters of between 50 mm and 300 mm. The total length of water distribution network is about 52,960 m, as provided in the Table 4-10.

Main technical parameters of water distribution network are presented in the Table 4-10.

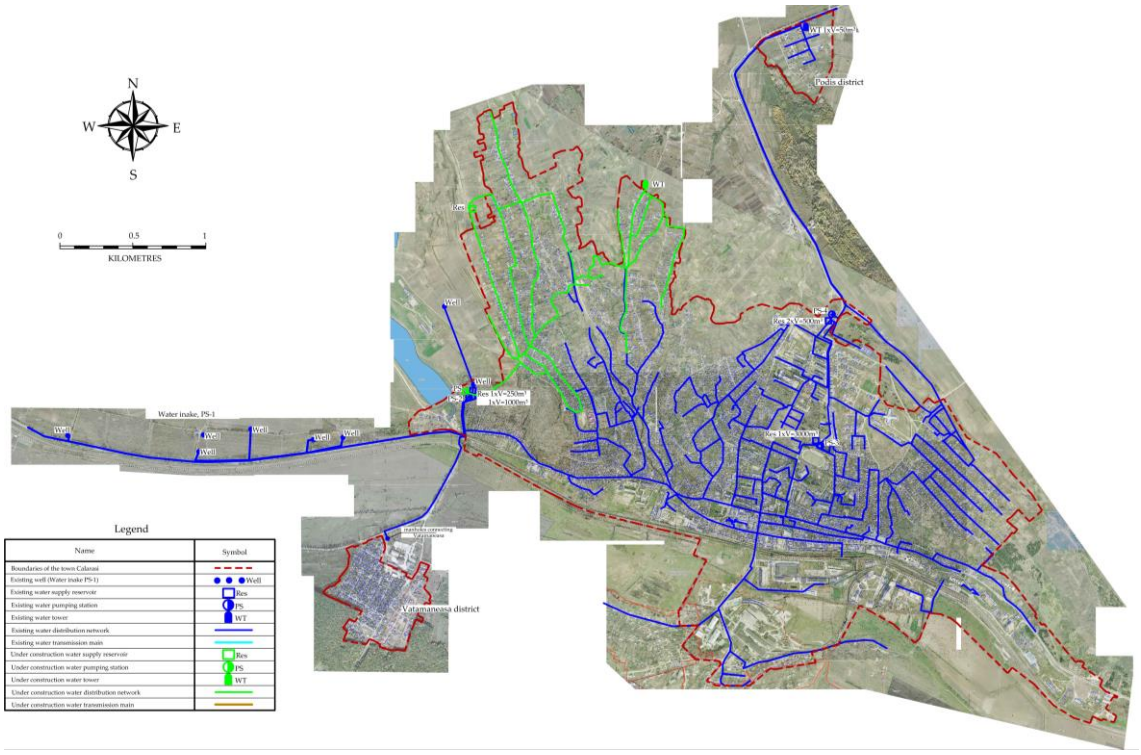
Table 4-10: Main technical parameters of water distribution network in the town of Calarasi

No.	Material	Length (m) / diameter (mm)						Length (m)	Pipe age (years)	Total length (m)
		50	63/ 75	90/ 110	125/ 150	200	300			
1.	Cast iron			2,300			4,100	6,400	30	52,960
2.	Steel	1,900	3,600	4,100	2,100		1,600	13,300	30	
3.	HDPE	12,000	4,565	12,202	3,633	180	680	33,260	10	

Source: Calarasi Municipal Services Utility

The water distribution network in the town of Calarasi is provided in Figure 4-8. More detailed information about water distribution network is provided in Annex 11.

Figure 4-8: Water distribution network in the town of Calarasi



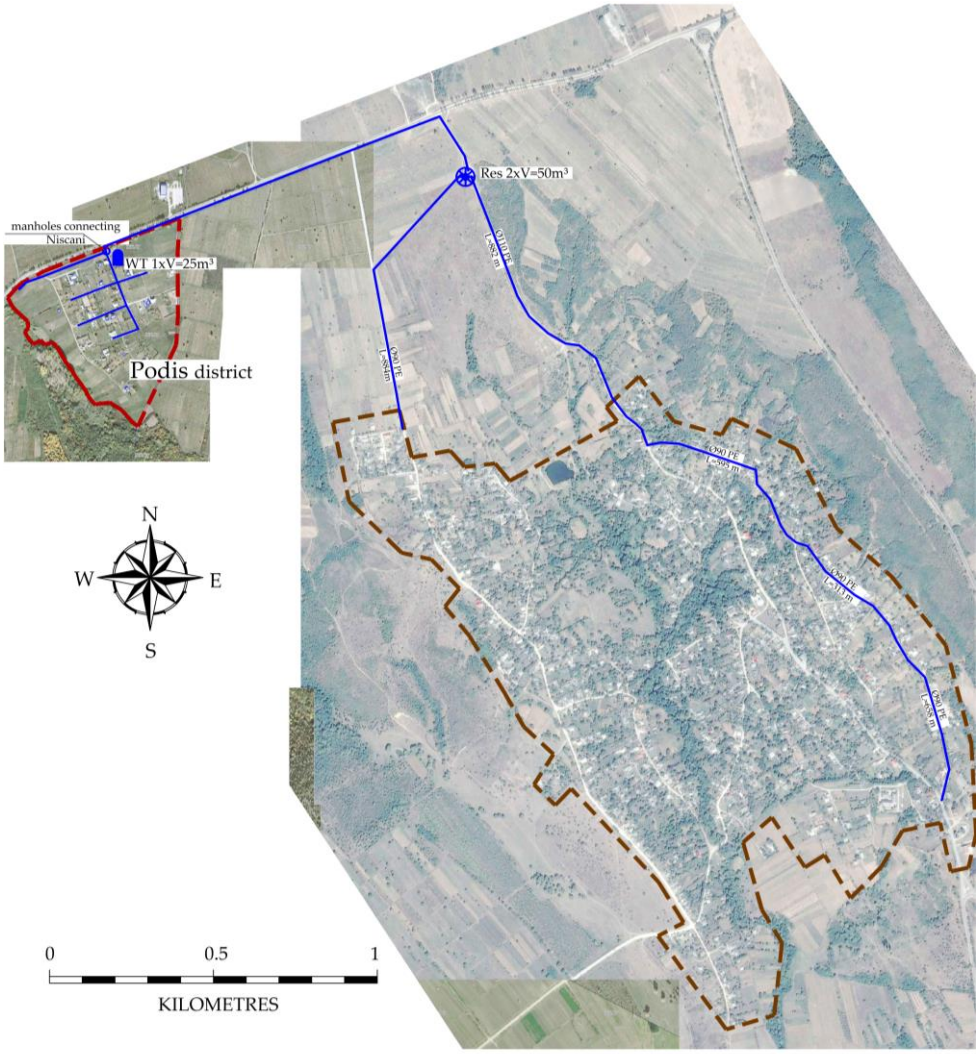
Source: www.geoportal.md, Calarasi Municipal Services Utility, GIZ/MLPS

4.3.2 Water supply system in the localities of Niscani, Paulesti and Novaci

At the time of site visits conducted by the GIZ/MLPS experts, nearby Niscani locality construction works of the water transmission main from the fourth level pumping station PS-4 located in the town of Calarasi to the Podis district and Niscani locality were underway. The funding sources are: up to the Podis district – from the local budget of the LPA Calarasi, from the Podis district up to the metallic reservoir situated in Niscani locality – from budgetary local sources of the LPA Niscani.

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

Figure 4-9: Water distribution network in the Niscani locality



Source: www.geoportal.md, Calarasi Municipal Services Utility, GIZ/MLPS

Figure 4-10: Connecting manhole of the water transmission main

Source: GIZ/MLPS

In Niscani and Paulesti localities, the centralised water supply system is not in operation. The inhabitants of above mentioned localities are supplied from individual wells.

4.4 Water balance

The data necessary for water balance calculation were provided by Calarasi Municipal Services Utility and included the following details: monthly volume of the extracted raw water, monthly volume of water sold to domestic consumers, monthly volume of water sold to public institutions and business entities.

Following the analysis of real water consumption, the volume of non-revenue water for water supply system of Calarasi was determined.

4.4.1 The monthly volume of the extracted raw water

According to the information provided by Calarasi Municipal Services Utility, the monthly volume of the extracted raw water is determined according to the water meters data from the rising pipe located at the first level pumping station (PS-1), as provided in Table 4-11.

4.4.2 Water consumption

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

Operational indicators figures for 2014, presented by Calarasi Municipal Services Utility, are provided in the Table 4-11.

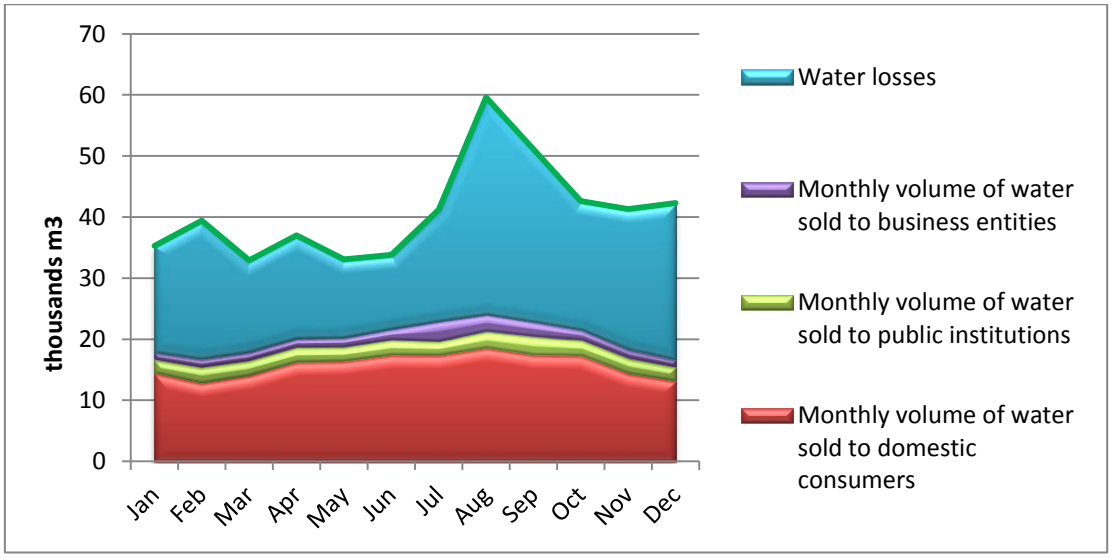
Table 4-11: Operational indicators for 2014

No.	Month	Program of water supply (hours/24 hours)	Monthly volume of the extracted raw water (m^3)	Monthly volumes of water sold, m^3		
				Domestic consumers	Public institutions	Business entities
1.	January	24	35,300	14,554	2,200	1,173
2.	February		39,400	12,860	2,592	1,395
3.	March		32,900	14,064	2,483	1,369
4.	April		37,000	16,267	2,393	1,469
5.	May		33,100	16,423	2,291	1,582
6.	June		33,800	17,431	2,425	1,854

No.	Month	Program of water supply (hours/24 hours)	Monthly volume of the extracted raw water (m^3)	Monthly volumes of water sold, m^3		
				Domestic consumers	Public institutions	Business entities
7.	July		41,200	17,358	2,277	3,325
8.	August		59,600	18,562	2,671	2,835
9.	September		51,100	17,407	2,980	2,495
10.	October		42,600	17,315	2,525	1,707
11.	November		41,300	14,362	2,501	1,510
12.	December		42,300	13,153	2,303	1,248
	Total		**489,600**	**189,756**	**29,641**	**21,962**

Source: Calarasi Municipal Services Utility

Figure 4-11: Operational indicators



Source: Calarasi Municipal Services Utility, GIZ/MLPS

4.4.3 Real water consumption

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 consumers is the ratio of daily water sold by the utility divided to the number of consumer (domestic, public institutions and business entities), as provided in Table 4-12.

Table 4-12: The real water consumption

No.	Indicator	Unit of measurement	Year		
			2012	2013	2014
1.	Number of domestic customers	pers.	12,915	13,050	13,213
2.	Annual volume of raw extracted water	m³/year	553,104	444,560	489,600
3.	Total water sold by the utility, of which: • Domestic consumers • Public institutions and business entities	m³/ year m³/ year m³/ year	217,477 172,609 44,868	236,470 189,402 47,068	241,359 189,756 51,603

No.	Indicator	Unit of measure-ment	Year		
			2012	2013	2014
4.	Real water consumption (based on daily water sold)	l/c/d	46	50	50
5.	Real water consumption (based daily water sold) to domestic consumers)	l/c/d	37	40	39

Source: Calarasi Municipal Services Utility, GIZ/MLPS assessments

4.4.4 Non-revenue water (NRW)

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

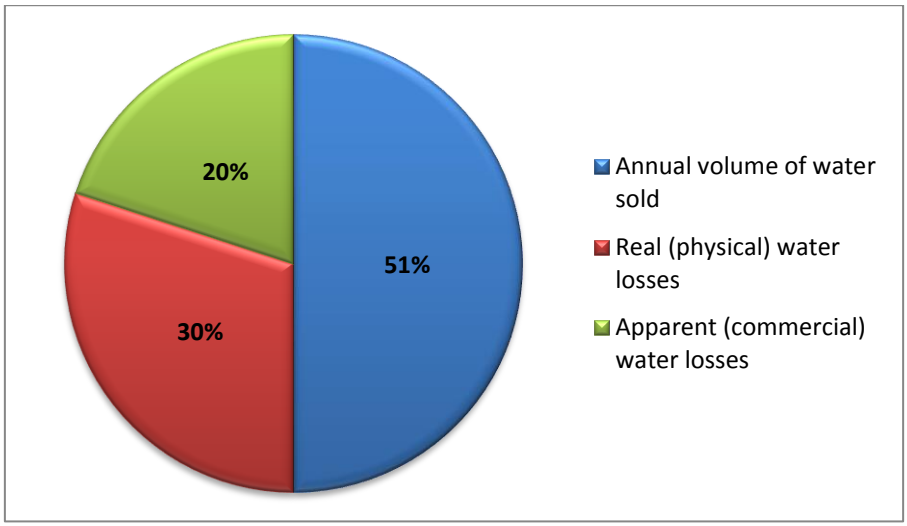
The water balance for water supply system in the town of Calarasi is provided in Table 4-13.

Table 4-13: The water balance for water supply system in the town of Calarasi

No.	Indicator	Unit of measure-ment		2014	
1.	Number of domestic consumers	pers.		13,213	
2.	Annual volume of extracted raw water	m³		489,600	
3.	Annual volume of water sold	m³		241,359	
4.	Annual volume of NRW, including:	m³	%	248,241	51
	• Real (physical) water losses (60% of NRW)	m³	%	148,945	30
	• Apparent (commercial) water losses (40% of NRW)	m³	%	99,296	21

Source: Calarasi Municipal Services Utility, GIZ/MLPS assessments

Figure 4-12: Water balance



Source: Calarasi Municipal Services Utility, 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 the 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 the town of Calarasi. With the purpose to reduce apparent water losses it is recommended to:

- Install high precision water meters to domestic consumers, as well at first level pumping station (PS-1);
- Identify and replace defective water meters;
- Water meters installed to public institutions and business entities must be subjected to metrological control after two (2) years of usage and as appropriate to be replaced.

4.4.5 Water metering

During the period 2006-2008, a water metering programme was implemented, resulting in a metering rate of about 98 - 99% of domestic consumers, public institutions and business entities in Calarasi. However, the water meter data already contain some error because the water meters installed at the first level pumping station (PS-1) have been in operation for more than 10 years and the water meters nodes installed for customers are of class "A".

4.4.6 Equipment and facilities

Calarasi Municipal Services Utility owns and operates the following equipment and facilities:

- Drainage truck GAZ-53 (two(2) units);
- Water transportation truck with a tank volume of 6 m^3 ZIL-130 (one (1) unit);
- Excavator New Holland – from a USAID project (one (1) unit);
- Rescue trailer truck Mercedes Sprinter (one (1) unit);
- Laboratory equipment AquaClean MBBR at the wastewater treatment plant;
- Water Utility "Apa-Canal" Straseni provides services for sewer network cleaning based on agreement between these companies.

4.5 Technical and operational analysis of the water supply system

4.5.1 Non-revenue water (NRW)

Non-revenue water (as provided in Table 4-13) 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 wear degree of existing pipelines is very high, causing large leaks in the water supply system in the town of Calarasi. The statistics on damages and repairs in the period 1 January 2014 – 31 December 2014 are provided in Tables 4-14 and 4-15.

Table 4-14: Statistics on pipe damage, 1 Jan-31 Dec, 2014

No.	Location	Pipeline breakdowns
1.	On water transmission main	2
2.	On distribution network	94

Source: Calarasi Municipal Services Utility

Table 4-15: Statistics on repairs made, 1 Jan-31 Dec 2014

No.	Type of repair	Location
1.	Current repairs	At two (2) underground water reservoirs with a volume of 500 m^3 each
2.	Capital repairs	At three (3) deep wells

Source: Calarasi Municipal Services Utility

4.6 Wastewater system

4.6.1 Wastewater system in the town of Calarasi

About 8,145 domestic consumers out of 16,500 inhabitants from the town of Calarasi are connected to the centralised wastewater system (connection rate for wastewater services is about 49%).

The wastewater system of the town of Calarasi consists of two separate sewerage networks that collect and dispose the domestic wastewater, industrial wastewater and storm water.

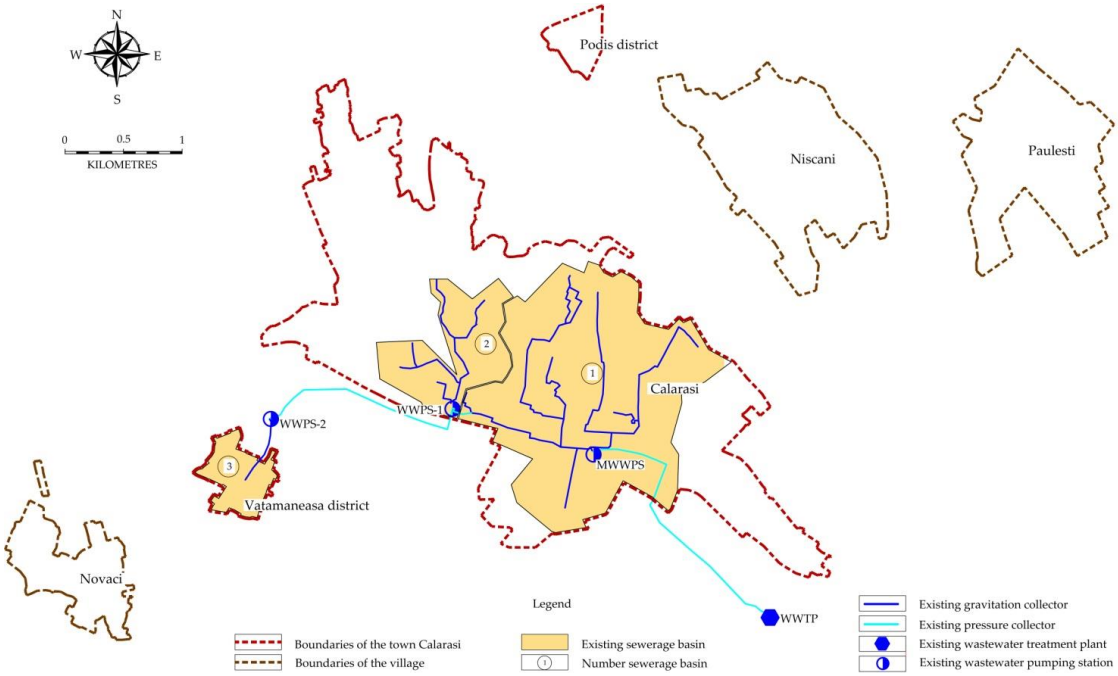
The main facilities of the wastewater system in the town of Calarasi are the following:

- Gravity and pressure sewerage networks;
- Wastewater pumping stations (three (3) wastewater pumping stations (WWPS), of which one is the main wastewater pumping station (MWWPS) and two (2) local wastewater pumping stations (WWPS): WWPS – Pedagogical College “Alexandru cel Bun” and WWPS-2 – Vatamaneasa district);
- Wastewater Treatment Plant (WWTP).

A scheme of wastewater system is presented in the Figure 4-13.

More detailed information about wastewater system in the town Calarasi is provided in Annex 11.

Figure 4-13: Scheme of wastewater system in the town of Calarasi



Source: Calarasi Municipal Services Utility, GIZ/MLPS

The drainage area is a defined territory, from which the wastewater is collected by a sewerage network.

The wastewater from the drainage area no.1 is collected by gravity to the Main Waste Water Pumping Station (MWWPS) located in the town's lower sector of Maria Cibotari street, further being pumped to the Waste Water Treatment Plant (WWTP) located in the town of Calarasi by two (2) pressure pipes with a diameter of 250 mm each.

The wastewater from the drainage area no.2 is collected by gravity to the Waste Water Pumping Station (WWPS-1) located in the Alexandru cel Bun street, further being pumped to the drop manhole and collected by gravity to the Main Waste Water Pumping Station (MWWPS) located in the town of Calarasi by two (2) pressure pipes with a diameter of 110 mm each.

The wastewater from the existing drain area no.3 (Vatamaneasa district) is collected by gravity to the Waste Water Pumping Station (WWPS-2) located in the lower part of the district area, further being pumped to the Waste Water Pumping Station (WWPS-1) located in the town of Calarasi by two (2) pressure pipes with a diameters of 90 mm each.

4.6.1.1 Sewerage network

The total length of gravity sewerage network is about 30,520 m. The main technical parameters of gravity sewerage network are provided in Table 4-16. The total length of pressure sewerage network is about 5,880 m. The main technical parameters of the pressure sewerage network are provided in Table 4-17.

Table 4-16: Main technical parameters of gravity sewerage network

No.	Material	Length (m) / diameter (mm)						Length (m)	Pipe age (years)	Total length (m)
		150	200	250	300	400	500			
1.	Reinforced concrete						704	704	>30	30,520
2.	Asbestos-cement	3,286	1,736	1,038	1,952	950		8,962	>25	
3.	Cast iron	2,552	1,348	806	1,516	738		6,960	>30	
4.	Ceramic	2,396	1,266	757	1,423	692		6,534	>30	
5.	PVC	6,240	1,120					7,360	<10	

Source: Calarasi Municipal Services Utility

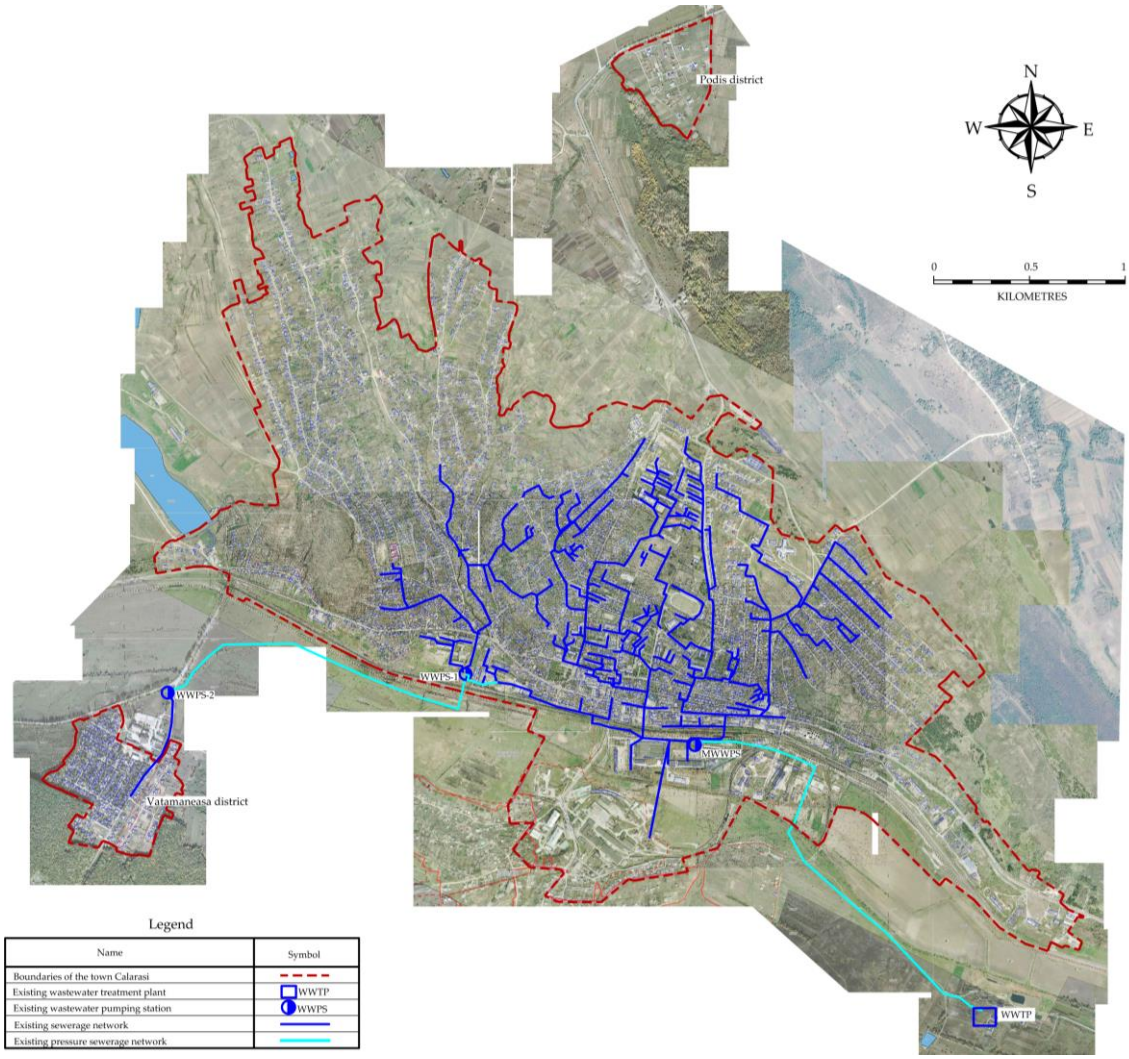
Table 4-17: Main technical parameters of pressure sewerage network

No.	Material	Length (m) / diameter (mm)			Length (m)	Pipe age (years)	Total length (m)
		250	110	90			
1.	HDPE	1,940	400	3,940	6,280	5	6,280

Source: Calarasi Municipal Services Utility

The sewerage network in the town of Calarasi is provided in Figure 4-14. More detailed information is provided in Annex 11.

Figure 4-14: Sewerage network in the town of Calarasi



Source: www.geoportal.md, Calarasi Municipal Services Utility, GIZ/MLPS

4.6.1.2 Wastewater pumping stations

The wastewater pumping stations are located in the lower part of sewerage drainage area, where the gravity collection is impossible because of the topography in this area.

The main technical parameters of the wastewater pumping stations and pumps are presented in Table 4-18.

Table 4-18: Technical main parameters of the wastewater pumping stations and pumps

No.	PS name	Year of instal-lation	Year of rehabili-tation	Pump type	Pump flow rate (m3/h)	Head (m)	Pump pow-er (kW)	Pump ener-gy specific consump-tion (kwh/m³)
1.	MW WPS	1970	2012	WILO FA 10,34 E+FK202-4/17H (2 pcs.)	123	16.4	11.5	0.09
2.				GRUNDFOS K33-	586-600	20	46.1	0.08

No.	PS name	Year of instal-lation	Year of rehabili-tation	Pump type	Pump flow rate (m3/h)	Head (m)	Pump pow-er (kW)	Pump ener-gy specific consump-tion (kwh/m³)
				70GU174-EX				
3.				WILO TP80E 230/34 (drainage)	10	14.5	1.5	0.15
4.	WWP S-1	1980	2012	WILO FA 10.33E+FK17.1-48/K (2 pcs.)	50.4	13.2	3.6	0.07
5.	WWP S-2	2012		Pentax DTRT750/1000 (2 pcs.)	28	40	7.5	0.27

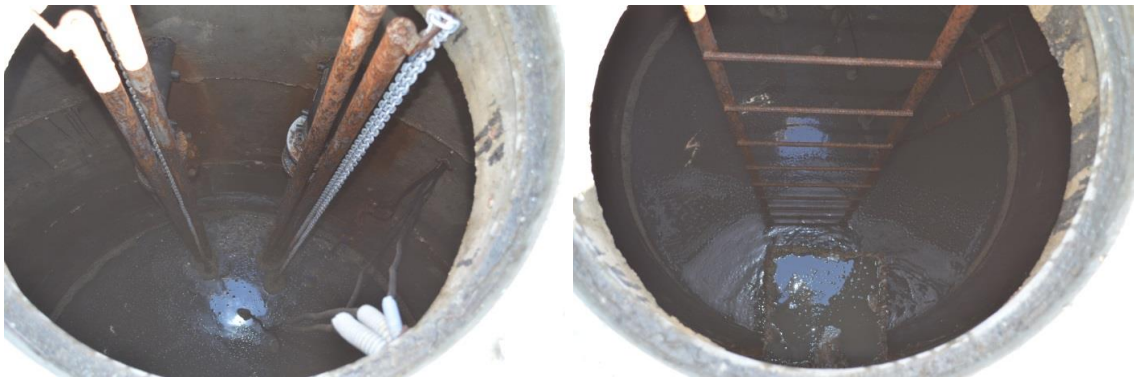
Source: Calarasi Municipal Services Utility

At the moment of FS elaboration the wastewater pumping stations are in a good condition, thus rehabilitation/ replacement is not required.

Figure 4-15: Main wastewater pumping station MWWPS: Grit chamber. Engine room

Source: GIZ/MLPS

Figure 4-16: Wastewater pumping station WWPS-2 (Vatamaneasa district)



Source: GIZ/MLPS

4.6.1.3 Wastewater treatment plant

The wastewater treatment plant (WWTP) is located at about 2 km in the south-east from Calarasi town's centre and was brought into operation in 1986, with a design capacity of 7,200 m³/day.

The wastewater treatment plant includes the following components:

- Horizontal grit chamber (2 units);
- Digester-settler (2 units);
- Activated sludge aeration tank (ASAT) (2 units);
- Secondary clarifier (4 units);
- Contact tanks (2 units);
- Sludge Pumping Station;
- Sludge drying beds;
- Lagoons (2 units);
- Chlorination.

Currently, the above-mentioned WWTP is functioning for wastewater treatment from the Calarasi dairy factory only.

In 2012, at a distance of about 300 m south from the town of Calarasi a new wastewater treatment plant AquaClean MBBR with a capacity of 1,400 m³/day, was built and put into operation.

Wastewater treatment plant AquaClean MBBR includes the following processes (according to the Operations and Maintenance manual of WWTP): mechanical treatment, biological treatment, chemical cleaning, disinfection level and sludge processing and dewatering level.

Gross solids and other constituents removal is carried out through screens and it is a mandatory operation to be performed at the inlet of the wastewater treatment plant. In the town of Calarasi, gross solids and other constituents removal is carried out through screens installed at the main wastewater pumping station (MWWPS).

The Wastewater treatment plant consists of the following components:

- Distribution tank;
- Primary sedimentation tank and pumping / stabilization / equalizing tank with a volume of 450 m³ each.

Figure 4-17: Wastewater treatment plant AquaClean MBBR: pumping / homogenisation / equalisation reservoir and biological ponds

Source: GIZ/MLPS

The biological wastewater treatment unit comprises biological reactors (four (4) units).

The chemical wastewater treatment unit comprises a preparation and storage tank for solution of ferric chloride and dosage pump for the ferric chloride solution.

Figure 4-18: Wastewater treatment plant AquaClean MBBR: biological reactor

Source: GIZ/MLPS

Ultraviolet disinfection of treated wastewater is used. Sludge processing and dewatering is carried out using a press-filter. The formed sludge cakes are temporarily stored in a warehouse, further transported to the sludge drying beds situated at the old wastewater treatment plant.

Figure 4-19: Wastewater treatment plant AquaClean MBBR: Ultraviolet lamps. Wastewater outflow into Bic River

Source: GIZ/MLPS

The tertiary treatment includes lagoons, which represents open underground basins. The functioning of lagoons is based on free/suspended in water microbial cultures (usually aerobic). The necessary oxygen for aerobic treatment process which occurs in oxidation ponds, is taken from wastewater, organic compounds (sulphates; nitrates), and atmosphere as a result of Algae photosynthesis in the pond. The treatment in the lagoon is ensured due to long period of wastewater retention, which is enough for development of natural auto treatment processes. The photosynthesis process is the main mechanism on which is based natural oxidation ponds. Regarding the design of ponds, their size depends on the required treatment, wastewater quality, climatic conditions (particularly temperature and brightness) and the depth of the pond. In ponds with a depth of 1.0 m anaerobic processes occur, which are acting on the bottom sludge, producing offensive odours. The technological scheme includes three (3) biological ponds.

According to obtained data, the quality of effluent wastewater does not comply to the current standards of the Republic of Moldova (Law no.950 of 25.11.2013 on Approval of the Regulations on the conditions of collection, treatment and wastewater evacuation into wastewater and /or water bodies for rural and urban localities), and corresponding treatment, for following indicators: suspended solids, biochemical oxygen demand (BOD_5), biochemical oxygen demand (BOD_5), ammonia Nitrogen (NH_4+). Quality indicators of influent and effluent wastewater were presented by “Municipal Services Utility” Calarasi, as provided in the Table 4-19.

Table 4-19: Wastewater quality indicators

No.	Indicator	Unit	Influent concentration	Effluent concentration	Maximum allowed concentration acc. to GD nr.950
1.	Hydrogen ion concentration (pH)		7.8	8	6.5 – 8.5
2.	Suspended solids	mg/l	420.42	43.8	35.0
3.	Biochemical oxygen demand (BOD_5)	mgO_2/l	272.6	28.4	25.0
4.	Biochemical oxygen demand (BOD_5)	mgO_2/l	542.42	164.15	125.0
5.	Ammonia Nitrogen (NH_4+)	mg/l	-	36.8	2.0
6.	Nitrites (NO_2)	mg/l	-	1.037	
7.	Nitrates (NO_3)	mg/l	-	<0.1	

No.	Indicator	Unit	Influent concentration	Effluent concentration	Maximum allowed concentration acc. to GD nr.950
8.	Chloride	mg/l	134	119	
9.	Total phosphorus (P)	mg/l	-		2.0
10.	Synthetic detergents biodegradable active anions	mg/l	-	1.27	0.5
11.	Fats	mg/l	-	0.052	

Source: Calarasi Municipal Services Utility

The treated wastewater is discharged into lagoons and then discharged into the Bic River. The monthly volume of treated wastewater is provided in the Table 4-20.

Table 4-20: Monthly volume of treated wastewater, 2014

Month	Monthly volume of treated wastewater (m^3)
January	25.648
February	29.260
March	31.577
April	31.083
May	32.091
June	27.744
July	32.611
August	33.829
September	33.493
October	35.618
November	36.834
December	37.267
Total	**387.055**

Source: Calarasi Municipal Services Utility

4.6.2 Wastewater system in Niscani, Paulesti and Novaci localities

There is no centralised wastewater system in the localities of Niscani, Paulesti and Novaci (Tuzara Commune).

4.7 Available pre-feasibility, feasibility studies and existing technical documentation

During the elaboration of the feasibility study for the town of Calarasi and the localities of Niscani, Paulesti and Novaci (Commune Tuzara); available studies, feasibility studies and existing technical designs have been consulted, as provided in Table 4-21.

Table 4-21: Available pre-feasibility, feasibility studies and existing 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	World Bank
2.	Network construction of water transmission	Implemented technical design	NEF

No.	Project Name	Type of document	Financing Agency
	main and sewerage in the North-West of town of Calarasi (2014)		
3.	Collecting of wastewater from Vatamaneasa district, town of Calarasi (2012)	Implemented technical design	NEF
4.	Repair of water transmission in Niscani locality (2011)	Implemented technical design	NEF
5.	Development of detailed design for the immediate investment program of eight (8) rural localities selected from Centre part of the Republic of Moldova, Niscani locality, rayon of Calarasi (LLC "ICON-Construct" LTD 2012)	Technical design	N.A.
6.	Design of water transmission main, sewerage network and waste water treatment plant in Novaci locality, rayon of Calarasi, Phase I (M.E. "GLOBENCO International" LTD 2012).	Technical design	N.A.
7.	Water and sewerage network in the North-West part of the town of Calarasi and rehabilitation of a water transmission main section in Doina and Alexandru cel Bun streets. ("BONCOM PROIECT" Ltd., 2013)	Technical design	N.A.
8.	Sewerage network design on Gr.Ureche, M.Costin, B.Lautaru, N.Testemiteanu streets in the town of Calarasi ("BONCOM PROIECT" Ltd., 2013)	Technical design	N.A.

Source: LPA Calarasi, http://mediu.gov.md/

4.8 Conclusions

The identified deficiencies related to water supply and wastewater services in the FS area are the following:

Water Supply:

- In Calarasi Town the coverage rate of water supply services is 97% and connection rate of about 80%;
- Localities in the vicinity of Calarasi Town (Niscani, Paulesti, Novaci) are not yet endowed with a water supply system;
- High real and apparent water losses (NRW of 51%) in the town of Calarasi;
- High number of pipe bursts due to old and obsolete water supply network in parts of the town Calarasi;
- Water quality does not comply with national standards. According to the presented data, the raw water quality does not comply with actual 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, ammonia NH4, fluorides);
- The absence of disinfection unit plant at the underground reservoir, located at the PS-3 (Biruinta Street): For the Rayon Hospital and a few streets of the Carabliu district, the water from counter-reservoir located in Biruinta Street is pumped through third level pumping station PS-3 into water distribution network without

disinfection, and the installation of water disinfection unit before the above mentioned reservoirs is required;

- Inadequate metering of water production and distribution (low metering accuracy) as well as inadequate operational equipment.

Wastewater:

- In Calarasi Town the coverage rate of wastewater services is 52% and the connection rate is 49%;
- The existing sewer network is highly degraded which leads to frequent sewer blockages and emergency driven maintenance;
- The quality of effluent wastewater from the existing WWTP does not comply to the current standards of the Republic of Moldova and the capacity of the WWTP in Calarasi Town is insufficient to treat the future wastewater volume beyond the year 2021;
- Localities in the vicinity of Calarasi Town (Niscani, Paulesti, Novaci) are not yet endowed with a wastewater system.

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 service 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[6] based on the following:

- Existing pre-feasibility, feasibility studies and detailed designs (see Chapter 4.7 - Available pre-feasibility, feasibility studies and existing technical documentation);
- WSS Regional Sector Programme (RSP) and Possible Project Concept (PPC) for Calarasi 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);
- Strategies, goals and priorities defined by the Mayor Office of the town of Calarasi and the Municipal Services Utility (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- Water demand and wastewater flow projection).

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).

[6] A Project Working Group (PWG), established by decision of the local council and comprising members from the Regional Development Agency Centre (RDA Centre), the Calarasi Local Public Authority (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 Calarasi 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 in this chapter are presented as follows:

- In Chapter 5.7 all identified measures are described (irrespective of their phasing);
- In Chapter 5.8 the identified measures will be 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

A water policy and strategy for the Water Supply and Wastewater Sector has been developed for the town of Calarasi for the planning period 2012 - 2016. The Mayor Office and the Municipal Services Utility of the town of Calarasi are well aware of the actual situation regarding to water supply and sanitation services and are willing to improve its quality. The general strategic goal is to achieve a viable and high quality management of the centralised water supply and wastewater systems[7]. 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 the Municipal Services Utility.

It is noteworthy that the National WSS Strategy (2014-2028) includes the regional transmission main from Chisinau to Straseni and Calarasi as a priority investment for the Government of Moldova (RM). Local and regional strategies are therefore aligned to this national objective since the local strategy foresees the regionalization of water supply and sanitation (WSS) services whilst the Regional Sector Programme (RSP)

[7] Activity Improvement Plan, (USAID, 2014)

provides the framework for improving the conditions of local operators so that they can expand services and provide a viable partner for any future regional transmission main should it be found to be the most feasible solution.

Urban development

According to the analysis of demographic development in recent years, the population of Calarasi Town can be expected to remain essentially steady throughout the period of analysis (see Chapter 2.4 - Population). Therefore, no major plans for large scale extensions into new residential areas in the town of Calarasi are foreseen.

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 the Municipal Services Utility 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 with sufficient quantity to all customers;
- Extend the water supply and sewerage service area in the town of Calarasi;
- Treat of wastewater from the sewer system in compliance with the current national legislation and in the future in compliance with the respective EU legislation (Urban Wastewater Treatment Directive 91/271/CEE);
- Reduce non-revenue water to an acceptable level of maximum 25% by 2045;
- Improve efficiency of service provision by enhancing operation and maintenance practices of the Mayor Office and the Municipal Services Utility;
- 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

For the last decades, there has been a constant trend of declining water consumption particularly in industrial use due to the decline in old industries. The town of Calarasi does not have significant industry and there is limited potential to develop industrial zones in the near future, given the proximity of free economic zones in Straseni and Ungheni. Specific for Calarasi are the brandy and wine factories which have maintained production and provided employment opportunities. The location of the town on the road between Ungheni and Chisinau provides employment opportunities for the population, which will support maintaining the population of Calarasi at the current level. The town also has access to the railway network which can contribute to the economic development of the town. The nearby towns, Straseni and Ungheni are expected to develop their industries due to existence/creation of free economic zones, which will also have an effect on the population development in the town of Calarasi. The development of the water demand, including water losses and wastewater flow projection, is presented in the Chapter 5.3-Design parameters and assumptions.

Metering policy

Water production metering:

Currently all the meters installed at the water sources/wells are operational, although they are in need of replacement due to their elapsed life span. According to the information provided by the Calarasi Municipal Services Utility, the highest priority is to replace all meters at water sources/wells.

Customer metering:

In general the current status of water metering is at high level reaching 98-99%. Most of the water meters were installed between 2006 and 2008. About 99% of the individual households (private houses) and 100% of the apartments are metered. In addition to this, about 15% of the multi-storey apartment buildings are endowed with master water meters (meter at the entrance of the building). All non-domestic customers are metered as well.

For domestic water meters, meter accuracy is low due to the fact that water meters in most of apartments and private houses are of “A” accuracy class (the lowest one). The second aspect related to this issue is that meter calibration and repair has to be paid by the customers themselves.

Installation of master water meters in multi-storey apartment buildings is given high priority, which will permit the assessment of the level of water losses and illegal consumption (Non-Revenue Water).

For non-domestic customers, meters are checked and replaced if needed once per two years and therefore accuracy of water meters is satisfactory.

Overall, improvement of the system knowledge (water flow, pressure and water losses) is of utmost importance and will be given high priority in the Investment Programme. The measures should reduce water wastage in households and at the same time will increase water sales due to reduction of commercial water losses.

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.-Population;

- The development of the service connection rate (water and wastewater) for domestic customers considers the following:
  - Existing population connected to water supply and wastewater services;
  - 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;
  - The 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 water supply and sewerage network) is different from the connection rate (population which actually is connected to the water supply and sewerage 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 Table 5-1 below.
- **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[8]”, 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[9]: During the last decades, the economy in the study area has slowed down and many industries closed, which resulted in a steep decline in industrial water consumption. In addition to this, the main three water consumers in the town, Calarasi wine and brandy distillery, Calarasi cannery and local bakery constructed their owns wells during the last decade and have refused to

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

[9] Including all commercial entities

be the Municipal Services Utility consumers. 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[10]11 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 1);
- Industrial wastewater flow from customers not connected to the water supply system (own wells) but discharging to the sewer system is unknown and cannot be determined based on the provided data from the Calarasi Municipal Service Utility). For future development it is assumed that this volume is insignificant and will not be taken into consideration for wastewater flow projection.

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

The Municipal Services Utility wishes to extend the services to the localities of Niscani, Paulesti and Novaci (com.Tuzara) in the vicinity of Calarasi Town. These localities are currently endowed neither with a water supply network nor with a sewer network. Within this study it is assumed that all localities will be served with water supply and sewer services from the Calarasi Municipal Services Utility by 2021 and respective investments have been included in Phase 2 of this study.

5.3.4 Water losses

Currently non-revenue water (NRW) in the water supply system of the town of Calarasi 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[12] (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 of the project measures;
- 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 pres-

[10] According to data from the Municipal Services Utility's sales department.

[11] According to data from the Municipal Services Utility's sales department.

[12] Including unbilled authorized consumption

sure management; improvement of revenue collection[13]) proposed in Phase 1 of the subject investment plan. Further, in the long-term it is assumed that continuous renovation of the network[14] 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 sewer network are foreseen. The development of this parameter is based on expert assessment, separate for each sewer network, depending on:

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

There is no information on the current infiltration rate available for Calarasi sewer network (see Chapter 4-Technical aspects- Existing situation) and therefore a typical[15] infiltration rate for the existing sewer networks in the region has been applied in the model (see Table 5-1). It is assumed that the infiltration rate will decrease after implementation of measures for rehabilitation or extension of the sewer network in accordance with the ratio of "new sewer network[16]" and "old sewer network[17]" (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[18].

5.3.6 Wastewater flow and load

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

- Specific domestic wastewater load: 60 g BOD_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 sewer network;

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

[14] Financed from additional revenues generated by the Municipal Services Utility as a result of technical assistance measures included in Phase 1 of this project.

[15] Outworn and obsolete sewer system

[16] Infiltration rate of 10% is assumed for new sewer networks

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

[18] It is assumed that without major investments after the 2nd Phase the infiltration rate cannot be further reduced. However, regular replacement of sewer network by the water utility will maintain the infiltration rate at constant level (increasing of the infiltration rate can be avoided by regular repairs and rehabilitation).

- Peak Storm Water Factor: 1.3 for allowance for storm water entering into the sewer network from "inappropriate[19]" 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 standards. The main design parameters are presented in the Table 5-1 (reference is made to explanations in the Chapter 5-3 Design parameters and assumptions).

Table 5-1: Design parameter

No	Design Parameter	Unit	2014[20]	2018[21]	2021[22]	2030	2045
0	Service coverage rate for domestic customers, disaggregated for urban and rural localities						
0.1	Water - total	%	78	81	100	100	100
0.2	Wastewater - total	%	42	42	94	98	98
0.3	Water supply – urban	%	97	100	100	100	100
0.4	Water supply – rural	%	0	0	100	100	100
0.5	Wastewater - urban	%	52	52	95	100	100
0.6	Wastewater - rural	%	0	0	86	86	90
1	Service connection rate for domestic customers, disaggregated for urban and rural localities						
1.1	Water - total	%	65	67	84	97	100
1.2	Wastewater - total	%	40	40	71	86	94
1.3	Water supply – urban	%	80	82	87	100	100
1.4	Water supply – rural	%	0	0	70	81	100
1.5	Wastewater - urban	%	49	49	75	90	95
1.6	Wastewater - rural	%	0	0	52	66	90
2	Volume of water sold for domestic consumers						
2.1	In urban localities	l/c/d	39	48	55	76	110
2.2	In rural localities	l/c/d	0	0	30	49	80
3	**Volume of water sold** for non- domestic consumers (industry, commercial, public institutions), disaggregated for urban and rural localities						
3.1	Industrial and commercial - urban	l/c/d	4.6	7.2	9.1	15.0	15.0
3.2	Industrial and commercial - rural	l/c/d	0.0	0.0	0.0	0.0	0.0
3.3	Institutional entities - urban	l/c/d	6.1	7.1	7.8	10.0	10.0
3.4	Institutional entities - rural	l/c/d	0.0	0.0	5.0	10.0	10.0
4	Wastewater generation as factor of the water demand						
4.1	Domestic consumers		1	1	1	1	1
4.2	Non-domestic consumers		1	1	1	1	1
5	Non-Revenue Water (NRW) as share from the water production						
5.1	Total NRW	%	51	45	43	40	25
5.2	Apparent losses	%	20	19	18	15	5
5.3	Real losses (physical losses)	%	30	25	25	25	20
6	Sewer Infiltration rate as share of total water discharged to the wastewater system						
6.1	Sewerage infiltration rate	%	50	45	15	15	15
7	Water demand variation factors (in compliance with SNIP 2.04.02-84 and 2.04.03-85)						

[19] 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 sewer network cannot be avoided.

[20] Existing situation

[21] 1st year of operation Phase 1 investments

[22] 1st year of operation Phase 2 investments

No	Design Parameter	Unit	2014[20]	2018[21]	2021[22]	2030	2045
7.1	Daily variation factor		1.1				
7.2	Hourly variation factor Water Supply		1.56				
7.3	Hourly variation factor Wastewater		1.8				
7.4	Peak storm water 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 above 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 measures (e.g. active leakage management, pressure management, etc.);
- Apparent (commercial) water losses are assumed to remain constant *without* implementation of the TA-measures (Revenue and metering improvement programme).

5.4 Water demand and wastewater flow projection

The water demand projection (water production, volume of water sold and non-revenue water) 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

No	Parameter	Unit	2014[23]	2018[24]	2021[25]	2030	2045
1	**Population in the study area served with water**						
1.1	Total population serviced	N°	13,213	13,589	16,982	19,434	19,707
1.2	In urban localities	N°	13,213	13,589	14,317	16,500	16,500
1.3	In rural localities	N°	0	0	2,665	2,934	3,207
2	**Volume of water sold in total and disaggregated for different consumers**						

[23] Existing situation

[24] 1st year of operation Phase 1 investments

[25] 1st year of operation Phase 2 investments

No	Parameter	Unit	2014[23]	2018[24]	2021[25]	2030	2045
2.1	Total volume sold	m³/y	241,359	311,183	411,635	670,061	918,401
2.2	Domestic customers	m³/y	189,756	240,379	318,164	508,790	756,131
2.3	Industrial customers	m³/y	21,962	35,541	47,679	90,338	90,338
2.4	Institutional customers	m³/y	29,641	35,264	45,792	70,934	71,932
3	**Total water sold disaggregated for urban and rural areas**						
3.1	Urban localities	m³/y	241,359	311,183	377,589	607,144	813,038
3.2	Rural localities	m³/y	0	0	34,046	62,917	105,364
4	**Non-Revenue Water (NRW) volume disaggregated for total NRW, apparent losses, and real losses**						
4.1	Total NRW	m³/y	248,241	250,993	316,729	446,708	306,134
4.2	Apparent losses	m³/y	99,296	108,077	132,334	167,515	61,227
4.3	Real losses (physical losses)	m³/y	148,945	142,915	184,395	279,192	244,907
5	**Water demand figures considering the demand variation factors**						
5.1	Yearly water demand/production	m³/y	489,600	562,176	728,364	1,116,769	1,224,535
5.2	Average daily water demand	m³/d	1,341	1,540	1,996	3,060	3,355
5.3	Maximum daily water demand	m³/d	1,407	1,625	2,108	3,243	3,607
5.4	Average hourly water demand	m³/h	56	64	83	127	140
5.5	Maximum hourly water demand	m³/h	76	90	117	182	215

Source: GIZ/MLPS

Wastewater flow and load projections are presented in the table below (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 sewer network and wastewater treatment plant (if applicable).

Table 5-3: Wastewater flow and load projection

No	Parameter	Unit	2014[26]	2018[27]	2021[28]	2030	2045
1	**Population in the study area served with sewerage**						
1.1	Total population serviced	N°	8,145	8,145	14,421	17,238	18,564
1.2	In urban localities	N°	8,145	8,145	12,450	14,850	15,675
1.3	In rural localities	N°	0	0	1,971	2,388	2,889
2	**Volume of wastewater charged in total and disaggregated for different customers**						
2.1	Total volume of wastewater	m³/y	153,600	187,920	351,766	581,541	867,286
2.2	by domestic customers	m³/y	98,724	128,182	251,284	437,318	713,707
2.3	by industrial customers	m³/y	26,523	31,041	52,626	81,304	85,821
2.4	by Institutional customers	m³/y	28,353	28,697	47,856	62,919	67,758
3	**Total wastewater charged disaggregated for urban and rural areas**						
3.1	in urban localities	m³/y	153,600	187,920	326,588	530,330	772,386
3.2	in rural localities	m³/y	0	0	25,178	51,211	94,900
4	**Sewer infiltration water based on the determined infiltration rate**						
4.1	Sewer infiltration water	m³/y	76,800	84,564	52,765	87,231	130,093
5	**Wastewater generation figures considering variation factors**						
5.1	Average wastewater flow (dry weather)	m³/y	230,400	272,483	404,531	668,772	997,379
5.2	Maximum daily dry weather flow (Qdmax)	m³/d	673	798	1,205	1,992	2,970
5.3	Maximum hourly dry weather flow	m³/h	45	54	90	149	222

[26] Existing situation

[27] 1st year of operation Phase 1 investments

[28] 1st year of operation Phase 2 investments

No	Parameter	Unit	2014[26]	2018[27]	2021[28]	2030	2045
	(QDWF)						
5.4	Maximum hourly storm water flow (QSWF)	m³/h	59	71	117	193	288
6	**Population equivalents in total and disaggregated for different customers**						
6.1	Total population equivalent	PE60	8,709	8,759	15,453	18,720	20,142
6.2	by domestic customers	PE60	8,145	8,145	14,421	17,238	18,564
6.3	by Industrial and institutional customers	PE60	564	614	1,032	1,482	1,578
7	**Pollution load – BOD in total and disaggregated for different customers**						
7.1	Total BOD_5 load	kg/d	523	526	927	1,123	1,209
7.2	by domestic customers	kg/d	489	489	865	1,034	1,114
7.3	by industrial and institutional customers	kg/d	34	37	62	89	95

Source: GIZ/MLPS

5.5 Water demand projection versus available water resources

As presented in Chapter 4- Technical aspects- Existing situation, the available production capacity of the existing 9 wells is 109.6 m³/h or 2,630 m³/day (9 wells -10 m^3/h each, 2 wells 6.3 m^3/h each and 1 well 7m^3/h)

The long term water demand projection for Calarasi Town (see Chapter 5.4- Water demand and wastewater flow projection) shows an increase of the water demand with the peak water demand in the year 2045.

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

No	Parameter	Unit	Quantity
1	Currently available water resources (Production capacity of 12 existing wells)	m³/d	2,630
2	Peak water demand (Qdmax) in year 2045	m³/d	3,607
3	Additionally required water production capacities (2 – 1)	m³/d	977

Source: GIZ/MLPS

This projected water demand can be covered with the 12 currently operated wells until the year 2025. In order to cover the water demand in the following period until 2045 five additional (new) wells with a capacity of 10 m³/h each need to be constructed and put into operation between 2026 and 2045 (see table 5-5). Alternatively, the future demand could be covered entirely by the regional water transmission main from Chisinau to Straseni and Calarasi (which would be the preferred option).

Table 5-5: Water demand projection and future production capacities

No	Parameter	Unit	2014[29]	2018[30]	2021[31]	2030	2045
1	Average daily water demand	m³/d	1,341	1,540	1,996	3,060	3,355
2	Maximum daily water demand	m³/d	1,407	1,625	2,108	3,243	3,607
3	Available water source/well capacities	m³/d	2,630	2,630	2,630	3,350	3,830
4		l/s	30.4	30.4	30.4	38.8	44.3

[29] Existing situation

[30] 1st year of operation Phase 1 investments

[31] 1st year of operation Phase 2 investments

No	Parameter	Unit	2014[29]	2018[30]	2021[31]	2030	2045
5	Number of well in operation	n°	12	12	12	15	17

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 5-6 show the unit costs for the water supply components applied for the cost estimations for the investment measures proposed for the Phase 1 and Phase 2.

Table 5-6: Unit costs for water supply facilities

No	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, electric 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

No	Item	Dimension		Investment costs	
				Unit	Unit cost
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 5-7 show the unit costs for the wastewater components applied for the cost estimations for the investment measures proposed for Phase 1 and Phase 2.

Table 5-7: Unit costs for wastewater facilities

No	Item	Dimension		Investment costs	
				Unit	Unit cost
1	**Sewer 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
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 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; and
- 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:

5.7.2.1 Water Supply:

- Currently there are 13,213 inhabitants (80% connection rate) in Calarasi Town connected to the existing water supply system (see Table 5-8 below and Chapter 4 Technical aspects - Existing situation). The water supply network is currently extended to the north-west part of the town, as a part of the on-going project: "Construction of water supply and sewerage network in the north–west Calarasi, financed by National Ecologic Fund (service connections implemented by this on-going project are included under current situation in 2014 in the table 5-8 below);
- In Calarasi Town the coverage rate of water supply services is projected to increase from currently 97% to 100% and the connection rate from 80% to 87% until the year 2021;
- The localities of Niscani, Paulesti and Novaci (com.Tuzara) in the vicinity of Calarasi Town do not have centralised water supply systems, but the Calarasi Municipal Services Utility envisages extension of services to these localities in the near future:
  - The installation of a water transmission main from PS-4 (Calarasi town) towards Podis district and further to Niscani locality was ongoing during the site visit of GIZ/MLPS experts);
  - The locality of Paulesti should be connected to the water supply system of Niscani Locality through a water transmission main;
  - The locality of Novaci (com.Tuzara) is planned to be connected to the water supply system of Calarasi Town through a water transmission main.

- Currently, there is no supply shortage for the service area of the Municipal Services Utility. The current production capacity is sufficient to cover the water demand until the year 2025 (including localities in the vicinity of Calarasi Town);
- In order to cover the future water demand of the town of Calarasi and the localities of Niscani, Paulesti and Novaci (com. Tuzara) until 2045, additional production capacities of 977 m³/day will have to be developed (increase by 37 %). There are two possibilities to provide these additional water resources: (i) Construction of additional five (5) new wells with a capacity of 10 m³/h each or (ii) connection to the planned regional transmission main Chisinau-Straseni-Calarasi (*below referred to as Regional Transmission Main*):
  - *Option 1 – Construction of new wells*. A thorough hydro-geological investigation (incl. pump-tests) will be necessary to assess if the additional capacities can be provided in the well-field of Sipoteni Locality. Otherwise, alternative locations for a well-field would have to be identified. Further, before the distribution, water treatment would be necessary in order to meet the water quality standards in the Republic of Moldova;
  - *Option 2 – Connection to the Regional Transmission Main*: At the moment of elaboration of this study, the German development bank “KfW” signed an agreement for financing a feasibility study: “Improvement of infrastructure in central region of Moldova”, regarding the extension of a water transmission main from Chisinau towards Straseni and Calarasi with inclusion of 20 rural localities along the pipeline. Considering the difficult institutional set-up and large investment amounts needed, it is assumed that this transmission main will realistically not be operational before 2021(end of Phase 2 of this ject[32]).
- The water quality for the service area does not comply with the national standards for drinking water quality[33] (exceedance of fluorine concentration). As treatment of fluorine is very costly (high investment and operation costs) there is no immediate solution which can be proposed within the investment plan of this study. The improvement of water quality in Calarasi has to be seen in the context of the above mentioned strategic supply options (connection to Regional Transmission Main versus treatment of groundwater water);
- 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 of this feasibility study (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.;

[32] It is noted that the investment measures proposed in this study are not in contradiction to investments which may be proposed in the Feasibility Study financed by KfW (irrespective of the outcome of the study).

[33] 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"

  - Installation of a SCADA system.
- **The Priority Investment Plan (reference is made to Chapter 5.10 – Priority Investment Plan) proposed in this study took into consideration that in the medium term (after the year 2021) the regional transmission main (Option 2) may[34] be implemented. Therefore no measures were proposed which might contradict to this possible development scenario.** The investment measures proposed within the framework of this project (see Chapter 5.7.3 - Investment measures - water supply system) include inter alia the rehabilitation and extension of the distribution network in Calarasi Town and the neighbouring localities as well as disinfection of water. The measures are justified for the following reasons:
  - The proposed measures will anyway be necessary to increase supply coverage and to reduce water losses;
  - Further, the proposed measures within this project will ensure that water quality will be improved (disinfection will be necessary anyway);
  - Finally, water provided from Chisinau regional transmission main together with development of groundwater (additional wells) would also increase supply security (second supply source) and would ensure that water will meet the quality standards (e.g. through mix[35] between groundwater and surface water sources in order to reduce fluorine concentration). Therefore no water treatment plant is proposed within the framework of this project (in case that the regional transmission main will not be implemented, a water treatment plant will have to be foreseen in the medium term).

Considering the above, it is concluded that the **investment measures proposed within this Project will be necessary irrespective of the future development of the Regional Transmission Main** (Chisinau–Straseni-Calarasi) **and are therefore consistent with the long-term infrastructure development plans.**

Table 5-8 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 5-8: Development of connection rates water supply

No	Locality	Population connected to the water supply system									
		2014		2018		2021		2030		2045	
		n°	%	n°	%	n°	%	n°	%	n°	%
1	Calarasi	13,213	80	13,589	82	14,317	87	16,500	100	16,500	100
2	Niscani	0	0	0	0	1,339	70	1,475	81	1,612	100
3	Paulesti	0	0	0	0	684	70	753	81	823	100
4	Novaci	0	0	0	0	642	70	706	81	772	100
Total		**13,213**	**65**	**13,589**	**67**	**16,982**	**84**	**19,434**	**97**	**19,707**	**100**

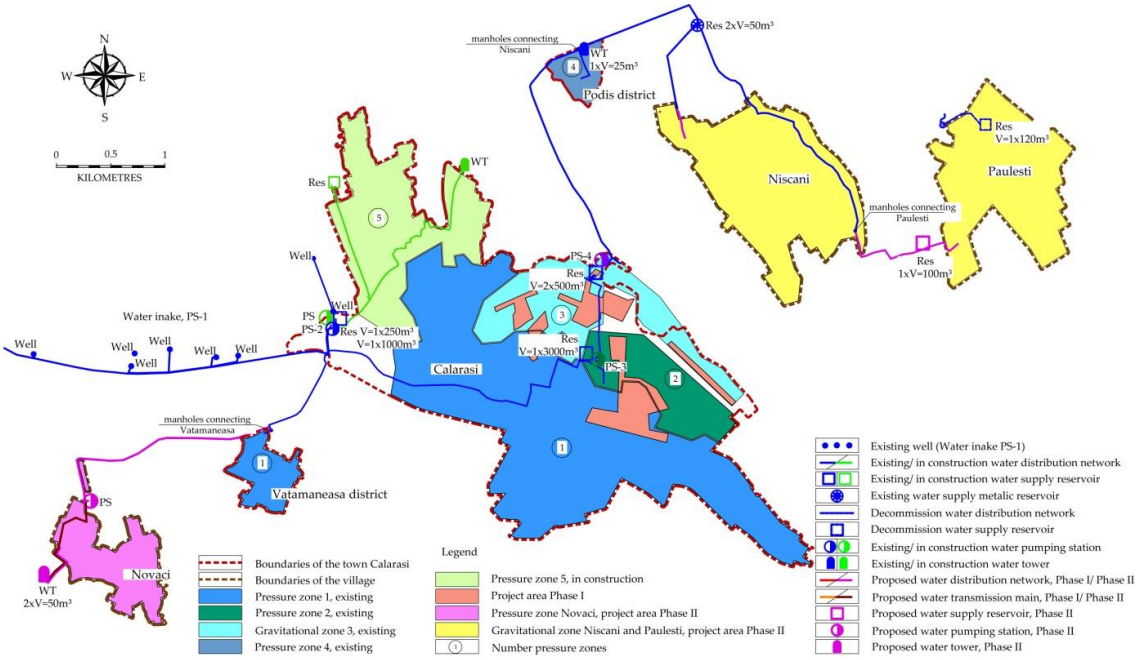
Source: GIZ/MLPS

[34] Although currently the results of the feasibility cannot be anticipated

[35] The ratio of mixing the supply sources will depend on the operator's decision related to (i) ensure that mixed water for consumers will meet the water quality standards, (ii) the water consumption, (iii) the purchase arrangement and the price of water from the Chisinau regional transmission main.

A scheme of existing and proposed extensions of the water supply system in the town of Calarasi is provided in Figure 5-1. More detailed information is provided in Annex 11.

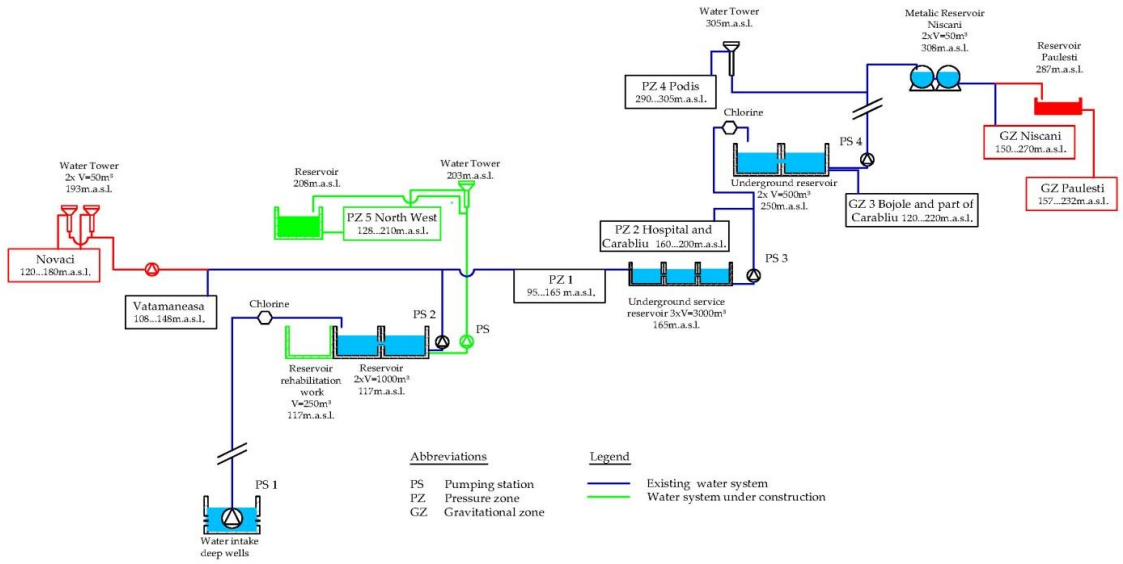
Figure 5-1: Scheme of existing and proposed extensions of the water supply system in the town of Calarasi



Source: GIZ/MLPS

A hydraulic scheme of existing and proposed extensions of the water supply system in the town of Calarasi is provided in Figure 5-2.

Figure 5-2: Hydraulic scheme of existing and proposed extensions of the water supply system in the town of Calarasi



Source: GIZ/MLPS

5.7.2.2 Wastewater:

- Currently there are 8,145 inhabitants (49% connection rate) in Calarasi Town connected to the existing wastewater system (see Chapter 4-Technical aspects-Existing situation);
- In Calarasi Town the coverage rate of wastewater services is projected to increase from currently 52% to 95% and the connection rate from 49% to 75% until the year 2021;
- Wastewater generated in Calarasi Town and the three localities in the vicinity of the town will increase from currently 8,709 P.E. to 15,453 P.E. in 2021 and is projected then to increase to 20,142 P.E. in 2045 (see Chapter 5.4 -Water Demand and Wastewater Flow Projection);
- In order to develop the wastewater infrastructure in the rayon, agglomerations (as per EU-definition Directive 91/271/EEC "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 Calarasi Town will be served in accordance with the results of the agglomeration analysis defined in this technical assistance component (see above) and possibly with the dates to be negotiated in the EU-accession treaty. Compliance of these localities with EU-environmental regulations (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 Calarasi Town there are several localities to be both endowed with a sewer network and connected to a WWTP in the medium and long-term, or alternative sanitation systems (e.g. on-site sanitation) have to developed in order to ensure adequate wastewater treatment;
- Collection and treatment for wastewater in Calarasi Town (current population of 16,500) should be given highest priority (in line with priorities defined in the Urban Wastewater Treatment Directive 91/271/EEC);
- Novaci Locality (935 inhabitants in 2014) is not endowed with a sewerage network. Due to the vicinity of the locality to Calarasi Town, it can be connected at relatively low cost to the Calarasi Wastewater System (through pumping to WWPS-2 in Vatamanesa district) and thus wastewater should be treated in the existing WWTP of Calarasi Town. In line with the national strategy to provide adequate wastewater solutions for each locality with existing or planned water supply networks, it is suggested to give medium to high priority for development of wastewater system in Novaci Locality. Within the framework of technical assistance measures proposed for Phase 1, a thorough assessment and option analysis should be carried out in order to confirm the proposed solution;
- For Niscani (1,952 inhabitants in 2014) and Paulesti (997 inhabitants in 2014) localities, located in the hilly areas north of the town centre, various options for wastewater treatment and collection are possible:

  - Option 1: Separate collection system and separate WWTP for each of the localities;
  - Option 2: Separate sewer collection system for each locality and discharge of wastewater either through a pressure main to the sewer network in Calarasi Town or transport of sewerage by trucks to the WWTP of Calarasi Town;
  - Option 3: On-site sanitation (no collection system).
- 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;
- The design capacity of the existing WWTP (MBBR plant commissioned in 2012) is 1,400 m³/day. In the short-term (until 2021) it is recommended to use the recently constructed WWTP, since its capacity would be sufficient to treat wastewater from Calarasi Town (including the proposed extension areas) and the three concerned localities in the study area (total population connected of 14,421 and Qdmax of 1,205 m³/day in 2021[36]). In the medium to long-term (beyond 2021), the capacity of the WWTP has to be increased. The design capacity of the extension will depend on the above mentioned agglomeration analysis. Depending on the number of localities to be connected to the WWTP in Calarasi Town the design capacity would be from about 16,400 P.E. in 2030 (only for Calarasi Town) but could be much higher (about 20,000 P.E.) if additional localities should be connected. Therefore the design capacity can only be roughly estimated at this stage. Further planning shall be based on 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 costs estimations a capacity of 17,000 P.E. for the WWTP in Calarasi Town has been used (additional capacity of about 8,000 P.E.). Separate WWTPs for the localities of Niscani and Paulesti were calculated[37], while the locality of Novaci was assumed to be connected to the WWTP in Calarasi Town;
- Rehabilitation of the sewer network in Calarasi Town is proposed due to the frequent emergency cases in some sewer network sections in the town centre (drainage area 1).

Conclusively, the extension of the sewerage network in Calarasi Town to 75% sewerage connection rate will require an extension of the existing (recently constructed) WWTP to a capacity of at least 2,000 m³/day (17,000 P.E.) in order to treat wastewater volume projected until the year 2030. The investment costs for the WWTP in Calarasi Town in this study include only the first stage (minimum requirement for extension of the WWTP up to 2,000 m³/day) and should be assessed in detail in a comprehensive wastewater study (technical assistance component Phase 1). Separate WWTPs for the localities of Niscani and Paulesti were calculated for a preliminary investment cost es-

[36] If wastewater from Niscani and Paulesti Localities will be treated separately, the capacity is sufficient until the year 2024.

[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 of this feasibility study.

timate, while the locality of Novaci was assumed to be connected to the wastewater system in Calarasi Town.

Table 5-9 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.

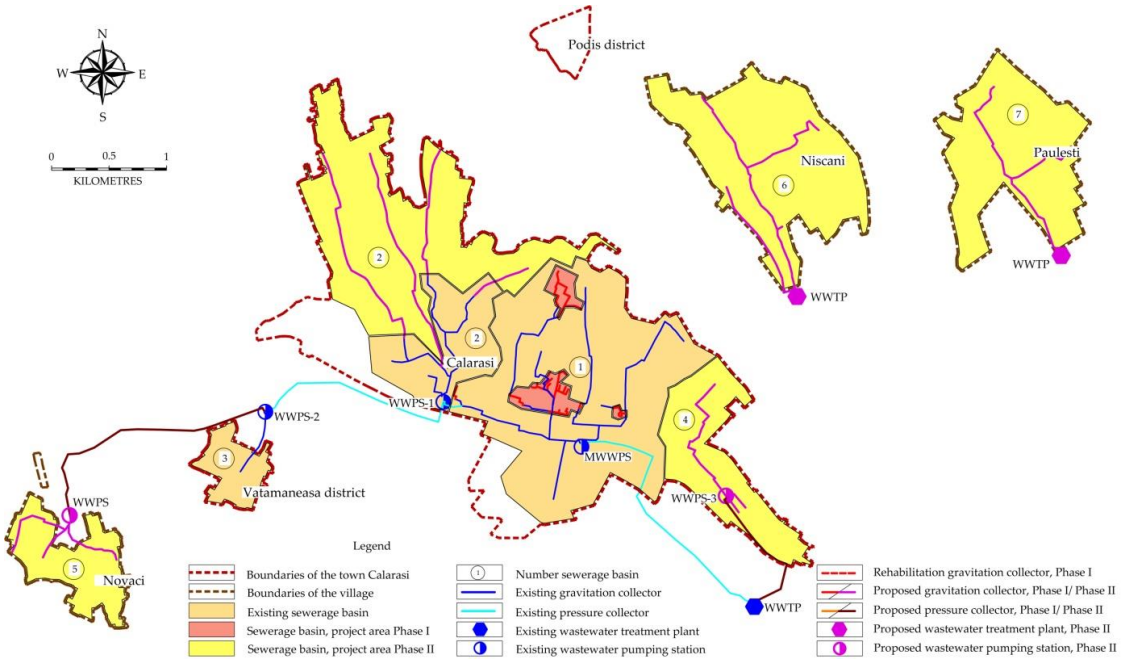
Table 5-9: Development of connection rates wastewater

No	Locality	Population connected to the wastewater system									
		2014		2018		2021		2030		2045	
		n°	%	n°	%	n°	%	n°	%	n°	%
1	Calarasi	8,145	49	8,145	49	12,450	75	14,850	90	15,675	95
2	Niscani	0	0	0	0	989	52	1,199	66	1,451	90
3	Paulesti	0	0	0	0	530	54	628	68	743	90
4	Novaci	0	0	0	0	453	49	562	65	695	90
Total		**8,145**	**40**	**8,145**	**40**	**14,421**	**71**	**17,238**	**86**	**18,564**	**94**

Source: GIZ/MLPS

A scheme of existing and proposed extension of the wastewater system in Calarasi is provided in Figure 5-3. More detailed information is provided in Annex 11.

Figure 5-3: Scheme of existing and proposed extension of the wastewater system in Calarasi



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 study area are as follows (see Chapter 4 – Technical aspects- Existing situation):

- Low water supply connection rate of about 80% (water supply coverage rate of 97 %) in Calarasi Town;
- High real and apparent water losses (NRW of 51%) in the town of Calarasi;
- High number of pipe bursts due to old and obsolete water supply network in parts of the town of Calarasi;
- Water quality does not comply with national standards;
- The absence of disinfection unit at the underground reservoir, located at the Pumping Station N°3 (Biruinta Street);
- Inadequate metering of water production and distribution (low metering accuracy) as well as inadequate operational equipment;
- Localities in the vicinity of Calarasi Town (Niscani, Paulesti, Novaci) are not yet endowed with a water supply system.

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

- Extension of the water distribution network in Calarasi Town;
- Rehabilitation of the water distribution network in Calarasi Town;
- Installation of a new chlorination plant (building, technical equipment, electric installations);

- Construction of a water supply system in the localities of Niscani, Paulesti, Novaci;
- Water metering[38] and equipment for operational improvement.

5.7.3.2 Proposed investment measures

Extension of the water distribution network in Calarasi Town

There is an on-going network extension project in the north-west of the town. Within this on-going project, it is planned to further extend the existing water supply system in order to reach full service coverage in the town. The total network length for this extension area is 3,900 m and 214 households (571 consumers) will be connected to the water supply system by implementing this measure. The water supply connection rate will be increased from 80% to 87% by this measure.

Rehabilitation of the water distribution network in Calarasi 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 Calarasi Town are estimated to be in the range of 51%. It is planned to replace 12,010 m of the pipe network (Diameter between 75 and 315 mm) in order to reduce the number of pipe bursts and water losses.

Construction of a new chlorination plant

Water distributed from the reservoir of 3,000 m³ located pumping station 3rd level in Biruinta Street is currently not disinfected. In particular the water distribution network for the Rayon Hospital and few streets in the Carabliu district are supplied with non-disinfected water.

In order to ensure adequate disinfection and compliance with bacteriological water quality requirements, it is proposed to construct a new chlorination building and to install a chlorination unit (reference is made to Chapter 5.9 – Option analysis for priority investment measures Phase 1).

Construction of new water supply system in the localities of Niscani, Paulesti, Novaci

The localities of Niscani, Paulesti, Novaci are not endowed with a central water supply system. Therefore it is proposed to construct new water supply systems including the following investments:

- Construction of a new water supply system in the locality of Novaci including 9,000 m water supply network, 1,130 m pressure main, 390 house connections), one pumping station and two water towers of 50 m³. The measure will increase the connection rate in the locality to 70% (642 people);
- Construction of a new water supply system in the locality of Niscani including 11,585 m water supply network (including 813 house connections and pressure reducing valves). The measure will increase connection rate in the locality to 70% (1,339 people);
- Construction of a new water supply system in the locality of Paulesti including 9,375 m water supply network (including 415 house connections) and a service

[38] Replacement of water meters

reservoir of 100 m³. The measure will increase connection rate in the locality to 70% (684 people).

5.7.3.3 Water metering and equipment for operational improvement

Currently, water production is metered but most (all) water meters are worn out and should be replaced in order to increase metering accuracy and to enable the Municipal Services Utility accurately to assess the water losses. Further, metering at all reservoirs and connection points to transmission mains in village water supply systems will be necessary to differentiate the service areas and to calculate a separate water balance for each of the localities. Installation of flow meters is therefore considered as a high priority measure. In the medium term, a SCADA 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 the Municipal Services Utility during the detailed design stage needed):

Ultrasonic flow meters are proposed at the following locations:

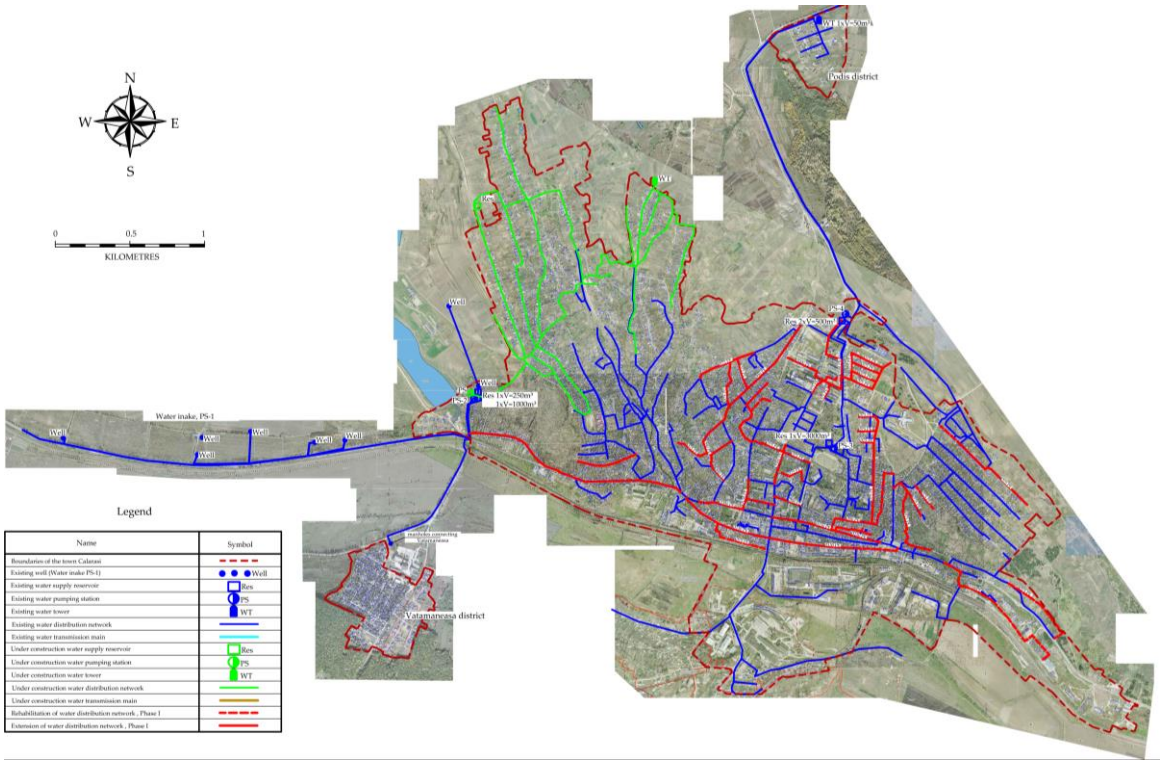
- Outflow of pumping station 2nd level (PS-2);
- Outflow of pumping station 3rd level (PS-3);
- Outflow of pumping station 4th level (PS-4);
- Reservoir at the locality of Niscani;
- Reservoir at the locality of Paulesti;
- Water towers at the locality of Novaci.

For improvement of the operational performance, the following equipment should be procured:

- 1 piece portable ultrasonic flow meter;
- 6 pieces pressure loggers;
- 6 pieces manometer (manual pressure measurement in the network);
- Leak Detection Equipment including acoustic detection equipment and correlator;
- Metal pipe detection/localization equipment;
- 1 truck with tank volume of 6 m³ for transport of water;
- Other equipment to be specified during the detailed design study (e.g. hardware and software, maintenance tools, water meter calibration unit, etc.).

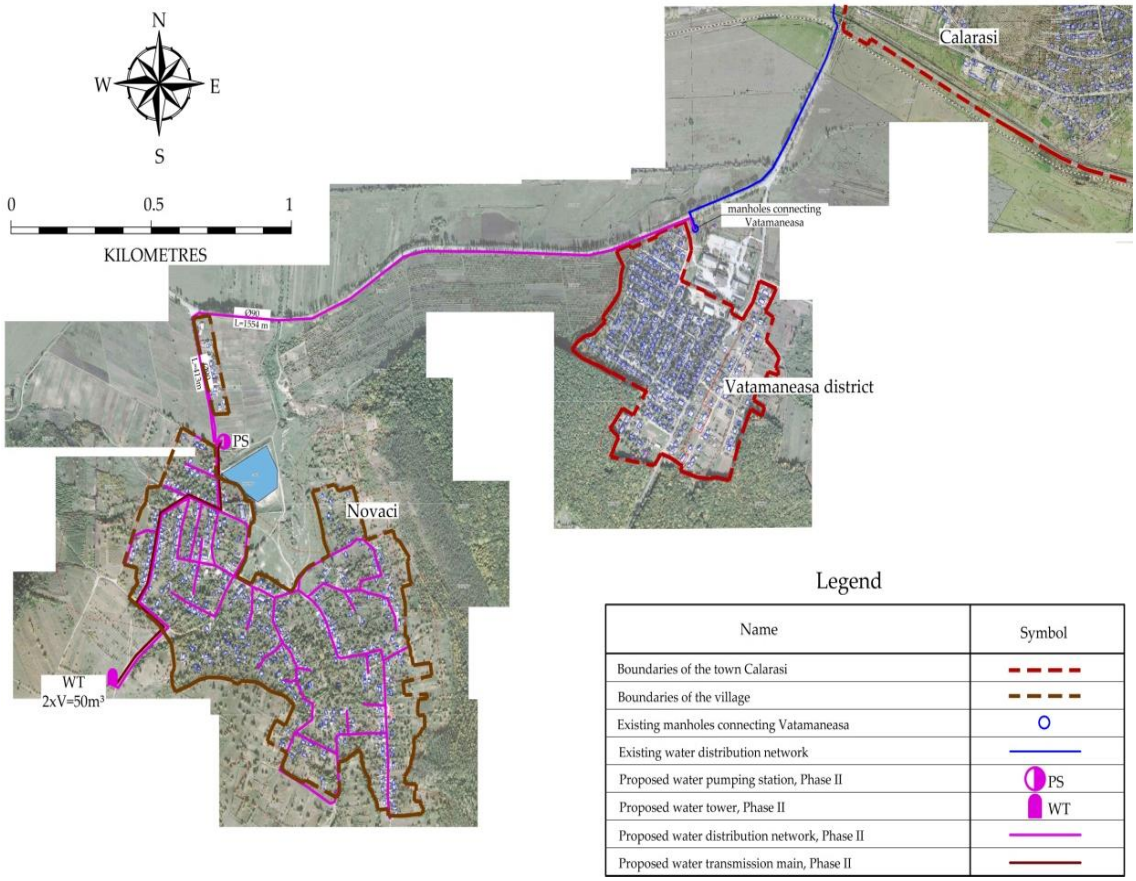
The existing and proposed water supply system in the town of Calarasi and the localities of Novaci, Niscani and Paulesti are presented in the Figures 5-4, 5-5, 5-6, 5-7. More detailed maps are provided in Annex 11.

Figure 5-4: Existing and proposed water supply system in the town of Calarasi



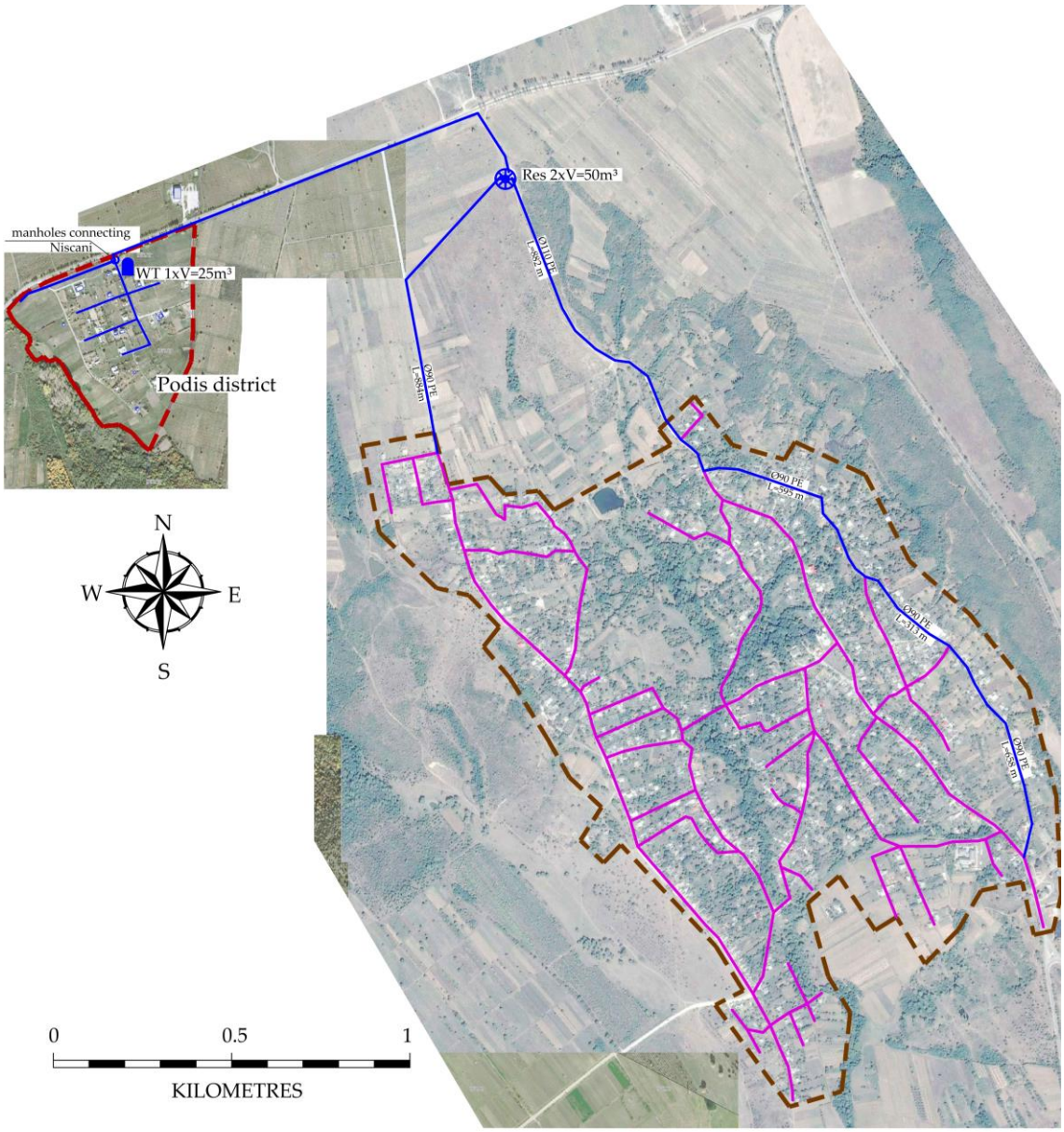
Source: GIZ/MLPS

Figure 5-5: Proposed water supply system in the locality of Novaci



Source: GIZ/MLPS

Figure 5-6: Existing and proposed water supply system in the locality of Niscani

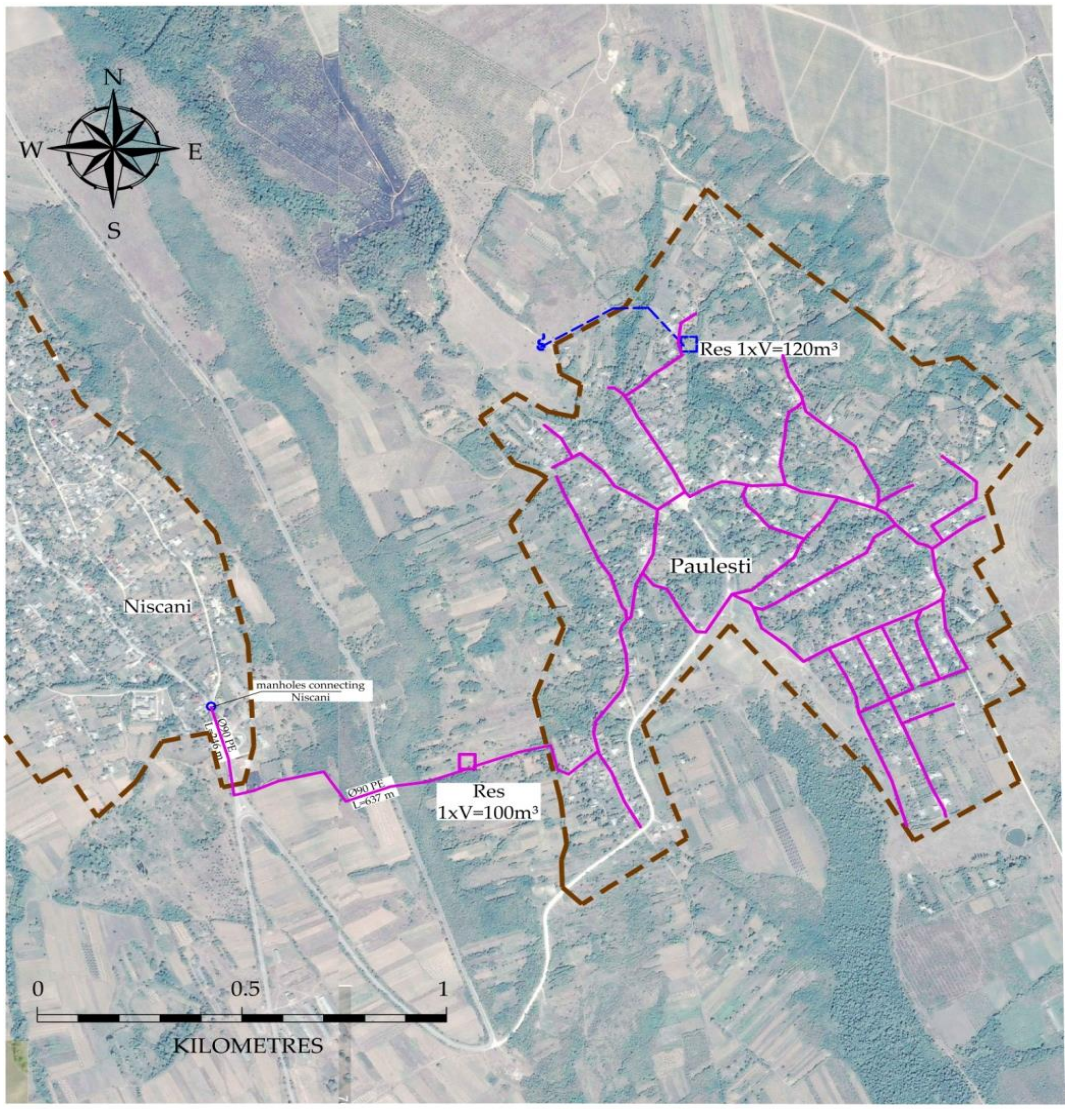


Legend

Name	Symbol
Boundaries of the town Calarasi	
Boundaries of the village	
Existing water distribution network	
Existing water tower	WT
Existing water supply metalic reservoir	Res
Proposed of water distribution network, Phase II	

Source: GIZ/MLPS

Figure 5-7: Proposed water supply system in the locality of Paulesti



Legend

Name	Symbol
Boundaries of the village	
Decommission source	
Decommission water supply reservoir	Res
Existing manholes connecting Niscani	
Decommission water distribution network	
Proposed water supply reservoir, Phase II	Res
Proposed of water distribution network, Phase II	

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 of the study area are as follows (see Chapter 4 –Technical aspects- Existing situation):

- In Calarasi Town the coverage and connection rate of wastewater services is low (coverage rate of 52%, connection rate of 49%);
- The existing sewer network is highly degraded which leads to frequent sewer blockages and emergency driven maintenance;
- The capacity of the WWTP in Calarasi Town is insufficient to treat the future wastewater volume beyond the year 2021;
- The localities in the vicinity of Calarasi Town (Niscani, Paulesti, Novaci) are not yet endowed with a wastewater system.

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

- Extension of the sewer network in Calarasi Town;
- Rehabilitation of the sewer network in Calarasi Town;
- Extension of the WWTP capacity in Calarasi Town;
- Extension of the sewer network in the localities of Novaci, Niscani and Paulesti;
- Procurement of equipment for operational improvement.

5.7.4.2 Proposed investment measures

The proposed investment measures are described as follows:

Extension of the sewer network in Calarasi Town:

In order to increase the service coverage for Calarasi Town to 95% in 2021 (from the current coverage rate of 52%) the sewer network (separate system) has to be extended by about 25,400 m gravity pipes (diameter 200 – 250 mm) and 2,870 new service connections. Additionally, construction of pressure sewers with a total length of 1,300 m and diameters between 90- 110mm will be necessary. The extension areas are located in the north-west (drainage area n° 2) and in the south-east (drainage area n° 4). Due to the topography of the planning area, the sewer system will be subdivided into the following wastewater collection areas (see Figures 5-3 and 5-8):

- Wastewater from the north-western part of the town (extension in drainage area n° 2) will be discharged by gravity to the existing waste water pumping station n°1 (WWPS-1), which pumps wastewater to a collector in drainage area n° 1;
- Wastewater from the central part of the town (drainage area n° 1) is collected by gravity to the existing main wastewater pumping station (MWWPS), which pumps wastewater through an existing pressure main to the WWTP;
- The extension area in the south-east of the town (drainage area n° 4) will discharge wastewater by gravity to the new WWPS-3 and from there through a new pressure main to the existing WWTP;
- 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. Conclusively, no investment measures are proposed for these WWPS;
- The capacity of the three pressure mains (HDPE OD 90 and 250 mm) between WWPS 1 and 2 and between the Main Wastewater Pumping Station (MWWPS) and the existing WWTP (see Figure 5-8) , is sufficient to convey existing and future wastewater from all extension areas. Therefore no investment measures are proposed for the pressure main.

Rehabilitation of the sewerage network in Calarasi Town:

Due to frequent sewer blockages in the centre of the town (drainage area n° 1), high priority has been given by the Municipal Services Utility to the rehabilitation of 4,070 m sewer network (diameter 200 – 315 mm). This measure will improve service quality (fewer sewer blockages), reduce the operating costs and may also reduce infiltration/exfiltration to/from the sewer network.

As a second priority, it is recommended to conduct a CCTV inspection of the sewer 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 sewer network. For the purpose of cost estimation in this study, it was assumed that about 30% of the sewer network older than 30 years should be rehabilitated (4,259 m).

Extension of the WWTP capacity in Calarasi Town:

The capacity of the recently constructed WWTP in Calarasi Town (1,400 m³/day) is sufficient to treat the wastewater volume until the year 2021 (including volume from proposed extensions in Calarasi Town but excluding the localities of Niscani and Paulesti which are assumed to be endowed with separate treatment plants). However, in order to cover future development of wastewater volume an extension to about 17,000 P.E. (2,000 m³/day) will be necessary.

Extension of the sewer network in the localities of Novaci, Niscani and Paulesti:

- The wastewater from the extension area in the locality of Novaci (drainage area n°5) will be collected and pumped (proposed new WWPS-4) through a new pressure main to the existing WWPS-2 (Vatamaneasa district) and from there through the existing pressure main to WWPS-1;
- Wastewater from Niscani and Paulesti localities (drainage area n° 6) are proposed to be collected by gravity (in two separate systems) and treated separately in two new WWTPs (as explained above, this is a tentative proposal in order to estimate investment cost, which needs to be confirmed by a thorough sanitation study in Phase 1 (technical assistance measures).

The wastewater investment measures described above are summarised for each locality as follows:

Calarasi Town:

- Extension of the existing sewer network in Calarasi Town and construction of 25,400 m of PP/PVC[39] sewer collectors with diameters between 200 mm and 250 mm in the north-western and south-eastern part of the town;
- Construction of a new wastewater pumping station (WWPS-3) and a pressure main (1,300 m OD 90 – 110 mm) aiming to pump wastewater from drainage area n°4 to the WWTP;
- Rehabilitation of 4,070 m of the existing sewer network (urgent replacement in drainage area n° 1);
- Rehabilitation of 4,259 m sewer network (second priority rehabilitation based on the assumption that 30% of the sewer network above 30 years will have to be re-

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

placed in the short term and the remaining 70% in the medium and long-term as they have reached the end of their service period);

- Extension of the existing Wastewater Treatment Plant (WWTP) from currently 1,400 m³/day to 2,000 m³/day.

Novaci Locality:

- Implementation of a new sewer network in the Novaci locality and construction of 5,541 m of PP/PVC[40] sewer collectors with diameters between 200 mm and 250 mm;
- Construction of a new wastewater pumping station (WWPS-4) and a pressure main (2,400 m OD 90 – 110 mm).

Niscani Locality:

- Implementation of a new sewer network in the Niscani locality and construction of 13,420 m of PP/PVC[41] sewer collectors with diameters between 200 mm and 250 mm;
- Construction of a new wastewater treatment plant (WWTP) with a capacity of 1,199 P.E.

Paulesti Locality:

- Implementation of a new sewer network in the Paulesti locality and construction of 6,530 m of PP/PVC[42] sewer collectors with diameters between 200 mm and 250 mm;
- Construction of a new wastewater treatment plant (WWTP) with a capacity of 628 P.E.

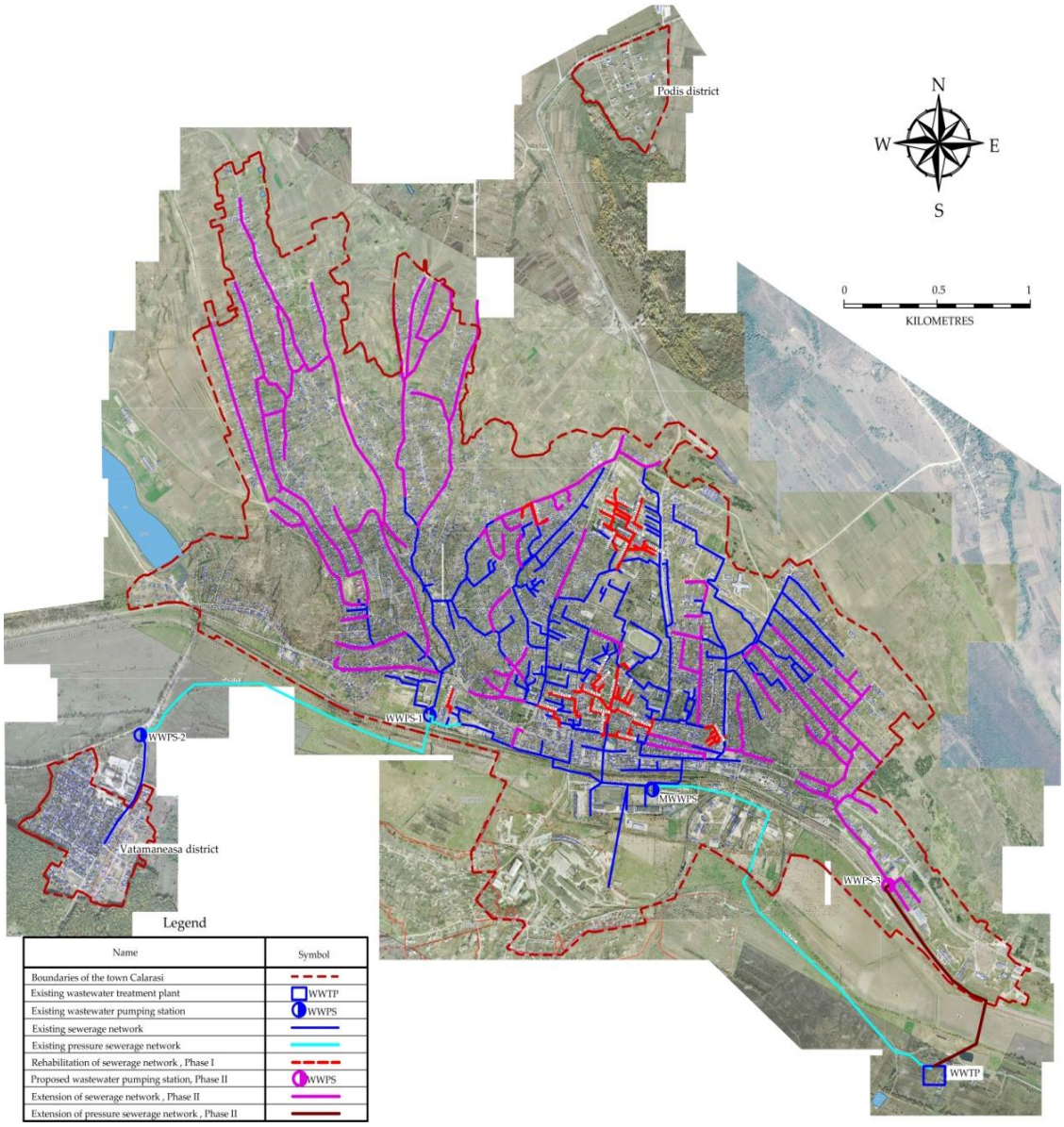
The existing and proposed sewer system in the town of Calarasi and the localities of Novaci, Niscani and Paulesti are presented in the Figures 5-8, 5-9, 5-10, 5-11. More detailed maps are provided in Annex 11.

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

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

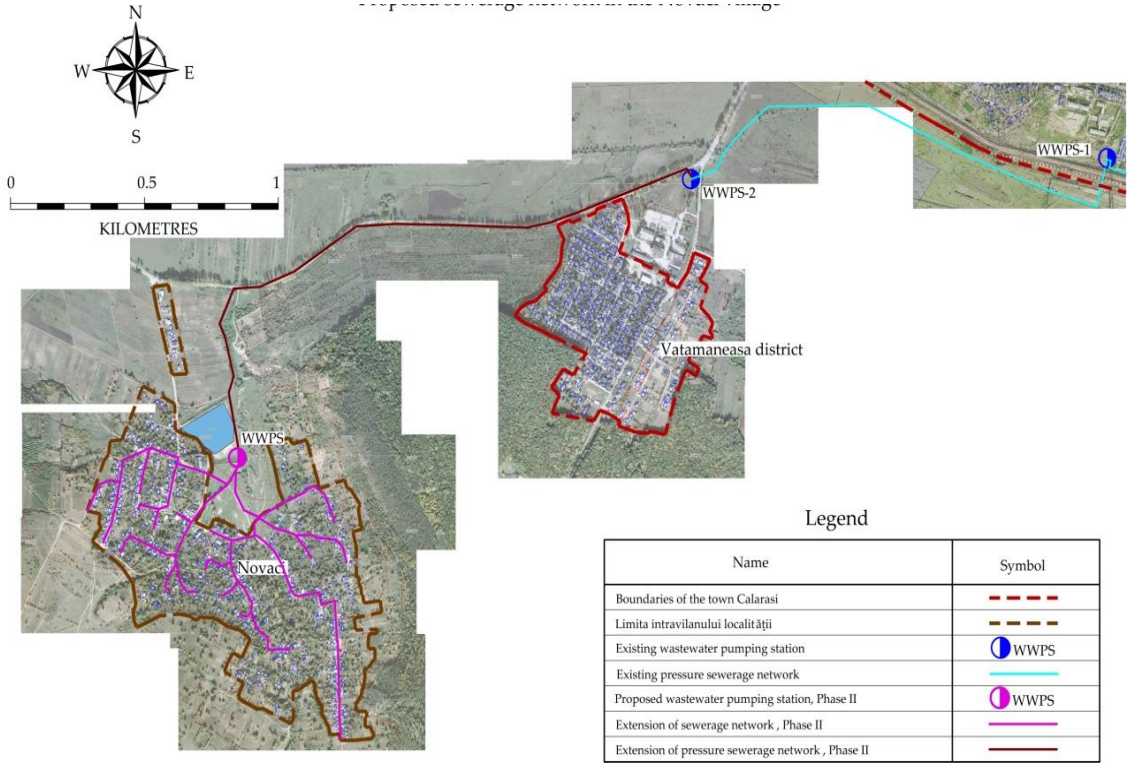
[42] Material to be defined in the detailed design phase.

Figure 5-8: Existing and proposed extension of the wastewater system in the town of Calarasi



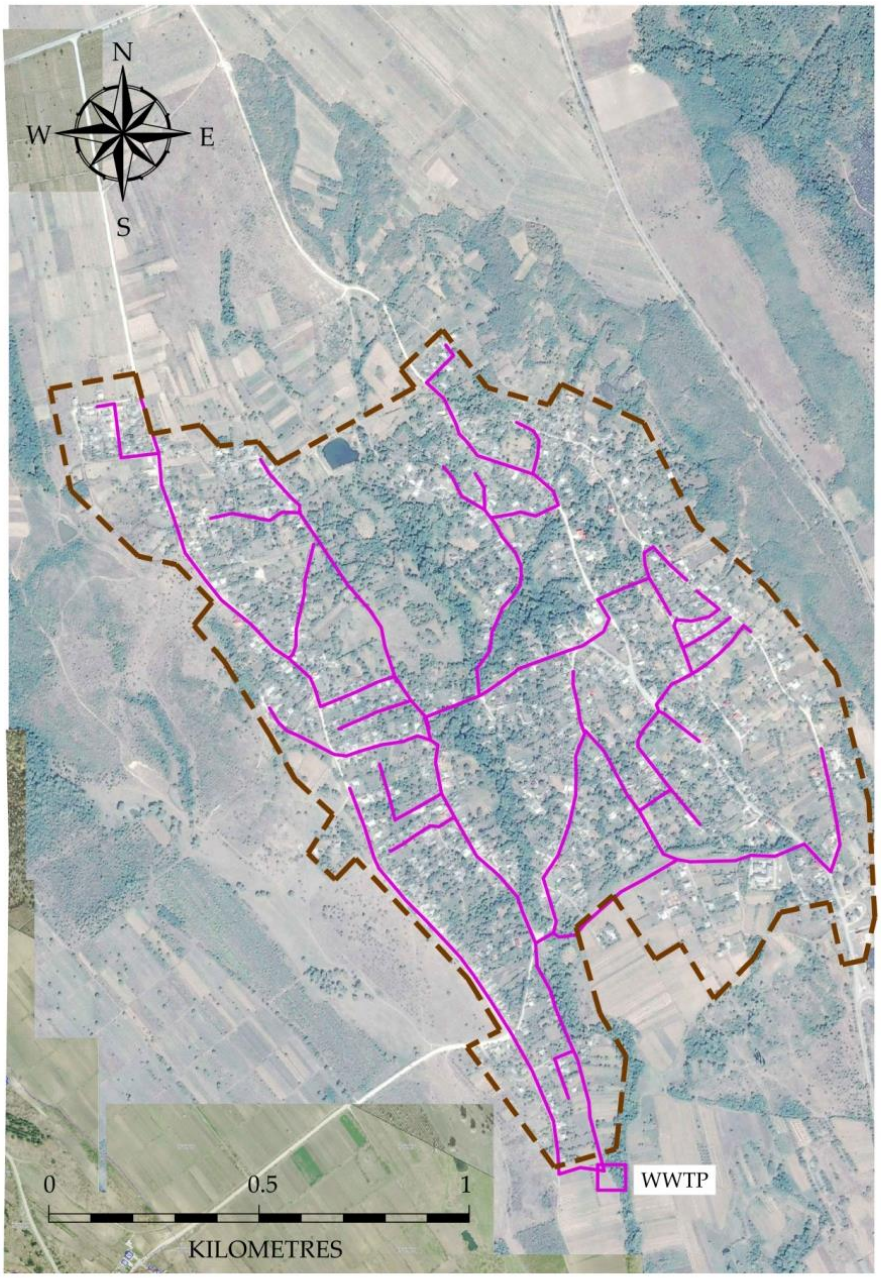
Source: GIZ/MLPS

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



Source: GIZ/MLPS

Figure 5-10: Proposed wastewater system in the locality of Niscani

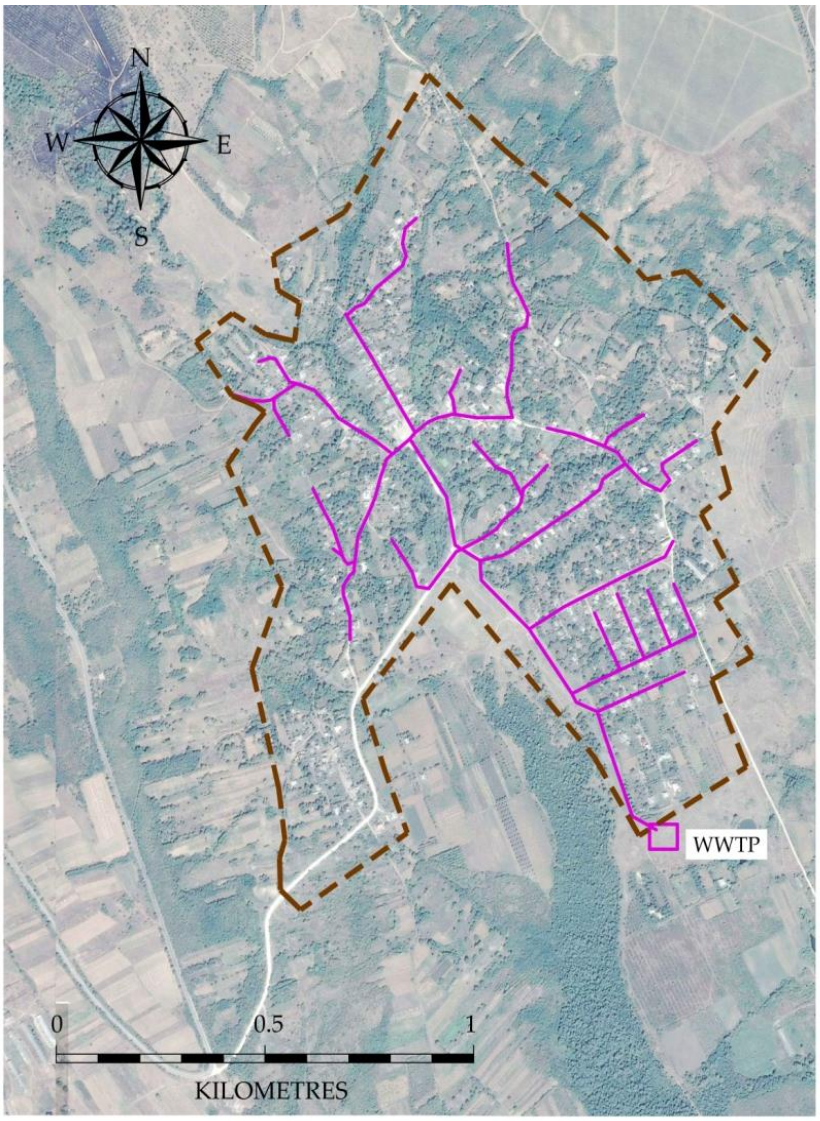


Legend

Name	Symbol
Boundaries of the village	
Proposed wastewater treatment plant, Phase II	WWTP
Extension of sewerage network , Phase II	

Source: GIZ/MLPS

Figure 5-11: Proposed wastewater system in the locality of Paulesti



Legend

Name	Symbol
Boundaries of the village	
Proposed wastewater treatment plant, Phase II	WWTP
Extension of sewerage network , Phase II	

Source: GIZ/MLPS

5.7.5 Operational improvement

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

- Laboratory equipment for measuring key parameters (BOD_5, COD, nitrogen, phosphorus, suspended solids, etc.) and flow meters. It is recommended to measure quality and volume of wastewater effluents at the outlet of the existing main collector during dry and wet weather conditions in order to ensure that sufficient data are available for designing the expansion of the WWTP;
- Two Sewer cleaning trucks (e.g. combined jetting and suction trucks) and other equipment needed in order to maintain the sewer network according to best practice;
- CCTV inspection equipment in order to assess in detail the condition of the sewer network and based on these results to plan sewer rehabilitation works;
- One truck for emergency repair measures.

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 sewer network rehabilitation;
- Ensuring high quality standard for implementation of works (detailed designs[43], tender documents and supervision of works).

The scope of work for the TA measures should include inter alia the following:

Table 5-10: Technical Assistance

Component	Objectives	Measures
Design and Engineering for Phase 1 investments	To ensure high quality and timely implementation of works and TA-measures through support of the Project Implementing Agency[44] (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 supervision and monitoring of TA-measures	**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 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

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

[44] Reference is made to Chapter 9.4 – Project Implementation Plan (Set-up of a Project Implementation Structure)

Component	Objectives	Measures
		(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; • To encourage transparency in decision-making; • Sustainability of dialogue.
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,	**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

Component	Objectives	Measures
	(ii) action plan, (iii) capacity building programme.	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 sanitation (Master Plan for Sanitation) 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[45], (ii) definition of agglomeration borders in the rayon (as defined in EU Urban Wastewater Treatment Directive EU 91/271/EEC)), (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 Niscani and Paulesti (at least the following 3 options should be assessed: • Option 1: Separate collection system and separate WWTP for each of the localities; • Option 2: Separate sewer collection system for each locality and discharge of wastewater either through a pressure main to the sewer network in Calarasi Town or transport of sewerage by trucks to the WWTP of Calarasi Town; • Option 3: On-site sanitation (no collection system). Further, the study should assess if other localities in

[45] Procurement strategy for CCTV inspection of sewer 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 recommendations a detailed action plan and draft specifications for a work contract should be prepared.

Component	Objectives	Measures
		the vicinity of Calarasi Town should be connected to the WWTP of Calarasi Town. Finally, based on the above agglomeration analysis, the study should define the necessary capacity and propose a staged development (including the feasibility of an extension of the existing WWTP)

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; and
- 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 5-11: Proposed investment measures and phasing

No	Investment Measures	Proposed Phase	Justification for phasing
1	Water supply	PH 1 and PH2	High priority due to all criteria: • Water supply has to be implemented before wastewater system[46]; • Capacity of operator sufficient (no complex systems); • Affordability is ensured (comparatively low cost per capita); • High contribution to public health improvement (water quality).
1.1	Rehabilitation of the water distribution network in the town of Calarasi	PH 1	About 13 km (25%) out of 53 km of the existing network is at the end of its service life and needs to be replaced in the short and medium term (see Chapter 4-Technical aspects-Existing situation). The Municipal Services Utility has identified rehabilitation of 12 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	Renovation of water supply network in Calarasi town	MT	It is recommended to optimize 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 of this project. These measures might inter alia include: • Replacement of water supply network (30% of network older than 30 years); • 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.
1.3	Extension of the water distribution network in the town of Calarasi	PH 1	High priority is given to this measure in order to reach 100 % of coverage rate for the town.
1.4	Construction of a new chlorination plant	PH 1	High priority to ensure compliance with national drinking water standards for all customers (mandatory investment)
1.5	Construction of new water supply system in the localities of Niscani, Paulesti, Novaci (com.Tuzara)	PH 2	It is proposed to construct the water supply system in parallel to the proposed wastewater network (reduction of costs). Further, due to the relatively high costs per capita and to avoid overloading of the operator's capacities, it is proposed to implement this investment measure in Phase 2.
1.6	Equipment for operational performance improvement	PH 1	High priority to reduce real water losses (e.g. leak detection and flow meters, hydraulic modelling software and hardware, etc.) and commercial water losses (billing hard- and software, etc.) The equipment shall be procured in parallel to the implementation of TA measures in order to ensure its effectiveness.

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

No	Investment Measures	Proposed Phase	Justification for phasing
2.	Wastewater system	PH 1 and 2	High Priority is given to the rehabilitation of the existing sewer network in order to ensure adequate functioning of the overall system and to reduce environmental impact. In order to ensure affordability of the measure and to avoid overloading of the operator's capacities, only part of the rehabilitation measures can be implemented in Phase 1 while the remaining part is proposed to be implemented in Phase 2. The following measures cannot be implemented in Phase 1 due to limited capacities of the operator to implement all measures within short time and due to the fact that additional studies (e.g. agglomeration study as mentioned above in Chapter 5.7.2-Investment framework) will be necessary to design the proposed investment components: • Extension of sewer network in Calarasi Town in Phase 2; • Construction of new sewer system (network and treatment) for localities of Novaci, Niscani and Paulesti in Phase 2; • Rehabilitation of sewer network in Calarasi Town in Phase 1 and 2; • Extension of the WWTP capacity in Calarasi Town in Phase 2.
2.1	Extension of sewer network in Calarasi Town (drainage area 2 & 4)	PH 2	Due to the size of the agglomeration (above 10,000 P.E.) the Municipal Services Utility gives priority for extension of the sewer network in Calarasi Town. The north-western part of the town (drainage area n° 2) and to the south-eastern part of the town (drainage area n ° 4) in order to reach the target of 100 % coverage rate. In order to avoid overloading the capacities of the operator the measure is proposed to be implemented in Phase 2.
2.2	Extension of the sewer network in the localities of Novaci, Niscani and Paulesti	PH 2	The need for extensions and the optimal technical solutions in the localities should be assessed thoroughly in the proposed Sanitation Study (TA in Phase 1). Therefore, the measure should be implemented in Phase 2 (based on the results of the Sanitation Study).
2.3	Rehabilitation of the existing sewer network	PH 1 & 2	About 16 km (53 %) out of 30 km of the existing sewer network (ceramic, reinforced concrete, asbestos cement pipes) are at the end of the service life (see Chapter 4-Technical aspects-Existing situation) and needs to be replaced in the short and medium term. Replacement of 4 km sewer network has been identified by the Municipal Services Utility as highest priority (location know due to frequent failures). Additional rehabilitation works (4.3 km) for the sewer network should be based on the results of CCTV inspection (proposed in TA measures in Phase 1 of this study) and are proposed to be implemented in Phase 2 or may be shifted to the Long-term investment phase (depending on the funds available).
2.4	Extension of the WWTP capacity in Calarasi Town	Ph 2	The capacity of the existing WWTP might be exceeded in the medium term (according to demand projection). However, depending on the development of the connection rate in Calarasi Town and the proposed solution in the sanitation study for the localities in the vicinity of the town the needed additional capacity is quite uncertain. Therefore the measure will not be included in Phase 2 but should be implemented in the long-term (staged approach based on results of sanitation study in Phase 1).

No	Investment Measures	Proposed Phase	Justification for phasing
2.5	Equipment for operational performance improvement	PH 1	Procurement of equipment has high priority for operational performance improvement and preparation of 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 the Municipal Services Utility in order to improve operational performance and to prepare sewer rehabilitation programmes.
3.	Technical assistance		
3.1	Design and Engineering for Phase 1 investments	PH 1	Mandatory for implementation of works contracts for Phase 1.
3.2	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).
3.3	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 the design phase)
3.4	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 of insufficient budget, this measure could be split into two phases (follow up in Phase 2 in order to determine long-term network development needs).
3.5	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

Note: PH 1: Phase 1, PH 2: Phase 2, MT: Medium Term, LT: Long-Term

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 options, etc.) will be carried out in the subsequent detailed design stage (technical assistance measure, Table 5-12, p. 3.1. and 3.4).

5.9.1 Option analysis for Phase 1

The identified options are described below:

Water Supply of the rayon through the regional transmission main Chisinau –Straseni-Calarasi in compassion with supply from well-field in Calarasi Town and Sipoteni well-field:

In the medium-term the water demand is projected to exceed the available water abstraction capacities. Further, water in Calarasi does not meet the drinking water standards (exceedance of fluorine concentration). There are two possibilities to provide additional water resources and to ensure compliance with national water quality standards: (i) Construction of five (5) new wells with a capacity of 10 m³/h each and construction of a new Water Treatment Plant or (ii) connection to the planned regional transmission main from Water Treatment Plant at Apa-Canal Chisinau to Straseni and Calarasi Rayons (*below referred to as Regional Transmission Main*):

- Option 1 – Construction of new wells. A thorough hydro-geological investigation (incl. pump-tests) will be necessary to assess if the additional capacities can be provided in the Sipoteni well-field. Otherwise, alternative locations for well-fields would have to be identified. Further, thorough investigations related to water quality will be necessary (comprehensive water quality analysis at all wells during a period of at least 1 year) to prepare conceptual design and cost estimates (investment and operation costs) for a water treatment plant.
- Option 2 – Connection to the Regional Transmission Main.

This strategic option cannot be analysed within the framework of this feasibility study (limited study area for Calarasi Town and some localities) as regional data would be necessary to compare these options. This option is about to be evaluated within the framework of a feasibility study financed by KfW “Improvement of water infrastructure in Central Moldova”. Considering the difficult institutional set-up and large investment amounts needed, it is assumed that this transmission main will realistically not be operational before 2021 (end of Phase 2 of this project). As mentioned above, the result of this option analysis will have no impact on the investments for Phase 1 and 2. However, in the medium term, the capacity of the current water abstraction facilities (Sipoteni well-field and wells in Calarasi Town) will not be sufficient to cover the projected water demand (see Chapter 5.5- Water Demand Projection versus available water resources and production capacities). In order to increase supply security both systems should be developed in the future (see also Chapter 5.7.2 - Investment framework). In case that the Regional Transmission Main will be realised, Sipoteni well-field should be maintained as second supply source. Due to the high costs for fluorine treatment, it is likely[47] that the Regional Transmission Main will be the least cost option.

Chlorine gas (conventional liquid chlorine dosing unit) versus electrolytic hypochlorite plant

A summary of advantages and disadvantages comparing chlorine gas (liquid chlorine dosing units) with electrolytic hypochlorite plants is given in the Table 5-12:

Table 5-12: Comparison of chlorine gas (liquid chlorine) with electrolytic hypochlorite

Disinfection Option	Advantages	Disadvantages
Chlorine gas (Liquid chlorine dosing unit)	• Low investment costs; • Low costs for procurement of chlorine; • Simple and well know technology for the chlorine dosing units.	• High safety risk during transportation of liquid chlorine (high concentration of chlorine); • High safety risk for storage of chlorine; • Neutralization of chlorine with sodium hydroxide solution (reservoir) in case of accident (state of the art safety standard in most

[47] The answer is expected in the feasibility study to be financed by KfW

Disinfection Option	Advantages	Disadvantages
		of the bigger plants); • Import of chlorine may be getting more and more difficult due to boarder restrictions.
Electrolytic Hypochlorite Plant	• As only water, common salt (NaCl) and electricity is needed for the electrolysis – comparatively moderate operating costs (depending on the electricity tariff and price for salt); • Common salt is the raw material – which is nontoxic and easy to store (low safety risk); • World-wide used with positive examples in some Russian, Tajik and Kyrgyz towns; • Fresh hypochlorite is always on hand – the disinfectant solution does not dissociate like commercial hypochlorite solutions; • Less safety requirements compared to chlorine-gas-based systems.	• High capital investment costs; • More complex technology compared to simple liquid chlorine units, requires well trained staff for maintenance and reliable supplier's support in Moldova; • High electricity consumption (operation costs highly depending on the future development of electricity tariffs); • Requires reliable power supply; • Requires constant room temperature for operation (highly productive ventilation system) • Requires specific ventilation system for hydrogen; • Requires water temperature between 5° – 15° Celsius (Heating/Cooling systems might be necessary); • Salt with adequate quality is needed (eventually high transport costs); • High storage capacity for salt (30-40 days); • Operation costs are highly depending on the development of electricity and salt prices.

Source: GIZ/MLPS

Selected option:

In conclusion, the use of chlorine gas has several disadvantages, in particular the high security and health risk. On the other hand, the use of electrolytic sodium hypochlorite is related to high investment costs, complex technology, requiring experienced staff for maintenance of equipment. The selection of the option for disinfection technology shall be done in technical assistance of Phase 1.

5.9.2 Identified options for Phase 2:

In order to define the required capacity of the WWTP (extensions) an assessments of the agglomerations (localities in the vicinity of Calarasi Town) to be connected to the central WWTP in Calarasi has to be carried out. This assessment includes an options 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 central sewer 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).

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 Niscani (1,952 inhabitants in 2014) and Paulesti (997 inhabitants in 2014) localities, located in the hilly areas north of the town centre, various options for wastewater treatment and collection are possible:

- Option 1: Separate collection system and separate WWTP for each of the localities;
- Option 2: Separate sewer collection system for each locality and discharge of wastewater either through a pressure main to the sewer network in Calarasi Town or transport of sewerage by trucks to the WWTP of Calarasi Town;
- Option 3: On-site sanitation (no collection system).

5.10 Proposed priority investment plan

The phased priority investment plan is presented in the tables below. The total investment costs for Phase 1 have been estimated at 3.0 MEUR and for Phase 2 at 22.7 MEUR (see Table 5-13, 5-14, 5-15).

Table 5-13: The investment plan for Phase 1

No	Component	Units	Quantity	Unit costs	Total cost
				EUR	EUR
1.	Water supply				
1.1	Rehabilitation of the water distribution network in the town of Calarasi				
1.1.1	Water distribution network HDPE pipe OD 315 mm	m	2,110	139	293,290
1.1.2	Water distribution network HDPE pipe OD 200 mm	m	1,360	90	122,400
1.1.3	Water distribution network HDPE pipe OD 160 mm	m	2,470	75	185,250
1.1.4	Water distribution network HDPE pipe OD 110 mm	m	1,110	65	72,150
1.1.5	Water distribution network HDPE pipe OD 90 mm	m	2,505	62	155,310
1.1.6	Water distribution network HDPE pipe OD 75 mm	m	2,455	60	147,300
ST-1.1	Subtotal 1.1 Rehabilitation of the water distribution network				975,700
1.2	Extension of the water distribution network in the town of Calarasi				
1.2.1	Water distribution network HDPE pipe OD 75	m	3,900	62	241,800
1.2.2	Manholes, ϕ 1500	pcs	25	423	10,575
1.2.3	Service connections	pcs	214	250	53,500
ST-1.2	Subtotal 1.2 Extension of the water distribution network				305,875
1.3	New chlorination unit - (building, technical equipment, electric installations)	LS	1	55,000	55,000
ST-1	TOTAL water supply (1.1+1.2+1.3)				1,336,575
2.	Wastewater				
2.1	Rehabilitation of the sewer network in the town of Calarasi				
2.1.1	Sewer network PP/PVC pipe DN 315	m	575	185	106,375
2.1.2	Sewer network PP/PVC pipe DN 250	m	720	165	118,800
2.1.3	Sewer network PP/PVC pipe DN 200	m	2,775	150	416,250
ST-2.1	Subtotal 2.1 Rehabilitation of the sewer network (2.1.1+2.1.2+2.1.3)				641,425
3	**Equipment and tools** for operational performance	LS	1	200,00	200,000

No	Component	Units	Quantity	Unit costs	Total cost
				EUR	EUR
	improvement (water supply and wastewater)			0	
ST-1&2&3	SUB-TOTAL (1&2&3)				2,178,000
4	Technical assistance				
4.1	Design and engineering (12 % of investment costs)				261,360
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)				561,360
5	Contingencies (10% of 1+2+3+4)				273,936
GT	Total Costs for Calarasi Phase 1 (1+2+3+4)				3,013,296

Source: GIZ/MLPS

Table 5-14: The investment plan for Phase 2

No	Component	Units	Quantity	Unit costs	Total cost
				EUR	EUR
A	Calarasi Town				
1	Wastewater				
1.1	Extension of the sewer network in the town of Calarasi				
1.1.1	Sewer network PP/PVC pipe OD 200 -250 mm	m	25,400	165	4,191,000
1.1.2	Manholes, ϕ 1000	pcs	508	1,030	523,240
1.1.3	Pressure main PE OD 90-110 mm	m	1,300	62	80,600
1.1.4	Service connections	pcs	2,870	500	1,435,000
ST-1.1	Subtotal 1.1 Extension of the sewer network				6,229,840
1.2	Wastewater pumping station				
1.2.1	Wastewater pumping station (WWPS-3)	LS	1	28,000	28,000
1.3	Extension of existing Wastewater Treatment Plant (WWTP)	P.E.	8,000	300	2,400,000
1.4	Rehabilitation of sewer network in the town of Calarasi (OD 200-250 mm)	m	4,259	165	702,801.00
ST-1	Subtotal wastewater (1.1+1.2+1.3+1.4)				9,360,641
B	Novaci Locality				
1	Water supply				
1.1	Construction of the water distribution network in the locality of Novaci				
1.1.1	Water distribution network HDPE pipe OD 90 mm	m	6,900	62	427,800
1.1.2	Water distribution network HDPE pipe OD 75 mm	m	2,100	60	126,000
1.1.3	Manholes, ϕ 1500	pcs	35	423	14,805
1.1.4	Pressure main HDPE OD 63 mm	m	1,130	60	67,800
1.1.5	Service connections	pcs	390	250	97,500
ST-1.1	Subtotal 1.1 Construction of the water distribution network				733,905

No	Component	Units	Quantity	Unit costs	Total cost
				EUR	EUR
1.2	Water tower				
1.2.1	Water tower (V = 50m³)	pcs	2	25,000	50,000
1.3	Water supply pumping station				
1.3.1	Water supply pumping station (WSPS)	LS	1	26,500	26,500
ST-1	TOTAL Water supply (1.1+1.2+1.3)				810,405
2	Wastewater				
2.1	Construction of the sewer network in the locality of Novaci				
2.1.1	Sewer network PP/PVC pipe OD 200-250 mm	m	5,541	165	914,265
2.1.2	Manholes, ϕ 1000	pcs	110	1,030	113,300
2.1.3	Pressure main PE OD 90-110 mm	m	2,420	62	150,040
2.1.4	Service connections	pcs	342	500	171,000
ST-2.1	Subtotal 2.1 Construction of the sewer network				1,348,605
2.2	Wastewater pumping station				
2.2.1	Wastewater pumping station (WWPS)	LS	1	28,000	28,000
ST-2	TOTAL Wastewater (2.1+2.2)				1,376,605
GT	Total Costs for _Novaci Phase 2 (1+2)				2,187,010
C	Niscani Locality				
1	Water supply				
1.1	Construction of the water distribution network in the town of Niscani				
1.1.1	Water distribution network HDPE pipe OD 90 mm	m	7,975	62	494,450
1.1.2	Water distribution network HDPE pipe OD 75 mm	m	3,610	60	216,600
1.1.3	Manholes, ϕ 1500	pcs	45	423	19,035
1.1.4	Pressure reducing valves OD 90 mm	pcs	2	3,500	7,000
1.1.5	Service connections	pcs	813	250	203,250
ST-1	TOTAL Water supply (1.1)				940,335
2	Wastewater				
2.1	Construction of the sewer network in the locality of Niscani				
2.1.1	Sewer network PP/PVC pipe OD 200-250 mm	m	13,420	165	2,214,300
2.1.2	Manholes, ϕ 1000	pcs	268	1,030	276,040
2.1.3	Service connections	pcs	700	500	350,000
ST-2.1	Subtotal 2.1 Construction of the sewer network				2,840,340
2.2	Wastewater Treatment Plant (WWTP)	P.E	1,199	500	599,500
ST-2	TOTAL Wastewater (2.1+2.2)				3,439,840
GT	Total Costs for Niscani Phase 2 (1+2)				4,380,175
D	Paulesti Locality				
1	Water supply				
1.1	Water Supply distribution network in the locality of Paulesti				
1.1.1	water distribution network HDPE pipe OD 90 mm	m	4,815	62	298,530
1.1.2	water distribution network HDPE pipe OD 75 mm	m	4,560	60	273,600
1.1.3	Manholes, ϕ 1500	pcs	35	423	14,805
1.1.4	Pressure reducing valves OD 90 mm	pcs	1	3,500	3,500
1.1.5	Service connections	pcs	415	250	103,750
ST-1.1	Subtotal 1.1 Water Supply distribution network				694,185
1.2	Water supply reservoir				
1.2.1	Water supply reservoir (V=100 m³)	LS	2	60,000	60,000
ST-1	TOTAL Water supply (1.1+1.2)				754,185

No	Component	Units	Quantity	Unit costs	Total cost
				EUR	EUR
2	Wastewater				
2.1	Extension of the sewer network in the locality of Paulesti				
2.1.1	Sewer network PP/PVC pipe OD 200-250 mm	m	6,530	165	1,077,450
2.1.2	Manholes, ϕ 1000	pcs	131	1,030	134,930
2.1.3	Service connections	pcs	375	500	187,500
ST-2.1	Subtotal 2.1 Extension of the sewer network				1,399,880
2.1	Wastewater Treatment Plant (WWTP)	P.E	628	510	320,280
ST2	Sub-total wastewater				1,720,160
GT	TOTAL Water supply and wastewater (1+2)				2,474,345
SUM	Summary for total investment costs for all localities				
1	Calarasi Town				
1.1	Water supply				-
1.2	Wastewater				9,360,641
ST-1	Sub-total capital investment costs Calarasi Town				9,360,641
2	Novaci Locality				
2.1	Water supply				810,405
2.2	Wastewater				1,376,605
ST-2	Sub-total capital investment costs Calarasi Town				2,187,010
3	Niscani Locality				
3.1	Water supply				940,335
3.2	Wastewater				3,439,840
ST-3	Sub-total capital investment costs Niscani Locality				4,380,175
4	Paulesti Locality				
4.1	Water supply				754,185
4.2	Wastewater				1,720,160
ST-4	Sub-total capital investment costs Paulesti Locality				2,474,345
TOT	Total capital Investment cost all localities (1+2+3+4)				
T1	Water supply				2,504,925
T2	Wastewater				15,897,246
TOT	Total capital investment cost all localities				18,402,171
TA	Technical assistance (TA)				
DE	Design and engineering (12 % of investment costs)				2,208,261
CON	Contingencies (10% of investment costs and TA)				2,061,043
GT 2	GRAND TOTAL for Phase 2 (Investment costs + TA + Contingencies)				22,671,475

Source: GIZ/MLPS

Table 5-15: Summary of the investment plan for Phase 1 and Phase 2

No	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	1,336,575	2,504,925	3,841,500
1.2	Wastewater	641,425	15,897,246	16,538,671
1.3	Equipment and tools	200,000		
ST-1	Sub-total capital investments water supply and wastewater	2,178,000	18,402,171	20,580,171
2	Technical assistance	561,360	2,208,261	2,769,621
3	Contingencies	273,936	2,061,043	2,334,979
Total	**Total costs Phase 1 & 2**	**3,013,296**	**22,671,475**	**25,684,771**

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[48] scenario[49], in reference to the EU Guide to Cost-Benefit Analysis (further EU guide) of investment projects.

The project was prepared using following assumptions:

- The service area for water supply service will be extended with 215 households in Calarasi in with project scenario and no extension of the service area is forecasted for BAU scenario;
- The sewerage service area will be restricted to the current service area of Calarasi Municipal Service Utility, no expanding of the service area is forecasted;
- 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 of 15% until 2030 and down to the 5% in 2045;
- Physical losses will decrease down to the target of 20% in 2045;
- Physical losses will remain at the same level for the forecasted project period;
- 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;

[48] Business as Usual

[49] BAU scenario is defined as what would happen in the absence of the project. For this scenario, projections are made of all cash flows related to the operations in the project area for each year during the period of reference.

- 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[50].

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-

[50] Source: (https://www.bnm.md/en/content/official-exchange-rates)

culated on an annual basis. The major source for the GDP forecast is the Poverty Reduction Strategy[51].

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.

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 2015-2020 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.

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

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

Source: GIZ/MLPS

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: Gross Domestic Product annual percentage of change (%)

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.

Table 6-4: Gross Domestic Product 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

In the optimistic scenario, the GDP growth will remain higher, while in the pessimistic scenario there will be stagnation.

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 Ministry of Economy of the Republic of Moldova.

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 for 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

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[52].

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 table presents the forecast for disposable household income for the period 2015-2020 and 2020-2045.

Table 6-9: Forecast of disposable household income, 2015-2020, capita/month, MDL

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, capita/month, MDL

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.

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;

[52] 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

- 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 subsidized 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 summarizes 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 a decrease in equity (see Table 6-12).

Table 6-12: Balance Sheet of the Calarasi Municipal Service Utility

Balance Sheet	Row Code	2012 (MDL)	2013 (MDL)	2014 (MDL)
ASSETS				
LONG-TERM FIXED ASSETS				
Incomplete fixed assets	040	825,882	148,808	242,000
Fixed Assets	060	38,115,007	68,755,859	73.806.485

Balance Sheet	Row Code	2012 (MDL)	2013 (MDL)	2014 (MDL)
Depreciation of long-term fixed assets	080	-23,482,568	-21,992,162	-25.613.208
Long-term fixed assets	090	15,458,321	46,912,505	48.435.277
Total Non-Current Assets	180	15,458,321	46,912,505	48.435.277
CURRENT ASSETS				
Stocks of goods and materials				
Raw materials	190	452,274	473,243	278.226
Inventory	210			27.588
Stocks of goods and materials	250	452,274	473,243	305.814
Short-term receivables				
Trade accounts receivables	260	1,243,183	1,379,673	967.410
Advances	290			13.332
Receivables related to budget	300			4.238
Receivables from staff	320			63.503
Deferred income	330			727.634
Other short-term receivables	340	48,085	33,421	4.757
Short-term receivables	350	1,291,268	1,413,094	1.780.874
Cash and equivalents				
Settlement Account	410	24.761	31.296	168.350
Cash and equivalents	440	24.761	31.296	168.350
Other current assets	450			149.107
Total Current Assets	460	1.768.303	1.917.633	2.404.145
TOTAL - ASSETS	**470**	**17.226.624**	**48.830.138**	**50.839.422**
LIABILITIES AND OWN EQUITY				
EQUITY				
Share capital and capital surplus				
Share capital	480	10,127,959	10,127,959	16.179.358
Share capital and capital surplus	520	10,127,959	10,127,959	16.179.358
Retained profit (uncovered loss) of previous years	580	-1,012,678	31,270,145	27.564.783
Net income (loss) of the reporting period	590			-1.757.437
Retained earnings (uncovered loss)	610	-1,012,678	31,270,145	25.807.346
Total Equity	650	9,115,281	41,398,104	41.986.704
LONG TERM LIABILITIES				
Special purpose funding and receipts	720	3,140,699	3,067,555	3.646.204
Long-term accrued liabilities	760	3,140,699	3,067,555	3.646.204
Total Long Term Liabilities	770	3,140,699	3,067,555	3.646.204
SHORT-TERM LIABILITIES				
Short-term accounts payables				
Commercial account payables	830	1,025,155	645,590	1.040.829
Short-term accounts payables	860	1,025,155	645,590	1.059.714
Wages owed	870	1,061,098	558,395	463.674
Other employee liabilities	880			288
Insurance	890	2,638,821	2,876,705	3.308.293
Debt settlement related to the budget	900			335.227
VAT to be paid	910			18.498
Other current liabilities	950	245,570	283,789	20.820
Short-term accrues liabilities	960	3,945,489	3,718,889	4.146.800
Total Short Term Liabilities	970	4,970,644	4,364,479	5.206.514
TOTAL – EQUITY and LIABILITIES	**980**	**17,226,624**	**48,830,138**	**50.839.422**

Source: Calarasi Municipal Service Utility

The following conclusions results from the Balance Sheet analysis:

- The largest assets category is long-term assets, which constituted 50.4% of the total. The increase of the long-term assets by MDL 7.9 million in 2013 resulted in long-term investments made by the Operator in 2013;
- Liabilities show that the operator is financed mainly from permanent capital. It is observed an increase in equity of MDL 32.3 million in 2013 compared with 2012 as a results of receiving of other services assets;
- The share of short-term debts in 2014 is 9% of 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 the Calarasi Municipal Service Utility

Income Statement	Row Code	2012 (MDL)	2013 (MDL)	2014 (MDL)
Income from sales	010	7,736,210	8,910,051	10.690.255
Cost of sales	020	4,206,124	4,382,905	6.398.601
Gross profit (gross loss)	030	3,530,086	4,527,146	4.291.654
Other operating income	040	135,266	316,064	510.055
Commercial expenses	050	36,601	57,765	43.981
General and administrative expenses	060	1,958,330	1,931,672	2.560.424
Other operating expenses	070	2,117,977	2,120,915	3.355.861
Result from operating activities: profit (loss)	080	-447,556	72,858	-1.158.557
Result from investing activities: profit (loss)	090	115,039	-291,523	-584.069
Result from financial activities: profit (loss)	100	403,214	32,349,051	5
Result from financial and economic activities: profit (loss)	110	70,697	32,790,386	-1.742.621
Extraordinary result: profit (loss)	120			
Profit (loss) before tax	130	70,69	32,790,386	-1.742.621
Income tax	140		14,816	
Net profit (net loss)	150	70,697	32,805,202	-1.742.621

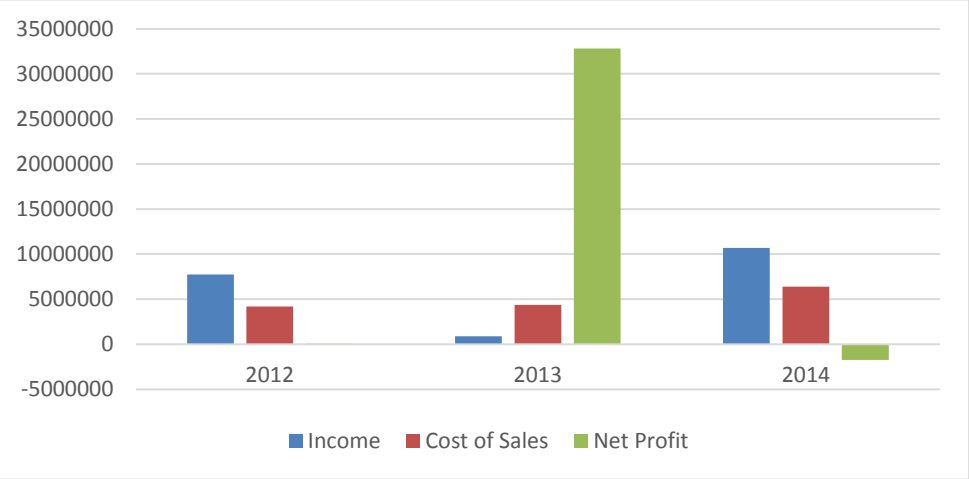
Source: Calarasi Municipal Service Utility

The operator generated losses from operating activities, with the exception of 2013 when the financial result is positive and constitutes MDL 72.9 thousand of profit.

Net profit shows a profitable situation of the operator's activities in 2012-2013 due to positive financial results from financial activities.

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: Evolution of 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 the Calarasi Municipal Service Utility

Cash Flow Statement	Row Code	2012 (MDL)	2013 (MDL)	2014 (MDL)
Operating activities				
Cash inflows from sales	010	8,022,989	9,975,582	12,345,882
Cash paid to suppliers and contractors	020	3,628,950	4,573,825	5,843,710
Cash payments to employees and social security contributions	030	4,207,357	4,398,353	5,464,546
Interest payments	040			
Income tax payments	050	153,101	135,056	
Other cash receipts	060	820,700		369,441
Other cash payments	070	827,389	861,813	1,270,013
Net cash flow from operating activities	080	26,892	6,535	137,054
Financing activities				
Other cash receipts (payments)	200			
Net cash flow from financial activity	210			
Net cash flow before extraordinary items	220	26,892	6,535	137,054
Cash proceeds (payments) from extraordinary items	230			
Net cash flow	240	26,892	6,535	137,054
Positive (negative) foreign exchange differences	250			
Cash balance at the beginning of the year	260	42,896	24,761	31,296
Cash balance at the end of the reporting period	270	69,761	31,296	168,350

Source: Calarasi Municipal Service Utility

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

No	Financial Indicators	2012	2013	2014	Indicators limits
1	Current Liquidity Ratio	0.36	0.44	0.46	1.0 – 2.0
2	ROE, %	0.8	79.2	-4.2	
3	ROA, %	0.4	67.2	-3.4	
4	Operating Profitability, %	-5.8	8.2	-10.8	> 0
5	Debts Service Converge Ratio	0.53	0.85	0.83	<1.2
6	Financial Ratio	0.47	0.15	0.17	
7	Accounts Receivable Turnover, days	61	55	55	< 30
8	Accounts Payable Turnover, days	89	70	49	< 30

Source: GIZ/MLPS

- Profitability indicators (2, 3, and 4) have oscillating values. They are positive for 2013 and negative for 2014;
- Debt ratio indicators (5, 6) show a reduced weight of debt for short-term period, promoting a short-term self-financing strategy;
- Liquidity indicator (1) shows a constant capacity of paying in the short-term, but demonstrates low cash reserves;
- The collection period of receivables decreased from 61 days in 2012 to 55 days in 2014. The accounts payable period also decreased from 89 days in 2012 to 49 days in 2014. This demonstrates the positive tendency of improving the efficiency of financial management.

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 and wastewater services for 2014 of the Calarasi Municipal Service Utility

Consumers	Revenues		Volumes	
	(MDL)	(%)	(m^3)	(%)
WATER SUPPLY	**4,505,680**	**100.0**	**241,359**	**100.0**
Population	3,131,651	69.5	189,756	78.6
Budgetary Consumers	828,899	18.4	29,641	12.3
Private Entities	545,130	12.1	21,962	9.1
WASTEWATER SERVICES	**2,269,736**	**100.0**	**153,600**	**100.0**
Population	987,659	43.5	98,724	64.3
Budgetary Consumers	651,011	28.7	28,353	18.5
Private Entities	631,066	27.8	26,523	17.3

Source: Calarasi Municipal Service Utility

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 of the Calarasi Municipal Service Utility

Tariffs for consumers	2013 (MDL / $1m^3$)	2014 (MDL / $1m^3$)	2015 (MDL / $1m^3$)
Budgetary Consumers	51.00	51.00	51.00

Tariffs for consumers	2013 (MDL / 1m^3)	2014 (MDL / 1m^3)	2015 (MDL / 1m^3)
• Water supply	28.00	28.00	28.00
• Wastewater services	23.00	23.00	23.00
Private Entities	51.00	51.00	51.00
• Water supply	28.00	28.00	28.00
• Wastewater services	23.00	23.00	23.00
Population	26.50	26.50	26.50
• Water supply	16.50	16.50	16.50
• Wastewater services	10.00	10.00	10.00
Weighted average		33.60	
• Water supply		18.96	
• Wastewater services		14.64	

Source: Calarasi Municipal Service Utility

In the period of 2013 - 2015, the tariffs for water and sanitation services provided by the operator 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 of water and wastewater services is shown in Table 6-18. It can be noticed that the majority of the costs are for electricity and salaries.

Table 6-18: Detailed cost structure for 2014 of the Calarasi Municipal Service Utility

Detailed cost structure for 2014	Amount (MDL)	Percentage (%)
WATER SUPPLY	**3,115,287**	**100.0**
Electricity (for pumping)	1,352,916	43.4
Chemicals for water treatment	39,483	1.3
Fuel for transport for water supply	85,603	2.7
Salaries of employees working in water supply	880,693	28.3
• Number of employees (pers.)	36	-
• Average monthly salary per employee	2,039	-
Social benefits (pension fund/insurance)	242,468	7.8
Depreciation	183,609	5.9
Maintenance costs for water supply	200,165	6.4
External services for water supply	1,113	-
Tax for water capturing	81,358	2.6
Other costs	47,879	1.5
WASTEWATER SERVICES	**2,014,629**	**100.0**
Electricity (for wastewater treatment)	624,006	31.0
Chemicals for wastewater treatment	2,867	0.1
Fuel for transport for wastewater services	52,145	2.6
Salaries of employees working in wastewater service	492,919	24.5
• Number of employees (pers.)	16	-
• Average monthly salary per employee	2,567	-
Social benefits (pension fund/insurance)	132,889	6.6
Depreciation	588,619	29.2
Maintenance costs for wastewater services	61,964	3.1
External services for wastewater services	872	-
Other costs	58,348	2.9

Detailed cost structure for 2014	Amount (MDL)	Percentage (%)
ADMINISTRATION AND OVERHEAD	**717,908**	**100.0**
Salaries of employees working in administration	563,516	78.5
• Number of employees (pers.)	12	-
• Average monthly salary per employee	3,913	-
Social benefits (pension fund/insurance)	154,392	21.5

Source: Calarasi Municipal Service Utility

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			30.102.534
Collection of wastewater in Vatamaneasa neighbourhood	FEN	2012	3.102.534
Rehabilitation of water and wastewater systems	FEN	2011-2012	27.000.000

Source: Calarasi Municipal Service Utility; National Ecological Fund

6.2.2 Information on existing loans (if any)

No long-term or short-term loans are in operation at the moment.

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 62.62 million (EUR 3.01 million). The outlays involve the construction of:

- Rehabilitation of water supply network by 12.01 km;
- Extension of water supply network by 3.9 km;
- Rehabilitation of sewer network 4.07 km;
- Clorination unit;
- 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.

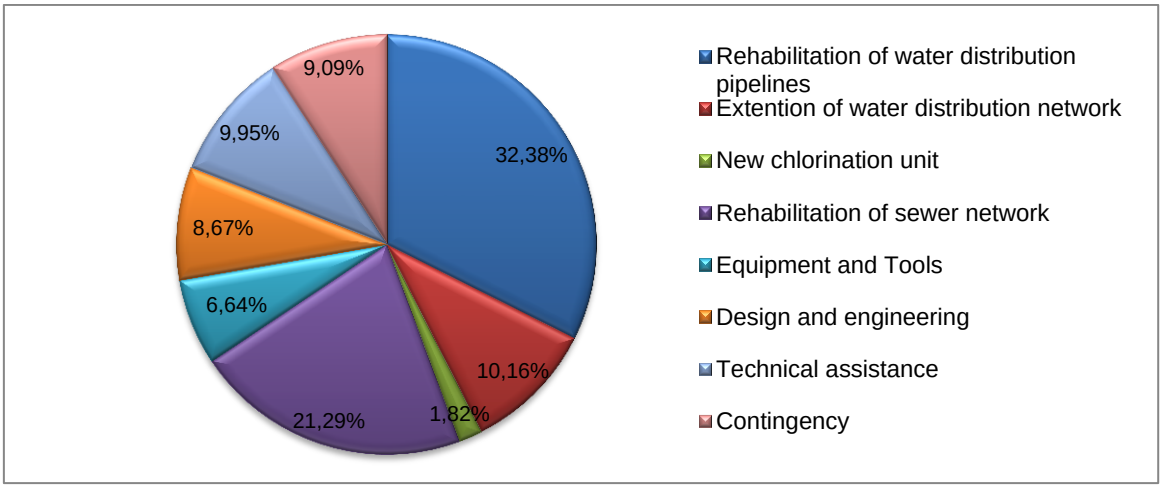
Table 6-20: Summary of the investment costs (MDL mil.)

Project investment outlays	Amount (MDL mil.)	Percentage (%)
Rehabilitation of water distribution pipelines	20.28	32.38
Extension of water distribution network	6.36	10.16
New chlorination unit	1.14	1.82
Rehabilitation of sewer network	13.33	21.29
Equipment and Tools	4.16	6.64
Detailed design and procurement	5.43	8.67
Technical assistance, supervision and capacity development	6.23	9.95
Contingency	5.69	9.09
Total	**62.62**	**100.00**

Source: GIZ/MLPS

The main part of investment costs about 67% will be for the rehabilitation and extension of water and wastewater pipelines, manholes and household connections. Capacity development and technical assistance will be around 19% of the total investment cost. Also, in the project are provided various and unforeseen expenditures in the amount of 10% 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[53].

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 157 households will be connected to water supply system in the first year of the project realization. This estimates the local contribution MDL 0.16 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 realized through loans, than the tariffs calculated, will exceed the affordable constrains. In addition, currently the Calarasi Municipal Service Utility 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 is MDL 11.81 million. This means that apart from citizen contributions of MDL 0.16 million, the additional MDL 11.66 million needs to be provided from other sources.

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 water supply system.

[53] This is not the total household spending capacity, as the connection to the water supply system also has to be financed.

Source of financing	Method used to estimate share in project financing
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'[54]. 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 Calarasi Municipal Service Utility 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.)

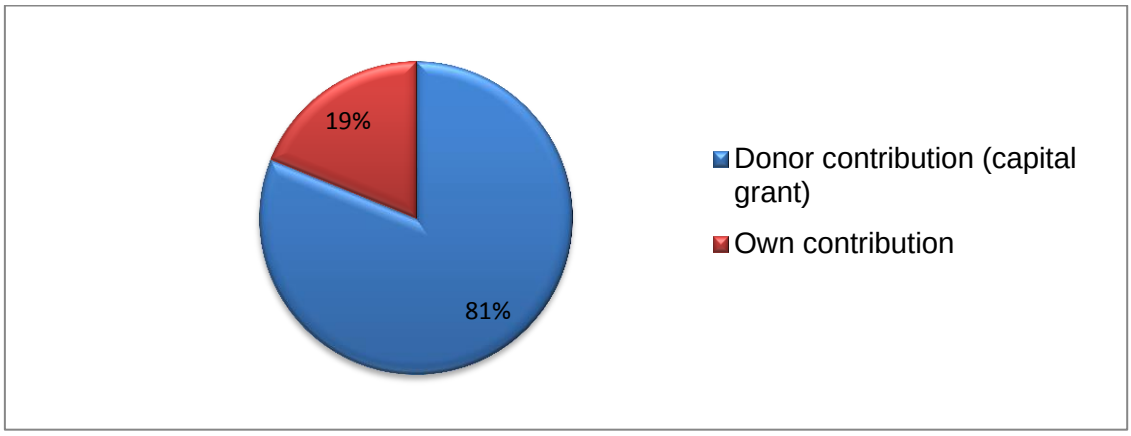
Project financing sources	Amount (MDL mil.)	Percentage (%)
Citizens providing local contribution	0.16	0.25
Domestic and International donors	50.80	81.14
Other domestic sources	11.65	18.61
Water utility	0.00	0.00
Total	**62.62**	**100.00**

Source: GIZ/MLPS

The donor contribution was estimated as 81.1% of the total investment costs, while the local sources' contribution is 18.9%, which will be split down by citizens' contribution about 0.25% and other domestic sources 18.6%.

[54] This is not an EU financing gap calculation, however, it is based on a similar assumptions.

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 distribution network	2.03	10.14	8.11	20.28
Extension of water distribution network	0.64	3.18	2.54	6.36
New chlorination unit	0.11	0.57	0.46	1.14
Rehabilitation of sewer network	1.33	6.67	5.33	13.33
Equipment and Tools	0.42	2.08	1.66	4.16
Detailed design and procurement	0.54	2.72	2.17	5.43
Technical assistance, supervision and capacity development	0.62	3.12	2.49	6.23
Contingency	0.57	2.85	2.28	5.69
Total	**6.26**	**31.31**	**25.05**	**62.62**

Source: GIZ/MLPS

6.3.3 Forecast of operating costs

A detailed cost structure of Calarasi Municipal Service Utility for the year 2014 was presented in section 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 Chapter 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 0.25 MDL/m^3 of water treated. No real cost increase is forecasted;
- **Direct costs (electricity)**. The following assumptions were used for unit consumption:
  - **For pumping stations**. Currently, the electricity consumption for the pumping stations is estimated at 1.814 kWh/m^3;
  - **For wastewater treatment plant**. Currently, the electricity consumption for the treatment plant is estimated at 1.6166 kWh/m^3;
  - **For wastewater pumping station**. Currently, the electricity consumption for the pumping station is estimated at 0.2823 kWh/m^3.

Electricity costs are estimated taking into account the electricity prices and the electricity consumption. Price of energy[55] 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 1.06 million MDL 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, depreciation is at the level of 0.77 million MDL annually. However, depreciation costs will increase to about 1.93 million MDL 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.	1.43	1.57	2.21	2.34	2.31	2.43	3.58	6.50	9.83
Electricity for pumping	MDL mil.	1.35	1.44	2.07	2.20	2.17	2.29	3.38	6.25	9.56
Water treatment costs	MDL mil.	0.08	0.13	0.14	0.14	0.14	0.14	0.19	0.26	0.27
Fixed costs wa-	MDL	2.12	2.12	2.29	2.99	5.36	5.46	6.34	7.94	9.61

[55] It has to be noted that current price of electricity in SP1 and wastewater pumping station is 1.40 MDL/kWh, while in other places it will be 1.58 MDL/kWh, which reflects the difference in prices according to the connection line.

Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
ter	mil.									
Salaries and related costs	MDL mil.	1.12	1.12	1.16	1.21	1.05	1.09	1.64	2.43	3.30
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	0.04	0.25	0.42	0.42	0.42	0.42	0.42
Fuel	MDL mil.	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Depreciation of fixed assets	MDL mil.	0.18	0.18	0.27	0.69	1.02	1.02	1.02	1.02	1.02
General and administrative expenditures	MDL mil.	0.48	0.48	0.48	0.50	0.52	0.55	0.66	0.98	1.33
Other costs	MDL mil.	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total costs for water	MDL mil.	3.55	3.69	4.49	5.33	7.67	7.89	9.91	14.44	19.44
Sanitation service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Variable costs wastewater	MDL mil.	0.63	0.66	0.94	0.99	1.03	1.02	2.16	4.01	7.23
Electricity for pumping	MDL mil.	0.62	0.65	0.93	0.98	1.03	1.01	2.15	4.01	7.22
Wastewater treatment costs	MDL mil.	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
Fixed costs water	MDL mil.	1.63	1.63	1.70	1.99	2.63	2.68	3.15	3.92	4.74
Salaries and related costs	MDL mil.	0.63	0.63	0.64	0.67	0.62	0.64	1.00	1.48	2.01
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	0.02	0.10	0.16	0.16	0.16	0.16	0.16
Fuel	MDL mil.	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Depreciation of fixed assets	MDL mil.	0.59	0.59	0.62	0.79	0.92	0.92	0.92	0.92	0.92
General and administrative expenditures	MDL mil.	0.24	0.24	0.24	0.25	0.26	0.27	0.33	0.49	0.67
Other costs	MDL mil.	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Total costs for wastewater	MDL mil.	2.26	2.28	2.64	2.97	3.67	3.70	5.31	7.93	11.97
TOTAL COSTS	**MDL mil.**	**5.81**	**5.97**	**7.13**	**8.30**	**11.33**	**11.59**	**15.23**	**22.37**	**31.41**

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 the project (MDL mil.)

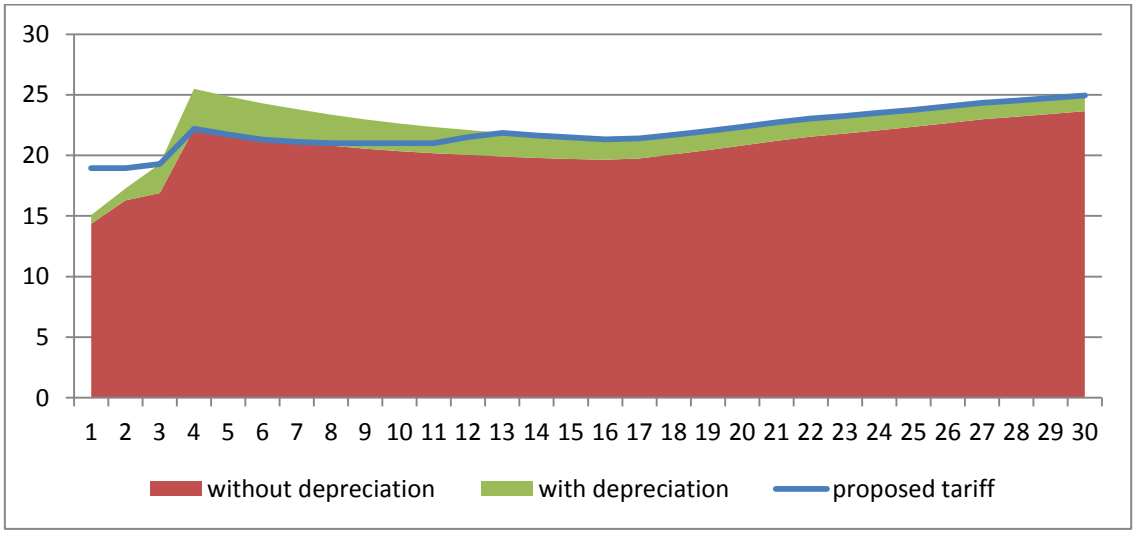
Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Variable and fixed costs	MDL mil.	3.08	3.50	4.23	4.64	6.64	6.87	8.89	13.42	18.42
Depreciation	MDL mil.	0.18	0.18	0.27	0.69	1.02	1.02	1.02	1.02	1.02
Interest and financial costs	MDL mil.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reserve for irregular receivables	MDL mil.	0.00	0.18	0.20	0.21	0.27	0.24	0.25	0.36	0.49
Sale of water	ths m^3	241.4	256.7	272.0	287.3	311.2	326.9	449.1	662.0	799.3
Tariff without depreciation	MDL/m^3	12.78	14.36	16.29	16.89	22.20	21.73	20.35	20.81	23.65
Tariff with depreciation	MDL/m^3	13.54	15.08	17.27	19.29	25.49	24.86	22.63	22.36	24.93
Proposed average tariff	MDL/m^3	18.96	18.96	18.96	19.29	22.20	21.73	21.00	22.36	24.93
Sanitation service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Variable and fixed costs	MDL mil.	1.55	1.70	2.02	2.19	2.75	2.78	4.40	7.02	11.05
Depreciation	MDL mil.	0.59	0.59	0.62	0.79	0.92	0.92	0.92	0.92	0.92
Interest and	MDL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
financial costs	mil.									
Reserve for irregular receivables	MDL mil.	0.00	0.11	0.12	0.12	0.13	0.11	0.13	0.20	0.30
Sale of wastewater	ths m^3	153.6	162.2	170.8	179.3	187.9	196.5	439.7	588.4	723.7
Tariff without depreciation	MDL/m^3	10.09	11.16	12.50	12.85	15.33	14.71	10.30	12.26	15.69
Tariff with depreciation	MDL/m^3	13.92	14.79	16.14	17.23	20.21	19.38	12.39	13.82	16.95
Proposed average tariff	MDL/m^3	14.64	14.79	16.14	16.50	16.50	16.50	12.39	13.82	16.95

Source: GIZ/MLPS

The following Figure 6-4 illustrates how 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 a full cost recovery tariff can be applied starting with year 10 of the forecast for water supply service and in year 7 for the sanitation system.

Figure 6-4: Forecast of the tariff for water (MDL/m^3)

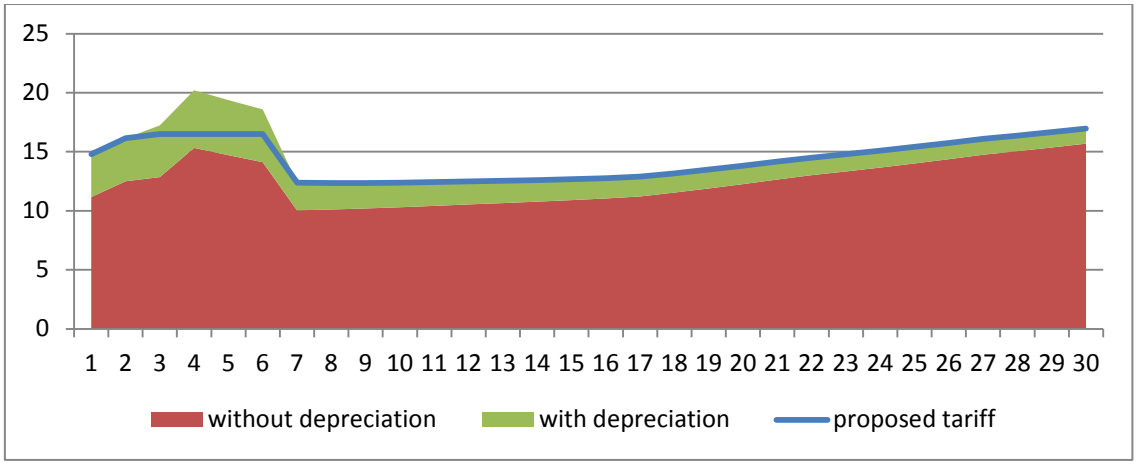


Source: GIZ/MLPS

The tariff of water is forecasted to be about MDL 22.05 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 14.40 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

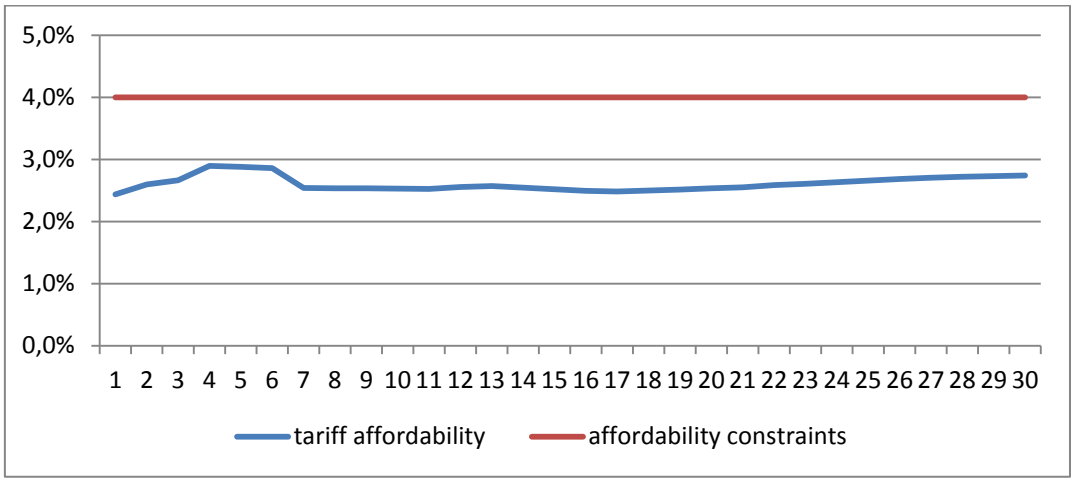
The affordability of tariffs, expressed as the ability of households to pay for services, is estimated as the household expenditures on water and wastewater services expressed as a percentage of disposable household income. For Eastern Europe countries, a common benchmark figure for the affordability 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 2.6% 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 the project (MDL mil.)

Water supply service	**Unit**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2024**	**2034**	**2044**
Sale of water	ths m^3	241.4	256.7	272.0	287.3	311.2	326.9	449.1	662.0	799.3
The weighted average tariff for water	MDL/ m^3	18.96	18.96	18.96	19.29	22.20	21.73	21.00	22.36	24.93
Revenues from water service	MDL mil.	4.58	4.87	5.16	5.54	6.91	7.10	9.43	14.80	19.93
Sanitation service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Sale of wastewater	ths m^3	153.6	162.2	170.8	179.3	187.9	196.5	439.7	588.4	723.7
The weighted average tariff for wastewater	MDL/ m^3	14.64	14.79	16.14	16.50	16.50	16.50	12.39	13.82	16.95
Revenues from sanitation service	MDL mil.	2.25	2.40	2.76	2.96	3.10	3.24	5.45	8.13	12.27
Total Revenues	**MDL mil.**	**6.83**	**7.26**	**7.91**	**8.50**	**10.01**	**10.35**	**14.88**	**22.93**	**32.20**

Source: GIZ/MLPS

The water demand will increase from 241.4 thousand m^3 per year to 799.3 thousand m^3 year at the end of the period of analysis. This increase is determined by the growth

of water consumption per capita from 46.6 l/c/d to 110 l/c/d in 2045 and the increase of consumers by 6,494.

The wastewater inflow is calculated based on the wastewater generation per capita and the number of consumers. It is assumed that the number of consumers will grow from the current number of 8,145 to 18,564 persons and the wastewater generation will increase from the current 37.4 l/c/d up to 110 l/c/d in 2045.

The tariff for water services will increase slowly from 21.0 MDL/m^3 to approximately 25.00 MDL/m^3 at the end of projection period. For the sanitation service the tariff will be higher in the first 6 years and will constitute about 16.1 MDL/m^3, and after that it will decrease and will constitute approximately 14.0 MDL/m^3 in the period 2021-2045.

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 with the exception of the fourth to eleventh years in which the profit is expected to be negative. The average annual profit is expected to be about MDL 150.0 thousand. For sanitation services, the financial results of the service will be positive with the exception of the period 2017-2020 when the financial results will be negative. The average annual profit for the sanitation service will be about MDL 200.0 thousand. The cumulated net profit for the projected period will be positive with a value of MDL 5.79 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 option with the project (MDL mil.)

Water supply service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Sale of water	MDL mil.	4.58	4.87	5.16	5.54	6.91	7.10	9.43	14.80	19.93
Costs of water services	MDL mil.	3.27	3.69	4.49	5.33	7.67	7.89	9.91	14.44	19.44
Gross profit from water services	MDL mil.	1.31	1.18	0.66	0.21	-0.76	-0.79	-0.48	0.36	0.49
Sanitation service	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Sale of wastewater	MDL mil.	2.25	2.40	2.76	2.96	3.10	3.24	5.45	8.13	12.27
Costs of wastewater services	MDL mil.	2.14	2.28	2.64	2.97	3.67	3.70	5.31	7.93	11.97
Gross profit from wastewater services	MDL mil.	0.11	0.11	0.12	-0.01	-0.57	-0.45	0.13	0.20	0.30
Total gross profit	MDL mil.	1.42	1.29	0.78	0.20	-1.32	-1.24	-0.35	0.56	0.79
Income tax	MDL mil.	0.00	0.16	0.09	0.02	0.00	0.00	0.00	0.07	0.09

Net profit	MDL mil.	1.42	1.14	0.69	0.18	-1.32	-1.24	-0.35	0.49	0.69
Cumulated net profit	MDL mil.		1.14	1.83	2.00	0.68	-0.56	-3.82	-0.50	5.51

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 1, table 17 and 18 for the “with project” and BAU scenario.

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 will face 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.)

Project sustainability	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Financial inflows	MDL mil.	0.00	10.09	38.11	33.60	10.20	10.37	14.93	23.02	32.29
Donor contribution (capital grant)	MDL mil.	0.00	5.08	25.40	20.32	0.00	0.00	0.00	0.00	0.00

Project sustainability	Unit	2014	2015	2016	2017	2018	2019	2024	2034	2044
Own contribution	MDL mil.	0.00	1.18	5.91	4.72	0.00	0.00	0.00	0.00	0.00
Revenues from sale	MDL mil.	0.00	7.26	7.91	8.50	10.01	10.35	14.88	22.93	32.20
Increase in current liabilities	MDL mil.	0.00	-3.44	-1.11	0.05	0.19	0.03	0.06	0.08	0.09
Financial outflows	MDL mil.	0.00	10.19	37.70	31.96	9.70	9.68	13.35	20.58	29.65
Investment costs	MDL mil.	0.00	6.26	31.31	25.05	0.00	0.00	0.00	0.00	0.00
Costs of providing services	MDL mil.	0.00	5.20	6.24	6.83	9.39	9.65	13.29	20.43	29.47
Increase in current assets	MDL mil.	0.00	-1.43	0.06	0.07	0.30	0.03	0.06	0.08	0.09
Income tax	MDL mil.	0.00	0.16	0.09	0.02	0.00	0.00	0.00	0.07	0.09
Net cash flow (inflow - outflow)	MDL mil.	0.00	-0.10	0.41	1.64	0.51	0.69	1.58	2.44	2.64
Cumulated cash	MDL mil.	0.17	0.07	0.48	2.12	2.63	3.32	9.74	32.44	57.89

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 62.62 million. In the first years of the project, the net cash flow is insignificant, and is increasing in value in later years. During the 30-year period of analysis, the project is expected to generate a MDL 57.89 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)=	-45.43	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 (See description in Chapter 6.1 ”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 water and wastewater treatment plant, water tanks, 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 sanitation 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[56] 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[57] 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

The demand analysis uses the annual increase in businesses proportional to the GDP increase. Currently, the water supply system is not able to provide water for new businesses. This situation is due to high level of leakages in the water distribution network in Calarasi, and lack of the network in other localities. The situation reduces the possibilities of business development or the business will have to find other sources of water - 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 delivery of water to new business were used. The shadow price was estimated at 30 MDL/m3, as equal to the production price and distribution costs (including distribution by cisterns). The shadow price was applied to the water demand from business.wastewater

[56] Peter Faircloth (Cranford Economics) and others “Approximation of Environmental legislation A Study of the Benefits of Compliance with the EU Environmental Acquis”

[57] 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 sewer 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.

Social effects due to uninterrupted water supply

Current working conditions in communes which have water supply are not optimal. The source is often working close to its maximum capacity and sand is often observed. Sand and poor maintenance often cause failure of the pumps. As the result, high pressure fluctuations in the water distribution network occur and sudden interruption of water supply is observed.

The valuation of the social benefits for uninterrupted water supply is difficult, thus it was not quantified.

New business enterprises

Demand analysis uses the annual increase in businesses proportional to the GDP increase. Currently, the supply system is not able to provide water for new businesses. This situation is due to high level of leakages in the water distribution network in the Calarasi and lack of the network in other localities. The situation reduces the possibilities of business development or the business will have to find other sources of water - 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 delivery of water to new business were used. The shadow price was estimated at 30 MDL/m^3, as equal to the production price and distribution costs (including distribution by cisterns). The shadow price was applied to the demand from business.

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.

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- 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 sewer 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 8% while the ENPV is MDL 18.21 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 service 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. Calarasi 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 Calarasi, commune of Tuzara, and localities of Niscani and Paulesti have agreed to appoint Calarasi Municipal Services Utility 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 Water Supply and Sanitation (WWS) services in the Calarasi 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 services dated December 13, 2013, the local councils have the competence to:

- Draw up and implement own business operations and development plans 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 wastewater public systems as the integrated components of the administrative-territorial units' infrastructure;
- Approve the regulations and specifications of the services;
- 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 organization, 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[58], 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, villages 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

[58] Art. 8 of Law no. 303 on water supply and wastewater 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 the 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 Calarasi Municipal Services Utility.
  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 Calarasi Municipal Services Utility 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 obligations assumed by entire property it owns under ownership right; • The administrative-territorial units are not re-	• The company is liable for its obligations with all its assets; • Shareholders are not liable for enterprise's obligations; they bear the risk of losses	• The enterprise is liable for its obligations by entire property it owns under ownership right; • The enterprise is not liable for obligations of its share-

	Municipal enterprise (inter-municipal)	Limited liability company	Joint-stock company
	sponsible for the obligations of municipal enterprises; • Municipal enterprises are not responsible for the obligations of administrative-territorial units.	resulting from the enterprise's activity within their participation in the share capital.	holders; • 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; • Subsidies from Local Public Administrations.	• 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; • Independence from Local Public Administrations; • More simple procedure on setting up and registration.	• 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); • Higher transparency of activity and management of public goods.

	Municipal enterprise (inter-municipal)	Limited liability company	Joint-stock company
Weaknesses	• Outdated legal regulations in this sector; • Limited possibility for investments; • Dependence on founding Local Public Administration; • 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 services 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.

The implementation of Phase 1 of this feasibility study does not depend on the establishment of the regional operator, but as Phase 2 begins, the work to establish the regional operator will be completed.

7.3.2 Delegated management contract

Under a delegated management contract, a LPA as delegator assigns to a licensed operator as a delegate, 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[59].

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 (delegatee), 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 Calarasi, commune of Tuzara, and localities of Niscani and Paulesti), signed by each

[59] Art. 13, par. 8 of Law no. 303

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 the 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 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[60].

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 Calarasi, commune of Tuzara, and localities of Niscani and Paulesti) should decide on the management model for water supply and wastewater services, specifically direct management or delegated management.

Under Law no. 303[61], 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.

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 Calarasi Rayon.

[60] Art.13, par. 12 of Law no. 303
[61] Art. 13, par. 14 of Law no. 303

Establishment of a working group to identify the fastest and most viable solution for setting up the regional operator. 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 Calarasi Municipal Services Utility 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 Calarasi, commune of Tuzara and localities of Niscani and Paulesti are responsible for:

- Drawing up and approving the delegated management contract and awarding this contract directly to the regional operator;
- Defining and elaborating performance indicators for water supply and wastewater services provided to consumers;
- Elaborating and approving the regulations and 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: An outline time schedule

No.	Method chosen for setting up the regional operator	Steps	Time
a)	Reorganisation of Calarasi Municipal Services Utility	Reorganisation of the Calarasi Municipal Services Utility into Joint Stock Company with Calarasi Town Council as a sole shareholder. Increase of the authorised capital stock through acceptance of the new shareholders, in person of administrative-territorial units Tuzara, Niscani, Paulesti 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

No.	Method chosen for setting up the regional operator	Steps	Time
b)	Setting up of a new business enterprise	Setting up of the Joint Stock Company, whose founders (shareholders) are Calarasi Town Council; Tuzara Local Council; Niscani Local Council and Paulesti 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 a water supply and wastewater services operator in the town of Calarasi, the reorganisation of the Calarasi Municipal Services Utility into Joint Stock Company (regional operator) is recommended 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). Once Phase 2 starts, the full regionalisation of water supply and wastewater services within the localities of the Calarasi Rayon will be completed.

7.6 Corporate and human resources development of the operator

The existing institutional setup of the Calarasi Municipal Services Utility will require considerable changes, in order to meet the increasing demands of the expanding service area.

In general, Calarasi Municipal Services Utility is currently overstaffed, as the staff efficiency indicator is 7.49 (both water and wastewater) per total (water and wastewater) connections, while an average value for Moldova is 5.5[62] persons.

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 the company (e.g. joint-stock company, municipal enterprise or use some other form) and ways of service management (e.g. direct or delegated to the company, certain activities outsourced to third-parties etc.). This may have an impact on 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;

[62] Moldova Apa-Canal Association. Water Utilities Benchmarks, 2013

- 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 considerable extension of water services over the rural localities is planned, while most of investments will be spent on rehabilitation of the existing networks (increase of 3% in total number of water consumers). The extension of wastewater services will have no considerable impact on increase of the number of consumers.

This means that the proposed investments for Phase 1 do not require an increase of the Operator's staffing. Therefore, the company needs to improve its staff efficiency to be able to operate WSS services in a sustainable manner in the future.

It is noteworthy that currently the Operator provides different municipal services, including water supply, wastewater collection and treatment, heating, town cleaning and development etc. All these services have common accounting system and no separate budgets. This situation does not allow an efficient monitoring and control of costs per different types of activities and therefore a separation of costs and accounting for water and wastewater services from other types of activities is recommended to be implemented by the Operator in first place.

Also, reduction of administrative and support staff is advised. Currently, only 52 out of 130 staff members are dedicated to water and wastewater operations, while 19 persons deal with the other services and 59 persons provide support and administrative services to all activities of the Operator.

A proportional split of administrative staff and support teams (total 59 persons) per different types of activities gives an estimative figure of 12 persons dedicated to water and wastewater services.

It is projected that the Operator 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 6.5 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 57 staff persons in 2018. In absolute values this means a decrease by 7 persons, as compared to the current situation. This could be done on account of the staff which approaches retirement age.

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 1000 W&WW connections by 2021. It is expected that that number of water 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: Human resources

Indicator	Unit	Current Situation, as of 2015	Projected Situation for 2018	Projected Situation for 2021
Number of water staff	pers.	36	31	38
Number of wastewater staff	pers.	16	14	19
Number of administrative and other W&WW staff	pers.	12	12	12
Total Number of staff	pers.	64	57	69
Number of water connections	con.	5,285	5,436	6,793
Number of wastewater connections	con.	3,258	3,258	5,768
Water & related admin staff per 1,000 W connections	pers./1,000con	8.33	7.17	6.77
WW & related admin staff per 1,000 WW connections	pers./1,000con	6.14	5.52	3.99
Total staff per 1,000 W&WW connections	pers./1,000con	7.49	6.50	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 Calarasi Municipal Services Utility, 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 and social assessment

It is proposed to rehabilitate and extend the water supply and wastewater system in Calarasi Town and in the localities of Niscani, Novaci and Paulesti.

The feasibility study for Calarasi town and Niscani, Novaci and Paulesti Localities has been developed for the WSS sector and it refers the following components:

Water Supply System:

- Rehabilitation of the water distribution network in the town of Calarasi- 12,010 m;
- Extension of the water distribution network in the town of Calarasi- 3,900 m;
- Installation of a new chlorination unit;
- Construction of the water distribution network in the Novaci Locality -10,130 m;
- Construction of water tower in the Novaci Locality- 2 pcs;
- Construction of water supply pumping station in the Novaci Locality;
- Construction of water distribution network in the Niscani Locality– 11,585 m;
- Construction of water distribution network in the Paulesti Locality – 9,375 m;
- Construction of water supply reservoir in the Paulesti Locality – 2 pcs;

Wastewater system:

- Rehabilitation of sewerage network in the town of Calarasi – 8,329 m;
- Extension of sewerage network in the town of Calarasi – 26,700 m;
- Construction of wastewater pumping stations in the town of Calarasi – 1 pcs;
- Extension of existing wastewater treatment plant;
- Construction of sewerage network in the Novaci Locality – 7,961 m;
- Construction of wastewater pumping station in the Novaci Locality – 1 pcs;
- Construction of sewerage network in the Niscani Locality – 13,420 m;
- Construction of wastewater treatment plant in the Niscani Locality– 1 pcs;
- Construction of sewerage network in the Paulesti Locality – 6,530 m;
- Construction of wastewater treatment plant in the Paulesti Locality– 1 pcs.

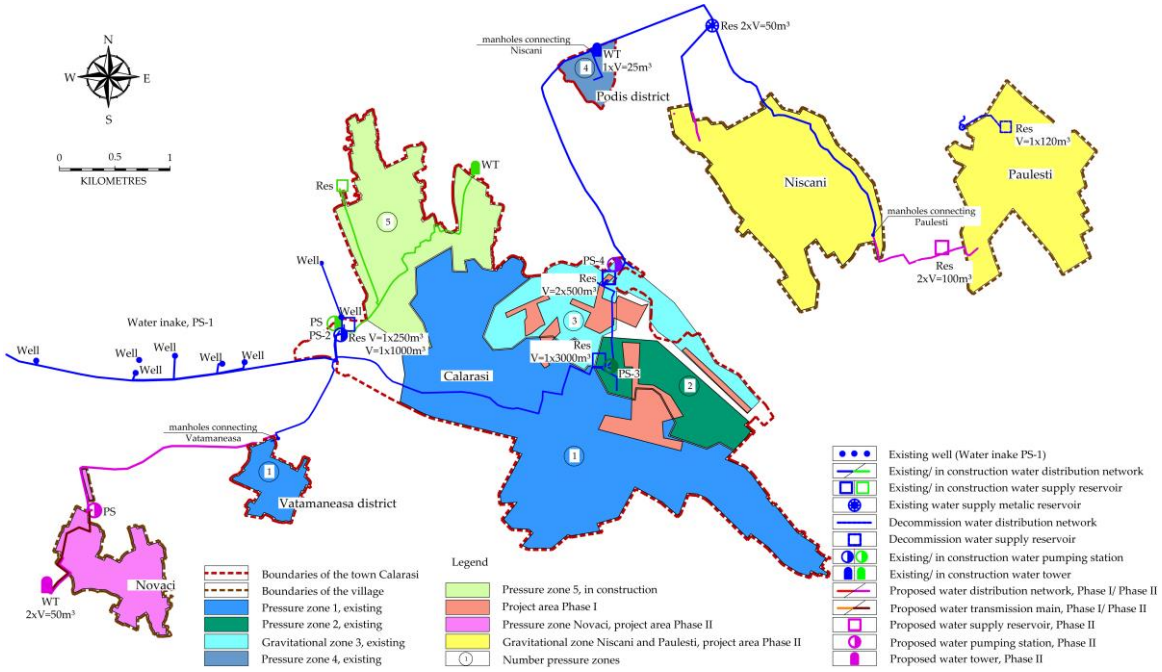
The investment programme includes short, medium and long term measures designed for a planning horizon until the year 2045. The short-term measures are referred to as Priority Investment Measures and are again sub-divided into two phases as follows:

- 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 (this period might be extended depending on the availability of funds and the capacity of the operator or implementing agency).

Priority Investment Plan (PIP) includes 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 Calarasi and localities of Novaci, Niscani and

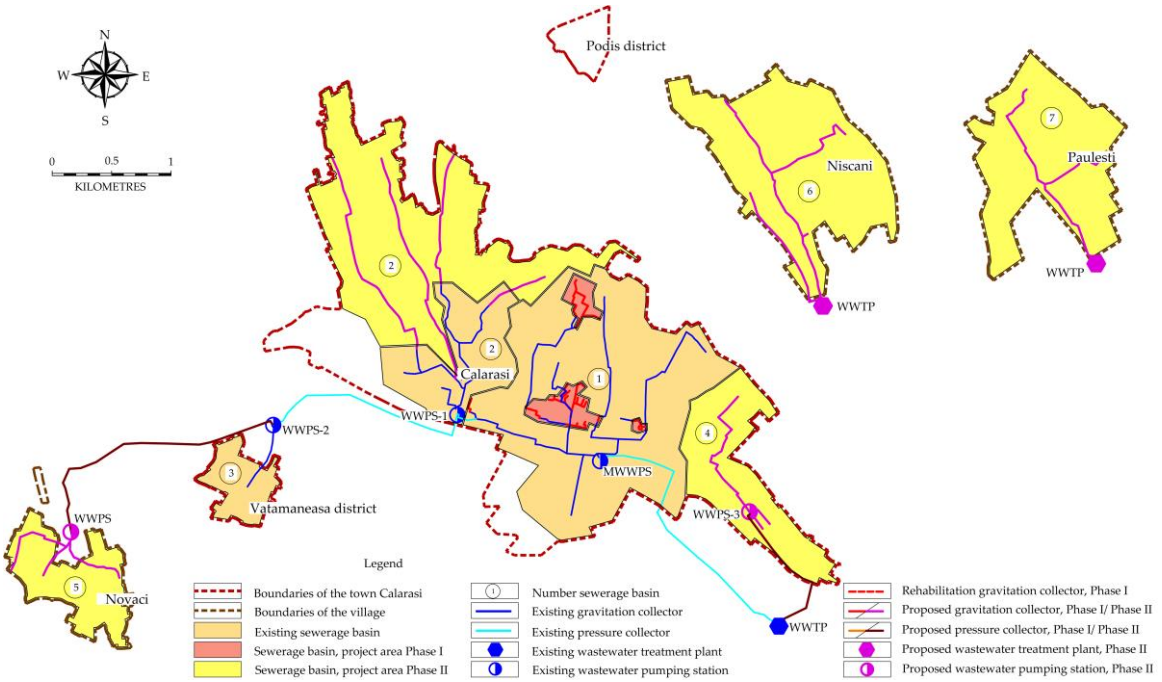
Paulesti, proposed for Phase 1 and Phase 2 are presented in the Figure 8-1 and Figure 8-2.

Figure 8-1: Scheme of existing and proposed water supply system in the town of Calarasi and localities of Novaci, Niscani and Paulesti



Source: GIZ/ MLPS

Figure 8-2: Scheme of existing and proposed sewerage system in the town of Calarasi and localities of Novaci, Niscani and Paulesti



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, as well as 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.

8.1 Introduction

This document presents the Environmental and Social Assessment (ESA) for Phase 1 of the feasibility study ("the Project"). The Environmental and Social Assessment is part of this feasibility study.

8.1.1 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.

8.1.2 Methodology

The methodology used for the preparation of this Environmental and Social Assessment was based upon the review of the 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

8.1.3 Study Area

The Project Area of Influence (PAI) comprises the territory of the town of Calarasi .The area that is foreseen for water supply rehabilitation and extension and the proposed sewerage area for rehabilitation is shown in the figures in Chapter 8.3 Project Description and Location.

8.2 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.

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 describes in detail the legal framework conditions and the SEE approval process.

8.3 Project description and Location

The FS involves the new construction and rehabilitation of various components in the WSS sector. It is designed to improve the service standards of the WSS system in Calarasi and the localities of Niscani, Paulesti and Novaci (commune of Tuzara).

Based on the existing situation the Project (which in this context refers to Phase 1, priority measures) foresees improvement of water supply and wastewater collection services as follows:

Water supply system:

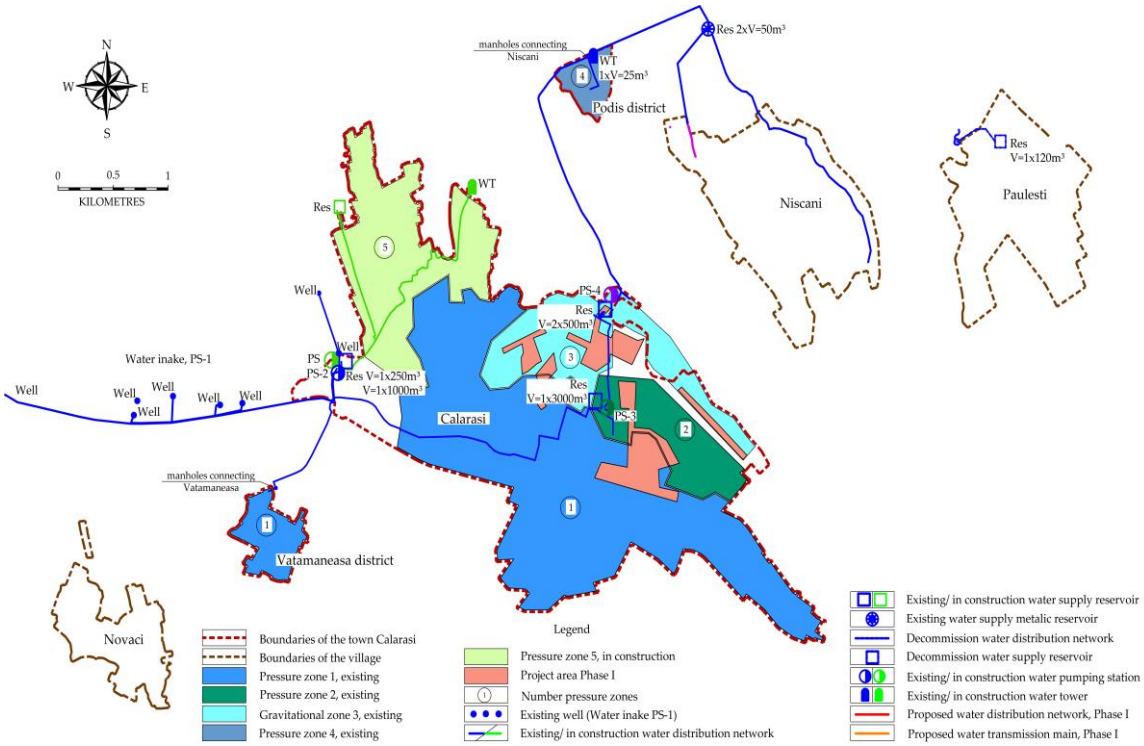
- Rehabilitation of the water distribution network in the town of Calarasi- 12,010 m;
- Extension of the water distribution network in the town of Calarasi- 3,900 m;
- Installation of a new chlorination unit.

Wastewater system:

- Rehabilitation of sewerage network in the town of Calarasi – 4,070 m.

The scheme of existing and proposed water supply system in the town of Calarasi (Phase 1) is presented in the following figure.

Figure 8-3: Scheme of existing and proposed water supply system in the town of Calarasi[63]

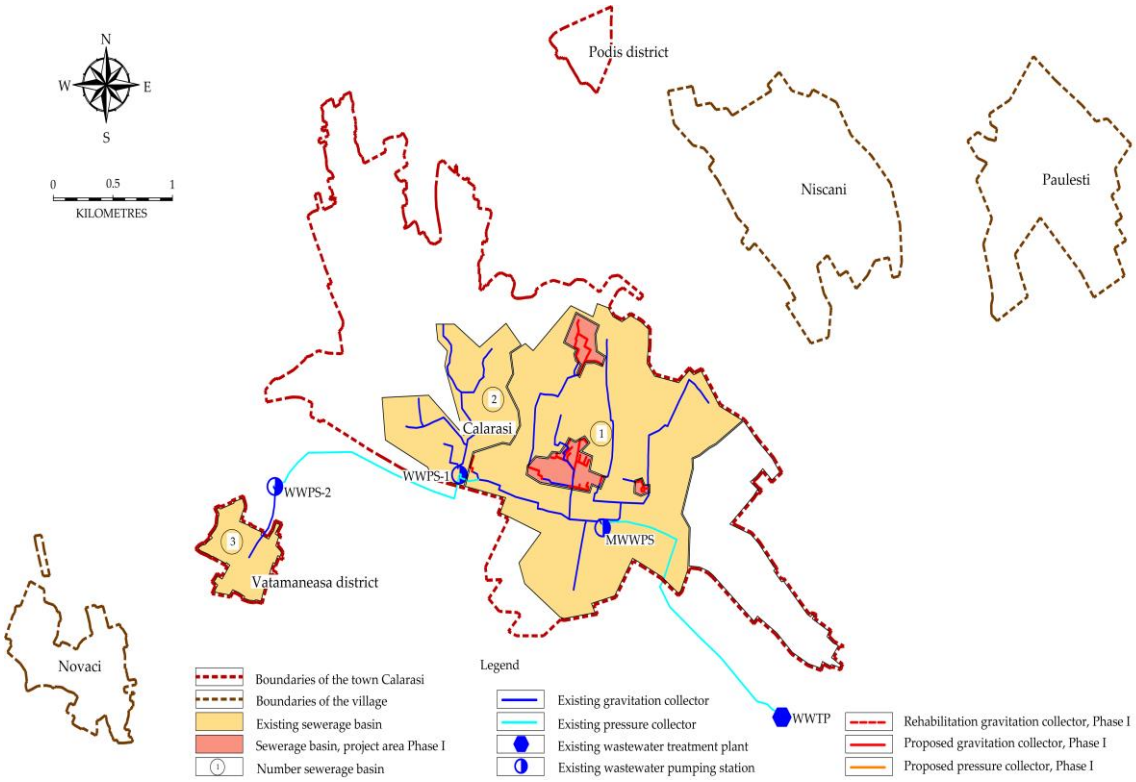


Source: GIZ/MLPS

Scheme of existing and proposed wastewater system in the town of Calarasi (Phase 1) is presented in the following figure.

[63] Phase 1

Figure 8-4: Scheme of existing and proposed wastewater system in the town of Calarasi[64]



Source: GIZ/MLPS

8.4 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.

8.4.1 Construction stage

In the Water Supply System the following main elements are planned.

Water Supply Sector:

- Rehabilitation of the water distribution network in the town of Calarasi- 12,010 m;
- Extension of the water distribution network in the town of Calarasi- 3,900 m;
- Installation of a new chlorination unit.

The new pipes for installing will be steel and polyethylene. Pipes of smaller diameter will be laid for rehabilitation and extension of the distribution network in Calarasi town. Trenches for new pipe sections will be dug using a backhoe digger, supplemented by manual digging.

[64] Phase 1

Excavated soil will be placed alongside the open trenches and the pipes will be placed in the trench. The trench will be refilled with excavated soil and sand and compacted manually. The depth of trench will be 1.5 m – 2.5m depending on topographical conditions. The width of the trench will vary depending on the pipe's outside diameter, type of soil and groundwater level. The minimum clear width of the trench, sheeted or unsheeted, measured at the spring-line of the pipe will be 0.3 m greater than the outside diameter of the pipe. The maximum clear width of the trench at the top of the pipe should not exceed a width equal to the pipe outside diameter plus 0.6 m. In average, a width of 0.6 – 1.0m is expected. After construction part of trench will be occupied by pipe and sand layer, and trench is refilled with the excavated material.

Earthwork for construction of the water towers will consist of site clearing, trench excavation, grading, embankment filling and backfilling of excavation trench after built in of structures. Excavated soil will be placed alongside. Surplus soil will be used for other construction activities. Base of foundation will be gravel and sand. Main construction materials used for the various components of the pumping station are concrete and steel.

In the wastewater system the following main elements are planned:

- Rehabilitation of sewerage network in the town of Calarasi – 4,250 m.

Construction practices for these works are described in the following.

The sewer lines in Calarasi town 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 depth of the trench will be between 1.5 – 2.5 m. Width of the trench will be 0.8 m. 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. The depth of trench will be 1.5 – 2.5m depending on topographical conditions. The width of the trench will be 0.6-1.0m. After construction part of trench will be occupied by pipe and sand layer, and trench is refilled with the excavated material.

Water needed for civil works comprises of potable water and construction 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 Bic River or other surface waters in the vicinity of construction site.

Transportation routes: construction site is accessible via the Regional Road R1 and local roads. At some locations, construction of temporary access roads might be required.

For mitigation measures please refer to subsequent chapters.

8.4.2 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 wastewater system will require repair and maintenance activities like cleaning and inspection. Repair work will be conducted in the same way the pipe was laid.

No significant environmental impacts are associated with the operation of the new water supply and wastewater system.

8.5 Environmental and social baseline conditions

Calarasi is located in central Moldova in the valley of the Bic River. Most of the study area is built up area. The adjoining area is mainly under agricultural use.

8.5.1 Physical environment

The prevailing chernozem soils in the wider vicinity of the study area support substantial and diverse agricultural production such as wheat, corn, barley, soybeans, sunflower, fruits and vineyards. Beef and dairy cattle, as well as pigs, sheep and poultry are mainly raised on a family farm scale. Within the floodplain of the Bic River alluvial soils prevail which also show a high fertility.

The whole study area is located within the watershed area of river Bic. River Bic is one of the 8 rivers of the country exceeding 100 km in length and is a right hand tributary of the river Nistru. Within the floodplain of Bic River high ground water levels are expected to occur.

The regional climate is temperately continental and characterized by a lengthy frost-free period, a comparatively mild winter, and significant fluctuations in temperature, erratic rainfall 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 rivers. The winter snow cover is usually thin. Winds tend to mainly come from northwest or southeast.

8.5.2 Biological environment

The natural vegetation of the study area is the Codri Forest. Main species in this type of forest are the beech (*Fagus sylvatica*), sessile oak (*Quercus petraea*) and pedunculate oak (*Quercus robur*). Other species are hornbeam (Carpinus betulus), silver lime (*Tilia tomentosa*), ash (*Fraxinus excelsior*) and others.

Due to human settlement and agricultural use the former forests in the study area have been cleared and are substituted by built up areas, agricultural fields and pastures. In the floodplain of the River Bic some relicts of natural habitats exist.

There is no area of natural protection status within the Project's area of influence.

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 shoreline of the river Bic 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*)

8.6 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 finalization of construction activities. Vegetation planting and stabilization of site, including replacement of any native plant species that were removed during construction activities.	Construction Contractor	Construction and labour camp, storage area. Aqueduct, distribution network, waste water pumping stations and water towers.	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 at aqueduct and distribution network. Construction site for waste water pumping stations and water towers.	Part of construction cost
	The Contractor shall coordinate with local Traffic Management Department to minimize 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	Contractor	Transportation routes of construction material	Part of construction cost

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
	schools and hospitals if the distance to the construction site is less than 50 m.			
Noise Pollution	Maintain machinery and vehicle silencer units to minimize noise 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.	Construction Contractor	Construction site in Calarasi, town	Part of construction 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	Construction Contractor	Construction site in Calarasi,town and in the localities of Novaci, Niscani and Paulesti	Part of construction cost

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
	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.			
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. 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.	Construction Contractor	Construction site, Access Roads	Part of construction cost
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 Contrac-	Construction site	Part of construction cost

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
	construction the same soil shall be replaced on the top.	tor		
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 Contractor	Calarasi town and the localities Novaci, Niscani and Paulesti	Part of construction cost
Socio-economic benefits from employing local people in construction work	To the extent possible labour force should be drawn from the local community.	Construction Contractor	All construction sites	Part of construction 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 recognized 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				

Activity / Impacts	Mitigation measures	Responsibility	Location	Cost
Influx of insects, rodents	Regular waste and sludge disposal	State Environmental Inspection of the Ministry of Environment and Centre of Public Health of the Ministry of Health	WWTP	Part of operation costs
Potential waste water discharges	Regular monitoring and control of pipe system regarding leakages	State Environmental Inspection of the Minis-try 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 Minis-try of Environment and Centre of Public Health of the Ministry of Health	Water intake, transmission main, distribution network	Part of operation cost

Source: GIZ/MLPS

8.7 Social and gender assessment of WSS project in Calarasi

8.7.1 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, with Calarasi rayon exhibiting the same trend**. 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. The same situation is observed in Calarasi rayon where the population decreased by 313 persons: from 78,795 in 2012 to 78,482[65] persons in 2014. The population of Calarasi town was 16,500 in 2014, which represented 21% of the total population of Calarasi rayon and 0.46% 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 breakdown of the population by gender was: 51.9% women and 48.1% men. In Calar-

[65] The recalculation of the data regarding the population of Calarasi rayon excluding the migrants missing the country more than 12 months show that the number of the present population is considerably lower, being of 59.8 thousand inhabitants (Strategia de dezvoltare integrata a raionului Calarasi, 2013-2020).

asi rayon, the gender distribution was the following: women – 50.7% and men – 49.3%[66]. In Calarasi town women constituted 51.1% and men 48.9% in 2013;

- **On average, at the national level women have higher life expectancy at birth than men by 7.9 years in 2014[67].** 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 life expectancy 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 Calarasi rayon, the average duration of life by ages is similar to the average per country (men – 67.7 years, women – 72.8 years)[68];
- **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 Calarasi rayon the average age increased from 36.5 years in 2012 to 36.9 years in 2014 while for the town the figures are 37.2 in 2012 and 37.9 in 2014. The average age by gender for the Project area is similar to the one at national level: men – 36.1 years, women – 39.5 years[69];
- **The employment rate among women was 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%)[70]. The analysis of 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[71];
- **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%)[72];
- **Women are mostly employed in low-paying jobs and occupy lower positions in the job hierarchy where they are employed**[73]. The statistical data

[66] Statistica teritoriala, 2014.

[67] http://www.statistica.md/newsview.php?l=ro&id=3814&idc=168.

[68] Statistica teritoriala, 2014.

[69] Ibid.

[70] Statistical databank, NBS website.

[71] Statistica Moldovei, 2014. Portretul statistic al barbatilor si femeilor in Republica Moldova.

[72] Ibid.

[73] http://www.undp.md/mdg/MDG3/gender.shtml.

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[74];

- **Unemployment affects men more than women**. The unemployment rate at the country level was 3.9% in 2014, compared to 5.6% in 2012[75], the rate among unemployed men being higher (4.6%) compared to women (3.1%). In 2013, in Calarasi town the unemployment rate was 1.9% 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 Calarasi rayon the gender pay gap was 91.7% or a difference of 279 MDL between the salary of men and women[76];
- **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 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)[77];
- **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%[78];
- **The average nominal monthly earning per employee** in Calarasi in 2013 was 3,209 MDL (compared to 3765.1 MDL in the country overall), with 611 MDL more than in 2011; this constitutes 87.3% 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, Calarasi rayon is ranked third for the index of multiple deprivation and fifth in income deprivation specifically[79];

[74] Statistica Moldovei, 2014. Portretul statistic al barbatilor si femeilor in Republica Moldova.

[75] Statistical databank, NBS website.

[76] Promote gender equality and empower women, PNUD Moldova; Statistica teritoriala 2014.

[77] Biroul National de Statistica, Chisinau 2013. Utilizarea timpului in Republica Moldova. Sinteza.

[78] Statistica Moldovei, 2014. Portretul statistic al barbatilor si femeilor in Republica Moldova.

[79] 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).

- **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[80];
- **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)[81];
- **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 Calarasi Rayon Council comprises 33 councillors, of whom two (6%) are women[82]. Regarding the local council of Calarasi town, of 23 councillors four (17.4%) are women[83];
- 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[84]. In Calarasi town, the vulnerable families constituted 18.4% of the total families in 2012 and included 781 families with persons with disabilities, 104 families – with one parent, 58 families – with three and more children, 51 families –that have children under the tutorship (IDAM, 2012)[85];
- **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 neces-

[80] 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.

[81] CEDAW. Replies of Moldova to the list of issues.

[82] Web page of the Rayonal Council Calarasi http://www.calarasi.md/index.php/consiliul-raional/consilieri

[83] Web page of the town hall Calarasi http://www.calarasi-primaria.md/index.php?pag=page&id=28&l=

[84] Raport privind saracia in Republica Moldova, 2014.

[85] Ministry of Economy, Deprivation Index for Small Areas, 2012 http://www.mec.gov.md/ro/content/indicatori-social-economici-pe-localitati

sary 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 wastewater 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[86].

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)[87] 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 sanitation, centralised heating systems, education and health. Given this situation, social and gender mainstreaming is an essential component of the implementation of WSS project in Calarasi town. The methodical approach and the description of the pilot gender study (performed for the town of Straseni and considered to apply also for the FS of Calarasi) are presented in Annex 8.2.

[86] Raport privind saracia in Republica Moldova, 2014.

[87] 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 Calarasi 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 and Engineering for Phase 1 investments;
  - Corporate Development Program;
  - Stakeholder Participation Program;
  - Water Supply Network Analysis and Water Loss Reduction Programme;
  - Medium to Long-term Sanitation Study.
- Capital investments and goods:
  - Rehabilitation of 12 km water distribution network in the town of Calarasi;
  - Extension of 3.9 km water distribution network in the town of Calarasi;
  - Construction of a new chlorination unit;
  - Rehabilitation of 4 km sewer network in the town of Calarasi;
  - 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.

9.3 Procurement strategy

It is proposed to arrange procurement into four different contracts:

- Design & engineering contract;
- Works contract;
- Supply contract;
- Technical assistance.

9.3.1 Design & engineering contract / technical assistance

Design and Engineering is proposed to be procured separately from the remaining Technical Assistance Tasks (Corporate Development Program, Stakeholder Participation Program, Water Supply Network Analysis and Water Loss Reduction Programme, Medium to Long-term Sanitation Study) as the requirements for the consulting company are different.

9.3.2 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 of equipment	Technical assistance
1	Water supply					
1.1	Rehabilitation of the water distribution network in the town of Calarasi	975,700		975,700		
1.2	Extension of the water distribution network in the town of Calarasi	305,875		305,875		
1.3	Construction of a new chlorination unit (building and equipment)	55,000		55,000		
2	Wastewater					
2.1	Rehabilitation of the sewer network in the town of Calarasi	641,425		641,425		
3	**Equipment and tools** for operational performance improvement (water supply and wastewater)	200,000			200,000	
4	Technical assistance					
4.1	Design and Engineering for Phase 1 investments (12% of investment costs)	261,360	261,360			
4.2	Technical assistance (Corporate Development Program, Stakeholder Participation Program, 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)	273,936	26,136	197,800	20,000	30,000
GT	Total costs for per contract	3,013,296	287,496	2,175,800	220,000	330,000

Source: GIZ/MLPS

Table 9-2: Procurement plan

N°	Description	Estimated contract value[88], EUR	Contract type	Procurement method
1	Design and Engineering for Phase 1 investments	287,496	Consulting services	Competitive
2	Construction works: Rehabilitation and extension of water supply network and sewer network in Calarasi Town	2,175,800	Works	Open
3	Supply of equipment for Operational performance improvement	220,000	Supply of goods	Shopping
4	Technical assistance: Corporate Development Program, Stakeholder Participation Program, Water Supply Network Analysis and Water Loss Reduction Programme, Medium to Long-term Sanitation Study	330,000	Consulting services	Competitive
GT	**Total Amount**	**3,013,296**		

Source: GIZ/MLPS

9.4 Project implementation plan

9.4.1 Key steps of project implementation

Key steps in project implementation will be the following:

9.4.1.1 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.

9.4.1.2 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[89] be the LPA Calarasi, which is the owner of the assets or the Municipal Services Utility of Calarasi, 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;

[88] Including Contingencies

[89] Depending on the funding arrangement (donor and type of contract)

- Tendering process for services and works contracts;
- 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.

9.4.1.3 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.

9.4.1.4 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.

9.4.1.5 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.

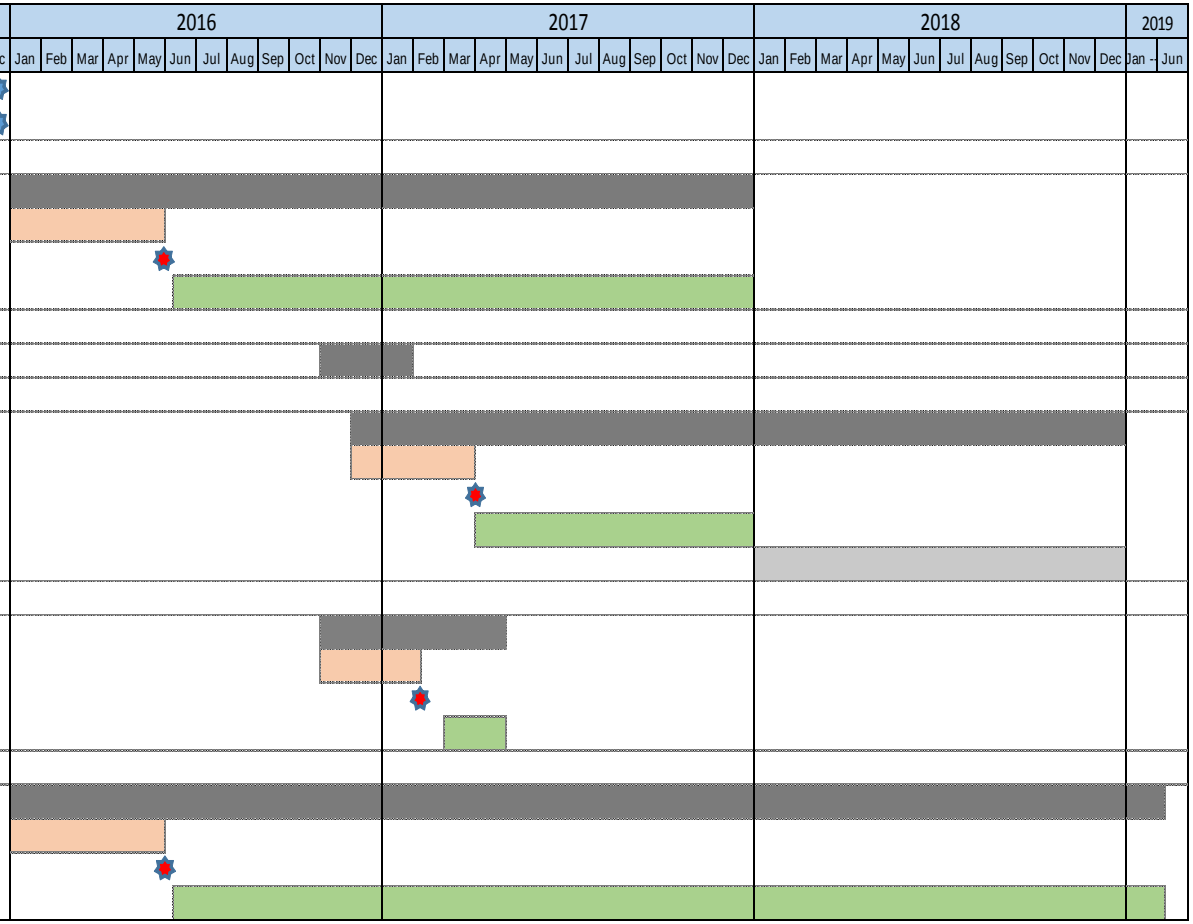
For both instruments the setting of targets and indicators as well as the methodology and administration of data collection need to be organised.

9.4.2 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[90].

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[91]."

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[92]". 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;

[90] European Commission, Guide to Cost-Benefit Analysis of Investment Projects, Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

[91] Ibid., p 69.

[92] Ibid., p. 71.

- The operators will implement unified tariffs for the entire area of their operations;
- 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 operator will not make necessary improvements to improve and expand its services;
  - Operator size – operators are rather small in Moldova, making regionalization of services difficult;
  - Institutional capacity – weak institutional capacity on the operational level in Water Supply and Sanitation (WSS), including financial weaknesses of the institutions to attract investments, manage assets, as well as provide quality services to the population;
  - Institutional capacity – ongoing and delayed decentralization process which leads to uncertainty in the WSS sector and artificial fragmentation of the areas managed by the specialized institutions;
  - Institutional capacity – financial weakness of the institutions which increases the perceived risks of making investments in WSS.
- Operational risks, including:
  - Insufficientnumber 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
AC 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
Regionalization 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 ongoing and delayed decentralization process which leads to uncertainty in WSS sector and artificial fragmentation of the areas managed by the specialized institutions	Operating revenues	Delays in establishment of new tariff policy for the regional and local water companies ongoing and delayed decentralization process which leads to uncertainty in WSS sector and artificial frag-	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
		mentation of the areas managed by the specialized 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	Delay in project start	Short to medium	Delay in establishing posi-	D	II	Moderate	Capacity development within partner systems	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
		local level			tive cash flow					
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
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Annex 8	Environmental impact assessment and gender aspects
Annex 11	Conceptual drawings

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 Calarasi

No.	Public institution name	No. of pupils/children/ /places/beds	Number of Employees	Connected to water supply system	Connected to centralised sewerage system
1.	Gymnasium “Ion Creanga”	181	30	yes	yes
2.	Theoretical Lyceum “Vasile Alecsandri”	483	66	yes	yes
3.	Theoretical Lyceum “Mihai Sadoveanu”	483	64	yes	yes
4.	Primary school	398	42	yes	yes
5.	Professional school	190	53	yes	yes
6.	Sport school “Mihai Viteazul”	299	25	yes	yes
7.	Pedagogical College “Alexandru cel Bun”	190	53	yes	yes
8.	Olympic Reserve Sport school	88	18	yes	yes
9.	Kindergarten Lastarel	200	41	yes	yes
10.	Kindergarten Guguța	225	40	yes	yes
11.	Kindergarten nr.2. n/f	195	3	yes	yes
12.	Calarasi Public Health Centre		39	yes	yes
13.	Centre of Family Physicians	7,049	98	yes	yes
14.	Raion Hospital	204	319	yes	yes

Source: LPA Calarasi, M.E. “Municipal Water Facility” Calarasi

Table 4-2: General information about public institutions in Niscani, Paulesti and Novaci villages

No.	Type of public institution	Locality name					
		Niscani		Paulesti		Novaci	
		No. of pupils/ children/ /places/ beds	Number of Employees	No. of pupils/ children/ /places/ beds	Number of Employees	No. of pupils/ children/ /places/ beds	Employee’s number
1.	School	131	22				
2.	Kindergarten	40	12	20	10	30	12
3.	Centre of Family Physicians		4		4		5

Source: LPA Tuzara, LPA Niscani and LPA Paulesti

Table 4-3: General information about business entities in the town of Calarasi

No.	Business entity	Number of Employees	Type of Activity	Type of property	Drinking water flow rate (m^3/year)	Collected wastewater flow rate (m^3/year)
1.	UCOOP		commerce	private	1,780	1,492
2.	JSC "Moldtelecom" Calarasi subsidiary		commerce	private	196	196
3.	"Palplast" Ltd.		commerce	private	226	226
4.	„Oldimcom Plus" Ltd.		commerce	private	846	677
5.	„Nirom Roz" Ltd.		commerce	private	811	649
6.	FFE „Red Union Fenosa"JSC		commerce	private	170	170
7.	I.E. "Pantelei"		commerce	private	691	553
8.	JSC Codreanca		commerce	private	626	626
9.	"Viotop" Ltd.		commerce	private	1,587	
10.	Ltd. „Iraid-Sor"		commerce	private	266	
11.	Ltd. „Promarchet Grup"		commerce	private	766	766
12.	Canning factory Calarasi		commerce	private		126
13.	JV „Calarasi Divin" JSC		commerce	private		5,837

Source: LPA Calarasi, M.E. "Municipal Water Facility" Calarasi

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°	13,213	13,213	13,213	13,213	13,589	13,589	13,589	16,982	17,257	17,531	17,804	18,077	18,350	18,622	18,893	19,164	19,434	19,457	19,479	19,501	19,522	19,542	19,562	19,581	19,599	19,616	19,633	19,649	19,665	19,680	19,694	19,707
1.2	In urban settlements	N°	13,213	13,213	13,213	13,213	13,589	13,589	13,589	14,317	14,560	14,802	15,045	15,287	15,530	15,772	16,015	16,257	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500
1.3	In rural settlements	N°	0	0	0	0	0	0	0	2,665	2,697	2,729	2,760	2,790	2,820	2,849	2,878	2,906	2,934	2,957	2,979	3,001	3,022	3,042	3,062	3,081	3,099	3,116	3,133	3,149	3,165	3,180	3,194	3,207
2	**Volume of water sold in total and disaggr. for different consumers**																																	
2.1	Total volume sold	m³/y	241,359	256,661	271,963	287,265	311,183	326,921	342,659	411,635	437,901	464,783	492,279	520,387	549,106	578,435	608,371	638,914	670,061	686,528	703,015	719,519	736,039	752,575	769,123	785,683	802,254	818,833	835,419	852,010	868,606	885,204	901,803	918,401
2.2	Domestic customers	m³/y	189,756	200,748	211,740	222,731	240,379	251,683	262,988	318,164	337,574	357,429	377,729	398,472	419,656	441,282	463,347	485,850	508,790	525,173	541,578	558,003	574,447	590,908	607,386	623,877	640,381	656,896	673,420	689,952	706,491	723,035	739,582	756,131
2.3	Industrial customers	m³/y	21,962	25,111	28,259	31,408	35,541	38,779	42,018	47,679	51,957	56,350	60,858	65,482	70,222	75,078	80,049	85,135	90,338	90,338	90,338	90,338	90,338	90,338	90,338	90,338	90,338	90,338	90,338	90,338	90,338	90,338	90,338	90,338
2.4	Institutional customers	m³/y	29,641	30,803	31,964	33,126	35,264	36,459	37,653	45,792	48,371	51,004	53,692	56,433	59,228	62,075	64,976	67,929	70,934	71,018	71,099	71,178	71,255	71,329	71,400	71,469	71,535	71,600	71,661	71,720	71,777	71,831	71,883	71,932
3	**Total water sold disaggr. for urban and rural areas**																																	
3.1	Urban Settlements	m³/y	241,359	256,661	271,963	287,265	311,183	326,921	342,659	377,589	400,848	424,668	449,051	473,995	499,501	525,569	552,199	579,390	607,144	620,870	634,596	648,323	662,049	675,775	689,501	703,228	716,954	730,680	744,406	758,133	771,859	785,585	799,311	813,038
3.2	Rural settlements	m³/y	0	0	0	0	0	0	0	34,046	37,054	40,115	43,228	46,392	49,605	52,866	56,173	59,524	62,917	65,658	68,418	71,196	73,990	76,799	79,622	82,456	85,300	88,152	91,012	93,878	96,747	99,619	102,491	105,364
4	**Non-Revenue Water (NRW) volume dissagregated for total NRW, apparent losses, and real losses**																																	
4.1	Total NRW	m³/y	248,241	263,979	275,806	287,250	250,993	259,583	267,839	316,729	331,666	346,506	361,235	375,844	390,322	404,657	418,839	432,860	446,708	438,928	430,880	422,575	414,022	405,232	396,215	386,978	377,531	367,881	358,037	348,004	337,791	327,404	316,850	306,134
4.2	Apparent losses	m³/y	99,296	105,591	109,165	112,472	108,077	110,690	113,068	132,334	137,110	141,687	146,057	150,212	154,144	157,847	161,315	164,539	167,515	161,315	154,966	148,472	141,841	135,077	128,187	121,175	114,046	106,804	99,455	92,001	84,448	76,799	69,057	61,227
4.3	Real losses (physical losses)	m³/y	148,945	158,388	166,641	174,778	142,915	148,894	154,770	184,395	194,556	204,818	215,179	225,633	236,178	246,810	257,525	268,320	279,192	277,613	275,914	274,102	272,181	270,155	268,028	265,803	263,485	261,077	258,582	256,003	253,343	250,606	247,793	244,907
5	**The water demand figures considering the demand variation factors**																																	
5.1	Yearly water demand/production	m³/y	489,600	520,641	547,769	574,516	562,176	586,505	610,498	728,364	769,567	811,289	853,514	896,232	939,428	983,092	1,027,211	1,071,774	1,116,769	1,125,456	1,133,894	1,142,093	1,150,061	1,157,807	1,165,338	1,172,662	1,179,785	1,186,714	1,193,455	1,200,014	1,206,397	1,212,608	1,218,652	1,224,535
5.2	Average daily water demand	m³/d	1,341	1,426	1,501	1,574	1,540	1,607	1,673	1,996	2,108	2,223	2,338	2,455	2,574	2,693	2,814	2,936	3,060	3,083	3,107	3,129	3,151	3,172	3,193	3,213	3,232	3,251	3,270	3,288	3,305	3,322	3,339	3,355
5.3	Maximum daily water demand	m³/d	1,407	1,497	1,575	1,653	1,625	1,696	1,766	2,108	2,228	2,350	2,473	2,598	2,724	2,852	2,981	3,111	3,243	3,272	3,299	3,326	3,353	3,378	3,403	3,428	3,452	3,476	3,499	3,521	3,543	3,565	3,586	3,607
5.4	Average hourly water demand	m³/h	56	59	63	66	64	67	70	83	88	93	97	102	107	112	117	122	127	128	129	130	131	132	133	134	135	135	136	137	138	138	139	140
5.5	Max. hourly water demand	m³/h	76	80	85	89	90	94	98	117	124	131	138	145	152	160	167	175	182	185	187	189	191	194	196	198	200	202	205	207	209	211	213	215

*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°	8,145	8,145	8,145	8,145	8,145	8,145	8,145	14,421	14,729	15,038	15,348	15,660	15,973	16,287	16,603	16,920	17,238	17,330	17,421	17,512	17,602	17,692	17,781	17,870	17,959	18,047	18,134	18,221	18,307	18,393	18,479	18,564
1.2	In urban settlements	N°	8,145	8,145	8,145	8,145	8,145	8,145	8,145	12,450	12,709	12,969	13,232	13,496	13,763	14,032	14,302	14,575	14,850	14,905	14,960	15,015	15,070	15,125	15,180	15,235	15,290	15,345	15,400	15,455	15,510	15,565	15,620	15,675
1.3	In rural settlements	N°	0	0	0	0	0	0	0	1,971	2,020	2,069	2,116	2,163	2,210	2,255	2,300	2,345	2,388	2,425	2,461	2,497	2,532	2,567	2,601	2,635	2,669	2,702	2,734	2,766	2,797	2,828	2,859	2,889
2	**Volume of wastewater charged in total and disaggr. for different customers**																																	
2.1	Total volume of wastewater gen,	m³/y	153,600	162,180	170,760	179,340	187,920	196,499	205,079	351,766	374,509	397,939	422,060	446,876	472,392	498,612	525,540	553,182	581,541	599,613	617,830	636,190	654,693	673,336	692,119	711,041	730,101	749,298	768,630	788,096	807,696	827,429	847,292	867,286
2.2	by domestic customers	m³/y	98,724	106,088	113,453	120,817	128,182	135,546	142,911	251,284	269,619	288,529	308,017	328,089	348,746	369,994	391,836	414,276	437,318	454,755	472,337	490,065	507,936	525,951	544,107	562,403	580,839	599,414	618,126	636,974	655,957	675,075	694,325	713,707
2.3	by industrial customers	m³/y	26,523	27,652	28,782	29,911	31,041	32,170	33,300	52,626	55,481	58,417	61,435	64,535	67,719	70,987	74,340	77,778	81,304	81,605	81,906	82,207	82,508	82,809	83,111	83,412	83,713	84,014	84,315	84,616	84,917	85,218	85,520	85,821
2.4	by Institutional customers	m³/y	28,353	28,439	28,525	28,611	28,697	28,783	28,869	47,856	49,409	50,993	52,607	54,252	55,927	57,631	59,365	61,128	62,919	63,254	63,587	63,918	64,248	64,576	64,902	65,226	65,549	65,870	66,189	66,506	66,822	67,136	67,448	67,758
3	**Total wastewater charged disaggr, for urban and rural areas**																																	
3.1	in urban Settlements	m³/y	153,600	162,180	170,760	179,340	187,920	196,499	205,079	326,588	346,757	367,529	388,909	410,904	433,521	456,766	480,645	505,164	530,330	545,771	561,312	576,951	592,690	608,529	624,467	640,505	656,642	672,878	689,214	705,649	722,184	738,819	755,552	772,386
3.2	in rural settlements	m³/y	0	0	0	0	0	0	0	25,178	27,752	30,410	33,150	35,971	38,871	41,846	44,896	48,018	51,211	53,842	56,519	59,239	62,002	64,807	67,652	70,536	73,459	76,419	79,416	82,447	85,512	88,610	91,740	94,900
4	**The sewer infiltration water based on the determined infiltration rate**																																	
4.1	**Sewer Infiltration water**	m³/y	76,800	79,063	81,111	82,945	84,564	68,775	51,270	52,765	56,176	59,691	63,309	67,031	70,859	74,792	78,831	82,977	87,231	89,942	92,675	95,429	98,204	101,000	103,818	106,656	109,515	112,395	115,294	118,214	121,154	124,114	127,094	130,093
5	**The wastewater generation figures considering the variation factors**																																	
5.1	Avg. wastewater flow (dry weather)	m³/y	230,400	241,243	251,871	262,284	272,483	265,274	256,349	404,531	430,686	457,630	485,369	513,907	543,250	573,404	604,372	636,159	668,772	689,556	710,505	731,619	752,896	774,336	795,937	817,697	839,616	861,692	883,924	906,311	928,851	951,543	974,386	997,379
5.2	Max, daily dry weather flow (Qdmax	m³/d	673	705	737	768	798	781	759	1,205	1,283	1,363	1,445	1,530	1,618	1,708	1,800	1,894	1,992	2,053	2,116	2,179	2,242	2,306	2,370	2,435	2,500	2,566	2,632	2,699	2,766	2,834	2,902	2,970
5.3	Max, hourly dry weather flow (QDW	m³/h	45	48	50	52	54	55	55	90	96	102	108	114	121	127	134	141	149	153	158	163	167	172	177	182	187	192	197	202	207	212	217	222
5.4	Max, hourly Storm Water Flow (QS	m³/h	59	62	65	68	71	71	71	117	124	132	140	149	157	166	175	184	193	199	205	211	218	224	230	236	243	249	256	262	268	275	282	288
6	**Population equivalents in total and disaggr, for different customers**																																	
6.1	Total population equivalent	PE_{60}	8,709	8,721	8,734	8,746	8,759	8,771	8,784	15,453	15,806	16,162	16,520	16,880	17,243	17,609	17,976	18,347	18,720	18,818	18,916	19,013	19,110	19,206	19,302	19,397	19,492	19,586	19,680	19,774	19,866	19,959	20,050	20,142
6.2	by domestic customers	PE_{60}	8,145	8,145	8,145	8,145	8,145	8,145	8,145	14,421	14,729	15,038	15,348	15,660	15,973	16,287	16,603	16,920	17,238	17,330	17,421	17,512	17,602	17,692	17,781	17,870	17,959	18,047	18,134	18,221	18,307	18,393	18,479	18,564
6.3	by Industrial and instit, customers	PE_{60}	564	576	589	601	614	626	639	1,032	1,078	1,124	1,172	1,220	1,270	1,321	1,374	1,427	1,482	1,488	1,495	1,501	1,508	1,514	1,521	1,527	1,534	1,540	1,546	1,553	1,559	1,565	1,572	1,578
7	**Pollution load – BOD in total and disaggr, for different customers**																																	
7.1	The total BOD_5 load	kg/d	523	523	524	525	526	526	527	927	948	970	991	1,013	1,035	1,057	1,079	1,101	1,123	1,129	1,135	1,141	1,147	1,152	1,158	1,164	1,170	1,175	1,181	1,186	1,192	1,198	1,203	1,209
7.2	by domestic customers	kg/d	489	489	489	489	489	489	489	865	884	902	921	940	958	977	996	1,015	1,034	1,040	1,045	1,051	1,056	1,062	1,067	1,072	1,078	1,083	1,088	1,093	1,098	1,104	1,109	1,114
7.3	by industrial and instit, customers	kg/d	34	35	35	36	37	38	38	62	65	67	70	73	76	79	82	86	89	89	90	90	90	91	91	92	92	92	93	93	94	94	94	95

*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	Calarasi	80%	80%	80%	80%	82%	82%	82%	87%	88%	90%	91%	93%	94%	96%	97%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2	Niscani	0%	0%	0%	0%	0%	0%	0%	70%	71%	72%	74%	75%	76%	77%	79%	80%	81%	82%	84%	85%	86%	87%	89%	90%	91%	92%	94%	95%	96%	97%	99%	100%
3	Paulesti	0%	0%	0%	0%	0%	0%	0%	70%	71%	72%	73%	75%	76%	77%	79%	80%	81%	82%	84%	85%	86%	87%	89%	90%	91%	92%	94%	95%	96%	97%	99%	100%
4	Novaci	0%	0%	0%	0%	0%	0%	0%	70%	71%	72%	74%	75%	76%	77%	79%	80%	81%	82%	84%	85%	86%	87%	89%	90%	91%	92%	94%	95%	96%	97%	99%	100%
TOT	**Total**	**65%**	**65%**	**65%**	**65%**	**67%**	**67%**	**67%**	**84%**	**85%**	**86%**	**88%**	**89%**	**91%**	**92%**	**94%**	**95%**	**97%**	**97%**	**97%**	**97%**	**98%**	**98%**	**98%**	**98%**	**98%**	**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	Calarasi	13,213	13,213	13,213	13,213	13,589	13,589	13,589	14,317	14,560	14,802	15,045	15,287	15,530	15,772	16,015	16,257	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500
2	Niscani	0	0	0	0	0	0	0	1,339	1,356	1,371	1,387	1,402	1,417	1,432	1,447	1,461	1,475	1,486	1,497	1,508	1,519	1,529	1,539	1,548	1,557	1,566	1,575	1,583	1,591	1,598	1,605	1,612
3	Paulesti	0	0	0	0	0	0	0	684	692	700	708	716	724	731	739	746	753	759	765	770	776	781	786	791	795	800	804	808	812	816	820	823
4	Novaci	0	0	0	0	0	0	0	642	650	657	665	672	679	686	693	700	706	712	717	723	728	732	737	742	746	750	754	758	762	765	769	772
TOT	**Total**	**13,213**	**13,213**	**13,213**	**13,213**	**13,589**	**13,589**	**13,589**	**16,982**	**17,257**	**17,531**	**17,804**	**18,077**	**18,350**	**18,622**	**18,893**	**19,164**	**19,434**	**19,457**	**19,479**	**19,501**	**19,522**	**19,542**	**19,562**	**19,581**	**19,599**	**19,616**	**19,633**	**19,649**	**19,665**	**19,680**	**19,694**	**19,707**

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	Calarasi	49	49	49	49	49	49	49	75	77	79	80	82	83	85	87	88	90	90	91	91	91	92	92	92	93	93	93	94	94	94	95	95
2	Niscani	0	0	0	0	0	0	0	52	53	55	56	58	59	61	63	64	66	68	69	71	72	74	75	77	78	80	82	83	85	87	88	90
3	Paulesti	0	0	0	0	0	0	0	54	56	57	59	60	62	63	65	66	68	69	71	72	74	75	77	78	80	81	83	84	86	87	89	90
4	Novaci	0	0	0	0	0	0	0	49	51	53	54	56	58	59	61	63	65	66	68	69	71	72	74	76	77	79	81	83	84	86	88	90
TOT	**Total**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**71**	**73**	**74**	**76**	**77**	**79**	**81**	**82**	**84**	**86**	**86**	**87**	**87**	**88**	**89**	**89**	**90**	**90**	**91**	**91**	**92**	**92**	**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	Calarasi	8,145	8,145	8,145	8,145	8,145	8,145	8,145	12,450	12,709	12,969	13,232	13,496	13,763	14,032	14,302	14,575	14,850	14,905	14,960	15,015	15,070	15,125	15,180	15,235	15,290	15,345	15,400	15,455	15,510	15,565	15,620	15,675
2	Niscani	0	0	0	0	0	0	0	989	1,013	1,038	1,062	1,085	1,109	1,132	1,154	1,177	1,199	1,217	1,235	1,253	1,271	1,288	1,306	1,323	1,340	1,356	1,372	1,389	1,404	1,420	1,436	1,451
3	Paulesti	0	0	0	0	0	0	0	530	541	553	564	575	586	597	607	618	628	637	646	655	663	671	680	687	695	703	710	717	724	731	737	743
4	Novaci	0	0	0	0	0	0	0	453	466	478	491	503	515	527	539	550	562	571	580	589	598	607	616	625	634	643	652	660	669	678	686	695
TOT	**Total**	**8,145**	**8,145**	**8,145**	**8,145**	**8,145**	**8,145**	**8,145**	**14,421**	**14,729**	**15,038**	**15,348**	**15,660**	**15,973**	**16,287**	**16,603**	**16,920**	**17,238**	**17,330**	**17,421**	**17,512**	**17,602**	**17,692**	**17,781**	**17,870**	**17,959**	**18,047**	**18,134**	**18,221**	**18,307**	**18,393**	**18,479**	**18,564**

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

Category of costs		TOTAL	1	2	3	4	5
Equipment and tools	MDL M	4.16	0.42	2.08	1.66		
Pipelines	MDL M	27.77	2.78	13.89	11.11		
Water towers							
Reservoirs							
Pumping stations							
Water treatment plant							
TOTAL Construction and installation costs	**MDL M**	**31.93**	**3.19**	**15.97**	**12.77**	**0.00**	**0.00**
Design and engineering	MDL M	3.83	0.38	1.92	1.53	0.00	0.00
Technical assistance	MDL M	6.23	0.62	3.12	2.49	0.00	0.00
Contingencies	MDL M	4.20	0.42	2.10	1.68	0.00	0.00
TOTAL Investment Coststs for Water Supply	**MDL M**	**46.20**	**4.62**	**23.10**	**18.48**	**0.00**	**0.00**

Table 6-3: Investment costs for wastewater

Category of costs		TOTAL	1	2	3	4	5
Equipment and tools	MDL M	0.00	0.00	0.00	0.00		
Sewage network	MDL M	13.33	1.33	6.66	5.33		
Pumping stations	MDL M						
Wastewater treatment plant	MDL M						
TOTAL Construction and installation costs	**MDL M**	**13.33**	**1.33**	**6.66**	**5.33**	**0.00**	**0.00**
Design and engineering	MDL M	1.60	0.16	0.80	0.64	0.00	0.00
Technical assistance	MDL M	0.00	0.00	0.00	0.00	0.00	0.00
Contingencies	MDL M	1.49	0.15	0.75	0.60	0.00	0.00
TOTAL Investment Coststs for Wastewater	**MDL M**	**16.42**	**1.64**	**8.21**	**6.57**	**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	27.8	2.8	13.9	11.1	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	0.0	0.0	0.0	0.0	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	5.0	4.0	0.0	0.0	0.0
9	Contingency	MDL M	4.2	0.4	2.1	1.7	0.0	0.0	0.0
	Total	**MDL M**	**42.0**	**4.2**	**21.0**	**16.8**	**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	MDL M	13.3	1.3	6.7	5.3	0.0	0.0	0.0
2	Pumping stations	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Equipment and tools	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	Wastewater treatment plant	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Land acquisition	MDL M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	Technical assistance	MDL M	1.6	0.2	0.8	0.6	0.0	0.0	0.0
7	Contingency	MDL M	1.5	0.1	0.7	0.6	0.0	0.0	0.0
	Total	**MDL M**	**16.4**	**1.6**	**8.2**	**6.6**	**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
8	Technical assistance	MDL M		0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
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**	**0.5**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**

			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	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
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	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**

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		0.0	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
	Total	MDL M	**0.0**	**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**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sewage network	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
	Total	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**

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	16.7	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8
8	Technical assistance	MDL M	1.0	6.0	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	2.5	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
	Total	**MDL M**	**4.2**	**25.2**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Pipelines	MDL M	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8
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	4.2	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
	Total	**MDL M**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**	**42.0**

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	1.3	8.0	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
6	Technical assistance	MDL M	0.2	1.0	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
7	Contingency	MDL M	0.1	0.9	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Total	**MDL M**	**1.6**	**9.9**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sewage network	MDL M	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
6	Technical assistance	MDL M	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
7	Contingency	MDL M	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Total	**MDL M**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**	**16.4**

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	16.6	27.4	26.8	26.3	25.7	25.2	24.6	24.1	23.5	22.9	22.4	21.8	21.3	20.7
8	Technical assistance	MDL M	1.0	6.0	9.9	9.7	9.5	9.3	9.1	8.9	8.7	8.5	8.3	8.1	7.9	7.7	7.5
9	Contingency	MDL M	0.4	2.5	4.1	4.1	4.0	3.9	3.8	3.7	3.6	3.6	3.5	3.4	3.3	3.2	3.1
	Total	**MDL M**	**4.2**	**25.1**	**41.5**	**40.6**	**39.8**	**38.9**	**38.1**	**37.2**	**36.4**	**35.6**	**34.7**	**33.9**	**33.0**	**32.2**	**31.4**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Pipelines	MDL M	20.2	19.6	19.1	18.5	17.9	17.4	16.8	16.3	15.7	15.2	14.6	14.1	13.5	12.9	12.4
8	Technical assistance	MDL M	7.3	7.1	6.9	6.7	6.5	6.3	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.5
9	Contingency	MDL M	3.0	3.0	2.9	2.8	2.7	2.6	2.5	2.5	2.4	2.3	2.2	2.1	2.0	2.0	1.9
	Total	**MDL M**	**30.5**	**29.7**	**28.8**	**28.0**	**27.2**	**26.3**	**25.5**	**24.6**	**23.8**	**23.0**	**22.1**	**21.3**	**20.4**	**19.6**	**18.7**

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	1.3	8.0	13.1	12.9	12.6	12.3	12.1	11.8	11.5	11.3	11.0	10.7	10.5	10.2	9.9
6	Technical assistance	MDL M	0.2	1.0	1.6	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2
7	Contingency	MDL M	0.1	0.9	1.5	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2	1.1	1.1
	Total	**MDL M**	**1.6**	**9.8**	**16.2**	**15.9**	**15.5**	**15.2**	**14.9**	**14.5**	**14.2**	**13.9**	**13.6**	**13.2**	**12.9**	**12.6**	**12.3**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sewage network	MDL M	9.7	9.4	9.1	8.9	8.6	8.3	8.1	7.8	7.5	7.3	7.0	6.7	6.5	6.2	5.9
6	Technical assistance	MDL M	1.2	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.7
7	Contingency	MDL M	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7
	Total	**MDL M**	**11.9**	**11.6**	**11.3**	**10.9**	**10.6**	**10.3**	**10.0**	**9.6**	**9.3**	**9.0**	**8.6**	**8.3**	**8.0**	**7.7**	**7.3**

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	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
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**	**0.5**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**

			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	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
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**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**

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		0.0	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
	Total	**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**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sewage network	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
	Total	**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**

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	1.44	2.07	2.20	2.17	2.29	2.40	2.66	2.89	3.13	3.38	3.66	3.94	4.22	4.52	4.83
2	Water treatment costs	MDL M	0.13	0.14	0.14	0.14	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24
	TOTAL variable costs for water	MDL M	1.567	2.209	2.338	2.310	2.432	2.556	2.823	3.061	3.312	3.577	3.857	4.153	4.443	4.748	5.068
	Wastewater																
1	Electricity for pumping	MDL M	0.653	0.935	0.983	1.031	1.014	0.990	1.760	1.886	2.017	2.155	2.299	2.450	2.595	2.746	2.903
2	Wastewater treatment 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	0.01	0.01
	TOTAL variable costs for water		0.656	0.938	0.986	1.035	1.017	0.993	1.766	1.891	2.023	2.161	2.306	2.457	2.602	2.753	2.910

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Water supply																
1	Electricity for pumping	MDL M	5.15	5.31	5.61	5.92	6.25	6.59	6.96	7.27	7.60	7.93	8.29	8.65	8.95	9.25	9.56
2	Water treatment costs	MDL M	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27	0.27
	TOTAL variable costs for water	MDL M	5.402	5.563	5.861	6.175	6.505	6.851	7.216	7.529	7.856	8.195	8.548	8.916	9.212	9.517	9.831
	Wastewater																
1	Electricity for pumping	MDL M	3.066	3.222	3.467	3.728	4.007	4.304	4.620	4.911	5.217	5.540	5.881	6.240	6.554	6.882	7.223
2	Wastewater treatment costs	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
	TOTAL variable costs for water		3.074	3.230	3.475	3.736	4.015	4.312	4.629	4.920	5.226	5.550	5.890	6.249	6.564	6.892	7.234

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	0.04	0.25	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
3	Salaries and related costs	MDL M	1.12	1.16	1.21	1.05	1.09	1.14	1.46	1.52	1.58	1.64	1.71	1.78	1.85	1.92	2.00
4	Fuel	MDL M	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
5	General and administrative expenditures	MDL M	0.48	0.48	0.50	0.52	0.55	0.57	0.59	0.61	0.64	0.66	0.69	0.72	0.75	0.78	0.81
6	Other costs	MDL M	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
	TOTAL fixed costs for water	MDL M	1.935	2.018	2.301	4.331	4.434	4.540	4.926	5.051	5.179	5.312	5.449	5.591	5.738	5.889	6.046
	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	0.00	0.02	0.10	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
3	Salaries and related costs	MDL M	0.63	0.64	0.67	0.62	0.64	0.67	0.89	0.93	0.96	1.00	1.04	1.08	1.13	1.17	1.22
4	Fuel	MDL M	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
5	General and administrative expenditures	MDL M	0.24	0.24	0.25	0.26	0.27	0.29	0.30	0.31	0.32	0.33	0.35	0.36	0.38	0.39	0.41
6	Other costs	MDL M	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
	TOTAL fixed costs for wastewater	MDL M	1.040	1.078	1.200	1.717	1.762	1.809	2.055	2.113	2.173	2.236	2.300	2.367	2.437	2.509	2.584

	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	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
3	Salaries and related costs	MDL M	2.08	2.16	2.25	2.34	2.43	2.53	2.60	2.68	2.76	2.84	2.93	3.02	3.11	3.20	3.30
4	Fuel	MDL M	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
5	General and administrative expenditures	MDL M	0.84	0.87	0.91	0.94	0.98	1.02	1.05	1.08	1.12	1.15	1.18	1.22	1.26	1.29	1.33
6	Other costs	MDL M	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
	TOTAL fixed costs for water	MDL M	6.208	6.375	6.548	6.727	6.912	7.103	7.252	7.404	7.560	7.720	7.885	8.053	8.226	8.404	8.586
	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	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
3	Salaries and related costs	MDL M	1.27	1.32	1.37	1.42	1.48	1.54	1.59	1.63	1.68	1.73	1.79	1.84	1.90	1.95	2.01
4	Fuel	MDL M	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
5	General and administrative expenditures	MDL M	0.42	0.44	0.46	0.48	0.49	0.51	0.53	0.55	0.56	0.58	0.60	0.61	0.63	0.65	0.67
6	Other costs	MDL M	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
	TOTAL fixed costs for wastewater	MDL M	2.661	2.741	2.824	2.911	3.000	3.093	3.165	3.239	3.316	3.394	3.474	3.557	3.642	3.730	3.820

Table 6-12: Total costs

		MDL M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Variable costs	MDL M	2.22	3.15	3.32	3.34	3.45	3.55	4.59	4.95	5.34	5.74	6.16	6.61	7.05	7.50	7.98
2	Fixed costs	MDL M	2.97	3.10	3.50	6.05	6.20	6.35	6.98	7.16	7.35	7.55	7.75	7.96	8.17	8.40	8.63
3	Depreciation	MDL M	0.77	0.89	1.47	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94
	TOTAL costs	**MDL M**	**5.971**	**7.132**	**8.299**	**11.334**	**11.587**	**11.839**	**13.511**	**14.057**	**14.629**	**15.227**	**15.854**	**16.509**	**17.161**	**17.841**	**18.549**

		MDL M	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Variable costs	MDL M	8.48	8.79	9.34	9.91	10.52	11.16	11.85	12.45	13.08	13.74	14.44	15.17	15.78	16.41	17.06
2	Fixed costs	MDL M	8.87	9.12	9.37	9.64	9.91	10.20	10.42	10.64	10.88	11.11	11.36	11.61	11.87	12.13	12.41
3	Depreciation	MDL M	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94
	TOTAL costs	**MDL M**	**19.285**	**19.850**	**20.650**	**21.490**	**22.373**	**23.301**	**24.203**	**25.034**	**25.899**	**26.800**	**27.739**	**28.718**	**29.586**	**30.484**	**31.412**

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	3.08	3.50	4.23	4.64	6.64	6.87	7.10	7.75	8.11	8.49	8.89	9.31	9.74	10.18	10.64	11.11
2	Depreciation	MDL M	0.18	0.18	0.27	0.69	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
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	0.18	0.20	0.21	0.27	0.24	0.20	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.29	0.30
5	Sale of water	m3	241,359	256,661	271,963	287,265	311,183	326,921	342,659	377,589	400,848	424,668	449,051	473,995	499,501	525,569	552,199	579,390
6	Tariff without depreciation	MDL M/m3	12.78	14.36	16.29	16.89	22.20	21.73	21.30	21.10	20.81	20.55	20.35	20.18	20.05	19.90	19.79	19.70
7	Tariff with depreciation	MDL M/m3	13.54	15.08	17.27	19.29	25.49	24.86	24.29	23.82	23.36	22.97	22.63	22.34	22.10	21.85	21.65	21.47
8	**Proposed avarage tariff**	**MDL/m3**	**18.96**	**18.96**	**18.96**	**19.29**	**22.20**	**21.73**	**21.30**	**21.10**	**21.00**	**21.00**	**21.00**	**21.00**	**21.50**	**21.85**	**21.65**	**21.47**
	Wastewater																	
1	Variable and fixed costs	MDL M	1.55	1.70	2.02	2.19	2.75	2.78	2.80	3.82	4.00	4.20	4.40	4.61	4.82	5.04	5.26	5.49
2	Depreciation	MDL M	0.59	0.59	0.62	0.79	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
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	0.11	0.12	0.12	0.13	0.11	0.09	0.12	0.12	0.13	0.13	0.14	0.14	0.15	0.15	0.16
5	Sale of wastewater	m3	153,600	162,180	170,760	179,340	187,920	196,499	205,079	392,435	408,194	423,953	439,712	455,471	471,230	486,989	502,748	518,507
6	Tariff without depreciation	MDL M/m3	10.09	11.16	12.50	12.85	15.33	14.71	14.12	10.04	10.11	10.20	10.30	10.42	10.54	10.65	10.77	10.90
7	Tariff with depreciation	MDL M/m3	13.92	14.79	16.14	17.23	20.21	19.38	18.59	12.37	12.36	12.36	12.39	12.43	12.49	12.54	12.60	12.67
8	**Proposed avarage tariff**	**MDL/m3**	**14.64**	**14.79**	**16.14**	**16.50**	**16.50**	**16.50**	**16.50**	**12.37**	**12.36**	**12.36**	**12.39**	**12.43**	**12.49**	**12.54**	**12.60**	**12.67**
	Dynamic prime costs for water	**MDL/m3**		**25.54**														
	Dynamic prime costs for wastewater	**MDL/m3**		**14.10**														

	Water Supply		**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	Variable and fixed costs	MDL M	11.61	11.94	12.41	12.90	13.42	13.95	14.47	14.93	15.42	15.92	16.43	16.97	17.44	17.92	18.42
2	Depreciation	MDL M	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
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	0.32	0.32	0.34	0.35	0.36	0.37	0.39	0.40	0.41	0.42	0.44	0.45	0.46	0.47	0.49
5	Sale of water	m3	607,144	620,870	634,596	648,323	662,049	675,775	689,501	703,228	716,954	730,680	744,406	758,133	771,859	785,585	799,311
6	Tariff without depreciation	MDL M/m3	19.64	19.75	20.08	20.44	20.81	21.20	21.54	21.80	22.07	22.36	22.66	22.98	23.19	23.42	23.65
7	Tariff with depreciation	MDL M/m3	21.33	21.40	21.70	22.02	22.36	22.72	23.03	23.26	23.50	23.76	24.04	24.33	24.52	24.72	24.93
8	**Proposed avarage tariff**	**MDL/m3**	**21.33**	**21.40**	**21.70**	**22.02**	**22.36**	**22.72**	**23.03**	**23.26**	**23.50**	**23.76**	**24.04**	**24.33**	**24.52**	**24.72**	**24.93**
	Wastewater																
1	Variable and fixed costs	MDL M	5.73	5.97	6.30	6.65	7.02	7.41	7.79	8.16	8.54	8.94	9.36	9.81	10.21	10.62	11.05
2	Depreciation	MDL M	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
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	0.17	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.29	0.30
5	Sale of wastewater	m3	534,266	547,798	561,331	574,863	588,396	601,930	615,463	628,997	642,531	656,065	669,600	683,135	696,670	710,205	723,741
6	Tariff without depreciation	MDL M/m3	11.04	11.21	11.54	11.89	12.26	12.65	13.02	13.33	13.66	14.01	14.37	14.75	15.05	15.36	15.69
7	Tariff with depreciation	MDL M/m3	12.76	12.89	13.18	13.49	13.82	14.17	14.51	14.79	15.09	15.41	15.74	16.09	16.37	16.65	16.95
8	**Proposed avarage tariff**	**MDL/m3**	**12.76**	**12.89**	**13.18**	**13.49**	**13.82**	**14.17**	**14.51**	**14.79**	**15.09**	**15.41**	**15.74**	**16.09**	**16.37**	**16.65**	**16.95**

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	23.67	24.97	26.72	32.28	33.07	33.88	35.01	36.27	37.71	39.15	40.58	43.02	45.22	46.27	47.37
2	Avarage bill for wastewater (per person)	MDL/month	18.47	21.26	22.86	23.99	25.12	26.25	20.53	21.35	22.20	23.09	24.02	24.99	25.94	26.93	27.96
3	Avarage bill for water and wastewater (per perso	MDL/month	42.15	46.23	49.58	56.27	58.19	60.13	55.54	57.62	59.91	62.24	64.60	68.01	71.16	73.20	75.33
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	%	2.4%	2.6%	2.7%	2.9%	2.9%	2.9%	2.5%	2.5%	2.5%	2.5%	2.5%	2.6%	2.6%	2.5%	2.5%
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	48.51	50.13	52.32	54.59	56.96	59.44	61.83	64.03	66.31	68.67	71.11	73.63	75.88	78.19	80.57
2	Avarage bill for wastewater (per person)	MDL/month	29.02	30.20	31.77	33.44	35.21	37.08	38.95	40.72	42.57	44.52	46.56	48.70	50.65	52.68	54.79
3	Avarage bill for water and wastewater (per perso	MDL/month	77.53	80.33	84.09	88.03	92.17	96.52	100.78	104.75	108.89	113.19	117.67	122.33	126.53	130.87	135.35
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	%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.6%	2.6%	2.6%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%
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	4.87	5.16	5.54	6.91	7.10	7.30	7.97	8.42	8.92	9.43	9.95	10.74	11.49	11.95	12.44
2	Sale of wastewater	MDL M	2.40	2.76	2.96	3.10	3.24	3.38	4.86	5.04	5.24	5.45	5.66	5.88	6.10	6.33	6.57
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**	**7.26**	**7.91**	**8.50**	**10.01**	**10.35**	**10.68**	**12.82**	**13.46**	**14.16**	**14.88**	**15.61**	**16.62**	**17.59**	**18.29**	**19.01**
5	Costs of water services	MDL M	3.69	4.49	5.33	7.67	7.89	8.12	8.77	9.14	9.52	9.91	10.33	10.77	11.21	11.66	12.14
	variable costs	MDL M	1.57	2.21	2.34	2.31	2.43	2.56	2.82	3.06	3.31	3.58	3.86	4.15	4.44	4.75	5.07
	fixed costs	MDL M	1.94	2.02	2.30	4.33	4.43	4.54	4.93	5.05	5.18	5.31	5.45	5.59	5.74	5.89	6.05
	depreciation	MDL M	0.18	0.27	0.69	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
6	Costs of wastewater services	MDL M	2.28	2.64	2.97	3.67	3.70	3.72	4.74	4.92	5.11	5.31	5.52	5.74	5.96	6.18	6.41
	variable costs	MDL M	0.66	0.94	0.99	1.03	1.02	0.99	1.77	1.89	2.02	2.16	2.31	2.46	2.60	2.75	2.91
	fixed costs	MDL M	1.04	1.08	1.20	1.72	1.76	1.81	2.06	2.11	2.17	2.24	2.30	2.37	2.44	2.51	2.58
	depreciation	MDL M	0.59	0.62	0.79	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
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**	**5.97**	**7.13**	**8.30**	**11.33**	**11.59**	**11.84**	**13.51**	**14.06**	**14.63**	**15.23**	**15.85**	**16.51**	**17.16**	**17.84**	**18.55**
10	**Gross profit**	**MDL M**	1.29	0.78	0.20	-1.32	-1.24	-1.16	-0.69	-0.59	-0.47	-0.35	-0.24	0.11	0.43	0.45	0.46
11	**Income tax**	MDL M	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
12	**Net profit**	**MDL M**	**1.14**	**0.69**	**0.18**	**-1.32**	**-1.24**	**-1.16**	**-0.69**	**-0.59**	**-0.47**	**-0.35**	**-0.24**	**0.10**	**0.38**	**0.39**	**0.41**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sale of water	MDL M	12.95	13.29	13.77	14.27	14.80	15.35	15.88	16.36	16.85	17.36	17.89	18.44	18.92	19.42	19.93
2	Sale of wastewater	MDL M	6.82	7.06	7.40	7.75	8.13	8.53	8.93	9.30	9.70	10.11	10.54	10.99	11.40	11.83	12.27
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**	**19.77**	**20.35**	**21.17**	**22.03**	**22.93**	**23.88**	**24.81**	**25.66**	**26.55**	**27.47**	**28.43**	**29.44**	**30.33**	**31.25**	**32.20**
5	Costs of water services	MDL M	12.63	12.96	13.43	13.93	14.44	14.98	15.49	15.96	16.44	16.94	17.46	17.99	18.46	18.95	19.44
	variable costs	MDL M	5.40	5.56	5.86	6.17	6.50	6.85	7.22	7.53	7.86	8.20	8.55	8.92	9.21	9.52	9.83
	fixed costs	MDL M	6.21	6.37	6.55	6.73	6.91	7.10	7.25	7.40	7.56	7.72	7.88	8.05	8.23	8.40	8.59
	depreciation	MDL M	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
6	Costs of wastewater services	MDL M	6.65	6.89	7.22	7.56	7.93	8.32	8.71	9.08	9.46	9.86	10.28	10.72	11.12	11.54	11.97
	variable costs	MDL M	3.07	3.23	3.47	3.74	4.01	4.31	4.63	4.92	5.23	5.55	5.89	6.25	6.56	6.89	7.23
	fixed costs	MDL M	2.66	2.74	2.82	2.91	3.00	3.09	3.17	3.24	3.32	3.39	3.47	3.56	3.64	3.73	3.82
	depreciation	MDL M	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
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**	**19.29**	**19.85**	**20.65**	**21.49**	**22.37**	**23.30**	**24.20**	**25.03**	**25.90**	**26.80**	**27.74**	**28.72**	**29.59**	**30.48**	**31.41**
10	**Gross profit**	**MDL M**	0.48	0.50	0.52	0.54	0.56	0.58	0.61	0.63	0.65	0.67	0.69	0.72	0.74	0.76	0.79
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	0.1	0.1	0.1	0.1
12	**Net profit**	**MDL M**	**0.42**	**0.44**	**0.45**	**0.47**	**0.49**	**0.51**	**0.53**	**0.55**	**0.57**	**0.59**	**0.61**	**0.63**	**0.65**	**0.67**	**0.69**

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	4.87	5.16	4.79	4.59	4.79	4.99	5.67	8.17	8.65	9.14	9.65	10.40	8.45	8.96	9.48
2	Sale of wastewater	MDL M	2.40	2.72	2.96	3.10	3.24	3.38	3.28	3.42	3.57	3.72	3.88	4.05	4.21	4.39	4.56
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**	**7.27**	**7.88**	**7.75**	**7.69**	**8.03**	**8.38**	**8.95**	**11.59**	**12.22**	**12.87**	**13.53**	**14.45**	**12.67**	**13.34**	**14.05**
5	Costs of water services	MDL M	3.69	4.38	4.60	4.62	4.83	5.05	5.71	6.08	6.47	6.88	7.32	7.78	8.25	8.74	9.25
	variable costs	MDL M	1.57	2.22	2.37	2.52	2.67	2.83	3.14	3.43	3.73	4.06	4.40	4.77	5.14	5.52	5.93
	fixed costs	MDL M	1.94	1.98	2.05	1.91	1.97	2.04	2.38	2.47	2.55	2.64	2.73	2.83	2.93	3.03	3.14
	depreciation	MDL M	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
6	Costs of wastewater services	MDL M	2.29	2.60	2.70	2.71	2.81	2.90	3.20	3.34	3.48	3.63	3.79	3.95	4.11	4.28	4.45
	variable costs	MDL M	0.66	0.95	1.01	1.07	1.13	1.19	1.25	1.34	1.44	1.53	1.64	1.74	1.85	1.96	2.07
	fixed costs	MDL M	1.04	1.06	1.10	1.05	1.09	1.12	1.36	1.41	1.46	1.51	1.56	1.62	1.68	1.74	1.80
	depreciation	MDL M	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
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**	**5.98**	**6.99**	**7.31**	**7.33**	**7.64**	**7.96**	**8.91**	**9.42**	**9.95**	**10.51**	**11.11**	**11.73**	**12.36**	**13.02**	**13.71**
10	**Gross profit**	**MDL M**	1.29	0.89	0.44	0.37	0.40	0.42	0.04	2.18	2.27	2.35	2.42	2.72	0.31	0.33	0.34
11	**Income tax**	MDL M	0.2	0.1	0.1	0.0	0.0	0.1	0.0	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0
12	**Net profit**	**MDL M**	**1.14**	**0.78**	**0.39**	**0.32**	**0.35**	**0.37**	**0.03**	**1.91**	**2.00**	**2.07**	**2.13**	**2.40**	**0.27**	**0.29**	**0.30**

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sale of water	MDL M	10.04	10.47	11.07	11.72	12.40	13.13	13.86	14.54	15.25	16.00	16.78	17.61	18.35	19.11	19.91
2	Sale of wastewater	MDL M	4.75	4.93	5.18	5.45	5.73	6.03	6.32	6.60	6.89	7.19	7.51	7.85	8.15	8.47	8.80
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**	**14.79**	**15.40**	**16.26**	**17.17**	**18.13**	**19.15**	**20.18**	**21.13**	**22.14**	**23.19**	**24.29**	**25.45**	**26.50**	**27.58**	**28.70**
5	Costs of water services	MDL M	9.79	10.21	10.80	11.43	12.10	12.81	13.52	14.18	14.88	15.61	16.37	17.18	17.90	18.65	19.42
	variable costs	MDL M	6.36	6.66	7.13	7.63	8.17	8.74	9.35	9.90	10.48	11.10	11.74	12.42	13.02	13.63	14.28
	fixed costs	MDL M	3.25	3.37	3.49	3.61	3.75	3.88	3.99	4.10	4.21	4.33	4.45	4.57	4.70	4.83	4.96
	depreciation	MDL M	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
6	Costs of wastewater services	MDL M	4.63	4.81	5.06	5.32	5.59	5.88	6.17	6.44	6.72	7.02	7.33	7.65	7.95	8.26	8.58
	variable costs	MDL M	2.18	2.29	2.47	2.65	2.85	3.06	3.29	3.49	3.71	3.94	4.18	4.44	4.66	4.89	5.14
	fixed costs	MDL M	1.86	1.93	2.00	2.07	2.15	2.23	2.29	2.35	2.42	2.49	2.56	2.63	2.70	2.78	2.86
	depreciation	MDL M	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
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**	**14.43**	**15.02**	**15.86**	**16.75**	**17.69**	**18.69**	**19.68**	**20.62**	**21.60**	**22.62**	**23.70**	**24.83**	**25.85**	**26.91**	**28.00**
10	**Gross profit**	**MDL M**	0.36	0.38	0.40	0.42	0.44	0.47	0.49	0.52	0.54	0.57	0.59	0.62	0.65	0.67	0.70
11	**Income tax**	MDL M	0.0	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
12	**Net profit**	**MDL M**	**0.32**	**0.33**	**0.35**	**0.37**	**0.39**	**0.41**	**0.43**	**0.45**	**0.48**	**0.50**	**0.52**	**0.55**	**0.57**	**0.59**	**0.62**

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**	**2.09**	**0.66**	**0.71**	**0.78**	**1.09**	**1.12**	**1.15**	**1.33**	**1.39**	**1.45**	**1.52**	**1.58**	**1.67**	**1.76**	**1.82**	**1.89**
1	Inventories	MDL M	0.31	0.06	0.06	0.08	0.26	0.27	0.27	0.28	0.28	0.29	0.29	0.30	0.31	0.31	0.32	0.33
2	Accounts receivable	MDL M	1.78	0.60	0.65	0.70	0.82	0.85	0.88	1.05	1.11	1.16	1.22	1.28	1.37	1.45	1.50	1.56
	Increase in current assets	MDL M		-1.43	0.06	0.07	0.30	0.03	0.03	0.18	0.06	0.06	0.06	0.07	0.09	0.09	0.06	0.07
B	**Current liabilities**	**MDL M**	**5.21**	**1.77**	**0.66**	**0.72**	**0.91**	**0.94**	**0.96**	**1.14**	**1.20**	**1.25**	**1.31**	**1.37**	**1.43**	**1.50**	**1.56**	**1.63**
1	Liabilities to suppliers	MDL M	1.06	0.43	0.51	0.56	0.77	0.79	0.81	0.95	1.00	1.04	1.09	1.14	1.20	1.25	1.31	1.36
2	Liabilities to employees	MDL M	4.15	1.34	0.15	0.15	0.14	0.14	0.15	0.19	0.20	0.21	0.22	0.23	0.23	0.24	0.25	0.26
3	Increase in current liabilities	MDL M		-3.44	-1.11	0.05	0.19	0.03	0.03	0.18	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Current assets**	**MDL M**	**1.96**	**2.01**	**2.09**	**2.16**	**2.25**	**2.33**	**2.41**	**2.49**	**2.57**	**2.65**	**2.74**	**2.83**	**2.91**	**2.99**	**3.07**
1	Inventories	MDL M	0.33	0.34	0.35	0.35	0.36	0.37	0.38	0.38	0.39	0.39	0.40	0.41	0.41	0.42	0.43
2	Accounts receivable	MDL M	1.62	1.67	1.74	1.81	1.88	1.96	2.04	2.11	2.18	2.26	2.34	2.42	2.49	2.57	2.65
	Increase in current assets	MDL M	0.07	0.05	0.07	0.08	0.08	0.09	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.09
B	**Current liabilities**	**MDL M**	**1.70**	**1.76**	**1.83**	**1.92**	**2.00**	**2.09**	**2.17**	**2.25**	**2.33**	**2.42**	**2.51**	**2.60**	**2.68**	**2.77**	**2.86**
1	Liabilities to suppliers	MDL M	1.43	1.47	1.54	1.61	1.68	1.76	1.83	1.90	1.97	2.04	2.12	2.20	2.27	2.35	2.42
2	Liabilities to employees	MDL M	0.27	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.37	0.38	0.39	0.40	0.41	0.42	0.44
3	Increase in current liabilities	MDL M	0.07	0.06	0.08	0.08	0.08	0.09	0.08	0.08	0.08	0.09	0.09	0.09	0.08	0.09	0.09

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**	**2.09**	**0.66**	**0.71**	**0.70**	**0.70**	**0.73**	**0.76**	**0.80**	**1.02**	**1.08**	**1.13**	**1.19**	**1.27**	**1.12**	**1.18**	**1.24**
1	Inventories	MDL M	0.31	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.09
2	Accounts receivable	MDL M	1.78	0.60	0.65	0.64	0.63	0.66	0.69	0.74	0.95	1.00	1.06	1.11	1.19	1.04	1.10	1.15
	Increase in current assets	MDL M		-1.43	0.05	-0.01	0.00	0.03	0.03	0.05	0.22	0.05	0.06	0.06	0.08	-0.14	0.06	0.06
B	**Current liabilities**	**MDL M**	**5.21**	**1.77**	**0.66**	**0.69**	**0.68**	**0.71**	**0.74**	**0.86**	**0.91**	**0.96**	**1.02**	**1.08**	**1.14**	**1.20**	**1.26**	**1.33**
1	Liabilities to suppliers	MDL M	1.06	0.43	0.51	0.54	0.54	0.56	0.59	0.67	0.71	0.75	0.80	0.85	0.90	0.95	1.01	1.06
2	Liabilities to employees	MDL M	4.15	1.34	0.15	0.15	0.14	0.14	0.15	0.19	0.20	0.21	0.22	0.23	0.23	0.24	0.25	0.26
3	Increase in current liabilities	MDL M		-3.44	-1.11	0.03	-0.02	0.03	0.03	0.12	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Current assets**	**MDL M**	**1.30**	**1.36**	**1.43**	**1.51**	**1.59**	**1.68**	**1.77**	**1.85**	**1.93**	**2.02**	**2.11**	**2.21**	**2.30**	**2.39**	**2.49**
1	Inventories	MDL M	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13
2	Accounts receivable	MDL M	1.22	1.27	1.34	1.41	1.49	1.57	1.66	1.74	1.82	1.91	2.00	2.09	2.18	2.27	2.36
	Increase in current assets	MDL M	0.06	0.05	0.07	0.08	0.08	0.09	0.09	0.08	0.09	0.09	0.09	0.10	0.09	0.09	0.10
B	**Current liabilities**	**MDL M**	**1.40**	**1.46**	**1.54**	**1.62**	**1.71**	**1.81**	**1.90**	**1.99**	**2.08**	**2.17**	**2.27**	**2.38**	**2.47**	**2.57**	**2.67**
1	Liabilities to suppliers	MDL M	1.12	1.17	1.24	1.31	1.39	1.47	1.55	1.63	1.71	1.80	1.88	1.98	2.06	2.15	2.24
2	Liabilities to employees	MDL M	0.27	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.37	0.38	0.39	0.40	0.41	0.42	0.44
3	Increase in current liabilities	MDL M	0.07	0.06	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10

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**	**50.84**	**54.80**	**85.69**	**110.97**	**109.84**	**108.62**	**107.49**	**106.99**	**106.44**	**106.03**	**105.74**	**105.56**	**105.72**	**106.16**	**106.62**	**107.10**
1	Fixed assets	MDL M	48.44	53.92	84.34	107.92	105.98	104.03	102.09	100.15	98.21	96.27	94.33	92.38	90.44	88.50	86.56	84.62
2	Current assets	MDL M	2.40	0.88	1.35	3.05	3.86	4.59	5.40	6.84	8.23	9.76	11.41	13.17	15.28	17.66	20.06	22.48
3	Inventories	MDL M	0.31	0.06	0.06	0.08	0.26	0.27	0.27	0.28	0.28	0.29	0.29	0.30	0.31	0.31	0.32	0.33
4	Short-term receivables	MDL M	1.78	0.60	0.65	0.70	0.82	0.85	0.88	1.05	1.11	1.16	1.22	1.28	1.37	1.45	1.50	1.56
5	Cash and other financial assets	MDL M	0.17	0.07	0.48	2.12	2.63	3.32	4.10	5.35	6.70	8.16	9.74	11.44	13.46	15.75	18.09	20.44
6	Other current assets	MDL M	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
B	**Liabilities**	**MDL M**	**50.84**	**54.80**	**85.69**	**110.97**	**109.84**	**108.62**	**107.49**	**106.99**	**106.44**	**106.03**	**105.74**	**105.56**	**105.72**	**106.16**	**106.62**	**107.10**
1	Equity capital	MDL M	41.99	43.13	43.81	43.99	42.66	41.42	40.27	39.58	38.98	38.51	38.16	37.93	38.03	38.40	38.80	39.20
2	Long-term liabilities	MDL M	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
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	0.00
4	Short-term 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	0.00
5	Short-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	0.00
6	Current liabilities to suppliers	MDL M	1.06	0.43	0.51	0.56	0.77	0.79	0.81	0.95	1.00	1.04	1.09	1.14	1.20	1.25	1.31	1.36
7	Current liabilities	MDL M	4.15	1.34	0.15	0.15	0.14	0.14	0.15	0.19	0.20	0.21	0.22	0.23	0.23	0.24	0.25	0.26
8	Accruals	MDL M	0.00	6.26	37.57	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Assets**	**MDL M**	**107.59**	**108.09**	**108.62**	**109.17**	**109.75**	**110.35**	**110.97**	**111.60**	**112.25**	**112.92**	**113.62**	**114.34**	**115.08**	**115.84**	**116.62**
1	Fixed assets	MDL M	82.68	80.74	78.79	76.85	74.91	72.97	71.03	69.09	67.15	65.20	63.26	61.32	59.38	57.44	55.50
2	Current assets	MDL M	24.91	27.35	29.82	32.32	34.84	37.38	39.94	42.51	45.10	47.72	50.36	53.02	55.70	58.40	61.12
3	Inventories	MDL M	0.33	0.34	0.35	0.35	0.36	0.37	0.38	0.38	0.39	0.39	0.40	0.41	0.41	0.42	0.43
4	Short-term receivables	MDL M	1.62	1.67	1.74	1.81	1.88	1.96	2.04	2.11	2.18	2.26	2.34	2.42	2.49	2.57	2.65
5	Cash and other financial assets	MDL M	22.81	25.19	27.59	30.00	32.44	34.90	37.37	39.87	42.38	44.92	47.47	50.05	52.64	55.26	57.89
6	Other current assets	MDL M	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
B	**Liabilities**	**MDL M**	**107.59**	**108.09**	**108.62**	**109.17**	**109.75**	**110.35**	**110.97**	**111.60**	**112.25**	**112.92**	**113.62**	**114.34**	**115.08**	**115.84**	**116.62**
1	Equity capital	MDL M	39.63	40.07	40.52	40.99	41.48	42.00	42.53	43.08	43.65	44.24	44.85	45.48	46.13	46.80	47.49
2	Long-term liabilities	MDL M	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
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	0.00	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
5	Short-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
6	Current liabilities to suppliers	MDL M	1.43	1.47	1.54	1.61	1.68	1.76	1.83	1.90	1.97	2.04	2.12	2.20	2.27	2.35	2.42
7	Current liabilities	MDL M	0.27	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.37	0.38	0.39	0.40	0.41	0.42	0.44
8	Accruals	MDL M	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62	62.62

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**	**50.84**	**48.54**	**48.21**	**48.63**	**48.94**	**49.32**	**49.72**	**49.88**	**51.85**	**53.90**	**56.02**	**58.21**	**60.67**	**61.00**	**61.35**	**61.72**
1	Fixed assets	MDL M	48.44	47.66	46.89	46.12	45.35	44.57	43.80	43.03	42.26	41.49	40.71	39.94	39.17	38.40	37.62	36.85
2	Current assets	MDL M	2.40	0.88	1.32	2.52	3.60	4.75	5.92	6.85	9.59	12.41	15.31	18.27	21.50	22.60	23.73	24.87
3	Inventories	MDL M	0.31	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.09
4	Short-term receivables	MDL M	1.78	0.60	0.65	0.64	0.63	0.66	0.69	0.74	0.95	1.00	1.06	1.11	1.19	1.04	1.10	1.15
5	Cash and other financial assets	MDL M	0.17	0.07	0.47	1.67	2.75	3.87	5.02	5.90	8.42	11.18	14.03	16.93	20.08	21.33	22.40	23.48
6	Other current assets	MDL M	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
B	**Liabilities**	**MDL M**	**50.84**	**48.54**	**48.21**	**48.63**	**48.94**	**49.32**	**49.72**	**49.88**	**51.85**	**53.90**	**56.02**	**58.21**	**60.67**	**61.00**	**61.35**	**61.72**
1	Equity capital	MDL M	41.99	43.13	43.91	44.30	44.62	44.97	45.34	45.37	47.29	49.29	51.36	53.49	55.89	56.16	56.44	56.75
2	Long-term liabilities	MDL M	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
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	0.00
4	Short-term 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	0.00
5	Short-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	0.00
6	Current liabilities to suppliers	MDL M	1.06	0.43	0.51	0.54	0.54	0.56	0.59	0.67	0.71	0.75	0.80	0.85	0.90	0.95	1.01	1.06
7	Current liabilities	MDL M	4.15	1.34	0.15	0.15	0.14	0.14	0.15	0.19	0.20	0.21	0.22	0.23	0.23	0.24	0.25	0.26
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**	**62.11**	**62.50**	**62.93**	**63.38**	**63.86**	**64.36**	**64.89**	**65.43**	**66.00**	**66.59**	**67.21**	**67.86**	**68.53**	**69.22**	**69.94**
1	Fixed assets	MDL M	36.08	35.31	34.54	33.76	32.99	32.22	31.45	30.67	29.90	29.13	28.36	27.59	26.81	26.04	25.27
2	Current assets	MDL M	26.03	27.19	28.39	29.62	30.87	32.15	33.44	34.76	36.09	37.46	38.85	40.28	41.71	43.18	44.67
3	Inventories	MDL M	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13
4	Short-term receivables	MDL M	1.22	1.27	1.34	1.41	1.49	1.57	1.66	1.74	1.82	1.91	2.00	2.09	2.18	2.27	2.36
5	Cash and other financial assets	MDL M	24.57	25.68	26.81	27.96	29.13	30.32	31.53	32.76	34.01	35.29	36.59	37.91	39.26	40.63	42.03
6	Other current assets	MDL M	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
B	**Liabilities**	**MDL M**	**62.11**	**62.50**	**62.93**	**63.38**	**63.86**	**64.36**	**64.89**	**65.43**	**66.00**	**66.59**	**67.21**	**67.86**	**68.53**	**69.22**	**69.94**
1	Equity capital	MDL M	57.06	57.39	57.74	58.11	58.50	58.91	59.34	59.80	60.27	60.77	61.29	61.84	62.41	63.00	63.62
2	Long-term liabilities	MDL M	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
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	0.00	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
5	Short-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
6	Current liabilities to suppliers	MDL M	1.12	1.17	1.24	1.31	1.39	1.47	1.55	1.63	1.71	1.80	1.88	1.98	2.06	2.15	2.24
7	Current liabilities	MDL M	0.27	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.37	0.38	0.39	0.40	0.41	0.42	0.44
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**		**10.09**	**38.11**	**33.60**	**10.20**	**10.37**	**10.71**	**13.01**	**13.51**	**14.21**	**14.93**	**15.68**	**16.69**	**17.65**	**18.35**	**19.08**
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		5.08	25.40	20.32	0.00	0.00										
3	Own contribution	MDL M		1.18	5.91	4.72	0.00	0.00										
4	Revenues from sale	MDL M		7.26	7.91	8.50	10.01	10.35	10.68	12.82	13.46	14.16	14.88	15.61	16.62	17.59	18.29	19.01
5	Increase in current liabilities	MDL M		-3.44	-1.11	0.05	0.19	0.03	0.03	0.18	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07
B	**Financial outflows**	**MDL M**		**10.19**	**37.70**	**31.96**	**9.70**	**9.68**	**9.93**	**11.75**	**12.17**	**12.75**	**13.35**	**13.98**	**14.67**	**15.36**	**16.02**	**16.73**
1	Investment costs	MDL M		6.26	31.31	25.05	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		5.20	6.24	6.83	9.39	9.65	9.90	11.57	12.12	12.69	13.29	13.91	14.57	15.22	15.90	16.61
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		-1.43	0.06	0.07	0.30	0.03	0.03	0.18	0.06	0.06	0.06	0.07	0.09	0.09	0.06	0.07
5	Income tax	MDL M		0.16	0.09	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.05	0.06
C	Net cash flow (inflow - outflow)	**MDL M**		-0.10	0.41	1.64	0.51	0.69	0.78	1.26	1.34	1.46	1.58	1.70	2.02	2.30	2.34	2.35
D	Cumulated cash	**MDL M**	0.17	0.07	0.48	2.12	2.63	3.32	4.10	5.35	6.70	8.16	9.74	11.44	13.46	15.75	18.09	20.44

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Financial inflows**	**MDL M**	**19.84**	**20.40**	**21.24**	**22.11**	**23.02**	**23.97**	**24.89**	**25.74**	**26.63**	**27.56**	**28.52**	**29.53**	**30.41**	**31.33**	**32.29**
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	19.77	20.35	21.17	22.03	22.93	23.88	24.81	25.66	26.55	27.47	28.43	29.44	30.33	31.25	32.20
5	Increase in current liabilities	MDL M	0.07	0.06	0.08	0.08	0.08	0.09	0.08	0.08	0.08	0.09	0.09	0.09	0.08	0.09	0.09
B	**Financial outflows**	**MDL M**	**17.47**	**18.02**	**18.84**	**19.69**	**20.58**	**21.52**	**22.42**	**23.24**	**24.11**	**25.02**	**25.97**	**26.95**	**27.81**	**28.72**	**29.65**
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	17.34	17.91	18.71	19.55	20.43	21.36	22.26	23.09	23.96	24.86	25.80	26.78	27.65	28.54	29.47
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	0.07	0.05	0.07	0.08	0.08	0.09	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.09
5	Income tax	MDL M	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09
C	Net cash flow (inflow - outflow)	**MDL M**	2.37	2.38	2.40	2.42	2.44	2.46	2.48	2.49	2.51	2.53	2.55	2.58	2.60	2.62	2.64
D	Cumulated cash	**MDL M**	22.81	25.19	27.59	30.00	32.44	34.90	37.37	39.87	42.38	44.92	47.47	50.05	52.64	55.26	57.89

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**		**3.83**	**6.77**	**7.78**	**7.68**	**8.07**	**8.41**	**9.07**	**11.64**	**12.27**	**12.92**	**13.59**	**14.51**	**12.73**	**13.41**	**14.12**
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		7.27	7.88	7.75	7.69	8.03	8.38	8.95	11.59	12.22	12.87	13.53	14.45	12.67	13.34	14.05
5	Increase in current liabilities	MDL M		-3.44	-1.11	0.03	-0.02	0.03	0.03	0.12	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07
B	**Financial outflows**	**MDL M**		**3.93**	**6.37**	**6.58**	**6.60**	**6.94**	**7.27**	**8.19**	**9.12**	**9.50**	**10.08**	**10.68**	**11.36**	**11.48**	**12.34**	**13.04**
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	Costs of providing services	MDL M		5.20	6.22	6.53	6.56	6.87	7.18	8.14	8.64	9.18	9.74	10.33	10.96	11.59	12.24	12.93
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		-1.43	0.05	-0.01	0.00	0.03	0.03	0.05	0.22	0.05	0.06	0.06	0.08	-0.14	0.06	0.06
	Income tax			0.16	0.11	0.05	0.04	0.05	0.05	0.00	0.26	0.27	0.28	0.29	0.33	0.04	0.04	0.04
C	**Net cash flow (inflow - outflow)**	**MDL M**		-0.10	0.39	1.20	1.08	1.12	1.15	0.88	2.52	2.77	2.84	2.91	3.15	1.25	1.06	1.08
D	**Cumulated cash**	**MDL M**	0.17	0.07	0.47	1.67	2.75	3.87	5.02	5.90	8.42	11.18	14.03	16.93	20.08	21.33	22.40	23.48

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Financial inflows**	**MDL M**	**14.86**	**15.46**	**16.34**	**17.25**	**18.22**	**19.25**	**20.27**	**21.22**	**22.23**	**23.29**	**24.39**	**25.56**	**26.59**	**27.68**	**28.81**
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	14.79	15.40	16.26	17.17	18.13	19.15	20.18	21.13	22.14	23.19	24.29	25.45	26.50	27.58	28.70
5	Increase in current liabilities	MDL M	0.07	0.06	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10
B	**Financial outflows**	**MDL M**	**13.76**	**14.35**	**15.21**	**16.10**	**17.05**	**18.06**	**19.06**	**19.99**	**20.97**	**22.01**	**23.09**	**24.23**	**25.24**	**26.31**	**27.41**
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	13.66	14.25	15.09	15.98	16.92	17.91	18.91	19.85	20.83	21.85	22.93	24.06	25.08	26.13	27.23
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	0.06	0.05	0.07	0.08	0.08	0.09	0.09	0.08	0.09	0.09	0.09	0.10	0.09	0.09	0.10
	Income tax		0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.08
C	**Net cash flow (inflow - outflow)**	**MDL M**	1.10	1.11	1.13	1.15	1.17	1.19	1.21	1.23	1.25	1.28	1.30	1.32	1.35	1.37	1.40
D	**Cumulated cash**	**MDL M**	24.57	25.68	26.81	27.96	29.13	30.32	31.53	32.76	34.01	35.29	36.59	37.91	39.26	40.63	42.03

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**	**-0.01**	**0.04**	**0.77**	**2.52**	**2.31**	**2.30**	**3.93**	**1.87**	**1.94**	**2.01**	**2.09**	**2.17**	**4.93**	**4.95**	**4.97**
1	Incremental revenues from sales	MDL M	-0.01	0.03	0.75	2.32	2.31	2.30	3.87	1.87	1.94	2.01	2.08	2.17	4.92	4.95	4.96
2	Incremental increase in current liabilities	MDL M	0.00	0.00	0.02	0.21	0.00	-0.01	0.06	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**	**4.83**	**31.39**	**25.41**	**3.14**	**2.81**	**2.75**	**3.61**	**3.53**	**3.57**	**3.61**	**3.64**	**3.70**	**3.72**	**3.72**	**3.74**
1	Investment costs	MDL M	6.26	31.31	25.05	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	-0.01	0.03	0.29	2.84	2.78	2.71	3.43	3.47	3.51	3.55	3.58	3.61	3.63	3.66	3.67
3	Incremental increase in current assets	MDL M	-1.43	0.06	0.07	0.30	0.03	0.03	0.18	0.06	0.06	0.06	0.07	0.09	0.09	0.06	0.07
C	**Net cash flow (inflow - outflow)**	**MDL M**	**-4.83**	**-31.35**	**-24.63**	**-0.62**	**-0.51**	**-0.45**	**0.32**	**-1.66**	**-1.63**	**-1.60**	**-1.56**	**-1.52**	**1.21**	**1.23**	**1.23**
D	FNPV(C)	**MDL M**	**-45.43**														
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**	**4.98**	**4.95**	**4.91**	**4.86**	**4.80**	**4.73**	**4.62**	**4.52**	**4.40**	**4.27**	**4.13**	**3.97**	**3.82**	**3.65**	**33.71**
1	Incremental revenues from sales	MDL M	4.98	4.95	4.91	4.86	4.80	4.73	4.63	4.53	4.41	4.28	4.14	3.98	3.83	3.67	3.49
2	Incremental increase in current liabilities	MDL M	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
3	Residual value	MDL M															30.23
B	**Financial outflows**	**MDL M**	**3.76**	**3.71**	**3.69**	**3.65**	**3.60**	**3.53**	**3.43**	**3.32**	**3.21**	**3.09**	**2.95**	**2.81**	**2.65**	**2.49**	**2.32**
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	3.69	3.66	3.62	3.57	3.52	3.45	3.35	3.25	3.13	3.01	2.87	2.72	2.57	2.41	2.24
3	Incremental increase in current assets	MDL M	0.07	0.05	0.07	0.08	0.08	0.09	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.09
C	**Net cash flow (inflow - outflow)**	**MDL M**	**1.22**	**1.23**	**1.21**	**1.21**	**1.20**	**1.19**	**1.19**	**1.20**	**1.19**	**1.18**	**1.17**	**1.16**	**1.17**	**1.16**	**31.38**

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**	**5.07**	**25.44**	**21.10**	**2.52**	**2.31**	**2.30**	**3.93**	**1.87**	**1.94**	**2.01**	**2.09**	**2.17**	**4.93**	**4.95**	**4.97**
1	Incremental revenues from sales	MDL M	-0.01	0.03	0.75	2.32	2.31	2.30	3.87	1.87	1.94	2.01	2.08	2.17	4.92	4.95	4.96
2	Incremental increase in current liabilities	MDL M	0.00	0.00	0.02	0.21	0.00	-0.01	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Donor contribution (capital grant)	MDL M	5.08	25.40	20.32	0.00	0.00										
4	Residual value	MDL M															
B	**Financial outflows**	**MDL M**	**4.83**	**31.39**	**25.41**	**3.14**	**2.81**	**2.75**	**3.61**	**3.53**	**3.57**	**3.61**	**3.64**	**3.70**	**3.72**	**3.72**	**3.74**
1	Investment costs	MDL M	6.26	31.31	25.05	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	-0.01	0.03	0.29	2.84	2.78	2.71	3.43	3.47	3.51	3.55	3.58	3.61	3.63	3.66	3.67
3	Incremental increase in current assets	MDL M	-1.43	0.06	0.07	0.30	0.03	0.03	0.18	0.06	0.06	0.06	0.07	0.09	0.09	0.06	0.07
C	**Net cash flow (inflow - outflow)**	**MDL M**	**0.25**	**-5.95**	**-4.31**	**-0.62**	**-0.51**	**-0.45**	**0.32**	**-1.66**	**-1.63**	**-1.60**	**-1.56**	**-1.52**	**1.21**	**1.23**	**1.23**
D	**FNPV(K) - Financial Net Present value of the Capital**	**MDL M**	**0.00**														
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**	**4.98**	**4.95**	**4.91**	**4.86**	**4.80**	**4.73**	**4.62**	**4.52**	**4.40**	**4.27**	**4.13**	**3.97**	**3.82**	**3.65**	**33.71**
1	Incremental revenues from sales	MDL M	4.98	4.95	4.91	4.86	4.80	4.73	4.63	4.53	4.41	4.28	4.14	3.98	3.83	3.67	3.49
2	Incremental increase in current liabilities	MDL M	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
3	Donor contribution (capital grant)	MDL M															
4	Residual value	MDL M															30.23
B	**Financial outflows**	**MDL M**	**3.76**	**3.71**	**3.69**	**3.65**	**3.60**	**3.53**	**3.43**	**3.32**	**3.21**	**3.09**	**2.95**	**2.81**	**2.65**	**2.49**	**2.32**
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	3.69	3.66	3.62	3.57	3.52	3.45	3.35	3.25	3.13	3.01	2.87	2.72	2.57	2.41	2.24
3	Incremental increase in current assets	MDL M	0.07	0.05	0.07	0.08	0.08	0.09	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.09
C	**Net cash flow (inflow - outflow)**	**MDL M**	**1.22**	**1.23**	**1.21**	**1.21**	**1.20**	**1.19**	**1.19**	**1.20**	**1.19**	**1.18**	**1.17**	**1.16**	**1.17**	**1.16**	**31.38**

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**	**-4.83**	**-31.35**	**-24.63**	**-0.62**	**-0.51**	**-0.45**	**0.32**	**-1.66**	**-1.63**	**-1.60**	**-1.56**	**-1.52**	**1.21**	**1.23**	**1.23**
1	Social costs	MDL M	0.00	0.00	0.00	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03	-0.04	-0.04	-0.05	-0.06	-0.06	-0.07
2	Shadow prices - electricity	MDL M	0.00	0.00	0.00	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03	-0.04	-0.04	-0.05	-0.06	-0.06	-0.07
B	**Social benefits**	**MDL M**	**2.82**	**14.09**	**11.27**	**2.06**	**2.06**	**2.07**	**2.94**	**2.97**	**3.00**	**3.04**	**3.07**	**3.10**	**3.14**	**3.17**	**3.21**
1	Tax correction - VAT	MDL M	1.25	6.26	5.01	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	1.57	7.83	6.26	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	0.03	0.03	0.03	0.91	0.94	0.97	1.00	1.04	1.07	1.11	1.14	1.17
4	Benefits of avoiding water related disease	MDL M	0.00	0.00	0.00	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03
C	**Net cash flow (inflow - outflow)**	**MDL M**	-2.01	-17.26	-13.36	1.46	1.58	1.64	3.28	1.34	1.41	1.48	1.56	1.63	4.40	4.46	4.50
D	**ENPV**	**MDL M**	**18.21**														
E	**ERR**	%	**8%**														

			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	**Net cash flow (inflow - outflow)**	**MDL M**	**1.22**	**1.23**	**1.21**	**1.21**	**1.20**	**1.19**	**1.19**	**1.20**	**1.19**	**1.18**	**1.17**	**1.16**	**1.17**	**1.16**	**31.38**
1	Social costs	MDL M	-0.08	-0.09	-0.10	-0.12	-0.13	-0.15	-0.17	-0.19	-0.21	-0.23	-0.26	-0.28	-0.30	-0.33	-0.36
2	Shadow prices - electricity	MDL M	-0.08	-0.09	-0.10	-0.12	-0.13	-0.15	-0.17	-0.19	-0.21	-0.23	-0.26	-0.28	-0.30	-0.33	-0.36
B	**Social benefits**	**MDL M**	**3.24**	**3.24**	**3.24**	**3.24**	**3.24**	**3.24**	**3.24**	**3.24**	**3.24**	**3.24**	**3.24**	**3.24**	**3.24**	**3.24**	**3.24**
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	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21
4	Benefits of avoiding water related disease	MDL M	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03
C	**Net cash flow (inflow - outflow)**	**MDL M**	4.54	4.56	4.55	4.56	4.57	4.58	4.60	4.62	4.64	4.65	4.67	4.68	4.71	4.73	34.98

Table 6-26: Sensitivity analysis

A	**Investment costs**	**%**	100%	105%	110.00%	115.00%	120.00%	125.00%
1	FNPV(C)	MDL M	-45.43	-44.78	-46.54	-48.29	-50.05	-51.80
2	FRR(C)	%	-1.29%	-1.15%	-1.13%	-1.11%	-1.10%	-1.08%
3	FNPV(K)	MDL M	0.00	0.25	0.41	0.58	0.74	0.90
4	FRR(K)	%	5.0%	5.1%	5.1%	5.2%	5.2%	5.3%
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	-45.43	-43.03	-42.51	-43.49
2	FRR(C)	%	-1.3%	-1.16%	-1.14%	-1.17%
3	FNPV(K)	MDL M	0.00	0.08	0.60	-0.38
4	FRR(K)	%	5.0%	5.0%	5.2%	4.9%
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	-45.43	-43.03	-42.80	-43.20
2	FRR(C)	%	-1.3%	-1.16%	-1.15%	-1.17%
3	FNPV(K)	MDL M	0.00	0.08	0.31	-0.09
4	FRR(K)	%	5.0%	5.0%	5.1%	5.0%
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	-45.43	-43.03	-43.79	-43.13
2	FRR(C)	%	-1.3%	-1.16%	-1.16%	-1.25%
3	FNPV(K)	MDL M	0.00	0.08	-0.68	-0.02
4	FRR(K)	%	5.0%	5.0%	4.8%	5.0%
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:

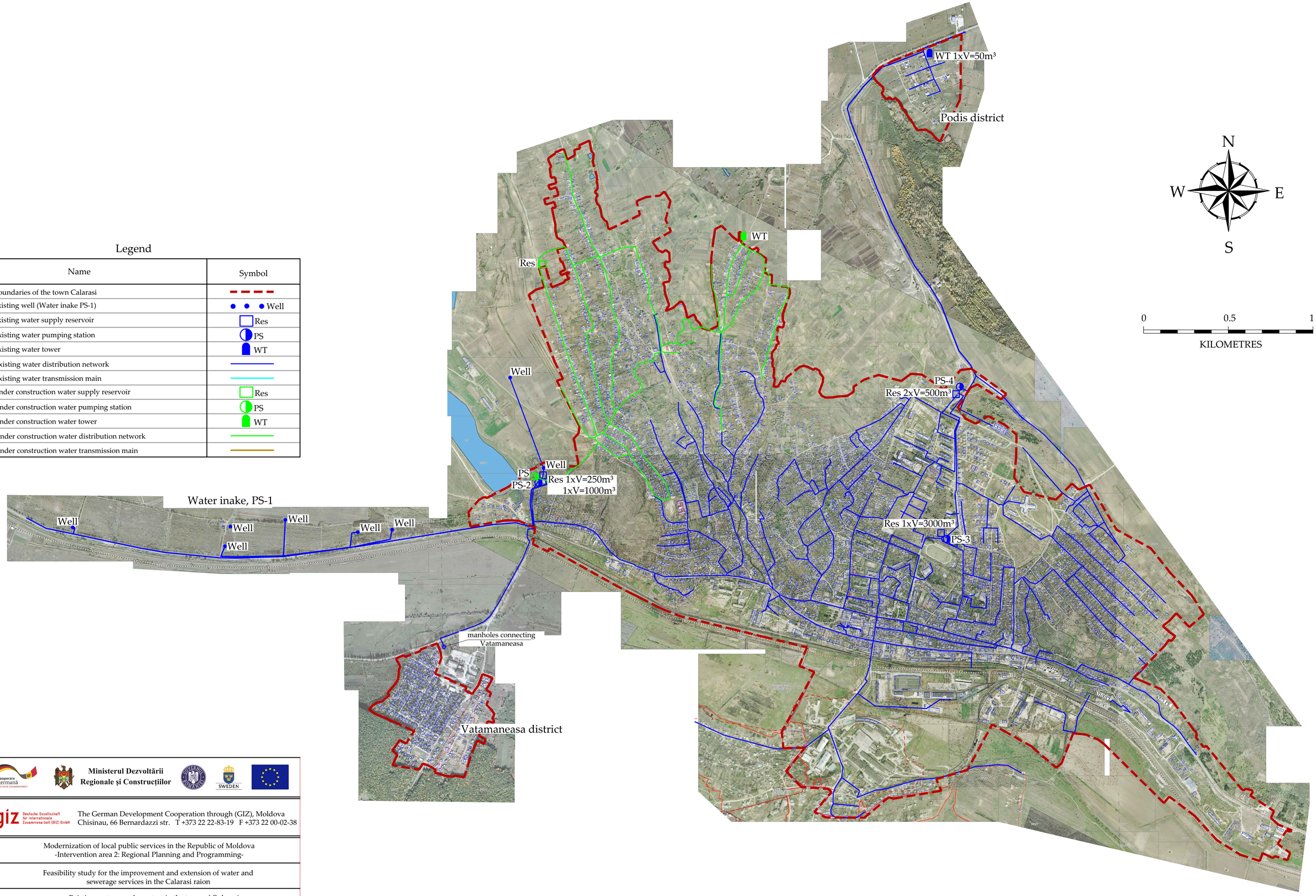
- Information of RDA staff on findings of social and gender assessment and their incorporation in the RDA plan of activities;
- Appointment of a gender focal point at the respective RDA;

- 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 Calarasi



Legend

Name	Symbol
Boundaries of the town Calarasi	
Existing well (Water inake PS-1)	Well
Existing water supply reservoir	Res
Existing water pumping station	PS
Existing water tower	WT
Existing water distribution network	
Existing water transmission main	
Under construction water supply reservoir	Res
Under construction water pumping station	PS
Under construction water tower	WT
Under construction water distribution network	
Under construction water transmission main	

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-Intervention area 2: Regional Planning and Programming-

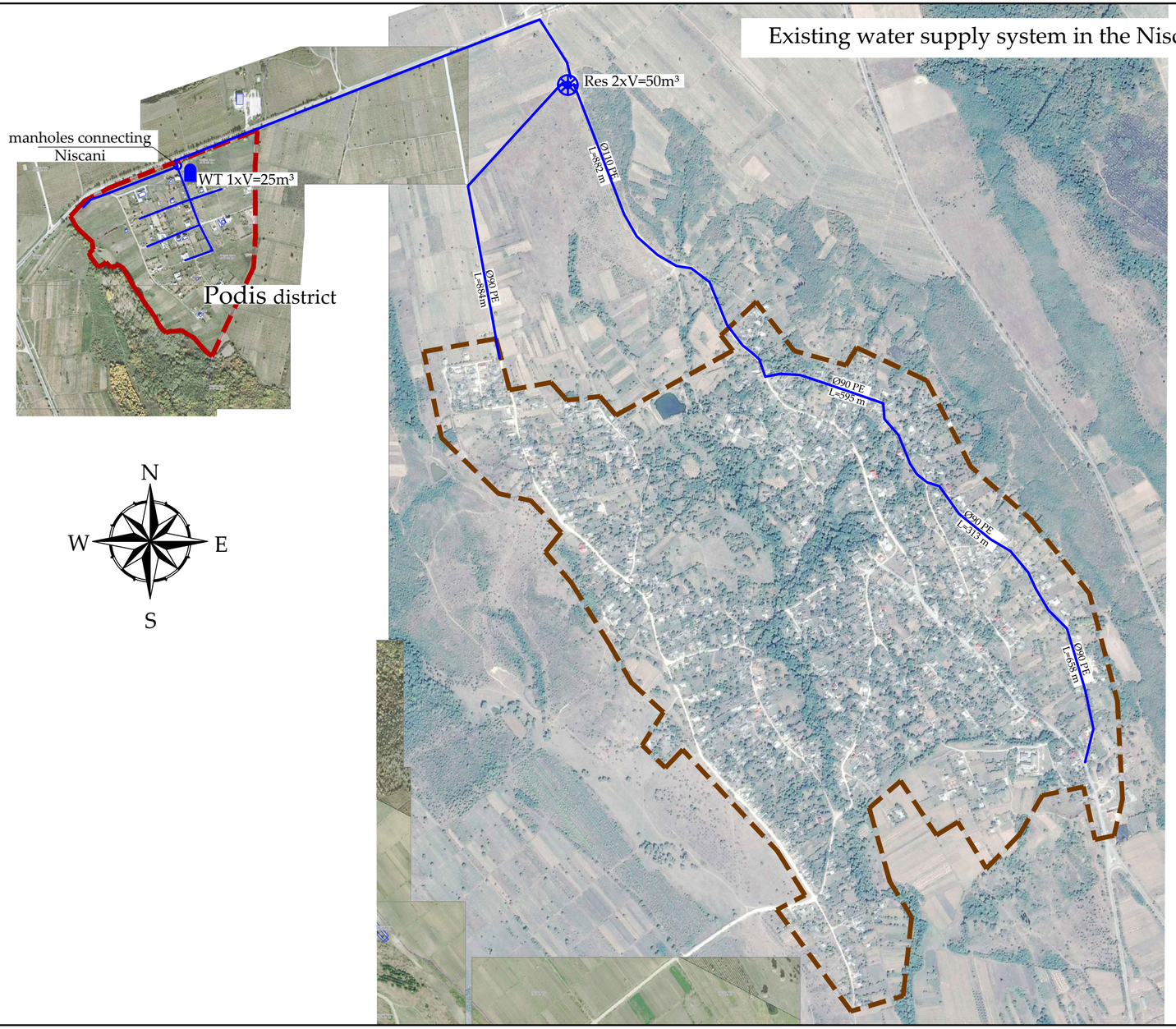
Feasibility study for the improvement and extension of water and sewerage services in the Calarasi raion

Existing water supply system in the town of Ca larasi

Scale:	Drawing No:	Date:	Annex:
1:10 000	1/11	2015.11.18	Nr.10

Format A1

Existing water supply system in the Niscani village



0 0.5 1

KILOMETRES

Legend

Name	Symbol
Boundaries of the town Calarasi	
Boundaries of the village	
Existing water distribution network	
Existing water tower	WT
Existing water supply metalic reservoir	Res

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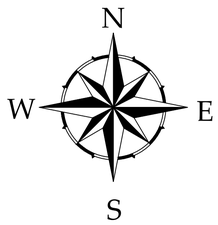
Existing water supply system in the Niscani village

Scale:	Drawing No:	Date:	Annex:
1:10 000	2/11	2015.11.18	Nr.10

Format 2970X5940

Existing sewerage system in the town of Calarasi



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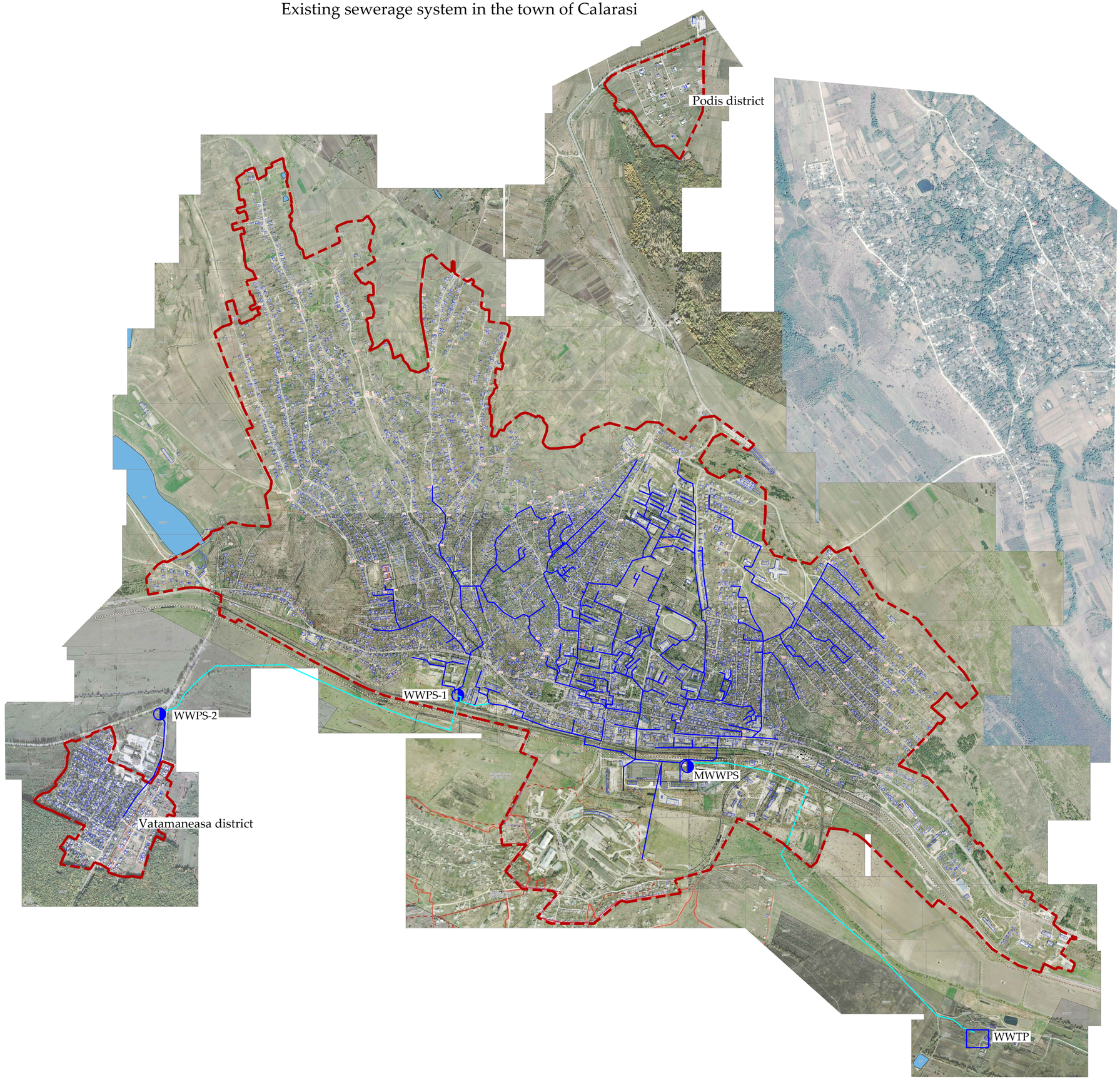
KILOMETRES



Legend

Name	Symbol
Boundaries of the town Calarasi	
Existing wastewater treatment plant	WWTP
Existing wastewater pumping station	WWPS
Existing sewerage network	
Existing pressure sewerage network	

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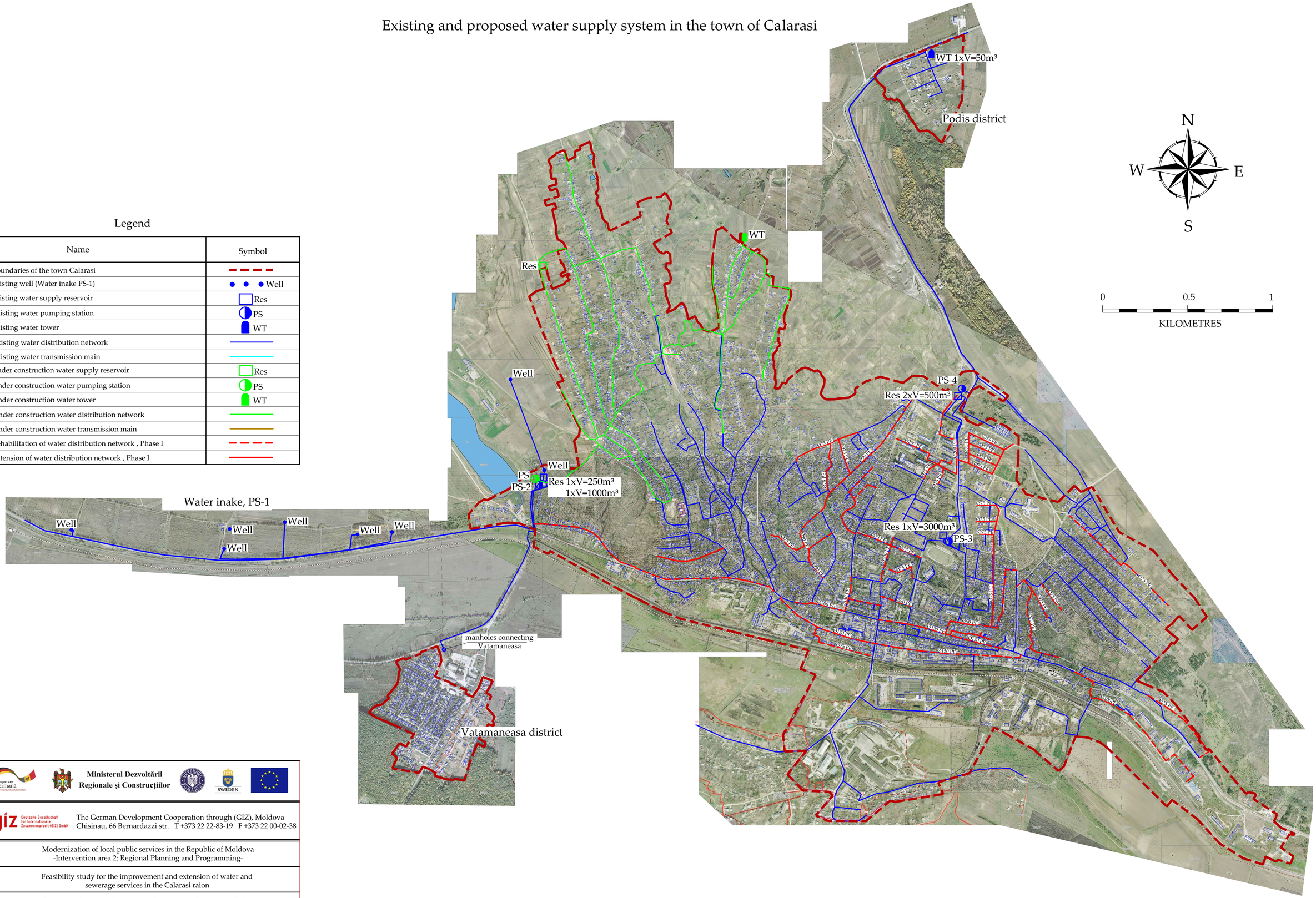
Existing sewerage system in the town of Ca larasi

Scale:	Drawing No:	Date:	Annex:
1:10 000	3/11	2015.11.18	Nr.10

Format A1

Existing and proposed water supply system in the town of Calarasi



Legend

Name	Symbol
Boundaries of the town Calarasi	
Existing well (Water inake PS-1)	Well
Existing water supply reservoir	Res
Existing water pumping station	PS
Existing water tower	WT
Existing water distribution network	
Existing water transmission main	
Under construction water supply reservoir	Res
Under construction water pumping station	PS
Under construction water tower	WT
Under construction water distribution network	
Under construction water transmission main	
Rehabilitation of water distribution network , Phase I	
Extension of water distribution network , Phase I	

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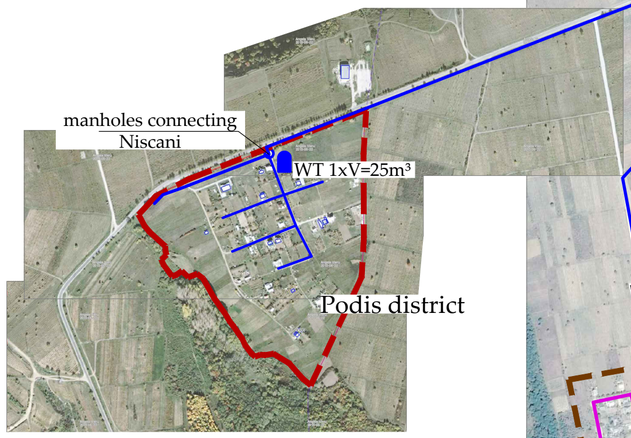
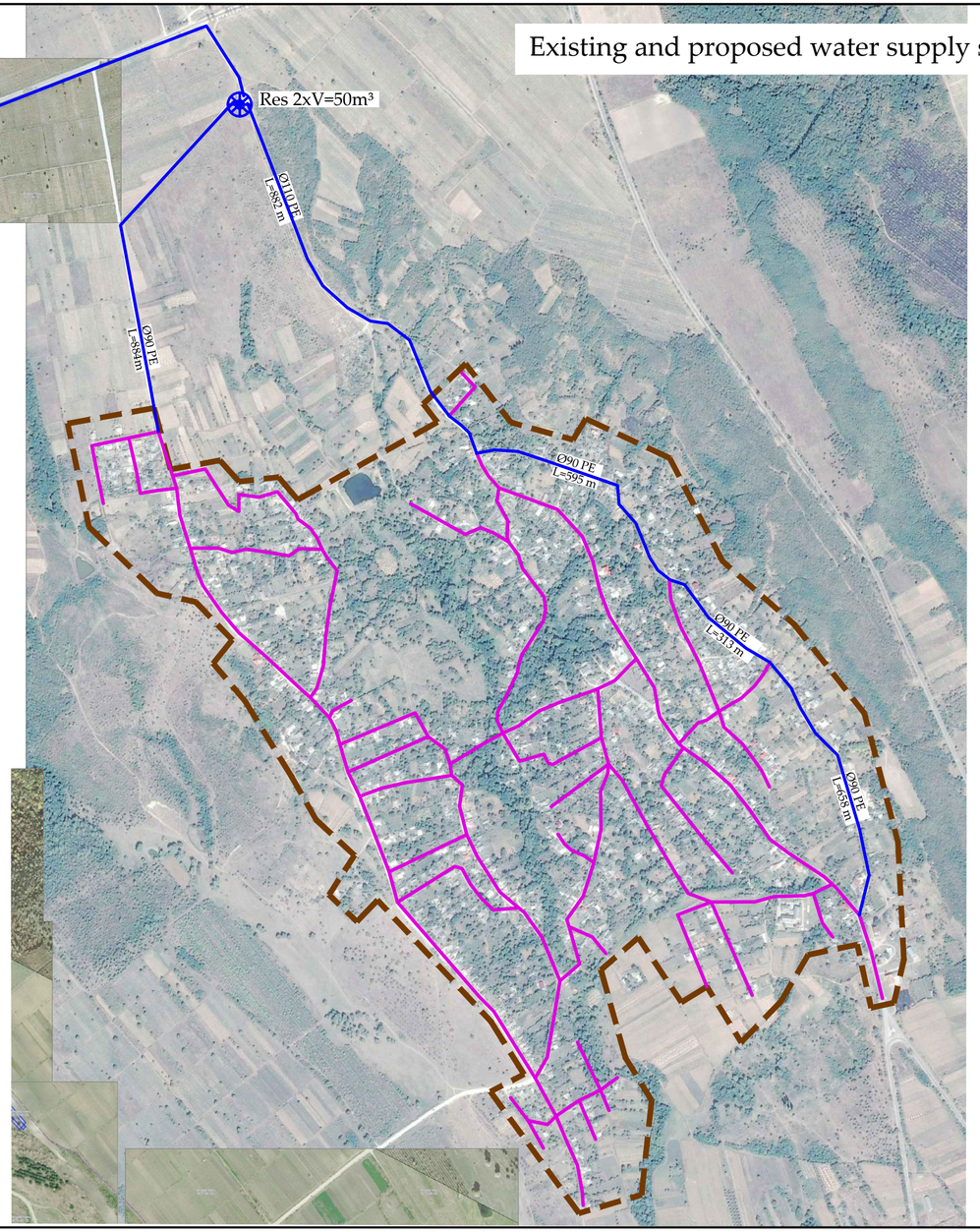
Existing and proposed water supply system in the town of Ca larasi

Scale:	Drawing No:	Date:	Annex:
1:10 000	4/11	2015.11.18	Nr.10

Format A1

Existing and proposed water supply system in the Niscani village





N
W E
S

0 0.5 1
KILOMETRES

Legend

Name	Symbol
Boundaries of the town Calarasi	
Boundaries of the village	
Existing water distribution network	
Existing water tower	WT
Existing water supply metalic reservoir	Res
Proposed of water distribution network, Phase II	

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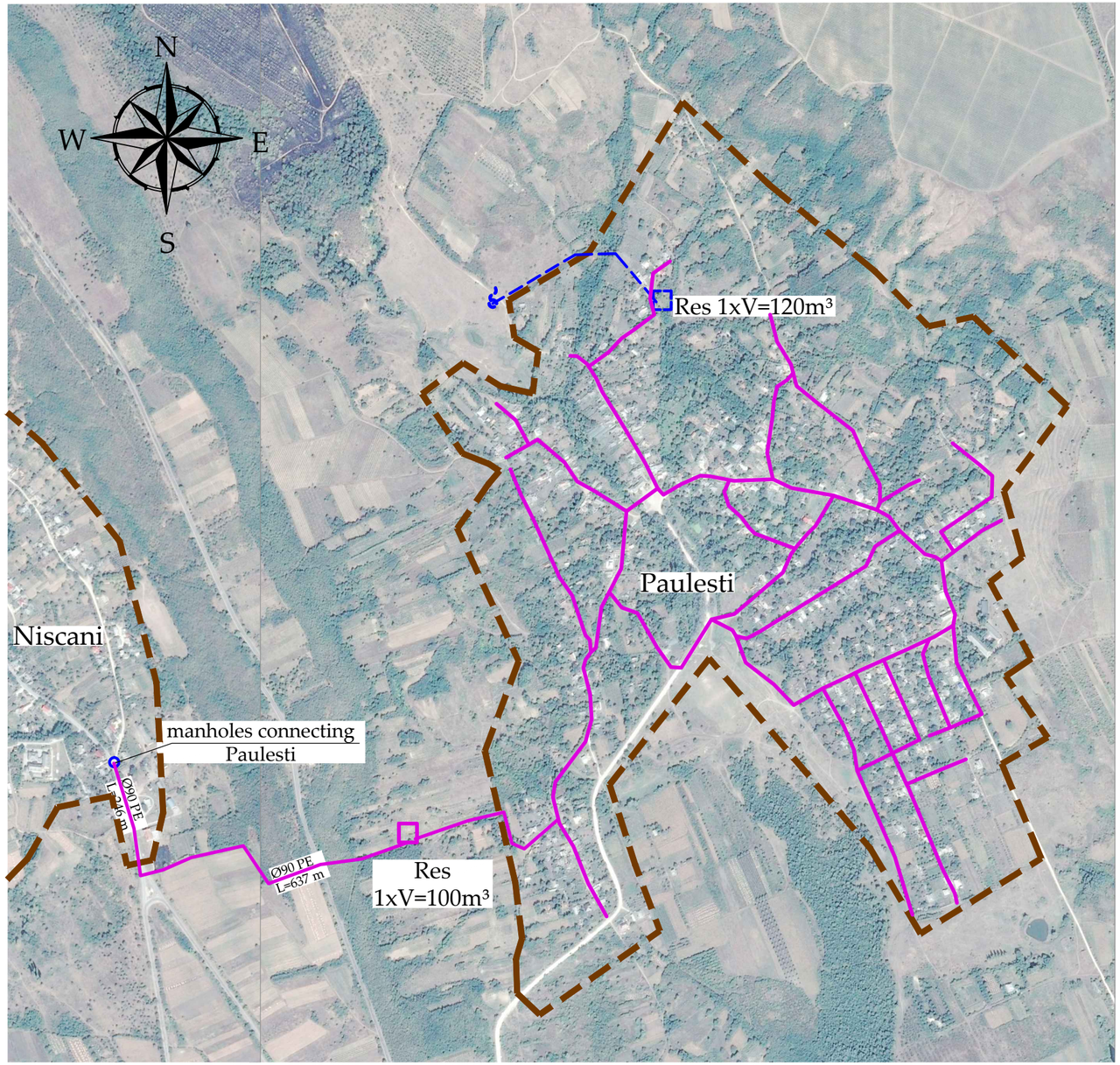
Existing and proposed water supply system in the Niscani village

Scale:	Drawing No:	Date:	Annex:
1:10 000	5/11	2015.11.18	Nr.10

Format 2970X5940

Proposed water supply system in the Paulesti village



0 0.5 1

KILOMETRES

Legend

Name	Symbol
Boundaries of the village	
Decommission source	
Decommission water supply reservoir	Res
Existing manholes connecting Niscani	
Decommission water distribution network	
Proposed water supply reservoir, Phase II	Res
Proposed of water distribution network, Phase II	

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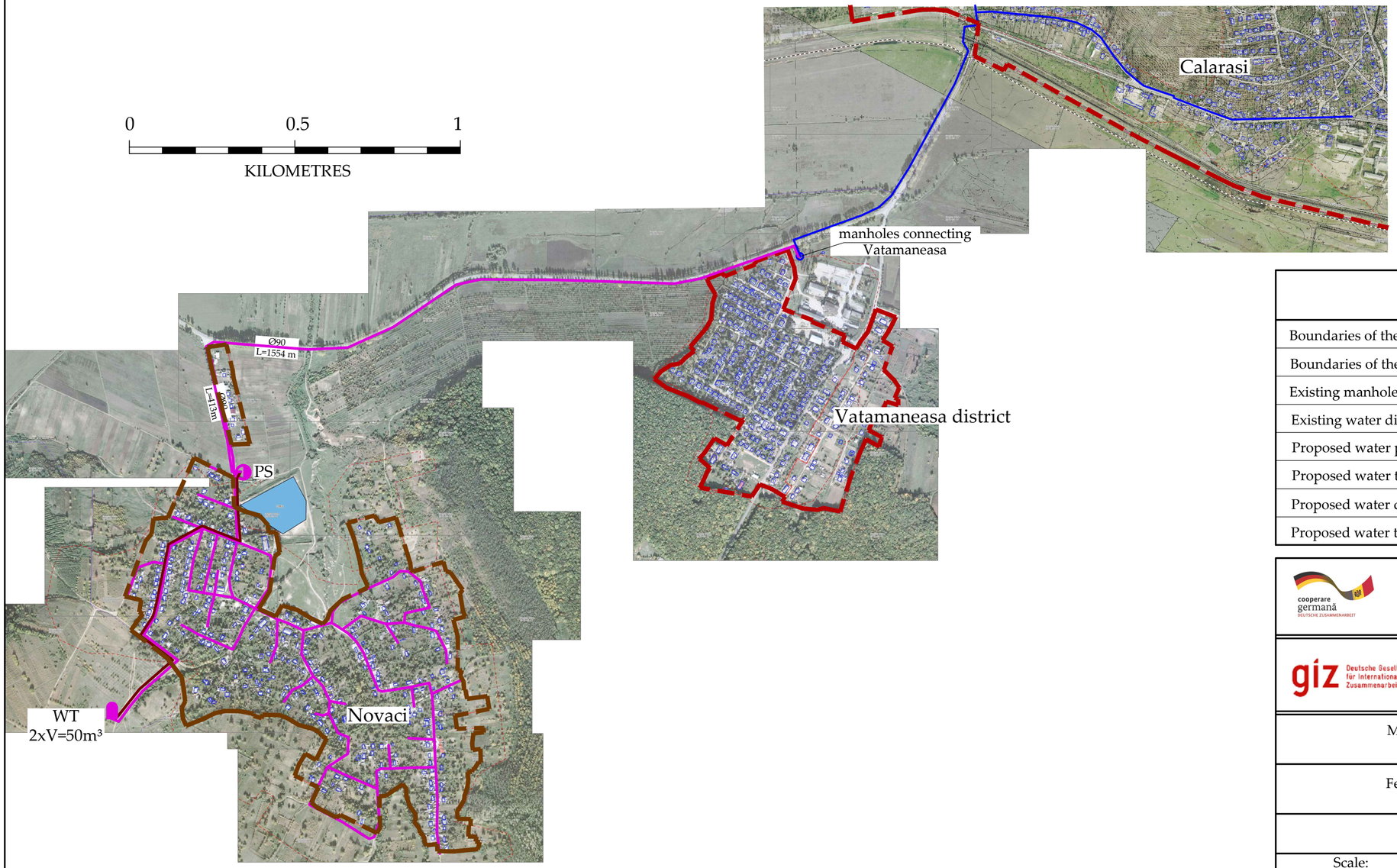
Proposed water supply system in the Paulesti village

Scale:	Drawing No:	Date:	Annex:
1:10 000	6/11	2015.11.18	Nr.10

Format 2970X4800

Proposed water supply system in the Novaci village



Legend

Name	Symbol
Boundaries of the town Calarasi	
Boundaries of the village	
Existing manholes connecting Vatamaneasa	
Existing water distribution network	
Proposed water pumping station, Phase II	PS
Proposed water tower, Phase II	WT
Proposed water distribution network, Phase II	
Proposed water transmission main, Phase II	

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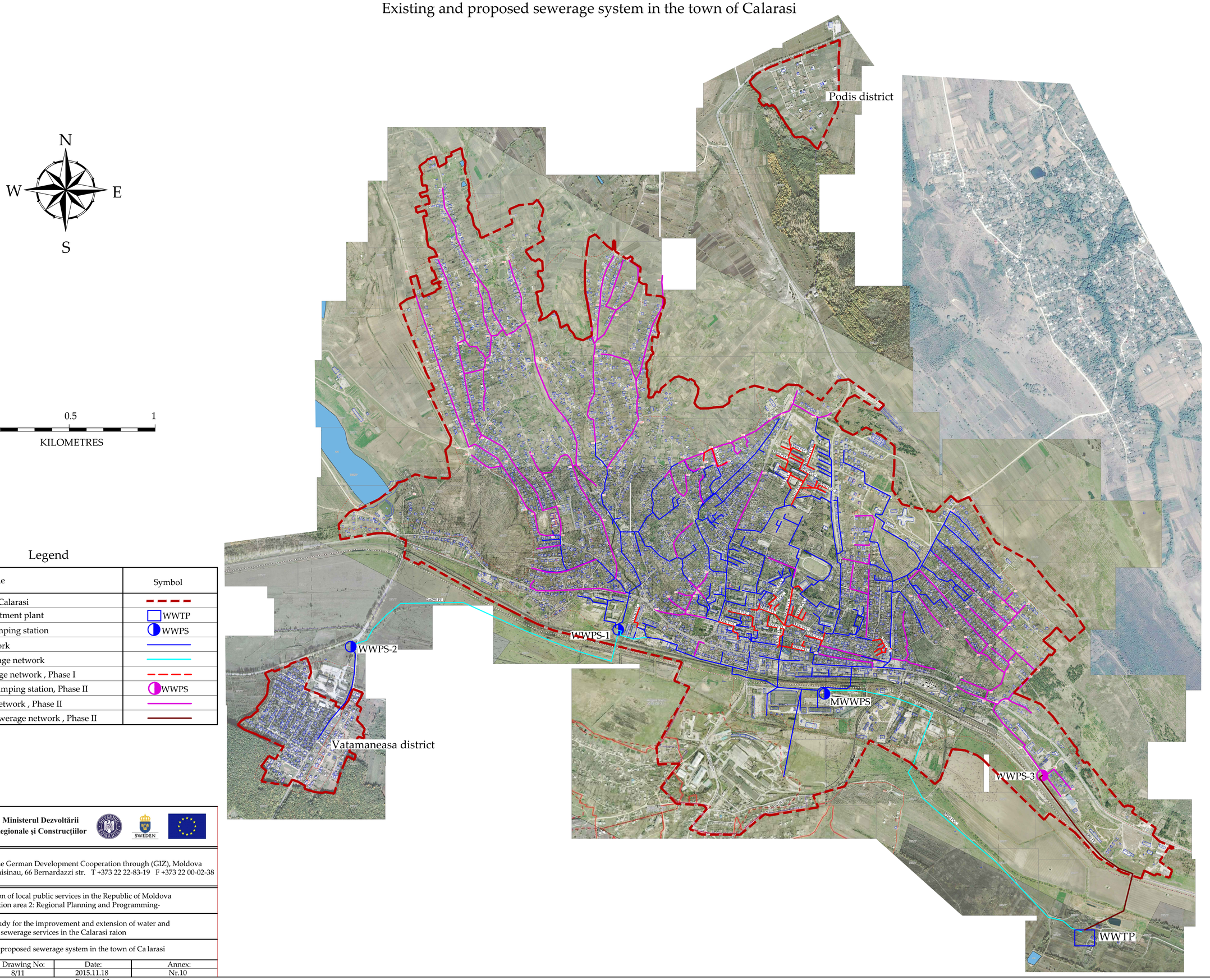
Proposed water supply system in the Novaci village

Scale:	Drawing No:	Date:	Annex:
1:10 000	7/11	2015.11.18	No.10

Format 2970X5940

Existing and proposed sewerage system in the town of Calarasi



Legend

Name	Symbol
Boundaries of the town Calarasi	
Existing wastewater treatment plant	WWTP
Existing wastewater pumping station	WWPS
Existing sewerage network	
Existing pressure sewerage network	
Rehabilitation of sewerage network , Phase I	
Proposed wastewater pumping station, Phase II	WWPS
Extension of sewerage network , Phase II	
Extension of pressure sewerage network , Phase II	

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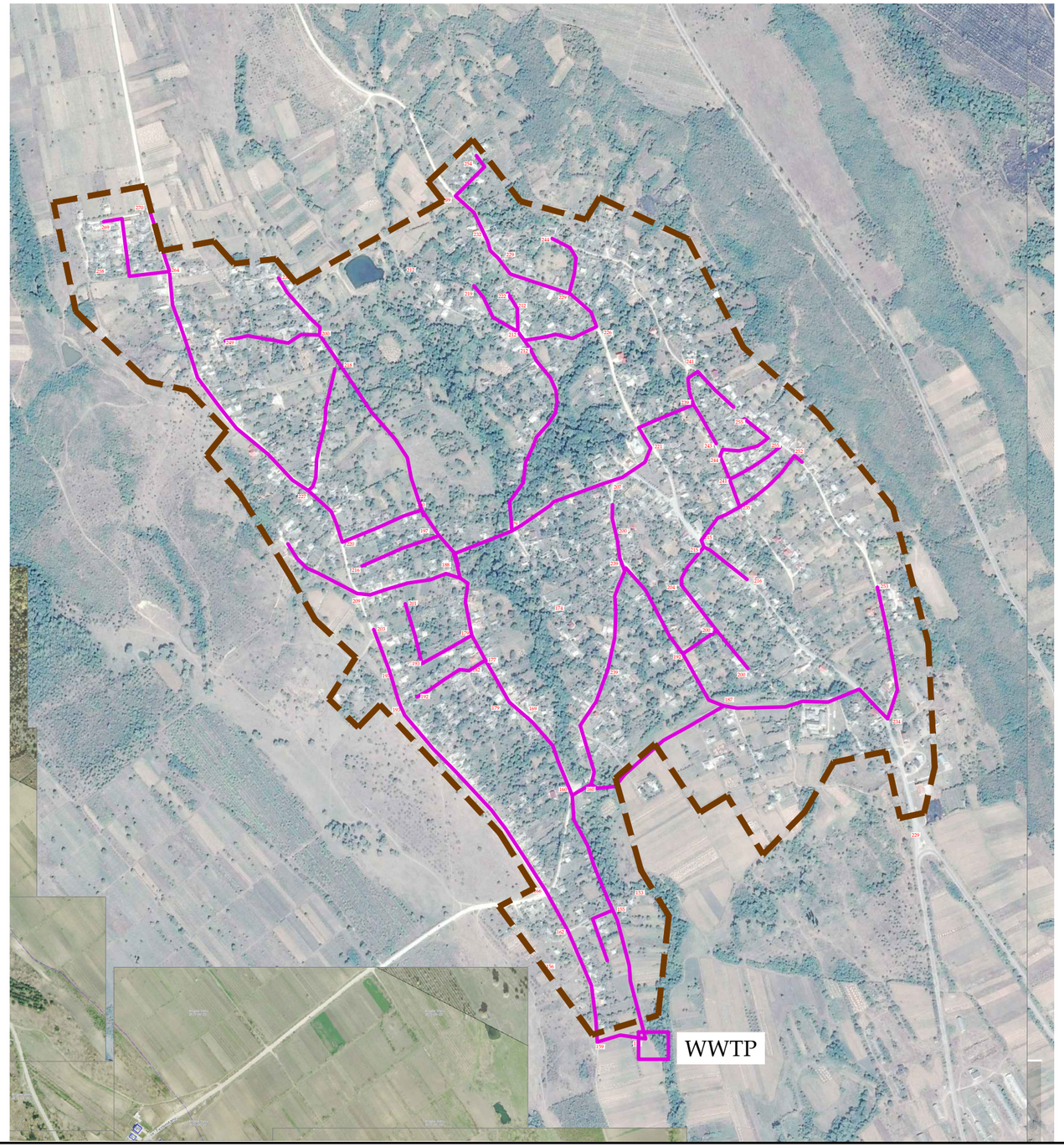
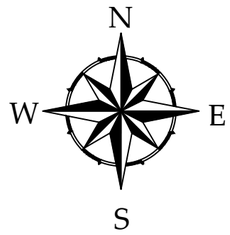
Existing and proposed sewerage system in the town of Ca larasi

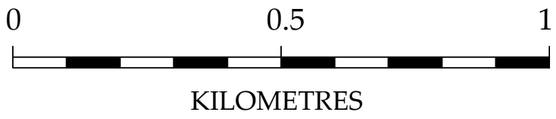
Scale:	Drawing No:	Date:	Annex:
1:10 000	8/11	2015.11.18	Nr.10

Format A1

Proposed sewerage system in the Niscani village







Legend

Name	Symbol
Boundaries of the village	
Proposed wastewater treatment plant, Phase II	WWTP
Extension of sewerage network , Phase II	

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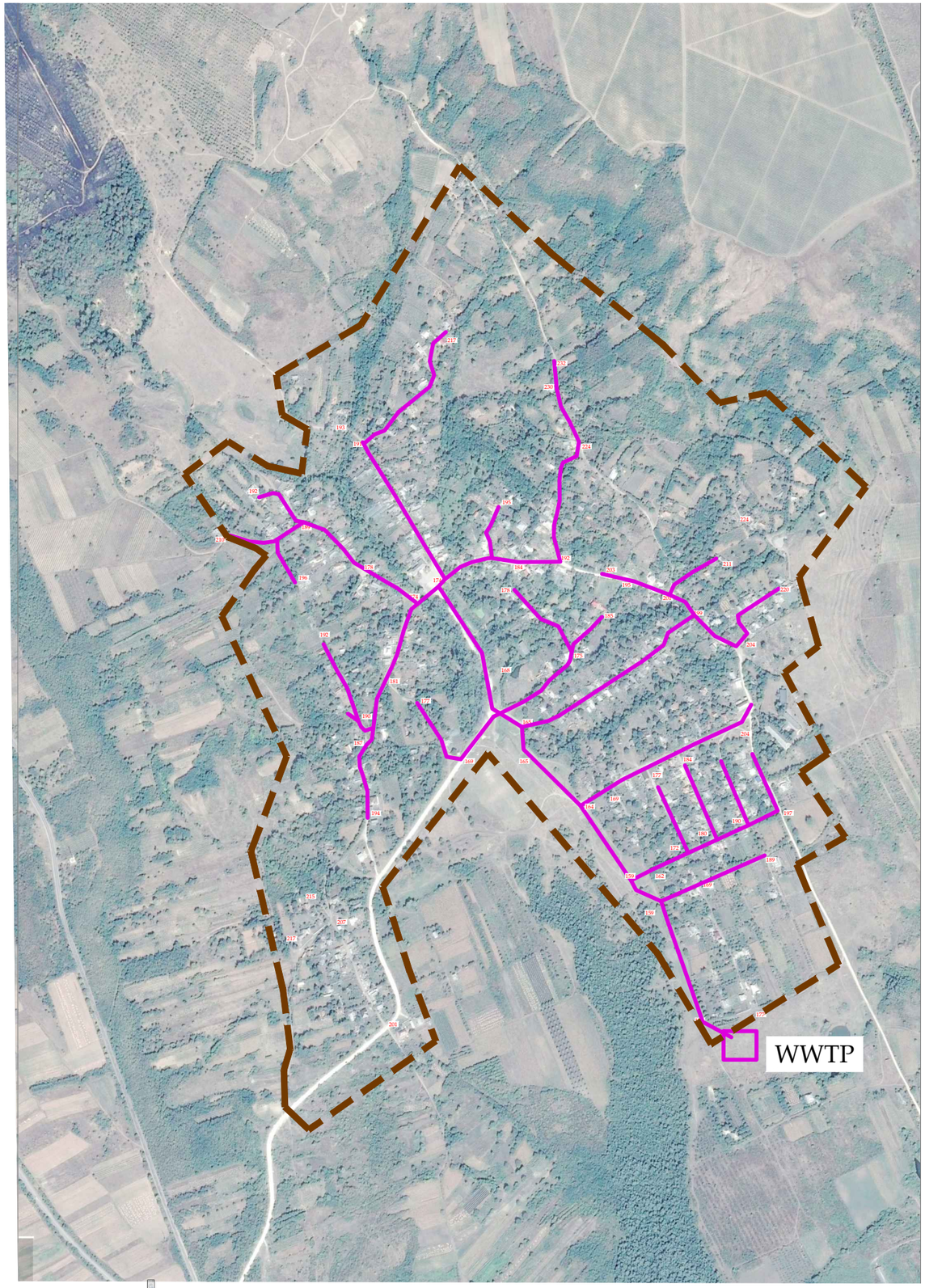
Feasibility study for the improvement and extension of water and sewerage services in the Calarasi raion

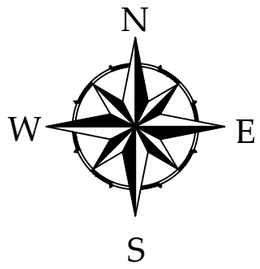
Proposed sewerage system in the Niscani village

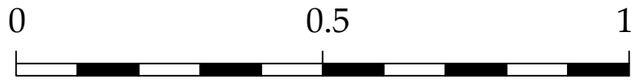
Scale:	Drawing No:	Date:	Annex:
1:10 000	9/11	2015.11.18	Nr.10

Format 2970x4800

Proposed sewerage system in the Paulesti village







Legend

Name	Symbol
Boundaries of the village	
Proposed wastewater treatment plant, Phase II	WWTP
Extension of sewerage network , Phase II	

cooperare germană DEUTSCHE ZUSAMMENARBEIT

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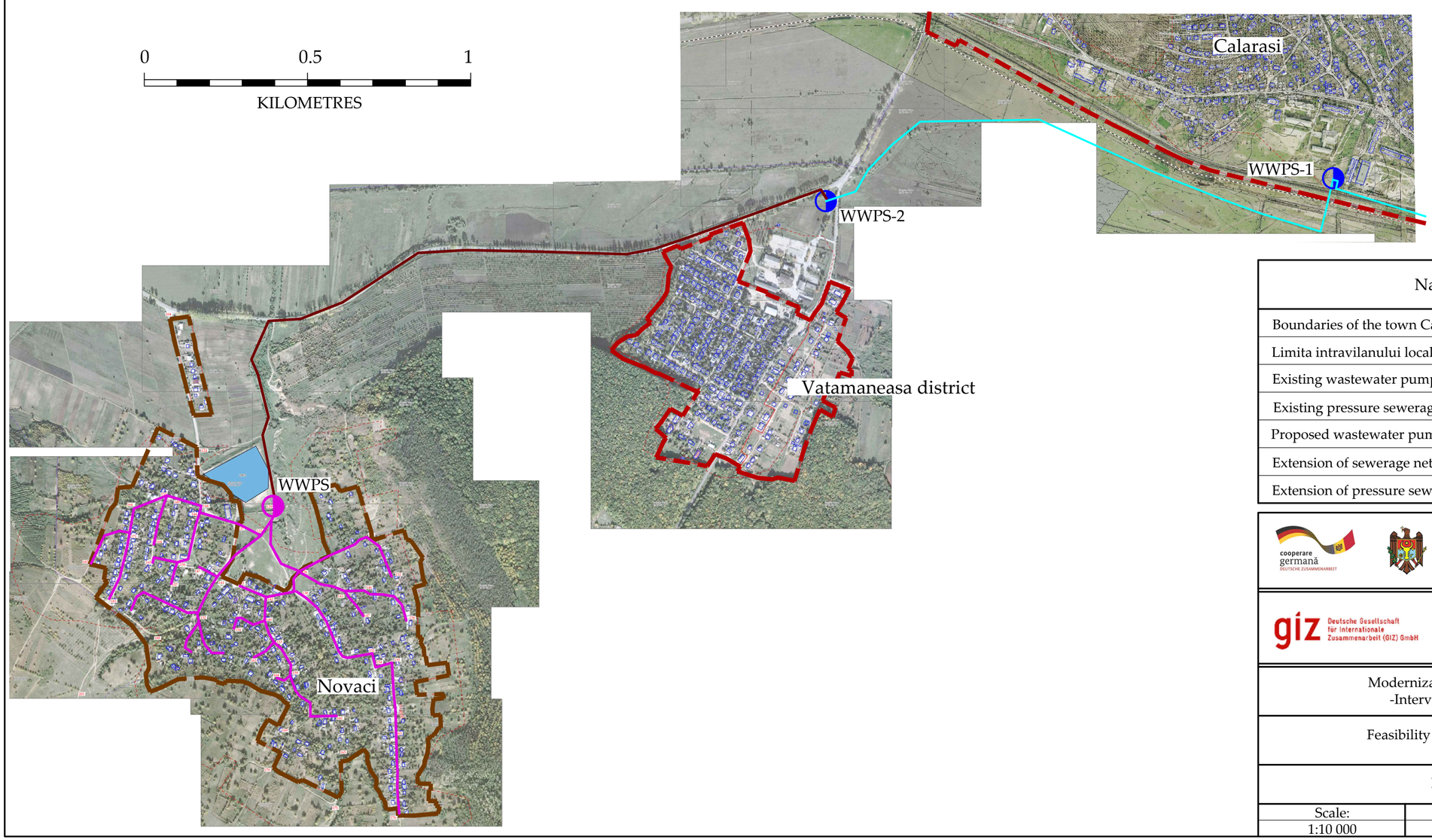
Proposed sewerage system in the Niscani village

Scale:	Drawing No:	Date:	Annex:
1:10 000	10/11	2015.11.18	Nr.10

Format A3

Proposed sewerage system in the Novaci village



Legend

Name	Symbol
Boundaries of the town Calarasi	
Limita intravilanului localităţii	
Existing wastewater pumping station	WWPS
Existing pressure 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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Proposed sewerage system in the Novaci village

Scale:	Drawing No:	Date:	Annex:
1:10 000	11/11	2015.11.18	Nr.10

Format 2970X5940