ROYAL HASKONING

HASKONING NEDERLAND B.V. WATER
IHS INSTITUTE FOR HOUSING AND URBAN DEVELOPMENT STUDIES
DELOITTE&TOUCHE CENTRAL EUROPE

Feasibility Study Leskovac

Wastewater Collection & Treatment
Water Supply Extension

European Agency for Reconstruction (EAR) in Belgrade

SER01/11/008

13 December 2007

Final Report

9R5927/CvS/R2006_21/R001

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Maršala Birjuzova 16/4
11000 Belgrade
Serbia
+381-11-2185 999 Telephone
+381-11-2185 946 Fax
office@miasp.com E-mail
www.miasp.com Internet
www.royalhaskoning.com
Arnhem 09122561 CoC

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Drafted by	Nenad Čolić – Senior Municipal Engineer Aleksandar Vlaški – Water Treatment Expert Michel Leushuis – Economist/Financial Expert Mirjana Strugar – Institutional Expert Paula van Meenen – Environmental Expert Peter Duindam – Institutional Expert Bojana Katuševski – Economist/Financial expert Aleksandar Radenović – Economist
Checked by	Peter Duindam - Institutional Expert
Date/initials check	…… ……
Approved by	Cok van Schooten – Team Leader
Date/initials approval	…… ……

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ABBREVIATIONS

AC	Asbestos Cement
BEN	Balkan Endemic Nephropathy
BOT	Built-Operate-Transfer
BOD	Biochemical oxygen demand
CBA	Cost Benefit Analyses
COD	Chemical oxygen demand
CSO	Combined Sewer Overflow
DI	Ductile iron pipe
DMA	District metered area
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EPA	Environmental protection agency
EU	European Union (from 1992)
EUR	European Euro
FIDIC	International Federation of Consulting Engineers
FOPIP	Financial and operational performance improvement program
GRP	Glass-reinforced-plastic pipe
LEAP	Local Environmental Action Plan
MBR	Membrane Bio-Reactor
MLSS	Mixed Liquor Suspended Solids
NEAP	National Environmental Action Plan
NES	National Environmental Strategy
NIVA	Norwegian Institute for water research
O&M	Operation and Maintenance
PCM	Project cycle management
PE	Population equivalent
PIP	Project Implementation Plan
PPP	Polluter-pays principle
PRAG	Practical Guide to Contract Procedures financed from the general budget of the EC in the context of external actions
PUC	Public Utility Company
PVC	Polyvinyl Chloride
RSD	Republic of Serbia Dinar
SCADA	Supervisory control and data acquisition
SBR	Sequencing batch reactor

SPS	Sewage Pumping Stations
SS	Suspended solids
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TOD	Total Oxygen Demand
TOR	Terms of reference
TSS	Total Suspended Solids
UF	Ultra filtration
UV	Ultra violet light
UFW	Unaccounted For Water
UWWD	Urban Wastewater Treatment Directive
UWWT	Urban wastewater treatment
VOC	Volatile organic compounds
WFD	Water Framework Directive
WTP	(Drinking) Water Treatment Plant
WPCR	Water Pollution Control Regulation
WU	Water utilities
WWT	Wastewater treatment
WWTP, STP	Wastewater treatment plant

EXECUTIVE SUMMARY

Introduction

This Feasibility Study for the Leskovac Water Utilities Project was requested by the EAR in January 2007 in order to be enable consideration of the possibility to provide grant funds towards the financing of the Project. The municipality of Leskovac is located in the south-east part of Serbia and administratively belongs to the Jablanica district.

In accordance with the 2002 census data the total population of the municipality was 156.252, while the total surface area of the municipality is 1.025 km^2, which makes around 1,2% of the total size of the Republic of Serbia. The municipality of Leskovac is considered to be a dynamic, economically diversified regional centre.

The project site(s) are within the boundaries of the municipality and include a number of suburban and rural settlements, which shall be detailed later in the report.

The objective of the project is to improve standards of communal services (potable water supply and wastewater collection and treatment) and corresponding operational efficiency. The outlined technical proposals must be compliant with the national and EU's legal, regulatory and environmental legislation and standards.

The feasibility study supported defining the project and the operational and institutional arrangements required to secure financing. The study supported the full preparation of the project to the level at which financing can be extended for its implementation.

Scope of the Feasibility Study
Basis for financial project appraisal;
Assessment of financial and operational performance plan of the PUC Vodovod;
Plan for the implementation and operation of the water utilities (water, wastewater) within the scope of the project;

Scope of the water utilities project
Extension of the communal water supply system to the settlements in the north of the municipality – some 12.000 inhabitants expected to connect;
Extension of the sanitary sewerage collection network in the suburbs and rural settlements close to urban area – with some 20.000 inhabitants expected to connect;
Construction of the WWTP Leskovac that is supposed to treat the complete communal and pre-treated industrial wastewaters prior to discharge into the recipient – the river South Morava;

Conclusions and Recommendations

General

1. The project was originally oriented towards the construction of the WWTP Leskovac only. However, in order to achieve overall project objectives and improve level of communal services, it was deemed necessary to also consider and include in the scope the extension of the sewerage system. The alarming situation with regard to a high incidence of the BEN disorder in the villages in the northern part of the municipality led to the decision – agreed between the municipal administration and consultants to include in the scope the sub-system for potable water supply of these villages.
2. The project is in line with the relevant EU directives and generally compliant with the requirements set out in the national legislation and regulations. However, additional, detail verification of the compliance with the design criteria set by the competent national authority is still required.
3. It is recommended to arrange for a preparation of a Water Supply Master Plan for the municipality of Leskovac, which would serve as the basic, framework document for any further developments of the communal water supply system within the municipal boundaries. In particular, the Master Plan should investigate the potentials, short-term and long-term role of the regional water management scheme Barje, which should become operational in 2008-2009. The potentials of the regional water management scheme Barje may well reach out of the municipal boundaries and the system may be utilized for transfer of surplus water to other neighbouring municipalities.

Extension of the communal water supply system

1. The technical proposal for the extension of the communal potable water supply system in the villages located in the northern part of the municipality is generally acceptable, in line with the current national regulations and positive engineering practices.
2. However, a number of modifications, improvements and supplements to the proposed concept are recommended:
    a. The sub-system must be implemented and put into operation as a whole. Partial implementation and operation without all key system components (transmission mains, balancing tanks, etc.) would not provide required standards of service.
    b. The assumed boundary condition – hydraulic head in the connection point to the main system must be verified taking into account the overall long-term development of the system – to be defined in the updated Water Supply Master Plan.
    c. The technical design of the local distribution networks is acceptable.
    d. Based on the preliminary hydraulic assessment, modifications of the some basic system features (tanks, mains) are recommended. The proposed changes are to be verified by a comprehensive hydraulic analysis.
    e. The system should be supplemented by an appropriate monitoring, control and regulation system.
    f. The proposed configuration of the system should be modified, in order to enable adequate control and regulation.

g. Generally, preparation of the corresponding more detail technical designs would be required before actual tendering and implementation of the works.

3. When completed, this system extension should provide safe, reliable and continual potable water supply for some 12.000 inhabitants in the rural areas, traditionally suffering from the water-related BEN disorder.

Extension of the sanitary sewerage collection system

1. The proposed extension of the sanitary sewerage collection system would significantly improved standard of service – in wastewater collection, and would substitute current practice relying on individual septic tanks that represent potential source of pollution of both underground and surface waters, and serious health hazard.
2. This extension is in line with the long-term development of the Leskovac sewerage system, as defined in the corresponding general project design submitted in early 2007.
3. This project component would enable an introduction of this very important communal service for some 20.000 additional inhabitants.
4. More importantly, the complete wastewater collected in the said settlements shall be transferred to the new WWTP Leskovac, where appropriate wastewater treatment is to be introduced.
5. The project implementation must be preceded by working out corresponding detail project designs, in line with the concepts set in the abovementioned general project design.

Construction of the WWTP Leskovac

1. The planned WWTP Leskovac would treat the complete communal wastewaters from the urban area and neighbouring suburbs, plus pre-treated industrial effluents in accordance with the set design criteria.
2. The set design criteria are in accordance with the EU wastewater treatment directive, and generally compatible with the requirements set by the competent national authority. However, the full compliance with the national requirements should be elaborated and justified in more detail.
3. The WWTP shall be located in the north of Leskovac, just off the highway M75 and close to the local road Bogojevce – Zlokucane. The location of the WWTP is in full accordance with the current Urban Master Plan of Leskovac. Communal wastewater, pre-treated industrial wastewater and partially stormwater discharges from the Leskovac area shall be directed to the WWTP through the main city gravity sewer (under construction) and the industrial gravity sewer (constructed). Based on the available information, the plot is owned by the municipality of Leskovac.
4. The recipient of the WWTP effluent is the river South Morava, with a typical average 95% low-flow is 4 m^3/s.
5. The WWTP has been designed to accept the most polluted portion of stormwater discharges, while all flows in excess of the WWTP maximum wet-weather design flow shall be discharged into the river in a form of so-called combined sewer overflow. It is recommended that the issue of combined sewer overflows be investigated in more detail with regard to the WWTP capacity and their possible effects both on the river Veternice (via the existing main outlet) and on the river South Morava (via the planned outlet).
6. The WWTP should serve the urban area of Leskovac and adjoining suburbs and rural settlements with some 85.000 inhabitants. Taking into account very moderate

population growth rate, the population to be served at the end of the project period is estimated at around 90.000. Apart from the population, the sewerage system and the WWTP shall also serve so called institutional users (municipal and other administration, schools, medical institutions, military facilities, etc.) and trade and industrial users. In the preliminary project design (references 3.4 to 3,6) it was recommended that the WWTP should be design to cater for the organic loading equivalent to 100.000 PE. However, taking into account the population to be served (around 90.000) and assuming very moderate industrial growth, it is recommended in this study to design the WWTP for the organic load of 129.000 PE, with a possibility to introduce phased implementation proportional to the growth of the design loading.

7. The considered technical solutions for achieving the required removal efficiency in compliance with the adopted local and EU regulation includes a wide range of technologies from conventional (low loaded activated sludge with preliminary denitrification and presumably $FeCl_3$ phosphorus removal), patented SBR technology (ICEAS®) with continuous intake, to patented AZENIT P® technology including nutrients (N and P) removal in one unit.
8. The process schemes are technically sustainable and include necessary pre-treatment and post treatment, thus in line with the pursued compliance with adopted effluent quality norms and requirements. Both, water and sludge processing are considered, minimizing the impact on the environment in line with local and EU regulations.
9. The presented costs overviews are not fully substantiated and impartial. A fair approach would split the cost assessments of the water and the sludge line, and would eventually consider comparable sludge treatment technology (if possible). Detailed construction cost analysis of the proposed (AZENIT P®) technology resulted in significantly higher costs than originally specified in the feasibility part of the documentation where the three alternatives were compared. The investment and operational costs overview suggests close competition of all three proposed alternatives.
10. To summarise, the unreliable and incomplete cost overview in the reference 3.4, accompanied with the relatively subjective assessment of additional factors do not substantiate the definitive choice of patented A_2O (AZENIT P®) technology for the CWWTP of Leskovac.
11. The investment and operational costs of both, alternative A (conventional treatment|) and B (SBR treatment) are close to that of the (AZENIT P®) technology. The choice of sludge treatment technology is not fully substantiated and may result in higher than necessary costs for the Alternative A and B compared to Alternative C. Detailed cost analysis shows that the (AZENIT P®) technology is possibly more expensive than the other two considered technologies. Moreover, the technology benefit/drawback analysis does not offer concrete proof of its supremacy relative to alternative A and B.
12. It is therefore recommended to re-consider the selection of the optimum process technology by:
    a. More detailed and accurate investment and O&M costs assessment and comparison
    b. Multi-criteria analysis of various assessment criteria with a clear (as much as possible) objective assignment of weights and marks per technology.
13. Two possibilities/scenarios with specific time and planning implications arise:
    a. The client (PUC Leskovac) accepts the results of this feasibility study and reconsiders a more detailed assessment, choice and application of optimal,

preferably patent-free technology. At this stage, **a conventional low-loaded activated sludge wastewater treatment plant is recommended as the preferred technical alternative in this study**. The main advantages of this alternative are that it is patent-free, it has got proven track-record of satisfactory operation of similar facilities throughout Serbia, and the costs are comparable, if not lower compared to other technical alternatives. If agreed upon, the additional assessment resulting in updated preliminary design and a well substantiated technology choice could be accomplished within 3-4 months. From that point there are two possible ways forward:

i. To engage in preparation of a corresponding detail project design, provide all necessary permits, and proceed with tendering of the WWTP in accordance with the Red FIDIC Book.

ii. After finalization, review and approval of the preliminary project design, the client (PUC Leskovac) proceeds with tendering of the plant without further detailing of the project design. The WWTP could be tendered according to open tender rules (Yellow FIDIC Book) implying that bidders may offer alternative technical solutions in line with tender instructions and requirements. The final choice of technology would depend on achieved scores for various tender criteria. **This approach is recommended for implementation in this study because of the following main reasons (elaborated in more detail in the main report):**

    1. ***Economizing solutions*** To allow the market to have an impact on the most economic solution of the wastewater treatment plant a Design-Build contract form, such as the FIDIC Yellow Book, is preferred as it places the responsibility for both the design and the construction on the Contractor.
    2. ***Construction and delivery time*** With Design-Build contracts time can be saved by allowing the Contractor to commence with his preparatory works prior to completion of the design and the receipt of construction permits
    3. ***Possibility of lowering costs*** Due to the flexibility afforded the contractor in the final design configuration he is able to offer cost savings based on alternate methods and designs and this is often reflected in time savings due to the application of his own approach, within the basic parameters as set by the Employer, with which he is more familiar than an imposed methodology.
    4. ***Risk allocation*** When considering risk allocation it is necessary to ascertain which party is best able to manage and control the apportioned risk. Risk allocation will vary according to the type of project and the location. The following factors were considered in this case:
        a. Regulatory compliance risks related to environmental and permitting issues
        b. Construction phase risks related to differing site conditions, weather conditions, access to site and continuing operational issues
        c. Post-construction risks related to the meeting of performance standards.

b. The client (PUC Leskovac) does not accept the results of this feasibility study and proceeds with implementation/tendering of the WWTP based on the patented A_2O (AZENIT P®) technology independently from this project. This

would imply excluding the WWTP from the current EAR project and tendering the other project components according to the EAR rules.

PUC Vodovod Leskovac

1. Running a WWTP would be a new component in the company operations. Training is required and should be provided by the contractor and in regular intervals by specialised staff.
2. Tariffs should be based on an agreed formula based on full costs, including depreciation and debt service, and the approved budget for the coming year.
3. It is recommended to implement a Financial and Operational Performance Enhancement Programme designed to prepare the PUC Vodovod to run expanded system under the proper conditions. The measures shall include as a minimum a policy framework, the Service Level Agreement, decision making, information systems, organising and the business plan.
4. Deployment of staff is foreseen as well as internal reorganisation of departments.

Financial assessment PUC Vodovod, Leskovac

Findings:

1. PUC Vodovod Leskovac operates consistently at below 0% net profit;
2. The companies' net loss would be even bigger if the current practice of recognizing re-valued fixed assets as revenues in the profit and loss statement would be omitted;
3. The company operates at a slight negative operational cash flow. Overall net cash flow is negative during the years 2004 and 2006. During the year 2005, a large net cash flow was realized, caused by large municipal and state investment grants;
4. The generated operational cash flow is insufficient to finance investments; most investments are funded directly by the Municipality or are provided for with capital subsidies from other sources;
5. There is no tariff setting formula or procedure, since it is currently national policy to cap tariff increase with the estimated inflation for the next year. The company did not even use this possibility, since tariffs have effectively not been increased since December 2005;
6. Collection rate for the company on the whole is low at 71% during 2006. This is not sustainable in the long run;
7. For the PUC as a whole, current water and waste water tariffs do not cover operating costs including depreciation and bad debt. The level of operational subsidies and the costs which they are supposed to cover is difficult to precisely assess in the absence of a cost centre based financial management system;

Recommendations:

1. Review and improve current collection system with the aim to increase the collection rate, revenues and cash flow. Both billing hardware/software and collection procedures can be improved. This has the highest priority, since current collection rates are unsustainable.
2. Review and improve the existing bad debt policy, including provisioning for bad debt, and make a one time clean up of the debtor database/accounts payables;
3. Reform or introduce a company's policy on reducing tolerance for non-paying customers. For example by shortening the period of tolerance, introduction of interest on late payment; introduction of discounts on prompt payments;
4. Improve current financial management system by establishing a cost centre based financial management system. In relation to this, establish a more decentralized budgeting and financial management system;
5. Based on the improved financial management system, agree on a cost based tariff setting formula or procedure. This is also useful if tariffs continue to be capped, since it serves as facts based information on the required level of tariff;
6. Establish a long term financial planning system and integrate this with the annual planning & budgeting cycle;
7. Make an inventory of the existing physical asset database and verify these with the financial fixed asset register.

<u>Creditworthiness assessment Leskovac municipality</u>

1. The budget of Leskovac municipality is balanced during the period 2004 to 2007. Part of the budget is however financed from external sources (commercial bank loans);
2. Leskovac municipality has a relatively high capital expenditure budget, which however is declining rapidly in relative terms: from 33% of total expenditure during the years 2004 and 2005 to 15% planned during the year 2007;
3. Large investments in water infrastructure, i.e. the Barje regional water supply system and the city sewage collector, are partly financed by the municipality through commercial loans amounting to in total € 5.5 million. Both loans, as well as the related actual investment are not included in the municipal's annual budget realization report discussed above;
4. The remaining legal borrowing capacity of the Leskovac municipality is limited due to these loans, and amounts to approximately € 2 million during the year 2007;
5. Projections of municipal revenue and costs show that the municipality still would have substantial financial room to finance water infrastructure from its budget during the period 2009 to 2011;
6. In addition to this, additional commercial borrowing is possible during the period 2009 to 2011, estimated to range between € 5 to 7.5 million, assuming a base case macro-economic scenario. The increased borrowing capacity is caused by growth of municipal revenues.

Financial analysis

1. A tariff policy is proposed, consisting of the following elements:
   a. A new waste water treatment tariff to be introduced in the year 2011, amounting to RSD 16/m3 (2007 price) or RSD 20/m3 (2011 price) of drinking water consumed, which only will need to be adjusted for inflation thereafter. It is recommended not to differentiate between customer groups, since costs do not differ between these groups;
   b. A sewage collection tariff to increase in real terms with 25% during 2008 and with 10% in both years 2010 and 2011. Thereafter the tariff is set at full cost price;
   c. A drinking water tariff increased in real terms with 10% in 2008 and 30% in 2009, because of start of operations of the Barje regional water supply. Thereafter correction for inflation until the year 2013, after which the tariff is set equal to the full cost price;
2. The tariff policy results in a real cumulative increase of the overall water and waste water tariff for domestic users of approximately 130% by the year 2011 and 160% cumulative by the year 2041. 40% of this adjustment is due to the current below cost recovery tariffs and impact of the start of operations of the Barje regional water supply system, which is not part of this feasibility study;
3. However, the overall tariff increase remains within affordability constraints. A maximum of 2.0% of average household income is forecasted to be spent on water & waste water during the years 2011, up from 1.0% in 2007.
4. These tariffs are based on an improvement of collection rates to 95% by the year 2013, up from the current 71% collection rate. This is considered a critical factor in the success of the project. Tariffs would have to be up to 37% higher, if collection rates do not improve;
5. The proposed tariff policy will generate sufficient cash flow to fully fund large re-investment requirements of both the waste water treatment and Barje drinking water treatment plants and is thus financial sustainable at the company level;
6. On the basis of this proposed tariff policy, a financial analysis was conducted. Assuming a macro economic base case scenario the analysis results in a nominal financial internal rate of return on total invested capital (FIRR/C) of 0.7% and a financial net present value (FNPV/C) of € -16,517 thousand;
7. This financial result justifies grant funding, like EU-IPA. Using the “modified formula”, a grant rate percentage of 75.2% is calculated. Assuming a maximum 75% rate, the project would be eligible for a grant amounting to € 20,805,000;
8. The grant rate determination methodology applicable to ERDF/CF funded projects during the 2007-2013 programming period yields different results. An assumed 75% grant rate would result in an EU grant of € 13,944,000, while a lower nominal discount rate of 7% would result in an EU grant amounting to € 13,101,000;
9. The project is financially sustainable, since the cumulative project cash flow in each year is positive;
10. The financial rate of return on national invested capital is acceptable at a level slightly higher than the nominal discount rate of 8%. FIRR/K is 10.4% and FNPV/K is € 1,718 thousand;
11. The sensitivity analysis shows that a variation of +/1% in selected key variables does not cause fluctuations higher than 5% in FNPV/C. There are therefore no critical variables requiring a further risk assessment;
12. The project is most sensitive to variations in the discount rate;

13. The project creates large positive external effects. The quantitative economic analysis shows positive results, even though not all external effects could be monetized: EIRR 14.0%, ENPV of € 21,786 thousand and a B/C ratio of 1.50. The project is therefore feasible from the point of view of society.
14. Good quality drinking water provision to 12,000 residents living in the Northern villages of Leskovac municipality constitute particular important external health benefits, due to the expected discontinuation of occurrence of water borne disease caused by Balkan Endemic Nephropathy (BEN).

Supervision and enforcement

1. Enforcement of the Local Environmental Action Plan implementation is required in particular in the areas related to pre-treatment of industrial waste waters. For this purpose, strengthening the position of the municipal Directorate for environmental protection should be supported by the municipality.
2. Increase of the level of fines for discharge of industrial waste waters at municipal level.
3. Coordination of all activities with republican and municipal inspection is required along with the period of constant monitoring of the quality of discharged industrial waste waters.

Environmental Impact Assessment

1. The construction of the WWTP in Leskovac will lead to an increase in water quality of the river Veternica and river South Morava. This will have a positive effect on public health and aquatic ecosystem of the river. From an environmental and social point of view there are no potential hazards or 'show-stoppers' in order for this project not to be financed as long as all the mitigation measures are taken and the monitoring programme is executed.
2. Waste management - It is not clearly stated how waste management will be dealt with during construction phase and operational phase of the WWTP. Sludge waste from the WWTP will be dumped at a landfill.
   The following needs to be elaborated on:
   a. Waste streams – during construction phase
      i. general waste from construction period (domestic waste and construction waste)
   b. Waste streams – during operational phase
      i. It needs to be clearly described what will be done with all the following waste streams. Where will they go, what are the best options from an environmental point of view (preferably, first recycling then other options such as landfill).
      ii. Primary waste from pre-treatment – the first step of treatment is a primary treatment which will take our all the rough waste from the sewage (bottles, plastics..etc..).
      iii. Oily products during primary treatment – this will be scraped of the top of the water during this primary treatment stage.
      iv. Settled sand during primary treatment – Dirty sand will settle at the bottom of the primary treatment and needs to be cleaned out from time to time.
      v. Sludge – what happens to the sludge, it would be best practice if the sludge can be used for agricultural use. This should be investigated. It is not stated what will happen to the sludge now, most likely it will be dumped to the landfill.

vi. General waste – from operations (domestic and operational waste from maintenance of machines etc).

2. Chemical management During the operation of the WWTP it is likely that the following three chemicals will be used:
3. Iron chloride ($FeCl_3$); for removal of phosphate during the treatment of the waste water
4. Polyelectrolyte; to be added to the sludge for better flocculation (therefore better settling) higher removal of sludge during last treatment stage of sludge
5. Lime (C_aO); also added to the sludge for stabilisation, higher removal and better for the pressing of the sludge
6. Monitoring plan - In various parts of the EIA some mention is made of sampling needed but no details are presented.
7. HSE management plan - A general HSE management plan must be put in place. It should elaborate on all the HSE issues, including necessary training of employees.

Financing and investment

1. The Total investment cost for phase I amounts to € 28,132 thousand;
2. In line with existing policy, the Ministry of Agriculture, Forestry and Water can commit 1/3 to the cost of the waste water treatment plant, or € 4,762 thousand. This has however not been committed in writing;
3. The total grant contribution (EU-IPA, others) is assumed to be 75% of eligible costs, or € 20,805 thousand. This amount is justified in the financial analysis by using the "modified formula" methodology;
4. The municipal contribution amounts to € 2,564 thousand;
5. It is recommended to finance construction of the waste water treatment plant with 1/3 form the Ministry of Agriculture, Forestry and Water and the remaining 2/3 from international grants (EU-IPA, others);
6. It is recommended that the municipal finance will be used during the years 2009 to 2011, to co-fund the sewage collection and drinking water network extension;
7. In parallel, Leskovac municipality has requested for 2008 National Investment Plan (NIP) funds for the waste water treatment plant (RSD 1,252 million or € 15.7 million) and drinking water network extension to the Northern villages (RSD 294 million or € 3.7 million). This could have a major impact on the proposed financing plan.

Table 0-1 Overview investment costs Leskovac WWTP, drinking water and sewage collection (in € '000)

Item #	Description	Phase I (€) 2009-2011
A1	Investigation works & design	490
A2	Construction works	5,444
A3	Electro-mechanical equipment	6,625
A4	Trial run, staff training, operation over 12 months	420
A5	Contingencies	1,307
A	**Subtotal waste water treatment plant**	**14,287**
B1	Extension sewage collection network	6,091
B2	Contingencies	305
B	**Subtotal sewage collection network**	**6,396**
C1	Extension drinking water supply	5,173
C2	Contingencies	259
C	**Subtotal drinking water supply extension**	**5,431**
	Subtotal investments costs	**26,114**
D1	Supervision excluding VAT	1,627
D2	VAT	391
	GROSS TOTAL	**28,132**

Table 0-2 Identified TA elements

Master plan drinking water supply	200
Financial and Operational Performance Improvement (FOPIP)	400
Environmental Impact Assessment follow-up	100
Industrial monitoring plan & management	100
Public awareness campaign	100
TOTAL in 1000x€	**900**

Table 0-3 Proposed financing plan

Grants (EU-IPA, other sources)	20,805
Ministry of Agriculture, Forestry and water	4,762
Leskovac municipality	2,564
TOTAL in 1000x€	**28,132**

Risks

The following major risks related to project preparation, implementation and operation have been identified:

Risk	Category	Probability	Adverse effect From: 1 (Severe) To: 5 (None)	Mitigation measures (for effects 1, 2 and 3 only)
PROJECT PREPARATION				
Failure of key industries to comply with the LEAP	Institutional	High	2	Coordinate with municipal authorities and Republican Inspectorate
PROJECT IMPLEMENTATION				
Limited management capacity available	Operational/ Institutional	High	1	Project management support
OPERATION				
Lack of enforcement measures towards industries to comply with required quality standards for waste water discharge	Institutional	High	2	Strengthen position of Municipal Directorate for Environmental Protection; introduce high penalties at municipal level, Coordinate inputs with inspectorates; introduce continuous monitoring
Inadequate tariff policies and payment discipline	Institutional, Financial	High	2	Ensure adequate tariff policy or introduction of separate charge for WWT or environmental protection tax
Higher operational costs due to Increased staff	Institutional, Financial	Moderate	3	Promote internal staff movements/job rotations and (re)train staff, include milestones/targets and monitoring mechanism of staff numbers in financing memorandum
Limited WWTP management experience	Institutional/ Operational	Moderate	1	Strengthen the institutions; include training in WWTP treatment in tender documents; introduce FOPIP

1 INTRODUCTION

Preliminary and background

Acting upon the request of Leskovac municipality, the European Agency for Reconstruction (EAR) commissioned MIASP in February 2007 to conduct a Feasibility Study to investigate and assess the proposed Wastewater and Water Supply extension Project. This would enable the EAR to consider the possibility to provide grant funds through the European Unions new financing instrument IPA (Instrument for Pre-Accession).

The Project Area includes settlements in the municipality of Leskovac, located in the south Serbia. The municipality of Leskovac administratively belongs to the Jablanica district, and is located just off the highway E-75, connecting Belgrade and Skoplje.

During 2005, 2006 and 2007 the municipality engaged in preparation of technical documentation related to upgrade and extension of water utilities:

1. Bankable Project Documentation, Leskovac wastewater collection and treatment, Halifax Consulting, 2005 (reference 3.1)
2. General Project Design – Collection and treatment of wastewater in Leskovac Municipality, J.Cerni, 2007 (reference 3.2)
3. Preliminary Project Design, WWTP Leskovac, J.Cerni, 2007 (reference 3.3-3.6)
4. Local Environmental Action Plan Leskovac, 2005, Municipal environmental department, 2005
5. Technical proposal for extension of communal water supply system to the villages in the northern part of the municipality, PUC Vodovod Leskovac, 2007

The abovementioned technical documents 2. and 3. related to wastewater collection and treatment were supported and subsidized by the GoS (Water Directorate).

Technical proposals presented in this study are primarily based on the proposals and recommendations included in the abovementioned technical documentation, however adjusted and modified to suit the latest plans for the project scope extension.

Meanwhile, the municipality proceeded in 2006 and 2007, with a financial support of the Government of Serbia (GoS), with the construction of the major gravity sewers:

- Main industrial sewer; DN700, L=1.855 m and DN800, L=2.150 m (construction completed in 2006);
- Main city sewer; DN1.000, L=2.050 m, and DN1.200, L=3.100 m (the works already contracted and approximately 85% completed).

Since these two major elements of the project have been either completed, or are under construction, these shall not be considered a part of the project scope in this study.

Because of the environmental problems in the municipality and in the Soth Morava River catchment, highlighted above, the project has been identified as one of the environmental priorities of the Serbian National Government in the water sector. The project is fully in line with the short term policy objective for the water and water resources sector of the National Environmental Strategy, since it passes the following criterion:

To provide primary and secondary wastewater treatment in agglomerations above 100,000 PE, excluding agglomerations discharging directly to large water bodies (Danube, Sava), where waste water treatment plants will be completed after 2014.

The project is also fully in line with recommendations set in the LEAP Leskovac for the period 2005-2010:

- Preparation of database of polluters
- Design, tendering and construction of CWWTP
- Updating the Rulebook on sanitary and technical conditions for discharge of wastewater into the public sewerage
- Activation of existing industrial pre-treatment facilities
- Construction of so called industrial collector
- Control of water polluters
- Monitoring of larger rivers in the Municipality

An integral approach to planned upgrade of water utilities in Leskovac assumes that the following elements shall be included in this feasibility study: wastewater treatment facilities (WWTP), completion of the sewerage collection system (collection network, sewers, sewage pumping stations, pressure mains) in surrounding settlements of Leskovac (approximately 20.000 residents) and an extension of the existing water supply system to a group of villages in the north of the municipality.

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Wastewater treatment facilities

In this study the proposed WWTP will be assessed which is in line with the original scope of work. However the technical proposal in this study shall also consider some additional features for the WWTP, as described in recent technical documentation.

Completion of the sewerage collection system

In line with the planned development of the sewer network in Leskovac it has also been proposed to connect a number of neighbouring settlements (suburbs and surrounding villages) to the network and the central WWTP.

Therefore, a completion of the sewer network (collection network, sewers, sewage pumping stations, pressure mains) to all settlements that are to be connected to the future WWTP in Leskovac has been included in the scope of this study. This extension shall result in an increase of the total investment and operational costs as foreseen in the available studies. But, it will also increase the level of service coverage, improve level of sanitation in all concerned settlements, lead to a higher efficiency of the WWTP, contribute to a further reduction of water course pollution and provide additional revenues to the system operator (PUC Vodovod of Leskovac). Therefore, construction of the WWTP and extension of the sanitary sewerage system are logically merged in a single wastewater project.

Extension of the existing water supply system

In addition to the abovementioned extension of the wastewater collection and treatment system, the representatives of Leskovac municipality requested an extension of their project to include the connection of a group of villages in the north of the municipality to the existing centralized public water supply system.

Currently, the population in these villages uses individual water wells as a source for drinking water. However, in the project area, an increased incidence of a disorder called Balkan Endemic Nephropathy (BEN, an irreversible, chronic, tubulo-interstitial nephropathy of unknown origin, geographically confined to several rural regions of the Balkan Peninsula) is found. In recent years, field and laboratory investigations have supported an environmental aetiology for the disease, with a prime role played by the geological background of the endemic settlements. In this regard, there is a growing body of evidence suggesting the involvement of toxic organic compounds present in the drinking water of these endemic areas. These compounds are hypothesized to be leached by groundwater from low rank Pliocene lignite deposits topographically linked to the endemic villages, and transported into shallow household wells or village springs. The population of villages in the endemic areas uses well/spring water almost exclusively for drinking and cooking, and is therefore potentially exposed to any toxic organic compounds in the water.

In order to reduce incidence of BEN and provide safe, reliable and controlled water supply to the concerned villages (at present population size is around 12.000) the scope of the project was extended to the connection of the villages to the central public water supply system. This extension would make use of the ongoing construction of the regional water supply scheme Barje (to be completed 2008-2009). The regional water supply scheme Barje will to provide substantial additional water supply capacity for the municipality of Leskovac, and other neighbouring municipalities.

1.1 Project development plan and Technical Assistance

It is envisaged that the Project will be developed and prepared in two phases. The first phase is this Feasibility Study, and the second phase will be subject to the findings and results of the first phase.

- Phase 1: Feasibility study. An assessment of the project has been made, a detailed project structure has been developed. Based on this study the project will be presented to the municipality.

- Phase 2: Implementation Support. This will be a separate follow-up assignment and financing for this support will be agreed upon during Phase 1. Technical co-operation required during this phase will likely include preparation of the majority of design work, tender documents and assistance in the tender process.

1.2 Project Objectives

The project objectives include an overall environmental and sanitation improvement in the project area and more specifically can be defined as follows:

- Introduction of adequate wastewater collection, treatment and disposal system for around 90.000 inhabitants (Leskovac: urban, suburban and nearby villages);
- Collection, transfer, treatment and disposal of pre-treated industrial effluents for identified major industries;
- Significant improvement of the quality of life with many indirect impacts, improved sanitation and reduced risks to public health;
- Protection of surface and groundwater resources;
- Provide compliance with short-term policy objectives (2005-2009) in accordance with the NES;

- Ensure implementation of a priority project in accordance with the NEAP;
- Trigger pre-treatment activities of the major polluting industries;
- Making a major step towards complying with the EU-s Wastewater Directive;
- Introduce centralized, controlled and safe public water supply to a number of villages where the population uses inadequate individual water sources and suffers from serious water-related disorders;
- Since the long-awaited completion of the Regional Water Supply Scheme Barje is expected sometime in 2008, the planned extension of the water distribution system in the rural area shall contribute to better utilization of the regional water supply scheme. Namely, when finalized, the regional scheme shall provide substantial additional capacity of potable water to the municipality of Leskovac, and other neighbouring municipalities that may show the interest (some 72.500 m3/day). In line with that, the municipality of Leskovac plans further extension of the water distribution network.

1.3 Scope of Work of the Feasibility Study

Based on the specific request by the municipality, and in accordance with the information in the references 3.2 and 3.3 (Annex 3.3), apart of the WTP Leskovac, the scope of the project was extended to also include suburbs and villages on the fringes of the urban area, i.e. all settlements that are to be connected to the central sewerage system and corresponding wastewaters diverted to the future WWTP.

As shall be elaborated further on, the connection of the abovementioned settlements would mean provision of adequate sanitation services (collection and treatment) for the additional population of about 20.000 inhabitants.

Basic components of the project have been mentioned before, and this section presents an integrated overview of the components of the scope.

The service coverage with sewer system has to be extended, i.e. to achieve full service coverage in town and the suburbs and villages next to the town area. This extension of the sewer complies with the proposal elaborated in the reference 3.2, and is also in full accordance with the design characteristics of the wastewater treatment facilities.

By introduction and extension of the sewer system overall sanitation in the areas concerned is going to be improved, and health hazards reduced or eliminated. However, connecting of additional users to the sewerage system shall generate additional wastewater discharges, and if not followed by an appropriate treatment, would only increase pollution of the receiving water bodies. Therefore, in parallel with planned extension of the sewerage system it is planned to install the wastewater treatment facilities that are going to ensure wastewater treatment in full accordance with the set design criteria.

The scope of the project also includes planned extension of the water supply system, i.e. introduction of a centralized public water supply system in the villages located in the northern part of the municipality.

To summarize, the scope of the project includes the following components:

1. Extension of the sewerage collection system
2. Construction of the wastewater treatment facilities for a complete wastewater generated in the town area and suburbs
3. Extension of the public water supply system in the villages located in the north part of the municipality

Technical proposals for the abovementioned components shall be elaborated further in the report.

2 SOCIO-ECONOMIC CONSIDERATIONS

2.1 Socio-economic structure

Table 2.1 below sets out the main indicators of the geography of the project area. The project area relates to the Municipality of Leskovac, namely the town of Leskovac and the adjoining suburbs and villages, and is located in the south-eastern part of Serbia. The project area occupies 1.2% of the total area of Serbia.

Table 2-1 Geography

Indicator	Serbia	Central Serbia	Leskovac Municipality
Total area in km^2	88.361	55.968	1.025
Share, as % of total	100,0%	63,3%	1,2%
Agricultural area as % of total	66%	59%	67%

Source: Municipalities of Serbia 2005, Statistical Office of Republic of Serbia, March 2006

This region is predominantly agricultural, and the agricultural land forms 67% of the total project area, which is slightly above the national average.

The total population of the project area according to official 2004 estimates is 154,895, corresponding to about 2% of Serbia's total population, and approximately 3% of the total population in Central Serbia.

Table 2-2 Demography

Indicator	Serbia	Central Serbia	Leskovac
Population 1991 census	7.576.837	5.606.642	159.478
Urban	4.126.728	3.025.802	67.381
Other	3.450.109	2.580.840	92.097
Population 2002 census	7.498.001	5.466.009	156.252
Urban	4.225.896	3.073.601	68.826
Other	3.272.105	2.392.408	87.426
Annual growth 1991-2002	-0,10%	-0,23%	-0,19%
Urban	0,22%	0,14%	0,19%
Other	-0,48%	-0,69%	-0,47%
Population estimate 30-6-1999	7.540.401	5.506.936	158.120
Population estimate 30-6-2004	7.463.157	5.440.900	154.895
Annual growth 1999-2004	-0,21%	-0,24%	-0,41%
Population density (2004, in persons/km^2)	84	97	151

Source: Municipalities of Serbia 2005, Population Census 2002, Statistical Office of Republic of Serbia

The project area annual population growth trend between the census years 1991 and 2002 is negative at -0.19 %, having almost a double negative growth in respect to national average decline rate of -0.10% (see Table 2-2).

The trend during the period 1999 – 2004 shows an even more negative population growth of -0.41% in the project area, and for the same period a decline was recorded in the Central Serbia and Serbia with negative population growth of 0.24% and 0.21% respectively.

When observing the project area, and also the whole region to which the Municipality of Leskovac belongs, these trends reflecting changes in population ratios, can be explained as follows. As elsewhere in Serbia, a clear urbanization trend can be noted for the project area. The migration from the rural to urban settlements is a common migrating trend. However, this was intensified over the years. During the census years 1991 -2002, the project area records actual positive growth in urban population at 0.19%, while for the same period rural population had a declining trend at – 0.47%. The latest migrating trends from smaller cities are caused by closing or privatisation of many factories (traditionally Leskovac was once known as “Serbian Manchester” because of highly developed textile industry, now in collapse for over a decade - due to crisis that the Serbian economy had faced in the recent war years), and the population migrates to the larger Serbian cities seeking any kind of employment. The rural areas are being depopulated at a high rate.

The population density in the project area is 151 persons per km^2, being well above the country average of 84 persons per km^2. This high population density is the result of the population migrating from the war affected areas (wars 1991 to 1996), and also population migrating from disturbed political situation in Kosovo autonomous Province, which is very close to the project area.

The 2004 data show that the number of employed people per 1,000 inhabitants for the project area is 225, and for the Central Serbia this number is at 278 employed people, slightly higher than the national average 275 (see Table 2-3).

Data from the National Privatisation Agency support the facts of the table below that out of 53 companies in different sectors of industry, 28 were privatised (of which 13 are industries). A number of 25 is still planning to undergo the privatisation process, (13 factories are also from the industrial sector, and of those 7 factories are textile industries). The above figures show that approximately 50% of the industrial sector was privatised or is in the line to do so, and they usually cut down on numbers of employees. This however, has a large impact on the employment in the region, and the population is forced to look for alternative employment opportunities.

Large public enterprises were privatised through auctions and tenders (“Zdravlje” pharmaceuticals and Radan). Further process of privatisation for socially owned enterprises is usually carried out through bankruptcy proceedings due to unattractiveness to potential investors.

Table 2-3 Employment and unemployment

Indicator	Serbia	Central Serbia	Leskovac Municipality
Active Population age (15-64) - 2002	5.032.805	3.646.774	104.241
% of active population in total population	67,1%	66,7%	66,7%
Unemployed persons 2002	904.494	623.425	24.110
(Un) Employed as % in Active population	18,0%	17,1%	23,1%
Total employed persons (2004 average)	2.050.854	1.513.708	34.875
Share, as % of total population	27,5%	27,8%	22,5%
Share, as % of labour force	67,9%	69,1%	56,8%
Total unemployed persons (2004 average)	969.888	675.817	26.536
Share, as % of total population	13,0%	12,4%	17,1%
Share, as % of labour force	32,1%	30,9%	43,2%
(Un) Employed as % of total population	40,5%	40,2%	39,6%
# of adult persons receiving social welfare	214.294	150.277	2.283
Share, as % of total population	2,9%	2,8%	1,5%

Source: Municipalities of Serbia 2005, Statistical Office of Republic of Serbia March 2006

By definition, the active population is the number of people in their working age both employed and unemployed. The municipality of Leskovac has a high share of around 66.7% of active working force, which is very close to the national level of 67.1%.

Another way to assess the socio-economic situation is to analyse data on the number of people entitled for social welfare. Here, we can conclude that in comparison with the national average of 2.9%, the Municipality of Leskovac has a relatively low percentage of social welfare recipients with 1.5% of the total population.

When analysing the employment number per economic sector (Table 2-4), the most striking feature is the contribution of the sectors of the manufacturers, of the entrepreneurs & sole proprietors, and of the public and social administration, with a share of 30%, 23% and 21% respectively (at national level this is 25, 23 and 20%) . The labour market is still dependent on the manufacturing sector, since the new owners employ a certain share of the labour force. However, the Regional Unemployment bureau is encouraging the unemployed to start small business, entrepreneur and agriculture.

Table 2-4 Employment by sector

Indicator	Serbia	Central Serbia	Leskovac Municipality
Agriculture. Fisheries & forestry	70.073	27.804	938
Do, as % of total	3,4%	1,8%	2,7%
Manufacturing/processing industry	515.774	379.257	10.383
Do, as % of total	25,1%	25,1%	29,8%
Energy & other utilities	46.470	37.375	709
Do, as % of total	2,3%	2,5%	2,0%
Construction	88.274	67.896	1.164
Do, as % of total	4,3%	4,5%	3,3%
Trade	208.279	161.921	3.301
Do, as % of total	10,2%	10,7%	9,5%
Tourism	27.869	23.950	717
Do, as % of total	1,4%	1,6%	2,1%
Logistics	119.028	91.996	1.692
Do, as % of total	5,8%	6,1%	4,9%
Commercial services	88.276	69.788	646
Do, as % of total	4,3%	4,6%	1,9%
Public administration & social sector	416.097	312.671	7.469
Do, as % of total	20,3%	20,7%	21,4%
Entrepreneurs & sole proprietors	470.714	341.050	7.856
Do, as % of total	23,0%	22,5%	22,5%
Total	2.050.854	1.513.708	34.875
Do, as % of total	100%	100%	100%

Source: Municipalities of Serbia 2005, Statistical Office of Republic of Serbia March 2006

The Jablanica district, to which the municipality of Leskovac belongs, is well known for off-season vegetable farming, and this could be a good starting point for further investment programs. This can be illustrated by the fact that the Chinese city of Lanchou already bought shares of the company “Agriculture” with the objective to build and offer for utilisation so-called poly-tunnels for off - season vegetable growing. To make this plan work, a number of 2,000 households of the municipality would have to invest and support this idea.

The trade sector also employs a high share of the active population at 9.5%, which is very close to the national level of 10.2%. This sector is highly developed in Serbia, since many other sectors are not very active, and trade gives possibilities to survive with small investments.

Tourism, on a national level is the industry that employs only 1.4% of the total population. The municipality of Leskovac exceeds the national level at 2.1%. The region is well known for the “grill festival”, local agricultural and an entrepreneur fair which is held annually.

The 2004 national income in the project area is 1.1% of Serbia’s total national income. Per capita income in Central Serbia in respect to national per capita level for the observed year was 69.8%.

Table 2-5 National income 2004

Indicator	Serbia	Central Serbia	Leskovac
National income (in '000 RSD, nominal)	887.723.556	619.522.288	10.034.947
Share, as % of total	100,0%	69,8%	1,1%
National income per capita (RSD)	118.947	113.864	64.785

Source: Municipalities of Serbia 2005, Statistical Office of Republic of Serbia March 2006

The national income per sector data confirm the employment patterns: the manufacturing/processing sector contributes the largest share to the total income of the project area with 32%, as compared to the national share of 29%. Second largest sector is agriculture with 25%, substantially higher than the national average of 17%. Trade sector is also dominant with 17% of the total national income. Income with the Construction and Utilities sector is at the national level of 7% and 5% respectively.

It can thus be concluded that the project area's economy is dominated by the manufacturing/processing industry, but also has an important agricultural and trade basis.

Table 2-6 National income by sector

Indicator	Serbia	Central Serbia	Leskovac Municipality
Agriculture. Fisheries & forestry	153.909.290	91.548.270	2.485.876
Do, as % of total	17,3%	14,8%	24,8%
Manufacturing/processing industry	259.152.928	156.648.645	3.181.152
Do, as % of total	29,2%	25,3%	31,7%
Energy & other utilities	43.053.993	33.248.105	457.944
Do, as % of total	4,8%	5,4%	4,6%
Construction	62.426.798	50.433.602	702.581
Do, as % of total	7,0%	8,1%	7,0%
Trade	219.635.212	168.559.427	2.001.642
Do, as % of total	24,7%	27,2%	19,9%
Tourism	16.709.320	13.136.140	174.283
Do, as % of total	1,9%	2,1%	1,7%
Logistics	91.612.237	73.110.860	719.421
Do, as % of total	10,3%	11,8%	7,2%
Commercial services	38.068.609	30.210.576	255.814
Do, as % of total	4,3%	4,9%	2,5%
Public administration & social sector	3.455.169	2.626.663	56.234
Do, as % of total	0,4%	0,4%	0,6%
Total	888.023.556	619.522.288	10.034.947
Do, as % of total	100,0%	100,0%	100,0%

Source: Municipalities of Serbia 2005, Statistical Office of Republic of Serbia March 2006

2.2 Strategic plan of the Municipality of Leskovac, 2006 -2009

The municipality of Leskovac has developed a Strategic Plan for the period 2006 to 2009, defining priorities, expected benefits for the municipality, impact on specific sectors, investment estimates and expected funding. This Strategic Plan is subdivided into four separate plans. For the purpose of this analysis, the plans are summed up, and total investment estimates are presented in the table below.

Table 2-7 Investment estimates in RSD (* 1,000)

STRATEGIC PLANS	2007	2008	2009
I	433.030	364,150	1,000
II	0	0	500,000
III	61.153	22,500	0
IV	10.505	0	0
TOTAL	**504.688**	**386,650**	**501,000**

It can be observed that the municipality has the largest investment plans for the current year: RSD 505 million (€ 6 million) followed by RSD 501 million in 2009. In 2008, the municipality has plans to invest RSD 388 million (€ 4.8 million).

In 2007, the largest investment priority is planned for the solid waste project, expected to be co-financed by the municipality and a selected strategic partner (approximately € 10 million).

Other large investments planned for the period 2007 to 2008, in which the municipality will participate actively are: replacement of asbestos water pipes, regulation of the riverbed of the river Veternica, investments in the water system Barje, and wastewater treatment plant and sewerage network.

The plan relies on the General Urban plan and on the municipal Spatial plan.

2.3 Memorandum on 2007 Budget and economic status of the Municipalities

By the directives of the Memorandum on the 2007 Budget (Based on the Law on Budget system, the Government adopts a Memorandum on the Budget), within its Projections for the years 2008 and 2009 and the policy on the Public finances, local communities are entitled to a share of 1.7% of total non-categorical transfers of the GDP.

Total of non-categorical transfers in absolute numbers for the year 2007 amount to RSD 29.7 billion. The Republic of Serbia is divided into 141 municipality and 4 cities, and according to this subdivision municipalities are apportioned RSD 18.5 billion and the share for the 4 cities is RSD 1.2 billion).

Local communities are also entitled to a share of RSD 2.0 billion of categorical transfers for financing investments in healthcare and for operational costs of tax authorities.

Based on the above provisions, the share of non-categorical transfer for the municipality of Leskovac for the year 2007 is RSD 498 million (€ 6.0 million).

Compared to 2006, transfers for 2007 have been increased. This was possible, mainly due to growth in GDP in real terms and higher tax revenues from especially the newly introduced VAT tax.

Consequently, in comparison with 2006, for the municipality of Leskovac the transfers in 2007 have been increased by 241%, see Table 2-8.

Table 2-8 Budget Transfers (in 1,000 * RSD)

Municipality 1	2006 2	2007 3	Index 4(3/2)
Leskovac municipality	206,679	498,429	241.2

Source: Serbian Bureau of Statistics

2.4 Maximum affordability water & wastewater tariffs

A wealth of materials is available on the issue of affordability of water and wastewater tariffs. Most studies indicate an affordability ratio of 3% to 5% of average household income. For the purposes of this report, we use a maximum affordable level of 4% of *average* household income or expenditure, a figure which is used in assessing maximum affordability of a number of EU-ISPA financed water and wastewater management projects in Romania. This maximum affordable level is still relatively low in comparison to other utility charges, like electricity and (district) heating, although higher than commonly charged for waste collection services. A recent study[1] sets the maximum affordability of all utility services *combined* at 25% of average household income/expenditure with the following break down per service:

- Electricity: 10 percent of household expenditures;
- Heating: 10 percent of household expenditures;
- Water and waste water: 5 percent of household expenditures

Table 2-8 summarises affordability levels used by various institutes or governments.

Table 2-9 Benchmarks maximum affordability utility services (in %)

Source	Electricity	Heating	Water	All utility bills
Wold Bank (2002)	10-15		3-5	
WHO (2004)	10			
IPA Energy (2003)	10	20		
UN/ECE		15		
UK government		10	3	
US government		6	2.5	
Asian Development Bank			5	
Ukraine government				20

Source: Can poor consumers pay for energy and water? Samuel Frankhauser, Tatjana Tepic (2005)

To assess the maximum affordable level of the combined water and waste water tariff in the project area, an estimate of the average household income is required. Since 2003, the Statistical Office of the Republic of Serbia publishes data on household income and expenditure, based on a survey of more than 4,000 households. The latest available

[1] *Can poor consumers pay for energy and water?, Samuel Frankhauser, Tatjana Tepic (2005)*

data refer to the year 2006, which will be the basis of household income estimate for the project area in this study.

The household survey shows that total average monthly household income for Serbia during the year 2006 was RSD 35,263 (€ 446) with expenditure slightly lower at RSD 33,910 (€ 429). These data are further broken down in Central Serbia without Belgrade, Belgrade and Vojvodina, with the following results:

Table 2-10 Household income and expenditure in Serbia (2006)

Description	Republic of Serbia	Central Serbia			Vojvodina
		Total	Excluding Belgrade	Belgrade	
Income	35,263	35,771	32,422	43,102	33,939
Expenditure	33,910	34,191	32,432	38,039	33,175

Source: Communication No. 72, Statistical Office of the Republic of Serbia 30/3/2007

Largest component of income consists of salaries and wages (45%), followed by cash transfers from government organisations (state pensions, social welfare) with 24%. 94% of the income is received in cash. The remaining 6% is received in kind and mainly consists of natural consumption, mainly comprised of self consumed agricultural production.

Expenditures are dominated by food & non-alcoholic beverages with 39%, with the next largest item spent on dwelling and utility services (16%). The latter can be compared with the maximum 25% affordability level for utility services, although it includes expenditure on housing like rent and interest.

Unfortunately, no further breakdown of these data is available for municipalities, nor are data available showing income distribution patterns. There is however a breakdown between urban and rural population available, which shows that rural population income is 91% and urban 106% of average total income. The expenditure is even less skewed: the urban population spends 102% of the average expenditure, whereas the rural population spends 97% of the average. This would indicate that income distribution is not very skewed, assuming that the rural population would have relatively more people with lower income than urban population.

To estimate the household income for Leskovac municipality, the available 2006 household survey data are adjusted for salary level differences, which are known for individual municipalities. The table below summarizes gross and net salaries actually paid during the years 2005 and 2006:

Table 2-811 Nominal salaries

Indicator	Serbia	Central Serbia	Leskovac
Jan - Dec 2005			
Gross salaries	25,514	25,179	16,522
Nett salaries	17,442	17,214	11,265
Jan - Dec 2006			
Gross salaries	31,745	31,509	21,625
Nett salaries	21,707	21,560	14,731
Growth rate			
Gross salaries	24%	25%	31%
Nett salaries	24%	25%	31%

Source: Communication no. 11, Statistical Office of Republic of Serbia, 23 January 2007

From the table it can be concluded that the average 2006 net salary of Leskovac is substantially lower than both Serbia and Central Serbia averages. To the contrary, the growth rate in gross and net salaries is higher for Leskovac, compared to Serbia and Central Serbia. Still, it can be concluded that a large difference in socio-economic circumstances exists between Leskovac and Serbian averages.

The following approach is used to adjust the household income:

- Basis is the 2006 household income data for Serbia;
- Household income data will be used. It is acknowledged that actual expenditure data will likely be the best proxy for total available income, since people in general are reluctant/underestimate their real sources of income. However, since the difference between income and expenditure is very small, this study will be based on income data (cash and in kind);
- The salary component of the household income data, including pensions, is recalculated by multiplying it with the ratio between the net salary in Leskovac municipality and Serbia;
- The non salary components are assumed to be the same as the average in Serbia.

For the years 2007 and later, the household income data are estimated by escalating the data with the assumed inflation rate and real wage increase (see also chapter 5 – financial and economic analysis).

The table below sums up the result of the adjustments:

Table 2-912 Household income estimate Leskovac municipality

	2005 RSD	2006 RSD	2007 RSD	2005 €	2006 €	2007 €
Serbia	26,952	35,263	39,045	317	446	488
Central Serbia	27,343	35,771	39,607	322	453	495
Leskovac	19,675	27,376	30,312	231	347	379

Thus, *average* household income in the project area is estimated to amount to RSD 30,312/€ 379 during the year 2007.

The next step is to calculate the maximum affordable tariff. Using the 4.0% threshold, the maximum combined water and waste water tariff for the project can be estimated at **RSD 1,212 per month for the year 2007**.

The 2007 actual household expenditure on the combined water and waste water services is estimated at RSD 309 per month (including VAT), or 1.0% of monthly household income, as set out in the table below. This estimate is only for households which make use of both water supply and sewage collection services.

The current tariffs would leave considerable room for tariff adjustments. One should, however, remember that the affordability ratio is an average indicator and does not necessarily reflect the affordability of water/waste water tariffs to low income groups.

Table 2-13 2007 tariffs and affordability domestic users

Municipality	liter per capita p. day	HH size /2	HH usage (m3/month)	Tariff/m3 (incl. VAT)	HH charge per month /1	Max. affordable W/WW tariff	
						RSD /1	% affordability
Leskovac	155	3.24	15.26	20.25	309	1,212	4.0%

/1 including 8% VAT

/2 population census 2002 extrapolated to 2007

The estimated monthly charge is based on average billed monthly consumption for Leskovac municipality, based on data provided by the utility. Household composition data are taken from official census 2002 data.

3 TECHNICAL ANALYSIS

3.1 Current Level of Service Delivery, Demand and Project Justification

3.1.1 Introduction

In 2005, the municipality presented as a priority for financial support the infrastructure project including extension and upgrading of the sewer system and construction of corresponding wastewater treatment facilities.

In the meanwhile, the municipality has proceeded, with a financial support of the Government of Serbia (GoS), with the construction of the major gravity sewers:

- Main industrial sewer; DN700, L=1.855 m and DN800, L=2.150 m (construction completed in 2006);
- Main city sewer; DN1.000, L=2.050 m, and DN1.200, L=3.100 m (the works already contracted and approximately 85% completed).

These two major elements of the original project have been either completed, or are under construction, and shall not be considered as a part of the project scope in this study.

This feasibility study shall include the wastewater treatment facilities (WWTP), completion of the sewerage collection system (collection network, sewers, sewage pumping stations, pressure mains) in surrounding settlements of Leskovac (approximately 20.000 residents) and an extension of the existing water supply system to a group of villages in the north of the municipality.

Wastewater treatment facilities
In this study the proposed WWTP will be assessed which is in line with the original scope of work. However the technical proposal in this study shall also consider some additional features for the WWTP, as described in recent technical documentation. Namely, during 2007 two sets of relevant project design documentation have been prepared:

1. General project design of collection, conveyance and treatment for settlements in Leskovac municipality, Institute Jaroslav Cerni, Belgrade, 2007, reference 3.2;
2. Preliminary project design of the WWTP in Leskovac with corresponding EIA and feasibility study, Institute Jaroslav Cerni, Belgrade, 2007, reference 3.3.

Although all available relevant information from the earlier reports was used in the study, the abovementioned general and preliminary project designs of the sewerage system and WWTP represent a basis for the technical proposal presented in this study.

Completion of the sewerage collection system
Therefore, a completion of the sewer network (collection network, sewers, sewage pumping stations, pressure mains) to all settlements that are to be connected to the future WWTP in Leskovac has been included in the scope of this study. This extension shall result in an increase of the total investment and operational costs as foreseen in the available studies. But, it will also increase the level of service coverage, improve level of sanitation in all concerned settlements, lead to a higher efficiency of the WWTP, contribute to a further reduction of water course pollution and provide additional revenues to the system operator (PUC Vodovod of Leskovac).

Therefore, construction of the WWTP and extension of the sanitary sewerage system are logically merged in a single wastewater project.

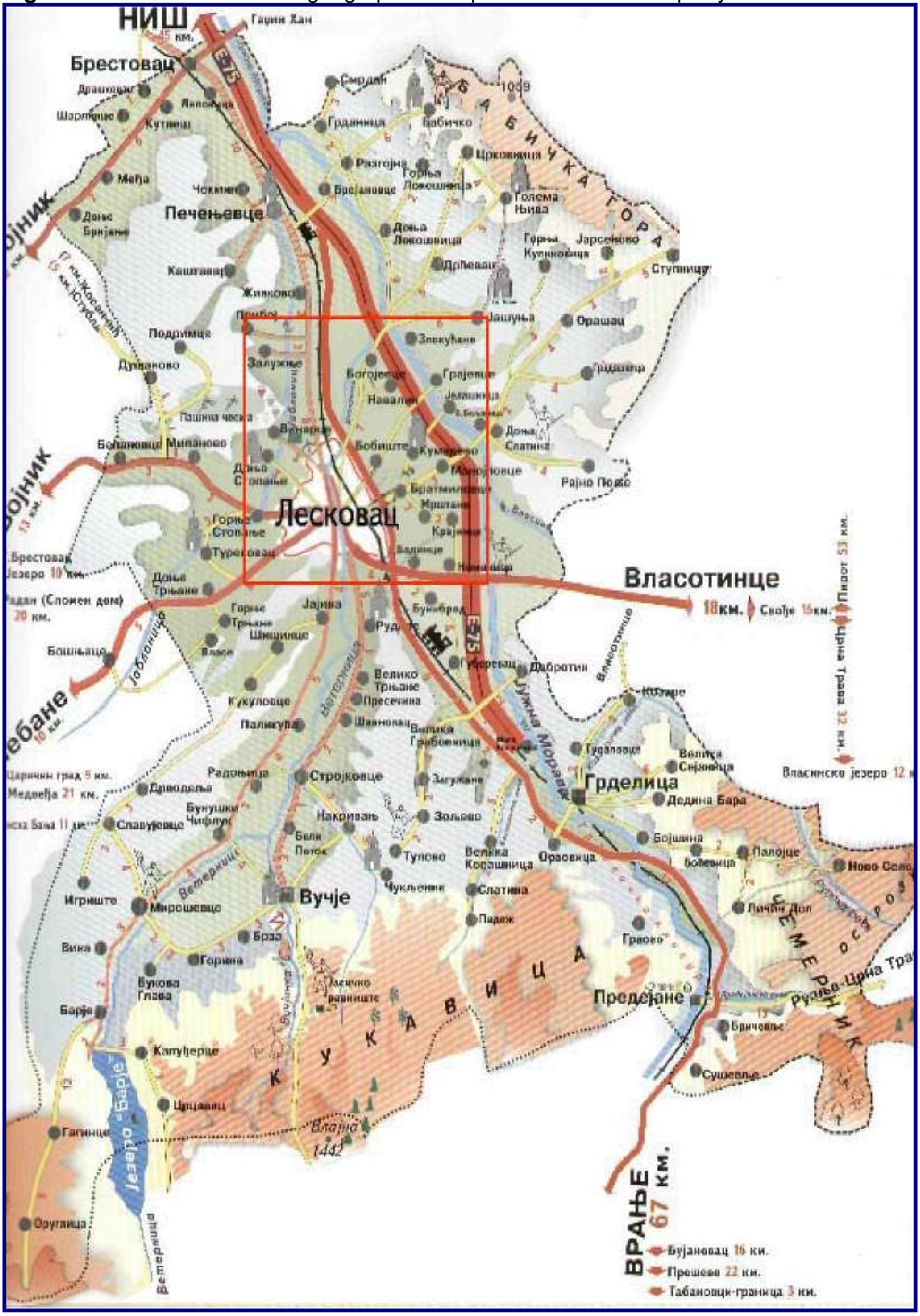
The planned extension of the sewerage system and construction of the WWTP are discussed in more detail further on in this report, and shown in the general layout (see figure 3.1). Also the new additional components are shown in this figure. On the basis of a geographical map of Leskovac municipality the positions are shown of both urban and rural areas of the municipality in relation to neighbouring municipalities and the major roads: highway E-75, Belgrade – Skoplje and other regional and local roads.

Extension of the existing water supply system
In addition to the abovementioned extension of the wastewater collection and treatment system, the representatives of Leskovac municipality requested an extension of their project to include the connection of a group of villages in the north of the municipality to the existing centralized public water supply system.

Currently, the population in these villages uses individual water wells as a source for drinking water. However, in the project area, an increased incidence of a disorder called Balkan Endemic Nephropathy (BEN, an irreversible, chronic, tubulo-interstitial nephropathy of unknown origin, geographically confined to several rural regions of the Balkan Peninsula) is found. In recent years, field and laboratory investigations have supported an environmental aetiology for the disease, with a prime role played by the geological background of the endemic settlements. In this regard, there is a growing body of evidence suggesting the involvement of toxic organic compounds present in the drinking water of these endemic areas. These compounds are hypothesized to be leached by groundwater from low rank Pliocene lignite deposits topographically linked to the endemic villages, and transported into shallow household wells or village springs. The population of villages in the endemic areas uses well/spring water almost exclusively for drinking and cooking, and is therefore potentially exposed to any toxic organic compounds in the water. The presumably low levels of toxic organic compounds present would likely favour relatively slow development of the disease and over a time interval of 10 to 30 years or more. The frequent association of BEN with upper urinary tract (urothelial) tumours suggests the action not only of a nephrotoxic, but also carcinogenic, factor. Basic features of BEN, its likely origin and description are presented in detail in Annexes 3-1 and 3-2.

In order to reduce incidence of BEN and provide safe, reliable and controlled water supply to the concerned villages (at present population size is around 12.000) the scope of the project was extended to the connection of the villages to the central public water supply system. This extension would make use of the ongoing construction of the regional water supply scheme Barje (to be completed 2008-2009). The regional water supply scheme Barje will to provide substantial additional water supply capacity for the municipality of Leskovac, and other neighbouring municipalities.

Figure 3-1 Administrative/geographical map of Leskovac municipality



3.1.2 Assessment of Operational Efficiency

This section presents an assessment of some (mainly technical) indicators of the operational efficiency of PUC Vodovod. An assessment of other operational and administrative performances of the PUC is included in chapter 7.

Overview of the existing sewer system
The total number of population of the municipality of Leskovac in accordance with the 2002 census was 156.252, out of which 63.185 are citizens of the town of Leskovac.

The existing sewer system is of the so-called combined type, i.e. collecting both communal wastewater and storm water by the same sewers. The town area and consequently the sewerage system have gradients towards the North-East, meaning that collected wastewater is transferred by means of gravity towards the main sewer outlet into the Veternica River. Collected and transported wastewater is not treated prior to discharge, which is considered to be one of the major deficiencies of the existing system. This main sewer has a rectangular cross section.

The total length of the existing sewers is around 220 km. The system is being extended by constructing an industrial main sewer (already completed) and the main city sewer (ongoing construction) towards the location of the planned WWTP with an outlet into the Southern Morava River.

Based on the information provided by PUC Vodovod, the total number of population connected to the sewer system in the town of Leskovac is some 58.000 (representing 92% of the urban population), while some 3.000 inhabitants in the suburban areas are also connected to the system. It means that the overall service coverage for the municipality is around 39%, see Table 3.1. In brief, the overall service coverage with sanitary sewerage collection in the municipality is rather low.

The plans that have been developed, subject of this study, for the extension of the sewerage service area to the suburbs and villages neighbouring the urban area, will connect an additional 20.000 inhabitants to the system. All additional wastewater from this extended service area shall be diverted to the future wastewater treatment facilities, in order to be properly treated. Therefore, in parallel with the planned extension of the sewer system, it is necessary to install adequate wastewater treatment facilities compliant with the required effluent standards.

Some of the major technical performance indicators related to operation of water supply and sewerage systems in the municipality of Leskovac are shown in the following table.

Table 3-1 -An overview of major technical performance indicators

Performance indicator	Leskovac town	Leskovac Municipality
Drinking water service coverage (%)	> 95	54
Connection to the sewer system (as % of total population)	92	Approximately 37
Wastewater Treatment (%)	0	0
Non revenue drinking water for period 2003 – 2006 (%)	27	27
Residential water consumption (l/cap/d)	155	155

From this overview the following conclusions can be drawn:

- Service coverage in terms sewage collection is very low;
- Wastewater treatment is, and shall remain a high priority because at the moment there is none;
- The percentage of non-revenue water is high;
- Recorded average residential consumption of 155 l/cap/day can be assessed as reasonable;

Overview of the main operational features of the existing water supply system

The central public water supply system supplies the population, institutions and large and small industries. It has been extended and upgraded on several occasions. Mainly, the centralized water supply system uses a sub-artesian water source in the Leskovac valley. There are 26 operational water wells divided in two groups: the Northern and the Southern groundwater collection area. The wells are 60 to 100 meters deep, with ground surface elevation ranging from 225 to 250 m.a.s.l., and operating water level in the wells generally 20 – 30 m below the ground level.

The total quantities of water produced in 2005 and 2006 have been reported as follows:

- Water produced in 2005: 10.645.000 m^3/year; $Q_{average}$= 338 l/s, $Q_{per\ well} \approx$ 13 l/s
- Water produced in 2006: 9.584.000 m^3/year; $Q_{average}$ = 304 l/s, $Q_{per\ well} \approx$ 12 l/s

The recorded maximum daily demand is around 430 l/s, but it is believed that the mentioned average and peak production from the water sources can not be sustained, because of steadily depleting groundwater levels. It is therefore necessary to provide additional or alternative water sources in the near future in order to maintain a continuous and stable water supply, and to be able to extend the services. With the current water sources this would not be possible.

Water from both groups of wells is transferred and collected in a balancing tank, constructed as a part of the Northern water source complex. This storage tank has a storage volume of some 3.000 m^3, and serves for balancing the flows from the individual wells and the distribution to the consumers. Next to the tank a pumping station has been constructed (Q=600 l/s, H=65m) in order to transport water to the consumers. Currently, water is not treated, except for a compulsory disinfection by means of chlorination.

The system also includes a balancing elevated tank on the Hisar hill (V=4.200 m^3, Z_{base}= 280,12 m, Z_{top} = 284,12 m) and a distribution network, in total some 330 km long, comprising pipes of DN50 to DN500.

The volume of this water storage tank accounts for approximately 20% of the total maximum daily demand, which indicates that there is a deficit of the water storage, because for a system of these characteristics the storage volume should ideally be about one third of the total maximum daily demand.

A major change for the operation of the water supply system is planned for the near future 2008 – 2009. Namely, the regional water supply scheme called Barje which is under construction and should be connected to the existing Leskovac distribution network.

This regional scheme includes:

- A dam and reservoir Barje constructed at the Veternica river some 25 km upstream of Leskovac;
- WTP Gorina of 840 l/s gross capacity that should provide adequate treatment for raw water coming from Barje reservoir;
- Raw water (from reservoir to WTP) and treated water pipelines (from WTP to Leskovac);
- A Water storage tank IN Rudarska kosa, with a storage capacity of 2 * 12.500 m^3;
- Main distribution pipelines (DN700 and DN1.000).

When completed the scheme should provide:

- Substantial quantities of potable water necessary to meet current demand and enable long term development of the system;
- Protection and preservation of the existing groundwater sources, which can be transformed into a stand-by source;
- Possibility to significantly increase the service coverage (currently limited by the available capacity of water sources), and also to connect consumers in the neighbouring municipalities of Lebane and Vlasotince, as laid out in the original Master Plan for the regional water supply;
- Provide sufficient capacity of water storage tank and substantially increase the capacity of the distribution network.

To conclude, no further extension of the existing water supply scheme can take place, until the regional water supply scheme is finalized.

Critical issues related to the operational efficiency of the public water supply system can be summarized as follows:

- Insufficient capacity of the current water sources, preventing further development of the system;
- Insufficient water storage capacity;
- Inadequate capacity of the water distribution network;
- Inadequate operational level of service, associated with frequent pipe malfunctions, and excessive water losses.

3.1.3 Description of the service area and current level of service delivery

The municipality of Leskovac, including its urban and rural settlements, belongs to the Jablanica District. The town of **Leskovac**, with its current population of around 63.200, represents by far the larges agglomeration in the municipality. The existing sanitation services are mostly developed and concentrated in the urban area of Leskovac town, with a steadily increasing number of service connections. Based on the information supplied by the local PUC the system serves mostly urban population, local administration and other institutions, smaller private companies, trades, and also identified major industries.

Based on the specific request by the municipality, and in accordance with the recommendations of the references 3.2 and 3.3 the scope of the project was extended to also include suburbs and villages on the fringes of the urban area, i.e. all settlements that are to be connected to the central sewerage system and corresponding wastewaters diverted to the future WWTP.

As shall be elaborated further on, the connection of the abovementioned settlements would mean provision of adequate sanitation services (collection and treatment) for the additional population of about 20.000 inhabitants.

The actual current and planned extended areas for service delivery are shown on the enclosed map of the sewerage system, see drawing DWG-01, and can be divided into two major zones:

1. Town of Leskovac (population and industries), its suburbs and neighbouring villages that shall be connected to the sewer network and connected to the future wastewater treatment plant (WWTP);
2. Villages in the northern part of the municipality that shall be connected to the public water supply system.

The service areas for both wastewater services (group 1) and water supply services (group 2) are shown on the enclosed maps, see drawings DWG-01, and DWG-02.

As far as wastewater collection, treatment and disposal are concerned, the settlements to be included find themselves in the same area as defined in references 3.1 and 3.2. An assessment was carried out in these references with regard to the number of inhabitants and specific location of the settlements to be connected to the WWTP. Based on this assessment, it was decided that the following settlements of the municipality will be included in the project:

Table 3-2 Service area for wastewater services with indicative numbers of users

No	Settlement	Type	No of users (2030 - in GP)
1	**Leskovac**	urban	66.161
	Sub-total		**66.161**
2	**Bobište**	suburban	2.216
3	**Bogojevce**	suburban	1.546
4	**Bratmilovce**	suburban	3.795
5	**Vinarce**	suburban	2.710
6	**Gornje Stopanje**	suburban	1.568
7	**Donje Stopanje**	suburban	779
8	**Donja Jajina**	suburban	1.216
9	**Donje Sinkovce**	suburban	2.086
10	**Mrštane**	suburban	1.246
11	**Navalin**	suburban	788
12	**Rudare**	suburban	495
13	**Turekovac**	suburban	1.518
	Sub-total		**19.963**
14	**Donje Trnjane**	rural	142
15	**Svirce**	rural	241
16	**Šišince**	rural	380
17	**Gornje Sinkovce**	rural	307
18	**Gornje Trnjane**	rural	190
19	**Vlase**	rural	324
	Sub-total		**1.584**
	Gross total		**87.708**

Source: Reference 3.2 – Wastewater General Project Design

The settlements to be connected to the central public water supply system are located in the northern part of the municipality, and are defined in the reference 3.3:

1. Živkovo;
2. Brejanovce;
3. Ćifluk Razgojnski;
4. Pečenjevce;
5. Čekmin;
6. Lipovica;
7. Brestovac;
8. Kutleš;
9. Šarlince;
10. Draškovac;
11. Međa;
12. D.Brijanje

The total number of population in these villages is around 12.000, with declining trends recorded over the past decades, see Table 3-7.

3.1.3.1 Current level of service delivery

In the assessment of the current service delivery, the following information has been used as reference documentation:

1. BPD of Halifax Consulting, see reference 3.1;
2. General Project Design of Institute Jaroslav Cerni, see reference 3.2;
3. The latest update on the current service delivery; prepared by the PUC Vodovod, Leskovac, 2007.

All this information has been assessed, in order to draw conclusions on the current service delivery.
As a baseline for this assessment a population size within the project area has been adopted in accordance with the latest census (of 2002) as shown in the following table.

Table 3-3 Leskovac population in accordance with 2002 census, target population for sanitation project

No	Settlement	Type	1948	1953	1961	1971	1981	1991	2002
1	Leskovac	urban	20.913	24.553	34.396	45.478	56.110	61.544	63.185
	Sub-total (urban)	**urban**	**20.913**	**24.553**	**34.396**	**45.478**	**56.110**	**61.544**	**63.185**
	Growth rate (%) - urban			*3,3*	*4,3*	*2,8*	*2,1*	*0,9*	*0,2*
2	Bobište	suburban	211	237	288	944	1.466	1.588	1.782
3	Bogojevce	suburban	1.469	1.531	1.485	1.526	1.592	1.501	1.571
4	Bratmilovce	suburban	649	719	1.101	1.990	2.754	3.309	3.531
5	Vinarce	suburban	2.179	2.247	2.414	2.796	3.006	3.161	3.090
6	Gornje Stopanje	suburban	507	548	651	1.092	1.407	1.703	1.756
7	Donje Stopanje	suburban	746	822	919	1.045	1.102	1.173	1.136
8	Donja Jajina	suburban	739	800	897	1.187	1.264	1.316	1.338
9	Donje Sinkovce	suburban	377	388	574	920	1.306	1.494	1.661
10	Mrštane	suburban	1.215	1.307	1.477	1.439	1.499	1.448	1.431
11	Navalin	suburban	974	967	922	956	939	925	898
12	Rudare	suburban	470	497	483	522	560	552	551
13	Turekovac	suburban	1.453	1.591	1.730	1.783	1.860	1.790	1.794
	Sub-total (suburban)		**10.989**	**10.935**	**12.941**	**16.200**	**18.755**	**19.960**	**20.539**
	Growth rate (%) - suburban			*-0,1*	*2,1*	*2,3*	*1,5*	*0,6*	*0,3*
14	Donje Trnjane	rural	271	273	291	338	345	360	289
15	Svirce	rural	462	498	506	516	524	480	436
16	Šišince	rural	529	560	602	658	653	646	639
17	Gornje Sinkovce	rural	345	367	361	358	404	428	454
18	Gornje Trnjane	rural	245	256	244	241	256	228	250
19	Vlase	rural	575	630	682	673	686	632	584
	Sub-total (rural)		**2.427**	**2.584**	**2.686**	**2.784**	**2.868**	**2.774**	**2.652**
	Growth rate (%) - rural			*1,3*	*0,5*	*0,4*	*0,3*	*-0,3*	*-0,4*
	Gross total		**34.329**	**38.072**	**50.023**	**64.462**	**77.733**	**84.278**	**86.376**
	Growth rate (%) - total			*2,1*	*3,5*	*2,6*	*1,9*	*0,8*	*0,2*

It can be concluded from the data in this table, that the total population in the project area which has been used in the design of the sanitation system is around 87.000 inhabitants.

Table 3-4 Leskovac population in accordance with 2002 census, target population for drinking water extension project

No	Settlement	Type	1948	1953	1961	1971	1981	1991	2002
1	Živkovo	rural	808	876	832	832	802	747	**669**
2	Brejanovce	rural	528	560	558	472	448	394	**364**
3	Čifluk Razgojnski	rural	466	469	443	425	413	365	**335**
4	Pečenjevce	rural	1.846	1.981	2.136	2.088	2.078	1.820	**1.776**
5	Čekmen	rural	1.171	1.189	1.229	1.207	1.169	1.020	**915**
6	Lipovica	rural	1.328	1.401	1.448	1.517	1.474	1.355	**1.287**
7	Brestovac	rural	1.687	1.742	2.003	2.077	2.140	2.127	**2.086**
8	Kutleš	rural	690	752	780	772	779	758	**651**
9	Šarlince	rural	790	881	921	958	950	936	**854**
10	Draškovac	rural	725	763	791	826	823	805	**791**
11	Međa	rural	762	871	914	989	1.049	911	**872**
12	Donje Brijanje	rural	1.526	1.604	1.639	1.682	1.673	1.584	**1.487**
	Sub-total (rural)		**12.327**	**13.089**	**13.694**	**13.845**	**13.798**	**12.822**	**12.087**
	Growth rate (%) - rural			***1,2***	***0,6***	***0,1***	***0,0***	***-0,7***	***-0,5***

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It can be concluded from the data in this table, that the total population the northern villages to be included in the Leskovac water supply scheme is just over 12.000 inhabitants.

The total population of Leskovac **municipality** in accordance with the census 2002 data was 156.252 inhabitants of which some 87.000 will be included in the sanitation component and some 12.000 into the drinking water extension component of the project.

The following table shows current level of service coverage (public water supply and sanitation) in the project area.

Table 3-5 Current levels of service coverage (water supply and sanitation) in Leskovac

No of population in Leskovac (town)	63.185
No of population in Leskovac (municipality)	156.252
Source - PUC Vodovod data (2007)	
No of service connections (water supply)	20.853
No of population served by public water supply (municipality)	88.000
Service coverage rate (water supply) for the municipality (%)	56,3
Service coverage rate (water supply) for the urban area (%)	100
No of population served by sanitary sewrage (town area)	58.000
Service coverage rate (sewerage) for the municipality (%)	37,1
Service coverage rate (sewerage) for the urban area (%)	91,8
Source - BPD (2005)	
No of population served by public water supply (municipality)	85.000
Service coverage rate (water supply) for the municipality (%)	54
Service coverage rate (water supply) for the urban area (%)	100
No of population served by sanitary sewrage (town area)	59.000
Service coverage rate (sewerage) for the municipality (%)	37,8
Service coverage rate (sewerage) for the urban area (%)	93,4
Source - General project design (2007)	
No of population served by public water supply (municipality)	75.000
Service coverage rate (water supply) for the municipality (%)	48,0
Service coverage rate (water supply) for the urban area (%)	100

From the table it can be concluded that the information is not completely consistent, with different data presented specifically for the number of inhabitants being served.

In order to verify the information additional consultations with PUC Vodovod were conducted. According to the PUC the actual service delivery rate in the urban area is around 94%, meaning that around 6% of the inhabitants in Leskovac town are not connected to the sewer system.

Assuming the mentioned boundaries of the project area (Leskovac town plus suburbs and villages to be connected to the sewerage system) the total population is around 87.000. Therefore, the actual service level for the project area is around 68%. A layout of the existing sanitary sewerage system is shown on the corresponding map of the project area.

Based on the considerations above the following conclusions can be made:

1. The current level of service delivery related to sanitation in Leskovac town and its suburbs is rather low, around 68%, and it is therefore important to gradually increase this level, and improve the overall sanitation and hygiene in the project area.
2. Apart from wastewater collection and transport, provision of adequate wastewater treatment is also a critical issue, especially with regard to mandatory reduction pollution of the receiving water bodies and groundwater. Treating collected wastewater is likely to become even more critical after the connection rate to the sewers system increases. An increasing connection rate to the sewer system shall produce even more untreated wastewater to the main sewerage outlet, unless proper treatment is installed.

At present, the population in the villages in the north of the municipality is supplied from individual water wells only, and no public water supply is available. Therefore, in those settlements the current level of service delivery is practically zero, and an introduction of a controlled, safe and adequate public water supply is urgently needed.

3.1.4 Demand Projections

This section presents the assessment of the forecasts of population size, water demand and generated wastewater quantities and loads. For planning purpose a period of 33 years has been chosen, covering the period 2009 to 2041. It has been assumed that the major construction works (including WWTP, main transport sewers, extension of drinking water main, etc.) shall be carried out between 2009 and 2011, followed by a 30-year operational period: 2012-2041.

3.1.4.1 Demography

The population forecast is an important starting point for estimating future water consumption and wastewater generation. The population projection has been based primarily on the recorded population trends in all types of settlements represented in the project area. The period 1991 – 2002 can be considered as being the most representative for an assessment of the current status and future projections. In the urban areas a slight increase of 0, 19% annually has been recorded, while in the rural areas a negative annual trend of -0, 47% is evident. To allow for uncertainties, for further considerations in this study it was assumed that the growth rate in the (sub)urban areas shall remain positive 0,25%, while in the rural area the zero growth rate is adopted.

Basic demographic information for the project area, based on the censuses conducted from 1948 to 2002 is shown on the following figures; see Tables 3-4 and 3-5. The most recent population estimates for the sewerage project are 86.500, while the current population in the northern villages is estimated at 12.000.

Figure 3-2 Population in wastewater service area 1948 - 2002

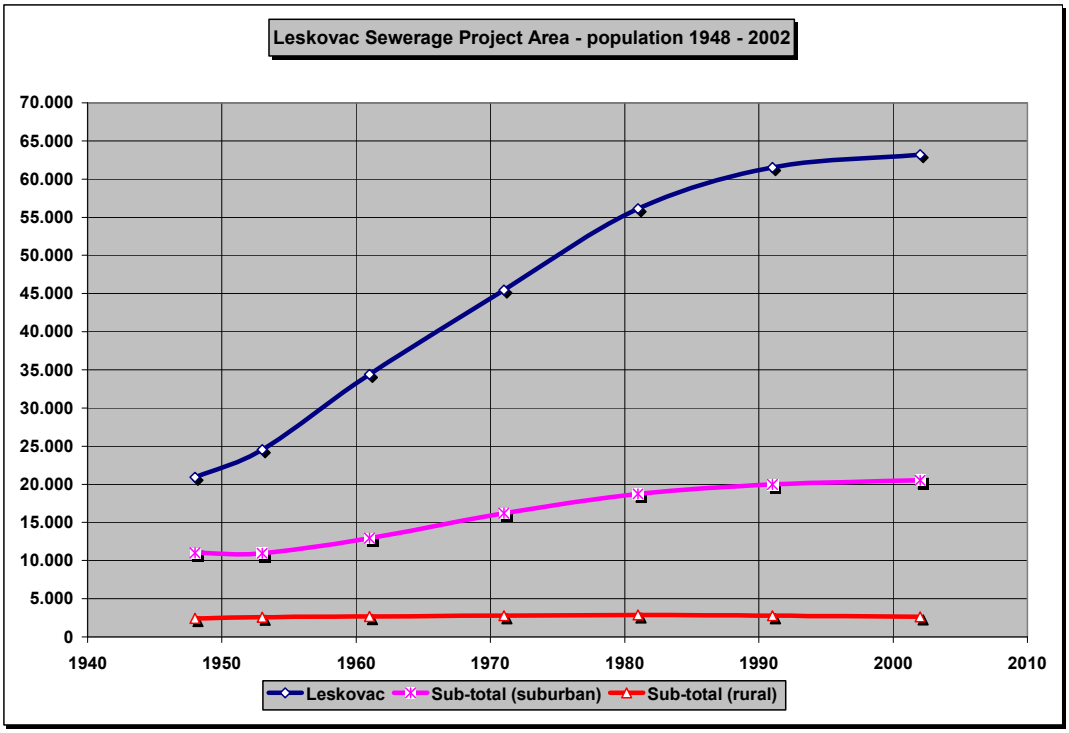
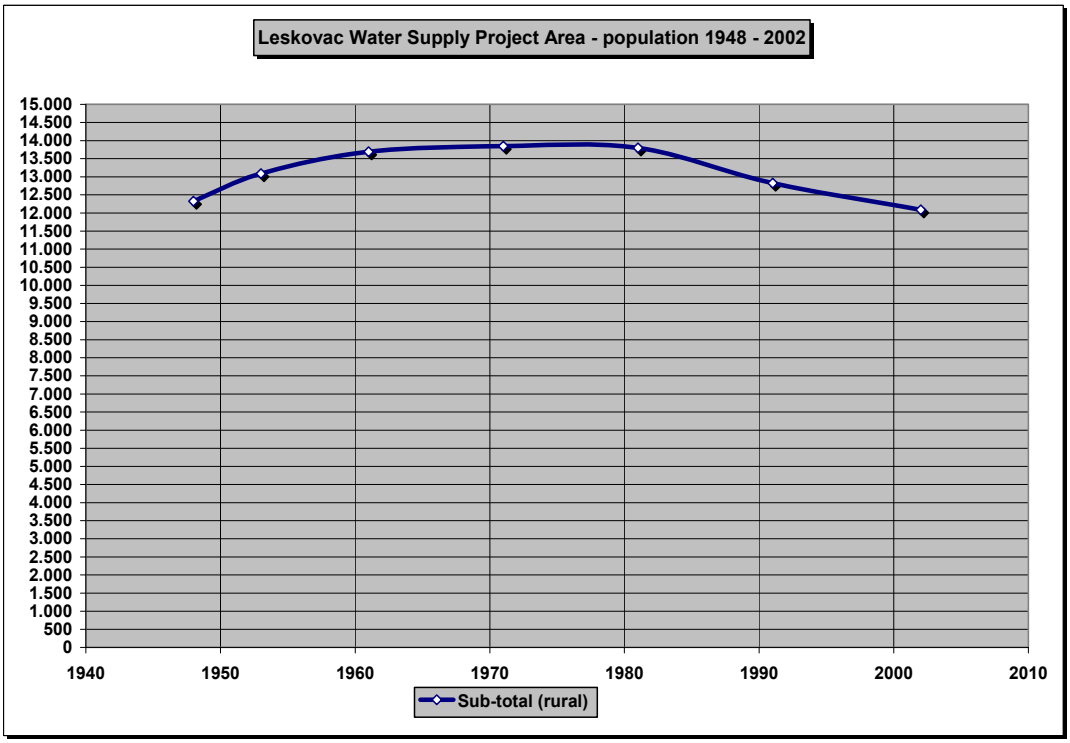


Figure 3-3 Population in water supply service area 1948 - 2002



The population projections in the project areas (sewerage and water supply extension) are shown in the following tables.

Table 3-6 Population projection sanitation component of project

No	Settlement	Type	2002	2011	2021	2031	2041
1	Leskovac	urban	63.185	64.621	66.255	67.930	69.647
	Sub-total (urban)	**urban**	**63.185**	**64.621**	**66.255**	**67.930**	**69.647**
	Growth rate (%) - urban		***0,24***	***0,25***	***0,25***	***0,25***	***0,25***
2	Bobište	suburban	1.782	1.822	1.869	1.916	1.964
3	Bogojevce	suburban	1.571	1.607	1.647	1.689	1.732
4	Bratmilovce	suburban	3.531	3.611	3.703	3.796	3.892
5	Vinarce	suburban	3.090	3.160	3.240	3.322	3.406
6	Gornje Stopanje	suburban	1.756	1.796	1.841	1.888	1.936
7	Donja Jajina	suburban	1.338	1.368	1.403	1.438	1.475
8	Donje Sinkovce	suburban	1.661	1.699	1.742	1.786	1.831
9	Mrštane	suburban	1.431	1.464	1.501	1.538	1.577
10	Navalin	suburban	898	918	942	965	990
11	Rudare	suburban	551	564	578	592	607
12	Turekovac	suburban	1.794	1.835	1.881	1.929	1.977
	Sub-total (suburban)		**19.403**	**19.844**	**20.346**	**20.860**	**21.387**
	Growth rate (%) - suburban		***0,29***	***0,25***	***0,25***	***0,25***	***0,25***
13	Donje Trnjane	rural	289	289	289	289	289
14	Svirce	rural	436	436	436	436	436
15	Šišince	rural	639	639	639	639	639
16	Gornje Sinkovce	rural	454	454	454	454	454
17	Gornje Trnjane	rural	250	250	250	250	250
18	Vlase	rural	584	584	584	584	584
	Sub-total (rural)		**2.652**	**2.652**	**2.652**	**2.652**	**2.652**
	Growth rate (%) - rural		***-0,4***	***0,0***	***0,0***	***0,0***	***0,0***
	Gross total		**85.240**	**87.117**	**89.252**	**91.442**	**93.687**
	Growth rate (%) - total		***0,231***	***0,242***	***0,242***	***0,243***	***0,243***

Table 3-7 Population projection water supply extension component of project

No	Settlement	Type	2002	2011	2021	2031	2041
1	Živkovo	rural	669	669	669	669	669
2	Brejanovce	rural	364	364	364	364	364
3	Čifluk Razgojnski	rural	335	335	335	335	335
4	Pečenjevce	rural	1.776	1.776	1.776	1.776	1.776
5	Čekmen	rural	915	915	915	915	915
6	Lipovica	rural	1.287	1.287	1.287	1.287	1.287
7	Brestovac	rural	2.086	2.086	2.086	2.086	2.086
8	Kutleš	rural	651	651	651	651	651
9	Šarlince	rural	854	854	854	854	854
10	Draškovac	rural	791	791	791	791	791
11	Međa	rural	872	872	872	872	872
12	Donje Brijanje	rural	1.487	1.487	1.487	1.487	1.487
	Sub-total (rural)		**12.087**	**12.087**	**12.087**	**12.087**	**12.087**
	Growth rate (%) - rural		***-0,5***	***0,0***	***0,0***	***0,0***	***0,0***

The actual number of users will be related to the annual rate of extension of the sewer systems. Based on the current status and expected implementation schedule, the following connection rates have been adopted:

Table 3-8 Anticipated connection rates to the sewerage system

Type of settlement	2007	2011	2021	2031	2041
Urban	94	98	100	100	100
Suburban	0	50	90	90	90
Rural	0	40	75	75	75

In accordance with these connection rates, the number of the sewerage system users is presented in the following table.

For the planned extension of the water supply system in the northern villages the number of users actually corresponds to the number of population, since it has been estimated that full coverage shall be reached till 2011.

3.1.4.2 Wastewater Flows

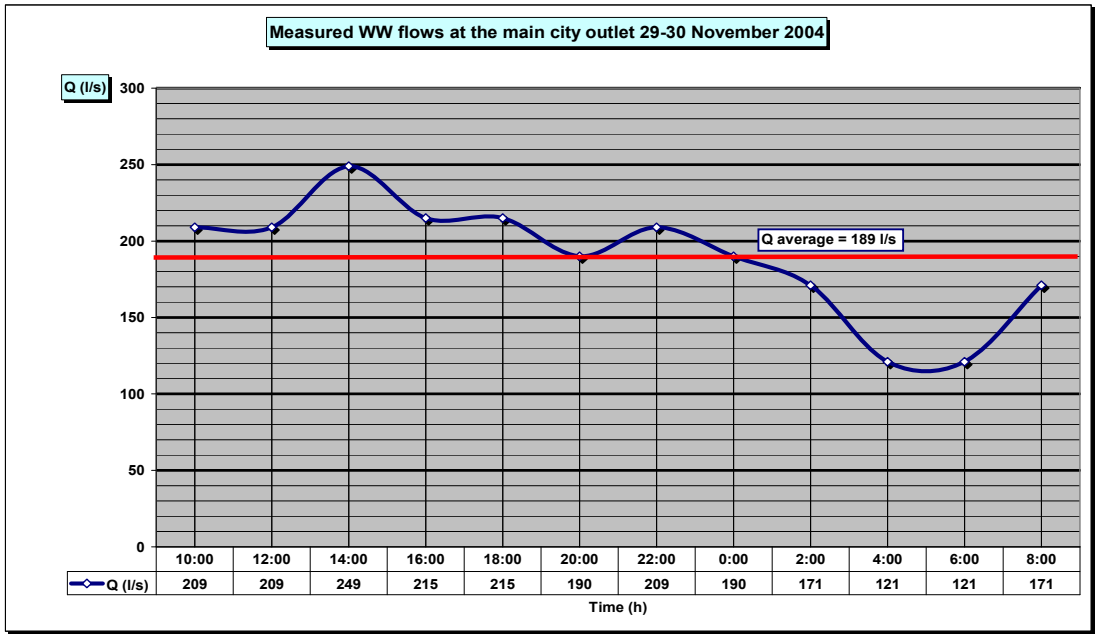
Since the existing sewer system is drained toward a single outlet point, it was possible to organise and conduct wastewater flow measurements to measure the total flows in the system.

The main city sewerage outlet is shown on the following figures.

Figure 3-4 Sewerage main outlet

Measurements conducted by the Faculty of Civil Engineering Nis, on 29 and 30 November 2004, resulted in wastewater flows at the outlet that have been used as input data in the BPD Report, reference 3.1, and are shown in Figure 3-5.

Figure 3-5 Measurements of WW flows in November 2004



Additional short-term measurements of flows were conducted on 12-13 December 2006 (Q average =171 l/s) and 7-9 February 2007 (Q average =184 l/s).

Since 2005 regularly intermittent measurements of the flow have been conducted (source – GP report 2007) and based on these a new series was carried out in the period June 2005 – November 2006 (39 individual measurements in total), resulting in an average flow of 196 l/s, somewhat higher than earlier results, see annex 3-6.

Although the measurements shown in reference 3.2 cover a much longer period and can be considered as more representative for the assessment of the average annual flow, with regard to the average flows recorded, the results appear to be comparable, and the average discharge of approximately 180 l/s can be adopted for further analysis in this study.

An additional limited number of flow measurements has been conducted and recorded, but on rather random basis, and therefore it is necessary to cross-check theses results with water consumption data in order to establish a correlation.

It has been decided to estimate current wastewater flows in relation to the recorded water consumption of consumers who are both connected to the water supply network, and the sewer system.

3.1.4.3 Water supply – basic balances

Water Supply – Consumption

Based on the Consultant's request a full set of data on produced and invoiced drinking water has been made available for the period 2003 to 2006 by the PUC Vodovod. Of particular concern for wastewater flows assessment is the data the drinking water consumed and invoiced, because there should be a direct correlation with generated wastewater flows. The average annual water consumption invoiced in Leskovac per user category is presented in the following table:

Table 3-9 Invoiced water consumption in Leskovac water supply system

Recorded water consumption in Leskovac (m^3/year)				
Consumer category	**2003**	**2004**	**2005**	**2006**
Households	5.354.840	5.216.155	4.855.631	4.768.789
Industrial users	1.511.288	1.299.412	1.214.294	1.196.099
Public consumption	879.242	852.951	782.615	785.273
Other consumption	204.971	206.180	195.113	197.856
Total water consumption	**7.950.341**	**7.574.698**	**7.047.653**	**6.948.017**
Recorded water consumption in Leskovac (l/s)				
Consumer category	**2003**	**2004**	**2005**	**2006**
Households	169,8	165,4	154,0	151,2
Industrial users	47,9	41,2	38,5	37,9
Public consumption	27,9	27,0	24,8	24,9
Other consumption	6,5	6,5	6,2	6,3
Total water consumption	**252**	**240**	**223**	**220**

In order to establish a sound basis for the forecast of future wastewater flows, it is important to have an insight into the structure of annual water consumption taking consumption of 2005 as representative:

Table 3-10 Invoiced water consumption per category of consumers (detailed breakdown)

No	Category	Invoiced water in 2005	
		m^3	%
1	Households	4369701	
2	Western sub-system	390805	
3	Households with office space	195113	
4	Users connected to the system, no meter installed	95125	
	Subtotal	**5050744**	**72**
5	Industries – manufacturers	981846	
6	Trades	16641	
7	Retail companies and restaurants	215807	
	Subtotal	**1214294**	**17**
8	Faculties, high schools and medical institutions	241934	
9	Military barracks	242577	
10	Elementary schools, kindergartens	148275	
11	Public companies, administration, banks, insurance companies	101504	
12	Public utility companies, local government	48325	
	Subtotal	**782618**	**11**
	Total	**7047653**	**100**

The PUC Vodovod also provided the information on monthly invoiced water consumption for 2004 and 2005; see Tables 3-11 and 3-12. These data are to be used for the initial assessment of water consumption variations also resulting in wastewater variations.

Table 3-11 Monthly water consumption in Leskovac (m3/month)

	Household		Industries		Total	
Month	Water	Wastewater	Water	Wastewater	Water	Wastewater
Jan-04	396.863	299.832	175.864	160.105	572.727	459.937
Feb-04	400.134	298.313	174.639	157.964	574.773	456.277
Mar-04	471.965	343.929	173.647	164.285	645.612	508.214
Apr-04	417.221	308.067	158.513	146.395	575.734	454.462
May-04	423.088	305.985	167.470	153.322	590.558	459.307
Jun-04	442.349	324.558	176.153	169.807	618.502	494.365
Jul-04	488.721	335.605	210.912	189.187	699.633	524.792
Aug-04	498.118	343.672	154.757	150.382	652.875	494.054
Sep-04	478.034	313.355	179.773	168.940	657.807	482.295
Oct-04	454.926	329.065	179.929	169.196	634.855	498.261
Nov-04	415.695	310.397	174.479	167.737	590.174	478.134
Dec-04	406.799	301.989	174.832	133.046	581.631	435.035
Total	**5.293.913**	**3.814.767**	**2.100.968**	**1.930.366**	**7.394.881**	**5.745.133**
Average	**441.159**	**317.897**	**175.081**	**160.864**	**616.240**	**478.761**
Jan-05	411.790	312.341	151.712	149.709	563.502	462.050
Feb-05	381.210	278.975	156.327	148.370	537.537	427.345
Mar-05	437.998	328.986	191.097	184.018	629.095	513.004
Apr-05	387.272	281.023	159.762	157.393	547.034	438.416
May-05	406.281	294.171	154.601	148.120	560.882	442.291
Jun-05	438.686	317.283	164.669	159.099	603.355	476.382
Jul-05					628.421	
Aug-05					681.092	
Sep-05					600.763	
Oct-05					601.934	
Nov-05					555.956	
Dec-05					528.082	
Total	**2.463.237**	**1.812.779**	**978.168**	**946.709**	**7.037.653**	**2.759.488**
Average	**410.540**	**302.130**	**163.028**	**157.785**	**586.471**	**459.915**

Table 3-12 Monthly water consumption in Leskovac (l/s)

	Household		Industries		Total	
Month	Water	Wastewater	Water	Wastewater	Water	Wastewater
Jan-04	153,1	115,7	67,8	61,8	221,0	177,4
Feb-04	154,4	115,1	67,4	60,9	221,7	176,0
Mar-04	182,1	132,7	67,0	63,4	249,1	196,1
Apr-04	161,0	118,9	61,2	56,5	222,1	175,3
May-04	163,2	118,0	64,6	59,2	227,8	177,2
Jun-04	170,7	125,2	68,0	65,5	238,6	190,7
Jul-04	188,5	129,5	81,4	73,0	269,9	202,5
Aug-04	192,2	132,6	59,7	58,0	251,9	190,6
Sep-04	184,4	120,9	69,4	65,2	253,8	186,1
Oct-04	175,5	127,0	69,4	65,3	244,9	192,2
Nov-04	160,4	119,8	67,3	64,7	227,7	184,5
Dec-04	156,9	116,5	67,5	51,3	224,4	167,8
Average	**170,2**	**122,6**	**67,5**	**62,1**	**237,7**	**184,7**
Jan-05	158,9	120,5	58,5	57,8	217,4	178,3
Feb-05	147,1	107,6	60,3	57,2	207,4	164,9
Mar-05	169,0	126,9	73,7	71,0	242,7	197,9
Apr-05	149,4	108,4	61,6	60,7	211,0	169,1
May-05	156,7	113,5	59,6	57,1	216,4	170,6
Jun-05	169,2	122,4	63,5	61,4	232,8	183,8
Jul-05					242,4	
Aug-05					262,8	
Sep-05					231,8	
Oct-05					232,2	
Nov-05					214,5	
Dec-05					203,7	
Average	**158,4**	**116,6**	**62,9**	**60,9**	**226,3**	**177,4**

From the above mentioned data it can be concluded that the maximum recorded monthly variation coefficient was 1,16, while the minimum monthly variation coefficient was 0,90, see Table 3-13.

However, typical maximal daily variations, which are essential for the design of wastewater facilities, are somewhat higher in comparison to monthly variations. The most appropriate means to accurately determine wastewater flow variations would be by continuous wastewater discharge measurements. Since only results of intermittent flow measurements are available, the maximum daily variation coefficient has been assessed based on the recorded monthly variations and characteristics and size of the project area.

Table 3-13 Monthly water consumption variations in Leskovac

	Household		Industries		Total	
Month	Water	Wastewater	Water	Wastewater	Water	Wastewater
Jan-04	0,90	0,94	1,00	1,00	0,93	0,96
Feb-04	0,91	0,94	1,00	0,98	0,93	0,95
Mar-04	1,07	1,08	0,99	1,02	1,05	1,06
Apr-04	0,95	0,97	0,91	0,91	0,93	0,95
May-04	0,96	0,96	0,96	0,95	0,96	0,96
Jun-04	1,00	1,02	1,01	1,06	1,00	1,03
Jul-04	1,11	1,06	1,20	1,18	**1,14**	1,10
Aug-04	1,13	1,08	0,88	0,93	1,06	1,03
Sep-04	1,08	0,99	1,03	1,05	1,07	1,01
Oct-04	1,03	1,04	1,03	1,05	1,03	1,04
Nov-04	0,94	0,98	1,00	1,04	0,96	1,00
Dec-04	0,92	0,95	1,00	0,83	0,94	0,91
Average	**1,00**	**1,00**	**1,00**	**1,00**	**1,00**	**1,00**
Jan-05	1,00	1,03	0,93	0,95	0,96	1,00
Feb-05	0,93	0,92	0,96	0,94	0,92	0,93
Mar-05	1,07	1,09	1,17	1,17	1,07	1,12
Apr-05	0,94	0,93	0,98	1,00	0,93	0,95
May-05	0,99	0,97	0,95	0,94	0,96	0,96
Jun-05	1,07	1,05	1,01	1,01	1,03	1,04
Jul-05					1,07	
Aug-05					**1,16**	
Sep-05					1,02	
Oct-05					1,03	
Nov-05					0,95	
Dec-05					0,90	
Average	**1,00**	**1,00**	**1,00**	**1,00**	**1,00**	**1,00**

Based on the information from PUC Vodovod the maximum daily water distribution in the water supply system corresponds to the maximum water source capacity of 430 l/s. On the other hand the average water distribution amounts to approximately 320 l/s. Therefore, the maximum daily variation coefficient can be calculated as:

$$k_{\max}^{day} = 430/320 = 1{,}34$$

Given the size and characteristics of the project area, the following maximum daily wastewater discharge variation coefficients have been adopted:

1. **For urban area - $K_{max\ day}$ = 1,34**
2. **Suburbs - $K_{max\ day}$ = 1,60**
3. **Rural areas - $K_{max\ day}$ = 2,00**

3.1.4.4 Unit water consumption rates

This section presents the unit water consumption rates calculated on the basis of recorded water consumption and the number of system users.
From this overview, and taking into account the data on the number of users in the system it is possible to derive unit water consumption and to allocate it per user category. In order to establish the unit water consumption two analysis have been carried out: based on the number of users defined by the PUC (increasing from 80.000 to about 88.000 between 2003 and 2006), and based on the average assumed number of consumers of around 85.000. More realistic results are obtained by adopting nearly constant number of consumers, with declining, but still stable values of unit water consumption.

Table 3-14 Unit potable water consumption per category of users

Variable number of consumers				
Consumer category	**2003**	**2004**	**2005**	**2006**
No of users	**80.000**	**81.500**	**83.000**	**88.000**
Households	183,4	175,3	160,3	148,5
Industrial users	51,8	43,7	40,1	37,2
Public consumption	30,1	28,7	25,8	24,4
Other consumption	7,0	6,9	6,4	6,2
Total water consumption	**272**	**255**	**233**	**216**
Stable number of consumers				
Consumer category	**2003**	**2004**	**2005**	**2006**
No of users	**85.000**	**85.000**	**85.000**	**85.000**
Households	172,6	168,1	156,5	153,7
Industrial users	48,7	41,9	39,1	38,6
Public consumption	28,3	27,5	25,2	25,3
Other consumption	6,6	6,6	6,3	6,4
Total water consumption	**256**	**244**	**227**	**224**

Based on the presented information, the following unit water consumption rates can be adopted as a baseline values for 2007:

- Households - 155 l/cap/day
- Industry - 40 l/cap/day
- Institutional - 25 l/cap/day
- Other - 5 l/cap/day
- **Total - 225 l/cap/day**

Corresponding current unit wastewater discharges, assuming 0,85 as a wastewater/water ratio are as follows:

- Households - 135 l/cap/day
- Industry - 35 l/cap/day
- Institutional - 21 l/cap/day
- Other - 4 l/cap/day
- **Total - 195 l/cap/day**

For the purpose of future wastewater flows analysis, the following unit wastewater rates are adopted and incorporated in the wastewater flows projection:

Table 3-15 Unit wastewater discharges till 2041 (l/capita/day)

Consumer category/Year	2007	2011	2021	2031	2041
Households	135	135	135	135	135
Institutional, public and other	25	30	35	40	45
Total	160	165	170	175	180

3.1.4.5 Unaccounted for water (UFW)

From the collected information on the water produced and water consumed, it was possible to derive basic water balances, including the UFW component. Below an overview of UFW is given, in terms of the total annual volumes and also expressed as a percentage of water produced.

From the data it can be seen that the UFW expressed as a percentage of water produced is very high in the Leskovac water supply system (26 to 34%, on average 30% or 85 to 100 l/s). Based on the generally accepted international criteria, this percentage of UFW is unacceptably high, and the issue of UFW should be studied in more detail, aiming to bring it into a technically and economically acceptable range.

Table 3-16 Unaccounted for water in Leskovac, 2003-2006

	2003	2004	2005	2006
Water distributed (m^3)	10.723.393	10.704.173	10.645.609	9.583.994
Water invoiced (m^3)	7.950.341	7.574.698	7.047.653	6.858.017
Water distributed (l/s)	340,0	339,4	337,6	303,9
Water invoiced (l/s)	252,1	240,2	223,5	217,5
Unaccounted water (m^3)	2.773.052	3.129.475	3.597.956	2.725.977
Unaccounted water (l/s)	87,9	99,2	114,1	86,4
Unaccounted water (%)	***25,9***	***29,2***	***33,8***	***28,4***

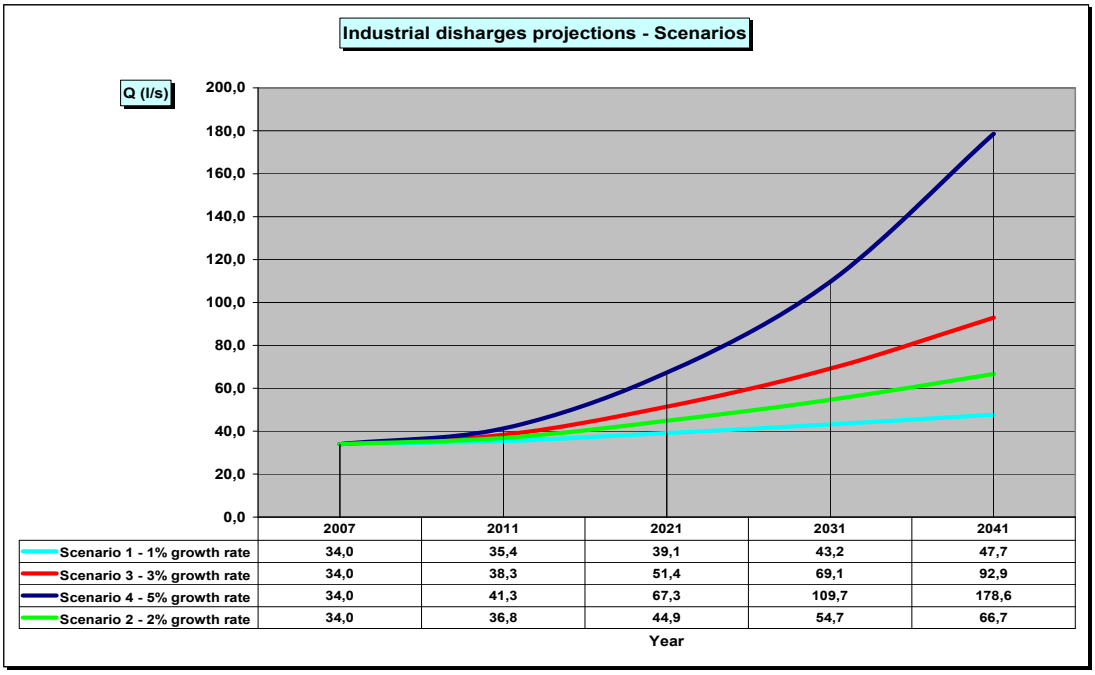
3.1.4.6 Industrial Discharges

As a baseline for the projection of industrial discharges the average discharge in the existing system of around 34 l/s has been adopted.
Three development scenarios were examined:

1. Low development scenario: considering a low annual growth of industrial discharges of 1% annually;
2. Two medium development scenarios: relating the growth of industrial discharges to the GDP growth rate, but also assuming reduction of wastewater discharges due to water conservation measures, recycling and reuse within industrial premises;
3. High scenario: assuming a growth rate of industrial discharges in direct correlation to the assumed GDP growth rate of 5% annually.

Based on the available information only, and taking into account uncertainties in the actual industrial growth, it is rather difficult to give an acceptable estimate of future industrial discharges over a 30-year period. However, it can be realistically assumed that the industrial activity will gradually recover (at a rate recorded over the last few years in Serbia). On the other hand it would be logical to expect some water consumption reduction measures driven by introduction of higher water tariffs. It has been estimated that the medium-growth scenario with 2% annual growth represents the best match for these assumptions, and it would be therefore adopted for further analysis in this study.

Figure 3-6 Industrial wastewater discharges



3.1.4.7 Wastewater to water ratio

As mentioned before, the wastewater flows at the main outlet are not recorded regularly, and it is not possible to establish an exact relationship between the water supply consumption and the consequently generated wastewater flow.
Therefore, for the purpose of this study a conventional value of wastewater/water ratio has been adopted: 0,85.

3.1.4.8 Infiltration

Based on the collected information it was established that the groundwater table in Leskovac town, depending on the micro-location and season varies from -6m up to 0,0m (surface level) in the downstream part of the system close to the WWTP location and next to the banks of the Rivers Veternica and South Morava. It is anticipated that most of the existing sewerage system is subject to infiltration.The main results of the flow measurements conducted in between 2005 and 2007 indicate that the mean overall wastewater discharge ranges between 180 and 190 l/s.

Although the presented information is representative for water consumption analysis, it could be misleading if not interpreted properly. Namely, the sewerage system in Leskovac serves only about 61.000 inhabitants (PUC data), and this must be taken into account on a pro-rata basis. Assuming wastewater/water ratio of 0,85, the average total wastewater flow in Leskovac can be calculated as follows:

- Households - 155 l/s x 61.000/85000 x 0,85 = 95 l/s
- Industry - 40 x 0,85 = 34 l/s (all major industries connected to the sewerage)
- Institutional - 25 x 0,85 = 21 l/s
- Other - 5 x 0,85 = 4 l/s

- **Total - 154 l/s**

Since the average wastewater flow is around 180 l/s, it can be concluded that a significant portion of the wastewater discharge originates from infiltration and inflow (**on average around 26 l/s, or some 14%**). Furthermore, taking into account the total length of sewers of **220 km**, it can be calculated that the average infiltration rate is around **0,12 l/s/km** of the network as a whole. This infiltration rate shall be taken into account both for the existing system and the planned system extension.

3.1.4.9 Storm water runoff

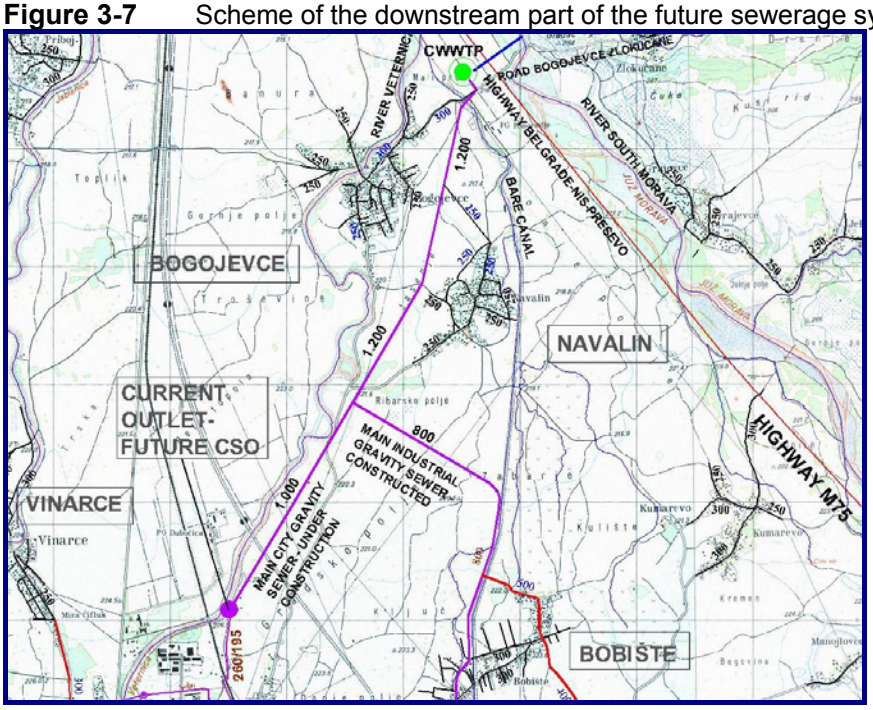
The existing sewer system has been developed in accordance with a so called combined system concept, i.e. common system for collection and transfer of both sewage and storm water. To change the existing system would be overly complex, expensive and impractical. Therefore, in the relevant design documentation the existing system will remain a combined type, but the system extensions shall be developed like a separate system; separate networks for collection and drainage sewage and storm water. This in particular relates to planned extension of the sewers in the settlements.

The existing main city sewer shall still retain its current function of draining both sewage and storm water, and transport it to the existing outlet at the Veternica River. The issue of the storm water drainage system shall be considered only with regard to the following two major points of consideration:

- Characteristics: quantities, quality and frequency of the combined sewer overflow that shall be introduced at the current main city outlet;
- A part of the collected storm water will be directed to the WWTP, and the remaining collected storm water shall be discharged into the receiving water body (Veternica and South Morava).

The scheme of the existing and proposed configuration of the sewerage system downstream of the current outlet location is shown in the figure 3-7.

Figure 3-7 Scheme of the downstream part of the future sewerage system



A complete wastewater discharge (sewage plus storm water) from the city area is to be conveyed via the existing main sewer (rectangular section 2,60 x 1,95 m) to the existing discharge point.

From the existing discharge point the main city gravity sewer will be extended towards the WWTP (already under construction). The extension consists of two major sections:

1. **Section 1: DN1.000, L= 2.050m, S= 0,15%, Design capacity Q_{max} (full pipe flow) ≈ 1.050 l/s;**
2. **Section 2: DN1.200, L= 3.100m, S= 0,13%, Design capacity Q_{max} ((full pipe flow) ≈ 1.600 l/s.**

Therefore, once the main city gravity sewer is constructed, the peak hydraulic loading (combined sewage and storm water) that will reach the WWTP (and be treated) is around 1.600 l/s. At the same time the maximum flow that can be diverted from the

existing discharge point towards the WWTP is around 1.050 l/s, while the rest of the flow shall be discharged via the overflow into the Veternica River.

It is accepted engineering practice to design a WWTP for a combined sewer system, with a peak hydraulic loading corresponding to the maximum dry weather flow multiplied by a factor (for instance 2 or 3), practically ensuring the treatment of wastewater (combined sewage and storm water) which is diluted enough to be discharged into a receiving water body without any treatment.
Only wastewater that is sufficiently diluted, for example **Q > (2-3) x Q** $_{\text{peak dry weather flow}}$ can be directly discharged into a receiving water body via an appropriate overflow.

This design principle has been followed in the reference 3.1 (BPD Report, 2005) and to a certain extent in the references 3.3 (WWTP Preliminary Project Design, 2007). Namely, although the design principle was introduced in the documentation 3.2, where the design hydraulic loading was firstly defined as:
(2 - 3) x Q $_{\text{peak dry weather flow}}$ **= 1.040 - 1.560 l/s**,

finally, the design hydraulic loading actually used in the design was set at 800 l/s (which is significantly lower than **2xQ** $_{\text{peak dry weather flow}}$ **~ 1.050l/s**), with no further elaboration of this issue.

3.1.4.10 Demand Projection – Future Wastewater Flows

In accordance with the preliminary project implementation schedule, the plant construction is planned to begin in 2009 and to finish in 2011, planned exploitation period of the plant can be 50 years, and the period for economic analysis is 30 years, i.e. 2012 – 2041, inclusive.

Household Water Demand
The overall trend in Europe has been that the average per capita water consumption increased from 1970s until 1990s ending at an average of 150 l/cap/day. As shown earlier, the records indicate that both in the town of Leskovac the average per capita household consumption reached around 155 l/capita/day.

Although based on the information provided by the PUC Vodovod there were no major supply restrictions or shortages in the water supply system, the plans have been laid out to gradually improve the level of service in water supply, both in term of water quality and operational pressures. It is therefore anticipated at this stage that the average per capita household consumption will remain around 155 l/capita/day over the project lifetime. The resulting wastewater unit discharge would be **135 l/capita/day**.

It is also anticipated that the water consumption related to public demand, municipal administration, medical institutions, schools shall gradually rise, so that the average overall unit per capita water wastewater discharge reach 180 l/capita/day. This increase, that is associated with so called dispersed pollutants, also contains a reserve provision for unforeseen developments of limited nature within the urbanized areas.

Table 3-17 Unit wastewater discharges related to public water users (administration, medical, schools, military, etc.)

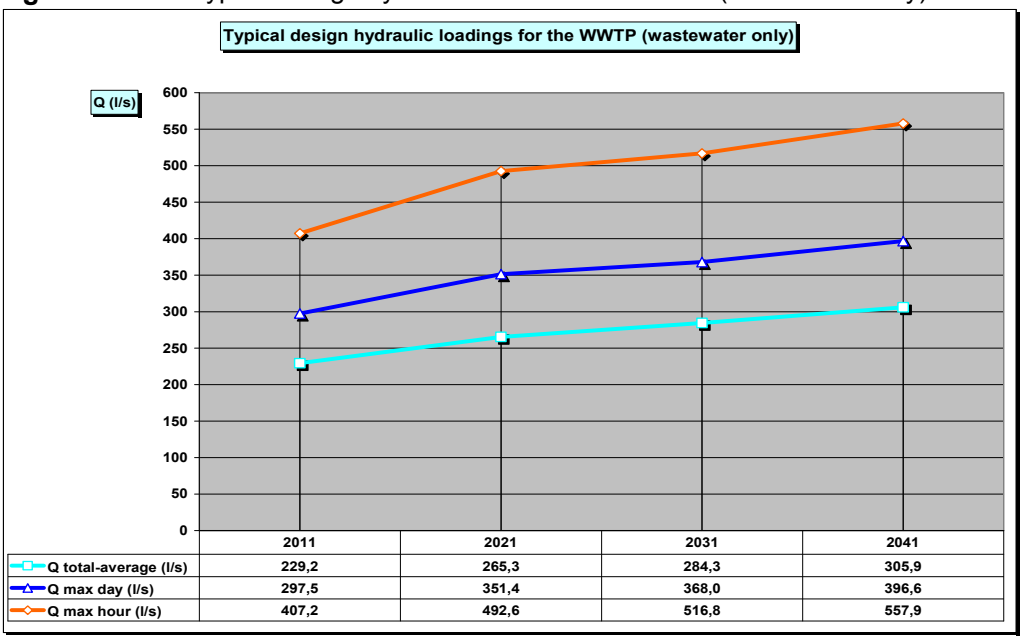
Year	2007	2011	2021	2031	2041
Unit wastewater discharge (l/capita/day)	25	30	35	40	45

At the same time it is estimated that the wastewater to water ratio shall remain around 0,85 throughout the project lifetime.

Infiltration
Infiltration in the future sewerage system has been calculated in accordance with the average infiltration rate (0,05 l/s/km) calculated earlier, and planned extension of the sewerage system (main sewers and collection network).

Wastewater Flows – an Overview
Based on the population projection, estimated per capita consumption, connection rates, wastewater to water ratio, estimated industrial effluents, respective peaking factors, infiltration rates, hereinafter is presented an overview of the wastewater flow to be diverted and treated at the future WWTP in Leskovac.

Figure 3-6 Typical design hydraulic loads of the WWTP (wastewater only)



	2011	2021	2031	2041
Q total-average (l/s)	229,2	265,3	284,3	305,9
Q max day (l/s)	297,5	351,4	368,0	396,6
Q max hour (l/s)	407,2	492,6	516,8	557,9

The abovementioned figure shows only summarized and integrated wastewater flows, while a detail breakdown of flow components is shown in annex 3.4.

In line with the earlier presented design principles the maximum wet-weather flow that should be allowed to the WWTP should be based on the defined peak dry-weather flow:

$Q_{\text{maximum wet-weather}}$ = 2-3 x $Q_{\text{maximum dry weather}}$ = 2-3 x 558 = 1.116 - 1.674 l/s

The table and resulting figures used for arriving at these results have been included in annex 3.4.

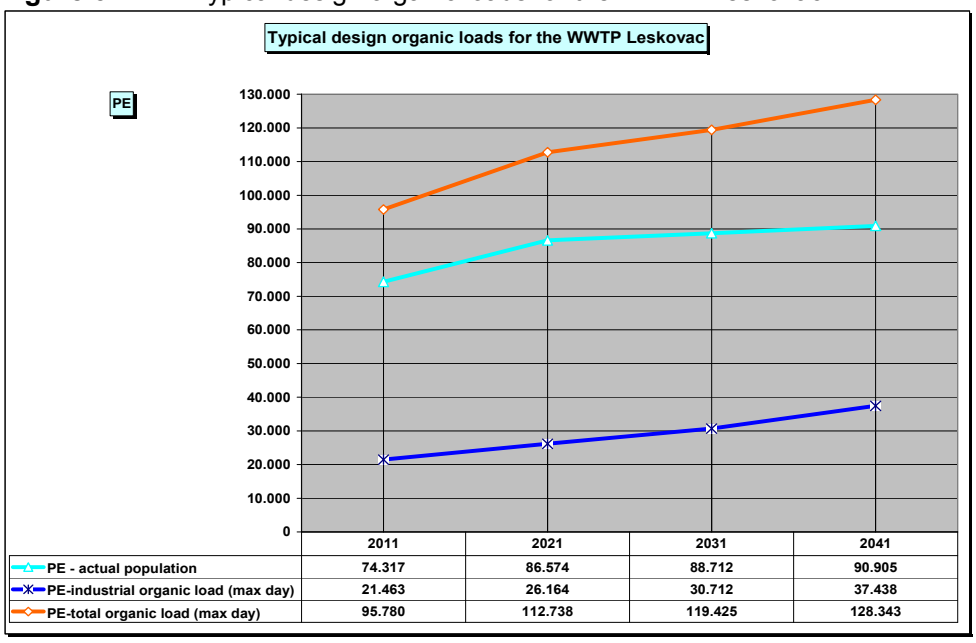
3.1.4.11 Comparative analysis of the basic design parameters for the WWTP– hydraulic and organic loads

The design organic load is usually expressed in “population equivalent, PE”, where ‘1 PE (population equivalent)' means the organic biodegradable load having a five-day biochemical oxygen demand (BOD_5) of 60 g of oxygen per day.
In assessing the design organic loading for the WWTP, the following major principles have been followed:

1. An organic load from domestic wastewater expressed in population equivalent corresponds to the projected number of population-users in the project area (approximately 91.000);
2. An organic load from industrial sources corresponding to a maximum daily discharge with the maximum allowed BOD_5 of 300 mg/l, in accordance with the Decision on the Sanitary and Technical Conditions for Wastewater Discharge into Public Sewerage (Annex 3-5);
3. Organic loading in infiltrated water into the sewers is considered negligible.

An overview of the typical design organic loads for the WWTP is shown in the following figure, while the detailed breakdown per settlements and user category is shown in the table 3.20.

Figure 3-7 Typical design organic loads for the WWTP Leskovac



Design Hydraulic Loads

The basic design parameters for the WWTP have been recently analysed in the following documents:

1. BPD, Halifax Consulting, reference 3.1
2. GPD, Institute Jaroslav Cerni, reference 3.2;
3. PPD, Institute Jaroslav Cerni, references 3.3;
4. MIASP – Royal Haskoning, Leskovac Water Utilities Feasibility Study, July 2007

The approach, methodology and results with regard to the selection of the basic design parameters in these technical documents varied considerably, and it was therefore deemed necessary to present a complete overview, and give appropriate recommendations regarding the selection of the design parameters.

Table 3-18 An overview of the hydraulic loads adopted in technical documentation

Document No	End of project period	No of population served	Q_{av} (l/s)	Q_{av} (m^3/day)	$Q_{max\ day}$ (l/s)	$Q_{max\ day}$ (m^3/day)	$Q_{peak\ dry\ weather}$ (l/s)	$Q_{peak\ wet\ weather}$ (l/s)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	2.035	81.000	188	16.250	212	18.300	424	636
2	2.030	86.100	358	31.900	533	46.000	944	Not defined
3	2.027	Not defined	250	21.600	320	27.600	520	800
4 (recommended)	2.041	90.900	306	26.400	397	34.300	558	Subject to further analysis: initially recommended 2-3 x $Q_{peak\ dry\ weather}$

Comments:

1. *It is believed that the project life time should cover 30 years of operation of major project components. Based on the current status, start of operation of the WWTP can be expected in 2011 – 2012, and therefore the project period should be 2012 – 2041 inclusive;*
2. *The scope of the project in documentation 1 does not cover all settlements to be connected in accordance with reports 2 and 4. Reduced scope resulted in a considerably lower number of users. Population projections in reports 2 and 4 can be considered fairly consistent;*
3. *The average and maximum daily hydraulic loads in documentation 1 are considered to be underestimated because an extension of the service area and peaking factors have not been taken into consideration fully. Documentation 2 presents overestimated loads, based on unrealistically high unit wastewater rates for households, industries and infiltration. On the other hand documentation 3 employs simplistic approach, by directly multiplying current rates, without necessary full justification. Also, documentation 3 excludes possible industrial growth scenarios, resulting in corresponding growth of industrial discharges;*
4. *Determination of the peak wet weather flow to be treated at the WWTP must be followed and justified by a comprehensive analysis of the combined sewerage system balances, resulting in combined sewer overflows (characteristics, frequency, environmental effects, control, etc.), and possibly technical measures aimed at controlling combined sewer overflows in a way to fulfil the set design criteria and not to endanger required water quality status of the receiving water*

bodies. This analysis must be integral and involve the sewerage system as well as the WWTP and necessary CSO control structures.

Design Organic Loads

This section elaborates on selection of a typical organic design load being one of the key parameters for the technical design of the WWTP. Similarly, it compares the parameters used in the different technical proposals, because there are differences in terms of methodology and adopted design loads. Below an overview is given of the adopted design loads in the different designs, converted into population equivalents.
Data on wastewater quality recorded at the sewer discharge are presented in Annex 3-6.

Table 3-19 Typical organic design loads for the WWTP Leskovac as presented in different technical designs

Document No	Typical organic Design Loads		Comments
	PE	BOD_5 (kg/day)	
(1)	(2)	(3)	(4)
1	53.300	3.200	Calculated on basis of the average influent BOD_5 recorded from 1997 to 2004 and an assumed maximum daily flow to the WWTP
2	115.000 -120.000	6.900-7.200	Calculated on basis of the projected number of population (1 inhabitant = 1 population equivalent), plus BOD_5 from industrial discharges (max allowed BOD_5 of 300 mg/l, multiplied by **the projected average industrial discharge**)
3	100.000	6.000	On basis of an adopted number of PE (not related to population projection) but assumed, multiplied by typical pollutant loads per single PE. Recent wastewater analysis data presented in the report, however, clear correlation with adopted design parameters not demonstrated.
4 (recommended)	128.000	7.680	Calculated on basis of the projected number of population (1 inhabitant = 1 population equivalent), plus BOD_5 from industrial discharges (max allowed BOD_5 of 300 mg/l, multiplied by **the projected maximum daily industrial discharge**)

Where:
1. Reference 3.1;
2. References 3.2;
3. References 3.3;
4. MIASP – Royal Haskoning, Leskovac Water Utilities Feasibility Study, July 2007.

Comments:

1. Report 1 is based on the average BOD_5 recorded in a number (29) of randomly taken samples between 1997 and 2004. However, it has not been proven if the recorded sewage quality is also representative for possible future organic loads. The period considered may not been representative because of the low level of industrial activity (which is generally anticipated to recover). The effect of wastewater dilution with infiltrated waters has not been assessed. Furthermore, the design organic loads are based on the hydraulic loads which are believed to be underestimated. Finally, it has been recommended that the WWTP should be sized to cater for approximately 53.000 PE, which is even less that the number of inhabitants currently connected to the sewerage system. This approach will lead to under-sizing of the WWTP, and can not be pursued.
2. The methodology presented in report 2 considers the number of projected population to be equal to the number of population equivalent. In addition to this organic loading, projected industrial discharges have been also taken into account, but related to the projected average flows. This approach should be modified and the maximum daily, rather than the average industrial discharges should represent the basis for calculation of typical pollutant loads to be used in the WWTP design.
3. The report 3 refers to the wastewater quality data indicating that the recorded values of certain wastewater quality parameters are lower than it would be expected in typical communal wastewater. This probably led to an attempt to optimise (downsize) the design of the WWTP. However, no clear and direct correlation has been established between recorded wastewater quality and adopted design parameters. Instead, as the starting point for assessment of the pollutant loads was an adopted number of 100.000 PE (no justification given), which is further multiplied by typical pollutant loads (per PE, per day) in accordance with ATV DVWK (German Association for water management, wastewater and waste) recommendations. Taking into account the number of system users adopted in the report 2 (nearly 90.000 to be diverted to the WWTP), major deficiency of the assumptions taken in the report 3 could be an underestimate of the industrial pollutant loads. Namely, if it was assumed that the number of system users corresponds to the number of PE, than the allowance of only around 10.000 PE for industrial loads is, in a long run, likely to be underestimated. The level of industrial activity is normally expected to recover and grow over the project lifetime, and this should be taken into account in the WWTP design. If there is concern about potentially over-sizing of the WWTP, it is possible to propose a gradual, staged implementation, i.e. to allow the WWTP capacity to follow the actual hydraulic and pollutant loads to the WWTP (for instance construct 2/3 of the WWTP capacity now, and another third when require).
4. The approach adopted in this report (No 4) is believed to be the most appropriate: it takes into account pollutant loads from population (where a single inhabitant corresponds to one PE) and allows for moderate growth of industrial discharges and loads (where industries provide compliance with the set discharge criteria). Although some of the available wastewater quality data suggest that typical values of a number of wastewater quality parameters are lower than expected, reference should be also made to the older wastewater quality data (recorded in 1990 when the level of industrial activity was much higher (see Annex 3-6) which may be representative for prospective future situation. If due caution is to be exercised with regard to the WWTP dimensioning, it is recommended to opt for a phased implementation of the WWTP.

3.2 Technical options

3.2.1 Scope of the Project

Basic components of the project have been given before, and this section presents an integrated overview of the components of the scope.

The service coverage with sewer system has to be extended to achieve full service coverage in Leskovac town, the suburbs and villages next to the town area. This extension of the sewer complies with the proposal elaborated in references 3.2, and is also in full accordance with the design characteristics of the wastewater treatment facilities.

By introducing and extending the sewer system overall sanitation in the concerned areas is going to be improved, and health hazards reduced or eliminated. However, connecting of additional users to the sewer system shall generate additional wastewater flows, and if not followed by an appropriate treatment, would only increase pollution of the receiving water bodies. Therefore, parallel to the planned extension of the sewer network it is planned to install a wastewater treatment facility that will ensure treatment in full accordance with the set design criteria.

The scope of the project also includes the extension of the water distribution system, i.e. introduction of a centralized public water supply system in the villages located in the northern part of the municipality.

In brief, the scope of the project includes the following components:

1. Extension of the sewer system;
2. Construction of a wastewater treatment facility for all wastewater generated in the town area and suburbs;
3. Extension of the water distribution system to the villages located in the northern part of the municipality.

3.2.2 Extension of the Sewer Network

3.2.2.1 Scope sewer extension

Planned extension of the sewer network has been elaborated in the technical documentation, see references 3.2 and 3.3. Based on the proposed extensions, as-built status of the sewerage system in individual settlements provided by the PUC Vodovod, and corresponding preliminary hydraulic assessment conducted for the purpose of this study, the following table shows the technical details of the proposed extension.

Table 3-20 Basic components of proposed extension of the sewer network (m)

No	Component description	DN200	DN250	DN300	DN400	DN500	L(km)
3.1	Mrštane - collection network	500	2.100	1.300			3,9
3.2	Bratmilovce - collection network	6.400	6.800				13,2
3.3	Bobište - collection network	2.500	5.100	2.000			9,6
3.4	Bratmilovce - Bobište - main sewer			1.500	1.100	900	3,5
3.5	Bogojevce - collection network	400	3.200	1.400			5,0
3.6	Bogojevce - SPS						0
3.7	Navalin - collection network	200	3.700				3,9
3.8	Vinarce - collection network (Jablanica right bank)		4.700				4,7
3.9	Vinarce - main sewer			800			0,8
3.10	G.Stopanje - collection network		2.800	1.600			4,4
3.11	Svirce - collection network	300	2.300				2,6
3.12	Svirce - SPS						0
3.13	D.Tranjane - collection network	200	1.600				1,8
3.14	Turekovac - collection network	2.500	2.200	4.100			8,8
3.15	Turekovac - SPS						0
3.16	Vlase - collection network	1.000	2.100				3,1
3.17	G.Trnjane - collection network	650	1.000				1,7
3.18	G.Sinkovce - collection network	400	1.000				1,4
3.19	G.Sinkovce - main sewer		3.300				3,3
3.20	D.Sinkovce - collection network	1.900					1,9
3.21	Šišince - collection network	3.400					3,4
3.22	Šišince - main sewer	1.400					1,4
3.23	Rudare - collection network	2.900					2,9
3.24	Rudare - main sewer		1.550				1,6
3.25	D.Jajina - collection network	500	2.500	2.200			5,2
3.26	D.Jajina - SPS						0

3.2.2.2 Cost estimate sewer extension

This section shows the cost estimate for the proposed extension of the sewer network in the suburban and rural areas close to the town of Leskovac.

Table 3-21 Cost estimate sewer extension

No	Component description	DN200	DN250	DN300	DN400	DN500	L(km)	Sewage pumping stations (€)	Total cost (€)	*Completeness (%) - source: PUC Vodovod*	Actual remaining costs (€)
3.1	Mrštane - collection network	500	2.100	1.300			3,9		398.000		398.000
3.2	Bratmilovce - collection network	6.400	6.800				13,2		1.256.000	*60*	502.400
3.3	Bobište - collection network	2.500	5.100	2.000			9,6		955.000	*20*	764.000
3.4	Bratmilovce - Bobište - main sewer			1.500	1.100	900	3,5		470.000		470.000
3.5	Bogojevce - collection network	400	3.200	1.400			5,0		510.000	*35*	331.500
3.6	Bogojevce - SPS						0	4.000	4.000		4.000
3.7	Navalin - collection network	200	3.700				3,9		388.000		388.000
3.8	Vinarce - collection network (Jablanica right bank)		4.700				4,7		470.000		470.000
3.9	Vinarce - main sewer			800			0,8		88.000		88.000
3.10	G.Stopanje - collection network		2.800	1.600			4,4		456.000	*80*	91.200
3.11	Svirce - collection network	300	2.300				2,6		257.000		257.000
3.12	Svirce - SPS						0	4.000	4.000		4.000
3.13	D.Tranjane - collection network	200	1.600				1,8		178.000		178.000
3.14	Turekovac - collection network	2.500	2.200	4.100			8,8		896.000		896.000
3.15	Turekovac - SPS						0	4.000	4.000		4.000
3.16	Vlase - collection network	1.000	2.100				3,1		300.000		300.000
3.17	G.Trnjane - collection network	650	1.000				1,7		158.500		158.500
3.18	G.Sinkovce - collection network	400	1.000				1,4		136.000		136.000
3.19	G.Sinkovce - main sewer		3.300				3,3		330.000		330.000
3.20	D.Sinkovce - collection network	1.900					1,9		171.000	*90*	17.100
3.21	Šišince - collection network	3.400					3,4		306.000		306.000
3.22	Šišince - main sewer	1.400					1,4		126.000		126.000
3.23	Rudare - collection network	2.900					2,9		261.000		261.000
3.24	Rudare - main sewer		1.550				1,6		155.000		155.000
3.25	D.Jajina - collection network	500	2.500	2.200			5,2		537.000		537.000
3.26	D.Jajina - SPS						0	15.000	15.000		15.000
	Sub-total with VAT (€)	**2.263.500**	**4.595.000**	**1.639.000**	**143.000**	**162.000**		**27.000**	**8.829.500**		**7.187.700**
	Engineering, supervision, commissioning - 3%	**67.905**	**137.850**	**49.170**	**4.290**	**4.860**		**810**	**264.885**		**215.631**
	Contingencies - 5%	**113.175**	**229.750**	**81.950**	**7.150**	**8.100**		**1.350**	**441.475**		**359.385**
	Sub-total with VAT and contingencies(€)	**2.444.580**	**4.962.600**	**1.770.120**	**154.440**	**174.960**		**29.160**	**9.535.860**		**7.762.716**
	VAT - 18 % (€)	**372.902**	**757.007**	**270.018**	**23.559**	**26.689**		**4.448**	**1.454.623**		**1.184.143**
	Sub-total witout VAT (€)	**2.071.678**	**4.205.593**	**1.500.102**	**130.881**	**148.271**		**24.712**	**8.081.237**		**6.578.573**

3.2.3 Central Wastewater Treatment Plant in Leskovac

3.2.3.1 General

One of the major project components is a new central Wastewater Treatment Plant for Leskovac town and some 20 of its suburbs. The current sewer coverage in Leskovac town is estimated at some 90%, while the coverage of its suburbs is very low.
Currently, municipal and industrial wastewater is discharged into the Veternica River without prior treatment. The project aims at combined domestic and (pre-treated) industrial wastewater treatment in one single plant.

Two main gravity sewers are either constructed or under constructed in order to ensure wastewater transport to the WWTP:

- An industrial main gravity sewer (construction completed);
- A main city gravity sewer (construction completed 85%).

The technical proposal assessed in this study is based on the project design of the WWTP elaborated in technical documentation (see references 3.2 and 3.3) with some modifications where required for optimisation.

Reference 3.3 includes an elaborate preliminary design of the plant, including detailed cost analysis per project discipline (civil, mechanical and electrical & process automation). The wastewater treatment plant has been proposed as a single-phase project for a design period of 20 years.

3.2.3.2 Location of the WWTP

The WWTP Leskovac shall be located at a location defined in the current Urban Master Plan of Leskovac (valid till 2010), just off the highway M75, close to the confluence of the Veternica and the South Morava rivers. The plot designated for the WWTP belongs to the cadastral zone Bogojevce and it is within a flood protected area. The plot boundaries can be described as follows:

- To the East : highway M75;
- To the West : flood-protection levy along the Bare canal;
- To the South: road Bogojevce-Zlokućane;
- To the North: right-bank flood-protection levy along the Veternica river.

The size of the plot is some 24 ha, while the average altitude of the terrain is 215,5 m, see Figures 3-8 and 3-9.

Figure 3-8 Location of the future WWTP

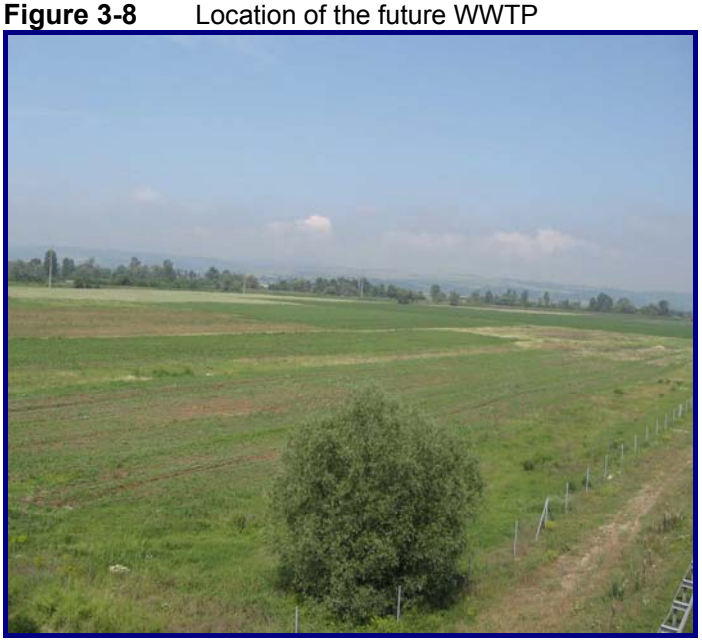
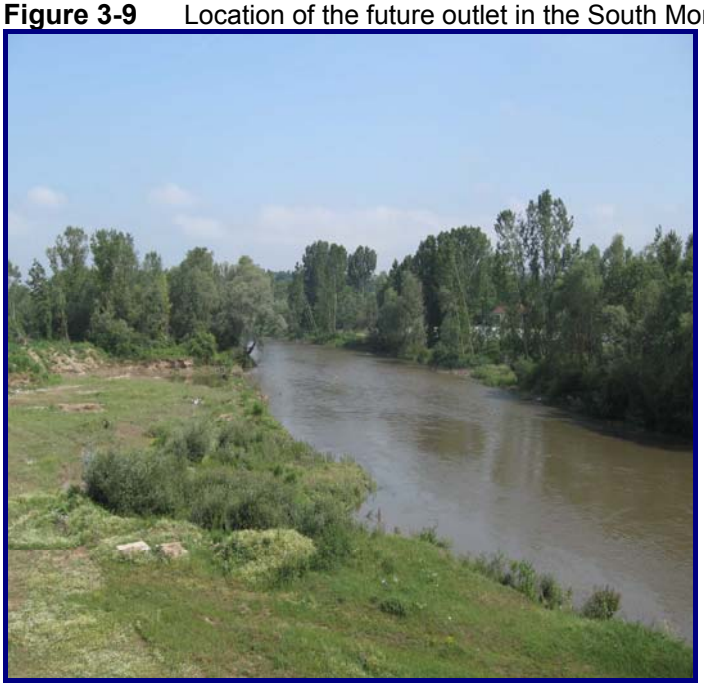


Figure 3-9 Location of the future outlet in the South Morava River



3.2.3.3 Users of the future WWTP

The central WWTP will treat discharged wastewater originating from the following major groups of water consumers:

- Domestic, public, and institutional wastewater of the municipality of Leskovac;
- industrial wastewater;
- wastewater from cattle farms.

The following categories and specific industrial facilities have been identified as relevant for the design and functioning of the future WWTP. The overview also provides an inventory of relevant discharge quantities and quality:

Food industry

- "Toma Kostic" candy industry – no pre-treatment available, main water quality characteristics: Q=8,5 m^3/h; pH 7, SS=300 mg/l; COD=1200 mg O_2/l, BOD_5=250 mg O_2/l, mineral oils and grease;
- "Umi-Pek" flour mill and bakery – no information regarding pre-treatment, main water quality characteristics: Q=7,81 m^3/h, pH 8, SS=250 and BOD_5=180 mg O_2/l;
- "Mlekara" milk industry, no information regarding pre-treatment, main water quality characteristics: Q=5,0 m^3/h, pH 7, SS=250 mg/l, COD=500 mg O_2/l and BOD_5=250 mg O_2/l;
- "Jugoprom" agriculture products, including freezing facility – no pre-treatment available, main water quality characteristics: Q=2 m^3/h, pH6.5, SS=70 mg/l, COD= 600 mg O_2/l and BOD_5=200 mg O_2/l;
- "Balkan" meat butchery and kitchen facilities - no information regarding pre-treatment, main water quality characteristics: Q=5 m^3/h, pH 7, SS=150 mg/l, COD=250 mg O_2/l and BOD_5=80 mg O_2/l;
- "Mesokombinat – Promet" meat industry – pre-treatment composed of $Al_2(SO_4)_3$ and $FeCl_3$ dosing, flotation and settling not functioning, main water quality characteristics: Q=24 m^3/h, pH 6,5 – 8,5, SS=200 mg/l, COD=230 mg O_2/l, BOD_5=90 mg O_2/l, Oil and grease=37 mg/l, N_{total} and P_{total} not available;
- "Porecje" fruit and vegetables processing – pre-treatment by settling, main water quality characteristics: Q=2,7 m^3/h, pH 6,5 – 9,0, SS=110 mg/l, COD=850 mg O_2/l, and BOD_5=450 mg O_2/l.

Metal finishing industry

- "Kremikovtzi-Lemind" plasticized metal plating – pre-treatment by means of neutralisation, main water quality characteristics :Q=0,5 m^3/h, SS=600 mg/l, COD=110 mg O_2/l and BOD_5=30 mg O_2/l;
- "Galpres" metal wire production and plating – pre-treatment not available, main water quality characteristics: Q=8 m^3/h, SS=60 mg/l, COD=60 mg O_2/l, BOD_5=15 mg O_2/l;
- "Rul" electro equipment and lighting, pre-treatment construction available but not functioning due to equipment installation delay, main water quality characteristics: Q=10 m^3/h, pH 6,5, SS=70 mg/l, COD and BOD_5 =120 mg O_2/l.

Chemical industry

- "Aktavis Zdravlje" pharmaceutical industry, pre-treatment not available, main water quality characteristics: Q=150 m^3/day, pH 5,3-10,2, SS=6-1200 mg/l, COD=30-650 mg O_2/l and BOD_5=10-550 mg O_2/l;
- "Nevena" cosmetic industry – pre-treatment not available, main water quality characteristics: 70 m^3/h, pH 7- 9, SS=150 mg/l, COD=300 mg O_2/l and BOD_5 =100 mg O_2/l;
- "Nevena-Kolor" chemical industry, oil and nitro solvents and colours – pre-treatment not available, main water quality characteristics: Q=4 m^3/h, SS=170 mg/l, COD=125 mg O_2/l and BOD_5=40 mg O_2/l;

- "Hemigal" cosmetics industry, pre-treatment not available, main water quality characteristics: Q=0.85 m^3/h, pH 7, SS=458 mg/l, COD=1400 mg O_2/l and BOD_5=600 mg O_2/l.

Transport companies

- "Jugexspres" truck transport company, pre-treatment not available, main water quality characteristics: two streams, stream 1: Q=4,50 m^3/h, COD=260 - 360 mg O_2/l, SS=450 mg/l and BOD_5=100 mg O_2/l; stream 2: Q=1,0 m^3/h; pH 7-8, SS=250 mg/l, COD=350 mg O_2/l and BOD_5=150 mg O_2/l;
- "Auto Moto Savez Srbije" auto repair and testing, pre-treatment not available, main water quality characteristics: Q=0.17 m^3/h, SS=500 mg/l, COD=250 mg O_2/l, BOD_5=70 mg O_2/l;
- "Dunav Auto" similar to "Auto Moto Savez Srbije";
- "Zoljevo Promet" car wash, pre-treatment not available, main water quality characteristics: Q=0.80 m^3/h, pH 7- 9, SS=200 mg/l; COD=500 mg O_2/l and BOD_5 =200 mg O_2/l.

Analyses clearly show that wastewater is discharged without or with minor pre-treatment into the sewer or directly into water streams. All industrial and other polluters producing wastewater that is not compliant with valid norms for discharge into city sewers (Annex 3-5) that will be connected to the future WWTP, will have to pre-treat their wastewater to the required quality levels prescribed for sewer discharge (MAC).

The limited number of existing and dysfunctional industrial wastewater pre-treatment facilities and the lack of a clear industrial wastewater management strategy, imply that the future WWTP should have sufficient operational flexibility to accommodate periodic peaks/variations in wastewater quantity and quality.

3.2.3.4 Available data on wastewater flows and quality

Available data on measured current wastewater flows have been shown earlier in the report. This information is important as a base for the projection of future wastewater quantities.

Water quality data

This section summarizes the wastewater and surface waters quality data presented in the references 3.1 to 3.3 which used for the design of the WWTP.

The data on communal wastewater quality in the town of Leskovac have been recorded since 1990 and although not very recent, may be representative for the design, because the investigations were actually carried out in the period of normal and dynamic industrial activity, unlike the period after the early 1990s. The former industrial activities resulted in substantial industrial wastewater discharges and rather high values of concentrations of pollutants.

Over the observed period wastewater quality showed great variations. Very high pollutant loads were observed between 1990 and 2000, with corresponding high average values of the key water quality parameters.

The peak value of organic pollution was recorded on 12/08/1991 with a COD of 7.281 mg O_2/l at the discharge point. At that time typical COD values were between 700 and 4.500 mg O_2/l. The average COD value for the period 1990 to 2000 was 1.465 mg O_2/l, and the average BOD_5 was 366 mg O_2/l.
On the other hand, the period 2000 – 2004 was characterized by significantly lower values of these parameters; the average COD was 332 mg O_2/l, while the average BOD_5 was 150 mg O_2/l.

Wastewater discharges detrimentally affected water quality in the receiving water body ,the Vetrinica River, which has been officially classified as a class IIb water course, as shown in the following table:

Table 3-22 Water quality in the Veternica River in 2000

	BOD_5	**Dissolved O_2 - minimum**	**Detergents (mg/l)**	**Phenol (mg/l)**	**Suspended matter (mg/l)**
MAC for class IIb water courses	6	5	0,05	0,001	40
Recorded value	26,5	4,98	0,65	0,045	134

Sets of data on water quality in the Vetrenica and South Morava Rivers and in the city sewerage system is shown in Annex 3-6. These water quality data clearly indicate deterioration of water quality in the rivers as a result of untreated communal wastewater disposal.

Apart from the aforesaid water quality analysis, in February 2007 a set of wastewater quality analysis was carried out in order to obtain updated and comprehensive data on the current status of sewage quality in Leskovac. These water quality tests were followed by flow measurements at the discharge point, essential for establishing the organic loads.

The results are shown in the following overview:

1. Water temperature ranged from 12,5 to 14,1 °C;
2. pH was between 7,77 and 8,78;
3. Conductivity: 808 – 1.221 µS/cm;
4. Sulphides: 0,26 to 4,10 mg/l – weighed average 2,60 mg/l;
5. Sulphates: 71,2 to 125 mg/l – weighed average 96,5 mg/l;
6. SS: 60 to 1.588 mg/l – weighed average 422 mg/l;
7. $NH4^+$: 14,0 to 47,6 mg/l – weighed average 33 mg/l;
8. N Kjeldahl : 28,0 to 75,6 mg/l – weighed average 53,1 mg/l;
9. COD: 110 – 840 mg O_2/l – weighed average 372,1 mg O_2/l;
10. BOD_5: 28,5 – 751,2 mg O_2/l – weighed average 175,9 mg O_2/l

The calculated average wastewater flow (as percentage of consumed water) over the observed period was 184 l/s and the average discharge was approximately 190 l/s.

Based on the calculated weighed average values of pollutants, and the average flow it was possible to calculate the daily pollutant loads:

- BOD_5: around 2.800 kg O_2/day
- SS: around 6.700 kg/day

Characterising typical municipal wastewater.
The measurements and analysis were carried out in wintertime, in "seasonal average", conditions and can not be automatically declared as the design parameters. These results therefore can be considered as an indication of the quality of the collected wastewater. These results can of course be compared with expected pollutant loads, derived from the recorded number of users in the system.

Table 3-23 Typical values of unit pollutant loading per PE in accordance with the ATV DVWK recommendations

Parameter	Unit	Typical value
Biochemical oxygen demand, BOD_5	g of O_2 /PE/day	60
Chemical oxygen demand, COD	g of O_2 /PE/day	120
Total suspended matter, TSS	g/PE/day	70
Total nitrogen, TN	g/PE/day	11
Total phosphorous, TP	g/PE/day	1.8

Based on these typical unit loads, the calculated organic loads can be expressed in a number of population equivalents:

BOD_5 of 2.800 kg O_2/day ≈ 47.000 PE,

which is significantly less than the assumed number of users connected to the system. This may be an indication than the actual current number of population served by the sanitary sewerage system is lower than the number assumed by the engineering teams.

3.2.3.5 Basis of design of the WWTP

This section presents the basis of the WWTP design, as adopted in reference 3.3, with corresponding review and comments of the Consultant.

The design capacity of the plant (organic load), was adopted as 100.000 PE (population equivalent) in the documentation. At the moment about 60.000 inhabitants are reported to be connected to the sewer network and will be to the future WWTP. Short term implementation of sewers extension will result in the connection of an additional 20.000 inhabitants. The total number of connected inhabitants will therefore be 85.000. Demographic developments are expected to contribute with additional 5.000 inhabitants in the future, totalling to around 90.000 inhabitants.

The ultimate design capacity of the WWTP (organic load) adopted in the preliminary design dominantly relies on the water quality and wastewater flow investigations, rather than on the actual number of population and anticipated industrial growth.

An alternative approach takes into account the projected number of inhabitants and assumes that it corresponds to the number of PE, and adds the anticipated potential industrial growth with its contribution in PE. This approach would lead to adopting the design organic load of some 125.000 to 130.000 PE. This can be further justified by the results of wastewater quality analysis carried out in early 1990-s which show that the

effect of industrial wastewater discharges on the overall wastewater quality was significant, and actually resulted in very high pollutant concentrations.

Although there is uncertainty about the future industrial development, it may be advisable to plan the WWTP facilities for its normal ultimate design capacity assuming the assumed population and industrial growth, but to also propose phased implementation, and thus practically avoid too much over dimensioning of the WWTP.

As described in reference 3.3, the plant would enable treatment of wastewater originating from the population, industry, storm water and infiltration water. The maximum design organic loading has been defined as 100.000 PE (or approximately 6.000 kg BOD_5/day) and the peak hydraulic loading (wet weather flow) is 800 l/s.

The design for the WWTP refers to the relevant local (Law on Waters and respective strategic documents, acts of law, rules and regulations, especially act 56 and act 59) and EU (EU Council Directive 91/271/EEC) legislation. The following EU emission standards for treated water quality have been considered:

Table 3-24 Emission standards for municipal wastewater treatments in accordance with the Council Directive 91/271/EEC

Parameter	Concentration	Lowest removal efficiency (%)[1]
Biochemical oxygen demand (BOD_5 at 20°C) Without nitrification	25 mg/l O_2	70-90 %
Chemical oxygen demand (COD)	125 mg/l O_2	75 %
Total suspended matter	35 mg/l [(3)] 35 mg/l (>10.000 PE) 60 mg/l (2000-10000 PE)	90 %[(3)] 90 % (>10000 PE) 70 % (2000 - 10000 PE)

(1) Decrease relative to loading inlet water.
(2) The use of other comparable parameters is allowed: Total Organic Carbon (TOC) or Total Oxygen Demand (TOD) if a relation can be established between BOD_5 and these alternative parameters.
(3) Optional parameter.

Discharge of wastewater effluents in sensitive areas implies tertiary treatment for the removal of nitrogen and phosphorus to required levels presented in Table 3-25.

Table 3-25 Emission requirements for discharge in sensitive areas.

Parameter	Concentration	Lowest removal efficiency (%)[1]
Total phosphorus	1 mg/l P (>100.000 PE) 2 mg/l P (10.000 – 100.000 PE)	80 %
Total nitrogen [(4)]	10 mg/l N (>100.000 PE)[(5)] 15 mg/l N (10.000 – 100.000 PE)	70-80 %

(4) Total nitrogen: sum of Kjeldahl-N (organic- N + NH_4 – N), and NO_2 –N
(5) Alternative, daily average value must not exceed >20 mg/l N. This requirement relates to water with temperature of 12°C or above, during operation of the bio-reactor for waste water treatment. An alternative to temperature is the use of utilization time that considers regional climate. This alternative can be applied if it can be proven that requirement 1 of Annex ID is fulfilled.

Besides compliance with the abovementioned EU emission standards it is also necessary to ensure compliance with the national imission standards, i.e. the design criteria set by the relevant GoS department, the Water Directorate.

In general the relevant national immision standards are defined in the following regulations:

- The Ordinance on Water Courses Classification, OGRS 5/68;
- The Ordinance on Classification of Waters, OGRS 5/68 (summary in Annex 3-8)
- The Ordinance on Dangerous Substances in Waters, OGRS 31/82 (summary in Annex 3-8)

Namely, the Ordinance on Dangerous Substances in Waters prescribes the maximum allowable concentrations of pollutants in wastewater for different classes of water courses. On the other hand the Ordinance on Classification of Water Courses defines water quality classification of all major water courses in Serbia.
The Ordinance on Classification of Waters defines required basic water quality parameters for different classes of waters.

These regulations are fully compliant with the key design criteria specified in the following documents:

- Decision on Water Management Conditions for WWTP Leskovac, Ministry of Agriculture, Forestry and Water Resources, September 14, 2005 – Annex 3-9;
- Expert Opinion in preparation of the Water Management Conditions, Public Company Srbijavode, July 21, 2005 – Annex 3-10;
- Expert Opinion in the procedure of issuing water management design conditions for the WWTP Leskovac, Serbian Institute of Hydro-meteorology, July 31, 2005 – Annex 3-11.

It is important to note that the following classification of local water courses applies:

1. Southern Morava from Grdelica to the Vlasina confluence: Class IIb
2. Southern Morava from Vlasina confluence to the Jablanica confluence: Class IIa
3. Southern Morava from Jablanica confluence to the Turija confluence: Class IIb
4. Veternica from Vucje to the Southern Morava confluence : Class IIb

To conclude, in accordance with the presented data, and with the abovementioned design conditions, the representative class for all major water courses in the area is II.

Further to the prescribed design criteria the wastewater treatment facility should provide such effluent quality that is not going to affect the set class of water quality in the receiving water body, the Southern Morava river.

The Veternica and Morava rivers fall under category II-IIb of the local legislation (implying that their water may be used fro drinking water purposes only after specific treatment). Similar EU categorization implies the necessity to treat water for drinking water purposes by conventional technology (coagulation/flocculation, sedimentation and/or rapid sand filtration, disinfection). Comparison of the EU and local legislation in the following table suggests that the local standards are more stringent.

Table 3-26 Imission standards for surface waters (EU and local)

Parameter	Unit	Category A2 (75/440/EEC)	MAC Category II
NO_3	mg/l	50	10
NO_2	mg/l	-	0.05
P_2O_5	mg/l	0.7=0.3 P = 0.9 mg PO_4/l	0.15 P = 0.4 mg PO_4/l
Saturation O_2		min 50 %	min 75 %
BOD_5	mg/l	5	Sub-class IIa:4 Sub-class Iib:6
NH_4^+	mg/l	1	0.1

The following table gives an overview of the basic hydraulic characteristics of the two rivers that will serve as receiving water bodies of the effluent from the sewer system and the WWTP.

Table 3-27 Typical flows in South Morava and Veternica rivers as prescribed in the design criteria

Regional characteristic flows of South Morava river	
Calculated flow of 1% probability	1.390 m^3/s
Calculated flow of 2% probability	1.220 m^3/s
Average flow	33,3 m^3/s
Average monthly low flow of 95% probability	4,0 m^3/s
Regional characteristic flows of Veternica river	
Calculated flow of 1% probability	210 m^3/s
Calculated flow of 2% probability	167 m^3/s
Average monthly low flow	0,15 m^3/s

** An inconsistency was recorded in the set design criteria, but after verification with the relevant Ministry, flow of 4,0 m^3/s has been confirmed*

The critical flow in the receiving water body that is representative for verification of the compliance with the set quality class of the receiving water body is an average monthly low flow of 95% probability.

The final receiving water body for the effluent of the WWTP will be the South Morava river. Both, the Morava and Veternica rivers are categorized as water bodies of category II according to the local legislation. Water quality measurements on the Veternica river upstream and downstream of the current sewer discharge confirmed deterioration of the river quality regarding BOD_5, suspended matter, chloride, sulphate, phosphate, oil and fat, detergent and phenols. This is partly related to the low average flow in the river and its relatively low carrying capacity.

With regard to preserving of the prescribed quality class in the receiving water bodies, the following must be taken into account and the compliance verified:

- Discharge of combined sewer overflows, at the location of the existing discharge point into the Veternica River
- Discharge of the WWTP effluent and surplus CSO-s, at the location of the foreseen outlet on the Southern Morava river

Required treatment/removal efficiency

The compliance with the following two sets of criteria must be checked in the design of the WWTP:

- National criteria (imission standard) based on a carrying capacity of the receiving water body;
- EU Directive (emission standards).

Both approaches have got their own specifics:

- **Imission standards** are properly oriented towards environmental protection; they take into account size, characteristics and typical flows of receiving water bodies, in such a way that a small water course requires higher treatment efficiencies than large rivers. It is important to establish a typical, representative low flow in a receiving water body that is used for challenging treatment processes. In accordance with the national standard this is the average monthly low flow of 95% probability in the receiving water body. At the profile of the future WWTP outlet in the Southern Morava river this flow amounts to 4 m^3/s.
- **Emission standards** generally prescribe the required effluent standards irrespective of hydrologic conditions (with exception of sensitive areas), which can be more practical to implement, and are widely used throughout the EU.

Serbia has not adopted the abovementioned EU criteria, and therefore, both sets of standards should be checked for compliance. The following table gives an overview of the required water quality parameters in different classes of water courses, which is going to be used as a basis for checking of the treatment efficiencies.

Table 3-28 An overview of required water quality for different classes of water courses

No	Parameter	Class I	Class IIa	Class IIb
1	Suspended matter - dry weather (mg/l)	10	30	40
2	Total dry residue – dry weather (mg/l)	350	1.000	1.000
3	pH	6,8-8,5	6,8-8,5	6,8-8,5
4	Dissolved oxygen (mg O_2/l), minimum	8	6	5
5	Five-day biochemical oxygen demand – BOD_5 (mg O_2/l)	2	4	6
6	Visible waste matter	without	Without	without
7	Colour	without	Without	without
8	Smell	without	Without	without

Based on the previous table and the EU Directive, the analysis of the required treatment efficiency for different classes of water courses (for BOD_5) was conducted in the reference documentation 3.2, as shown in the next table.

The required treatment efficiency has been calculated in accordance with the following formula:

$$TE = \left(1 - \frac{C_{REC}}{C_{WW}}\right) x100[\%]$$

Where:

TE - Required treatment efficiency (%);
C_{REC} - Maximum allowed concentration in the receiving water body (mg/l);
C_{WW} - Pollutant concentration in wastewater (mg/l);
C_{TWW} - Pollutant concentration in effluent (treated wastewater) (mg/l).

It should be noted that, although numerically correct, the conducted analysis appears to be incomplete: although the abovementioned national standards are clearly marked as being of imission type, hydrological features of relevant receiving water bodies have been disregarded, and the imission standards have practically been treated as emission standards with very strict effluent criteria, numerically resulting in very high treatment efficiencies. The analysis should therefore be supplemented with regard to typical wastewater and receiving water body flows.

Table 3-29 WWTP required treatment efficiencies, in accordance with the National and EU standards, source reference 3.2

Type of settlement	C_{WW} (mg/l)	National standards						EU standards		
		Class I		Class IIa		Class IIb		C_{TWW} (mg/l)	Related to C	Related to TE
		C_{REC} (mg/l)	TE (%)	C_{REC} (mg/l)	TE (%)	C_{REC} (mg/l)	TE (%)		TE (%)	TE (%)
Urban	227	2	99,1	4	98,2	6	97,4	25	89	70-90
Suburban	227	2	99,1	4	98,2	6	97,4	25	89	70-90
Rural	261	2	99,2	4	98,4	6	97,7	25	90	70-90

In reference 3.2 it was further concluded that the EU criteria should be adopted in the design, as “being more favourable” (meaning in this particular case a less stringent treatment). This is further justified by the likelihood that the Serbian national standards should soon be brought in full accordance with the EU standards.

With due regard to this reasoning, it can not be accepted directly because:
- A treatment can not be marked as “more favourable” simply because it is less stringent and therefore produces the effluent with a higher pollutant loading;
- Serbia has not (yet) adopted the EU Directive as National policy, and it is therefore necessary to verify compliance with the current National criteria.

After that, phased implementation of the WWTP with regard to required treatment efficiency can be arranged, or a similar measure which is not going to disregard the national requirements.

In reference 3.2 it was recommended to introduce nutrient removal it only for receiving water bodies of class I, i.e. in the upper catchment of the Barje reservoir which is going to be used for water supply. However, in the documentation reference 3.2 – 3.3, it was suggested that nutrients removal should be introduced as a part of the treatment at the WWTP.

Verification of compliance with the national design criteria
It is recommended to verify compliance of the proposed solution with the national design criteria. The compliance has been tested for some of the basic water quality parameters: BOD_5 and SS.

Basic input data for the verification:

- Effluent flow - 396 l/s (design maximum daily flow in accordance with assessment in this study);
- Effluent BOD_5 - 25 mg O_2/l;
- Effluent SS - 35 mg/l;
- Recipient category - II class;
- Q average low 95% - 4 m^3/s;
- BOD_5 - 4 mg O_2/l (class IIa), 6 mg O_2/l (class IIb);
- SS - 30 mg/l (class IIa), 40 mg/l (class IIb).

The analysis shall be based on the following basic formula:

$$C_{DOWN} = \frac{C_{UP} x Q_{UP} + C_{EF} x Q_{EF}}{Q_{UP} + Q_{EF}}$$ Where:

- C_{UP} (mg/l) - pollutant concentration upstream of the discharge point;
- C_{EF} (mg/l) - pollutant concentration in effluent ;
- C_{DOWN} (mg/l) - pollutant concentration downstream of the discharge point;
- Q_{UP} (l/s) - flow in the recipient upstream of the discharge point;
- Q_{EF} (l/s) - effluent flow.

The design conditions issued by the relevant Ministry specify that the receiving water body, the Southern Morava river, should retain its prescribed Class II of water quality.

Assuming that **Class IIb** is required, the proposed WWTP can satisfy the requirements provided that water quality in the receiving water body upstream of the discharge point satisfies the following:

- For BOD_5: maximum Cup = 4,1 mg O_2/l (which closely corresponds to IIa class water)
- For SS: maximum Cup= 40,5 mg/l (which corresponds to IIb class water)

In conclusion, the WWTP can ensure compliance with the Class IIb water quality provided that the water quality upstream of the discharge point corresponds to the class IIa requirements.

Assuming that **Class IIa** is required, the proposed WWTP can satisfy the requirements provided that:

- For BOD_5: maximum Cup = 1,9 mg O_2/l (which closely corresponds to Class I water);
- For SS: maximum Cup= 29,5 mg/l (which corresponds to Class IIa water).

In conclusion, the WWTP can ensure compliance with the Class IIa water quality provided that the water quality upstream of the discharge point corresponds to the class I requirements.

It can be concluded that the proposed WWTP can ensure compliance with the national design criteria, provided that specific conditions in the upstream section of the receiving water body are met. It proposed also to monitor compliance with the set national standards in the operational phase.

Future actions shall depend on whether the national standards will be harmonized with the EU directives, which are the basics for the WWTP design. In case the harmonisation does not take place in due course, and the compliance with the local standards is still not ensured, the WWTP will have to be upgraded accordingly, in order to enhance its treatment efficiency in a way that the national requirements will be fulfilled.

Practically, compliance with the criteria set in the corresponding EU directive would also provide general compliance with the set national criteria.

Furthermore, it is quite likely that the national standards are going to be harmonized with the EU directive in the near future. In conclusion, it is recommended that the following basic design criteria be applied for the design of the WWTP:

Table 3-30 Recommended effluent design criteria for the WWTP

Parameter	Concentration	Lowest removal efficiency (%)[1]
Biochemical oxygen demand (BOD_5 at 20°C) Without nitrification	25 mg/l O_2	70-90 %
Chemical oxygen demand (COD)	125 mg/l O_2	75 %
Total suspended matter	35 mg/l [(3)]	90 %[(3)]
Parameter	**Concentration**	**Lowest removal efficiency (%)[1]**
Total phosphorus	1 mg/l P (>100.000 PE)	80 %
Total nitrogen [(4)]	10 mg/l N (>100.000 PE)[(5)]	70-80 %

[(4)] Total nitrogen: sum of Kjeldahl-N (organic- N + NH_4 – N), and NO_2 –N
[(5)] Alternative, daily average value must not exceed >20 mg/l N. This requirement relates to water with temperature of 12℃ or above, during operation of the bio-reactor for waste water treatment. An alternative to temperature is the use of utilization time that considers regional climate. This alternative can be applied if it can be proven that requirement 1 of Annex ID is fulfilled.

However, because of possible financial constraints and aforementioned reasons, a phased implementation of the WWTP can be considered, with nutrient removal to be constructed in a later phase.

Hydraulic Loads of the WWTP

The following table presents typical hydraulic design loads for the WWTP adopted in the Preliminary Project Design (reference 3.3) and adjustments suggested in this report:

Table 3-31 Design hydraulic loads of the WWTP – Dry weather flow

	Adopted in the Preliminary Project Design - 2027	Recommended in this report - 2031	Recommended in this report - 2041
$Q_{average}$ (l/s)	280	285	306
$Q_{average}$ (m^3/day)	*24.192*	*24.620*	*26.440*
$Q_{max\ daily}$ (l/s)	320	368	396
$Q_{max\ daily}$ (m^3/day)	*27.648*	*31.795*	*34.200*
$Q_{peak\ hour}$ (l/s)	520	518	558

Table 3-32 Design hydraulic loads of the WWTP – Wet weather flow

	Adopted in the Preliminary Project Design	Recommended in this report – 2041
$Q_{peak\ wet\ weather}$ (l/s)	800	To be specified in a separate analysis taking into account set design criteria

Notes:
Design horizon in the Preliminary Project Design is 2027, and in this report 2041.

Typical hydraulic design loads for the WWTP adopted in the Preliminary Design and recommended here are quite consistent for average and peak values, but they differ considerably for maximum daily flows at the end of the economic life of the plant. Furthermore, it is recommended to re-confirm the peak wet-weather flow.

Pollutant Loads

In the Preliminary Project Design of the WWTP (reference 3.3) the representative pollutant load of the WWTP was related to the number of population equivalent, with a total of 100.000 PE at the end of project period, 2027.

The total pollutant loads are calculated by multiplying the assumed number of population equivalent by the typical unit (per capita) pollutant loads, as recommended by the ATV DVWK.

Table 3-33 Typical values of unit pollutant loading per PE in accordance with the ATV DVWK recommendations

Parameter	Unit	Typical value
Biochemical oxygen demand, BOD_5	g of O_2 /PE/day	60
Chemical oxygen demand, COD	g of O_2 /PE/day	120
Total suspended matter, TSS	g/PE/day	70
Total nitrogen, TN	g/PE/day	11
Total phosphorous, TP	g/PE/day	1.8

Table 3-34 Total pollutant loads of the WWTP (references 3.4, 3.5 and 3.6)

Parameter	Total pollutant loads (kg/day)	Dry-weather concentration in influent – for assumed maximum daily flow (mg/l)	Wet-weather (for peak flow) concentration in influent (mg/l) **	Required concentration in effluent – in accordance with directive 91/271/EEC(mg/l)
BOD_5	6.000	217	87	≤ **25**
COD	12.000	434	174	≤ **125**
SS	7.000	253	102	≤ **35**
Total N *	1.100	39.8	16	≤ **15**
Total P *	180	6.5	2.6	≤ **2**

* - Nitrogen and phosphorous removal were not included in the design criteria for the WWTP in the General Project Design of the WWTP, also prepared by J.Cerni. The abovementioned criteria are applicable for WWTP-s up to 100.000 PE.
** - The analysis assumes that the pollutant loads of these parameters (BOD_5, COD, SS, N, P) in storm water discharge equals zero. In reality, these discharges are very likely to contain certain level of these parameters, especially SS, which should be considered account and checked whether the plant can cope with it in a satisfactory way.

Required treatment efficiency

The following table presents the required treatment efficiency of the WWTP in accordance with the WWTP Preliminary Project Design.

Table 3-35 Required treatment efficiency (source: references: 3.4-3.6)

PARAMETAR	Required treatment efficiency (%)		
	In accordance with required concentration in effluent (dry weather)	**In accordance with required concentration in effluent (wet weather)**	**Minimum percentage of reduction (EU Directive)**
BOD_5	88,5	71,2	70 - 90
COD	77,1	28,2	75
SS	86,2	65,7	90
Total N	62,3	6,3	80
Total P	69,2	30,0	70 - 80

Based on this overview, the WWTP Preliminary Project Design recommended designing the WWTP on the basis of the required concentration in its effluent.

3.2.3.6 Description of alternative technical options

Three technical options (i.e. technological process schemes) have been evaluated for the Leskovac WWTP in the preliminary project design (reference 3.3):

A. Conventional low-loaded activated sludge and mechanical sludge treatment;
B. Sequencing Batch Reactor plant, low loaded with continuous inflow and mechanical sludge treatment;
C. Modified low-loaded activated sludge treatment type A2O with mechanical sludge treatment.

A detailed description of the three proposed options is included in annex 3.13.

The considered options are comprised of various process lines, including:

- A water line,
- A sludge line,
- An air line,
- A chemicals line,
- infrastructure.

Common to all three alternatives per process line are:

Water line:

- preliminary treatment including intake pumping station, automated fine screening, aerated grit chamber with provisions for fat removal, flow measurement device, treatment of accumulated waste materials from screens and grit chamber;
- post treatment comprised of flow measurement and UV disinfection.

Sludge line:

- aerobic sludge stabilisation, chemical sludge conditioning, sludge dewatering and storage of sludge cake;

Water line:

- Exclusive to the third alternative C is the treatment of air by means of biological filters.

Infrastructure:

- accompanying structures, including administration building, workshops, energy supply block, parking space, terrain water supply and sewerage, etc. ,

The following table gives an overview of theoretically achievable process efficiencies of the three alternatives, based on practical experiences, as described in reference 3.3.

Table 3-36 Process efficiency of considered treatment alternatives

Parameter	Explanation	Alternative "A"	Alternative "B"	Alternative "C"
		% removal	% removal	% removal
BOD_5	Biochemical oxygen demand	75-95	80-95	80-95
COD	Chemical oxygen demand	60-85	65-85	70-85
TSS	Total suspended matter	85-95	80-95	85-95
TN	Total nitrogen	≤ 90	≤ 92	≤ 92
TP	Total phosphorus *	≤ 30	≤ 35	≤ 35

* - inconsistent with the treatment efficiency set earlier

3.2.3.7 Preliminary investment and O&M costs

The following table (taken from reference 3.3) gives an overview of indicative investment and operational costs per alternative, for a WWTP of 100.000 PE capacity.

In all of the considered technical alternatives the primary treatment is similar, and includes the following elements:

- coarse screens;
- raw water pumping station;
- automatic fine screens;
- aerated grit chambers;
- grit removal equipment.

Table 3-37 Indicative investment and O&M costs of the WWTP per alternative.

Type of costs	Alternative „A“ (EURO)	Alternative „B“ (EURO)	Alternative „C“ (EURO)
Construction works	4.724.000	4.477.000	4.293.000
Equipment	5.076.000	4.840.000	4.872.000
Total:	9.800.000	9.317.000	9.165.000
Ratio to the lowest investment cost	1,069	1,017	1,000
Operational costs (€/m^3)	0.244	0.225	0.228
Ratio to the lowest operational costs	1,084	1,000	1,013

In accordance with the table 3-37, the lowest investment costs are for alternative C (AZENIT P® process), followed by alternative B (SBR) and alternative A (conventional). The operational costs are comparable and lowest for alternative B, followed by alternatives C and A.

The presented investment costs overview is not fully and clearly substantiated. A quick scan of the investment costs of Alternative A showed that the stated costs are within realistic boundaries. A quick scan of the investment costs of Alternative B, however, led to the conclusion that the real SBR investments are lower than budgeted in the project documentation.

A more suitable approach would be to split and present separately the costs of the water treatment line and the sludge treatment line. Namely, the background and resulting cost implications from adopting the specific sludge treatment approach for alternative A and B, including two stage polymer dosing and centrifuging with an intermediary additional thickening stage versus the relatively simple gravity filter belt thickening and filter belt press approach adopted for Alternative C are not fully substantiated. A fair costs comparison would be based on a similar technology, unless sludge quality differences do not allow for such an approach.

A comparison of the proposed technical alternatives should normally include an overview of major operational costs (energy, chemicals, labour, etc.), which would enable fair and impartial analysis.

The more complex the treatment the higher its related costs will be. It can be concluded that both, investment and operational costs, are in the same order of magnitude, making unanimous final choice of technology impossible. Under such circumstances it is recommendable to make a comprehensive assessment of all benefits and drawbacks of the three options. A multi criteria analysis with relevant analysis criteria and assigned weights per criterion for each option may offer an objective approach to choosing the most appropriate alternative.

However, during the course of preparation of the WWTP preliminary project design, the preferred alternative C was elaborated in more detail, including detailed calculations, drawings and the corresponding BoQ. As a result, the bill of quantities with cost estimate has been produced including a detailed breakdown of construction works, process and mechanical and electrical equipment. The cost estimate based on the preliminary project design can be summarized as follows:

- Construction works - 7.225.000 €
- Process and mechanical equipment - 4.143.000 €
- Electrical equipment - 543.000 €
- **Total investment (with VAT) - 11.911.000 €**
- **Total investment (without VAT) - 9.767.000 €**

This is not consistent with the earlier mentioned cost estimate. Based on the experience in implementation of a number of wastewater treatment facilities, it is here recommended to supplement the abovementioned cost estimate with the following elements:

- Provision for site investigation works and preparation of a detailed project design, as-built technical documentation, remaining permits, which are all compulsory in accordance with the relevant national regulations (Law on planning and construction);
- Given the fact that the existing technical design has been prepared in a form of a preliminary project design, which still requires some detailing in the next, more detail stage – detail project design, it was deemed necessary to introduce reasonable provision for contingencies both for works and equipment of 5% of the calculated costs;
- Also, the costs for the wastewater treatment facility construction include corresponding construction supervision and preferably a provision for the trial run, staff training, and operation over 12-moth period after construction.

The supplemented cost estimate, based on the technical alternative recommended in the preliminary project design is presented in the following table:

Table 3-38 Supplemented budget - modified low-loaded activated sludge treatment type A_2O with mechanical sludge treatment (WWTP of 100.000 PE capacity)

1 Investigation works and design				
	Description	**Unit**	**Quantity**	**Cost(€)**
1.1	Site investigation works, detail design, as-bulit documentation	lump sum	1	480.000
1	**Investigation works & design - Sub-total**			**480.000**
2 Construction works				
	Description	**Unit**	**Quantity**	**Cost(€)**
2.1	Preparatory works and roads	lump sum	1	1.752.097
2.2	Pre-treatment	lump sum	1	522.510
2.3	Biological basins	lump sum	2	1.324.156
2.4	Degassing	lump sum	1	103.754
2.5	Final clarifiers	lump sum	2	984.800
2.6	Sludge treatment and storage	lump sum	1	522.550
2.7	Odor control	lump sum	1	210.675
2.8	Air blowers building	lump sum	2	185.763
2.9	Energy block	lump sum	1	81.763
2.10	Service block	lump sum	1	102.063
2.11	Administration building	lump sum	1	269.313
2.12	Flowmeters	lump sum	1	51.713
2.13	Guard house	lump sum	1	14.850
	Construction works & design - Sub-total without contingencies			**6.126.004**
2.27	Contingencies-works (5%)	lump sum		322.421
2	**Construction works & design - Sub-total with contingencies**			**6.448.425**

3 Process & mechanical equipment				
	Description	**Unit**	**Quantity**	**Cost(€)**
3.1	Inlet structure	lump sum	1	23.000
3.2	Pre-treatment	lump sum	1	518.000
3.3	Grit removal chamber equipment	lump sum	1	174.000
3.4	Biological basins	lump sum	1	523.000
3.5	Air blowers	lump sum	1	156.000
3.6	Degassing	lump sum	1	23.000
3.7	Final clarifiers-equipment	lump sum	1	142.000
3.8	Sludge recirculation, surplus sludge	lump sum	1	336.000
3.9	Sludge treatment	lump sum	1	816.000
3.10	Storing and dosing of lime	lump sum	1	74.000
3.11	Preparation and dosing of polyelectrolyte	lump sum	1	70.000
3.12	Preparation and dosing of feri-cholride	lump sum	1	31.000
3.13	Odour control equipment	lump sum	1	16.000
3.14	Laboratory equipment	lump sum	1	45.000
3.15	Pipes and fittings, valving	lump sum	1	450.000
	Process & mechanical equipment - total without contingencies			**3.397.000**
	Contingencies - process and mechanical equipment (5%)	lump sum		178.789
3	**Process & mechanical equipment - total with contingencies**			**3.575.789**
4 Electrical equipment				
	Description	**Unit**	**Quantity**	**Cost(€)**
4.1	Transformer station 10/0,4 kV, 2x1000kVA	lump sum	1	94.900
4.2	High-voltage underground cable	lump sum	1	46.000
4.3	Cables 10 kV	lump sum	1	3.275
4.4	TT cables	lump sum	1	738
4.5	Electrical installations in the CWWTP	lump sum	1	155.850
4.6	Electrical installations (general)	lump sum	1	80.150
4.7	Stand-by diesel engine	lump sum	1	34.000
4.8	External lightening	lump sum	1	26.950
	Electrical equipment - total without contingencies			**441.863**
	Contingencies - electrical equipment (5%)	lump sum		23.256
4	**Electrical equipment - total witht contingencies**			**465.118**
	Total investment - without VAT			**10.969.333**
	5 Trial run, staff training, operation over 12-moth period, construction supervision			
	Description	**Unit**	**Quantity**	**Cost(€)**
5.1	**Trial run, staff training, operation over 12 moths**	lump sum	1	**350.000**
5.2	**Construction suprevision (8%)**	lump sum	1	**839.147**
5	**Trial run, staff training, operation over 12-moth period, construction supervision**			**1.189.147**
	WWTP - Sub-total without VAT			**12.158.480**
	VAT (18 %)			**2.188.526**
	WWTP - Sub-total with VAT			**14.347.006**

Table 3-39 WWTP Leskovac - Investment costs summary for recommended alternative

WWTP Leskovac type $A_2$0 - Investment cost summary		
No	**Description**	**Total cost (€)**
1	**Investigation works & design**	**480.000**
2	**Construction works**	**6.448.425**
3	**Process and mechanical equipment**	**3.575.789**
4	**Electrical equipmant**	**465.118**
5	**Construction supervision and trial run, staff training, operation over 12-moth period**	**1.189.147**
	Total	**12.158.480**
	Gross total - without VAT	**12.158.480**
	VAT (18%)	**2.188.526**
	Gross total - with VAT	**14.347.006**

The abovementioned cost estimate applies for the WWTP Leskovac sized to handle the following basic hydraulic and pollutant loads:

Table 3-40 Summary of hydraulic loads adopted in the preliminary project design

	Hydraulic loads adopted in the Preliminary Project Design
$Q_{average}$ (l/s)	280
$Q_{average}$ (m^3/day)	*24.192*
$Q_{max\ daily}$ (l/s)	320
$Q_{max\ daily}$ (m^3/day)	*27.648*
$Q_{peak\ hour}$ (l/s)	520
$Q_{peak\ wet\ weather}$ (l/s)	800

Table 3-41 Summary of pollutant loads adopted in the preliminary project design

Parameter	**Total pollutant loads adopted in the Preliminary Project Design (100.000 PE)**
BOD_5 (kg O_2/day)	6.000
COD (kg O_2/day)	12.000
SS (kg/day)	7.000

However, based on the demand analysis in this study it is recommended to apply the scenario that includes a provision for moderate demographic and industrial growth, and to use the following figures as the design parameters for the WWTP.

Table 3-42 Summary of recommended adjustments of hydraulic loads for the WWTP

	Recommended adjusted hydraulic loads for sizing of the WWTP
$Q_{average}$ (l/s)	306
$Q_{average}$ (m^3/day)	*26.440*
$Q_{max\ daily}$ (l/s)	396
$Q_{max\ daily}$ (m^3/day)	*34.200*
$Q_{peak\ hour}$ (l/s)	558
$Q_{peak\ wet\ weather}$ (l/s)	To be studied and confirmed

The calculated adjusted value of the pollutant loading expressed in population equivalent is some 129.000 PE, and if the same methodology is applied, based on the

unit pollutant loads per single population equivalent, than the following total pollutant loads would be representative for the WWTP planning:

Table 3-43 Summary of recommended adjustments of pollutant loads of the WWTP

Parameter	Total pollutant loads (129.000 PE)
BOD_5 (kg O_2/day)	7.740
COD (kg O_2/day)	15.480
SS (kg/day)	9.030

Consequently, the investment costs for the WWTP construction had to be adjusted, as shown in the following table:

Table 3-44 Adjusted investment costs for WWTP A_20 type, 129.000 PE

WWTP Leskovac type A_20 - Investment cost summary for 129.000 PE		
No	**Description**	**Total cost (€)**
1	**Investigation works & design**	**500.000**
2	**Construction works**	**7.930.311**
3	**Process and mechanical equipment**	**4.457.895**
4	**Electrical equipmant**	**574.306**
5	**Construction supervision and trial run, staff training, operation over 12-moth period**	**1.387.001**
	Total	**14.849.513**
	Gross total - without VAT	**14.849.513**
	VAT (18%)	**2.672.912**
	Gross total - with VAT	**17.522.425**

It is considered that the abovementioned comparative analysis of the proposed technical alternative is not sufficiently substantiated to draw final conclusions regarding the selection of the optimum alternative. Therefore, the Consultant considered it appropriate to supplement the alternatives selection by a generic cost estimate for a conventional low-loaded activated sludge WWTP of similar characteristics as the WWTP Leskovac.

An overview of the investment costs for the conventional low-loaded activated sludge WWTP is shown in the table 3-45. This overview shows that the investment costs for the conventional low-loaded activated sludge wastewater treatment plant can be competitive, or even lower than the proposed WWTP concept, alternative C.

However, it was considered necessary to introduce certain modifications and improvements into the proposed conventional low-loaded activated sludge WWTP concept:

1. The sludge line is supplemented by a two-stage anaerobic digestion of thickened sludge which enables utilization of generated bio-gas for power generation (for internal supply) and heat production (heating of digesting units);
2. Additional process units should ensure the required level of nutrient removal. It should be noted that the criteria adopted apply for WWTP-s of more than 100.000 PE; i.e. total P < 1 mg/l and total N < 10 mg/l.

The proposed modified sludge and bio-gas line, as well as the nutrient removal can be described as follows:

The sludge line is comprised of:
- thickening of primary sludge from the primary sedimentation and activated sludge from the activated sludge process;
- two stage anaerobic sludge digestion of thickened sludge;
- thickening of fermented sludge;
- dewatering of thickened sludge by means of a filter belt press;
- sludge disposal to solid waste disposal site;
- recycle of filter belt press water back to process.

The air line is comprised of low pressure air supply necessary for the operation of:
- the aerated sand and grit removal unit;
- the operation of the pumps in the aerated sand and grit removal unit;
- the first stage aeration basin for provision of oxygen and mixing of biomass.

The bio gas line includes the following:
- transport and storage of bio gas from the anaerobic digestion units;
- gas motors serving for utilization of bio gas for electricity (internal supply) and heat generation (heating of digesting units).

The chemicals line includes the following:
- storage, preparation and dosing equipment for polyelectrolyte for sludge conditioning prior to the filter belt press.

In accordance with the adopted design criteria, it is necessary to provide nutrient removal as follows:
- Total N < 1 mg/l, minimum removal efficiency 83%;
- Total P < 10 mg/l, minimum removal efficiency 75%.

Construction works related to this phase of the WWTP construction include the following:
- Basins for de-nitrification of approximately 4.400 m^3 capacity;
- Modification of the existing and installation of additional piping and canals in the water line;
- Building for preparation and dozing of ferry-chloride ($FeCl_3$).

The cost for execution of these works has been estimated at 590.000 €.

Necessary equipment includes the following:
- Submerged mixer in the de-nitrification basin;
- Recirculation pumps aeration basin => de-nitrification basin;
- Recirculation pipelines and accessories;
- Equipment for storing, preparation and dosing of $FeCl_3$;
- Modification of pumping stations for sludge recirculation and surplus sludge;
- New pipe works, fittings and valves;
- Control and instrumentation equipment;
- Additional power supply equipment;
- Installation, testing, trial run, commissioning.

Additional operational costs as a consequence of this plant extension include the following:

- Power consumption of the mixer in the de-nitrification basin;
- Additional power consumption related to operation of the recirculation of water and sludge from the aeration basin in the de-nitrification basin;
- Preparation and dozing of $FeCl_3$.

The total installed electrical power of the additional equipment (taking into account operational pumps only, without stand-by pumps) is more than 100 kW.

Additional power consumption is estimated at around 600.000 kWh annually. A reduction of power generation from bio-gas can be expected, as well. Anticipated annual consumption of $FeCl_3$ is 350 t/year (in a form of 41% solution).

Table 3-45 Conventional low-loaded WWTP for 129.000 PE – preliminary assessment of investment costs

WWTP Leskovac - conventional low-loaded activated sludge - Preliminary investment costs - Phase I				
No	**Description**			**Total cost (€)**
1	**Investigation works & design**			**490.000**
2	**Construction works**			**5.567.669**
3	**Electro-mechanical equipment**			**6.149.895**
4	**Construction supervision**			**937.405**
5	**Trial run, staff training, operation over 12-moth period**			**300.000**
	Total			**13.444.969**
	Gross total Phase I- without VAT			**13.444.969**
	VAT (18%)			**2.420.094**
	Gross total Phase I - with VAT			**15.865.064**
	WWTP Leskovac - Phase II - tertiary treatment (nutrient removal) - to be constructed 2021			
	Description	**Unit**	**Quantity**	**Cost(€)**
6.1	Construction works: basin for de-nitrification, pipelines, building for dosing of FeCl3	lump sum	1	600.000
6.2	Equipment: Mixers in denitrification basin, pumps for recirculation MLSS, recirculation piping, equipment for storing, preparation dosing FeCl3, modification of PS for sludge recirculation and surplus sludge, process and instrumentation equipment, additional power supply equipment, installation of the above	lump sum	1	980.000
6	**Tertiary treatment - Sub-total without contingencies**			**1.580.000**
	Contingencies - 5%			**79.000**
6.3	Trial run, staff training, operation for 6 moths	lump sum	1	120.000
6.4	Construction supervision (8%)	lump sum	1	126.400
	Total			**1.905.400**
	Gross total Phase II- without VAT			**1.905.400**
	VAT (18%)			**342.972**
	Gross total Phase II - with VAT			**2.248.372**
	Gross total Phases I & II- without VAT			**15.350.369**
	VAT (18%)			**2.763.066**
	Gross total Phases I & II - with VAT			**18.113.436**

The adjusted operational costs for the A_2O-type WWTP (recommended for further implementation in the preliminary project design) and for the modified conventional low-loaded activated WWTP are shown in the following table:

Table 3-46 Operational costs for alternative proposals of the WWTP

PHASE I						
	WWTP A_2O type			Conventional WWTP		
	Quantity	Unit cost (€)	Total cost (€)	Quantity	Unit cost (€)	Total cost (€)
Labour	9	9.000	81.000	9	9000	81.000
El. Energy	4.500.000	0,06	270.000	3.400.000	0,06	204.000
Energy recovery	-	-	-	1.400.000	0,06	-84.000
Chemicals - PE	7.788	7	54.513	14.800	7	103.600
Chemicals - $FeCl_3$	141.750	0,20	28.350	-	-	-
Chemicals - CaO	415.000	0,085	35.275	-	-	-
Transport and disposal of sludge and sand	11.250	15	168.750	11.200	15	168.000
Maintenance-structures (0,5% annually)			39.652			27.838
Maintenance-equipment (3% annually)			150.966			184.497
TOTAL			**828.505**			**684.935**
PHASES I & II						
	WWTP A_2O type			Conventional WWTP		
	Quantity	Unit cost (€)	Total cost (€)	Quantity	Unit cost (€)	Total cost (€)
Labour	9	9.000	81.000	9	9.000	81.000
El. Energy	4.500.000	0,06	270.000	4.000.000	0,06	240.000
Energy recovery	-	-	-	1.400.000	0,06	-84.000
Chemicals - PE	7.788	7	54.513	14.800	7	103.600
Chemicals - $FeCl_3$	141.750	0,2	28.350	350.000	0,2	70.000
Chemicals - CaO	415.000	0,085	35.275	-	-	-
Transport and disposal of sludge and sand	11.250	15	168.750	11.200	15	168.000
Maintenance-structures (0,5% annually)			39.652			27.838
Maintenance-equipment (3% annually)			150.966			184.497
TOTAL			**828.505**			**790.935**

3.2.3.8 Justification of the preferred option

The benefits and drawbacks of all alternatives have been summed up and compared in the reference 3.3.

Included here is a summary of the pros and cons of the three alternatives described in annex 3.13.

The stated benefit of lowest investments of alternative 3 is not fully substantiated. Furthermore, the cost estimates presented in the WWTP Preliminary Project Design are quite inconsistent (with VAT approximately 30% higher). This implies that the abovementioned cost comparison is not representative and conclusive enough.

Summary of the cost estimate based on the detailed BoQ of the design is as follows:

- Construction works - 7.225.000 €
- Process and mechanical equipment - 4.143.000 €
- Electrical equipment - 543.000 €
- Total investment (with VAT) - 11.911.000 €
- Total investment (without VAT) - 9.767.000 €

The stated benefit of lowest required footprint for the plant is not of relevance. The area necessary for the SBR is presumably similar, if not lower than the area required for this process. Moreover, land acquisition and costs are of lower priority under local circumstances.

The benefit of low labour requirements is also problematic. No comparison is made with the other alternatives. A quick scan of labour requirements shows that Alternative A and B require more or less the same number of employees, thus contradicting this statement.

An important drawback of this technology is the very limited number of similar units built in the last 10 years. This limits the flexibility of the PUC and increases their dependency on knowledge of the provider of the technology.

An additional drawback related to the previous remarks is the complex operational management of the process. Namely, achievement of required water quality requires continuous and flawless functioning of process measurement and regulation equipment. A small failure or omission in maintenance of such measuring and regulation equipment (e.g. O_2 measuring electrodes) can have a significant negative effect on the effluent water quality. As in all similar Orbal-like processes, the recirculation of sludge cannot be regulated/fine tuned, thus the process is less flexible than the conventional processes. Namely, process regulation is largely dependant on the speed of the rotor propellers.

It is furthermore not fully clear which amount of P would be removed by the dosing of $FeCl_3$. As a result, it is not clear how much chemical sludge will be produced. The stated sludge quantities in the project documentation are not substantiated.

Finally, a quick scan costs analysis contradicts the stated benefit of the lowest investments.

However, in the preliminary design report, based on the stated benefits and drawbacks of analysed alternatives, as well as because of

- The total costs;
- The operational costs;
- The possibility of phased plant construction;
- The treatment efficiency in compliance with discharge standards;
- The reliability of operation,

alternative C, the modified low loaded activated sludge treatment type A2O with aerobic and mechanical sludge treatment has been recommended for further implementation and more detailed elaboration.

The Institute “Jaroslav Cerni” further prepared a preliminary design for the WWTP based on Alternative C. The preliminary design includes rather detailed unit dimensioning, process schemes (PFD and P&IDs), construction drawings of process units, equipment specifications and a detailed costs overview.

3.2.3.9 Assessment of the design

Process technology

The considered technical solutions for achieving the required removal efficiency in compliance with the adopted local and EU regulation includes a wide range of technologies from conventional (low loaded activated sludge with preliminary denitrification and presumably $FeCl_3$ phosphorus removal), patented SBR technology (ICEAS®) with continuous intake), to patented AZENIT P® technology including nutrients (N and P) removal in one unit. The process schemes are technically sustainable and include necessary pre-treatment and post treatment, thus in line with the pursued compliance with adopted effluent quality norms and requirements. Both, water and sludge processing are considered, minimizing the impact on the environment in line with local and EU regulations.

The considered design parameters for the separate process units (primary and secondary water treatment and sludge treatment) for the first two alternatives (conventional and SBR) are not specified. For instance, it is not clear whether and to which extent the conventional activated sludge alternative incorporates nutrients removal. It is also not clear whether removal of peaks of phosphorus concentration have been considered in the SBR alternative. Under such circumstances it is also very difficult to judge the reliability of the presented cost calculation figures for the two alternatives. If the necessary measures have been considered (i.e. preliminary denitrification for Alternative A and dosing of $FeCl_3$ for peak phosphorus removal in Alternative A and B) it can be presumed that these alternatives can achieve the required water quality.

The preliminary design of the patented A_2O (AZENIT P®) technology is hard to evaluate since it relies on a patented technology where specific design values and their background are not always and fully disclosed. This is even more pronounced considering nutrients removal takes place in one compact unit. However, a quick scan of adopted loadings, sludge concentrations, residence times and other design values suggests that the values are in line with minimum to maximum ranges applicable for the targeted BOD, COD and nutrients removal in separate units. In the absence of data and experience from practical applications it is hard to draw final conclusions.

The presented costs overviews are not fully substantiated and impartial. A fair approach would split the cost assessments of the water and the sludge line, and would eventually consider comparable sludge treatment technology (if possible). Detailed construction cost analysis of the proposed (AZENIT P®) technology resulted in significantly higher costs than originally specified in the feasibility part of the documentation where the three alternatives were compared. The investment and operational costs overview suggests close competition of all three alternatives.

Under such circumstances other factors play a decisive role when choosing the most appropriate treatment technology, such as (not necessarily in descending order of importance):

- Possibility of phasing technology (e.g. nutrients removal in a second phase) and related investments;
- Robustness of technology (ability to efficiently cope with quantity and quality fluctuation);

- Reliability and flexibility of operation under fluctuating operational circumstances (e.g. variation of electricity voltage in the network);
- Local familiarity with the specific technology;
- Complexity of the installation and related operation and maintenance;
- Labour requirements;
- Environmental emissions (water, odour, aerosols, sludge, chemicals, noise);
- Footprint requirements (lesser importance if land available), etc.

These factors have been rightfully evaluated in the overall assessment and choice of process technology. However, the evaluation is not finalised with a final ranking of the technologies, leaving space for free interpretation of the assessment and other choices, possibly influenced by local and/or client priorities.

To summarise, the unreliable and incomplete cost overview, accompanied with the relatively subjective assessment of additional factors do not substantiate the definitive choice of patented A2O (AZENIT P®) technology for the WWTP of Leskovac. The investment and operational costs of both, alternative A (conventional treatment|) and B (SBR treatment) are close to that of the (AZENIT P®) technology. The choice of sludge treatment technology is not fully substantiated and may result in higher than necessary costs for the Alternative A and B compared to Alternative C. A detailed cost analysis shows that the (AZENIT P®) technology is possibly more expensive than the other two considered technologies. Moreover, the technology benefit/drawback analysis does not offer concrete proof of its supremacy relative to alternatives A and B.
An appropriate way of choosing the optimal technology should include:

- more detailed and accurate investment and O&M costs assessment and comparison;
- multi-criteria analysis of the various assessment criteria with a clear (as much as possible) objective assignment of weights and marks per technology.

In conclusion, the choice of proposed technology for the WWTP of Leskovac is not sufficiently substantiated. Additional steps are required to come up with the optimal technology choice.

Conclusions and recommendations

Considering the fact that the existing documentation does not substantiate the choice of the proposed patented A_2O (AZENIT P®) a number of options arise regarding project planning. These depend on the client interests and choices. Financing of a patented technology by the EAR without full, undoubted proof of its superiority relative to other alternatives is considered impossible and not recommended. Two possibilities/scenarios with specific time and planning implications arise:

1. The client (PUC Leskovac) accepts the results of this feasibility study and reconsiders a more detailed assessment, choice and application of optimal, preferably patent-free technology. At this stage**, a conventional low-loaded activated sludge wastewater treatment plant is recommended as the preferred technical alternative in this study.** The main advantages of this alternative are that it is patent-free, it has got proven track-record of satisfactory operation of similar facilities throughout Serbia, and the costs are comparable, if not lower compared to other technical alternatives. If agreed upon, the additional assessment resulting in updated preliminary design and a well substantiated technology choice could be accomplished within 3-4 months. From that point there are two possible ways forward:

a. To engage in preparation of a corresponding detail project design, provide all necessary permits, and proceed with tendering of the WWTP in accordance with the Red FIDIC Book.
b. After finalization, review and approval of the preliminary project design, the client (PUC Leskovac) proceeds with tendering of the plant without further detailing of the project design. The WWTP could be tendered according to open tender rules (Yellow FIDIC Book) implying that bidders may offer alternative technical solutions in line with tender instructions and requirements. The final choice of technology would depend on achieved scores for various tender criteria. **This approach is recommended for implementation in this study.**
    i. ***Economizing solutions*** To allow the market to have an impact on the most economic solution of the wastewater treatment plant a Design-Build contract form, such as the FIDIC Yellow Book, is preferred as it places the responsibility for both the design and the construction on the Contractor. Instead of imposing detailed solutions on Contractors the choice is made to allow contractors flexibility in choosing the most economic solution to achieve the project objectives. Therefore, the Tender Documents would be prepared with a limited number of boundary conditions, to be set in consultation with the final beneficiary, the PUC Vodovod and municipality of Leskovac. Limiting the responsibility of the Contractor to construction only, such as with the use of the FIDIC Red Book or the PRAG standard Works contract, would have meant limiting the process design choice and therefore losing the advantage of flexibility by the contractor which would possibly increase the price.
    ii. ***Construction and delivery time*** With Design-Build contracts time can be saved by allowing the Contractor to commence with his preparatory works prior to completion of the design and the receipt of construction permits
    iii. ***Possibility of lowering costs*** Due to the flexibility afforded the contractor in the final design configuration he is able to offer cost savings based on alternate methods and designs and this is often reflected in time savings due to the application of his own approach, within the basic parameters as set by the Employer, with which he is more familiar than an imposed methodology. These possibilities are less available in the traditional construction (Red Book) type contract. In this case, however, the flexibility with respect to the process design choice was somewhat curtailed by the inclusion in the tender documents of relatively detailed Employer's Requirements with a view to narrowing the variety of solutions to facilitate evaluation. This, in our opinion, will assist in reducing the time required by the Contractor for preparation of the Final or Main design. This approach was designed to reduce time and therefore cost.
    iv. **Risk allocation** When considering risk allocation it is necessary to ascertain which party is best able to manage and control the apportioned risk. Risk allocation will vary according to the type of project and the location. The following factors were considered in this case:
        - Regulatory compliance risks related to environmental and permitting issues
        - Construction phase risks related to differing site conditions, weather conditions, access to site and continuing operational issues

- Post-construction risks related to the meeting of performance standards.

2 The client (PUC Leskovac) does not accept the results of this feasibility study and proceeds with implementation/tendering of the WWTP based on the patented A_2O (AZENIT P®) technology independently from this project. This would imply excluding the WWTP from the current EAR project and tendering the other project components according to the EAR rules.

Care should be taken regarding planning of the WWTP under the different scenarios relative to other project components. In this light it is recommended to include clear milestones in the project planning/phasing. The achievement of such milestones should be the prerequisite for further interrelated investments and construction activities. Such an approach will ultimately result in optimization of investment and O&M costs.

Water Supply of Northern Villages

3.2.3.10 General Overview of the Project

Status of the existing water supply
Water supply of the northern parts of the Leskovac municipality has been a permanent and disturbing issue for a long time. The villages in this zone do not have access to safe, potable water from the public water supply network, and mostly rely on their own local water sources – dominantly individual water wells serving a household, or a small group of households. In most cases these systems are inadequate in terms of water availability, sanitary protection, and hydraulic capacities and most importantly with regard to water quality both chemically and bacteriologically. The region under study has been exposed for a long period of time to water-related diseases, and in particular to the Balkan Endemic Nephropathy – BEN (for more information see Annexes 3-1 and 3-2), which is believed to be caused solely by the use of inadequate groundwater for water supply.

The following settlements are being considered in the study: Živkovo, Brejanovce, R. Čifluk, Pečenjevac, Čekmin, Lipovica, Brestovac, Kutleš, Šarlince, Draškovac, Međa and D. Brijanje. The total number of consumers is estimated to around 12.000 at present, and shall remain stable until the final target year.

In order to improve overall sanitary and health conditions in the North of the municipality, preliminary designs of local/secondary water distribution networks in the villages have been prepared. Also there is a design of the main transport main from Leskovac to D. Brijanje. Generally, the water supply system for the northern villages will be an extension of the central water supply system of Leskovac. At the moment Leskovac and surrounding settlements are supplied from the well-fields, i.e. groundwater sources located near Leskovac, as shown on the general layout map. However, the regional water supply system Barje, relying on the Barje reservoir constructed on the Vetrenica River is being finalized and expected to be operational towards the end of 2009. The nominal design capacity of the Barje system, including the treatment facilities in Gorina village, is 840 l/s. This regional scheme shall become the primary potable water source for Leskovac, while groundwater sources shall be sanitary protected, used to a minor extent, and kept operational as a stand-by source capacity.

Input data
Necessary input data for this technical analysis have been collected from the PUC Vodovod – Leskovac, and include the following:

- Digital, geo-referenced, rectified topographic maps of the project area of scale 1: 25.000;
- Current status of water supply in the project area;
- Technical proposals of the extension of the existing Leskovac water supply system that should include the abovementioned villages;
- Technical documentation regarding the as-built status of the water supply system in Leskovac and the available Water Supply Master Plan;
- Assumed boundary conditions for the hydraulic analysis, and basic results of the existing hydraulic analysis;
- Master Plan of the water distribution system in Leskovac, Energoprojekt, Belgrade, 1989.

3.2.3.11 Proposed Concept of Planned Water Supply System Extension

This section outlines the proposal of the water supply system extension, as presented in the technical project design prepared by the PUC Vodovod – Leskovac.

Main water supply system components
The main role of the planned extension of the primary water supply system is to convey potable water from the town's central water supply network to the abovementioned villages in the north.

The essential prerequisite for planning and implementing of the system extension is finalization of the ongoing works on the regional water supply scheme Barje.

The ongoing works that should enable the system to become operational include:

- Construction of the WTP Gorina;
- Finalization of the treated water pipeline from the WTP Gorina to Leskovac;
- Construction of the water storage tank Rudarska kosa next to Leskovac;
- Installation of the main distribution pipeline DN1.000/DN700 from the tank Rudarska kosa to Leskovac town.

The planned connection to the Barje system will be at the terminal point of a DN700 trunk pipeline (node LE 2 or 27*7 in earlier reports), near the railway station. From this point, treated water is transported to each village via the trunk mains and two service tanks located in Pečenjevce and Kutleš, as shown on the system layout map. The main properties of the trunk mains are shown in the table below:

Table 3-47 Extension of the water supply system – transmission mains

Section	DN (mm)	L (m)	Connected villages
LE-2 – LE-3	DN500	3.851	
LE-3 – R Pecenjevce	DN300	10.960	Živkovo, Brejanovce, R. Čifluk
R Pecenjevce – LE-11 (Brestovac)	DN300	8.797	Pečenjevce, Čekmin, Lipovica, Brestovac
LE-11 – R Kutles	DN200	2.215	
R Kutles – LE-14 (Medja)	DN200	4.303	Kutleš, Šarlince, Draškovac, Međa
LE-14 (Medja) – LE-15 (D. Brijanje)	DN200	2.824	D. Brijanje

Consumers in Leskovac shall receive water from the service water tank Rudarska kosa located in the southern part of the town about 22 km from the Barje dam. Just upstream of Leskovac a water tank has been designed with the final storage capacity of 25.000 m^3 (at the moment the storage of 12.500 m^3 is being constructed), with the top water level at 287 m.a.s.l. and the minimum water level at 282 m.a.s.l. It shall feed the primary and secondary water distribution network in Leskovac and shall also deliver water to nearby villages.

As the length of the transport mains is significant due to distance of the villages from the urban area of Leskovac, the villages cannot be supplied directly from the Rudarska kosa tank, but have to be supplied from the local service/distribution tanks located near the centres of consumption. The role of the tanks is to balance the inflow from the Barje system and consumption in the villages, as well as to provide normal and stable service pressures. In brief, the transmission pipelines themselves would not be sufficient for ensuring stable and favourable service pressures, but the system must include the storage tanks.

Table 3-48 The following table shows design data for the proposed service water tanks

Water tank name	Volume (m^3)	Top water level (m.a.s.l.)	Minimum water lever (m.a.s.l.)
WT Pecenjevce	1.000	261.00	257.00
WT Kutles	500	250.00	246.00

It is obvious from the above data that the water supply system has been designed to transport water by gravity, so there is no need for pumping facilities and eventually power consumption.

3.2.3.12 Review of the existing design

As mentioned earlier, there is a technical project design for the main transport pipeline and distribution networks in villages. It includes the hydraulic calculation results; BoQ's and cost estimate, layout drawings, details of nodes, and list of pipe fittings and valves. There are no longitudinal profiles of the pipelines and civil drawings of structures on the pipelines are not included either. The technical documentation covers most of technical aspects required for the preliminary design level.

It is very important to note that the strategic planning documents in the area of water supply in Leskovac date back to the late 1980-ies or early 1990-ies. Since then the overall social, urban, economic, industrial environments have changed substantially. Therefore, it would be highly recommendable to arrange a preparation of a new Water Supply Master Plan for the municipality, as the reference document for planning of all partial system developments.

The water supply extension has been conceptualised as follows:
Transport water mains DN300 and DN200 deliver clean water from the Leskovac water supply network to consumers and two service tanks in Pečenjevce and Kutleš. The water tanks are located close to these villages with the top water levels of 257m.a.s.l. for WT Pecenjevce and 253 m.a.s.l. for WT Kutleš. The tanks are connected to the distribution network via a single inlet/outlet pipe, which represents a constraint for operation and control of the tanks. Results of the hydraulic calculation show that the water storage tank in Kutleš empties during the maximum day simulation. On the other

hand, the water tank Pečenjevce is almost always full or overflowing, meaning it has got an inadequate elevation for the given hydraulic boundary conditions. Effectively, it acts as a break-pressure tank reducing the head in the transmission main unnecessarily.

As inlets/outlets of the abovementioned tanks have been designed as single pipes. It means that this subsystem is hydraulically directly connected to the central water supply system of Leskovac and regular control and balanced operation of the tanks is very difficult to achieve.

As a result, given the tank elevations do not provide enough head difference required for transport of required flow, and the WT Kutleš empties, and does not work in a balanced manner. The WT Pečenjevce does not use its volume for balancing inflow and outflow (as it is always full), but only represents a break pressure tank in the system.

With regards to the local/secondary networks, the existing design conforms to technical standards necessary for provision of potable water to all consumers in each village. Pipes used are mainly HDPE, and pipe diameters range from DN63 to DN225. Hydrants are designed at junctions and ends of each line allowing for air evacuation during pipeline testing and commissioning. Detailed verification of the water distribution networks sizing should be conducted in a corresponding detailed design.

The current technical proposal does not define the system for control and regulation of the sub-system operation. This is very important and sensitive issue, because of the following reasons:

- The sub-system concerned is directly linked to the city distribution network. Uncontrolled, water consumption in the sub-system may affect normal hydraulic conditions in the city network;
- The area of interest is rural, dominantly agricultural. If the inflow in the sub-system is not controlled, there is a risk that the central system may be exposed to excessive water consumption for purposes other than normal household consumption;
- This sub-system must be integrated in the overall monitoring, control and regulation of the operation of the complete Leskovac public water supply system.

To summarize, the following main deficiencies of the existing technical proposal have been identified:

- Absence of an updated Water Supply Master Plan for the municipality which would represent the basis for planning of the system development;
- Lack of or inadequate monitoring, control and regulation of the system;
- Absence of identified zones (sub-zones) in the project area that can serve for zonal demand monitoring and control;
- The issue of residual chlorine concentration has not been tackled. The analysis of the residual chlorine concentration has to be conducted, and if it proves to be necessary, additional chlorination station(s) should be introduced in order to provide residual chlorine concentration in accordance with the relevant national standard for potable water;
- Unbalanced operation of the water storage tanks for given boundary conditions;
- Detail verification of the distribution network sizing to be conducted in a corresponding detail design.

3.2.3.13 Proposed improvements of the design

This section elaborates on the improvements of the proposed technical design.

- It is necessary to introduce a range of measurements and control and regulation of this sub-system that shall be compatible and integrated in the overall control system of the central water supply system. Measurements of all key hydraulic parameters should be introduced:
  - Examples of continuous measurements: inflow in the zone, pressure at the inlet point, inflow in tanks, water levels in tanks, operational pressure in a number of selected junctions, etc;
  - Examples of intermittent measurements: control flow measurements in pre-defined sub-zones, control pressure measurements, chlorine residual and other water quality parameter at a frequency defined in the corresponding national regulations;
  - Inflow into the sub-system should be regulated with flow as a control parameter, while at the same time pressure should be monitored. Inflow into the zone should be nearly constant, with possibility to intervene and increase/decrease the flow, as required.
- Preparation of the updated Water Supply Master Plan for Leskovac;
- Introduction of DMA's in order to monitor and control water demand in the sub-zones;
- Another measure addresses the characteristics and configuration of the tanks in respect to the consumption area. Unlike the existing proposal, the tanks should be filled and drained through separate pipes, which means that they receive maximum daily flow from the WT Rudarska kosa and WT Pečenjevce and deliver peak hourly flow to downstream consumers;
- For the given hydraulic boundary conditions in the connection point to the central system, the water tank elevations should be adjusted. Balanced operation of the tank can be maintained provided that the top water level in the WT Pečenjevce is 261,0 m.a.s.l. and for WT Kutleš 250,0 m.a.s.l.;
- Based on the hydraulic assessment of the system, it is necessary to modify the dimensions of the pipeline section from WT Kutleš to village Medja (LE-14). Namely, it is proposed to increase the pipe diameter from DN 200 to DN250 mm.

These improvements should insure an adequate level of service, and safe and stable water supply. The modifications of the sub-system physical elements have been tested in a corresponding hydraulic model, with results indicating normal operation of the system.

3.2.3.14 Hydraulic Analysis of the Water Supply System

Water Demand Analysis
Water demand has been defined based on the following parameters:

- Recoded number of population in the past;
- Specific/unit water consumption;
- Applicable peaking factors;
- Water losses assessment;
- Planned connection rate;
- Population number projection.

Population projection

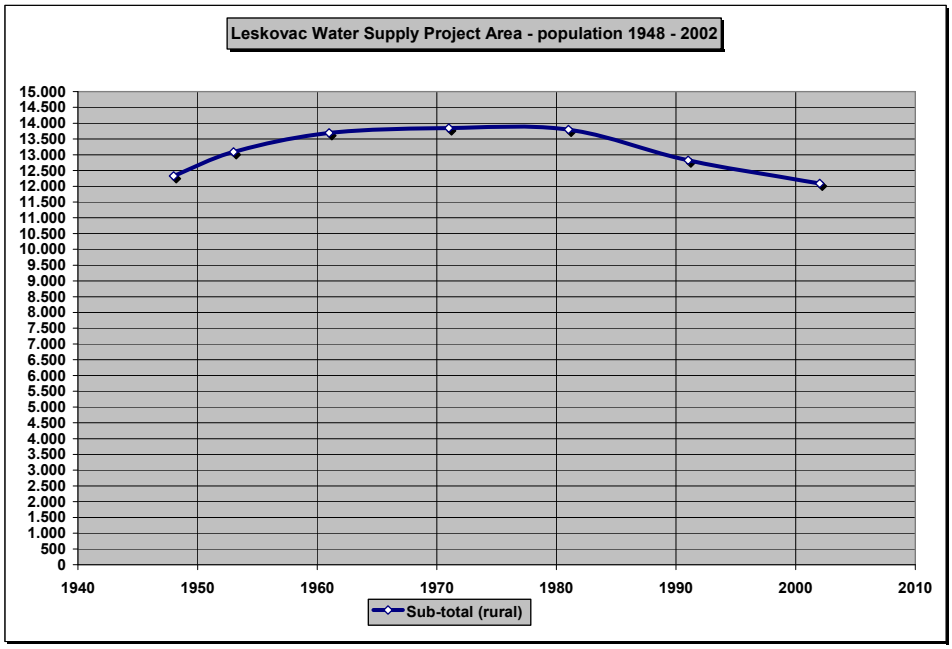
Based on the census data from 1948 to 2002 shown in the following table and figure, the number of population in the concerned area is generally declining.

Table 3-49 An overview of Leskovac population (water supply) in accordance with census data

No	Settlement	Type	1948	1953	1961	1971	1981	1991	2002
1	Živkovo	rural	808	876	832	832	802	747	**669**
2	Brejanovce	rural	528	560	558	472	448	394	**364**
3	Čifluk Razgojnski	rural	466	469	443	425	413	365	**335**
4	Pečenjevce	rural	1.846	1.981	2.136	2.088	2.078	1.820	**1.776**
5	Čekmen	rural	1.171	1.189	1.229	1.207	1.169	1.020	**915**
6	Lipovica	rural	1.328	1.401	1.448	1.517	1.474	1.355	**1.287**
7	Brestovac	rural	1.687	1.742	2.003	2.077	2.140	2.127	**2.086**
8	Kutleš	rural	690	752	780	772	779	758	**651**
9	Šarlince	rural	790	881	921	958	950	936	**854**
10	Draškovac	rural	725	763	791	826	823	805	**791**
11	Međa	rural	762	871	914	989	1.049	911	**872**
12	Donje Brijanje	rural	1.526	1.604	1.639	1.682	1.673	1.584	**1.487**
	Sub-total (rural)		**12.327**	**13.089**	**13.694**	**13.845**	**13.798**	**12.822**	**12.087**
	Growth rate (%) - rural			***1,2***	***0,6***	***0,1***	***0,0***	***-0,7***	***-0,5***

The data shown indicate that the population trends are generally negative, with a decline of approximately 0,5% annually since the mid 1980's. However, it is considered appropriate to assume stable number of population in the future, practically allowing for a minor adjustments and developments over the long project period.

Graph 3-1 Water supply project – historic demographic data



Specific/unit consumption
The average per capita consumption is based on the unit consumption recorded in the water supply system of Leskovac. The water consumption data show that the household unit consumption is around 150 l/capita/day.

This figure can be adopted for the settlements under consideration, as it complies with normal water consumption that can be expected in settlements of this size and characteristics.

Water losses assessment
It has been estimated that water losses in the system can reach 30% of the total average demand, which is generally in line with current status of water losses in the existing Leskovac system.

Connection rate
The connection rate of the population to the centralized water supply system has been planned in accordance with the following table:

Table 3-50 Connection rate of population in the villages to the central water supply system

	2011	2021	2031	2041
Connection rate	80%	100%	100%	100%

Table 3-51 Water demand for the villages in the northern part of Leskovac municipality

Settlement	Živkovo	Brejanovce	Ćifluk Razgojnski	Pečenjevce	Čekmin	Lipovica	Brestovac	Kutleš	Šarlince	Draškovac	Međa	D.Brijanje	Total/ average
Population	669	363	335	1 778	909	1 280	2 077	648	853	788	873	1 501	12 074
Connection rate (%)	100	100	100	100	100	100	100	100	100	100	100	100	100
Unit consumption (l/cap/day)	150	150	150	150	150	150	150	150	150	150	150	150	150
Losses (% of the average demand)	25	25	25	25	25	25	25	25	25	25	25	25	25
$K_{max\ day}$	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
$Q_{average\ -\ without\ losses}$ (l/s)	**1.2**	**0.6**	**0.6**	**3.1**	**1.6**	**2.2**	**3.6**	**1.1**	**1.5**	**1.4**	**1.5**	**2.6**	**21.0**
$Q_{average\ -\ with\ losses}$ (l/s)	**1.5**	**0.8**	**0.8**	**4.1**	**2.1**	**3.0**	**4.8**	**1.5**	**2.0**	**1.8**	**2.0**	**3.5**	**27.9**
Q_{losses} (l/s)	*0.4*	*0.2*	*0.2*	*1.0*	*0.5*	*0.7*	*1.2*	*0.4*	*0.5*	*0.5*	*0.5*	*0.9*	*7.0*
$Q_{max\ day\ -\ without\ losses}$ (l/s)	2.4	1.3	1.2	6.5	3.3	4.7	7.6	2.4	3.1	2.9	3.2	5.5	44.0
$Q_{max\ day\ -\ with\ losses}$ (l/s)	**2.8**	**1.5**	**1.4**	**7.5**	**3.8**	**5.4**	**8.8**	**2.7**	**3.6**	**3.3**	**3.7**	**6.3**	**51.0**

The total average demand in the villages considered by the study equals to 27.9 l/s, whereas the total maximum daily demand equals to 51.0 l/s. Spatial distribution of the maximum daily demand has been carried out by assigning the maximum daily demand of each village to its connection point represented by a hydraulic model node/junction.

Basic design criteria and constraints
Technical evaluation, design and dimensioning of the primary water supply system have been carried out taking into account well recognised engineering principles given hereafter. Also, as the planned system is connected to the existing water distribution system in Leskovac, it was very important to determine boundary conditions i.e. hydraulic grades at connecting points/nodes.

The following criteria have been applied:

- Assuming that the pipe material will be PVC, HDPE or DI, which is usual for projects of this kind, equivalent roughness in the Colebrook-White equation has been adopted as k=0.1 mm;
- The minimum service pressure has been set to 15 meters of water column, which is considered satisfactory for consumers living in villages and small towns;
- Pipe diameters of the transport mains have been designed taking into consideration relatively long lengths of pipelines i.e. low head losses, pressure fluctuations within 1 bar, normal filling of service tanks in Pecenjevce and Kutleš;
- The peak hourly factors for villages has been set to K_{max}=2.00, and K_{min}=0.25.
- The balancing volume/capacity of service water tanks has to be around 20% of the maximum daily consumption. They also have to provide an extra emergency storage for 2 - 8 hours of maximum daily demand. Together the two volumes equal to 30 - 40% of the maximum daily consumption.

The boundary condition refers to the hydraulic grade at the connection point, i.e. pressure in the network/water distribution system in Leskovac. Constant hydraulic grade of 275 m has been assumed in node L-1 based on data from the available technical documentation. This value has been adopted as the worst-case scenario expected to happen in the real system. The above stated boundary condition provides a safety margin in hydraulic calculations and results as they have been derived based on the most unfavourable boundary conditions.

Approach and methodology – Hydraulic/mathematical modelling of the system
This section outlines basic features of the software package EPANET used for the analysis of the existing water supply system and planning and design of the future water supply system. EPANET has become a world-wide standard engineering tool for analysis and planning of water supply distribution system. The methodology and the software applied are described in the Annex 3-12.

Results of hydraulic analysis

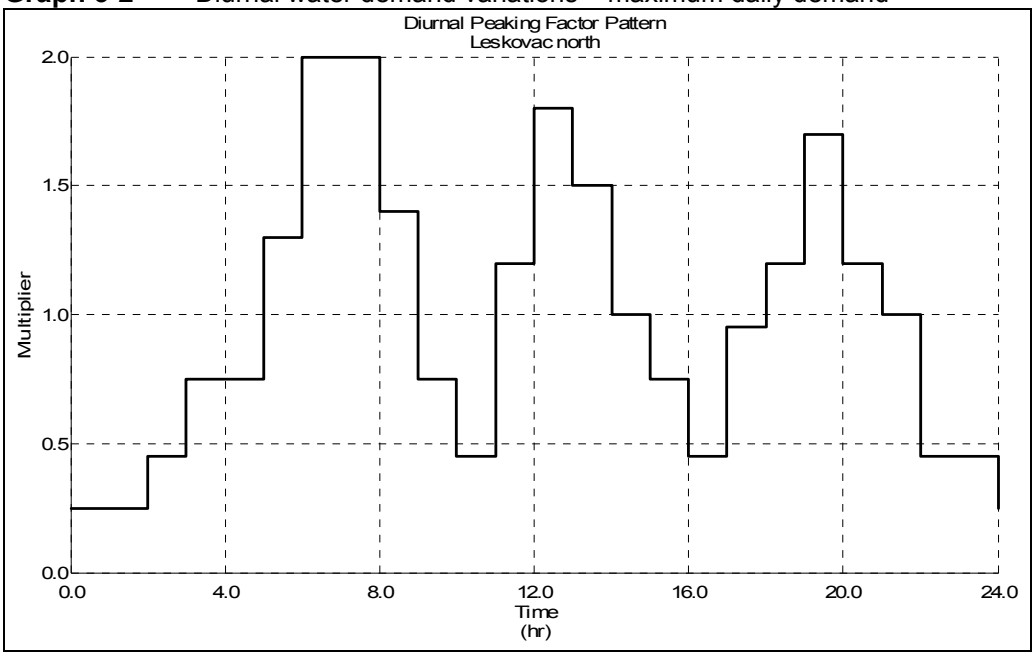
Original technical proposal
The hydraulic model of the original system was built based on the following network/component data:

- Transport pipes size DN300 to Brestovac and DN200 from Brestovac to D. Brijanje;
- Connection nodes with elevation data as well as demand data and diurnal variation patterns;

- WT Pecenjevce with 1000 m^3 capacity and TWL 257.0 m.a.s.l.;
- WT Kutleš with 500 m^3 capacity and overflow elevation 253.0 m.a.s.l.;
- Maximum daily demand shown in the table above allocated at each connection node;
- Hydraulic grade at connection point L-1 set to 275 m.a.s.l.

Diurnal variations of water demand during the day with maximum daily demand are presented in the figure below.

Graph 3-2 Diurnal water demand variations – maximum daily demand



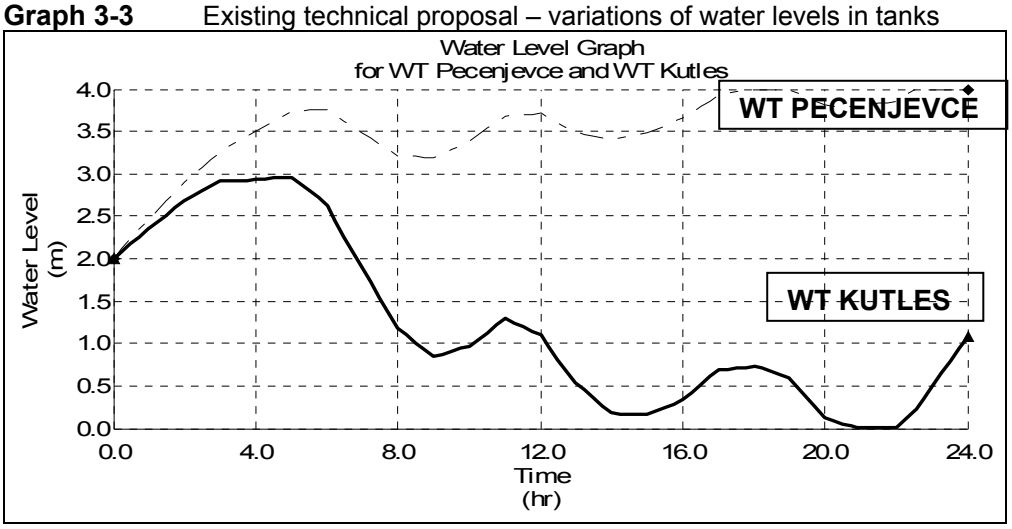
Results of the hydraulic calculation are presented in the form of graphs, tables and charts. As the hydraulic model was used for performing extended period simulation (24h), the results for hydraulic parameters are presented as graphs. In case of a steady state calculation, results for pipes and nodes are presented in a tabular form. The main hydraulic parameters that are subject to analysis are levels in water tanks, flow rates in pipes and pressures / hydraulic grade at nodes.

The first graph presents 24h variation of water level in the water tanks Pecenjevce and Kutleš.

It is obvious that the WT Pecenjevce is full, and WT Kutleš runs out of water in the second half of the simulation, as a result of insufficient inflow from WT Pecenjevce. Also the WT Pecenjevce does not use its volume of 1.000 m^3 to balance inflow and outflow, so it does not serve its purpose. At 21:00 o'clock, WT Kutleš is empty and WT Pecenjevce is full, meaning that all of the northern villages are supplied directly from Leskovac water distribution system.

The scenario with both tanks disconnected from the main system was also tested to establish if the water supply system can run without the service tanks. The hydraulic results confirmed that the main system cannot provide water at the peak hour demand (7:00 o'clock) to almost all villages and that service pressures are sufficient only for the village Zivkovo near Leskovac.

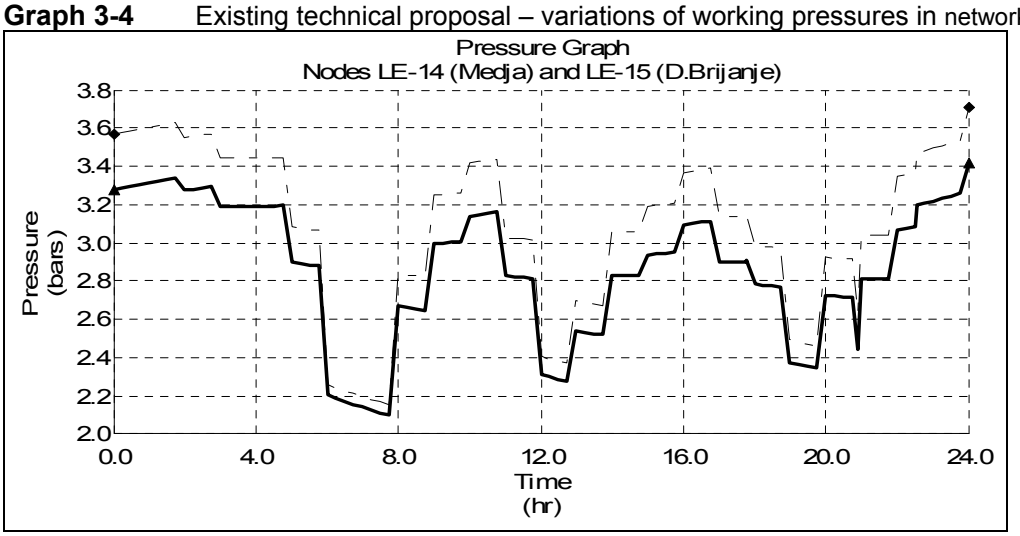
Graph 3-3 Existing technical proposal – variations of water levels in tanks



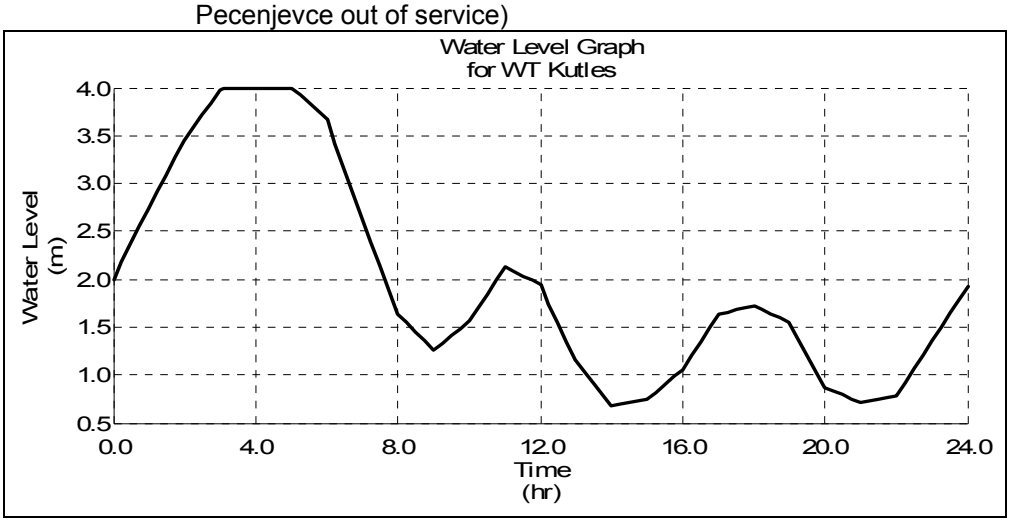
However, as the water level graph for WT Kutleš shows below, in case the WT Pecenjevce is disconnected from the system the operation of WT Kutleš improves and also the pressures in all nodes are satisfactory, although with greater fluctuations. This confirms the fact that the elevation of WT Pecenjevce is too low, and as such represents a bottleneck, as it breaks the hydraulic grade of the system.

The second graph in Figure 3-16 depicts pressures at the connection nodes for Medja and D. Brijanje. The graph shows significant pressure variations, of over 1 bar, which should be avoided in water supply networks.

Graph 3-4 Existing technical proposal – variations of working pressures in network



Graph 3-5 Existing technical proposal – variations of water levels in WT **Kutleš** (WT Pecenjevce out of service)



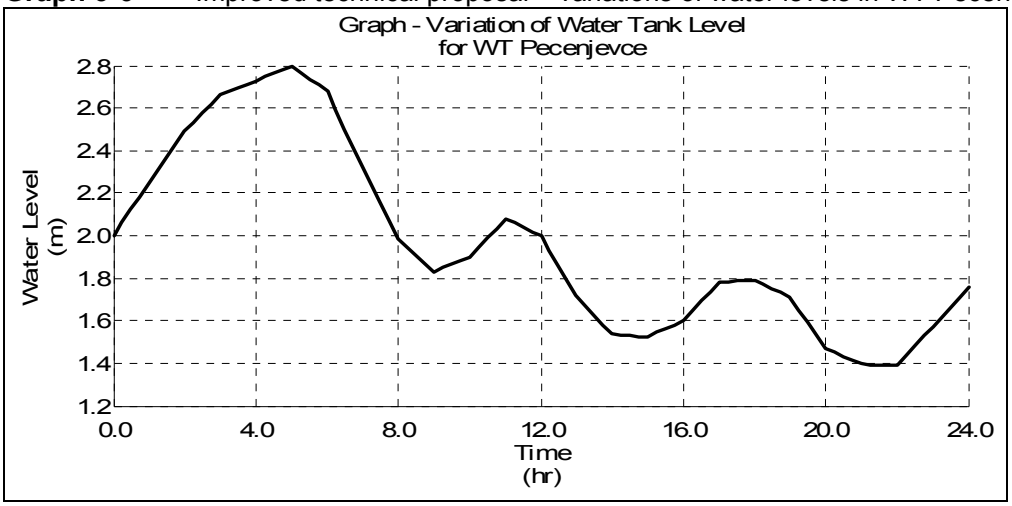
Generally, the calculations have shown that the system layout and hydraulic parameters as proposed by the original technical solution/documentation, do not provide technically viable operation of the primary water supply system. Although the system pressures are acceptable in all villages, the operation of the tanks needs fine tuning in order to achieve controlled system operation and full engagement of the tanks storage and balancing volumes.

Improved water supply scheme
An improved hydraulic model was built on the basis of the original one. The following water supply system components were modified.

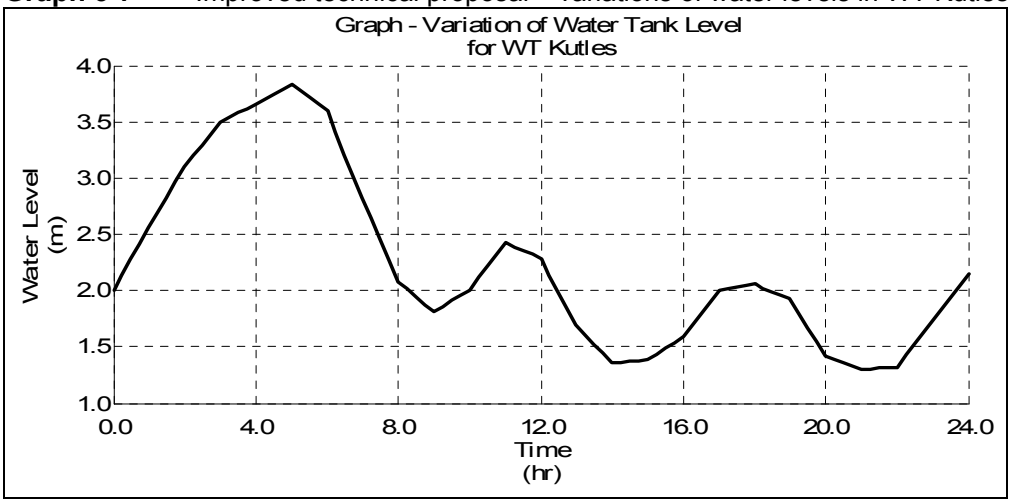
- Inlet and outlet pipes at WT Pecenjevce and Kutleš were designed as individual, hydraulically independent pipes;
- The top water elevation of WT Pecenjevce was raised to 261.00 m.a.s.l.; whereas the TWL at WT Kutleš was lowered to 250.00 m.a.s.l.;
- Outlet pipe size from WT Kutleš to Medja was increased from DN200 to DN250.

The results of the extended period simulation confirmed that the proposed modifications were necessary. Water tank level variations are shown below.

Graph 3-6 Improved technical proposal – variations of water levels in WT Pecenejevce



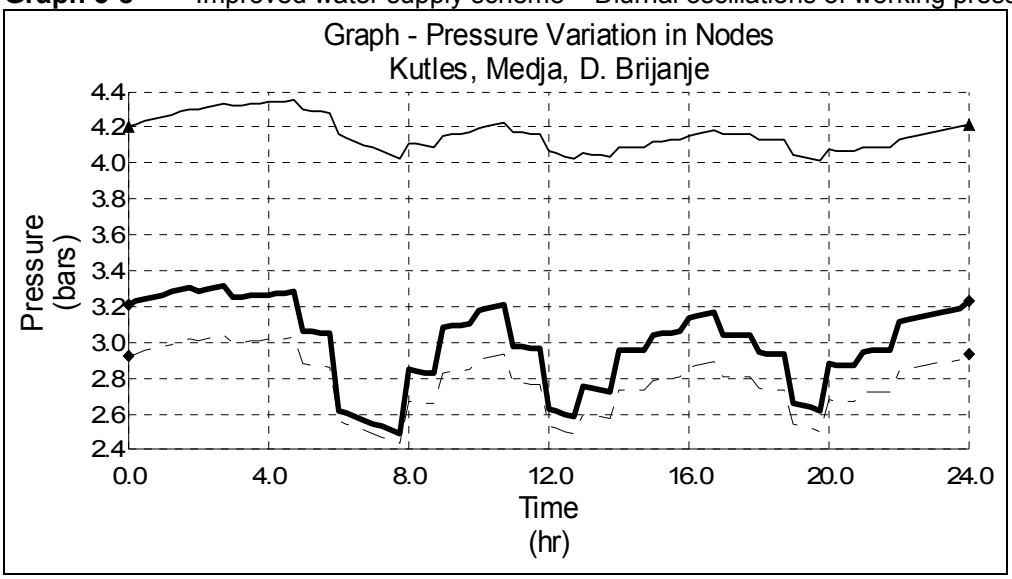
Graph 3-7 Improved technical proposal – variations of water levels in WT Kutleš



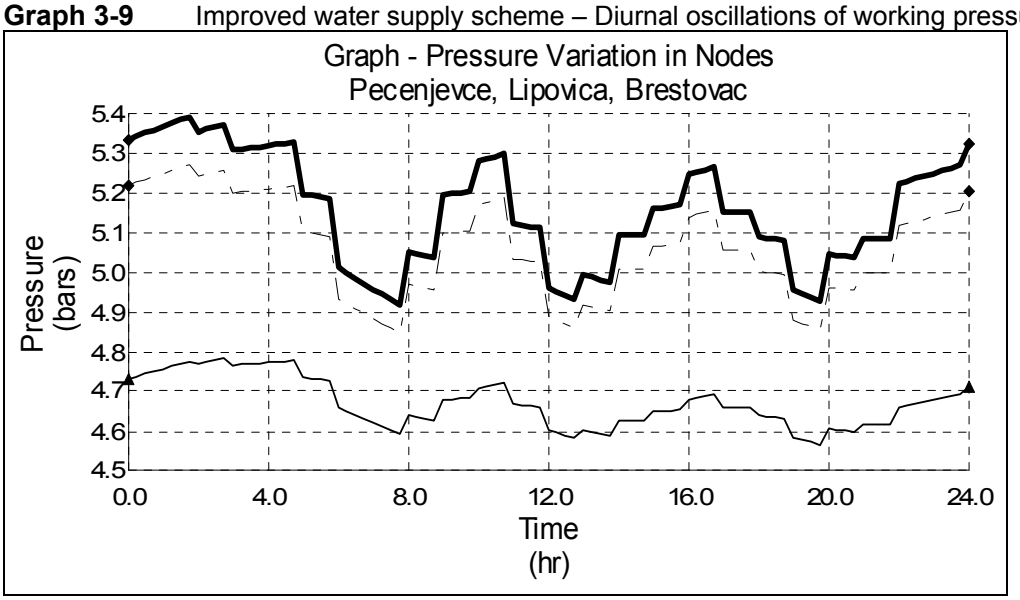
These graphs show improved usage of tank volume in both cases, and solved the problem of imbalanced operation of the WT Kutleš. The total balancing volume amounts to around 700 m^3, which represents around 18% of the maximum daily demand. The remaining tank volume in both tanks provides emergency water storage for a period of 4 hours. The total balancing and emergency volume is 34 % of the maximum daily demand.

The next graph shows working pressures in several characteristic nodes in the system. It may be concluded that the working pressures in the primary water supply system conform to technical standards and engineering practice.

Graph 3-8 Improved water supply scheme – Diurnal oscillations of working pressures



Graph 3-9 Improved water supply scheme – Diurnal oscillations of working pressures

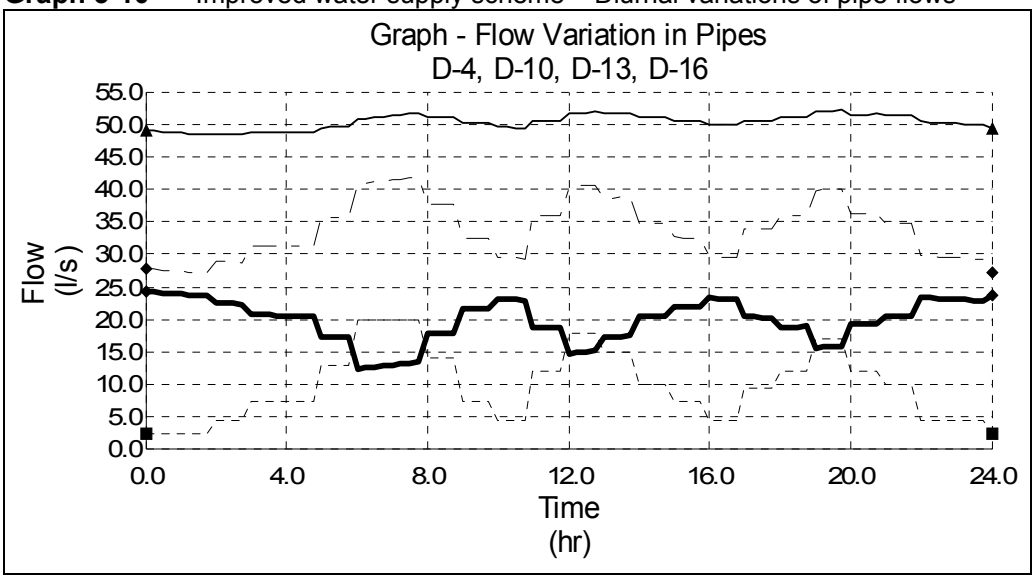


Finally, the graph shown below denotes flow rates in main transport pipes during a 24 hour period.

Flow in pipe D-4 of approximately 50 l/s, includes peak hour flow to villages Zivkovo, Brejanovce, R. Cifluk, and maximum daily flow to WT Pecenjevce. The same applies to pipe D-10, whereas pipe D-13 transports maximum daily flow for villages Kutleš, Sarlince, Draskovac, Medja and D. Brijanje to WT Kutleš.

Pipe D-16 transports the peak hour flows to the villages Medja and D. Brijanje, based on the peak hourly pattern provided earlier.

Graph 3-10 Improved water supply scheme – Diurnal variations of pipe flows



3.2.3.15 Conclusions and Recommendations

The hydraulic analysis of the primary water supply system for the villages in the northern part of Leskovac municipality along with technical evaluation of the existing documentation enable clear engineering assessment of the problems related to water supply of this region.

Another problem that became obvious during the course of this study was that the existing master plan is outdated and has limited potential for future planning of the water supply system. On the other hand the existing water supply system in Leskovac has not always been expanding and developing as set out in the relevant technical documentation. These two issues make the analysis of the water supply of the northern villages a preliminary assessment and a technical guideline to be built upon.

Main conclusions and recommendations of the study are summarised below:

- The primary water supply system for the northern villages in Leskovac should include water storage/service tanks in Pečenjevce and Kutleš, as the consumption area is at considerable distance from urban Leskovac. Without the tanks the system cannot handle/transport the peak hourly flows due to head loss in long pipelines. The tanks also provide balancing of inflow and demand, transport of lower flow rates in the transmission pipelines;
- The locations of the tanks were correctly determined in the previous design stages, although their elevations need to be modified, as explained earlier (WT Pečenjevce – overflow at 261 m.a.s.l., WT Kutleš – overflow at 250 m.a.s.l.).
- The capacity of the tanks, 500 m^3 for the WT Kutleš, and 1.000 m^3 for the WT Pečenjevce, covers around 34% of the maximum day demand, which is in line with technical recommendations and positive engineering practice;
- Water tanks should be designed with individual inlet/outlet pipes, as this allows adequate control and regulation of their operation;

- Boundary condition in the connection point, i.e. hydraulic grade of 275 m.a.s.l., needs additional verification, as it is the vital information for establishing system layout – tanks location and elevation;
- Main transport pipelines are correctly sized except for the section WT Kutleš – Medja which needs to be increased from DN200 to DN250;
- Design of local/secondary network in villages is technically acceptable;
- The system should be supplemented by an appropriate monitoring, control and regulation system.

Finally, it needs to be emphasized that an updated Water Supply Master Plan for the whole municipality of Leskovac is a prerequisite for the next stages of the design of the primary water supply system. The Master Plan would provide an updated review of the existing water supply situation and suggest development planning for the entire water supply system, including the northern sub-system. The analysis and design of the primary water supply system would then be compliant with the Master Plan.

3.2.3.16 Cost estimate

This section provides an overview of the investment costs for the construction of the water supply of the villages in the northern part of the municipality:

Table 3-52 Water Supply of Villages - Investments Overview

No	Component description	Cost estimate (€)	Cost estimate (DIN)
	Project designs and investigations		
1	Preparation of a detail design including updated hydraulic analysis and necessary investigations	250.000	20.000.000
	Design preparation - sub-total	**250.000**	**20.000.000**
	Transmission mains		
2	Transmission main in WDS Leskovac DN500mm, L=4.000m	796.438	63.715.000
3	Transmission main DN300mm, L=14.125m	1.562.500	125.000.000
4	Transmission main DN250mm, L=3.190m	271.150	21.692.000
5	Transmission main DN200mm, L=1.970m	137.500	11.000.000
6	Bridge crossings	30.000	2.400.000
7	Control and regulation	50.000	4.000.000
	Sub-total transmission mains	**2.847.588**	**227.807.000**
	Water distribution networks		
7	WDS Zivkovo	150.863	12.069.000
8	WDS Brejanovce	147.063	11.765.000
9	WDS Cifluk Razgojnski	73.663	5.893.000
10	WDS Pecenjevce	186.088	14.887.000
11	WDS Cekmen	138.863	11.109.000
12	WDS Lipovica	105.775	8.462.000
13	WDS Brestovac	315.350	25.228.000
14	WDS Kutles	145.425	11.634.000
15	WDS Sarlince	104.438	8.355.000
16	WDS Draskovac	129.363	10.349.000
17	WDS Medja	59.375	4.750.000
18	WDS Donje Brijanje	68.750	5.500.000
19	Storage tank V=500m^3 Kutles	150.000	12.000.000
20	Storage tank V=1000m^3 Pecenjevce	300.000	24.000.000
	Sub-total distribution networks	**2.075.013**	**166.001.000**
	Total Investment	**5.172.600**	**413.808.000**
	Overhead cost - contractor		
	Implementation costs - included above		
	General costs, profits and risks - included above		
	Subtotal without contingencies	**5.172.600**	**413.808.000**
	Engineering, supervision, commissioning - 3%	155.178	12.414.240
	Contingencies - 5%	258.630	20.690.400
	TOTAL INVESTMENT COST - excluding VAT	**5.586.408**	**446.912.640**
	VAT - full 18%	**1.005.553**	**80.444.275**
	TOTAL INVESTMENT COST - including VAT	**6.591.961**	**527.356.915**

3.2.4 Investment Overview

This sections shows an overview of the investment costs related to the project, elaborated in more detail earlier in the report.

Table 3-52 Water Utilities Project Leskovac - Investments Overview

Item #	Description	Phase I (€) 2009-2011
A1	Investigation works & design	490
A2	Construction works	5.444
A3	Electro-mechanical equipment	6.625
A4	Trial run, staff training, operation over 12 months	420
A5	Contingencies	1.307
A	**Subtotal waste water treatment plant**	**14.287**
B1	Extension sewage collection network	6.091
B2	Contingencies	305
B	**Subtotal sewage collection network**	**6.396**
C1	Extension drinking water supply	5.173
C2	Contingencies	259
C	**Subtotal drinking water supply extension**	**5.431**
	Subtotal investments costs	**26.114**
D1	Supervision excluding VAT	1.627
D2	VAT	391
	GROSS TOTAL	**28.132**

VAT calculation	
EU-IPA grant	20.805
MAFW	4.762
Municipality	2.173
Subtotal	**27.741**
VAT 18% in municipal financed portion	391
Total	**28.132**

4 ENVIRONMENTAL AND SOCIAL ANALYSIS

4.1 Introduction & scope of EIA

The review of the environmental and social aspects of this project is set against the requirements found in the following documents:

- Environmental Integration Handbook for EC Development Cooperation, Europe Aid, December 2006, reference 3.4;
- Local legislation, Law on Environmental Impact Assessment, 2004, reference 3.5.

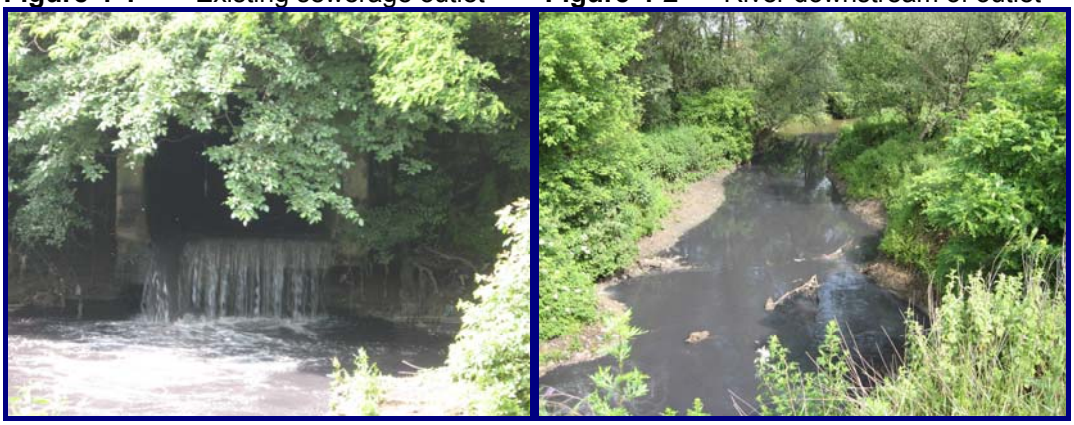
An EIA was carried out by the Institute for the development of water resources "Jaroslav Cerni", department for water supply, sewage and water quality protection, Belgrade, May, 2007, reference 3.6.

Scope of EIA in relation to project feasibility study
The EIA covers specifically the foreseen WWTP Leskovac and is referred to as the central WWTP for Leskovac.

By Serbian law, an EIA needs to be carried out in order to get a construction permit. As the planned WWTP will serve about 110.000 -130.000 population equivalent it is not necessary to carry out an EIA according to the EU regulations (EIA needed if > 150.000 population equivalent). However, as the EIA has been prepared in accordance with the National regulations, it will assess critically and recommendations will be made in order to ensure that the impacts on the environment be minimized.

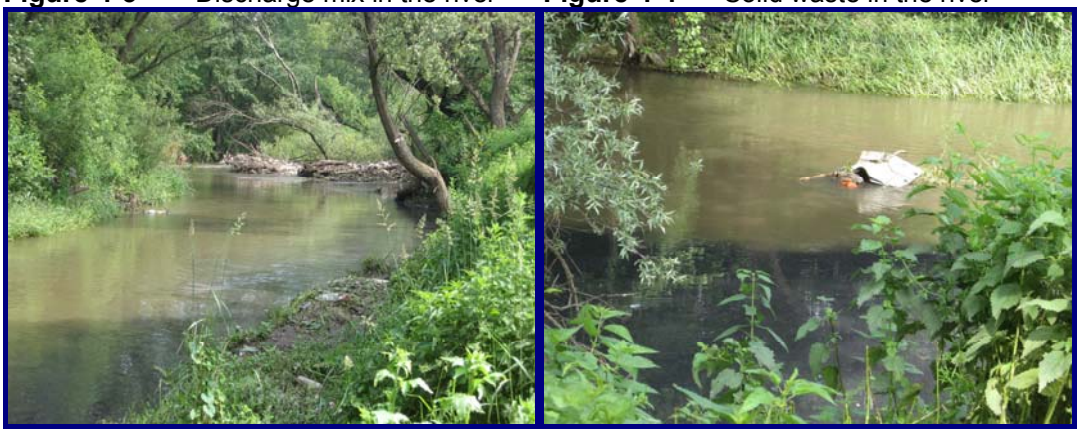
At present, the sewage discharge is directly discharged into the receiving water body, the Veternica river.
Construction of the WWTP will definitely be an improvement to the environment, especially the ecological status of the Veternica river, and of the South Morava river, which is the essence of the EU Water Framework Directive. The photos below show the current situation. Figure 4.1 shows the current sewerage outlet and figure 4.2 the effects on the river directly downstream of the discharge point. The water is black, dirty, of low oxygen content.

Figure 4-1 Existing sewerage outlet **Figure 4-2** River downstream of outlet



The two photos below show how this discharge stream joins the Veternica river. It can also be detected in the far end of the photo 4.2. It is clear that the water quality in the river Veternica is of better quality upstream compared to downstream of the discharge point. Photo 4.4 shows the solid waste which is accumulated in the riverbed resulting from the sewage discharge. This is a public and an ecological hazard (especially plastic bags can cause death to animals roaming around for food).

Figure 4-3 Discharge mix in the river **Figure 4-4** Solid waste in the river



Chapter lay-out
A brief an explanation is given of the main environmental requirements set by the Serbian government and the EAR. An initial check is made on completeness of the issues that should be dealt with, followed by a more detailed check on the content of the EIA. This deals with the standard environmental issues during construction and operation of the WWTP. Some separate issues are dealt with in separate paragraphs. The final paragraph describes the main issues which have to be carried out as soon as possible and some issues to be taken up during tendering of the construction documents.

4.2 EIA Procedure

4.2.1 Serbian requirements

According to the Serbian legislation, an Environmental Impact Assessment has to be conducted and approved in order to obtain a construction permit. The Law on Environmental Impact Assessments (Official Gazette of the Republic of Serbia 135/2004) gives requirements for such an EIA. This law on EIA has been developed to be compatible with EU Directives.

EIA scope and contents
According to article 12 – 15 of the Serbian Law on EIA, the Competent Authority decides on the required scope and contents of an EIA study. Article 17 of the Law lists the following data:
1. The data on project developer;
2. The description of the planned project developer;
3. The description of the project;
4. The outline of the main alternatives studied by the project developer;

5. The outline of the environmental status at the site and its close vicinity (micro location and macro-location);
6. The description of likely significant effects of the project on the environment;
7. The environmental impact assessment in cases of accidents;
8. The description of measures envisaged to prevent, reduce and, if possible, eliminate any significant adverse effects on the environment;
9. The monitoring programme for impact on the environment;
10. The short non-technical summary of data listed in points 2) to 9);
11. The data on technical shortcomings, absence of the appropriate expertise and skills or, impossibility of obtaining the appropriate data.

Public consultation

Article 14 of the Law on EIA requires public announcement of the decision by the Competent Authority on the scope. Article 20 and 21 describe the public consultation procedures to be followed on the results of the EIA

4.2.2 Requirements set by EU

According to Annex 7 of the Environmental Integration Handbook, an EIA is necessary if the waste disposal site is of large scale (i.e. >150.000 population equivalent) or if it effects a particular vulnerability of the receiving water body environment or an existing Strategic Environmental Assessment (SEA) report advices it. This project is not of large scale (< 150.000 population equivalent) and there is no SEA for the project area of Leskovac, so for compliance with the EU Directive no EIA is necessary.

The standard format for an EIA report is as follows:

1. Executive summary;
2. Background;
   a. Project justification and purpose
   b. Project location
   c. Project description and associated activities
   d. Alternatives
   e. Environmental policy, legislation and institutional framework
3. Approach and Methodology;
   a. General approach
   b. Geographical or mapping units
   c. Environmental quality indicators
   d. Assumptions, uncertainties and constraints
4. Environmental baseline study;
5. Impact identification and evaluation;
6. Mitigation/optimisation measures and residual impacts;
7. Recommendations;
8. Conclusions;
9. Technical appendices;
10. Other appendices.

4.2.3 Status of the EIA

The EIA report (draft report) for the WWTP Leskovac has been completed and submitted to the Municipality of Leskovac in June 2007. This has to be followed by a full review and public consultation procedure, and finally approved by a competent authority, as set out in the Law on EIA.

4.3 Gap Analysis on completeness of EIA

In the table below a review is given of which parts are dealt with in the EIA. It does not give a judgment on whether it has been sufficiently done.

Table 4-1 Review of parts that have been dealt with in available EIA in compliance with Serbian Law

	Requirement	**EIA 2007**
1	The data on project developer;	√
2	The description of the planned project developer;	√
3	The description of the project;	√
4	The outline of the main alternatives studied by the project developer	√
5	The outline of the environmental status at the site and its close vicinity (micro location and macro-location);	√
6	The description of likely significant effects of the project on the environment;	√
7	The environmental impact assessment in cases of accidents;	√
8	The description of measures envisaged to prevent, reduce and, if possible eliminate any significant adverse effects on the environment;	√
9	The programme of monitoring of impact on the environment;	√
10	The short non-technical summary of data listed in points 2) to 9);	√
11	The data on technical shortcomings, absence of the appropriate expertise and skills or, impossibility of obtaining the appropriate data.	No

Table 4-2 Review of parts that have been dealt with in available EIA in compliance with EU requirements

	Requirement	**EIA 2007**
1	Executive summary	√
2	Background	
2a	Project justification and purpose	√
2b	Project location	√
2c	Project description and associated activities	√
2d	Alternatives	√
2e	Environmental policy, legislation and institutional framework	√
3	Approach and Methodology	
3a	General approach	√
3b	Geographical or mapping units	√
3c	Environmental quality indicators	√
3d	Assumptions, uncertainties and constraints	√
4	Environmental baseline study	√
5	Impact identification and evaluation	√
6	Mitigation/optimisation measures and residual impacts	√

7	Recommendations	√
8	Conclusions	√
9	Technical appendices	
10	Other appendices	

4.4 Gap analysis on content of EIA

In the tables below an overview is given on the content of the EIA. It focuses on the possible impacts and proposed mitigation measures. Within the column 'evaluation' it is indicated whether the item is dealt with sufficiently or whether additional information is needed.
Table 4.1 describes the issues relevant during construction phase and table 4.2 for the operational phase of the project. Figure 4.1 gives an illustration of the main environmental issues during normal operation of the WWTP.

Figure 4-5 Illustration of main environmental issues during operational phase

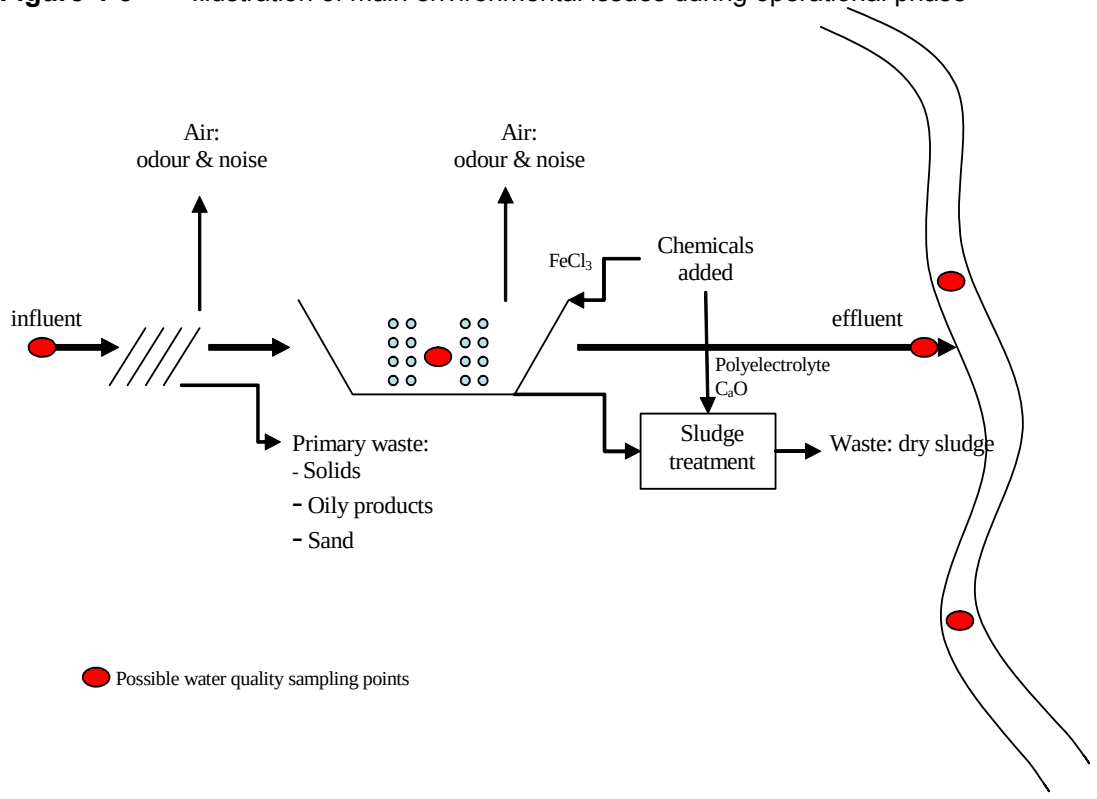


Table 4-3 Main environmental issues and mitigation measures for construction phase

Type	Description of impact related to activity	Evaluation	Mitigation measures proposed
Physical environment			
Air pollution	Caused by • Release of aerosols and unpleasant odours, especially during dry and hot spells caused by construction works.	**no gap in EIA**	• During the construction phase it is not necessary to take any measures with respect to odour as this is not to be expected.
Noise pollution	Caused by • Construction machinery; this may cause noise levels at short time periods which might exceed the allowed levels, however due to the timeframe of the works and the distance to the city it is negligible.	**no gap in EIA**	• Good maintenance and check up on vehicles and equipment. Periodic control should take place. • Prevent any unnecessary noise production, leaving equipment and vehicles running whilst they are not being used. • Provide ear protection if limits exceed safety standards
Soil pollution	Caused by • Any spillage at the WWTP construction site during construction works of waste water, or liquids from machinery (oil, chemicals, fuels)	**no gap in EIA**	• No mitigation measures needed during construction • Good housekeeping at the WWTP through good management during construction
Water pollution	Groundwater caused by: • Any spillage at the WWTP construction site during construction works Surface water caused by: • Any spillage at the WWTP construction site during construction works	**no gap in EIA** **no gap in EIA**	Groundwater • Good housekeeping at the WWTP through good management during construction Surface water caused by: • Good housekeeping at the WWTP through good management during construction
Waste	Domestic waste caused by • Construction workers daily needs, e.g. waste produced due to lunches, toilet, etc. Construction waste • Construction waste: all material which is finally not used during the construction.	**GAP in EIA**	Domestic waste: • It should be stated what will happen to this waste, construction workers should be made responsible for this. Construction waste • Indicate what will happen with the construction waste.

Natural environment			
Terrestrial flora & fauna	There are no protected natural estates, habitats of natural rarities or endangered species of flora and fauna. There are no negative effects expected on the terrestrial flora and fauna.	**no gap in EIA**	No mitigation measures necessary
Aquatic flora & fauna	There are no negative effects expected on the aquatic flora and fauna during the construction period.	**no gap in EIA**	No mitigation measures necessary
Cultural estate	No protected cultural estate registered	**no gap in EIA**	No mitigation measures necessary In case any archaeological sites are found during the construction, it is necessary to inform the Authorities and to take necessary measures
Human environment			
General HSE	During the construction phase, workers are inevitably exposed to hygiene, safety and security risks. The following activities (mainly safety) should have special attention; • Excavation work, • Working with heavy machinery, • Working with chemicals, • Working in very noisy environments (noisy machines), • Lifting and or loading of heavy loads. Receptors of this impact are the construction workers of the WWTP. The impact can be classed as minor or major, depending on what will happen in practice. If the correct measures are taken and the correct working atmosphere allows for safe working conditions then the impact will be minor as it will be as low as reasonably practical (ALARP).	**Minor GAP**	For the construction phase an extensive HSE management plan should be made. It should include all relevant aspects (as mentioned in the chapter on HSE management) but for labour protection the following is essential • Provision of PPE (Personal Protection Equipment), specific for each task, • Regular checks in the field if regulations and standards are respected, • Well trained staff for the operations work needed at the WWTP. • Provide medical assistance to all workers, • Education of all workers on their risks and what to do (also hygiene and illnesses – working in an environment where pathogenic bacteria are present).
Population	With this new WWTP and the choice of its location there are no adverse affects envisaged for the people in Leskovac during the construction period.	**no gap in EIA**	No mitigation measures necessary

Table 4-4 Main environmental issues and mitigation measures for operational phase

Type	Description of impact related to activity	Evaluation	Mitigation measures during operational phase
Physical environment			
Air pollution	Caused by • Release of aerosols and unpleasant odours, especially during dry and hot spells.	**no gap in EIA**	• There where unpleasant odours occur coverage will reduce these impacts and will also be equipped with artificial ventilation system
Noise pollution	Caused by • General operations (aeration, pumps, etc.)	**MINOR**	• Coverage of the installations causing the highest noise levels, such as the aeration pumps. • Good maintenance and check up on vehicles and equipment. Periodic control should take place. • Prevent any unnecessary noise production, leaving equipment and vehicles running whilst they are not being used. • Provide ear protection if limits exceed safety standards
Soil pollution	Caused by • Improvement of soil quality due to the reduction in septic tanks in the Leskovac region. • Prevent any spillage of chemicals, sludge and waste water during operations. • Less pollution of river bed soil due to reduction in suspended solids which reach the river through the untreated effluent discharge. Great improvement for the long term quality of the river.	**MINOR**	• Design of tank bottom with water-permeable coating

Water pollution	Groundwater caused by: • Pollution to groundwater will decrease as septic tanks will no longer be used by a certain area of the town of Leskovac. This is a very positive aspect. Surface water caused by: • Pollution reduction of the Veternica river (and therefore water quality improvement in the Danube). This is also in line with the EU Water Framework Directive. • Possible wash-through of sludge into the river due to incidence on the WWTP or spillage from chemical used or cleaning solvents.	**no gap in EIA** **no gap in EIA** Minor GAP	Groundwater • No measures needed Surface water caused by: • No measures needed • Good maintenance and operation of the WWTP by employees who are properly trained. Good HSE plan for the operations of the WWTP
Waste	Domestic waste caused by • General operation of the WWTP, e.g. waste produced by the operators, maintenance. Sludge from WWTP • General operation of the WWTP and during incidences Waste from primary treatment; • Rough solid waste (bottles, etc.) • Oily waste removed within primary stage • Sand which settles in the primary treatment stage Chemical management • Phosphates, chalk, $FeCl_3$; where are these stored and how to prevent any adverse effects	**GAP in EIA**	Domestic waste caused by • It should be stated what will happen to this waste, will it be collected or is the WWTP operator responsible for the disposal of the waste Sludge from WWTP • Disposed of to landfill as sludge cake. It is not clear to which landfill. • Using the sludge as soil improvement within agriculture should be considered Waste from primary treatment; • What will be done with this type of sludge? Chemical management • How are these stored and kept

Natural environment			
terrestrial flora & fauna	There are no protected natural estates, habitats of natural rarities or endangered species of flora and fauna. There are no negative effects expected on the terrestrial flora and fauna. At the location there is already a non functional WWTP so there is no removal of any flora and fauna necessary.	**no gap in EIA**	No mitigation measures necessary
Aquatic flora & fauna	There are no negative effects expected on the aquatic flora and fauna. Due to the improvement of the water quality there will be a positive impulse to the aquatic live in the Veternica river (which is favourable for the aquatic ecological goals set within the EU Water Framework Directive)	**no gap in EIA**	No mitigation measures necessary
Cultural estate	No protected cultural estate registered	**no gap in EIA**	No mitigation measures necessary
Human environment			
General HSE	During the operational phase, workers are inevitably exposed to hygiene, safety and security risks. The following activities (mainly safety) should have special attention; • Excavation work, • Working with heavy machinery, • Working with chemicals, • Working in very noisy environments (noisy machines), • Lifting and or loading of heavy loads. Receptors of this impact are the operators of the WWTP. The impact can be classed as minor or major, depending on what will happen in practice. If the correct measures are taken and the correct working atmosphere allows for safe working conditions then the impact will be minor as it will be as low as reasonably practical (ALARP).	**Minor GAP**	For the operational phase an extensive HSE management plan should be made. It should include all relevant aspects (as mentioned in the chapter on HSE management) but for labour protection the following is essential • Provision of PPE (Personal Protection Equipment), specific for each task, • Regular checks in the field if regulations and standards are respected, • Well trained staff for the operations work needed at the WWTP. • Provide medical assistance to all workers, • Education of all workers on their risks and what to do (also hygiene and illnesses – working in an environment where pathogenic bacteria are present).
Population	With this new WWTP and the choice of its location there are no adverse affects envisaged for the people in Leskovac. The WWTP will only increase the standard of living for everyone.	**no gap in EIA**	No mitigation measures necessary

4.5 Monitoring plan during construction and operational phase

There needs to be a clear monitoring plan for the construction and operational phase. This is not present at the moment or in a minor form. In chapter 8 of the EIA there is some mention of the necessity to sample the effluent of the WWTP. However there needs to be a clear monitoring plan with quality limits mentioned for each (sampling) point. In figure 4.a an indication is given of the necessary sampling points (influent, and effluent of WWTP, upstream and downstream of the discharge point in the river). Sludge will also need to be monitored and checked on its quality, especially if it will be used for agricultural use. The table below gives an indication of what needs to be done for the monitoring plan.

Table 4-5 Tentative monitoring plan (as example for consultant)

Environmental compartment	Location	Type of monitoring	Monitoring frequency
Physical environment			
Air quality - noise - odour	- In the vicinity of the WWTP - Based on physical registration		
Sludge	Study of bacteriological activity; Sludge before and after drying;	Chemical composition, depending on needs for disposal requirements (landfill/agriculture)	
Water quality	Influent WWTP itself Effluent Receiving water body - upstream of discharge point - downstream of discharge point	All relevant parameters E.g., BOD, pH, T, O_2, E.Coli, metals (need to check with permit)	Not all parameters have the same frequency. (check with permit)
Human environment			
HSE	At the site	Correct PPE	

4.6 Inventory of hazardous areas

There are no hazardous areas in the vicinity of the WWTP. There are some hazardous parts within the WWTP which can cause accidental negative effects on the environment. These need to be described in the management plan of the WWTP during operation.

4.7 Health and safety measures and contingency planning

This section is missing in the EIA, which focuses more on the environmental issues and less attention is given to the general operation of the WWTP.

HSE plans should be included in construction permits. Based on interviews with experienced workers in Serbia this is a new way of working which is not so common. The MIASP program will therefore be an opportunity to learn and implement this way of working.

Inspections should be conducted in order to check if the HSE rules and regulations are being followed by the construction company. Fines and additional checks will be carried out if incompliance is registered.

During construction and the operational phase there must be first aid kids and fire fighting material available for workers. Staff should be properly trained to use all the necessary HSE equipment.

4.8 Regulatory compliance

The current regulatory environment has been elaborated in chapter 6, the institutional analysis. During construction and operation of the WWTP, the below mentioned procedures will be applied:

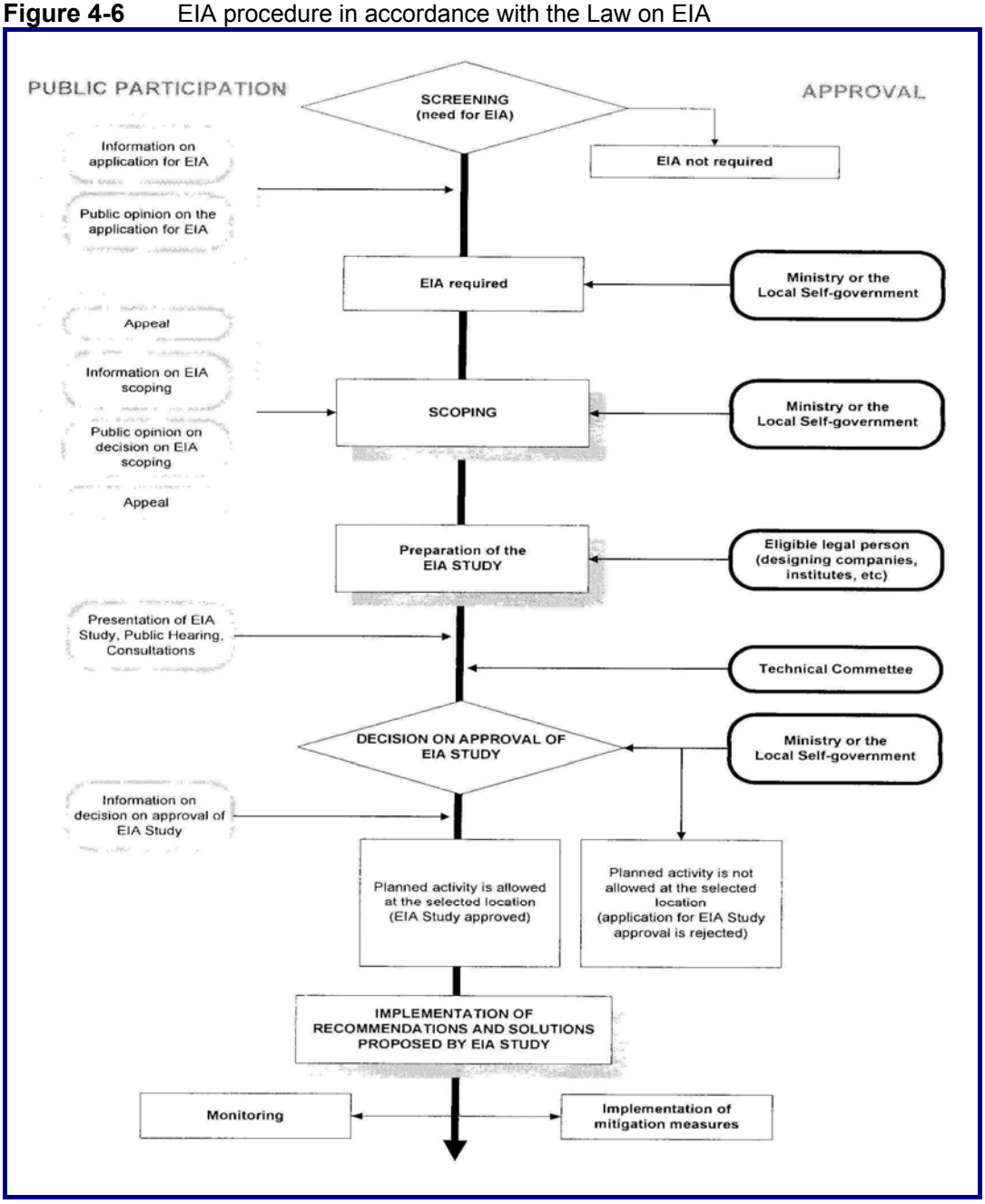
Supervision and enforcement
The Republican Directorate for Waters has its inspectorate with 4 field offices covering the total of 19 regions with 18 inspectors. Authorities of water management and sanitary inspectors are defined in the Water Law. While sanitary inspectors are in charge of the control of potable water, water management inspectors are responsible for supervision and control of existing and new water management facilities including functioning and efficiency of waste water treatment facilities, as well as the inspection of polluters. In the event that hazardous elements exceed limits set by Rule book on hazardous elements in water (RS Official Gazette 31/82), inspectors may order closure of enterprises until the limits are met. The latter one is not a popular measure due to economic reasons and is applied only in event of accidents.

In the Municipality of Leskovac, Republican water management inspectors monitor primary treatment in industries and main gravity sewer while communal inspectors are in charge of small enterprises and collection network.

4.9 Public Participation

A draft report on the Environmental Impact Assessment has been submitted to the PUC Vodovod of Leskovac in June 2007. Further to the said report, the PUC and the municipality shall arrange for the corresponding review and the public consultation procedure. A complete EIA procedure, as defined in the Law on EIA, is shown on the enclosed scheme, and described further in this section.

Figure 4-6 EIA procedure in accordance with the Law on EIA



The Law on Environmental Impact Assessments (OGRS 135/2004) prescribes a procedure of public consultations, presentation and debate on the EIA Study – article 20 as follows:

The competent authority shall make the EIA Study available to the public and arrange for a public presentation and debate on the Study.

Within seven days from the date of reception of the application for the EIA Study approval, the competent authority shall inform the project developer, the authorities, organisations and the public concerned about the time and venue for public consultation, presentation and debate on the EIA Study.

Public debate may not be held sooner than 20 days from the date when the public was informed.

The project developer shall participate in the public presentation and debate on the EIA Study.

More specifically, the procedure for public consultations, presentation and debate is defined in the corresponding rulebook (OGRS, 69/2005).

The competent authority should make the EIA public within 7 days of the request for approval. The availability of the EIA must be published in a daily newspaper, or in a local newspaper in all languages that are in official use in the area affected by the project. Public exposure of the EIA should last at least 20 days.

The EIA can be presented by means of electronic public media.

The announcement of the EIA presentation must include the following:

- Title of the competent authority;
- EIA title;
- Data on schedule and venue of the EIA public presentation;
- Way to get full information and submit comments by all stakeholders (public, organizations, etc.).

The EIA should be publicized in the office of the competent authority, in a specifically allocated room.

Upon the completion of the public consultations, the competent authority should submit to the project developer within 15 days all received comments and objections. If required, the project developer should modify the EIA accordingly within the following 15 days.

4.10 Resettlement

Resettlement is not relevant to this project investment. There are no houses or any other buildings on the reserved site or in the vicinity.

4.11 Social analysis of the project

The construction of the WWTP at Leskovac will not negatively influence the population of Leskovac or of the nearby settlements.

Construction phase
During construction phase this project will provide jobs for the construction of the WWTP. There is no need for people to be resettled. There will be an increase of traffic in order for the materials to arrive at the site which might be noticed by the public but this adverse effect is neglect able.

Operational phase
During operation the WWTP will need to be run and maintained which will provide job opportunities in the region.

4.12 Impact on public health

The impact on public health of the WWTP will be positive. It is expected that it will reduce the amount of sick people directly related to contact with the rivers. It will reduce the amount of E.coli bacteria which is an indicator for the presence of pathogenic bacteria which can cause illnesses (leading to diarrhoea, stomach pains etc.). Treating of wastewater in this WWTP is a good start and in line with EU Directives.

Construction phase
There will be no negative impacts on public health during the construction phase. To limit any possible negative impacts to the construction workers it is essential to have a Health Safety and Environmental Management plan in place, making sure that all the PPE (Personal Protective Clothing is present) is made available to the workers and that they are properly trained and aware of the risks during construction. This must be demanded from the construction company.

Operational phase
Possible impacts on the public are negligible, as wind directions are favourable and there are no other risks involved for the WWTP.
The operator(s) of the WWTP must be fully trained and equipped to properly run the WWTP

4.13 Conclusion and Recommendations

4.13.1 Conclusion

The construction of the WWTP for Leskovac will lead to an improvement of the water quality of the Veternica and the South Morava rivers. This will have a positive effect on public health and aquatic ecosystem of the rivers. From an environmental and social point of view there are no potential hazards or ‘show-stoppers’ in order for this project not to be financed as long as all the mitigation measures are taken and the monitoring programme is executed.

4.13.2 Recommendation

The following issues need to be described or solved if not known.

Waste management
It is not clearly stated how waste management will be dealt with during construction phase and operational phase of the WWTP. Sludge waste from the WWTP will be generated and will have to be handled properly. The following needs to be elaborated on:

Waste streams – during construction phase
- general waste from construction period (domestic waste and construction waste);

Waste streams – during operational phase
It needs to be clearly described what will be done with all the following waste streams. Where will they go, what are the best options from an environmental point of view (preferably, first recycling then other options such as landfill).
- **Primary waste from pre-treatment** – the first step of treatment is a primary treatment which will take our most large particles from the sewage (bottles, plastics, sand and silt, etc.);
- **Oily products during primary treatment** – this will be skimmed off of the water surface during this primary treatment stage.
- **Settled large particles during primary treatment** – Large particles will settle at the bottom of the primary treatment and need to be removed from the tank from time to time.
- **Sludge** – what happens to the sludge, it would be best practice if the sludge can be used for agricultural usage? This should be investigated. In the EIA, it is not stated what will happen to the sludge now, most likely it will be dumped to the landfill.
- **General waste** – from the operations (domestic and operational waste from maintenance of machines etc).

Chemical management
During the operation of the WWTP it is likely that the following three chemicals will be used;
- Ferri chloride ($FeCl_3$); for floc forming and removal of phosphate during the treatment of the wastewater;
- Polyelectrolyte; to be added to the sludge for better flocculation (resulting in better settling) higher removal of sludge during last treatment stage of sludge;
- Lime (CaO); also added to the sludge for stabilisation, higher removal and better for the pressing of the sludge.

Monitoring plan
In various parts of the EIA some mention is made of sampling needed but no details are presented.

HSE management plan
A general HSE management plan must be put in place. It should elaborate on all the HSE issues, including necessary training of employees.

5 FINANCIAL AND ECONOMIC ANALYSIS

5.1 Financial assessment Public Utility Company

The PUC Vodovod, Leskovac was founded in 1954. Its primary activities are the production and distribution of water and maintenance of the city's water system, purification and conveyance of sewerage and atmospheric waters, supervision over the quality of the potable water, sanitary protection and securing of the water system plant, maintenance, reconstruction and expansion of the water and waste water systems.

5.1.1 Profit and Loss statements

The Municipality of Leskovac founded PUC Vodovod for the purpose of performing activities dealing with water supply and waste water management. On January 1st 2004, PUC Vodovod Leskovac started implementing a new method of financial reporting in accordance with International Financial Reporting Standards (IFRS). The financial statements are prepared under the historical cost convention as modified for the effects of inflation and valuation of property, plant and equipment.

The Company maintains its accounting records in Serbian dinar (RSD) and prepares its statutory financial statements in accordance with the Serbian Law on Accounting. The accompanying financial statements are based on the statutory records, with adjustments and reclassifications recorded for the purpose of fair presentation in accordance with IFRS. Official data are submitted to the Central Bank of Serbia.

Table 5-1 Profit & Loss statement PUC Vodovod Leskovac (RSD '000)

No	Description	2004 actual		2005 actual		2006 actual	
		RSD	%	RSD	%	RSD	%
1.	**Total revenues**	**207.087**	**100%**	**207.921**	**100%**	**254.826**	**100%**
1.1.	Revenues from the business	198.493	96%	204.973	99%	252.197	99%
1.2.	Other revenues	8.594	4%	2.948	1%	2.629	1%
2.	**Expenditures**	**190.694**	**92%**	**215.166**	**103%**	**250.875**	**98%**
2.1.1	Material costs	35.826	17%	38.226	18%	40.904	16%
2.1.2	Salaries	113.217	55%	133.351	64%	150.044	59%
2.1.3	Depreciation	22.512	11%	24.716	12%	25.627	10%
2.1.4	Other	19.139	9%	18.873	9%	34.300	13%
3.	**GROSS PROFIT**	**16.393**	**8%**	**(7.245)**	**-3%**	**3.951**	**2%**
3.1.	Net Interest payment	**11.965**	**6%**	**13.435**	**6%**	**7.416**	**3%**
3.2.	Net extraordinary items	**(38.952)**	**-19%**	**(16.374)**	**-8%**	**(20.651)**	**-8%**
3.3.	Taxes and contributions	-	**0%**	-	**0%**	-	**0%**
4.	**NET PROFIT**	**(10.594)**	**-5%**	**(10.184)**	**-5%**	**(9.284)**	**-4%**

Below are some of the most important findings of the financial performance analysis of the PUC Vodovod - Leskovac:

Profitability and revenues

- Main feature of the profit & loss statement of PUC Vodovod, Leskovac is operational revenue that shows positive operational results of 8% and 2% of total revenues in 2004 and 2006 respectively. During the year 2005, an operational loss was incurred of 3% of total revenues.
- All years, however, show a negative net result, caused by extraordinary items. Net extraordinary items mainly consist of revalued assets, which is recognized as revenues and written down uncollectible debts, which is a cost.
- The company recognizes extraordinary revenues as a result of revaluation of its fixed asset base. Although International Accounting Standards IAS) allow for the revaluation of plant, property and equipment, under the condition that an independent valuation can be carried out, it also prescribes that a revaluation resulting in an increase of the relevant asset should be directly credited to the companies' equity (revaluation reserve) and not be recognized as revenues. To the contrary, a revaluation leading to a decrease of asset value should be recognized as a cost in the profit and loss statement. Therefore, the extraordinary revenues due to revaluation of fixed assets as tated by the PUC Vodovod Leskovac should be re-classified under equity. This would lead the company to report a large net loss during 2006 of RSD 48 million or 19% of revenues;
- Financial performance at a net loss is general practice of PUC Vodovod, Leskovac. Most other PUC's in Serbia operate at around 0% net profit.
- Total revenues of the PUC Vodovod Leskovac ranged from RSD 207 million (€ 2.6 million) in 2004 to RSD 255 million (€ 3.2 million) in 2006. Revenues are mainly comprised of collected revenues for water and wastewater services. In total, revenues have increased by 23% for the period of 3 years. Revenues from business activities are dominant throughout the observed period with 99% of total revenues. This situation is typical for PUC's in Serbia.
- Total expenditures of the PUC Vodovod Leskovac ranged from RSD 191 million (€ 2.4 million) in 2004, to RSD 251 million (€ 3.2 million) in 2006. In 2004 and 2006 total revenues exceeded total expenditures by 8% and 2% respectively. It was only in 2005 that the total expenditures exceeded total revenues by 3%.

Table 5-2 Total Expenditures PUC Vodovod – Leskovac (RSD 000)

No	Description	2004		2005		2006	
		RSD	%	RSD	%	RSD	%
2.	**Expenditures**	**190.694**	**100%**	**215.166**	**100%**	**250.875**	**100%**
2.1	Material costs	35.826	19%	38.226	18%	40.904	16%
2.2	Salaries	113.217	59%	133.351	62%	150.044	60%
2.3	Depreciation	22.512	12%	24.716	11%	25.627	10%
2.4	Other	19.139	10%	18.873	9%	34.300	14%

Expenditures

- Most significant items on the expenditure side of the PUC are salaries and material costs. Salaries ranged from 59% in 2004 to 60% in 2006. This reflects the typical situation of state owned companies, in which labor costs overtime become almost fixed costs. Increase in salaries is strictly prescribed by the Government, through the Ministry of Finance;
- Another large share of total expenditure can be attributed to material costs, which ranged from 16% to 19%. Large expenditures on fuel, electricity and maintenance, are typical for this type of company. However these costs have decreased relatively to total cost during 2006;
- Depreciation costs as a share of total costs are limited to10-12% during the period 2004 to 2006. This reflects the fact that the equipment and other assets are almost completely depreciated with little re-investment or renewal.
- All these indicators reflect the poor financial performance of the PUC Vodovod Leskovac.

5.1.2 Cash flow statements

Table 5-3 Cash flow statement (RSD 000)

Description	2004 actual	2005 actual	2006 Actual
A. CASH FLOWS FROM OPERATING ACTIVITIES I. Cash inflows from operating activities	160.068	188.779	230.529
II. Cash outflows from operating activities	180.038	193.892	230.529
III. Net cash inflow from operating activities (I-II)	-19.970	-5.113	0
B. CASH FLOW FROM INVESTING ACTIVITIES I. Cash inflow from investing activities	6.415	64.456	533.823
II. Cash outflow from investing activities	7.404	11.296	538.379
III. Net cash inflow from investing activity (I-II)	-989	53.160	-4.556
C. CASH FLOW FROM FINANCING ACTIVITIES I. Cash inflow from financing activities	12.181	0	2.750
II. Cash outflow from financing activities	707	4.895	2.725
III. Net cash inflow from financing activities (I-II)	11.474	-4.895	25
D. GROSS INCREASE IN CASH	178.664	253.235	767.102
E. GROSS DECREASE IN CASH	188.149	210.083	771.633
F. NET INCREASE IN CASH	-9.485	43.152	-4.531
G. CASH AT THE BEGINNING OF PERIOD	11.991	1.979	45.015
H. CASH AT THE END OF PERIOD	1.979	45.015	40.550

In 2006 **cash inflow from operating activities** increased by 44% compared to 2004, whereas cashoutflow increased during the same period with only 28%. This was due to settling accounts payable and salaries for the employees. On balance, the operational cash flow improved considerably during the period, starting form a large negative operational cash flow during 2004 and 2005 to a balanced cash flow during the year 2006.

Cash inflow and cash outflow from investing activities. Considerable cash inflow and at the same time cash outflow of RSD 533 million, almost € 7 million in 2006 was a direct investment received from the Ministry of agriculture, forestry, and water management and capital subvention from the municipality of Leskovac for completion of the water system Barje regional water supply system.. This extensive investment, of which the maintenance falls under the responsibility of the PUC Vodovod Leskovac, is based on the provisions of the contract signed with the Ministry of Agriculture, forestry and water management in 2004. Actual investments were slightly higher than this, causing a net cash outflow from investment activities.

In 2005 there was no **cash inflow from financing activities**. There is only record of one lease agreement. In 2006 the company took a short term loan of RSD 2.7 million.

Cash outflow from financing activities was for the repayment of the lease and the short term loan of RSD 2.7 million. In 2006, the PUC had on the balance a 0 cashflow as a result of financing activities.

5.1.3 Balance sheet review

The table below summarizes the balance sheet of PUC Vodovod Leskovac during the period 2004 to 2006:

Table 5-4 Balance Sheet (RSD 000)

Description	2004		2005		2006	
	RSD	%	RSD	%	RSD	%
ASSETS	**1.212.944**	**100%**	**1.301.911**	**100%**	**1.857.989**	**100%**
Fixed assets	1.155.789	95%	1.178.194	90%	1.685.562	91%
Current assets	57.155	5%	123.717	10%	172.427	9%
Inventories	13.722	1%	11.763	1%	15.962	1%
Account receivables	41.454	3%	60.632	5%	84.100	5%
Cash and cash equivalent	1.979	0%	45.015	3%	50.004	3%
Accrued/pre-payments	0	0%	6.307	0%	22.361	1%
LIABILITIES	**1.212.944**	**100%**	**1.301.911**	**100%**	**1.857.989**	**100%**
Equity	1.178.368	97%	1.168.184	90%	1.158.900	62%
Losses	10.594	1%	10.184	1%	9.284	0%
Long term reserves	0	0%	0	0%	0	0%
Liabilities	34.576	3%	133.727	10%	699.089	38%
Long term liabilities	1.832	0%	693	0%	0	0%
Long term loans	1.832	0%	693	0%	0	0%
Short term liabilities & Accrued	32.744	3%	133.034	10%	699.089	38%
Short term loans	4.681	0%	2.054	0%	2.750	0%
Accounts payable	21.946	2%	73.529	6%	105.942	6%
Accruals/other ST liabilities	6.117	1%	57.451	4%	590.397	32%

During the period 2004 to 2006 **fixed assets** have increased by 2% in 2005 and 43% in 2006. The large increase during the year 2006 is due to investments in the Barje regional water supply system.

Current assets in this period have increased almost three times. Within current assets, **account receivables** were dominant. In 2005 account receivables increased by 46% compared to 2004. This increase continued at the rate of 39% in 2006. The cash position increased considerable during this period.

However the **Equity** of the company remained in 2004 and 2005 almost on the same level. The share of equity fell to 62% in 2006.

In 2004 the company took one leasing contract for the purchase of a vehicle and had repaid the same in 2005, so that in 2006 there are no outstanding debts from long term contract liabilities.
Account payables for the period increase considerably during the period. The share in total liabilities ranges from 2% to 6%. During the past two years (2005 and 2006), however, the company owed more to its creditors than it was owed to.

A large increase in accruals/other short term liabilities is realized during the year 2006. A breakdown of this amount reveals that it mainly consist of government and municipal capital subsidy to finance the Barje regional drinking water system (RSD 533 million). Since this concerns grants and does no to be repaid by the PUC, the amount should be reclassified under equity, accumulated Government Grants.

For the purposes of analyzing the balance sheets of the PUC and specifically the level of indebtedness and liquidity, the following indicators are used:

- **Net Current Fund (NCF)**: the relation between long term assets (fixed assets plus long term financial investments) and long term funds (own capital plus long term debts/financial obligations). A positive value of NCF is a simple and relatively reliable indicator of soundness of the financial situation of the company;
- **Relation between NCF and stocks**: this is an additional test of company's financial position of liquidity and general indebtedness. Again, a positive value of this indicator reflects a good financial position;
- **Relation between total revenues and net debt**: calculated as the share of fixed assets, other long term investments and stocks, which are financed with borrowed funds. This includes loans, but also receivables and other non-paid financial liabilities. A common benchmark is that borrowed funds expressed as a share of total revenues should not exceed 10% of total revenues.

Table 5-5 Balance sheet indicators – PUC Vodovod Leskovac (RSD 000)

No.	Indicator	2004	2005	2006
1.	Long term sources (own capital and other long term sources)	1,180,200	1,168,877	1,158,900
2.	Long term assets (fixed assets and long-term investments)	1,155,789	1,178,194	1,685,562
3.	Net current fund - NCF (1-2)	24,411	(9,317)	(526,662)
4.	NCF minus Stocks	10,689	(21,080)	(542,624)
5.	Borrowed sources/Total revenues (general indebtedness)	13.3%	34.7%	40.6%
	Liquidity ratio I, II, III			
6.	Rigorous Liquidity Ratio (Cash/Short term liabilities)	0.06	0.34	0.07
7.	Current Liquidity Ratio (Short term receivables and cash/Short Term Liabilities)	1.33	0.79	0.19
8.	General Liquidity Ratio (Short term receivables and cash and stocks/Short Term Liabilities)	1.75	0.93	0.25

The main findings regarding the balance sheet review of The PUC Vodovod, Leskovac are:

- A common benchmark is that General Liquidity ratio should be 2, and Current liquidity ratio and Rigorous liquidity ratio should be 1.
- ***General liquidity ratio.*** The PUC was close to reaching the ratio of 2 in 2004, but had achieved only 1.75, meaning that short time liabilities were not covered well by working capital. In the later years this proportion worsened to decrease to 0.25 in 2006. ***Current liquidity ratio*** shows good performance of the PUC for the observed year 2004, after which it also deteriorates to 0.19 in 2006. However, ***rigorous liquidity ratio*** over the observed period shows actually that the PUC has extremely serious problems in covering short term liabilities, since it is dramatically less than 1, and in 2006 it was only 0.07. As elaborated further in the text, lack of cash for current operating activities, jeopardizes the liquidity of the company. These indicators would improve of the large government grants received would be reclassified as equity.
- ***Net current fund*** was positive value during the year 2004, but was negative during the next two years. The indicators of indebtedness are relatively high in the range of 13.3% in 2004 to 40.6% in 2006. This reflects an active investment activity of the PUC. Again, if the Government grants received during the year 2006 would be reclassified under equity, the net current fund would be only slightly negative.

5.1.4 Capital structure

The PUC Vodovod Leskovac was founded in 1954. The PUC, like the majority of public utility companies in Serbia, is organized as a 100% state owned company. Therefore, the Municipality of Leskovac has a majority right of management. There has not been a change in the capital structure since founding of the PUC Vodovod Leskovac.

Table 5-6 Ownership structure (2006)

No	Capital	'000 RSD	Structure (%)
1.	Legal reserves		
2.	Shareholders capital		
3.	Public capital	1,167,349	100%
4.	Other capital		
	Total Capital	**1,167,349**	**100%**

5.1.5 Water and waste water tariffs, revenue and collection rates by customer group

Tariffs for utility companies are regulated and capped by the Ministry of Finance since the year 2006. The current general policy is that tariffs are not allowed to be increased beyond the year's estimated inflation. For the year 2007, the maximum tariff increase has been set at 7.5%, and 9.3% for the year 2006. For this reason, PUC's are currently severely constrained in applying a full cost based tariff setting approach. In general, water and waste water tariffs are already at below cost recovery levels, whereas considerable investments will be required to rehabilitate existing infrastructure, let alone extension of service coverage or introduction of new services like waste water treatment.

Each municipality in Serbia has its own policy of deciding on the moment of tariff increase, often using its power as the PUC owner, and holding the increase for the political or other reasons. Tariffs are often not increased before political elections to maintain social peace.

The last tariff increase occurred in December 2005. Although the PUC Vodovod Leskovac asked for another tariff increase of 9.3% in 2006, it was not approved by the municipality. Also, tariffs have not been adjusted during the year 2007.

The tables below show tariffs invoiced amounts, collected revenue and collection rate during the year 2006, separately for water and waste water. The 2007 current tariffs are the same as stated in the tables below.

Table 5-7 Tariffs and collection rates for water services in 2006 (RSD '000)

No	Consumers/ categories	Tariff m3 (no VAT)	Consumption in '000 m3	Annual revenue in RSD '000	Average collection rate%	Revenue collected
1	**2**	**3**	**4**	**5(3x4)**	**6**	**7(5x6)**
1	Households	15.62	4,711	73,591	82%	60,345
2	Households owning business premises	19.84	198	3,925	80%	3,140
3	Consumers with Network / no water meter	15.62	57	897	89%	713
4	Industry/businesses	52.84	1,107	58,478	53%	30,976
5	Universities and hospitals	32.80	269	8,829	83%	7,328
6	Schools/culture/sports	19.37	153	2,965	95%	2,817
7	Army	18.18	220	3,996	66%	2,637
8	Public companies	64.51	91	5,866	74%	4,341
9	PUC's	32.18	52	1,683	71%	1,195
	Total		**6,859**	**160,231**	**71%**	**113,492**

Tariffs for water supply are differentiated by nine customer groups, with the highest tariff set for the business category and public companies at respectively RSD 52.84/m3 and RSD 64.51/m3. The lowest tariff is charged to households at RSD 15.62/m3. This differentiation is not based on actual cost of service, but rather on the perceived ability to pay. The PUC Vodovod Leskovac does not have a category of low income customers with subsidized tariffs, like in some other PUC's in Serbia.

The overall collection rate is low at 71%, even if compared to other PUC's in Serbia. The main contributor to this low collection rate is the industry/business category, from which only 53% of invoiced revenues were collected during the year. This has a relatively large impact, since invoiced revenues from this customer group is 36% of total invoiced revenues.

Table 5-8 Tariffs and collection rates for sewage collection services in 2006 (RSD '000)

No	Consumers/ categories	Tariff/m3 (no VAT)	Consumption in '000 m3	Annual revenue i n RSD '000	Average collection rate%	Revenue collected
1	**2**	**3**	**4**	**5(3x4)**	**6**	**7(5x6)**
1	Households	3.13	3,363	10,527	82%	8,632
2	Households owning business premises	3.94	148	584	80%	467
3	Consumers with network/ no water meter	3.13	54	170	80%	136
4	Industry/businesses	10.39	1,089	11,310	53%	5,994
5	Universities and hospitals	7.61	280	2,131	83%	1,769
6	Schools/culture/sports	3.76	131	494	95%	469
7	Army	4.13	219	904	66%	597
8	Public companies	12.74	89	1,135	74%	840
9	PUC's	6.39	49	315	71%	224
	Total		**5,423**	**27,571**	**69%**	**19,128**

Waste water tariffs are set at 20% of the drinking water tariffs. Waste water tariffs are charged pro-rata the quantity of drinking water consumed, without applying a factor water to waste water (usually, wastewater actually discharged into the sewer system is less than the quantity of drinking water consumed).

Total collection rate for sewage collection services is even lower than drinking water at 69%. The same collection pattern as for drinking water is achieved, which is not surprising since both services are invoiced in one bill. The impact of the industry/business category on overall collection rate is even higher, since the portion of invoiced revenues of the total reaches 41%. This ratio is higher than drinking water invoiced revenues, because relatively more industries are connected to the sewage collection system, or have their own water source and only make use of sewage collection services.

Finally, the tables below summarize the data by three customer groups:

- Households;
- Industry/commerce;
- Public sector/institutes.

This is the most common tariff differentiation as seen in other PUC's within Serbia. The same differentiation will be used in the financial analysis in paragraph 5.3 of this chapter.

Table 5-9 Summary tariffs and collection rates drinking water services (2006)

No	Consumers/ categories	Consumption in m3	Annual revenu (RSD '000)	As % of total invoiced revenues	Average collection rate %	Revenue collected (RSD '000)	Average tariff/ m3
1	Households	4,768,790	74,488	46%	82%	61,058	15.62
2	Industry/ business	1,106,699	58,478	36%	53%	30,976	52.84
3	Public sector/ institutes	983,129	27,264	17%	79%	21,458	27.73
	Total	**6,858,618**	**160,231**	**100%**	**71%**	**113,492**	**23.36**

Table 5-10 Summary tariffs and collection rates sewage collection services (2006)

No	Consumers /categories	Consumption in m3	Annual revenu (RSD '000)	As % of total invoiced revenues	Average collection rate %	Revenue collected (RSD '000)	Average tariff/ m3
1	Households	3,417,570	10,697	39%	82%	8,768	3.13
2	Industry/ business	1,088,588	11,310	41%	53%	5,994	10.39
3	Public sector/ institutes	917,085	5,564	20%	78%	4,366	6.07
	Total	**5,423,243**	**27,571**	**100%**	**69%**	**19,128**	**5.08**

Table 5-11 Overall summary tariffs and collection rates (2006)

No	Consumers /categories	Annual revenu (RSD '000)	As % of total invoiced revenues	Average collection rate %	Revenue collected (RSD '000)
1	Households	85,185	45%	82%	69,826
2	Industry/ business	69,788	37%	53%	36,970
3	Public sector/ institutes	32,828	17%	79%	25,824
	Total	**187,802**	**100%**	**71%**	**132,620**

PUC Vodovod Leskovac invoiced in total RSD 188 million (€ 2.4 million), out of which RSD 133 million was collected (€ 1.7 million).

Overall, households account for the largest share of invoiced revenues at 45% and have the highest collection rate at 82%. In terms of invoiced revenues, industries/commerce closely follows households with 37% of invoiced revenues. However, collection rates for this customer group are much lower at 53%.

Collection rates at this level are unsustainable and will need to be improved, if tariffs are to be set at reasonable levels. Especially the low collection rates for industry/businesses will need to be improved.

5.1.6 Cost structure water and wastewater services

Cost structure

PUC Vodovod Leskovac records all its costs at company level. No breakdown is available for costs by service or place of origin. Therefore, for the purposes of estimating costs incurred for water and waste water and to arrive at an estimate of variable and fixed costs, data had to be extracted manually from the companies' financial accounts.

Certain costs vary directly with each increase or decrease of production units. For example, electricity consumption will increase if more water is produced from the PUC's drinking water wells or treated at the drinking water treatment plant. These costs are called variable costs. For this study, the following variable costs are identified:

- Electricity consumption
- Fuel consumption
- Chemical consumption

Other costs do not directly fluctuate in the short run when production is increased. These costs are known as fixed costs. The following costs belong to this category:

- Wages & salaries
- Repair & Maintenance
- Taxes and fees
- Depreciation

For the purpose of the financial analysis, the PUC has divided the company into four departments, subdividing costs into fixed and variable for each department:

- Waste water department
- Drinking water supply;
- Construction sector, where planning and actual technical constructing is the scope of activities
- Financial and general department overhead costs. This includes costs for the financial & accounting unit, sales department, customer service, billing & collection. It also includes costs for general management, department for investment and development as well as human resources and legal affairs department.

An organization chart of the current PUC organization is included in chapter 7. The PUC within its organizational chart has strictly divided people and equipment within the water supply, wastewater and construction department. But in case of urgent repairs, leakages or lack of staff for interventions, staff and equipment is used flexible. Sharing of especially the skilled labor between departments is quite a frequent practice. Therefore, it should be kept in mind that costs cannot be divided strictly between the various identified departments. Despite this, it is believed that the table below provides the best available estimate of direct costs incurred by service. The cost breakdown is inclusive of extraordinary expenditures, which mainly consist of write downs of doubtful debt.

Table 5-12 Cost breakdown for different services (RSD)

	2006	**2007 plan**
Water supply		
Variable costs	17,578,972	17,635,173
Fixed costs	143,820,751	153,556,559
Subtotal	**161,399,723**	**171,191,732**
Water supply/total costs	53%	53%
Wastewater		
Variable costs	995,677	1,023,710
Fixed costs	27,808,290	29,255,927
Subtotal	**28,803,967**	**30,279,637**
Wastewater/total costs	9%	9%
Construction section		
Variable costs	2,449,576	2,462,452
Fixed costs	43,791,196	47,828,304
Subtotal	**46,240,772**	**50,290,756**
Construction/ total costs	15%	15%
Overhead costs		
Fixed costs	66,937,975	72,488,107
Overhead/total costs	22%	22%
Subtotal Variable costs	**21,024,225**	**21,121,335**
Subtotal Fixed costs	**282,358,212**	**303,128,897**
Total costs	**303,382,437**	**324,250, 232**

Fixed costs account for by far the largest share of total costs with more than 90%. This is mainly comprised of wages and salaries, as well as large write downs of bad debt. Variable costs are small at less than 10%. Drinking water costs are the largest cost component with more than 50%. Overhead costs are high at 22% of total costs.

The share of total variable and fixed costs of the wastewater department in total costs of the company vary and are low due to the fact that the company does not treat waste water and thus does not consume a lot of chemicals or electricity. The company only uses limited electricity for sewerage pumps. Total sewage collection services only account for 9% of total costs. The share of variable costs in total costs will increase considerably once the new wastewater treatment plant starts to operate.

Since the PUC does not have a decentralized financial management system which allocates overhead to various (productive) departments, the following methodology is used to arrive at an estimate of total water/wastewater costs, including overhead:

- First, total overhead costs are calculated. For PUC Vovodod Leskovac, overhead costs only consist of the costs of the overhead department as defined above;
- Next, for each of the productive departments, including the construction department, the total gross payroll costs are determined;
- Finally, total overhead costs are divided over the various productive departments pro-rata their share in gross payroll.

The rationale for this methodology lies in the assumption that the majority of overhead costs (office costs, human resources costs, financial accounting etc) are directly related to the number of people employed by each of the productive departments.

Application of this methodology leads to the following costs. Since the focus of this study is on the water and waste water activities, only these departments are highlighted, with a more detailed breakdown of costs:

Table 5-13 Cost breakdown water supply including overhead (RSD '000)

Item	2006 actual	2007 plan
Variable costs	**17,579**	**17,635**
Liquid chlorine	418	446
Electricity	15,903	15,919
Fuel and oil	1,258	1,271
Fixed costs	**190,648**	**204,267**
Wages and Salaries	50,741	55,308
Employee benefits	9,087	9,996
Other benefits	1,852	2,068
Other materials	6,395	6,843
Transport services	-	-
Repair services	4,271	4,968
Other services	4,350	5,220
Taxes and fees	2,507	2,510
Depreciation	15,526	16,080
Other costs	49,092	50,565
Overhead	46,827	50,710
TOTAL	**208,227**	**221,902**

Table 5-14 Cost breakdown waste water collection including overhead (RSD '000)

Item	2006 actual	2007 plan
Variable costs	**996**	**1,024**
Liquid chlorine	795	821
Electricity	201	203
Fuel and oil	-	-
Fixed costs	**33,200**	**35,094**
Wages and Salaries	5,842	6,368
Employee benefits	1,046	1,150
Other benefits	230	257
Other materials	1,062	1,156
Transport services	-	-
Repair services	127	148
Other services	328	394
Taxes and fees	590	601
Depreciation	7,469	7,736
Other costs	11,115	11,446
Overhead	5,391	5,838
TOTAL	**34,195**	**36,118**

Cost recovery

As a general rule, in the analysis of this PUC and in the PUC's alike, full cost recovery can only be achieved through economically set tariffs. From the profit & loss it can be concluded that for the PUC as a whole, tariffs are insufficient to cover the operating costs, since the PUC operates at a net loss. However, it should be kept in mind that the PUC receives third party revenues because of the operations of its construction department. A large part of this revenue is paid for by Leskovac municipality, some of which is possibly an operational subsidy. Therefore it is also important to see to what level the costs of the construction department are covered by the proceeds of this construction activity, whether provided as a subsidy or revenues generated from other parties.

The table below sets out the pro-forma profit and loss statement of PUC Leskovac with the following amendments:

- Extraordinary revenues amounting to RSD 38,348 thousand, mainly comprised of revaluation of fixed assets, are omitted;
- Extraordinary costs amounting to RSD 58,999 thousand, mainly comprised of write off of bad debt, is included in the costs by service;
- Revenues and costs are grouped by service/cost centre instead of by cost category including overhead charges.

The pro-forma statement would result in large operational loss at company level.

Table 5-15 Pro-forma profit & loss PUC Vodovod (RSD '000)

Description	2006
Revenues	**254,826**
Water supply	160,231
Waste water	27,571
Extraordinary revenues	-
Construction activities	67,024
Costs	**303,382**
Water supply	208,227
Waste water	34,195
Construction activities	60,960
Gross profit/(loss)	**-48,556**
Gross profit margin	-19%

Water and waste water activities would result in the following pro-forma profit & loss statement:

Table 5-16 Pro-forma profit & loss water and waste water activities PUC Vodovod (RSD '000)

Description	2006
Revenues	**187,802**
Water supply	160,231
Waste water	27,571
Extraordinary revenues	-
Costs	**242,422**
Water supply	208,227
Waste water	34,195
Gross profit/(loss)	**-54,620**
Gross profit margin	-29%

It can be concluded from the table that the 2006 tariffs are not sufficient to cover the current costs. Since the tariffs have not been adjusted during 2007, most likely the results will have worsened. A continuation of this trend would deteriorate the financial sustainability of the company. It is therefore clear that an adjustment of the tariffs would be required, independent form implementation of the project.

5.1.7 Assets

Except for land, capital assets are depreciated each year and the total accumulated depreciation is deducted from the original cost. With the exception of land, capital assets wear out in time or otherwise lose their economic usefulness. Between the time when a given asset is acquired and when it is no longer economically useful, a decrease in its value takes place. This loss in value over a period of years is known as depreciation.

Depletion is a term applied to tangible fixed assets, whereas amortization is a term sometimes used to describe the writing off of intangible assets such as patents and trademarks.

All purchases during the observed years 2004 to 2006 are valued at historical cost. Depreciation is calculated based on the historical value of the real estate, installations and equipment, and intangible assets, applying the linear method.

Table 5-17 Plant and equipment at 31.12.2006 (RSD '000)

No.	Item	Land	Buildings/	Equipment	Plants/ equipment in preparation	Advances /plants and equip.	Total
1	Purchase value 31.12.05	23,112	960,303	92,047	654,237	7,622	1,737,321
2	Additions		16	10,373	519,352	4,501	534,242
3	Disposals		48	4,291		1,046	5,385
4	End of year 31.12.2006 (1+2-3)		960,271	98,929	1,173,489	11,177	2,266,178
5	Accumulated depreciation 31.12.2005		479,767	79,491			559,258
6	Depreciation during the year		21,181	4,350			25,531
7	Disposals during the year		27	3,942			3,969
8	End of year 31.12.2006 (5+6-7)		500,921	79,899			580,820
9	Net book.val. 31.12.2006	23,112	459,350	18,330	1,173,489	11,177	1,685,358
10	Net book.val. 31.12.2005	23,112	480,536	12,566	554,237	7,622	1,178,063

Total net asset value for plant and equipment as at 31 December 2006 is RSD 1,685 million or € 21 million, a large increase compared to 31 December 2005 when net fixed assets amounted to RSD 1,178 million or € 15 million. Main addition was caused by the Barje regional water supply system.

A major item of the plant and equipment is accounted for under work in progress. This mainly relates to the Barje regional water supply system and partly to the city sewer collector. Since these projects are not in use yet, the assets are not depreciated.

As we have seen earlier through the analysis of the Profit and Loss statement, depreciation costs are generally very limited at around 10% of total costs during the period 2004 to 2006. This proves the fact that the equipment and other assets are almost entirely depreciated. The depreciation charge will increase dramatically as soon as the Barje regional water supply system will become operational. Currently, it is expected that the system will be operational as from the year 2009.

The major categories of assets related to water and waste water are depreciated annually at the following rates:

- Buildings and civil works:
  - Head office 2.5%;
  - Water distribution network 2.5%;
  - Pumping stations 1.5%;
  - Wells 10%;
  - Other buildings / water treatment 2.5%;
  - Other buildings / water supply network 8%;
  - Other buildings / waste water treatment 2%;

For mechanical and electrical equipment, the following rates are used:

- Electrical equipment on capital objects 8%;
- Other mechanical/electrical equipment 6% - 10%;

These rates are in accordance with the government regulation, and are applied respecting the instructions from the Treasury department. By these instructions, fixed assets are depreciated annually, at the end of the fiscal year (some of the other PUC's we have analyzed, that also operate rendering water and waste water services, do not follow this practice). The company reported that at the year end, a committee within the company is formed, that writes off all the assets they decide are subject to final disposal.

5.1.8 Extraordinary revenues and expenditures

As it was elaborated on in the analysis of the Profit and lost statement, large extraordinary revenues in the PUC Vodovod Leskovac are the result of the asset revaluation. Extraordinary expenses are mainly comprised of written down bad debt.

5.1.9 Financial self sufficiency and the current use of profits

In our analysis of the PUC Vodovod, Leskovac, and through the practice in analyzing other PUC's in Serbia, it is evident that none of these companies is capable of functioning on its own. At best, tariffs are sufficient to cover the direct operating costs. Investments usually are funded directly by the municipality, since these cannot be funded by the PUC from internally generated cash flow. As a result of negative profits and a low depreciation charge, the generated cash flow is low or even negative.

The PUC is limited in setting its own tariffs. Any tariff adjustments need to be approved by the municipal council, and since 2006 are regulated by the Ministry of Finance.

Any profits made are added to the internal reserves of the company, rather than paid out as dividend.

5.1.10 Billing and collection system

In respect to outstanding debts the PUC Vodovod, Leskovac has a clear policy. Consumers are charged monthly, after which regular reminders are sent for unpaid invoices. PUC Vodovod Leskovac is rather flexible when it comes to sending reminders to their consumers, both legal entities and households. After sending a reminder to the legal entity, stating that the entity has approximately 7 to 10 business days to settle their past due obligations, the PUC than gives them a "grace" period of up to 4-5 months before these entities are either sent to court or disconnected. In respect to households, the policy of the PUC is even more liberal, and after sending reminders, the company usually waits six months before sending this consumer category to court.

Courts in Serbia are however rather slow in addressing complaints and it may take up to several years before any court decision actually emerges. However, only upon reaching court decision, the PUC, has the legal right to write off their outstanding debts. This practice is not in line with international accounting standards (IAS) and might lead to the underreporting of expenditures and liabilities of the company.

With the current system, a collection rate of 71% is achieved during the year 2006. This is not very high, so the company has to look for the alternatives to improve this figure. A number of measures could be considered, such as:

- A stricter policy towards both individual and legal consumers, by shortening the period of sending them to court for outstanding payments. A tolerance for 4-6 months for the households should be cut down to a more reasonable time.
- For metered customers, a monthly estimate could be made and invoiced, based on their past consumption patterns. Meter reading could then be done on an annual basis, followed by a final settlement;
- Introduce interest or late payment penalty fees;
- Introduce financial incentives to invoice collectors, by linking cash collected to remuneration;
- Establish a clear disconnection and reconnection policy, backed by the municipality and council.

5.1.11 Financial management and budgeting practices and systems.

<u>Budgeting system & investment planning</u>
Once per year, a consolidated annual plan and budget is submitted to the Municipal Council for approval. This budget contains:

- A review of last year's operations, including financial overview (budget/realized);
- A descriptive part setting out the plan for the next year;
- A cost/spending budget for the next year;
- An investment plan for the next year, including financing plan;
- A proposed tariff structure for the next year;
- A proposal for operational subsidies from the Municipality.

If approved, this annual plan forms the basis of the operations for the PUC. Problems with this system are:

- Only a 1 year investment and financing plan is prepared. Investments in water/waste water infrastructure are long term in nature, necessitating long term planning and its financing as well;

- Management of the budget is centralized. Monthly management reports compare (cumulative) actual expenditure against the approved budget at the level of the PUC only. No budgets are made available by service line, managed by department heads, nor are costs reordered by service line. Such a hierarchical management system prevents flexibility of operations and actually might lead to higher cost.
- Limited information is available on the actual costs by service; setting of cost based tariffs is therefore next to impossible.
- Operating of the company is only partly computerized; even basic data are recorded in hard copy, not systemized, easily susceptible to incorrect entries. Only limited number of computerized reports can be generated.

Short term financing

In order to maintain uninterrupted functioning of its company, the PUC has two ways of providing necessary financial means. It is either through borrowing from commercial banks, or through municipal subventions. In respect to subventions from the Municipality of Leskovac, the PUC Vodovod has to follow a rather strict procedure in order to obtain any funding. The PUC has to provide a list of documents that is often more extensive than the list of documents required by a bank for a commercial loan. However, the PUC Vodovod Leskovac would rather request subventions, since this is interest free.

PUC Vodovod Leskovac borrowed from Banka Intesa one short term loan for RSD 5.5 million to support their employee's seasonal purchase of coal and wood for winter heating. The loan signed in October 2006 was for a 1 year period, to be repaid in 12 semi annual installments, first installment falling due in October, the last to be paid in March 2007. The interest rate calculated on the loan was 0.95% and the front end fee 0.5%.

The major problem every PUC in Serbia faces is the problem of generating cash, and this is mainly the reason for taking short term loans. The PUC Vodovod Leskovac has problems with the Urban Directorate, and other debtors, that are mainly causing this cash shortage (as elaborated above), and forcing the company to find alternative ways of providing uninterrupted services.

Long term financing

In 2006 the PUC Vodovod Leskovac, did not take any long term loans, nor did it have any outstanding payment obligation in respect to the lease contract signed in 2004

5.1.12 Accounts receivable and bad debts

Accounts receivable

The table below shows a list of major debtors of the PUC Vodovod Leskovac for the year 2006. The highest debtor is Direkcija za izgradnju (Urban directorate of Leskovac municipality), which makes up in 2006 a total of 46% or almost half of the total accounts receivable. In 2005 this ratio was lower at 31%, and the increase of 15% shows that the problem is still continuing in 2006. The PUC Vodovod Leskovac signs bilateral contracts with Direkcija za izgradnju (Urban directorate) for the operations that are within the scope of activity of the PUC Vodovod. Apart from its regular activity, water supply and wastewater removal, the PUC covers many other activities, such as maintenance of public fountains, rough civil engineering and ground works, for the maintenance of the water and wastewater network, production, collection and distribution of water steam and warm water for district heating, and other related activities.

The settling of outstanding debt with Direkcija za Izgradnju is an issue of continuous negotiations, and the PUC Vodovod Leskovac has problems to fund its operating activities.

Table 5-18 Major debtors PUC Vodovod Leskovac 2005

No	NAME	place	RSD ('000)	%
1	URBAN DIRECTORATE	LESKOVAC	18.784	31%
2	GRADITELJ	LESKOVAC	7.357	12%
3	ZDRAVLJE	LESKOVAC	5.999	10%
4	POLJOPRIVREDA	LESKOVAC	4.600	8%
5	PORECJE VUCJE	LESKOVAC	3.890	6%
6	CRNA TRAVA	LESKOVAC	3.636	6%
7	TOMA KOCUR	LESKOVAC	3.288	5%
8	7 JULI	LESKOVAC	1.424	2%
9	BALKAN	LESKOVAC	1.291	2%
10	PARUNOV CENTAR	LESKOVAC	1.202	2%
	TOTAL		**51.471**	**85%**
	Account receivables		**60.632**	**100%**

Table 5-19 Major debtors PUC Vodovod Leskovac 2006

No	NAME	place	RSD (000)	%
1	URBAN DIRECTORATE	LESKOVAC	39.055	46%
2	ZDRAVLJE	LESKOVAC	5.105	6%
3	7 JULI	LESKOVAC	2.882	3%
4	ZDRAVSTVENI CENTAR	LESKOVAC	2.134	3%
5	BALKAN	LESKOVAC	2.679	3%
6	JUGODRVO	LESKOVAC	2.610	3%
7	JUGOEKSPRES	LESKOVAC	1.540	2%
8	CRNA TRAVA	LESKOVAC	874	1%
9	LIVNICA	LESKOVAC	846	1%
10	NEVENA	LESKOVAC	428	1%
	TOTAL		**58.153**	**70%**
	Total account receivable		**84.100**	**100%**

At the end of the year 2005, total accounts receivable were RSD 61 million (or € 763 thousand), to increase in 2006 to RSD 84 million (or € 1 million). In 2005 companies like Graditelj, a civil engineering company and again Zdravlje, the pharmaceutical company owed to the company 12% and 10% respectively.

Other debtors like private companies Zdravlje, pharmaceutical factory and 7 Juli, a civil engineering company, owed to the PUC in 2006 6% and 3% respectively. The ten major debtors made up 85 % in 2005 and 70% in 2006 of total accounts receivable.

Bad debts

As discussed earlier in this chapter, PUC Vodovod, Leskovac has a collection rate of 71% for all customer categories combined. This low collection rate leads to substantial bad debt provisions. As was discussed above, this bad debt is recognized as an extraordinary expense in the companies' profit and loss account. In 2006 it is estimated that RSD 59 million (€ 0.75 million) is written off or provisioned for as bad debt. This has a major impact on the companies' financial results and in the long run is unsustainable.

5.1.13 Account payables

At the end of the year 2005, PUC Vodovod Leskovac owed their 10 largest creditors a total amount of RSD 58 million, or € 0.73 million. The 10 largest creditors accounted for 79% of the total account payables. For the year 2006, total accounts payable increased to RSD 106 million (€ 1.3 million). Out of this, the 10 largest creditors had claims totaling RSD 85 million or 80% (€ 1.1 million)

Table 5-20 Major Creditors PUC Vodovod Leskovac 2005

No	Creditor	City	RSD (000)	%
1	PROJEKTNI BIRO	CRNA TRAVA	42.427	58%
2	ELEKTRODISTRIBUCIJA	LESKOVAC	3.437	5%
3	DDOR NOVI SAD	NOVI SAD	3.055	4%
4	UNIPROSTOR	LESKOVAC	3.032	4%
5	CISO	ZEMUN	1.930	3%
6	VELIKA MORAVA	LESKOVAC	1.115	2%
7	VITRAKO	LESKOVAC	1.066	1%
8	KRAFT	LESKOVAC	859	1%
9	ELEKROGRADJEVINSKO PRED.	LESKOVAC	682	1%
10	NIM HOLDING	LESKOVAC	657	1%
	TOTAL		**58.260**	**79%**
	Accounts payable		**73.529**	**100%**

Table 5-21 Major Creditors PUC Vodovod Leskovac 2006

No	Creditor	City	RSD (000)	%
1	JEDINSTVO	SEVOJNO	31.341	30%
2	CRNA TRAVA	LESKOVAC	22.665	21%
3	VELIKA MORAVA	LJIG	13.931	13%
4	2200 NOVI SAD	NOVI SAD	4.990	5%
5	UNIPROGRES	RUMA	3.662	3%
6	JUGOISTOK	LESKOVAC	2.468	2%
7	AKVAPAN	CACAK	1.757	2%
8	FORTUNA	LESKOVAC	1.615	2%
9	EUROOPREMA	BEOGRAD	1.280	1%
10	PUT	LESKOVAC	1.085	1%
	TOTAL		**84.794**	**80%**
	Accounts payable		**105.942**	**100%**

In 2005, the major creditor of the PUC Vodovod, Leskovac was Projektni biro, Crna Trava, a civil engineering company, dealing with spatial planning. To them the company owed over half of their total debt, or 58%. To all the nine other creditors, the company owed between 1% and 5% of total accounts payable.

Three major creditors in 2006 were the companies: “Jedinstvo”, Sevojno, which produces and installs hydro - installations and equipment, Crna Trava, Leskovac, a civil engineering company, and Velika Morava, Ljig. To these three companies the PUC owed respectively 30%, 21% and 13%, or in total 64%, out of 80% that was owed to the ten major creditors.

Until now, the creditors have not imposed any legal measures against PUC Vodovod, Leskovac. The existing debts toward creditors are settled by means of negotiations and good business practice. Creditors are ready to wait for the PUC and the only measure imposed, is usually an interest and/or penalty fee. The PUC has not experienced any disruptions of their ordinary activities because of the delay in payments.

5.1.14 Non cash settlements

The PUC Vodovod, Leskovac does not have any operating activities that are covered through non cash settlements.

5.1.15 Tax settlements

Main taxes payable by the PUC are value added tax (VAT) and payroll related taxes and statutory contributions. Corporate tax is also applicable; however in the absence of profits this is usually negligible.

PUC Vodovod, Leskovac follows the regulations prescribed by the Law on Value Added Tax which states that VAT has to be paid on the 10th of the current month for the previous month. Regulations for taxes on salaries and all other taxes payable to the tax authorities are also prescribed by law for settling each category of taxes.

All of these taxes are paid in cash. No evidence was found on any in kind tax settlements.

5.1.16 Summary and conclusions

Main findings:

- PUC Vodovod Leskovac operates consistently at below 0% net profit;
- The companies’ net loss would be even bigger if the current practice of recognizing revalued fixed assets as revenues in the profit and loss statement would be omitted;
- Labor cost is the single largest cost item at 60 of total costs, during the year 2006;
- Depreciation costs are relatively low and range between 10% and 12% of total costs;
- The company operates at a slight negative operational cash flow. Overall net cash flow is negative during the years 2004 and 2006. During the year 2005, a large net cash flow was realized, caused by large municipal and state investment grants;

- The generated operational cash flow is insufficient to finance investments; most investments are funded directly by the Municipality or are provided for with capital subsidies from other sources;
- There is no tariff setting formula or procedure, since it is currently national policy to cap tariff increase with the estimated inflation for the next year. The company did not even use this possibility, since tariffs have effectively not been increased since December 2005;
- Collection rate for the company on the whole is low at 71% during 2006. This is not sustainable in the long run;
- For the PUC as a whole, current water and waste water tariffs do not cover operating costs including depreciation and bad debt. The level of operational subsidies and the costs which they are supposed to cover is difficult to precisely assess in the absence of a cost centre based financial management system;
- The PUC prepares annual plans and budgets, in conformity with guidelines provided by the Ministry of Finance. There is no multi year planning, integrated with this annual planning & budgeting cycle;
- Management of the budget is centralized at director level;
- The top 10 of large debtors account for 85% of total accounts receivable during the year 2006. Largest debtor is the urban directorate of the municipality of Leskovac, owing to the company 46% of the total debt;
- The top 10 of largest creditors account for 80% of total accounts payable, which is highly concentrated. Main creditor Jedinstvo, Sevojno, a producer of contractor of hydro - installations and equipment, accounted for 30% of the total during 2006.

Main recommendations:

- Review and improve current collection system with the aim to increase the collection rate, revenues and cash flow. Both billing hardware/software and collection procedures can be improved. This has the highest priority, since current collection rates are unsustainable.
- Review and improve the existing bad debt policy, including provisioning for bad debt, and make a one time clean up of the debtor database/accounts payables;
- Reform or introduce a company's policy on reducing tolerance for non-paying customers. For example by shortening the period of tolerance, introduction of interest on late payment; introduction of discounts on prompt payments;
- Improve current financial management system by establishing a cost centre based financial management system. In relation to this, establish a more decentralized budgeting and financial management system;
- Based on the improved financial management system, agree on a cost based tariff setting formula or procedure. This is also useful if tariffs continue to be capped, since it serves as facts based information on the required level of tariff;
- Establish a long term financial planning system and integrate this with the annual planning & budgeting cycle;
- Make an inventory of the existing physical asset database and verify these with the financial fixed asset register.

5.2 Creditworthiness asseaament of Leskovac Municipality

5.2.1 Introduction

PUC Vodovod in Leskovac is founded and owned by the Municipality of Leskovac. Its functioning is under the direct influence of the local government, which is reflected in all segments of its operations, especially in relation to financial matters. The managing board of the PUC Vodovod in Leskovac is established in such a way that local government representatives are forming the majority. The managing board of the PUC is entitled to propose tariffs for the services that the PUC is delivering to the citizens. The proposals become effective after municipal assembly approval.

In order to support low income households, tariffs are usually set at a minimum level, that is, at a level at which the PUC can cover their operating costs only without making any profit. As for depreciation costs, which are supposed to recover investments, made for long term assets, the PUC is including this item in its costing schemes in accordance with the accounting and other laws and regulations. However, the problem is that the assets of Serbian PUC's were worn out during the 1990-ties with hardly any re-investment or capital replacements taking place. Thus, PUC's were effectively financing their operations - and very often some other social needs - on the expense of their capital asset base. As a result of this policy, most of today's PUC's have a low capital base with corresponding low tariffs. Consequently, they are in a bad position to finance any larger investment from consumer tariffs through internally generated cash flow.

The current situation is that most investments made in Serbian PUC's are financed from the municipal budget. Municipal budgets are the source of direct investments and/or provider of guarantees to the banks for commercial loans. After completion of the investment, the acquired assets are transferred to the PUC's and become part of their balance sheet. PUC's usually do not have any financial obligation against municipal budgets for these assets. To the contrary, if a PUC cannot service its debts, the local government is legally obliged to assume all liabilities and cover the financial obligations.

Therefore, when considering investment in PUC's, it is important to identify the financial position and development of the municipal budget, as well as the financial position of the PUC. The analysis of the budget of Leskovac municipality presented below is based on data from official reports submitted by municipal budget offices to the Ministry of Finance at the end of every budget year, in accordance with the current budget law.

5.2.2 Analysis of the national and local context

The current legal basis for local budget revenues is governed by the Law on Local Self-Government from 2002. Financing of local governments, went through some changes:

- In 2004, local governments' share of revenues based on salary fund tax was discontinued. In order to compensate this decrease in revenues to local budgets, the share of local government in income taxes was increased from 5% to 30%, In addition, the share of sales tax was increased in favour of selected poorer municipalities;
- From January 2005 onwards, sales tax has been replaced with value added tax (VAT). This change affects the way of providing local government budgets with revenues. Instead of sharing the sales tax with central government, the VAT is now

going directly to the central funds, from which local governments are getting current transfers.

- In 2006, a new Law on local government finance has been adopted. The Law became effective on June 23rd, 2007. The main novelty is the decentralization of property tax. Property tax used to be collected by local offices of the National Government and than distributed to local government. By the provisions of the new Law, property tax is directly collected by local government, enabling them to broaden their own tax base/original revenues. Consequently, a unit for collecting property tax is established at the local level and related expenditure is to be borne by local government.

According to the new Law, the local government budgets obtain revenues from three main sources:

- Through local level, where local government can set taxes and collect its own revenues. These are called original revenues, according to the law terminology;
- Through central level, by allocating or sharing the revenues with the central government. These are called shared revenues; and
- Through transfers from central government. This source is defined separately, but since it is coming from central funds it might be considered as a specific type of shared revenue.

Original (own) revenues

The original revenues of local government budgets comprise:

- **Local fees** – administrative, communal and tourist fees;
- **Charges on construction land** – charges for utilization and for development of the city construction land;
- **Other revenues** – include a dozen different revenues (charges for natural resources, charges on sales of assets, interest on deposited budget funds, etc). Generally, revenues generated from this group are small compared to the above two sources. In particular cases these can however provide substantial revenues
- **Self-contribution** – this revenue can be introduced by the decision of citizens made through local referendum. By definition, it is used for development of local capital infrastructure;
- **Donations** – donations could come from different sources such as central level, international organization and other. In this case, they are going directly to the local government;
- **Property taxes** – according to the new Law on local government financing, taxes on property of the private and legal entities are becoming original revenues. This change is important as such, but equally important is the change related to the way how it is collected. After the introduction of this Law (June 23rd, 2007), local governments have taken over part of the central tax administration in order to fully control collection of this revenue. The tax on passing absolute rights is reduced from 5% to 2.5% However during the initial phase, the Republic will for a certain period control the spending of money from tax on passing absolute rights.

Shared (allocated) revenues

The second large group of local budget revenues consists of revenues that are allocated by national level to the local level. According to the legal terminology, these are called allocated revenues. These revenues consist of:

- **Income taxes** – include a number of taxes on different personal incomes generated from different sources: agriculture and forestry, private business activities, immovable property, leased movable property; prizes in games of chance, personal insurance, part of the salary tax and others; This tax was lowered from 18% to 12% by the Law on income tax in 2006.
- **Property related taxes** – include taxes on inheritance and gift tax, on transfer of absolute rights and on goods and services; These taxes have undergone changes within the new Law on local government financing passed in June 2007, by which the tax on passing absolute rights is reduced from 5% to 2.5%,
- **Different charges on assets of public interest** – include charges for the utilization of different assets of public interest like mineral raw materials; river material; forest land; agricultural land, public roads, environmental protection and environment; investments;
- **Privatization revenues** – include part of the funds (5%) collected through the sale of capital in the privatization process that is taking place within the municipal territory;
- **Transfers** – include transfers from central government. Transfers as a specific type of local budget revenues were introduced in 2005 when the sales tax was replaced by VAT. The new Law on local government finance introduces a wide array of transfers: categorical and non-categorical transfers (which include equalization transfers), compensation, transitional, general and block transfers.

The investment capacity and creditworthiness of local budgets depends on the efficiency of the overall local financial management, which includes the capacity for generating revenues as well as the way in which these revenues are spent. Certain revenues are especially important for funding capital expenditure. These are:

- **Land use development charge**. This revenue is directly related to local investments. It is paid by investors who are planning to invest in construction on land within municipal boundaries. The investor is obliged to pay this charge in cases when he is the owner of the specific construction site, but also when he has the right for using it or the right to erect objects on it. The charge is set in accordance with the costs of developing the site, the purpose of the object and the city zone. Setting the base and rate of this charge is under the jurisdiction of local government.
- **Land use charge**. This charge is used to cover the costs of maintenance of local infrastructure and it is set in accordance with the costs of maintenance. This charge is also under the jurisdiction of local government.
- **Revenue from renting the City assets**. Revenues from renting immobile and mobile assets of the local governments are original revenues. They are supposed to be used exclusively for capital investments. But, since this is not strictly prescribed by law, in certain cases they are used for covering costs of current operations.
- **Self-contribution**. Self-contribution is a traditional revenue source of local government that is to be used for capital investment of special local communities needs such as water supply, roads etc. The contribution is raised and set by local referendum.

- **Privatization revenues**. According to the Law on Privatization, 5% of the proceeds received from selling state or socially owned companies on the territory of the municipality is going to the local government budget.
- **National Investment Plan (NIP) funds** The Government of Serbia had by end of the year 2006, for the first time adopted the NIP for the Serbian economy, covering the period the period 2006 – 2011. The NIP covers all vital economic sectors, employing and allocating on a national level the surplus of the funds from the process of privatization. Due to the increase in citizens' savings and the implementation of a number of economic reforms, the budget of the State of Serbia showed a significant surplus, thus making favourable conditions for development of a concise plan on financing public investments. Municipalities were invited to apply for investment funding.
- **Donations**. From the year 2000 donations, especially from international funds, became an important source of funding capital investments at local government level. In the near future, local government is still planning certain financial inflow from this source, but in mid, and especially in longer period, it is expected that this will decrease. It is expected that accession towards the EU will enable further funding through the EU's new Instrument for Pre-Accession (IPA).
- **Transfers**. Transfers are a relatively new type of revenues for Serbian local government. Until 2005 these transfers were relatively small. It is expected that after the introduction of the new Law on local government finance there will be a considerable increase in transfers. It is expected that this source will become very important for local governments.
- **Property tax**. From June 23rd, 2007 local government has taken over the control of property tax from the Republican level. However, effective from the same date, the taxation rate on tax on passing absolute rights lowered from 5% to 2.5%. However, lowering of this tax rate does not mean that the local government will be less motivated to collect this revenue. Establishment of the local tax administration is considered to be a big change as such and it is expected that this might generally increase fiscal capacity of local government in Serbia.

5.2.3 Municipalities financial operations

Municipal Budget Revenues

As mentioned above, the revenues of the Serbian municipalities consist of two main groups of revenues: own or so called original revenues (the revenues that local governments control, both in defining its level as well as in collecting it) and the allocated or so called shared revenues that are collected by and than distributed from the central level. The new Law on local government finance introduces new types of revenues like transfers which in general could be treated as allocated revenues.

One time transfers for capital investments are apportioned through the National Investment Plan, i.e. if the Municipality presents a well grounded plan to the relevant Ministry, for the investment they wish to be financed.

The budget of municipalities is prepared on the basis of unified budget classification system, that is functional, economic and organizational classification in accordance with the Budget System Law. All the revenues are planned based on the budget realization from previous years, and the plan for current year which is in accordance with the Memorandum on the budget for that year (2007).

The data in the tables below show the limited improvement of the financial autonomy of Serbian local governments, which is the result of Ministry of Finance policy during the last 4-5 years.

Table 5-22 Budget revenues Leskovac municipality

No	Type of revenues	2004 a		2005 a		2006 est		2007 plan	
		RSD m	%	RSD m	%	RSD m	%	RSD m	%
1	2	3	4	5	6	7	8	9	10
I	**Original revenues**	**152**	**17**	**234**	**23**	**215**	**17**	**360**	**24**
1.1.	Fees (administrative, communal, tourist)	32	4	36	3	62	5	62	4
1.2.	Land development charge	12	1	138	13	92	7	131	9
1.3.	Property tax		0		0		0	62	4
1.4.	Other	108	12	60	6	61	5	105	7
II	**Allocated revenues**	**720**	**80**	**770**	**74**	**993**	**79**	**1,116**	**75**
2.1.	Sales tax	271	30	-	0		0		0
2.2.	Income tax	254	28	469	45	604	48	529	35
2.3.	Property tax	48	5	55	5	58	5		0
2.4.	Property tax and tax on passing absolute rights	41	5	50	5	71	6	92	6
2.5.	Transfers		0	182	18	257	20	498	34
2.6.	Other	106	12	14	1	3	0	7	0
III	**Privatization revenues**	**10**	**1**	**4**	**0**	**4**	**0**	**5**	**0**
IV	**Credits**		**0**	**20**	**2**	**40**	**3**		**0**
V	**Revenue from previous year**	**16**	**2**	**9**	**1**	**10**	**1**		**0**
	TOTAL REVENUES	**898**	**100**	**1,037**	**100**	**1,262**	**100**	**1,491**	**100**

Original revenues
The most important sources of own revenue are different fees that local governments are entitled to introduce and collect.

The share of own (original) revenues in the Leskovac municipal budget was 17% in 2004 and 2006 and increase in 2005 to 23%. However, the plan for 2007 is to keep the share of original revenues to 24%, mainly as a result of the land development charge and inclusion of property tax from allocated to original revenues.

Compared to the year 2006, the Municipality of Leskovac plans to increase its original revenues during 2007 with 67%. This plan is based on the facts, as presented above, and it is most likely that the Municipality will be able to follow this plan after the switching of property tax collection and introduction of new own revenues sources.

Allocated revenues
The share of allocated revenues changed from 80% in 2004 to 74% in 2005. This change was due to sales tax being replaced by VAT and the introduction of transfers from the Republican level. However, the share of transfers was not as high as the revenue collected through the sales tax. During the following year, 2005, transfers were at RSD 182 millions and increased with 41% during the year 2006. At the start of 2007 and as a result of the new Law on public financing, transfers apportioned to the

Municipality of Leskovac were set at RSD 498 million, 94% year-on-year. This, of course, should not necessarily represent the final amount; due to the fact that additional revenues can also be approved by the Budget rebalance.

With transfers and revenues from property tax, the Municipality will have a significant increase in both own and allocated revenues. The share of income tax in 2007 is lower compared to 2006, because of lowering of this tax from 18% to 12% by the Law on income tax. Despite this, income tax is still the most significant source of allocated revenues.

Despite the decline of income tax revenues, total allocated revenues for 2007 will, according to the plan for that year, record a 12% increase. This is again an increase compared to the year 2006.

Privatization revenues
Revenues from privatization for Leskovac municipality are relatively minor during the period 2004 to 2007. In 2004 privatization revenue was RSD 10 million, declining to RSD 4 million during the year 2005 and 2006. For 2007 it is planned that privatization revenue will remain on the same level. This is supported by the fact that most of the companies in the area are already privatised, and this trend will continue to decrease even more in the near future, since not many industries are left to be privatised.

Credits
In respect to loans, the municipality of Leskovac borrowed funds from two commercial banks to finance part of their capital expenditures. It is reported by the municipality that loans were taken in 2005 and 2006, with a share in total revenues of respectively 2% and 3%. The municipality does not plan to take any loans in 2007.

As discussed further on in this chapter, the municipality has also taken sizable loans to finance part of the city sewer collector and Barje regional drinking water system. These loans, amounting respectively to RSD 116 million signed in 2005 and RSD 316 million signed in 2006 are not reflected in the above statement. It is stated by the municipality that the loans are used to directly pay (part of) the costs incurred for both water infrastructure projects and are thus kept off balance sheet. Since the loans are signed by the municipality and the liability for repayment of principal and interest therefore directly rests with the municipality, municipal accounts should in principle include these.

Revenues from previous years
Any surplus of budget revenues over expenditures in the previous year is brought forward in the next budget year as budget revenue. As can be seen from the above table, the Municipality of Leskovac carried over a revenue surplus of RSD 16 million in 2004, RSD 9 million in 2005 and RSD 10 million in 2006. There is no surplus planned for the year 2007.

Municipal Budget Expenditures
All Serbian municipalities are spending their budget predominantly within the following three areas:

- Financing work of local government administration and governmental bodies, i.e. the municipal council, Mayor office;

- Financing social functions that are under local government competency like education, sport and culture. These institutes are financed by means of transfer of funds; and
- Investments, mostly in local infrastructure.

According to Serbian budget laws, there are no legal restrictions to the use of allocated revenues. These revenues have a general nature. However, for the Serbian municipalities it is compulsory to fund certain social functions like communal services, funding material costs of educational institutions, provision of cultural and sport activities etc. The level of funding of these services and functions is to be decided by the municipality. So, formally local budget expenditures are discretionary, i.e. local governments can independently decide the level of funding for each function.

Having this in mind, it is understandable that the relative share of certain expenditures vary between different Serbian municipalities. Still, a general standard is that municipalities are spending around 1/3 of the total budget to each of the three group of expenditures listed above.

Table 5-23 Budget expenditure Leskovac municipality

No	Type of expenditure	2004 a		2005 a		2006 est		2007 plan	
		RSD m	%	RSD m	%	RSD m	%	RSD m	%
1	2	3	4	5	6	7	8	9	10
I	**Municipal bodies and administration**	**196**	**22**	**276**	**27**	**292**	**24**	**404**	**27**
II	**Social functions (education, sport, culture, welfare)**	**230**	**26**	**300**	**29**	**374**	**30**	**460**	**31**
III	**Reserves**	**21**	**2**	**28**	**3**	**33**	**3**	**36**	**2**
IV	**Funds-residential & others**	**13**	**1**	**101**	**10**	**148**	**12**	**60**	**4**
V	**Agency for urbanism and development**		**0**		**0**		**0**	257	**17**
VI	**Subsidies**	**343**	**39**	**244**	**24**	**283**	**23**	**274**	**18**
1	Current subsidies	95	11	15	1	25	2	69	**5**
2	Capital subsidies	248	28	229	22	258	21	205	**14**
VII	**Self-contribution**		**0**	**-**	**0**		**0**		**0**
VIII	**Other budget expenditure**	**86**	**10**	**77**	**8**	**111**	**9**		**0**
	TOTAL EXPENDITURE	**889**	**100**	**1,026**	**100**	**1,241**	**100**	**1,491**	**100**

The Municipality of Leskovac more or less follows this budget spending pattern, although during the years 2004 to 2006 and the plan for 2007, spending of municipal bodies is a little lower than with a share of 25% on average.

Municipal Investment Expenditures

The above presented data specify at a rather general level budget revenues and spending in relation to different purposes and/or budget beneficiaries. This paragraph provides more details of the capital investment expenditure budget of Leskovac municipality.

In Serbian municipalities, four main mechanisms of financing investments can be distinguished. These are:

- Capital subventions to the municipal entity specifically established to deal with municipal investments and development. Most Serbian municipalities have this kind of entity, usually called the Agency for Construction and/or Development. Till 2005 this organization had the status of an independent public company and as such was financed through subsidies from the municipal budget. In 2005 in accordance with changes in the current law, the Agency was transformed into a direct budget beneficiary. The scope of work of these departments usually includes spatial planning and development and designing and implementation or monitoring of different municipal investment projects;
- Capital transfers to budget beneficiaries/institutions. Local governments are in accordance with the Law on Local Self Government legally obliged to provide their citizens with certain services like children welfare, culture, sport, covering the material costs of primary and secondary education institutions, etc. Local government is financing the entities that are providing these services. Both operational as well as capital costs are financed;
- Capital subventions to the public companies, include direct transfers of operational and/or capital funds to public companies;
- Direct investments. In this case, municipalities are investing directly into certain projects, so that officially the investor is the municipal administration as a whole. De facto, the investor is usually one of the specific municipal administration departments.

The first two mechanisms are strictly speaking the same: the transfers are made to entities or institutions founded by local government and they have the status of budget beneficiaries, since their legal framework is defined by the Law of Budget System. The practical consequence of this is that all of these institutions are from the financial point of view a part of the local public finance system, meaning that all of them are operating financially within the local treasury system. The only difference is that in the first case municipalities are transferring capital funds to one specialized entity which is then dealing with different investments, while in the second case, each entity is supposed to carry out its own investments.

On the other hand, the third mechanism, subventions to public utility companies, is basically different because the transfers are made to the public companies that do not have a status of budget beneficiaries, although they are users of budget funds. Their legal framework is defined by the Law on Companies/Enterprises, which means that they are not operating within the system of public finance. After the transfer of subventions, the further financial flow to and from the public utility companies is out of the local treasury. In other words, their actual expenditure is not reflected in the local government accounts.

The municipality of Leskovac disburses funds from the local budget to finance capital investments through different channels and institutions:

Table 5-24 Capital expenditure – Leskovac municipality

No	Type of expenditure	2004 a		2005 a		2006 est		2007 plan	
		RSD m	%	RSD m	%	RSD m	%	RSD m	%
1	2	3	4	5	6	7	8	9	10
I	**Capital subventions**	**219**	**75%**	**229**	**69%**	**284**	**100%**	**59**	**26%**
	Water system	8	3%	6	2%	21	7%	34	15%
	Communal infrastructure	211	72%	223	68%	263	93%	0	0%
	Sports Centre		0%		0%		0%	25	11%
II	**Capital expenditure of budget beneficiaries**	**75**	**25%**	**101**	**31%**	**0**	**0%**	**170**	**74%**
	Total I+II	**293**	**100%**	**330**	**100%**	**284**	**100%**	**229**	**100%**

During the last few years the municipality of Leskovac directed capital subventions to the Water system Barje, communal services and Sports centre. The municipality plans to change the mechanism from capital subventions to capital expenditure of budget beneficiaries during the year 2007.

During 2006, capital expenditure of the municipality amounted to RSD 284 million, equivalent to € 3.5 million. Planned capital expenditure budget for the year 2007 is lower at RSD 229 million, equivalent to € 2.9 million.

Main emphasis of the investments during the years 2004 to 2006 is on the communal infrastructure which represents a variety of communal services including land development, construction and repair of roads and parking lots, maintenance, sewerage etc. More then 93% of capital expenditure is allocated for this purpose. During 2006, RSD 21 million or 7% of total capital investment was spent on water infrastructure. The plan for 2007 is to spend RSD 34 million or 15% on water infrastructure and RSD 25 million or 11% on the Sports centre.

These expenditures are financed from budget revenues and long term loans. The plan for 2007 is that the capital expenditures will be financed by introducing new original revenues like: self contribution on wages from employees on the municipality territory (RSD 6.5 million), Municipal budget revenues from interest on budget funds deposited in banks, revenues from renting real estate owned by the state for the usage of municipality bodies, organisations, and institutions/public offices.

Another source of finance is the National Investment Plan. The Municipality of Leskovac has applied for funding from the NIP to finance investments in sewerage network and was granted in total € 670 thousand. Out of this, € 180 thousand was disbursed during 2006, with the remainder expected to be paid during 2007. It should be noted that these funds are directly paid by the organisation managing the fund at national level and thus, are not included in the Leskovac municipal budget.

According to the current Budget System Law, municipalities can borrow up to 50% of current revenues from the previous' year realized budget revenues. Furthermore, the

sum of the repayment and interest rate for all unsettled long term debits shall not exceed, on an annual basis, 15% of revenues in the previous year.

The Ministry of Finance is regularly publishing these limits and they are applied very strictly. According to the last official release from the Ministry of Finance, valid for the year 2007, the municipalities of Leskovac can borrow up to the following limits:

Table 5-25 Borrowing limits Leskovac municipalities (2007, € 1 = RSD 79)

No	Municipality	Realized revenues 2006		Borrowing limit 2007	
		RSD m	€ th	RSD m	€ th
1	Leskovac	1,205	15,253	164	2,072
	Total	**1,205**	**15,253**	**164**	**2,072**

Source: Ministry of Finance Serbia

Because of loans already taken during prior years, the borrowing limit of Leskovac municipality as of 2007 is limited to RSD 164 million or € 2 million.

Municipal balance sheet

The balance sheets of Serbian municipalities are burdened with a number of limitations and deficiencies. One of the biggest deficiencies is the fact that during 90-ties, the Republic government took over most of the local government property. This has made a tremendous impact on Local Government balance sheets. Some of the Local governments continued to keep record of the assets in their balance sheets. Others stopped doing that, only to restart recording these assets again around the year 2000. Another group transferred the bookkeeping of their assets to some of their entities, like the Agency for development. Because of this, balance sheets of Serbian local government cannot be compared in a meaningful way.

It was found that the balance sheet of the municipality of Leskovac was not a reliable document to be used in this analysis, and the analysis is only relying on the budgets of the municipality that are presented to the Municipal Assembly for verification and approval.

The municipalities' main fixed assets as at the end of 2006 are detailed in the table below:

Table 5-26 Main assets (as at 31.12.1006)

Offices and buildings	RSD	€
Municipality Head office/new building	7,423,508	92,794
Municipality/old building	7,090,915	88,636
Children's fund/building	1,531,332	19,142
Municipality service centre	13,295,254	166,191
Head office/social care	1,440,082	18,001
House of the retired	3,309,084	41,364
District offices	4,031,367	50,392
Total	**38,121,542**	**476,519**

The list of property given above relates only to the major assets that were given by the State of Serbia to the municipality of Leskovac for their further use.

Credit history and financial management capacity

In general, Serbian municipalities do not have a long credit history since the legal framework enabling municipalities to borrow for investments purposes was limited. Major changes started from 2002 with the new Budget System Law which introduced the possibility for Serbian municipalities to make use of capital markets and draw loans. However, the practice of taking long term loans to finance large investment projects did not become significant until the year 2003.

Municipalities in Serbia are now changing the practice of applying conservative financial policies of avoiding loans and keeping a relatively high surplus of cash in order to avoid liquidity problems. They are more interested in improving the functioning of their regions, and are assisted in this by a number of international grants being awarded to improve communal services.

Being given legal rights to borrow money from commercial banks, municipalities are entering into these agreements respecting various conditions under which banks are ready to lend money to local communities. Municipalities have equal borrowing rights as any other company in the trade market. The difference lies in providing collateral. Each municipality has an account with the State Treasury, through which all the transfers from the State budget to the Municipality are directed. In case of borrowing, the bank usually requires signing a letter of authorisation with the municipality to debit their account with the Treasury for any outstanding loan repayment. This proves to be a rather firm collateral since the municipalities have regular transfers from the State and loans practically bear very little risk of being repaid.

Presently, the municipality of Leskovac has signed two loans amounting to approximately € 5.6 million:

- A contract for a long term loan with Raiffeisen bank signed in December 2005. amounting to € 1.5 million for financing the project of WWTP and the sewerage network, and
- A long term loan with Banca Intesa signed in September 2006 for € 4 million for finalizing the project of the water system Barje

The first loan, signed in December 2005, and amounting to € 1.5 million, carries an interest rate of 7.3% and a front end fee at 0.40%. Principal repayment is spread over 120 monthly instalments with a 27 months grace period. The first instalment of the loan is falling due upon expiry of the grace period, i.e. in March 2008. The loan is Euro denominated but payable in RSD. The last instalment of the loan is falling due in December 2015.

Under this contract the municipality has submitted to the bank 32 promissory notes with authorisations as security payment, authorising the bank to debit the consolidated treasury account of the municipality of Leskovac with the National Bank of Serbia, in case the municipality fails to fulfil its contractual obligations. At the same time the municipality is placing as a collateral a mortgage on the Museum building in Leskovac, property of the municipality, with a trade value of RSD 161 million (approximately € 2 million) at the moment of signing the contract.

The second loan, signed with Banka Intesa, amounts to € 4 million, has an interest rate of 6.76% and a front end fee of 0.40%. The principal repayment is spread over 143 monthly instalments, with the grace period set at 36 months. The first instalment falls due after the expiry of the grace period, i.e. in March 2009. According to the repayment schedule, the last instalment is falling due in June 2021. This loan is also Euro denominated but payable in RSD. The municipality had to submit to the bank, as a security payment, a total of 30 promissory notes (ten promissory notes each) with authorisations from three PUC's , and with the same conditions applied as in the above loan, regarding non payment of contractual obligations. The property of the PUC Vodovod Leskovac, was placed as a collateral.

Both loans were financed from the line of credit which local commercial banks signed with European Investment Bank and Central European Bank.

Creditworthiness assessment Leskovac municipality

Creditworthiness during the period 2004 – 2007

The Table below summarizes the trends regarding the financial position of Leskovac municipality:

Table 5-27 Leskovac municipality actual 2004 – 2006 and plan 2007 (RSD million)

No	Item	2004	2005	2006	2007 plan
I	**Current Revenues (1+2+3+4)**	**860**	**866**	**1,116**	**1,349**
1	Own Current Revenues	140	96	123	223
2	Share of State Taxes	720	588	736	628
3	Other state Transfers	-	182	257	498
4	Donations	-	-	-	-
II	**Current Expenditures**	**573**	**652**	**877**	**1,205**
A	**Current Surplus/Deficit (I-II)**	**287**	**214**	**239**	**144**
5	Capital Revenues	22	142	96	143
6	Capital Expenditures	293	330	284	229
B	**Capital Surplus/Deficit (5-6)**	**(271)**	**(188)**	**(188)**	**(87)**
C	**Net Surplus/Deficit Before Financing (A+B)**	**16**	**25**	**51**	**57**
7	Borrowing	-	20	40	-
8	Cash brought from previous year	16	9	10	-
9	Debt Service	1	15	49	21
10	Reserves	21	28	31	36
D	**Net Debt Increase/decrease (7+8-9-10)**	**(7)**	**(14)**	**(30)**	**(57)**
E	**Net Surplus/Deficit (C+D)**	**9**	**11**	**21**	**0**

- Municipal current revenues have increased during the period 2004 to 2006 with 30%. The plan for the year 2007 is RSD 1,349 million or a further grow of 21%;
- During the same period, current expenditures were growing faster than current revenues at 35%. The plan for year 2007 is to increase current expenditures by 37%, from RSD 877 million in 2006 to RSD 1,205 million in 2007;
- Capital expenditures during the period 2004 to 2006 did not change much and was at about the same level. The plan for 2007 is to reverse this trend and decrease capital expenditure with 19% year-on-year;

- Capital revenues during the analysed years oscillated between RSD 22 million in 2004 to RSD 142 million in 2005. The plan for year 2007 is RSD 143 million or an increase with 48% compared to the year 2006.

Although investment expenditure does not increase during the years 2004 and 2005, it still is at a relatively high level of more than 30% of total expenditure. This is comparable to other medium sized municipalities in Serbia. A sharp drop off in overall investments is however estimated and planned, to a low 15% during the year 2007. This is rather surprising, taken into consideration overall revenues increase of about 20% per annum.

- Leskovac municipality realizes a current surplus in each of the years. In relative terms, this surplus is however declining;
- The capital cash flow (capital revenues minus capital expenditures) during these years was consistently negative: capital revenues only can finance part of the investment expenditures, although the gasp is narrowing in relative terms.

In the case of Leskovac municipality, the current surplus during each of the years 2004 to 2007 was sufficient to fund the capital deficit. In other words, Leskovac municipality can manage to finance a sizable investment program without having to borrow funds.

The Table below provides some selected indicators which confirm the above trend.

Table 5-28 Municipality of Leskovac financial indicators

Indicators of revenues	**Benchmark**	**2004**	**2005**	**2006**	**2007**
Current revenues / Total revenues		98%	86%	92%	90%
Shared revenues / Total revenues		82%	58%	61%	42%
Original (local) revenues / Total revenues		17%	23%	18%	24%
Revenues from sale of property / Total revenues	2 - 5%	0%	0%	0%	0%
Capital revenues / Total revenues		2%	14%	8%	10%
Operating result / Current revenues		33%	25%	21%	11%
Indicators of expenditures					
Current expenditures / Total expenditures		66%	66%	76%	84%
Operating result / Current expenditures		50%	33%	27%	12%
Capital revenues / Capital expenditures		8%	43%	34%	62%
Capital investments / Total expenditures		33%	33%	23%	15%
Indicators of financial state					
Total expenditures / Total revenues	95% - 100%	98%	97%	96%	96%
Total expenditures / Current revenues		101%	113%	104%	106%
Indicators of indebtedness					
Debt / Total revenues from previous year		0%	1%	5%	4%
Debt service / Total revenues from previous year		0%	2%	5%	2%

Revenue indicators:

- The share of current in total revenues is oscillating throughout the years from 98% in 2004 to 92% in 2006; the plan for the year 2007 is to maintain this level;
- The share of allocated revenues in total revenues decreased from 82% in 2004 to 61%, in 2006, and according to 2007 plan revenues will be further decreased to 42%, due to the switch of the property tax and decrease income tax;
- Original revenues show oscillations from 17% to 23%. The plan for 2007 is to increase these revenues to 24%, again being the result of reclassified property tax collection.
- The ratio between operating result and current revenues was above positive, however with a declining trend to 11% in 2007.

Expenditure indicators:

- The share of current in total expenditures during the period 2004 to 2006 ranged between 66% and 76%. The plan for the year 2007 is to increase current spending to 84%;
- Capital revenues coverage of capital expenditures increased considerably during the period 2004 to 2006. This trend is set to continue during the year 2007;
- Capital investment as a percentage of total expenditure shows a declining trend from 33% during the years 2004 and 2005 to 15% during the year 2007.

Indicators of financial state:

- Total expenditures were lower than total revenues in presenting years and remained with the benchmark 95% to 100%;
- On the other hand, total expenditures exceeded current revenues with 1% to 13%.

Indicators of Indebtedness:

- During the observed period Debt to Total revenues from previous year was in the range of 1% to 5% in 2004-2006, and is expected to keep this level during the year 2007. As stated before, municipal accounts of loan draw downs do not reflect debt taken to finance water infrastructure. The ratio of outstanding debt to prior year's realized revenues would be much higher if these loans were taken into account.

Creditworthiness forecast during the period 2009-2018

The projection of Leskovac municipal creditworthiness is based on data supplied by the budget department of Leskovac municipality. In order to assess the sensitivity of the projections to changes in the macro-economic environment, three different scenarios are presented: a base case, an optimistic and a pessimistic macro-economic scenario. Details of these macro-economic scenarios are presented in paragraph 5.3 financial and economic analysis. The projections are based on the municipal plan for 2007, with corrections for changes related to the new Law on local government financing.

The projection of budget revenues is based on the following assumptions:

- Current division of local budget revenues in accordance with the new law on local government finance;
- According to the same law, as from 2007, the tax on property is going to change its status from allocated to own revenues. The administration of this tax will be decentralized, so that the local government will be directly in charge of collecting this tax. For this reason it is assumed that this tax will have an autonomous increase in the future

The specific revenue growth parameters that have been used for the projection are presented in the table below:

Table 5-29 Municipal projection – revenue growth assumptions

I	**Own revenues**	
1.	Fees (administrative, communal, tourist)	- RSD Inflation - Real GDP growth
2.	Charge for land use and development	- RSD Inflation - Real GDP growth - Autonomous growth of revenues 1.5% (base), 3% (optimistic), 0% pessimistic
1.3.	Property tax	- RSD Inflation - Real GDP growth - Autonomous growth of this revenues from 0 (1-5 year), 3%/5%/0% (5-10 year), 6%/10%/0% (11-15 year)
4.	Other	- RSD Inflation
II	**Allocated revenues**	
2.1.	Income tax	- RSD Inflation - Real Wage Increase
2.2.	Heredity tax and tax on passing the absolute rights	- RSD Inflation - Real GDP growth
2.3.	Property tax	- RSD Inflation - Real GDP growth
2.4.	Transfers	- RSD Inflation - Real GDP growth
2.5.	Other	- RSD Inflation

The projection of Leskovac municipality budget expenditures is based on different growth patterns for the following three main groups of expenditure:

- Expenditure related to the administration and governmental bodies;
- Expenditures related to social functions; and
- Expenditures related to operational expenditures of local development and utility operational subsidies.

The projection of budget expenditures is based on the following assumptions:

Table 5-30 Municipal projection – expenditure growth assumptions

No	Type of expenditures	Parameters of the projections
1.	Administration and municipal bodies	- RSD Inflation
2.	Social functions	- RSD Inflation - Real GDP growth
3.	Current subsidies	- RSD Inflation - Real GDP growth
4	Other current expenses	- RSD Inflation

After projecting revenues and expenditures, the net surplus before financing and before capital expenditure is estimated for each of the three macro economic scenarios. Expenditures include a provision for landfill tipping fees, in relation to a contract which the municipality has signed with a private contractor/operator. It is assumed that the municipality will pay for these expenditures and not pass on the cost to the final consumers. Estimate of landfill tipping fees is estimated as follows:

- Landfill tipping fee of RSD 1,540/ton, 2007 price, as per contract. Landfill tipping fee will be adjusted for inflation in subsequent years;
- In 2007, 60% of the municipal population is served by the private operator, or 93,000 people;
- Solid waste production is estimated at 0.8 kg/capita/day. Solid waste production per capita grows pro-rata real GDP growth;
- No increase in population or service coverage is included in the estimate.

Next, debt service commitments arising from the outstanding loans with Raiffeisen and Banca Intesa banks are deducted from this amount. The remaining balance is in principle available for the funding of capital projects.

Based on this, the model will assess the capability of Leskovac municipality during the period 2009 to 2011 to assume any further debt and/or capital financing directly from the municipal budget.

Of course this does not mean that this study proposes the Municipality of Leskovac to finance 100% of the investment. The projection just assesses the possibility of Leskovac municipality to assume the *maximum* amount of the liabilities. In the end it is up to the municipality to decide on an appropriate key or mechanism to finance the municipal part of the project, or to attract funding from other sources to close the financing plan.

The final result of the projection is presented in the tables below. The results are presented both in RSD as well as Euro.

Table 5-31 Leskovac Municipality budget forecast – base case

	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Leskovac - base case											
Total budget revenues	RSD m	1,764	1,935	2,122	2,339	2,564	2,811	3,082	3,338	3,620	3,928
Total current expenditures	RSD m	1,387	1,490	1,601	1,720	1,839	1,969	2,109	2,249	2,399	2,560
Tipping fees landfill	RSD m	62	70	78	87	97	107	118	130	143	157
Operating result	**RSD m**	**315**	**375**	**444**	**532**	**628**	**735**	**855**	**959**	**1,078**	**1,211**
Budget capital financing											
Solid waste	RSD m	-	-	-	-	-	-	-	-	-	-
Water treatment plant	RSD m	-	-	-	-	-	-	-	-	-	-
Waste water treatment plant	RSD m	-	-	-	-	-	-	-	-	-	-
Water supply network extension	RSD m	-	-	-	-	-	-	-	-	-	-
Others	RSD m										
Debt service											
Loan 1: WTP	RSD m	20	50	49	48	46	45	43	42	40	39
Loan 2: industrial collector	RSD m	23	22	22	21	20	19	18	0	-	-
New loan	RSD m	-	-	-	-	-	-	-	-	-	-
Available for capital spending	**RSD m**	**272**	**303**	**373**	**464**	**562**	**671**	**794**	**917**	**1,038**	**1,172**
Outstanding principal amount	RSD m	414	378	339	298	256	213	169	140	111	80
Total budget revenues	€ th	21,180	22,790	24,620	26,732	28,872	31,196	33,720	35,967	38,433	41,087
Total current expenditures	€ th	16,654	17,553	18,571	19,652	20,710	21,853	23,071	24,236	25,471	26,781
Tipping fees landfill	€ th	743	819	903	995	1,087	1,187	1,296	1,402	1,516	1,639
Operating result	**€ th**	**3,784**	**4,418**	**5,147**	**6,085**	**7,075**	**8,157**	**9,353**	**10,329**	**11,446**	**12,667**
Budget capital financing											
Solid waste	€ th										
Water treatment plant	€ th										
Waste water treatment plant	€ th										
Water supply network extension	€ th										
Others	€ th										
Debt service											
Loan 1: WTP	€ th	246	590	567	545	520	497	475	452	429	406
Loan 2: industrial collector	€ th	278	264	250	236	222	208	193	0	-	-
New loan	€ th	-	-	-	-	-	-	-	-	-	-
Available for capital spending	**€ th**	**3,260**	**3,564**	**4,330**	**5,304**	**6,333**	**7,452**	**8,684**	**9,878**	**11,018**	**12,261**
Outstanding principal amount	€ th	4,970	4,449	3,929	3,408	2,887	2,367	1,846	1,511	1,175	839
Max borrowing capacity	€ th	9,881	10,590	11,395	12,310	13,366	14,436	15,598	16,860	17,984	19,217
Max additional borrowing capacity (50%	€ th	4,912	6,141	7,466	8,902	10,479	12,069	13,752	15,349	16,809	18,377

Table 5-32 Leskovac Municipality budget forecast – optimistic case

	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Leskovac - optimistic case											
Total budget revenues	RSD m	1,775	1,942	2,125	2,340	2,577	2,839	3,130	3,431	3,773	4,154
Total current expenditures	RSD m	1,380	1,476	1,579	1,692	1,814	1,946	2,090	2,246	2,416	2,601
Tipping fees landfill	RSD m	61	67	74	82	91	101	112	124	137	152
Operating result	**RSD m**	**333**	**399**	**472**	**566**	**672**	**792**	**928**	**1,061**	**1,220**	**1,401**
Budget capital financing											
Solid waste	RSD m	-	-	-	-	-	-	-	-	-	-
Water treatment plant	RSD m	-	-	-	-	-	-	-	-	-	-
Waste water treatment plant	RSD m	-	-	-	-	-	-	-	-	-	-
Water supply network extension	RSD m	-	-	-	-	-	-	-	-	-	-
Others	RSD m										
Debt service											
Loan 1: WTP	RSD m	20	47	45	44	42	40	39	37	35	34
Loan 2: industrial collector	RSD m	22	21	20	19	18	17	16	0	-	-
New loan	RSD m	-	-	-	-	-	-	-	-	-	-
Available for capital spending	**RSD m**	**291**	**330**	**406**	**503**	**612**	**735**	**874**	**1,023**	**1,184**	**1,367**
Outstanding principal amount	RSD m	807	809	799	776	729	662	572	514	439	344
Total budget revenues	€ th	22,182	24,271	26,568	29,103	31,894	34,969	38,358	41,837	45,791	50,173
Total current expenditures	€ th	17,251	18,448	19,744	21,043	22,448	23,968	25,612	27,393	29,323	31,415
Tipping fees landfill	€ th	764	842	928	1,023	1,128	1,244	1,371	1,511	1,666	1,837
Operating result	**€ th**	**4,167**	**4,982**	**5,896**	**7,036**	**8,318**	**9,758**	**11,375**	**12,933**	**14,802**	**16,921**
Budget capital financing											
Solid waste	€ th										
Water treatment plant	€ th										
Waste water treatment plant	€ th	-	-								
Water supply network extension	€ th	-	-								
Others	€ th										
Debt service											
Loan 1: WTP	€ th	246	590	567	545	520	497	475	452	429	406
Loan 2: industrial collector	€ th	278	264	250	236	222	208	193	0	-	-
New loan	€ th	-	-	-	-	-	-	-	-	-	-
Available for capital spending	**€ th**	**3,642**	**4,128**	**5,079**	**6,255**	**7,576**	**9,053**	**10,707**	**12,481**	**14,373**	**16,515**
Outstanding principal amount	€ th	4,970	4,449	3,929	3,408	2,887	2,367	1,846	1,511	1,175	839
Max borrowing capacity	€ th	10,174	11,091	12,136	13,284	14,551	15,947	17,485	19,179	20,919	22,895
Max additional borrowing capacity (50%	€ th	5,204	6,642	8,207	9,876	11,664	13,580	15,638	17,668	19,744	22,056

Table 5-33 Leskovac Municipality budget forecast – pessimistic case

	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Leskovac - pessimistic case											
Total budget revenues	RSD m	1,897	2,080	2,258	2,430	2,590	2,786	2,997	3,224	3,468	3,731
Total current expenditures	RSD m	1,531	1,668	1,801	1,926	2,041	2,173	2,313	2,464	2,624	2,796
Tipping fees landfill	RSD m	83	98	113	127	140	152	166	181	198	216
Operating result	**RSD m**	**283**	**314**	**344**	**377**	**409**	**462**	**518**	**579**	**646**	**719**
Budget capital financing											
Solid waste	RSD m	-	-	-	-	-	-	-	-	-	-
Water treatment plant	RSD m	-	-	-	-	-	-	-	-	-	-
Waste water treatment plant	RSD m	-	-	-	-	-	-	-	-	-	-
Water supply network extension	RSD m	-	-	-	-	-	-	-	-	-	-
Others	RSD m	-	-	-	-	-	-	-	-	-	-
Debt service											
Loan 1: WTP	RSD m	24	61	62	61	59	57	55	53	51	49
Loan 2: industrial collector	RSD m	27	27	27	26	25	24	22	0	-	-
New loan	RSD m	-	-	-	-	-	-	-	-	-	-
Available for capital spending	**RSD m**	**232**	**225**	**256**	**289**	**324**	**380**	**440**	**526**	**595**	**671**
Outstanding principal amount	RSD m	-	-	-	-	-	-	-	-	-	-
Total budget revenues	€ th	19,438	20,092	20,777	21,715	22,698	24,181	25,766	27,458	29,241	31,144
Total current expenditures	€ th	15,687	16,117	16,567	17,212	17,886	18,859	19,890	20,984	22,126	23,338
Tipping fees landfill	€ th	851	946	1,042	1,137	1,229	1,317	1,424	1,540	1,666	1,801
Operating result	**€ th**	**2,900**	**3,030**	**3,169**	**3,366**	**3,583**	**4,006**	**4,452**	**4,934**	**5,449**	**6,005**
Budget capital financing											
Solid waste	€ th										
Water treatment plant	€ th										
Waste water treatment plant	€ th	-	-								
Water supply network extension	€ th	-	-								
Others	€ th										
Debt service											
Loan 1: WTP	€ th	246	590	567	545	520	497	475	452	429	406
Loan 2: industrial collector	€ th	278	264	250	236	222	208	193	0	-	-
New loan	€ th	-	-	-	-	-	-	-	-	-	-
Available for capital spending	**€ th**	**2,376**	**2,176**	**2,352**	**2,584**	**2,841**	**3,301**	**3,784**	**4,482**	**5,020**	**5,599**
Outstanding principal amount	€ th	4,970	4,449	3,929	3,408	2,887	2,367	1,846	1,511	1,175	839
Max borrowing capacity	€ th	9,452	9,719	10,046	10,389	10,858	11,349	12,091	12,883	13,729	14,620
Max additional borrowing capacity (50%	€ th	4,482	5,270	6,118	6,981	7,970	8,982	10,244	11,372	12,554	13,781

The main findings of the above projections are:

- Due to existing debt service obligations, the available annual surplus for capital spending is constrained;
- Cumulative *total* available budget for capital projects during the period 2009 to 2011 under macro-economic base case scenario amounts to € 11.2 million, with a pessimistic scenario resulting in € 6.9 million and an optimistic scenario totaling € 12.9 million;
- Assuming that around 50% of this balance is allocated to water and waste water infrastructure, the municipality could commit an additional € 5.6 million during the period 2009 to 2011, assuming a base case scenario;
- There is some limited scope for additional borrowing during the period 2009 to 2011, as a result of growing municipal revenues and principal repayment of existing loans. This is estimated at € 7.5 million cumulative (base case scenario);
- Assuming that the grace period for this loan would be set at a minimum of 3 years, the total available municipal capital budget for the period 2008 to 2010 would amount to € 18.7 million (base case scenario);
- If 50% of this would be used to fund waste water infrastructure, the total municipal financing of the project could amount to ~ € 9.3 million.

Finally, the table below summarizes some key indicators of Leskovac. These indicators confirm that Leskovac municipality can sustain the current debt taken under all macro-economic scenarios. Of course this is also a result of the strict borrowing constraints imposed by the Ministry of Finance.

Table 5-34 Leskovac Municipality - budget forecast indicators

	Unit	Rate		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Indicators - base case													
Leskovac													
Operating result / total revenues	%	MIN=	18%	18%	19%	21%	23%	25%	26%	28%	29%	30%	31%
Operating result / Total debt service	multiple	MIN=	5.2	7.2	5.2	6.3	7.8	9.5	11.6	14.0	22.9	26.7	31.2
Outstanding Debt / operating result	multiple	MAX=	1.3	1.3	1.0	0.8	0.6	0.4	0.3	0.2	0.1	0.1	0.1
Outstanding Debt / revenues previous yr	%	MAX=	25%	25%	21%	17%	14%	11%	8%	6%	4%	3%	2%
Debt service / revenues previous yr	%	MAX=	4%	3%	4%	4%	3%	3%	2%	2%	1%	1%	1%
Indicators - optimistic case													
Leskovac													
Operating result / total revenues	%	MIN=	19%	19%	21%	22%	24%	26%	28%	30%	31%	32%	34%
Operating result / Total debt service	multiple	MIN=	5.8	8.0	5.8	7.2	9.0	11.2	13.8	17.0	28.6	34.5	41.7
Outstanding Debt / operating result	multiple	MAX=	1.2	1.2	0.9	0.7	0.5	0.3	0.2	0.2	0.1	0.1	0.0
Outstanding Debt / revenues previous yr	%	MAX=	24%	24%	20%	16%	13%	10%	7%	5%	4%	3%	2%
Debt service / revenues previous yr	%	MAX=	4%	3%	4%	3%	3%	3%	2%	2%	1%	1%	1%
Indicators - pessimistic case													
Leskovac													
Operating result / total revenues	%	MIN=	15%	15%	15%	15%	15%	16%	17%	17%	18%	19%	19%
Operating result / Total debt service	multiple	MIN=	3.5	5.5	3.5	3.9	4.3	4.8	5.7	6.7	10.9	12.7	14.8
Outstanding Debt / operating result	multiple	MAX=	1.7	1.7	1.5	1.2	1.0	0.8	0.6	0.4	0.3	0.2	0.1
Outstanding Debt / revenues previous yr	%	MAX=	26%	26%	23%	20%	16%	13%	10%	8%	6%	4%	3%
Debt service / revenues previous yr	%	MAX=	4%	3%	4%	4%	4%	3%	3%	3%	2%	2%	1%

5.2.4 Risks & Weaknesses

The risk of default on credits and other financial obligations of municipalities in Serbia is generally not very high, because of the strict application of the law on public finance by the Central Government/Ministry of Finance. This law regulates the municipal debt market by setting the limit to accumulated municipal debt to maximum 50% of the previous' year realized budget revenues. In addition, debt service is not to exceed 15% of the previous' year realized budget revenues. Municipalities have to apply for a permit to the Ministry of Finance for any debt they wish to take. The Ministry of Finance controls whether the municipalities adhere to the stipulations of the law on public finance and especially these debt limits, before issuing the permit.

The other factor that is decreasing risk in servicing debts of local governments is the still relatively slow procedure in creating debts. According to the new law on public procurement and new treasury procedures, the process of initiating project implementation is very slow. It could be said that Serbian municipalities still did not develop management capacity to spend efficiently funds available on viable projects. This is one of the reasons for not having spent funds as planned during the budget year.

The municipality of Leskovac has in the recent past actively used the instrument of borrowing from commercial banks. Although the municipality will be exposed to debt service liabilities, its financial position is not considered to be very risky, as shown in the table above.

Certain risks could be related to the coming reform of the local governmental system which includes considerable changes in the financial operational system:

- The new law on local governments financing envisages the establishment of a tax administration at the local level and take over much bigger responsibility for collecting larger original (own) revenues;
- Introduction of the new elaborated treasury system that will integrate the system of public finance in Serbia;
- Introduction of public procurement law;
- Starting with the accounts of the 2006 financial year, municipalities and public companies are obliged to have their accounts audited and certified by an external auditor.

The risk is related to the reforms not being implemented successfully or creating excessive bureaucracy. On the other hand, a successful implementation will enhance the local government financial management system and increase the creditworthiness of the municipalities.

There is a political risk. Change of either the mayor or the constitution of the assembly can change political priorities. Frequently, (senior) managers in both the city administration as well as related public companies are changed as a result of a newly elected mayor from a different political party or a change of the assembly.

Although municipal accounts do separate between capital and current accounts, little attention is paid to a strict separation of the two types of expenditure. Frequently, current and investment expenditures are mixed up. Actual expenditures of subventions given to public utility companies are not reflected in the municipal accounts. This all makes it difficult to track planned investment versus actual expenditure.

Conclusion is that many local government reforms are recently introduced which, if implemented successfully, will contribute to enhance the creditworthiness of municipalities. A potential item for a creditworthiness enhancement program could be strengthening the municipalities' capacity to plan and track long term capital investment.

5.3 Financial analysis of the Project and affordability analysis

5.3.1 Introduction

Based on several assumptions as outlined below, this chapter analyses the financial feasibility of both the project and its effect on the finances of the planned new water and waste water treatment Public Utility Company. The analysis and projections for the profit & loss account, balance sheet, cash flow statement of the company as well as the financial cost-benefit analysis will be carried out for 33 years in total (3 year construction and 30 operational years), which coincides with the estimated usable lifetime of the equipment of the waste water treatment plant and is in accordance with international practice for such type of projects. Therefore, the analysis will cover the years 2009 to 2041.

The model uses as an input the water and waste water demand projections elaborated upon in chapter 3. Furthermore, it builds upon the estimated staffing numbers required to operate the scheme as set out in chapter 7 and the priority investment plan detailed in chapter 3.

The financial analysis also takes into consideration the necessary reinvestment required to sustain operations of the investments of the project. Main re-investment required is replacement of electro-mechanical equipment of the proposed waste water treatment plant. Replacement of the electro-mechanical equipment of the drinking water treatment plant at Barje, which is currently being constructed, is included in the financial statement projections of the PUC, but excluded from the financial and economic cost-benefit analysis since this is outside of the scope of the project.

All revenues and expenditures are presented in nominal values.

The appendices contain the full set of outputs of the financial model.

5.3.2 Option analysis

This chapter does not contain a further option analysis, since this has been discussed already in chapter three – technical analysis. The financial projections contained in this chapter are based on the following project investments:

- Construction of waste water treatment plant of 129,000 PE, based on a conventional low loaded activated sludge including tertiary treatment;
- Extension of the sewage collection network, targeting 20,000 residents in suburban areas and surrounding villages of Leskovac town;
- Extension of the drinking water distribution network to connect an additional 12,000 residents living in a number of villages in the northern part of Leskovac municipality.

5.3.3 Assumptions

Macroeconomic scenarios

Underlying macro-economic assumptions of the model build upon data used by the EBRD, with some changes to reflect recent actual exchange rates. A base case scenario, with a probability of 50% will be used throughout this chapter. Pessimistic and optimistic scenarios are used to assess the sensitivity of the financial model to changes in these assumptions.

The table below summarizes the three macro economic scenarios:

Table 5-35 Base case scenario

Financial year ending	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
RSD Inflation	7.5%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
EUR Inflation	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%
RSD/EUR Nominal Exchange Rate	80	81.7	83.3	84.9	86.2	87.5	88.8	90.1	91.4	92.8	94.2	95.6	110.7	134.0
Real Appreciation RSD vs EUR	4.2%	0.9%	1.0%	1.1%	1.5%	1.5%	1.5%	1.5%	1.6%	1.5%	1.5%	1.5%	1.5%	1.5%
Real GDP Growth	4.0%	4.0%	5.0%	5.0%	5.0%	5.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%	3.0%	3.0%

Table 5-36 Pessimistic scenario

Financial year ending	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
RSD Inflation	20.0%	15.0%	10.0%	8.0%	7.0%	6.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
EUR Inflation	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%
RSD/EUR Nominal Exchange Rate	80	90.4	97.6	103.5	108.7	111.9	114.1	115.2	116.3	117.4	118.6	119.8	132.1	149.9
Real Appreciation RSD vs EUR	16.7%	0.0%	0.0%	0.0%	0.0%	1.1%	1.0%	2.0%	2.0%	2.1%	2.0%	2.0%	2.0%	2.0%
Real GDP Growth	0.0%	0.0%	1.0%	2.0%	2.0%	2.0%	2.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%

Table 5-37 Optimistic scenario

Financial year ending	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
RSD Inflation	5.0%	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%
EUR Inflation	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%
RSD/EUR Nominal Exchange Rate	80	80.0	80.0	80.0	80.0	80.4	80.8	81.2	81.6	82.0	82.4	82.8	86.8	92.1
Real Appreciation RSD vs EUR	1.7%	2.0%	2.0%	2.0%	2.0%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
Real GDP Growth	7.0%	7.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%

Investments

In chapter 3, a priority investment plan is elaborated upon. The financial model assumes that the first phase priority investment plan can be completed during the years 2009 to 2011.

Re-investments are required after 15 operational years for the electro-mechanical part of the waste water treatment plant and pumping stations of the sewerage network extension. Tariff calculations are based on this investment schedule. No subsequent phases are identified in this project. However, if additional major investments are implemented, a tariff review will be required.

The estimated investment amounts are summarized in the table below. Individual items include provisions for contingencies and VAT.

Table 5-38 Investments

Financial year ending	Units	Total	2009	2010	2011
WWTP (incl. contingencies, incl. VAT)					
Investigation works & design	€ m	0.49	0.49	-	-
Construction works	€ m	6.25	3.13	3.13	-
Electro-mechanical equipment	€ m	7.24	3.62	3.62	-
Additional land acquisition	€ m	-	-	-	-
Trial run, staff training, operation	€ m	0.44	-	-	0.44
Sewerage					
Leskovac suburbs sewerage extension - elctr/mechanical	€ m	0.02	0.01	0.01	0.01
Leskovac suburbs sewerage extension - pipes & fittings	€ m	6.49	2.14	2.14	2.21
Drinking water supply					
Leskovac villages - design	€ m	0.26	0.26	-	-
Leskovac vilages - civil works	€ m	0.57	0.19	0.19	0.19
Leskovac villages - pipes & fittings	€ m	4.70	1.55	1.55	1.60
Supervision					
Supervision WWTP	€ m	1.08	0.48	0.48	0.11
Supervision sewer extension	€ m	0.31	0.10	0.10	0.11
Supervision drinking water supply	€ m	0.26	0.09	0.09	0.09
Total	**€ m**	**28.13**	**12.07**	**11.31**	**4.75**

Table 5-39 Re-investments

Financial year ending	Units	Total	2024	2025
Reinvestment				
WWTP - electro-mechanical equipment	€ m	10.25		10.25
Sewerage pumps Leskovac suburban	€ m	0.03	0.03	

Apart from the re-investment listed above, no other discretionary investments have been included for the new investments, since the investment program is assessed to capture all required investments for support of the operations of the waste water treatment plant, sewage collection and drinking water extension in Leskovac. In addition, sizable allocations are made in the projections for maintenance and repair, which should be sufficient to keep the investments in a proper condition.

For the current operations however, discretionary investments are included. The level of these discretionary investments is as a starting point made dependent on the operating result and cash position of the specific component. For sewage collection, this results in an estimated discretionary investment level roughly or slightly higher than the current depreciation charge. Investments in the finalization of the city sewer collector, estimated at RSD 66 million (€ 0.83 million) to be invested during the years 2007 and 2008, are included in the financial estimates and depreciation charge.

A major impact on current operations and tariffs of the PUC and the drinking water component will be the regional drinking water system “Barje”. Investment in this gravity fed system, comprised of an upstream dam and water reservoir, drinking water treatment plant, water main pipeline to Leskovac city and water tank has been going on for several years. It is currently estimated that the system will be operational as from the year 2009. Depreciation for the investment will thus start as from the year 2009.

The total investment cost of the system is estimated at RSD 1,634 million (€ 20.4 million). This amount can be broken down as follows:

- Work in progress related to the Barje system as registered in the balance sheet of the PUC as at 31 December 2006, amounts to RSD 1,102 million (€ 13.8 million). This work in progress has not start to depreciate yet;
- Estimated investment cost to finalize the system during the years 2007 and 2008 is estimated at RSD 532 million (€ 6.7 million).

These investments are jointly financed by the Serbian National Government through the Ministry of Agriculture, Forestry and Water and Leskovac municipality.

The total depreciation impact of using this system is estimated at an annual RSD 54 million (€ 0.68 million). Re-investments after 15 years of the electrical-mechanical equipment of the drinking water treatment plant, estimated at RSD 454 million (€ 5.7 million, 2007 prices) is included in the financial model as well. Like for the sewage collection component, discretionary investments for the current drinking water system are made dependent on the operating result and cash generated by this component, however in such a way that the level of investment is approximately half of the total depreciation charge of this component. This is sufficient to keep the current system in operation and to finance from internal sources the replacement of the electrical-mechanical equipment of the drinking water treatment plant. It should be noted however, that the level of discretionary investment is not sufficient to extend current service level quantity.

Financing

The priority investment plan is planned to be financed by Leskovac municipality, a grant from the Ministry of Agriculture, Forestry and Water, Directorate-General Water and EU-IPA funds or other international grants

In line with the current policy of the Ministry of Agriculture, Forestry and Water, 1/3 of the cost of the waste water treatment plant is included in the financing plan. The Ministry of Agriculture, Forestry and Water, Directorate-General Water has confirmed that the Leskovac waste water treatment is in line with current policy for this type of investment. However, formal/written confirmation of this financing has yet to be obtained by Leskovac municipality.

For the purposes of the financial analysis, EU-IPA funds/international grants are assumed to amount to 75% of eligible costs (excluding VAT, land acquisition). Actual grant size will depend on the appraisal of this feasibility study, availability of funds and the applicable grant determination mechanism. This is further discussed in paragraph 5.3.10 of this chapter.

Table 5-40 Source of financing/Priority Investment Plan

Financial year ending	Units	Total	2009	2010	2011
EU-IPA/int. Grants	€ m	20.81	8.97	8.41	3.43
Min. Agriculture, DG Water	€ m	4.76	2.39	2.23	0.14
Municipal contribution	€ m	2.56	0.71	0.68	1.18
Loan	€ m	-	-	-	-
Total	**€ m**	**28.13**	**12.07**	**11.31**	**4.75**

Leskovac municipality has also applied for funding to the NIP (National Investment Plan) for its 2008 budget:

- RSD 1,252 million (€ 15.7 million) for the waste water treatment plant, including main city sewage collector;
- RSD 294 million (€ 3.7 million) for extension of the drinking water network to the Northern villages;
- RSD 185 million (€ 2.3 million) for the Barje regional water supply system;
- RSD 191 million (€ 2.4 million) to extend the drinking water supply network to several villages in the Eastern part of the municipality.

The first two NIP applications are also part of this feasibility study.

Revenues

The single main revenue stream for the PUC is tariffs charged to different customer groups. The setting of these tariffs will be elaborated upon in paragraph 5.3.6, but in principle is based on full cost recovery, using straight line historical depreciation.

The WWTP sludge treatment process generates electricity, which in principle is a second revenue stream. Since this generated electricity is used for the operations of the WWTP itself, it will be directly deducted from the plant's operational costs, instead of being treated as additional revenues.

A final source of revenues is the construction department, which operates as a contractor. A large part of these revenues are however paid for by Leskovac municipality, so that is safe to assume that at least part of this revenue stream can be considered as operational subsidies to keep the utility solvent.

A distinction will be made in revenue projections between the "with" and the "without" project situation. This is necessary in order to be able to:

- Estimate total future water and waste water costs and to assess incremental impact on final consumer's tariff and affordability to pay;
- Determine the costs and required tariffs for each component of the water and waste water system;
- Estimate the project's incremental revenue stream for the cost benefit analysis.

The "without" project is comprised of the following components:

- Drinking water production and distribution in Leskovac municipality, including impact of the regional water supply system "Barje"
- Sewage collection in Leskovac municipality, including impact of the main city sewage and industrial collector;
- Construction activities;
- Management & administration of the PUC (i.e., overhead costs).

In addition to the above two components, the "with" project is comprised of the following additional components:

- Extension of the drinking water supply network to reach 12,000 residents living in villages in the Northern part of Leskovac municipality;
- Sewage collection and transport of an additional 20,000 residents living in suburban areas or villages in the vicinity of Leskovac city;
- Waste water treatment plant in Leskovac municipality.

Revenues for both without and with project situation will be estimated based on a full cost recovery tariff setting.

Allowances for bad debt will reduce the revenue stream of the PUC. Two scenarios for revenue collection rate will be used in the analysis. The Base case assumes that collection rates will improve from the current average 71% for all customer groups to 95% by the year 2013. This base case scenario will be used throughout the analysis. A low case scenario, which assumes that the collection rate remains constant at 71% during the analysis period, will be used to assess the impact on the required tariffs.

It should be emphasized that the increase of the collection rate is of crucial importance to be able to set tariffs at a reasonable level. For this reason, it is proposed by consultants to support the PUC with technical assistance to improve revenue collection systems and procedures and to carry out a public awareness campaign at the start of operations of the various new components.

Expenditures

Expenditures are distinguished in two categories:

- Variable costs (electricity, fuel, water, chemicals and sludge transport). These costs directly fluctuate with the amount of drinking water produced and waste water delivered to the sewage collection system;
- Fixed costs (wages, maintenance, insurance, depreciation). These costs do not directly fluctuate with the amount of drinking water produced and waste water delivered to the sewage collection system.

Also for expenditures a distinction will be made between the “without project” situation and the “with project situation”

The following 2007 base prices are assumed for the various expenditure categories:

Table 5-41 Variable operation and maintenance assumptions (2007 prices)

Variable costs		
Electricity	RSD/kwh	5.0
Chemicals - FeCl3/Coagulant	RSD/kg	16
Chemicals - polyelectrolyte	RSD/kg	560
Transport & disposal sludge	RSD/ton	1,540

Table 5-42 Fixed operation and maintenance assumptions (2007 prices)

Fixed costs		
Maintenance rates % of investment		
Civil works	%	0.50%
Pipes & fittings - water	%	0.75%
Pipes & fittings - sewerage	%	0.75%
Mechanical equipment	%	3.00%
Electrical equipment	%	2.00%
Insurance costs % of investment		
Civil works	%	0.10%
Pipes & fittings - water	%	0.10%
Pipes & fittings - sewerage	%	0.10%
Mechanical equipment	%	0.70%
Electrical equipment	%	0.70%
Depreciation		
Civil works	years	50
Pipes & fittings - water	years	40
Pipes & fittings - sewerage	years	50
Electro/mechanical equipment	years	15

Salary costs and employee benefits are assumed to amount to the average 2007 planned salaries. At the company level, on average RSD 30 thousand/month gross salary was paid, with employee benefits amounting to 18%.

Depreciation rates are set in accordance with current practice of PUC Standard. It should be noted that the depreciation of civil works at 50 years is rather high compared to international practice, although not unrealistic.
Starting from the first year of operations, input prices are adjusted for real and nominal price increases, using the following assumptions:

Wages and salaries:	inflation + real wage increase
Employee benefits:	inflation + real wage increase
Electricity:	inflation + real GDP growth
Transport services:	50% inflation + 50% real wage increase
Repair/Maintenance:	50% inflation + 50% transport services
Other services:	50% inflation + 50% transport services
Taxes & fees:	inflation only
Chemicals:	inflation only
Other costs:	inflation only

This results in the following nominal increases:

Table 5-43 Price escalation O&M costs

Financial year ending	Units	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Wages and Salaries	%	8.2%	8.2%	9.2%	9.2%	10.3%	10.3%	10.3%	10.3%	8.2%	8.2%	8.2%	8.2%	8.2%
Employee benefits	%	8.2%	8.2%	9.2%	9.2%	10.3%	10.3%	10.3%	10.3%	8.2%	8.2%	8.2%	8.2%	8.2%
Electricity	%	9.2%	10.3%	10.3%	10.3%	10.3%	9.2%	9.2%	9.2%	8.2%	8.2%	8.2%	8.2%	8.2%
Transport services	%	6.6%	6.6%	7.1%	7.1%	7.6%	7.6%	7.6%	7.6%	6.6%	6.6%	6.6%	6.6%	6.6%
Repair services	%	5.8%	5.8%	6.1%	6.1%	6.3%	6.3%	6.3%	6.3%	5.8%	5.8%	5.8%	5.8%	5.8%
Other services	%	5.8%	5.8%	6.1%	6.1%	6.3%	6.3%	6.3%	6.3%	5.8%	5.8%	5.8%	5.8%	5.8%
Taxes and fees	%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Chemicals	%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Other costs	%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%

Apart from unit prices and unit price increases, expenditure patterns are estimated based on the following assessment (major items only):

- The staffing schedules are based on the assumption that overall staff levels will be fixed at 349 employees, as elaborated in chapter 7. Thus, any new staff required for operation of the new system will be recruited from within the utility. In total 21 staff members are required (9 for the WWTP, 7 for the extension of the sewage collection system and 5 for the extension of the drinking water distribution network). For modeling purposes, these 21 staff members are assumed to be recruited from the construction department, although in reality this could of course also be from other internal departments.

Table 5-44 Staffing levels without and with project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Without project													
Drinking water - existing	No.	151	151	151	151	151	151	151	151	151	151	151	151
Drinking water - new	No.												
Sewage collection - exist	No.	20	20	20	20	20	20	20	20	20	20	20	20
Sewage collection - new	No.												
Waste water treatment p	No.	-	-	-	-	-	-	-	-	-	-	-	-
Construction unit	No.	42	42	42	42	42	42	42	42	42	42	42	42
Overhead/management	No.	136	136	136	136	136	136	136	136	136	136	136	136
Total		**349**	**349**	**349**	**349**	**349**	**349**	**349**	**349**	**349**	**349**	**349**	**349**
With project													
Drinking water - existing	No.	151	151	151	151	151	151	151	151	151	151	151	151
Drinking water - new	No.			3	5	5	5	5	5	5	5	5	5
Sewage collection - exist	No.	20	20	20	20	20	20	20	20	20	20	20	20
Sewage collection - new	No.		2	4	7	7	7	7	7	7	7	7	7
Waste water treatment p	No.	-	-	9	9	9	9	9	9	9	9	9	9
Construction unit	No.	42	40	26	21	21	21	21	21	21	21	21	21
Overhead/management	No.	136	136	136	136	136	136	136	136	136	136	136	136
Total		**349**	**349**	**349**	**349**	**349**	**349**	**349**	**349**	**349**	**349**	**349**	**349**

- Overhead mainly consists of personnel costs. Overhead is charged to the four production units pro-rata their share in total salary- and wages costs. Overhead allocated to the new project components is treated as incremental overhead costs.
- Drinking water supply
  - Planned 2007 costs are used as a basis for estimating future costs;
  - Discretionary investments are estimated at 50% of the lower of either realized earnings before interest, tax, depreciation and amortization (EBITDA) or cumulated cash;
  - As from the year 2009, an additional depreciation charge is added as a result of start of operation of the € 20.4 million Barje system;
  - Usage of chemicals for drinking water treatment will increase as a result of start of Barje system;
  - Electricity consumption will decrease after start of the Barje system, since pumping of the existing ground water wells can be discontinued.
- Sewage collection
  - Planned 2007 costs are used as a basis for estimating future costs;
  - Discretionary investments is estimated at the lower of either realized earnings before interest, tax, depreciation and amortization (EBITDA) or cumulated cash;
  - As from the year 2009, an additional depreciation charges is added as a result of finalization of the city sewer collector;
- Waste water treatment
  - Start of operations in 2011;
  - Use of poly-electrolyte estimated at 14,800 kg at full design capacity utilization;
  - Use of coagulant estimate at 350,000 kg at full design capacity utilization;

- Electricity usage estimated at 2,600 million Kwh at full design capacity utilization;
- Sludge production estimated at 11,200 to at full design capacity utilization;

Working capital will be calculated assuming:

- Average day of accounts receivable will gradually reduce to 60 days by the year 2012;
- Average day of accounts payable will reduce to 45 days by the year 2029;
- Inventories will reduce to 30 days by the year 2019;
- Accruals/short term liabilities will reduce to 30 days by the year 2020.

Water and waste water demand projection

In chapter 3, demand projections for both water and waste water have been elaborated upon. The main assumptions have been set out in this chapter as well. This analysis is used as an input in the financial model.

In situations where steep hikes in tariffs occur, final consumer demand can be expected to decrease because of price elasticity effects. Especially in situations where actual water usage is high, demand can be expected to fall per consumer, because consumers can easily and at low cost decrease their (excessive) water usage. Water usage per capita in Leskovac municipality is however not excessively high at 155 liter per capita per day. Although tariff increases are inevitable, price and income elasticity effects on water and waste water demand are not expected to have a major effect on demand per capita and have therefore not been taken into consideration. The sensitivity analysis set out later in this chapter will assess the impact of variations in demand on the financial feasibility of the project.

The tables below summarize the drinking water and waste water demand for Leskovac municipality.

Table 5-45 Drinking water demand projection Vrbas town and villages

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Water sale total - Leskovac town & villages	m3/y	7,053,353	7,134,217	7,745,237	7,816,545	7,888,509	7,961,139	8,034,448	8,108,446	8,183,145	8,258,558	8,982,508	9,992,458
by type of customer													
domestic	m3/y	4,760,658	4,772,196	5,313,173	5,336,800	5,360,457	5,384,142	5,407,857	5,431,600	5,455,373	5,479,176	5,646,638	5,806,293
industry	m3/y	1,274,905	1,300,403	1,326,411	1,352,939	1,379,998	1,407,598	1,435,750	1,464,465	1,493,754	1,523,629	1,857,296	2,402,610
institutional users	m3/y	1,017,790	1,061,618	1,105,653	1,126,805	1,148,054	1,169,399	1,190,841	1,212,380	1,234,017	1,255,753	1,478,574	1,783,555
by location													
Leskovac existing	m3/y	7,053,353	7,134,217	7,215,827	7,275,102	7,335,034	7,395,632	7,456,909	7,518,875	7,581,542	7,644,923	8,320,745	9,330,695
Leskovac new (Northern villages)	m3/y	-	-	529,411	541,443	553,475	565,507	577,539	589,571	601,603	613,635	661,763	661,763
Losses													
Water losses out of water sold	%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Water losses out of water produced	%	28%	28%	28%	28%	28%	28%	28%	28%	28%	28%	28%	28%
Water losses	m3/y	2,803,621	2,835,763	3,078,636	3,106,980	3,135,585	3,164,454	3,193,594	3,223,007	3,252,699	3,282,675	3,570,436	3,971,878
Water production - TOTAL	m3/y	9,856,974	9,969,980	10,823,873	10,923,525	11,024,093	11,125,594	11,228,041	11,331,453	11,435,844	11,541,232	12,552,944	13,964,336

As can be concluded from the table, water demand is expected to increase slightly over the 32 year analyzed period, at about 0.8% per annum. This is the result of a slightly projected increase in population and a fixed per capita demand of 15 liter per capita per day. Water losses as a result of technical and commercial losses have been kept constant at 28% throughout the period. This is done based on the assumption that no major replacement of distribution network or water mains will take place.

Table 5-46 Waste water demand projection Leskovac municipality – with project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Wastewater Leskovac existing + new	m3/y	5,180,296	5,454,516	5,730,525	5,829,363	5,928,991	6,029,419	6,130,657	6,232,718	6,335,612	6,439,351	7,167,908	8,034,417
by type of customer													
domestic	m3/y	3,221,183	3,440,941	3,661,690	3,720,882	3,780,325	3,840,018	3,899,964	3,960,164	4,020,617	4,081,326	4,338,464	4,478,365
Industry -small	m3/y	1,115,542	1,137,853	1,160,610	1,183,822	1,207,498	1,231,648	1,256,281	1,281,407	1,307,035	1,333,176	1,625,134	2,102,284
industry - big	m3/y	-	-	-	-	-	-	-	-	-	-	-	-
institutional users	m3/y	843,570	875,722	908,225	924,659	941,168	957,752	974,412	991,147	1,007,960	1,024,849	1,204,310	1,453,768
by location													
Leskovac town - existing	m3/y	4,958,018	5,010,954	5,066,327	5,109,597	5,153,357	5,197,620	5,242,396	5,287,697	5,333,535	5,379,920	5,890,941	6,673,142
Lekosvac suburbs - new	m3/y	222,277	443,562	664,198	719,767	775,634	831,799	888,261	945,021	1,002,078	1,059,431	1,276,967	1,361,275
Infiltration													
Leskovac town - existing	m3/y	1,182,600	1,182,600	1,182,600	1,182,600	1,182,600	1,182,600	1,182,600	1,182,600	1,182,600	1,182,600	1,182,600	1,182,600
Lekosvac suburbs - new	m3/y	421,479	421,479	421,479	421,479	421,479	421,479	421,479	421,479	421,479	421,479	421,479	421,479
Wastewater delivered to the WWTP	m3/y	6,784,374	7,058,595	7,334,604	7,433,442	7,533,070	7,633,497	7,734,736	7,836,797	7,939,691	8,043,430	8,771,987	9,638,496
Wastewater delivered to the WWTP	m3/d	18,587	19,339	20,095	20,366	20,639	20,914	21,191	21,471	21,753	22,037	24,033	26,407

Waste water demand is expected to grow by about 5% during the period 2009 to 2011 when the sewage collection system in suburban areas of leskovac town is planned to be constructed. Thereafter, demand only grows marginally, roughly in line with growth in water demand.

Financial statements

Projections of financial statements are in principle based on actual 2006 and planned 2007 data provided by the PUC. A number of reclassifications are made, in order to align the statements with International Accounting Standards (IAS):

- Currently, the PUC recognizes extraordinary revenues, as a result of fixed asset revaluation. This practice is not in accordance with IAS 16, which states that a revaluation of fixed assets should be credited directly to equity. A reclassification of this revaluation to equity leads to the PUC making a substantial loss during the years 2006 and 2007, instead of a slight loss. In projecting future profit & loss statements, no further allowance for revaluation of fixed assets is made.
- Extraordinary costs, largely consisting of write off of bad debts, are recognized by the PUC. Although in principle it is correct to charge the profit & loss statement for write downs or provisions for bad debt, it is reclassified as being a normal business expense instead of extraordinary costs;
- Substantial grants are received from the State Government to fund the Barje regional water supply system. These grants are recognized by the PUC as a short term liability. Since these funds are provided as a grant and do not have to be repaid, the relevant amount (RSD 533 million) is reclassified under equity (accumulated government capital grants).

5.3.4 Expenditure forecast

"Without project" expenditures

Based on the assumptions elaborated upon above, a forecast of expenditures of the "without project situation" is made. The "without project situation" consists of the existing drinking water supply system, sewage collection system, construction department and part of the overhead costs. The tables below summarize the projected expenditures of these components. The expenditures include allowances for overhead.

Table 5-47 Drinking water expenditures – without project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Variable costs		**16,234**	**17,606**	**19,503**	**21,114**	**22,769**	**24,563**	**26,510**	**28,485**	**30,615**	**32,912**	**68,576**	**184,200**
Liquid chlorine	000 RSD	7,938	8,431	9,140	9,679	10,250	10,854	11,494	12,173	12,891	13,652	24,199	51,047
Electricity	000 RSD	6,863	7,653	8,712	9,687	10,668	11,749	12,940	14,115	15,397	16,795	40,008	123,936
Fuel and lubricant	000 RSD	1,433	1,522	1,650	1,748	1,851	1,960	2,075	2,198	2,328	2,465	4,369	9,217
Fixed costs	000 RSD	**230,517**	**243,924**	**258,496**	**276,545**	**296,612**	**318,603**	**342,544**	**363,993**	**387,090**	**411,969**	**824,680**	**2,019,089**
Wages and Salaries	000 RSD	64,690	70,642	77,141	85,048	93,765	103,376	113,972	123,261	133,306	144,171	315,604	873,952
Employee benefits	000 RSD	14,110	15,408	16,825	18,550	20,451	22,548	24,859	26,885	29,076	31,445	68,837	190,619
Other materials	000 RSD	7,544	7,921	8,317	8,733	9,170	9,628	10,110	10,615	11,146	11,703	19,064	35,947
Transport services	000 RSD	-	-	-	-	-	-	-	-	-	-	-	-
Repair services	000 RSD	5,559	5,896	6,252	6,647	7,066	7,512	7,987	8,449	8,938	9,455	16,596	34,488
Other services	000 RSD	5,842	6,195	6,570	6,984	7,425	7,894	8,392	8,878	9,392	9,936	17,439	36,239
Taxes and fees	000 RSD	2,767	2,906	3,051	3,204	3,364	3,532	3,709	3,894	4,089	4,293	6,993	13,187
Depreciation	000 RSD	69,928	69,928	69,928	70,525	71,455	72,448	73,347	74,254	75,205	76,207	118,494	138,639
Other costs (excl. write o	000 RSD	1,534	1,611	1,692	1,776	1,865	1,958	2,056	2,159	2,267	2,380	3,877	7,311
Overhead costs	000 RSD	58,542	63,417	68,720	75,077	82,051	89,706	98,112	105,597	113,671	122,378	257,775	688,706
TOTAL	000 RSD	**246,751**	**261,530**	**277,999**	**297,658**	**319,381**	**343,167**	**369,054**	**392,478**	**417,705**	**444,882**	**893,256**	**2,203,289**

Table 5-48 Sewage collection system expenditures – without project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Variable costs	000 RSD	**1,184**	**1,270**	**1,363**	**1,460**	**1,561**	**1,670**	**1,786**	**1,906**	**2,035**	**2,173**	**4,246**	**10,518**
Liquid chlorine	000 RSD	932	989	1,050	1,112	1,178	1,247	1,321	1,399	1,482	1,569	2,799	5,979
Electricity	000 RSD	252	281	313	348	383	422	465	507	553	604	1,447	4,539
Fuel and lubricant	000 RSD	-	-	-	-	-	-	-	-	-	-	-	-
Fixed costs	000 RSD	**31,375**	**33,382**	**35,498**	**37,998**	**40,696**	**43,564**	**46,673**	**49,501**	**52,524**	**55,767**	**104,366**	**251,202**
Wages and Salaries	000 RSD	7,448	8,133	8,881	9,792	10,795	11,902	13,122	14,191	15,348	16,598	36,336	100,618
Employee benefits	000 RSD	1,646	1,798	1,963	2,164	2,386	2,631	2,901	3,137	3,393	3,669	8,032	22,242
Other materials	000 RSD	1,275	1,339	1,406	1,476	1,550	1,627	1,708	1,794	1,884	1,978	3,221	6,075
Transport services	000 RSD	-	-	-	-	-	-	-	-	-	-	-	-
Repair services	000 RSD	165	175	186	198	210	223	237	251	266	281	493	1,025
Other services	000 RSD	441	467	496	527	560	595	633	670	708	749	1,315	2,733
Taxes and fees	000 RSD	673	714	757	804	855	909	967	1,023	1,082	1,144	2,009	4,174
Depreciation	000 RSD	10,716	11,070	11,394	11,765	12,132	12,450	12,767	13,083	13,402	13,734	17,542	24,222
Other costs	000 RSD	2,271	2,385	2,504	2,629	2,761	2,899	3,044	3,196	3,356	3,523	5,739	10,822
Overhead	000 RSD	6,740	7,301	7,912	8,644	9,447	10,328	11,296	12,157	13,087	14,089	29,678	79,291
TOTAL costs for existi	000 RSD	**32,559**	**34,652**	**36,861**	**39,459**	**42,257**	**45,234**	**48,459**	**51,407**	**54,560**	**57,940**	**108,612**	**261,720**

Table 5-49 Construction department expenditures – without project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Wages and Salaries	000 RSD	20,334	22,205	24,248	26,733	29,473	32,494	35,825	38,744	41,902	45,317	99,204	274,709
Employee benefits	000 RSD	4,868	5,316	5,805	6,401	7,057	7,780	8,577	9,276	10,032	10,850	23,752	65,772
Other materials	000 RSD	10,983	11,532	12,109	12,714	13,350	14,017	14,718	15,454	16,227	17,038	27,753	52,333
Transport services	000 RSD	3,335	3,571	3,825	4,116	4,430	4,768	5,132	5,469	5,829	6,212	11,743	26,872
Repair services	000 RSD	369	392	415	442	470	499	531	561	594	628	1,103	2,292
Other services	000 RSD	8,355	8,860	9,396	9,990	10,620	11,291	12,003	12,698	13,433	14,210	24,943	51,831
Taxes and fees	000 RSD	150	157	165	173	182	191	200	210	221	232	378	712
Depreciation	000 RSD	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231
Other costs	000 RSD	7,369	7,737	8,124	8,530	8,957	9,405	9,875	10,368	10,887	11,431	18,620	35,111
Overhead	000 RSD	18,402	19,934	21,601	23,599	25,791	28,197	30,840	33,192	35,730	38,467	81,026	216,481
TOTAL	**000 RSD**	**75,395**	**80,936**	**86,919**	**93,928**	**101,560**	**109,873**	**118,932**	**127,206**	**136,086**	**145,617**	**289,753**	**727,344**

Total overhead costs are set out in the table below. Overhead is allocated to the various production departments pro-rata their share in total wages and salaries costs. Overhead expenditures do not change as a result of the project; the expenditures are the same for the "without" and "with" project situation, despite a growth of the number of connections and service area.

Table 5-50 Overhead expenditures

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Wages and Salaries	000 RSD	54,545	59,563	65,043	71,710	79,060	87,164	96,098	103,930	112,401	121,561	266,110	736,894
Employee benefits	000 RSD	12,042	13,149	14,359	15,831	17,454	19,243	21,215	22,944	24,814	26,836	58,748	162,680
Other materials	000 RSD	-	-	-	-	-	-	-	-	-	-	-	-
Energy (Electricity)	000 RSD	486	536	591	652	711	777	848	918	992	1,073	2,349	6,506
Transport services	000 RSD	18	19	20	22	23	25	27	29	31	33	62	142
Repair services	000 RSD	404	429	454	483	514	546	581	614	650	687	1,206	2,507
Other services	000 RSD	2,728	2,893	3,068	3,261	3,467	3,686	3,919	4,145	4,385	4,639	8,143	16,921
Taxes and fees	000 RSD	448	470	494	518	544	571	600	630	661	695	1,131	2,133
Depreciation	000 RSD	1,412	1,412	1,412	1,412	1,412	1,412	1,412	1,412	1,412	1,412	1,412	1,412
Other costs	000 RSD	11,602	12,182	12,791	13,431	14,102	14,807	15,548	16,325	17,141	17,998	29,317	55,283
TOTAL	**000 RSD**	**83,684**	**90,653**	**98,232**	**107,320**	**117,288**	**128,231**	**140,248**	**150,947**	**162,488**	**174,935**	**368,479**	**984,478**

"With project" expenditures

Expenditures related to the "with project" situation consist of the above expenditures plus incremental costs as a result of the new operations for the waste water treatment plant and the sewage collection network and drinking water network expansion

Table 5-51 Drinking water expenditures – with project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Variable costs		**16,234**	**17,606**	**20,506**	**22,215**	**23,972**	**25,879**	**27,947**	**30,049**	**32,315**	**34,760**	**72,392**	**193,363**
Liquid chlorine	000 RSD	7,938	8,431	9,610	10,184	10,791	11,435	12,118	12,841	13,607	14,419	25,546	53,586
Electricity	000 RSD	6,863	7,653	9,160	10,192	11,232	12,379	13,642	14,890	16,252	17,738	42,234	130,102
Fuel and lubricant	000 RSD	1,433	1,522	1,735	1,839	1,949	2,065	2,188	2,319	2,457	2,604	4,613	9,676
Fixed costs	000 RSD	**230,517**	**244,078**	**271,445**	**298,232**	**319,173**	**342,119**	**367,104**	**389,492**	**413,600**	**439,566**	**868,936**	**2,115,014**
Wages and Salaries	000 RSD	64,690	70,642	78,673	87,864	96,870	106,799	117,746	127,342	137,721	148,945	326,055	902,891
Employee benefits	000 RSD	14,110	15,408	17,160	19,164	21,128	23,294	25,682	27,775	30,039	32,487	71,116	196,931
Other materials	000 RSD	7,544	7,921	8,317	8,733	9,170	9,628	10,110	10,615	11,146	11,703	19,064	35,947
Transport services	000 RSD	-	-	-	-	-	-	-	-	-	-	-	-
Repair services	000 RSD	5,559	5,896	7,320	8,898	9,460	10,057	10,692	11,310	11,965	12,657	22,217	46,167
Other services	000 RSD	5,842	6,195	6,717	7,296	7,756	8,246	8,766	9,274	9,811	10,378	18,217	37,855
Taxes and fees	000 RSD	2,767	2,906	3,051	3,204	3,364	3,532	3,709	3,894	4,089	4,293	6,993	13,187
Depreciation	000 RSD	69,928	69,928	77,523	82,344	83,273	84,266	85,165	86,073	87,023	88,025	130,312	150,457
Other costs (excl. write o	000 RSD	1,534	1,611	1,692	1,776	1,865	1,958	2,056	2,159	2,267	2,380	3,877	7,311
Overhead costs	000 RSD	58,542	63,571	70,992	78,953	86,287	94,338	103,178	111,050	119,540	128,697	271,085	724,267
TOTAL	000 RSD	**246,751**	**261,684**	**291,951**	**320,447**	**343,145**	**367,998**	**395,051**	**419,541**	**445,915**	**474,327**	**941,328**	**2,308,377**

Table 5-52 Waste water treatment expenditures – with project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Variable costs		**-**	**-**	**44,423**	**48,497**	**52,789**	**57,471**	**62,578**	**67,659**	**73,158**	**79,110**	**166,834**	**440,265**
Use of chemicals	000 RSD			12,846	13,670	14,546	15,477	16,466	17,518	18,635	19,822	35,213	72,958
Electricity	000 RSD			14,477	16,176	17,901	19,808	21,917	24,016	26,315	28,831	68,831	209,430
Fuel and lubricant	000 RSD												
Sludge transport & dispo	000 RSD			17,100	18,652	20,343	22,186	24,195	26,126	28,209	30,456	62,790	157,877
Effluent discharge fee	000 RSD												
Fixed costs	000 RSD	**-**	**-**	**84,792**	**89,788**	**92,382**	**95,179**	**98,195**	**101,019**	**104,031**	**107,245**	**185,792**	**317,506**
Wages and Salaries	000 RSD			4,519	4,982	5,493	6,056	6,677	7,221	7,809	8,446	18,489	51,197
Employee benefits	000 RSD			904	996	1,099	1,211	1,335	1,444	1,562	1,689	3,698	10,239
Other materials	000 RSD												
Transport services	000 RSD												
Repair services	000 RSD			18,379	19,539	20,773	22,084	23,478	24,837	26,274	27,795	48,787	101,381
Other services	000 RSD			4,953	5,266	5,598	5,951	6,327	6,693	7,080	7,490	13,147	27,320
Taxes and fees	000 RSD												
Depreciation	000 RSD			51,959	54,527	54,527	54,527	54,527	54,527	54,527	54,527	86,299	86,299
Other costs	000 RSD												
Overhead	000 RSD	-	-	4,078	4,477	4,893	5,349	5,851	6,297	6,778	7,298	15,372	41,069
TOTAL incremental co	**000 RSD**	**-**	**-**	**129,214**	**138,285**	**145,172**	**152,650**	**160,773**	**168,678**	**177,190**	**186,355**	**352,625**	**757,771**

Table 5-53 Sewage collection expenditures – with project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Variable costs	000 RSD	**1,237**	**1,383**	**1,542**	**1,666**	**1,796**	**1,937**	**2,089**	**2,247**	**2,417**	**2,601**	**5,167**	**12,664**
Liquid chlorine	000 RSD	974	1,077	1,188	1,269	1,355	1,447	1,545	1,649	1,760	1,878	3,406	7,199
Electricity	000 RSD	263	306	354	397	441	490	544	598	657	723	1,761	5,465
Fuel and lubricant	000 RSD	-	-	-	-	-	-	-	-	-	-	-	-
Fixed costs	000 RSD	**31,375**	**40,095**	**49,492**	**62,770**	**66,478**	**70,447**	**74,757**	**78,673**	**82,865**	**87,363**	**155,096**	**359,929**
Wages and Salaries	000 RSD	7,448	8,946	10,657	13,219	14,574	16,067	17,714	19,158	20,719	22,408	49,053	135,835
Employee benefits	000 RSD	1,646	1,978	2,356	2,922	3,222	3,552	3,916	4,235	4,580	4,953	10,843	30,027
Other materials	000 RSD	1,275	1,339	1,406	1,476	1,550	1,627	1,708	1,794	1,884	1,978	3,221	6,075
Transport services	000 RSD	-	-	-	-	-	-	-	-	-	-	-	-
Repair services	000 RSD	165	1,531	3,006	4,641	4,933	5,245	5,576	5,899	6,240	6,601	11,587	24,078
Other services	000 RSD	441	467	496	527	560	595	633	670	708	749	1,315	2,733
Taxes and fees	000 RSD	673	714	757	804	855	909	967	1,023	1,082	1,144	2,009	4,174
Depreciation	000 RSD	10,716	14,686	18,694	24,675	25,042	25,360	25,676	25,993	26,312	26,644	30,544	37,224
Other costs	000 RSD	2,271	2,385	2,504	2,629	2,761	2,899	3,044	3,196	3,356	3,523	5,739	10,822
Overhead	000 RSD	6,740	8,051	9,617	11,878	12,981	14,193	15,523	16,707	17,984	19,362	40,783	108,962
TOTAL costs for existi	000 RSD	**32,612**	**41,478**	**51,034**	**64,436**	**68,274**	**72,384**	**76,845**	**80,920**	**85,282**	**89,964**	**160,262**	**372,593**

Table 5-54 Construction department expenditures – with project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Wages and Salaries	000 RSD	20,334	21,147	15,010	13,366	14,737	16,247	17,912	19,372	20,951	22,659	49,602	137,354
Employee benefits	000 RSD	4,868	5,063	3,594	3,200	3,528	3,890	4,289	4,638	5,016	5,425	11,876	32,886
Other materials	000 RSD	10,983	11,532	12,109	12,714	13,350	14,017	14,718	15,454	16,227	17,038	27,753	52,333
Transport services	000 RSD	3,335	3,571	3,825	4,116	4,430	4,768	5,132	5,469	5,829	6,212	11,743	26,872
Repair services	000 RSD	369	392	415	442	470	499	531	561	594	628	1,103	2,292
Other services	000 RSD	8,355	8,860	9,396	9,990	10,620	11,291	12,003	12,698	13,433	14,210	24,943	51,831
Taxes and fees	000 RSD	150	157	165	173	182	191	200	210	221	232	378	712
Depreciation	000 RSD	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231
Other costs	000 RSD	7,369	7,737	8,124	8,530	8,957	9,405	9,875	10,368	10,887	11,431	18,620	35,111
Overhead	000 RSD	18,402	19,031	13,545	12,011	13,127	14,351	15,696	16,894	18,185	19,578	41,239	110,181
TOTAL	**000 RSD**	**75,395**	**78,722**	**67,414**	**65,774**	**70,631**	**75,890**	**81,587**	**86,897**	**92,574**	**98,645**	**188,488**	**450,804**

Note that by the end of the project period, the costs of the construction department are 40% lower than the without project situation. This cost saving is a result of the fixing of the overall staff levels and will be attributed to the project.

The table below summarizes the operational costs of all components and their percentage share. These costs do not include allowances for bad debt.

Table 5-55 Summary expenditures by component

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Expenditure by component - without project													
Drinking water	000 RSD	246,751	261,530	277,999	297,658	319,381	343,167	369,054	392,478	417,705	444,882	893,256	2,203,289
Sewage collection	000 RSD	32,559	34,652	36,861	39,459	42,257	45,234	48,459	51,407	54,560	57,940	108,612	261,720
Waste water treatment	000 RSD	-	-	-	-	-	-	-	-	-	-	-	-
Construction department	000 RSD	75,395	80,936	86,919	93,928	101,560	109,873	118,932	127,206	136,086	145,617	289,753	727,344
Total		**354,705**	**377,117**	**401,779**	**431,045**	**463,198**	**498,273**	**536,445**	**571,091**	**608,350**	**648,438**	**1,291,620**	**3,192,354**
Drinking water	%	70%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%
Sewage collection	%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	8%	8%
Waste water treatment	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Construction department	%	21%	21%	22%	22%	22%	22%	22%	22%	22%	22%	22%	23%
Total	**%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Expenditure by component - with project													
Drinking water	000 RSD	246,751	261,684	291,951	320,447	343,145	367,998	395,051	419,541	445,915	474,327	941,328	2,308,377
Sewage collection	000 RSD	32,612	41,478	51,034	64,436	68,274	72,384	76,845	80,920	85,282	89,964	160,262	372,593
Waste water treatment	000 RSD	-	-	129,214	138,285	145,172	152,650	160,773	168,678	177,190	186,355	352,625	757,771
Construction department	000 RSD	75,395	78,722	67,414	65,774	70,631	75,890	81,587	86,897	92,574	98,645	188,488	450,804
Total		**354,758**	**381,883**	**539,614**	**588,942**	**627,221**	**668,921**	**714,256**	**756,036**	**800,961**	**849,290**	**1,642,704**	**3,889,545**
Drinking water	%	70%	69%	54%	54%	55%	55%	55%	55%	56%	56%	57%	59%
Sewage collection	%	9%	11%	9%	11%	11%	11%	11%	11%	11%	11%	10%	10%
Waste water treatment	%	0%	0%	24%	23%	23%	23%	23%	22%	22%	22%	21%	19%
Construction department	%	21%	21%	12%	11%	11%	11%	11%	11%	12%	12%	11%	12%
Total	**%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Depreciation - with project													
water services	000 RSD	69,928	69,928	69,928	70,525	71,455	72,448	73,347	74,254	75,205	76,207	118,494	138,639
sewage collection	000 RSD	10,716	14,686	18,694	24,675	25,042	25,360	25,676	25,993	26,312	26,644	30,544	37,224
wastewater services	000 RSD	-	-	51,959	54,527	54,527	54,527	54,527	54,527	54,527	54,527	86,299	86,299
construction department	000 RSD	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231
Depreciation	**000 RSD**	**81,875**	**85,845**	**141,812**	**150,958**	**152,255**	**153,567**	**154,781**	**156,005**	**157,276**	**158,609**	**236,568**	**263,393**
going to water	%	85%	81%	49%	47%	47%	47%	47%	48%	48%	48%	50%	53%
going to sewage collectic	%	13%	17%	13%	16%	16%	17%	17%	17%	17%	17%	13%	14%
going to wastewater	%	0%	0%	37%	36%	36%	36%	35%	35%	35%	34%	36%	33%
going to construction dep	%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	0%
Total	**%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

The project will increase expenditure of the PUC with about 33% during the year 2011, decreasing to 22% during the year 2041, the final year of the analysis.

Presently, the water supply system accounts for almost 65% of total expenditure, rising to 70% after start of operations of the Barje system in the year 2009. The share will drop to 55% in 2011, when the waste water treatment plant starts to operate.

The effect of the new investments on the total depreciation charge is even more pronounced. As from the year 2011, the WWTP is responsible for 37% of the total depreciation charge, whereas drinking water drops to under 50%.

Unit cost prices

The unit cost price per m3 of drinking water invoiced and waste water delivered to the sewage network is calculated in such a way to cover at least the below mentioned costs. Full cost coverage is achieved if revenues generated by the applicable tariffs equals or exceeds total costs as calculated below.

- Operation & maintenance costs;
- Depreciation;
- (Provision for) bad debt;
- Interest payment;
- Working capital;
- Profit margin.

Depreciation is calculated at historical cost and by using a straight line depreciation methodology. The provision for bad debt is based on an improvement from the current 71% to 95% collection rate in the year 2013 for all customer groups. Since no debt financing is envisaged for this project, interest payment is nil. Finally, the profit level is set at 0%, in line with current practice in Serbia. Although this is not uncommon, it will

constrain the possibility for the PUC to invest in other service improvements or system extensions, such as improvement of quality and quantity of drinking water supply.

Using this methodology, a cost price for each of the PUC's services is calculated as detailed in the tables below. Unit cost prices can be expressed in a number of different ways:

- Drinking water supplied and billed to consumers;
- Waste water delivered to the sewage collection system;
- Waste water delivered to the waste water treatment plant, including infiltration. This is the physical quantity of waste water treated by the waste water treatment plant.

In order to enable a meaningful comparison between the cost prices of each of the different services, prices are expressed in RSD per m3 of drinking water supplied and billed to customers. This does not fully reflect the actual situation, since some clients have their own water source and thus only pay for sewage collection and treatment services. However, the current tariff system is set up in such a way that customers are charged a tariff for sewage collection services for each m3 of drinking water consumed.

Table 5-56 Cost price drinking water – with project

Financial year ending	Units	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Cost to cover - water															
operating costs & depreciation	RSD m	173	185	247	262	292	320	343	368	395	420	446	474	941	2,308
increase in working capital	RSD m		(20)	(10)	26	(14)	(18)	(13)	(0)	1	2	5	7	18	9
bad debt	RSD m	49	58	69	54	37	24	18	19	21	22	24	25	50	122
Interest and fee payment	RSD m		-	-	-	-	-	-	-	-	-	-	-	-	-
DSCR over depreciation	RSD m		-	-	-	-	-	-	-	-	-	-	-	-	-
Loan repayment over depreciation	RSD m		-	-	-	-	-	-	-	-	-	-	-	-	-
Total Water Costs to cover	RSD m	222	222	306	341	314	326	348	387	417	444	475	506	1,010	2,439
Volume produced	'000 m3	9,634	9,745	9,857	9,970	10,824	10,924	11,024	11,126	11,228	11,331	11,436	11,541	12,553	13,964
Volume billed															
Domestic	'000 m3	4,738	4,749	4,761	4,772	5,313	5,337	5,360	5,384	5,408	5,432	5,455	5,479	5,647	5,806
Institutional users	'000 m3	931	974	1,018	1,062	1,106	1,127	1,148	1,169	1,191	1,212	1,234	1,256	1,479	1,784
Business	'000 m3	1,225	1,250	1,275	1,300	1,326	1,353	1,380	1,408	1,436	1,464	1,494	1,524	1,857	2,403
Total	'000 m3	6,894	6,973	7,053	7,134	7,745	7,817	7,889	7,961	8,034	8,108	8,183	8,259	8,983	9,992
Unit cost of water produced	RSD / m3	23	23	31	34	29	30	32	35	37	39	42	44	80	175
Unit cost of water billed	RSD / m3	32	32	43	48	41	42	44	49	52	55	58	61	112	244

The forecasted unit cost of drinking water billed in the year 2009 is RSD 43/m3, up 36% as compared to the year 2008. This can be solely attributed to the start of operations of the Barje regional drinking water system. After some fluctuations during the following years due to working capital requirements and start of operations of the extension of the drinking water supply network to the Northern villages, cost price increases slightly above inflation at 6% to 7% annually. The unit cost price is almost equivalent to the "without" project situation. In other words, the marginal cost of the network extension is equivalent to the without project situation.

Table 5-57 Cost price sewage collection – with project

Financial year ending	Units	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Cost to cover															
operating costs & depreciation	RSD m	27	28	33	41	51	64	68	72	77	81	85	90	160	373
increase in working capital	RSD m	-	4	(2)	(1)	(3)	(4)	(3)	0	0	0	1	1	3	1
bad debt	RSD m	9	12	11	10	7	5	3	4	4	4	5	5	9	20
Interest and fee payment	RSD m	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DSCR over depreciation	RSD m														
CAPEX injection	RSD m														
Total Waste Water costs to cover	RSD m	36	44	42	51	56	65	69	76	81	86	91	96	172	393
Volume billed															
Domestic	'000 m3	2,963	3,002	3,221	3,441	3,662	3,721	3,780	3,840	3,900	3,960	4,021	4,081	4,338	4,478
Institutional users	'000 m3	776	812	844	876	908	925	941	958	974	991	1,008	1,025	1,204	1,454
Business - small	'000 m3	1,072	1,094	1,116	1,138	1,161	1,184	1,207	1,232	1,256	1,281	1,307	1,333	1,625	2,102
Business - large	'000 m3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	'000 m3	4,811	4,908	5,180	5,455	5,731	5,829	5,929	6,029	6,131	6,233	6,336	6,439	7,168	8,034
Unit cost of wastewater discharged	RSD / m3	8	9	8	9	10	11	12	13	13	14	14	15	24	49
Unit cost of wastewater of drinking wa	RSD / m3	6	8	7	8	8	10	10	11	11	12	12	13	21	42

The unit cost price for sewage collection services is expressed both in waste water delivered to the sewerage system and drinking water supplied. It is estimated that 83% to 88% of the consumed drinking water ends up in the sewerage system. The unit cost of sewage collection in 2007 is RSD 6 per m3 drinking water consumed. This increases to RSD 10 in 2012, as a result of project investments. After 2012, unit prices increase moderately with 4% to 6%, a little below drinking water cost price increases. Initially, the unit cost price of sewage collection services is 40% higher than the sewage collection without project, but this difference narrows to 20% towards the end of the project period. Still, it can be concluded that the marginal cost of extension of sewage collection services is higher than that of the existing system, thus pushing up the average cost price.

Table 5-58 Cost price waste water treatment

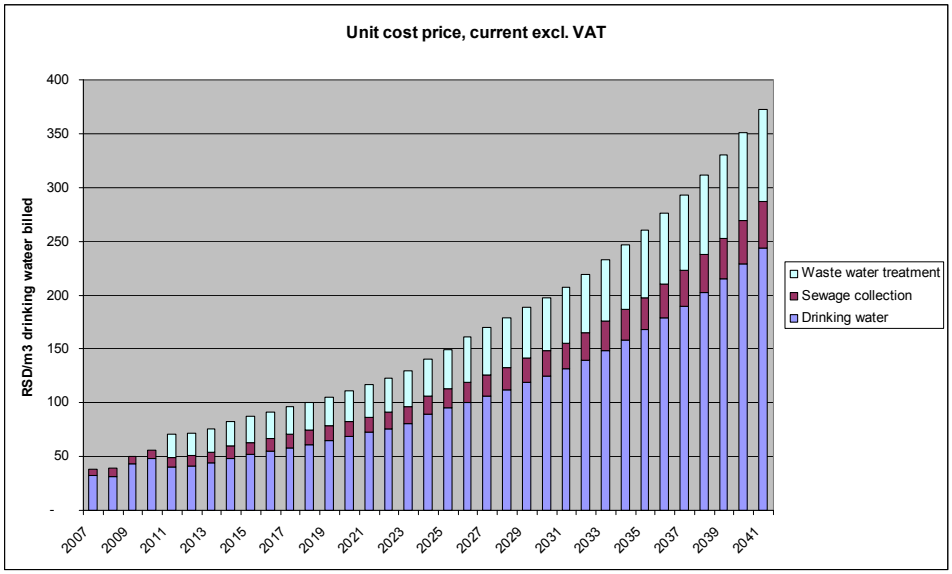
Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Cost to cover waste water treatment													
operating costs & depreciation	RSD m	-	-	129	138	145	153	161	169	177	186	353	758
increase in working capital	RSD m	-	-	-	(7)	(4)	(1)	(1)	(1)	(1)	(1)	7	4
bad debt	RSD m	-	-	12	8	8	8	9	9	10	10	19	40
Interest and fee payment	RSD m	-	-	-	-	-	-	-	-	-	-	-	-
DSCR over depreciation	RSD m												
CAPEX injection	RSD m												
Total Waste Water costs to cover	RSD m	-	-	141	140	148	160	168	177	186	196	379	802
Volume billed													
Domestic	'000 m3			3,662	3,721	3,780	3,840	3,900	3,960	4,021	4,081	4,338	4,478
Institutional users	'000 m3			908	925	941	958	974	991	1,008	1,025	1,204	1,454
Business - small	'000 m3			1,161	1,184	1,207	1,232	1,256	1,281	1,307	1,333	1,625	2,102
Business - large	'000 m3			-	-	-	-	-	-	-	-	-	-
Total	'000 m3	-	-	5,731	5,829	5,929	6,029	6,131	6,233	6,336	6,439	7,168	8,034
Unit cost of wastewater treated (incl. i	RSD / m3			19	19	20	21	22	23	23	24	43	83
Unit cost of wastewater delivered to c	RSD / m3			25	24	25	26	27	28	29	30	53	100
Unit cost of wastewater of drinking wa	RSD / m3			21	21	22	23	24	25	25	26	46	86

The unit cost for waste water treatment during the year 2011, the first operational year of the waste water treatment plant, amounts to RSD 21 per m3 of drinking water supplied. Annual increases thereafter are limited to 4% to 5% on average, at approximately the same rate as inflation.

The graph below summarizes the various cost prices for each of the services supplied by the PUC. The total unit cost price in 2007 per m3 of drinking water supplied amounts to RSD 39/m3 (€ 0.48/m3). This increases to RSD 70/m3 (€ 0.82/m3) during the year 2011, when the investments become operational. By the year 2020, unit cost prices have increased to RSD 111/m3 (€ 1.13/m3).

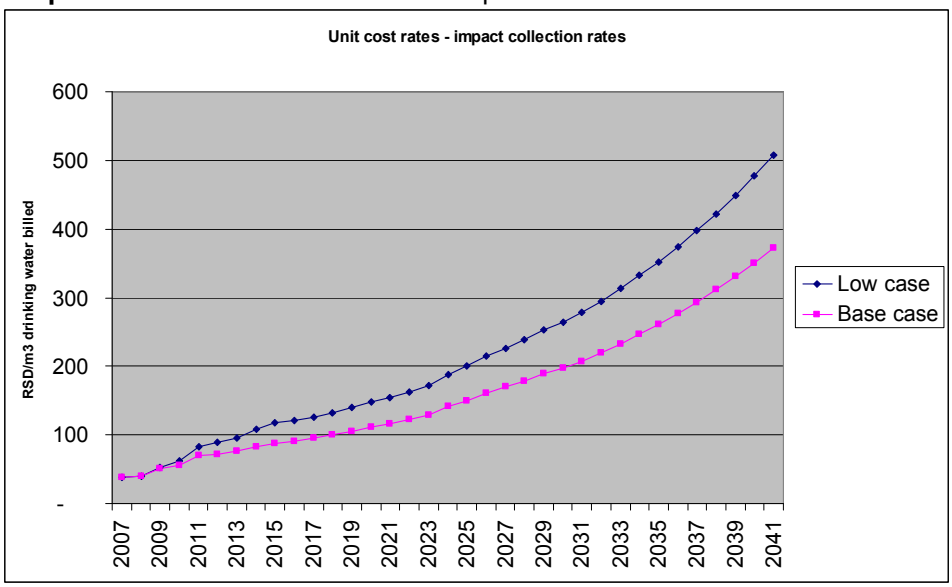
As can be clearly seen, the introduction of Barje regional drinking water supply system causes the water & waste water unit cost price to increase with 25% in 2009, followed by another 10% during the year 2010. Start of operation of the waste water treatment plant in the year 2011 results in another increase of the total unit cost price with about 25%, compared to the previous year. Thereafter, unit cost prices increase with about 5% to 8% annually, which is above inflation.

Graph 5-1 Unit cost prices (current prices)



The impact of collection rates has a major impact on the unit cost rate. A low case case collection, in which the current low collection rate of 71% does not improve, will cause the unit cost prices to be 36% higher than a base case collection rate scenario which manages to increase the collection rate to 95% average by the year 2013.

Graph 5-2 Total unit cost rates – impact base case versus low case collection rates



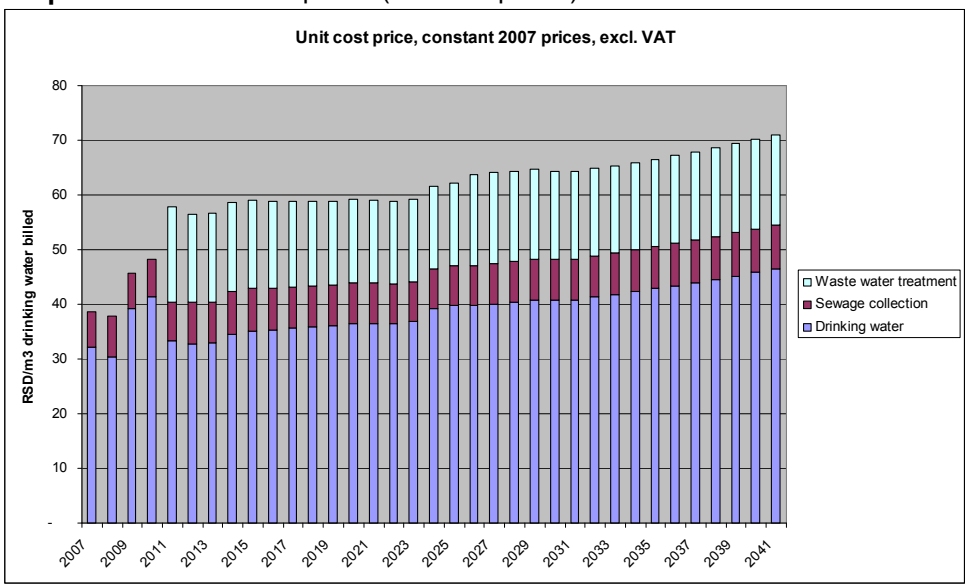
Obvious consequence of a low case collection rate scenario is that the tariffs would have to be set higher as well, in order to mitigate the adverse effects of low collections.

The graph below summarizes the unit cost prices, however expressed in constant 2007 prices. By doing so, real increases in prices can be easily analyzed and compared between years.

Not surprisingly, the general pattern of increases is repeated. At first, constant unit cost prices increase with respectively 20% and 5% as a result of the start of the Barje regional drinking water supply system. A subsequent increase of 20% is caused during the year 2011, when the waste water treatment plant starts to operate.

Compared to the year 2007, the introduction of waste water treatment and sewage and drinking water extension, as well as introduction of the Barje regional water supply system, causes the total unit cost price to increase with 50% in real terms, from RSD 39/m3 during 2007 to RSD 58/m3 in 2011. Towards the end of the project period in the year 2041, real cumulative unit prices have increased to RSD 71/m3 or 83% compared to the 2007 unit price. Without the project, real increase of total unit price has reached 3% by the year 2011 and 40% by the year 2041.

Graph 5-3 Unit cost prices (constant prices)



5.3.5 Tariffs

Having calculated the cost price for all different components for the water and waste water, a tariff and tariff policy for each client group can be proposed. The following principles, will serve as a basis for determining a suitable tariff and tariff policy:

- Tariffs are based on full cost coverage as defined above;
- Tariffs will be based on the polluter pays principle;
- Tariffs should not exceed maximum affordability levels;
- Tariffs should ensure financial sustainability;
- Steep tariff increases should as much as possible be avoided.

Furthermore, the current Government policy of regulated tariffs, which does not allow tariffs to increase more than estimated inflation levels, should be taken into consideration as well. It is expected that at least in the short term, this policy will be continued. Only in case of new services, like waste water treatment, a separate tariff can be introduced. Extension of services, however, is subject to existing tariffs. This would

for example be applicable for the extension of the drinking water and sewage collection network.

For this reason it is proposed to introduce, as from the year 2011, a new tariff for waste water treatment. Thus, the following tariffs will have to be determined for each user group:

- Drinking water;
- Sewage collection;
- Waste water treatment.

In order to be able to make a meaningful comparison, all tariffs are recalculated in m3 drinking water equivalent, in line with the current tariff methodology. This also applies to the majority of the industries, since they do not have their own drinking water source. In case industries have their own water source, either a separate sewage discharge rate will need to be set and the discharge itself measured, or the charge should be based on the own drinking water consumption of these industries. This could however be difficult to obtain.

Furthermore, all tariffs are expressed in constant 2007 prices, to allow a meaningful comparison of tariff adjustments over time. Information on the effect of the proposed tariff policy on the current tariff – the tariff which clients will actually see on their invoice, will be outlined at the end of this paragraph.

Drinking water tariff

The current 2007 drinking water tariff structure is as follows:

Table 5-59 2007 drinking water tariffs (without VAT)

Customer group	RSD/m3
Domestic	15.62
Institutional /1	27.73
Business	52.84

/1 calculated average tariff

Compared to the domestic tariff, the tariff for business is more than three times higher, and the average tariff for institutions almost two times higher. This is not based on higher costs for delivery of drinking water services to either business or institutions. Therefore, the domestic tariff is cross subsidized by institutional and business tariffs. The overall level of cross subsidy is substantial, since institutions and businesses account for 31% of total drinking water quantity invoiced during the year 2007. However, to prevent large increases of the drinking water tariff for domestic clients, it is proposed not to eradicate this cross subsidy, but rather to keep the cross subsidy fixed at the 2007 level.

The average drinking water tariff charged during 2007 amounts to RSD 24/m3m which is considerably below the calculated 2007 unit cost price of RSD 32/m3. This fact alone would necessitate a major increase of the 2007 drinking water tariff with 33%, with or without project.

The real unit cost price of drinking water increases with a cumulative 28% as a result of introduction of the Barje regional drinking water system. During the following years, large reductions in the unit cost price are achieved, mainly as a result of improved

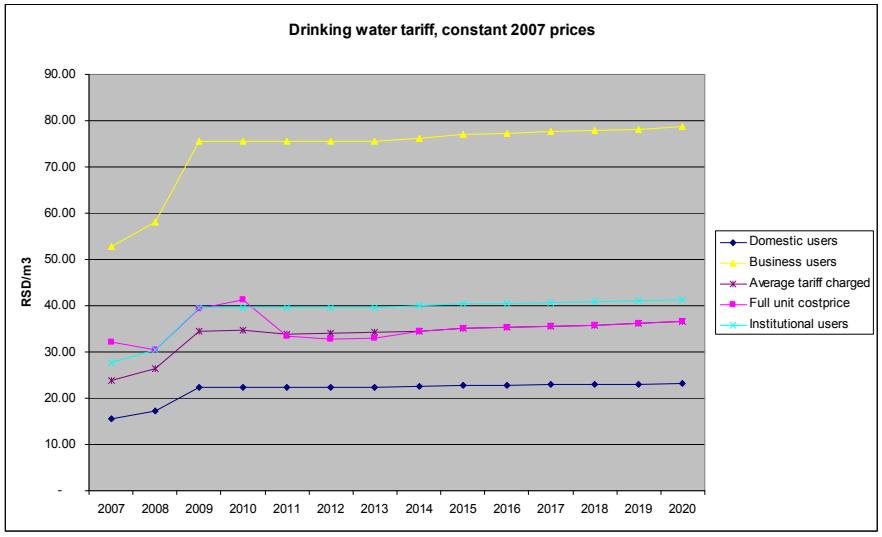
collection rates and despite substantial investments in the extension fo the drinking water network to the Northern villages in Leskovac municipality. After this has settled, unit rates increase annually with approximately 0% to 1.5%, to reach a cumulative increase of 44% by the year 2041. In case collection rates remain at the current low level of 71%, unit cost would have increased with 103% by the year 2041.

Despite current Government policy, it is proposed to increase the current drinking water tariff in real terms as follows, for all customer groups:

- 10% in real terms as from the year 2008 to start closing the gap with the unit cost price and to correct the real decline of the tariff during the year 2007. This translates into a nominal increase of 15.5%.
- 30% in real terms in the year 2009, upon start of operations of the Barje regional drinking water system. The nominal increase would amount to 36.5%.
- Adjustment for inflation only during the years 2010 to 2013;
- Thereafter, adjustment of tariffs in line with full unit cost price fluctuations.

The result of this policy is illustrated in the graph below.

Graph 5-4 Drinking water tariffs (2007 constant prices)



Sewage collection tariff

The current 2007 collection tariff is set at 20% of the drinking water tariff. The table below summarizes the current sewage collection tariffs.

Table 5-60 2007 Sewage collection tariffs (without VAT)

Customer group	RSD/m3
Domestic	3.13
Institutional /1	6.07
Business	10.39

/1 calculated average tariff

Again, the business tariff is more than three times, and the institutional tariff almost twice the domestic tariff, without a clear cost justification. Therefore, both business and institutional tariffs are cross subsidizing the domestic tariff. The overall impact is substantial, since sewage produced by institutions and businesses comprise 38% of 2007 invoiced sewage discharge. To prevent large increases of the sewage collection tariff for domestic clients, it is proposed not to eradicate this cross subsidy, but rather to keep the cross subsidy fixed at the 2007 level.

The average sewage collection tariff charged during 2007 amounts to RSD 5.3/m3 which is below the calculated 2007 unit cost price of RSD 6.5/m3. This fact alone would necessitate a large increase of the 2007 sewage collection tariff with 22%, with or without project.

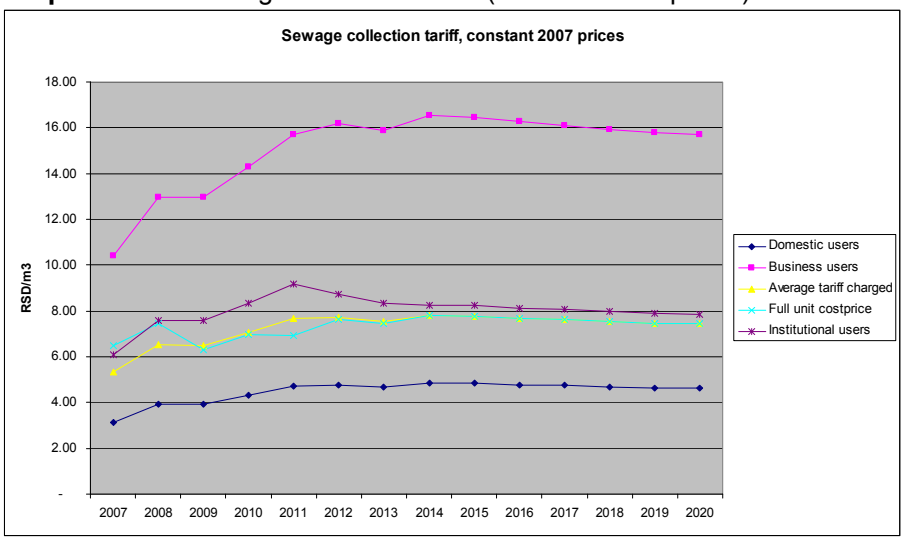
The connection of an additional 20,000 domestic clients has an impact on the required sewage collection tariff. On the one hand, large investments are required to extend the sewage collection network to suburban areas. Also, operational costs to run this extension are substantial. This causes the average unit cost of sewage collection for the whole of the municipality to increase. On the other hand, the addition of 20,000 additional clients will increase revenues.

These factors taken together cause the average unit cost price of sewage collection in Leskovac municipality to rise with a relatively low 20% in real terms up to the year 2014, by which year the impact of the new investments and additional operational costs have settled. After this year, the real increase of the unit cost price is relatively stable and fluctuates from -1% to 1%.

Despite current Government policy, it is proposed to increase the sewage collection tariff in real terms as follows, for all customer groups:

- 25% in real terms as from the year 2008 to start closing the gap with the unit cost price and to correct the real decline of the tariff during the year 2007. This translates into a nominal increase of 31%.
- 10% in real terms in both 2010 and 2011, because of implementation of the sewage collection network extension in Lekovac suburbs. The nominal increase in each year would amount to 15.5%.
- Thereafter, adjustment of tariffs in line with full unit cost price fluctuations.

Graph 5-5 Sewage collection tariffs (2007 constant prices)



Wastewater treatment tariff

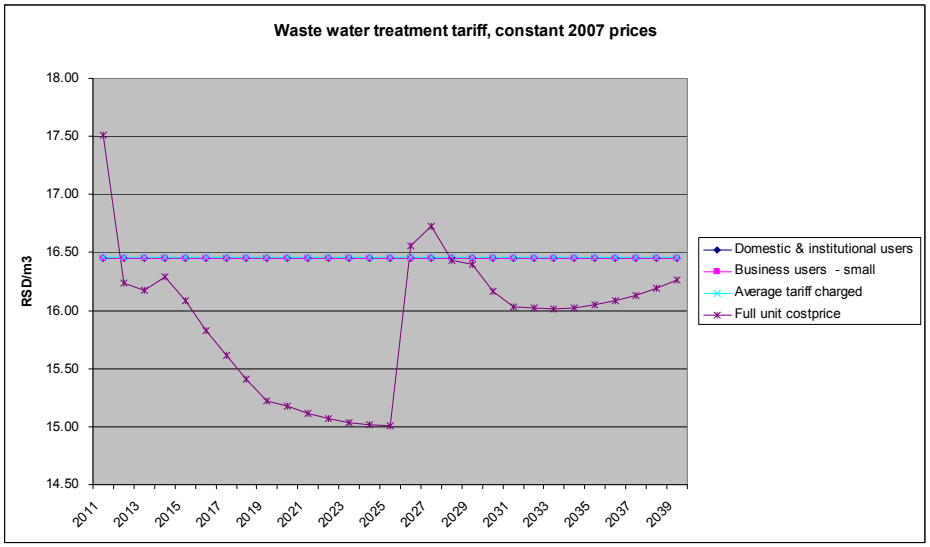
The treatment of waste water is a new service in Leskovac municipality. It is expected that this service becomes operational as from the year 2011. Therefore, it is proposed to introduce a completely new tariff for waste water treatment, which also should be clearly distinguished on invoices sent to customers. The introduction of a new tariff would enable the PUC to cover its costs and would be in line with current Government policy, which allows the introduction of new tariffs for new services. A separate tariff for waste water treatment is not uncommon for those Serbian municipalities who have operational waste water treatment plants. The municipality of Subotica charges its customers a separate tariff for waste water treatment.

When analyzing the development of the unit cost price of waste water, it can be concluded that after the first operational year 2011, the real unit cost price decreases with around 0.5% to 1.0% until the year 2026. In the year 2025, large re-investment in mechanical and electrical equipment is required, which causes the real unit cost price to increase with 10% during the next year, almost back to the same tariff level as at the start of operations. After this year, real unit cost prices fluctuate at around 0%, without a clear increasing or declining trend.

It is proposed to set the waste water tariff from the start at the full unit cost price at the same level for all customer groups, including industries. The allowed BOD pollution load of industries is restricted to 300 mg/l, which is equivalent to the pollution load of communal type waste water. Therefore, the polluter pays principle would lead to a tariff which is dependent on hydraulic loading only.

Furthermore, it is proposed to set the tariff right from the year 2011 at full cost recovery level, without a gradual introduction. Although this will cause the overall tariff for domestic users to increase with about 20% during the year 2011, this is still well within average affordability levels as will be shown later on. Furthermore, it will have as an added advantage that real tariff increases are not required thereafter. Tariffs would only have to be adjusted for inflation.

Graph 5-6 Waste water treatment tariff (2007 constant prices)



Summary tariffs

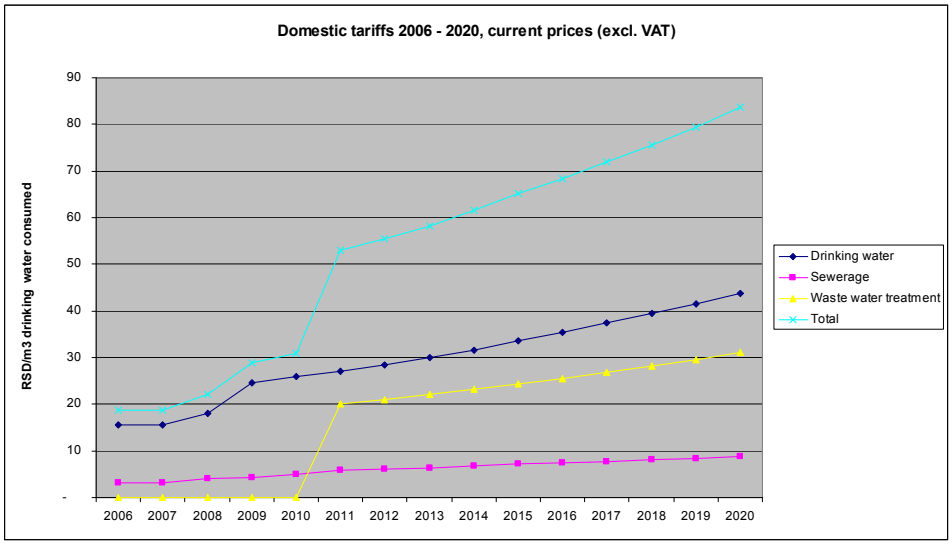
The effect of the proposed tariff policy is summarized in the table below. The mentioned tariffs in this table are however expressed as current values. Thus, apart from real increases, tariffs are also corrected for inflation. This will be the tariff charged to customers. The base case macro economic scenario projects an inflation rate of 5% as from the year 2008 onwards. Therefore, if a tariff increases with 5%, no real increase in tariffs is proposed, but only an adjustment for inflation.

Table 5-61 Summary proposed tariff structure (current prices)

Financial year ending	Units	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Drinking water															
Domestic	RSD / m3	16	18	25	26	27	29	30	32	34	35	37	39	69	143
Institutional users	RSD / m3	28	32	44	46	48	51	53	56	60	63	66	70	123	253
Business - small	RSD / m3	53	61	83	87	92	96	101	107	114	120	126	133	235	483
Waste water treatment															
Domestic	RSD / m3	-	-	-	-	20	21	22	23	24	26	27	28	46	86
Institutional users	RSD / m3	-	-	-	-	20	21	22	23	24	26	27	28	46	86
Business - small	RSD / m3	-	-	-	-	20	21	22	23	24	26	27	28	46	86
Sewerage															
Domestic	RSD / m3	3	4	4	5	6	6	6	7	7	7	8	8	13	24
Institutional users	RSD / m3	6	8	8	10	11	11	11	12	12	13	13	14	21	41
Business - small	RSD / m3	10	14	14	17	19	21	21	23	24	25	26	27	42	82
Total W&WW (RSD)															
Domestic	RSD / m3	19	22	29	31	53	56	58	62	65	68	72	76	128	253
Institutional users	RSD / m3	34	40	52	56	79	83	86	91	96	101	106	112	190	381
Business - small	RSD / m3	63	75	98	104	131	138	145	154	163	171	180	189	323	651
Total W&WW (€)															
Domestic	€ / m3	0.23	0.27	0.35	0.36	0.61	0.64	0.66	0.68	0.71	0.74	0.76	0.79	1.15	1.89
Institutional users	€ / m3	0.42	0.49	0.63	0.65	0.92	0.95	0.97	1.01	1.05	1.09	1.13	1.17	1.72	2.84
Business - small	€ / m3	0.79	0.91	1.17	1.23	1.52	1.58	1.63	1.70	1.78	1.84	1.91	1.97	2.92	4.86
Tariff summary - % increase year-on-year avg															
Drinking water															
Domestic	%	0%	16%	37%	5%	5%	5%	5%	6%	6%	5%	6%	5%	6%	6%
Institutional users	%	0%	16%	37%	5%	5%	5%	5%	6%	6%	5%	6%	5%	6%	6%
Business - small	%	0%	16%	37%	5%	5%	5%	5%	6%	6%	5%	6%	5%	6%	6%
Waste water treatment															
Domestic	%						5%	5%	5%	5%	5%	5%	5%	5%	5%
Institutional users	%						5%	5%	5%	5%	5%	5%	5%	5%	5%
Business - small	%						5%	5%	5%	5%	5%	5%	5%	5%	5%
Sewerage															
Domestic	%	0%	31%	5%	16%	16%	6%	3%	9%	4%	4%	4%	4%	5%	6%
Institutional users	%	0%	31%	5%	16%	16%	0%	0%	4%	4%	4%	4%	4%	5%	6%
Business - small	%	0%	31%	5%	16%	16%	8%	3%	9%	4%	4%	4%	4%	5%	6%
Total W&WW															
Domestic	%	0%	18%	31%	7%	72%	5%	5%	6%	6%	5%	5%	5%	5%	6%
Institutional users	%	0%	18%	30%	7%	43%	4%	4%	5%	6%	5%	5%	5%	5%	6%
Business - small	%	0%	18%	31%	7%	26%	5%	5%	6%	6%	5%	5%	5%	5%	6%

The effect over time of the proposed domestic tariff is depicted in the graph below. Note that this concerns current fees, including inflation.

Graph 5-7 Domestic tariffs (current prices)



5.3.6 Affordability

Domestic users/household

The proposed tariff policy causes the tariffs to increase substantially, especially during the years 2008, 2009 and 2011. This is of course not very surprising given the scale of investments required, both in project investment and investments being made in the regional water supply system. In addition, current tariffs which are substantially below cost recovery level require substantial tariff adjustments. Only the tariff increase during the year 2011 is a result of project investments.

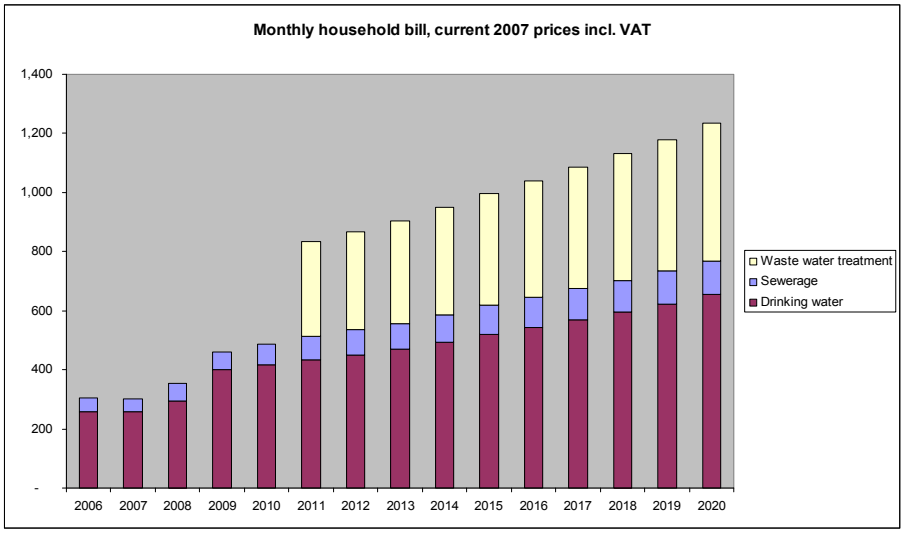
The question of affordability to domestic consumers is usually assessed by estimating the share of expenditures on water and waste water out of total available income in a single household. Chapter 2 of this report has elaborated on the household income trend as well as the maximum affordability, using a 4% maximum affordability ratio. In doing so, a maximum affordable household bill of RSD 1,212/month was calculated, for the year 2007. This is much higher than the actual 2007 bill for a household, which is estimated at RSD 302/month or 1.0% of household income.

In assessing future affordability, the following factors are taken into consideration:

- Consumption per capita will remain the same at 155 liter per capita per day, in accordance with the demand analysis elaborated upon in chapter 3;
- The size of the households will decline with a rate similar to that realized during the period 1991 to 2002, i.e. with 0.71% per annum down to a minimum of 2.80 members per household. This will decrease the average household bill;
- Value added tax will be fixed at 8% throughout the analyzed period;
- Household income will grow with inflation and projected real wage increase;

The monthly average household bill, including VAT based on the proposed domestic tariffs is shown in the graph below.

Graph 5-8 Monthly household expenditure on water & waste water

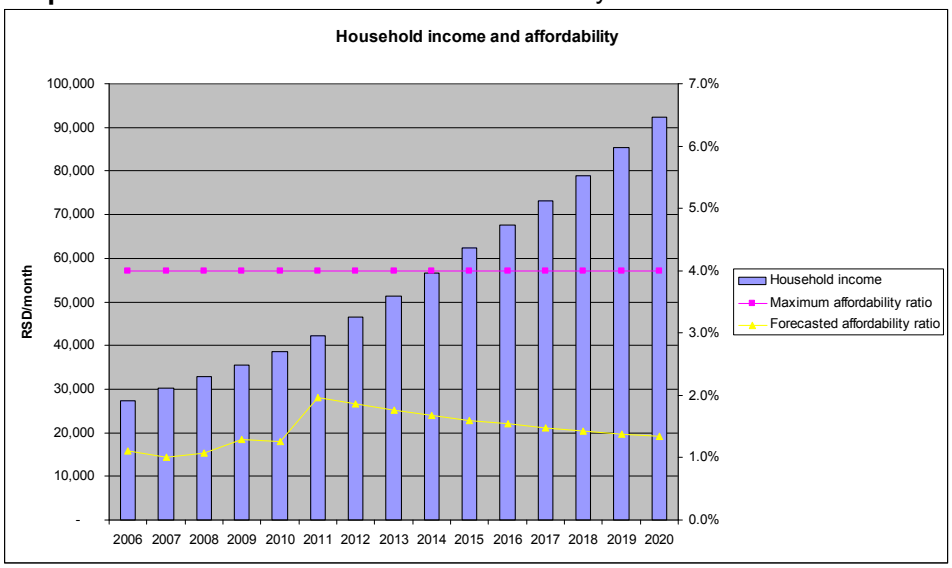


Next, the growth in household income is compared with both the forecasted and maximum affordability ratios. As can be seen in the graph below, the affordability ratio

will peak during the year 2011 at 2.0%, as a result of the introduction of a waste water treatment tariff. This increase, however, is well below the maximum affordability ratio of 4.0%. Conclusion therefore is that the proposed tariffs are on average affordable to domestic users. It should be realized however, that the calculations are based on average consumption patterns and average household income. A large low income family with above average consumption per capita will face a higher total monthly bill, while at the same time household income will be lower. On the other hand, pensioners are a recognized vulnerable group, but will most likely have smaller households and consequently lower consumption patterns and lower monthly bills to pay.

In any case, this could cause affordability constraints. It is suggested to identify cases where this might occur and build upon an existing or introduce a new social support program to mitigate these effects.

Graph 5-9 Household income and affordability



5.3.7 Revenue forecast

After setting the tariffs, total revenues for the company can be calculated. A distinction will be made between “without” and “with” project revenues, which later on will be used in the cost benefit analysis.

The following revenue streams can be distinguished:
- Drinking water revenues;
- Sewage collection revenues;
- Waste water treatment revenues;
- Construction department revenues.

Waste water treatment is entirely an incremental “with” project revenue stream, while drinking water, sewage collection as well as the construction department all have different “without” and “with” revenue streams.

Connection fees chargeable to new consumers in both drinking water supply and sewage collection is not taken into account in the financial model, since it is assumed that these charges are covering the direct cost of making a connection from the household to the drinking water or sewage collection secondary network. Thus, connection charges are cost neutral to the PUC. The new customer is responsible to finance and build the sewer network and internal plumbing on his own premises.

Drinking water revenues

Drinking water revenues are estimated based on the tariff policy elaborated upon above. For both the "without project" and the "with project" situation, the following tariff setting methodology is used:

- Real increase of tariffs of respectively 10% in 2008 and 30% in 2009;
- Adjustment for inflation during the period 2010 to 2013;
- Tariff equivalent to full unit cost for the period 2014 to 2041.

As can be seen from the table, revenues from domestic consumers are the biggest source of income, followed closely by industrial consumers.

Table 5-62 Drinking water revenues – with project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Tariffs													
Domestic	RSD/m3	25	26	27	29	30	32	34	35	37	39	69	143
Business	RSD/m3	83	87	92	96	101	107	114	120	126	133	235	483
Institutional users	RSD/m3	44	46	48	51	53	56	60	63	66	70	123	253
Water charged													
Domestic	'000 m3	4,761	4,772	5,313	5,337	5,360	5,384	5,408	5,432	5,455	5,479	5,647	5,806
Business	'000 m3	1,275	1,300	1,326	1,353	1,380	1,408	1,436	1,464	1,494	1,524	1,857	2,403
Institutional users	'000 m3	1,018	1,062	1,106	1,127	1,148	1,169	1,191	1,212	1,234	1,256	1,479	1,784
Revenue													
Domestic	RSD m	117	123	144	152	160	170	182	192	204	216	392	828
Business	RSD m	106	114	122	130	140	151	163	175	189	203	436	1,159
Institutional users	RSD m	44	49	53	57	61	66	71	76	82	88	182	452
Total	**RSD m**	**268**	**286**	**319**	**340**	**361**	**387**	**417**	**444**	**475**	**506**	**1,010**	**2,439**

The without project revenues are lower, mainly as a result of lower quantities invoiced. The cost covering tariff for the "without" and "with" project situation is almost the same, i.e. the incremental cost of connecting 12,000 inhabitants in the Northern villages can be covered from incremental demand without having to increase the drinking water tariff.

Table 5-63 Drinking water revenues – without project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Tariffs													
Domestic	RSD/m3	25	26	27	29	30	31	33	35	37	39	69	142
Business	RSD/m3	83	87	92	96	101	105	111	118	124	131	233	479
Institutional users	RSD/m3	44	46	48	51	53	55	58	62	65	69	122	251
Water charged													
Domestic	'000 m3	4,761	4,772	4,784	4,795	4,807	4,819	4,830	4,842	4,854	4,866	4,985	5,145
Business	'000 m3	1,275	1,300	1,326	1,353	1,380	1,408	1,436	1,464	1,494	1,524	1,857	2,403
Institutional users	'000 m3	1,018	1,062	1,106	1,127	1,148	1,169	1,191	1,212	1,234	1,256	1,479	1,784
Revenue													
Domestic	RSD m	117	123	130	137	144	149	159	168	178	189	344	729
Business	RSD m	106	114	122	130	140	147	160	172	186	200	433	1,151
Institutional users	RSD m	44	49	53	57	61	64	69	75	81	86	181	449
Total	**RSD m**	**268**	**286**	**305**	**324**	**345**	**361**	**388**	**415**	**445**	**475**	**958**	**2,328**

Sewage collection revenues

Sewage collection revenues are estimated based on the tariff policy elaborated upon above. For the "without project", the following tariff setting methodology is used:

- Real increase of tariffs of 25% in 2008;
- Adjustment for inflation during the year 2009;
- Tariff equivalent to full unit cost for the period 2010 to 2041.

Tariffs methodology for the "with project" is:

- Real increase of tariffs of 25% in 2008;
- Adjustment for inflation during the year 2009;
- Real increase of tariffs of 10% in both 2010 and 2011;
- Tariff equivalent to full unit cost for the period 2012 to 2041.

This methodology leads to sewage collection revenues which increase annually with about 20% until the year 2011, caused by the connection of new clients. Thereafter, revenues growth slows to about 7% annually.

The tariffs mentioned in the table are expressed in waste water discharged in the sewer system. This is done for calculation purposes. Of course, actual sewage collection fees are charged as a function of drinking water supplied.

Table 5-64 Sewage collection revenues – with project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Tariffs													
Domestic	RSD/m3	5	6	7	7	7	8	8	9	9	9	14	28
Institutional users	RSD/m3	10	12	13	13	13	14	15	15	16	16	25	49
Business - small	RSD/m3	16	19	22	24	24	27	28	29	30	31	49	94
Wastewater charged													
Domestic	'000 m3	3,221	3,441	3,662	3,721	3,780	3,840	3,900	3,960	4,021	4,081	4,338	4,478
Institutional users	'000 m3	844	876	908	925	941	958	974	991	1,008	1,025	1,204	1,454
Business - small	'000 m3	1,116	1,138	1,161	1,184	1,207	1,232	1,256	1,281	1,307	1,333	1,625	2,102
Revenue													
Domestic	RSD m	16	20	24	26	27	30	32	34	36	38	62	124
Institutional users	RSD m	8	10	12	12	13	13	14	15	16	17	31	72
Business - small	RSD m	18	22	25	28	29	33	35	37	39	42	79	197
Total	RSD m	43	51	62	66	69	76	81	86	91	96	172	393

The "with project" revenues are substantially higher than the "without project" revenues, both because of incremental demand and higher tariffs. In other words, project investments and incremental operational costs cannot be covered by incremental demand alone. An additional tariff adjustment of 10% real increase in 2010 as well 2011 is necessary in order to achieve full cost recovery.

Table 5-65 Sewage collection revenues – without project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Tariffs													
Domestic	RSD/m3	5	5	5	5	5	5	6	6	6	7	11	22
Institutional users	RSD/m3	10	10	10	10	10	10	10	11	11	12	20	39
Business - small	RSD/m3	16	17	17	17	17	18	20	21	22	23	38	74
Wastewater charged													
Domestic	'000 m3	3,042	3,081	3,121	3,135	3,149	3,163	3,178	3,192	3,206	3,221	3,322	3,432
Institutional users	'000 m3	801	792	785	791	797	803	809	814	820	826	944	1,139
Business - small	'000 m3	1,116	1,138	1,161	1,184	1,207	1,232	1,256	1,281	1,307	1,333	1,625	2,102
Revenue													
Domestic	RSD m	15	16	16	16	16	17	18	19	20	22	37	76
Institutional users	RSD m	8	8	8	8	8	8	8	9	9	10	19	44
Business - small	RSD m	18	20	20	21	21	23	25	26	28	30	61	156
Total	RSD m	41	44	44	45	45	48	51	54	58	62	117	276

Waste water treatment revenues

Waste water treatment revenues are considered to be entirely incremental, since this is a new service extended not only to new sewage collection customers, but also to existing consumers in Leskovac city. Without the project, this tariff would not be charged at all.

The tariffs mentioned in the table below are again expressed as waste water discharged into the sewer system for calculation purposes.

Table 5-66 Waste water treatment revenues – with project

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Tariffs													
Domestic	RSD/m3	-	-	23	24	25	27	28	29	31	32	53	99
Institutional users	RSD/m3	-	-	24	25	26	28	29	31	32	34	55	104
Business - small	RSD/m3	-	-	23	24	25	26	28	29	31	32	52	99
Business - large	RSD/m3	-	-	-	-	-	-	-	-	-	-	-	-
Wastewater charged													
Domestic	'000 m3	-	-	3,662	3,721	3,780	3,840	3,900	3,960	4,021	4,081	4,338	4,478
Institutional users	'000 m3	-	-	908	925	941	958	974	991	1,008	1,025	1,204	1,454
Business - small	'000 m3	-	-	1,161	1,184	1,207	1,232	1,256	1,281	1,307	1,333	1,625	2,102
Revenue													
Domestic	RSD m	-	-	84	90	96	102	109	116	124	132	228	444
Institutional users	RSD m	-	-	22	23	25	27	28	30	32	35	66	151
Business - small	RSD m	-	-	27	28	30	33	35	37	40	43	85	208
Total	**RSD m**	**-**	**-**	**132**	**141**	**151**	**161**	**172**	**184**	**196**	**209**	**380**	**803**

Construction department revenues

Leskovac PUC has a separate construction department, which derives its revenue from external sources through contracting. A large part of these revenues come from Leskovac municipality.

In estimating the “with project” and “without project” revenues, the following assumptions are made:

- Revenues in case of the “with project” cover the cost of the department, including allocation of overhead. Costs for the department are expected to decrease substantially, as a result of decreasing staff numbers, so that revenues would fall as well
- Revenues in case of the “without project” are expected to amount to the “with project” situation revenues and 80% of the cost difference between the with and without project. The without project costs of the engineering department are estimated to be much higher, since no reduction in staffing will take place. It is assumed that the municipality will not subsidize the full additional cost in this particular situation, but limits it to 80%. This would provide a financial incentive to the PUC relocate staff from this department.

Table 5-67 Construction department revenues & subsidies

Financial year ending	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Revenue - without project													
Construction contracts &	RSD m	75	80	83	88	95	103	111	119	127	136	269	672
Revenue - with project													
Construction contracts &	RSD m	75	79	67	66	71	76	82	87	93	99	188	451

5.3.8 Profit & loss, balance sheet and cash flow statement

This paragraph presents one of the final outputs of the financial model: forecasted financial statements of PUC water & waste water for the "with project" situation. Full printouts of the model, both in RSD as well as Euro, are included in the annexes.

The following statements are presented and briefly discussed:

- Profit & loss statement;
- Balance sheet;
- Cash flow statement.

These financial statements include the financial effects of the project on the company. Thus, it helps to assess whether the project can be carried out in a financially sustainable way, i.e. without jeopardizing the financial viability of the company.

Profit & loss statement

With the proposed tariff policy, the company makes a decreasing loss during the initial years of the project, but breaks even as from the year 2014. The loss in the initial years is caused by tariffs set at below cost recovery levels. As from the year 2014, a small net profit is forecasted for the remaining project period.

Table 5-68 Profit and loss statement (RSD million)

Financial year ending	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Revenue												
Drinking water	268	286	319	340	361	387	417	444	475	506	1,010	2,439
Sewerage service	43	51	62	66	69	76	81	86	91	96	172	393
Waste water treatment	-	-	132	141	151	161	172	184	196	209	380	803
Other	75	79	67	66	71	76	82	87	93	99	188	451
Total	**386**	**416**	**581**	**613**	**652**	**700**	**752**	**800**	**854**	**910**	**1,750**	**4,087**
Expenditure												
Variable costs	17	19	66	72	79	85	93	100	108	116	244	646
Chemicals	9	10	24	25	27	28	30	32	34	36	64	134
Electricity	7	8	24	27	30	33	36	40	43	47	113	345
Fuel & lubricant	1	2	2	2	2	2	2	2	2	3	5	10
Sludge transport	-	-	17	19	20	22	24	26	28	30	63	158
Effluent discharge fee	-	-	-	-	-	-	-	-	-	-	-	-
Fixed costs	255	277	324	354	385	418	455	488	524	562	1,150	2,968
Wages and Salaries	92	101	109	119	132	145	160	173	187	202	443	1,227
Employee benefits	21	22	24	26	29	32	35	38	41	45	98	270
Other materials	20	21	22	23	24	25	27	28	29	31	50	94
Transport services	3	4	4	4	4	5	5	5	6	6	12	27
Repair services	6	8	29	34	36	38	40	43	45	48	84	174
Other services	15	16	22	23	25	26	28	29	31	33	58	120
Taxes and fees	4	4	4	4	4	5	5	5	5	6	9	18
Other costs	11	12	12	13	14	14	15	16	17	17	28	53
Overhead costs	84	91	98	107	117	128	140	151	162	175	368	984
Operating costs	**273**	**296**	**390**	**426**	**463**	**504**	**548**	**588**	**632**	**679**	**1,394**	**3,614**
Depreciation	82	86	149	163	164	165	167	168	169	170	248	275
Bad debt	80	64	56	37	29	31	34	36	38	41	78	182
Total costs	**435**	**446**	**596**	**626**	**656**	**700**	**748**	**792**	**839**	**890**	**1,721**	**4,071**
Net Operating Income	**(49)**	**(30)**	**(15)**	**(12)**	**(4)**	**0**	**4**	**9**	**15**	**20**	**29**	**15**
Interest charges	-	-	-	-	-	-	-	-	-	-	-	-
FX loss (gain)	-	-	-	-	-	-	-	-	-	-	-	-
Net Income before Tax	**(49)**	**(30)**	**(15)**	**(12)**	**(4)**	**0**	**4**	**9**	**15**	**20**	**29**	**15**
Income tax	-	-	-	-	-	-	-	-	-	-	3	2
Net Income after Tax	**(49)**	**(30)**	**(15)**	**(12)**	**(4)**	**0**	**4**	**9**	**15**	**20**	**26**	**14**

Balance sheet

The balance sheet is healthy, with a high share of equity out of the balance sheet total and a slow conversion of fixed assets into cash. By the end of the analyzed period, the company will have build up substantial cash reserves available for necessary re-investment in infrastructure. Apart for the years 2009 and 2010, the quick ratio is above minimum standards.

Table 5-69 Balance sheet (RSD million)

Financial year ending	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2028	2041
Fixed assets	3,175	4,064	4,364	4,254	4,144	4,028	3,912	3,796	3,681	3,567	3,992	1,754
Current assets												
Inventories	25	24	37	35	32	28	24	19	14	7	8	17
Receivables	93	83	98	91	97	103	110	117	124	132	256	601
Cash	4	63	186	304	412	528	646	766	888	1,014	717	3,105
Total	**122**	**170**	**322**	**430**	**540**	**658**	**780**	**901**	**1,026**	**1,154**	**982**	**3,722**
Non-operating	-	-	-	-	-	-	-	-	-	-	-	-
Total assets	**3,297**	**4,234**	**4,685**	**4,684**	**4,683**	**4,686**	**4,692**	**4,697**	**4,707**	**4,721**	**4,974**	**5,476**
Equity bf	2,175	3,132	4,062	4,457	4,444	4,440	4,440	4,444	4,453	4,468	4,792	5,092
Retained earnings	(49)	(30)	(15)	(12)	(4)	0	4	9	15	20	29	15
Grants	1,005	960	409	-	-	-	-	-	-	-	-	-
Equity cf	**3,132**	**4,062**	**4,457**	**4,444**	**4,440**	**4,440**	**4,444**	**4,453**	**4,468**	**4,488**	**4,821**	**5,107**
Long term liabilities												
Equity	3,132	4,062	4,457	4,444	4,440	4,440	4,444	4,453	4,468	4,488	4,821	5,107
Long-term liabilities	-	-	-	-	-	-	-	-	-	-	-	-
Total	**3,132**	**4,062**	**4,457**	**4,444**	**4,440**	**4,440**	**4,444**	**4,453**	**4,468**	**4,488**	**4,821**	**5,107**
Current liabilities												
Payables	106	112	167	177	182	187	192	194	195	195	105	245
Overdraft	-	-	-	-	-	-	-	-	-	-	-	-
Other	59	60	62	63	61	59	55	50	44	37	48	124
Total	**165**	**172**	**228**	**239**	**243**	**246**	**247**	**244**	**239**	**232**	**152**	**369**
Non-operating	-	-	-	-	-	-	-	-	-	-	-	-
Total liabilities	**3,297**	**4,234**	**4,685**	**4,684**	**4,683**	**4,686**	**4,692**	**4,697**	**4,707**	**4,721**	**4,974**	**5,476**

Cash flow

Cash flow generation of the project is sufficient to finance all necessary investments after the initial investment. This means that no further capital subsidy from either the municipalities or state level is required, so that the PUC finances are sustainable.

The most substantial follow on investments are required during the year 2023 and 2025. During the year 2023, electrical-mechanical equipment of Barje drinking water treatment plant will need to be replaced. This followed by another large investment during the year 2025, when the electrical-mechanical equipment of waste water treatment plant is due for replacement.

Although these investments will cause the cash flow within the year to become negative, accumulated cash flow from previous years is sufficient to finance the total required investment. The cumulative cash flow is positive for each of the years during the analyzed period, including an allowance for discretionary capital expenditures. Thus, at company level, the project is financially sustainable.

Table 5-70 Project cash flow statement (in RSD million)

Financial year ending	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2023	2024	2025	2041
Cash bf	12	4	63	186	304	412	528	646	766	888	1,547	695	908	2,928
Overdraft bf	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net cash bf	**12**	**4**	**63**	**186**	**304**	**412**	**528**	**646**	**766**	**888**	**1,547**	**695**	**908**	**2,928**
Revenue														
Water sales	268	286	319	340	361	387	417	444	475	506	695	781	839	2,439
Sewerage service	43	51	62	66	69	76	81	86	91	96	127	135	143	393
Waste water treatment	-	-	132	141	151	161	172	184	196	209	285	302	320	803
Other	75	79	67	66	71	76	82	87	93	99	136	145	155	451
Less bad debt	(80)	(64)	(56)	(37)	(29)	(31)	(34)	(36)	(38)	(41)	(55)	(61)	(65)	(182)
Total	**306**	**352**	**525**	**576**	**623**	**669**	**718**	**765**	**816**	**870**	**1,187**	**1,302**	**1,391**	**3,905**
Costs														
Variable costs	17	19	66	72	79	85	93	100	108	116	170	182	196	646
Chemicals	9	10	24	25	27	28	30	32	34	36	48	51	54	134
Electricity	7	8	24	27	30	33	36	40	43	47	74	80	87	345
Fuel & lubricant	1	2	2	2	2	2	2	2	2	3	3	4	4	10
Sludge transport	-	-	17	19	20	22	24	26	28	30	44	47	51	158
Effluent discharge fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fixed costs	255	277	324	354	385	418	455	488	524	562	803	862	927	2,968
Wages and Salaries	92	101	109	119	132	145	160	173	187	202	300	324	350	1,227
Employee benefits	21	22	24	26	29	32	35	38	41	45	66	71	77	270
Other materials	20	21	22	23	24	25	27	28	29	31	39	41	43	94
Transport services	3	4	4	4	4	5	5	5	6	6	9	9	10	27
Repair services	6	8	29	34	36	38	40	43	45	48	63	67	71	174
Other services	15	16	22	23	25	26	28	29	31	33	43	46	49	120
Taxes and fees	4	4	4	4	4	5	5	5	5	6	7	8	8	18
Other costs	11	12	12	13	14	14	15	16	17	17	22	23	24	53
Overhead costs	84	91	98	107	117	128	140	151	162	175	254	273	294	984
Total	**273**	**296**	**390**	**426**	**463**	**504**	**548**	**588**	**632**	**679**	**972**	**1,045**	**1,123**	**3,614**
Working capital required	(25)	17	29	20	2	0	(2)	(5)	(7)	(9)	(16)	(25)	(22)	(15)
Operating cash flow	**8**	**74**	**163**	**171**	**161**	**166**	**169**	**171**	**177**	**182**	**199**	**233**	**246**	**276**
Capex subsidy	87	83	148	-	-	-	-	-	-	-	-	-	-	-
Capex	1,005	960	409	-	-	-	-	-	-	-	-	4	1,086	-
Discretionary capex	15	14	40	53	54	50	50	52	55	56	1,051	17	17	99
Investment cash flow	**934**	**892**	**302**	**53**	**54**	**50**	**50**	**52**	**55**	**56**	**1,051**	**20**	**1,103**	**99**
Credit / overdraft interest														
Debt drawdown	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grants	918	877	262	-	-	-	-	-	-	-	-	-	-	-
Financing cash flow	**918**	**877**	**262**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Cash for debt service	**(8)**	**59**	**123**	**118**	**108**	**116**	**119**	**119**	**123**	**126**	**(852)**	**212**	**(857)**	**177**
Capital repayment	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest and fee payment	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total debt service	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Net change in cash	**(8)**	**59**	**123**	**118**	**108**	**116**	**119**	**119**	**123**	**126**	**(852)**	**212**	**(857)**	**177**
Cash cf	4	63	186	304	412	528	646	766	888	1,014	695	908	51	3,105
Overdraft cf	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net cash cf	**4**	**63**	**186**	**304**	**412**	**528**	**646**	**766**	**888**	**1,014**	**695**	**908**	**51**	**3,105**

5.3.9 Financial cost benefit analysis

A financial cost-benefit analysis has been carried out based on the assumptions set out in previous paragraphs. The purpose of the financial cost benefit analysis is to assess the financial feasibility and viability of the project and to determine the maximum possible EU grant assistance. The analysis is carried out in accordance with the "Guide to cost-benefit analysis of investment projects" (EC DG Regio, 2002). The output of the analysis is:

- Calculation of the project financial net present value (FNPV/C) and internal rate of return (FIRR/C) of the total investment, in order to assess financial feasibility and need for (grant) assistance;
- Assessing the financial sustainability of the project by calculating the projects' financial and cumulative cash flow, including financing;
- Calculating the financial net present value of invested capital (FNPV/K) and internal rate of return of invested capital (FIRR/K). This analysis calculates financial feasibility from the viewpoint of the recipient and only takes into consideration the total invested public capital;
- Sensitivity and risk analysis. This analysis identifies and assesses the sensitivity of the project to key input variables;

- Economic cost benefit analysis. Assessment of the economic feasibility of the project from the viewpoint of society as a whole.

EU grant assistance

The EU grant assistance is calculated using the so called funding gap method calculate by means of the "modified formula". The rationale behind this methodology is to identify the financial needs of a project (funding gap) and to provide grant assistance in order to make them financially feasible.

The formula used is defined as:

Grant rate = DIC / (DIC + DNR)

Where DIC = discounted investment cost and DNR is discounted net revenues. Under the current ISPA regulation, this grant rate can be up to 75% and in exceptional cases 85%. This study assumes that the maximum grant rate under IPA is 75%.

Subsequently, the maximum EU grant can be calculated by multiplying the grant rate with the total eligible investment cost (excluding amongst others VAT and land acquisition costs).

It should be noted however, that the methodology to determine the level of grant assistance of ERDF and Cohesion fund assistance projects for the 2007 – 2013 programming period differs from the "modified formula" elaborated upon above. A special methodology is developed for revenue generating projects, such as projects in the water & waste water sector.[2] This methodology leads to substantially lower grant amounts. For the sake of completeness, this different grant calculation methodology is also applied. The methodology is as follows:

Step 1: determination of funding gap rate (R):

R = Max EE/DIC

Where

Max EE is the maximum eligible expenditure = DIC-DNR
DIC is the discounted investment cost
DNR is the discounted net revenue = discounted revenues – discounted operating costs + discounted residual value

Step 2: calculating the "decision amount" (DA):

DA = EC*R

Where

EC is the eligible cost

[2] *Council regulation (EC) 1083/2006 dated 11 July 2006, article 55 "revenue generating projects"*

Step 3: find the (maximum) EU grant:

EU grant = DA*Max CRpa

Where

Max CRpa is the maximum co-funding rate fixed

Discount rate

In the absence of a national Serbian discount rate, a discount rate as applied in EU-ISPA financed projects in neighboring countries is used, which is also recommended by the EU guide to Cost-Benefit Analysis of Investment Projects[3]. This discount rate amounts to 6% in real terms. Since the analysis is carried out in current prices, a nominal discount rate of 8% is applied, after adjusting the real rate for 2% inflation.

It is recognized that the most recent guidance from the EU concerning ERDF and Cohesion Fund financed projects during the programming period 2007 – 2013 recommends a lower real discount rate of 5%[4]. However, this is to be applied for countries which have acceded into the EU already and which have more advanced financial markets and a lower financial risk profile than Serbia. For this reason, a slightly higher discount rate is used which reflects this higher cost of capital.

Assumptions

As elaborated upon in the previous paragraphs, a distinction between the “without” and “with” project is made. Incremental costs and revenues are defined as the difference between “with” and “without” cost and revenue estimate. These incremental costs are a direct result of the project intervention.

In doing so, consultants have made the following assumptions:

- Net present values and internal rate of return are calculated back to base year 2007, with a project period starting in 2009 up to the year 2041 (33 years);
- Only project related investments and re-investments are included in the financial cost benefit analysis. Re-investments in the Barje regional water supply system are excluded from the analysis.
- Non-eligible costs for EU financing are included in the discounted cash flow analysis, since these present a real outflow for the company. Thus, non-reimbursable value added tax is included in the investment cost. However, in calculating the potential EU grant, these non-eligible costs are excluded;
- Residual investment value is included at the end of the project period. The residual value is calculated simply as the remaining book value at the end of the year 2041. The calculation ignores exchange rate losses.

Full printouts of the financial cost-benefit analyses are included in the annexes.

[3] *EU guide to Cost-Benefit Analysis of Investment Projects (EU Commission 2002), available at http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide02_en.pdf*
[4] *Working document 4: Guidance on the methodology for carrying out Cost-Benefit Analysis, available at http://ec.europa.eu/regional_policy/sources/docoffic/2007/working/wd4_cost_en.pdf*

The results of the analysis are, assuming a base case macro – economic scenario:

Financial cost benefit analysis total invested capital

- During the 33 year analysis period, the nominal internal rate of return (FNPV/C) is 0.7%;
- The financial net present value (FNPV/K) is negative and amounts to € -16,517 thousand;
- Therefore, EU grant assistance is required to make the project financially feasible, which is calculated below.

Table 5-71 Financial cost benefit analysis total invested capital

CF			2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2024	2025	2041
Drinking water	€ 000		-	-	167	176	187	291	317	312	316	327	398	414	829
Sewage collection	€ 000		16	92	204	248	270	315	329	337	348	358	431	446	873
Waste water treatment	€ 000		-	-	1,536	1,616	1,701	1,790	1,884	1,981	2,083	2,190	2,892	3,019	5,992
Other	€ 000		-	(21)	(181)	(257)	(279)	(302)	(327)	(347)	(370)	(393)	(570)	(607)	(1,651)
Residual value	€ 000		-	-	-	-	-	-	-	-	-	-	-	-	6,550
Incremental revenues	**€ 000**		**16**	**71**	**1,726**	**1,784**	**1,879**	**2,094**	**2,203**	**2,282**	**2,377**	**2,482**	**3,150**	**3,271**	**12,593**
Drinking water	€ 000		-	2	82	134	144	159	171	180	190	201	281	297	737
Sewage collection	€ 000		3	52	101	155	161	174	186	196	206	218	301	318	774
Waste water treatment	€ 000		-	-	1,032	1,054	1,106	1,179	1,257	1,329	1,406	1,488	2,075	2,191	5,311
Other	€ 000		-	(26)	(226)	(322)	(348)	(377)	(409)	(434)	(462)	(491)	(713)	(759)	(2,064)
Incremental operational costs	**€ 000**		**3**	**28**	**989**	**1,021**	**1,062**	**1,134**	**1,205**	**1,270**	**1,341**	**1,416**	**1,943**	**2,046**	**4,758**
Drinking water	€ 000		2,003	1,739	1,791										
Sewage collection	€ 000		2,151	2,152	2,216										
Waste water treatment plant	€ 000		7,243	6,750	437										
Supervision	€ 000		672	673	306										
Subtotal investment costs	€ 000		12,070	11,313	4,749	-	-	-	-	-	-	-	-	-	-
Re-investment costs	€ 000		-	-	-	-	-	-	-	-	-	-	34	10,253	-
Incremental investment costs	**€ 000**		**12,070**	**11,313**	**4,749**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**34**	**10,253**	**-**
Net cash flow	**€ 000**		**(12,057)**	**(11,270)**	**(4,012)**	**762**	**817**	**960**	**998**	**1,012**	**1,036**	**1,066**	**1,173**	**(9,028)**	**7,835**
Cumulative cash flow	€ 000		(12,057)	(23,327)	(27,339)	(26,577)	(25,760)	(24,800)	(23,802)	(22,790)	(21,754)	(20,688)	(13,780)	(22,808)	4,562
Discount rate (nominal)	%	8.0%													
FNPV/C	€ 000	(16,517)													
FRR/C	%	0.7%													

The maximum EU grant, using the modified formula, is calculated to amount to € 20,805K (current prices) as set out in the table below. The calculated grant rate is 75.2% and exceeds the assumed maximum of 75%.

Table 5-72 EU grant calculation, modified formula

NPV incremental revenues		
Drinking water	€ 000	3,462
Sewage collection	€ 000	3,923
Waste water treatment	€ 000	25,124
Other	€ 000	(5,003)
Residual value	€ 000	517
Subtotal incremental revenues	**€ 000**	**28,023**
NPV incremental operational costs		
Drinking water	€ 000	2,430
Sewage collection	€ 000	2,671
Waste water treatment	€ 000	18,267
Other	€ 000	(6,254)
Re-investment	€ 000	2,781
Subtotal incremental operational c	**€ 000**	**19,895**
Discounted net revenues (DNR)	**€ 000**	**8,127**
NPV investment costs (DIC)		
Drinking water	€ 000	4,767
Sewage collection	€ 000	5,596
Waste water treatment plant	€ 000	12,840
Supervision	€ 000	1,442
Subtotal investment costs (DIC)	**€ 000**	**24,645**
Grant rate, calculated DIC/(DIC+DNR	%	75.2%
Grant rate, applied (max 75%)	%	75.0%
Eligible investment cost (current price	€ 000	27,741
EU grant (maximum)	**€ 000**	**20,805**

The funding gap methodology applicable to ERDF/CF financed project during the programming period 2007 – 2013 leads to a substantially lower maximum grant level of € 13,944 thousand, assuming a maximum co-financing rate of 75%. In case the discount rate would be set at 5% in real terms (7% current) as required for ERDF/CF financed projects during the programming period 2007 - 2013, the maximum EU grant would amount to € 13,101 thousand.

Table 5-73 EU grant calculation, ERDF/CF 2007-2013

Step 1: funding gap rate		
Discounted net revenues (DNR)	€ 000	8,127
Discounted investment costs (DIC)	€ 000	24,645
Eligible expenditure EE (DCI-DNR)	€ 000	16,517
Funding gap rate R (EE/DIC)	**%**	**67.0%**
Step 2: decision amount		
Eligible investment costs EC (current	€ 000	27,741
Decision amount DA (R x EC)	**€ 000**	**18,592**
Step 3: maximum EU grant		
Maximum co-funding rate Crpa	%	75%
EU grant (maximum)	**€ 000**	**13,944**

Financial sustainability

The cash flow statement of the company as set out in paragraph 5.3.9 already showed that at company level no cash flow problems arise. Cumulative cash is in any single year positive. Large reinvestments in the electrical-mechanical equipment of both the waste water treatment plant and the drinking water treatment plant can be completely financed from internally generated cash, i.e. from the tariffs charged to customers.

In order to assess financial sustainability of the project in isolation, a separate calculation is made which only includes incremental costs, revenues, investments as well as the all financing sources available.

The table below shows that the project is also financially sustainable, since in any one year cumulative cash flow is positive. Although cash flow in the year 2025 is negative as a result of large reinvestments, accumulated cash during previous years is sufficient to finance this.

Table 5-74 Project financial sustainability

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2024	2025	2041
Total financial sources	12,070	11,313	4,749	-	-	-	-	-	-	-	-	-	-
Revenues	16	71	1,726	1,784	1,879	2,094	2,203	2,282	2,377	2,482	3,150	3,271	6,043
Total inflows	**12,085**	**11,384**	**6,476**	**1,784**	**1,879**	**2,094**	**2,203**	**2,282**	**2,377**	**2,482**	**3,150**	**3,271**	**6,043**
Total operating costs	3	28	989	1,021	1,062	1,134	1,205	1,270	1,341	1,416	1,943	2,046	4,758
Total investment costs	12,070	11,313	4,749	-	-	-	-	-	-	-	34	10,253	-
Interest on loans	-	-	-	-	-	-	-	-	-	-	-	-	-
Retirement bonus	-	-	-	-	-	-	-	-	-	-	-	-	-
Loan principal repaymenrt	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxes	-	-	-	-	-	-	-	-	-	-	-	-	-
Total outflows	**12,073**	**11,341**	**5,738**	**1,021**	**1,062**	**1,134**	**1,205**	**1,270**	**1,341**	**1,416**	**1,977**	**12,299**	**4,758**
Total cash flow	**13**	**43**	**737**	**762**	**817**	**960**	**998**	**1,012**	**1,036**	**1,066**	**1,173**	**(9,028)**	**1,284**
Cumulative cash flow	**13**	**55**	**793**	**1,555**	**2,372**	**3,332**	**4,330**	**5,341**	**6,378**	**7,444**	**14,351**	**5,323**	**26,144**

Financial cost benefit analysis invested capital

A third analysis is made to determine the net present value and rate of return of the public funds invested on the project. In this project, the national contribution consists of funds provided by:

- Municipality of Leskovac;
- Ministry of Agriculture, Forestry and Water, Directorate General Water

The analysis reveals that:

- Financial internal rate of return of invested capital (FIRR/K) is 10.4%, above the discount rate of 8%;
- Financial net present value (FNPV/K) is positive and equals € 1,718 thousand.

Therefore, it can be concluded that with the EU grant, the project is financially feasible from the perspective of Serbia, without creating excessive returns on national capital invested.

Table 5-75 Financial cost benefit analysis invested national capital

CF			2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2024	2025	2041
Revenues			16	71	1,726	1,784	1,879	2,094	2,203	2,282	2,377	2,482	3,150	3,271	6,043
Residual value			-	-	-	-	-	-	-	-	-	-	-	-	6,550
Total revenues			**16**	**71**	**1,726**	**1,784**	**1,879**	**2,094**	**2,203**	**2,282**	**2,377**	**2,482**	**3,150**	**3,271**	**12,593**
Total operating costs			3	28	989	1,021	1,062	1,134	1,205	1,270	1,341	1,416	1,943	2,046	4,758
Re-investment financed from internal cash flow			-	-	-	-	-	-	-	-	-	-	34	10,253	-
Interest on loans			-	-	-	-	-	-	-	-	-	-	-	-	-
Retirement bonus			-	-	-	-	-	-	-	-	-	-	-	-	-
Loan principal repaymenrt			-	-	-	-	-	-	-	-	-	-	-	-	-
Private equity			-	-	-	-	-	-	-	-	-	-	-	-	-
Total national public contribution			3,098	2,906	1,323	-	-	-	-	-	-	-	-	-	-
Total expenditures			**3,101**	**2,934**	**2,312**	**1,021**	**1,062**	**1,134**	**1,205**	**1,270**	**1,341**	**1,416**	**1,977**	**12,299**	**4,758**
Net cash flow			**(3,086)**	**(2,863)**	**(586)**	**762**	**817**	**960**	**998**	**1,012**	**1,036**	**1,066**	**1,173**	**(9,028)**	**7,835**
Cumulative cash flow			**(3,086)**	**(5,948)**	**(6,534)**	**(5,771)**	**(4,955)**	**(3,995)**	**(2,997)**	**(1,985)**	**(949)**	**118**	**7,025**	**(2,003)**	**25,368**
Discount rate	%	8.0%													
FNPV/K	€ 000	1,718													
FIRR/K	%	10.4%													

5.3.10 Sensitivity analysis

A sensitivity analysis is conducted to analyze the impact of:

- Variations in the macro-economic environment;
- Identify the sensitivity of the model to changes in some key input factors.

Macro-economic scenarios

The table below summarizes the results of the sensitivity analysis for changes in the macro-economic environment. Revenues have been fixed at the level as proposed for the base case scenario.

Table 5-76 Sensitivity analysis macro-economic assumptions

Description	FIRR/C	FNPV/C (€ '000)	Remarks
Base case	0.7%	-16,517	Cashflow negative 2009, 2023, 2025, cumulative cashflow positive
Optimistic case	2.2%	-13,955	Cashflow negative 2009, 2023, 2025, cumulative cashflow positive
Pessimistic case	-1.2%	-19,901	Cashflow negative 2009, 2023, 2025, cumulative cashflow negative 2009, 2025-2027

Conclusion is that the project is not very sensitive to changes in the macro-economic environment: the internal rate of return varies between -1.2% and 2.2% for respectively the pessimistic and optimistic macro economic scenario. PUC operations would be financially sustainable under an optimistic and base case macro economic scenario, since cumulative cash flow is positive in every single year of the analyzed period. This would, however, not be the case under a pessimistic macro economic scenario. A pessimistic macro economic scenario causes the cumulative cash flow at company level to become negative during the years 2009 and during the period 2025 to 2027. This means that the PUC would have to look for external finance to bridge this gap.

Key input variables

A number of key input variables are identified and varied with respectively +/- 1%, 2%, 3% and 5%, in order to assess the sensitivity of the project to such changes. If a change of 1% in an input leads to an increase of more than 5% of the net present value (FNPV/C), the variable is considered to be a key risk factor and a more in depth risk analysis is required.

The following key input variables are identified:

- Discount rate
- Demand: unit consumption of water/waste water
- Investment cost (total)
- Operation & maintenance cost (total)
- Revenues (incremental)

The discount rate is changed with 1% percentage in *absolute* terms. For example, +1% would mean a discount rate of 8% + 1% = 9%.

The other variables are changed *relative* to the base value, while keeping the other input variables fixed. Variations are only added to the base value of a single year, so that changes are *not* cumulative. The tariff is also fixed at the base level, although underlying costs would change as a result of variations, which in turn would prompt a different level of tariffs, following the full cost price setting policy proposed in this study.

Variations will be carried out assuming a base case macro economic scenario.

Table 5-77 Sensitivity analysis key input variables

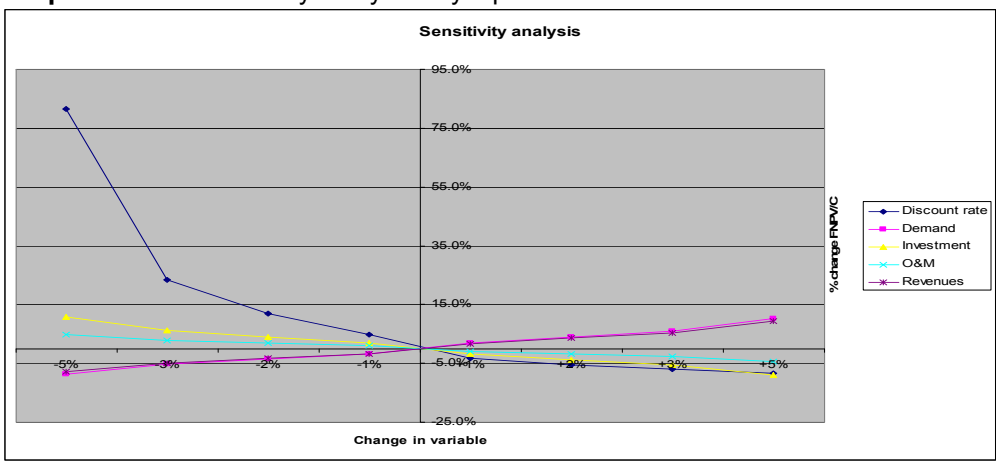
		Change in value FNPV/C				
Description	**Change in variable**	**Discount rate**	**Demand**	**Investment**	**O&M**	**Revenues**
Change in variable of	+5%	-8.4%	10.4%	-8.9%	-4.5%	9.3%
Change in variable of	+3%	-6.9%	6.0%	-5.5%	-2.7%	5.4%
Change in variable of	+2%	-5.4%	3.9%	-3.8%	-1.8%	3.5%
Change in variable of	+1%	-3.2%	1.9%	-1.9%	-0.9%	1.7%
Change in variable of	-1%	4.8%	-1.8%	2.0%	0.9%	-1.7%
Change in variable of	-2%	12.0%	-3.6%	4.1%	1.9%	-3.3%
Change in variable of	-3%	23.4%	-5.3%	6.2%	2.9%	-4.8%
Change in variable of	-5%	81.5%	-8.6%	10.8%	4.9%	-7.8%

A change of +/- 1% of any of the identified key input variables does not cause the FNPV/C to change with more than 5%. Therefore, none of the key input variables are critical to the financial outcome, although of course they do impact the financial result. Therefore, no further risk analysis of these variables will be carried out.

The FNPV/C value is clearly most sensitive to changes in the discount rate and in particular to lower discount rates. A lower discount rate would rapidly increase the financial net present value of the project. The level of the discount rate has been discussed and justified already in paragraph 5.3.10.

Changes in demand, investment and incremental revenues also cause considerable variations in the FNPV/C value, as shown in the graph below.

Graph 5-10 Sensitivity analysis key input variables



Economic cost benefit analysis

In this paragraph, an economic analysis of the Leskovac drinking and waste water project is carried out. The analysis builds upon the financial analysis and model as elaborated upon in the previous paragraph. The analysis is conducted following the methodological guidelines as presented in the Guide to cost-benefit analysis of investment projects (European Commission - Evaluation Unit, DG Regional Policy, & European Commission, Brussels 2002)

Approach and methodology

The main objective of an economic analysis is to analyze the cost and benefits of the proposed project to society as a whole. It differs from a financial analysis, which only takes actual money flows into consideration, accruing to or to be paid by the investor of the project. However, the financial analysis and specifically the financial cost-benefit analysis, forms the basis on which the economic analysis is conducted.

An economic analysis usually consists of:

- A qualitative assessment of the external benefits and costs of a project to society as a whole;
- A quantitative economic analysis, in which first external effects are quantified and subsequently monetized. However, environmental, social, health and economic external benefits are often difficult to quantify, let alone monetize. Usually, only part of all identified benefits and costs can be quantified and monetized. For that reason, the qualitative assessment complements the quantitative analysis and improves the overall quality of the analysis. The main output of the quantitative economic analysis is an estimate of the economic internal rate of return (EIRR), the economic net present value (ENPV) and the Benefit-Cost ratio, all of which are to be judged against certain minimum thresholds. The minimum threshold of the Benefit-Cost ratio is 1, which means that the overall benefits to society are higher than its costs.

The analysis is carried out in nominal terms during the 33 year project period, i.e. from 2009 to 2041, equivalent to the financial analysis referred to above.

In the absence of an official Serbian economic discount rate, a nominal rate of 7% is used, comprised of 5% real and 2% inflation. This social discount rate is commonly used to evaluate EU-ISPA co-financed projects and is also proposed to be used in the Guide to cost-benefit analysis of investment projects. It is recognized however, that this rate differs from the social discount rates to be used by ERDF/CF financed projects during the 2007-2013 programming period[5]. The latter proposes a social discount rate of 5.5% for cohesion countries (meaning most regions in Eastern European EU countries) and 3.5% for other countries within the EU.

For the quantitative analysis, the following steps are carried out:

- ***Fiscal corrections***. All financial prices in the financial analysis should be net of all indirect taxes/subsidies and other transfers, like value added tax. Direct taxes (income taxes) however, are to be included in the analysis;
- ***Corrections for externalities***. External costs and benefits which are not priced in the financial are to be quantified and valued. Waste water treatment plants usually have large external benefits, such as increased health benefits;
- ***Conversion of market prices to accounting prices***. Market prices are distorted because of imperfect markets. An example of market distortions, which is also valid for this study, is legally enforced minimum wages in countries with high unemployment figures. To convert market prices to accounting prices or economic prices, corrections are made by means of:
  - Standard conversion factors to estimate marginal cost. Standard conversion factors are calculated as follows:

    (M + X) / ((M + Tm) + (X – Tx)), where:

    M = total imports
    X = total exports
    Tm = import taxes
    Tx = export taxes
  - Shadow wages. The shadow wage is calculated to assess societies' true marginal cost of labor. This is especially relevant in Serbia, where high unemployment exists. The shadow wage is calculated as follows:

SW = FW*(1-u)*(1-t)

SW is the shadow wage
FW is the financial (market) wage
u is the regional unemployment rate
t is the rate of social security payments and relevant taxes

This shadow age will only be applied to unskilled labor, since this is in abundant supply. Skilled labor, however, is assumed to be properly priced, since the market for this is competitive.

[5] *Working document 4: Guidance on the methodology for carrying out Cost-Benefit Analysis, available at http://ec.europa.eu/regional_policy/sources/docoffic/2007/working/wd4_cost_en.pdf*

Qualitative economic analysis

In summary, the project would generate the following economic benefits:

Health

Water and waste water projects have major health benefits due to the prevention of water borne diseases caused by pollution of surface and groundwater. Economic benefits arise from prevention of medical costs, but also prevention of lost production hours due to illness and improved work efficiency. These benefits not only accrue to people living in Leskovac municipality, but also extend to downstream municipalities along the Southern Morava. In the absence of detailed medical statistics, it is difficult to quantify these benefits in the case of Leskovac, but is clear that:

- Construction and operation of the waste water treatment plant will significantly reduce the pollution of the Southern Morava of untreated waste water originating from Leskovac city, which is currently being discharged directly into the surface water;
- Construction of the sewage collection network in suburban areas of Leskovac city and subsequent connection to the waste water treatment plant of 20,000 residents will significantly reduce pollution of groundwater caused by current disposal of sewage in septic tanks. In addition, emptying of septic tanks and subsequent discharge of sewage will reduce health risks due to reduced transport and elimination of disposal of raw sewage in surface water, landfill or elsewhere.
- Connection of 12,000 residents in the Northern villages to the regional water supply system will have very significant health benefits for these villagers, since the occurrence of the water borne BEN disease from local water sources would be dramatically reduced.

Resource benefits, costs and savings

- Improvement of groundwater and surface water quality would lower the cost of treatment or enable the use of these sources for drinking water or agricultural or industrial (cooling water) purposes;
- Connection to the sewer system would mean elimination of costs to residents related to the construction of septic tanks and especially costs related to emptying, transport and disposal of sewage from septic tanks;
- Improvement of surface water quality increases the potential of the Southern Morava as a fishing resource;
- Real estate prices are likely to increase in the suburban areas of Leskovac, after connection to the sewage collection system;
- The waste water treatment plants' sludge treatment process generates electricity, which means a saving on the costs of primary electricity generation. This saving is already included in the financial analysis. However, the current electricity price is significantly below regional electricity prices, suggesting that prices are set at below market prices. This study uses a 2007 price of € 0.06/kwh, while regional prices are closer to € 0.11/kwh. This of course also depends on the cost electricity generation in each country, so the real resource saving is difficult to estimate;
- Related to the above, conversion of methane gas into electricity and reduction of methane gas emissions by properly storing sludge reduces the adverse effects of these gases on global warming due to the greenhouse effect;
- Use of land for the waste water treatment plant would mean loss of agricultural production;

Social and development benefits

- Improved water quality of the Southern Morava will improve the potential for recreation and encourage tourism;
- A related, but different value is increased bio-diversity and nature preservation;
- Better drinking water quality will greatly increase quality of life in the Northern villages. Quality of life will also be improved by reduction of bad smells and odors as a result of untreated waste water discharge and prevention of emptying of septic tanks;
- Construction of the project will generate significant employment opportunities, especially for unskilled labor;
- Disamenity costs are minimal, since there are no houses near the waste water treatment plant.

Quantitative economic analysis

Starting from the financial cost benefit analysis and using the economic analysis methodology elaborated upon above, the following corrections are made:

Fiscal corrections.

A correction is made for value added tax included in the investment cost estimate of the project.

External corrections

Although many external benefits have been identified in the qualitative assessment, proper quantification and monetization of these effects is difficult or very time consuming. Different techniques are available to estimate external benefits, such as:

- Willingness to pay studies (contingent valuation). A survey is conducted in which people are asked what they would want to pay in order to achieve certain results, for example reduced odour levels, better recreational/swimming/angling opportunities because of improved surface water quality or better quality drinking water. This method is time consuming and beyond the scope of this study;
- Direct estimation of reduced health costs as a result of the project. In order to be able to estimate these effects, detailed statistical information of the project area on incidence of illness and associated costs would be required. Furthermore, a precise dose-response relation would need to be researched, i.e. what is the relation between effluent quality improvements caused by the project on improved water quality and ultimately reduced illnesses and associated costs. The detailed statistical information is not available, nor is a primary study on dose-response relations within the scope of this project;
- A simpler approach is to use existing (primary) studies or approaches which resemble project circumstances: the benefits transfer method. This method is selected to estimate external benefits for this project.

In several Eastern European countries, national guidelines exist to estimate external environmental effects of water quality improvement projects. These guidelines are specifically used for the preparation of ISPA and CF financed projects.

The Czech Republic uses as a proxy for estimating environmental external benefits € 35 for each person connected to a waste water treatment plant (2006 prices). Social benefits are estimated at CZK 0.064 to 0.142 per household connected to the sewer system per kilometre of river per year.

Poland's National Fund for Environmental Protection and Water Management uses a different approach. It provide guidelines for estimating external benefits for each unit quantity of pollutant not discharged into the environment as follows:

- € 0.84 for each kg of BOD removed;
- € 0.34 for each kg of COD removed;
- € 0.11 for each kg of suspended solids removed.

In Romania, a similar approach is used in ISPA financed projects, although at a lower rate: € 0.60/kg BOD removed.

This studies uses an amount of € 0.60/kg BOD removed (2007 prices), as is done in Romania. It should be noted that this results in significantly lower estimates of environmental benefits compared to the approaches used in the Czech Republic and Poland. It is recognized that the absolute valuation of external benefits in Poland and Czech Republic will be higher than those in Serbia, since price levels will be higher. However, even after this correction, net benefits are still higher. An estimate of € 0.60/kg BOD removed is therefore on the low side, something which should be taken into consideration when evaluating the results of the economic analysis.

As identified in the qualitative economic analysis, property prices in Leskovac municipality are likely to increase as a result of connection of premises to the sewage collection network. An attempt is made to valuate this by estimating the prevented costs of transport of sewage from septic tanks. The cost saving would arise from the fact that Leskovac municipality might enforce unconnected residents to build septic tanks and transport sewage to the waste water treatment plant. Residents which are connected would be able to prevent these costs.

This benefit, or more precisely cost saving, would only accrue to residents living in the suburban areas of Leskovac town, since they are to be connected to the sewage system as a result of the project. It is estimated that an average septic tank will have to be emptied twice per year at a cost of RSD 5,000/trip. This translates into a charge of RSD 54/m3 (€ 0.62/m3) of generated wastewater, which will be used in this study.

A study on the overall benefits of compliance with the Environmental Acquis for candidate countries[6] (Ecotec, 2001) provides useful data to quantify and monetize environmental benefits. Estimates of the benefits of better quality benefits of drinking water quality are based on various willingness-to-pay studies conducted in the UK and USA. After adjustment for purchasing power parity, monetized benefits per house hold per year for neighbouring countries are summarized in he table below

Table 5-78 Annual household external benefits of EU drinking water directive approximation (€ 1999 prices)

	low	high
Bulgaria	5.48	95.08
Hungary	12.40	215.04
Romania	6.58	114.17
Slovenia	17.35	300.80
Turkey	7.20	124.86

[6] *Benefits of compliance with the Environmental Acquis for candidate countries (Ecotec, 2001)*

The lower estimate is based on a UK study which specifically asked for willingness to pay of reduced nitrate levels in drinking water. The study arrived at a willingness to pay of € 25 per household per year in 1999 prices.

The high estimate is based on the average of several studies conducted in the, which estimated the willingness to pay to avoid ground water pollution. The average willingness to pay per household is € 650 in 1999 prices.

The higher estimate is a better estimate of the likely external effects in Leskovac Northern villages, since the project would provide an entirely different source from the currently polluted local ground water sources.

For this analysis consultants use Bulgaria as a proxy for Serbia, being the lowest in the table above. However, the high estimate is used, since it is obvious that this is a better estimate of the likely external effects in Leskovac Northern villages, since the project would provide an entirely different source from the currently polluted local ground water sources. Adjusted for the 2007 price level, estimated external benefits for the project therefore are estimated at € 109 per household per year.

The incremental served population in the Northern villages of Leskovac municipality is 12,000 or approximately 3,700 households. This would translate into an external benefit of € 403 thousand per year.

Conversion of market to economic prices

Based on National Bank of Serbia statistics for the year 2006, the standard conversion factor for Serbia is 0.97, assuming an export tax rate half of the average import tax rate. Conversion of market prices to economic/accounting prices is summarized in the table below:

Table 5-79

Description	SCF
(Re) Investment – domestic costs	0.97
(Re) Investment – foreign costs	1.00
Revenues	0.97
Operation & Maintenance	0.97
Residual value (mainly civil works)	0.97
Operation & Maintenance	0.97

Finally, a large benefit to society is the creation of additional jobs, assuming these would be recruited from the ranks of the unemployed. This is a likely assumption, especially in light of high unemployment in the project area of 23%.

During the construction phase, large civil works are carried out which are labour intensive. It is estimated that 30% of the value of civil works is spent on labour.

Total employment generated during operation of drinking water, sewage collection and waste water treatment is limited to 21 new jobs (9 staff for the waste water treatment plant, 7 for the new sewage collection system and 5 for the extension of the drinking water distribution network). However, since these jobs are to be sourced from within the company, no incremental jobs are created as a result of the project. Hence, this benefit is excluded from the analysis.

Economic net present value

As elaborated upon above, the project will have high environmental, social and economic benefits. After correction for some of the external benefits, as well as fiscal adjustments and conversion of market to economic prices, the project gives a return of 14.0%, generates a positive economic net present value of € 21,786 thousand and a benefit cost ratio of 1.50. The conclusion therefore is that the project is feasible from the point of view of society as a whole. It should further be noted that the overall benefit to society will probably be higher, since not all external benefits have been monetized.

Table 5-80 Economic cost benefit analysis

	CF	NPV 7.0%	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2024	2025	2041
correction VAT on investment		338	108	103	180	-	-	-	-	-	-	-	-	-	-
Fiscal corrections		**338**	**108**	**103**	**180**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Environmental effects of BOD reduction		16,712	-	-	1,063	1,103	1,143	1,185	1,228	1,272	1,318	1,366	1,650	1,697	2,666
Prevention of transport costs of septic tanks		11,299	157	320	489	540	594	650	708	768	831	896	1,192	1,222	1,815
Improved drinking water quality		6,173	-	-	363	382	401	421	441	463	485	508	644	662	923
External benefits		**34,185**	**157**	**320**	**1,915**	**2,024**	**2,138**	**2,255**	**2,377**	**2,503**	**2,634**	**2,770**	**3,486**	**3,581**	**5,404**
Revenues	0.97	30,812	15	69	1,674	1,730	1,823	2,031	2,136	2,214	2,306	2,408	3,056	3,173	5,862
Residual value	0.97	681	-	-	-	-	-	-	-	-	-	-	-	-	6,354
Operational costs	0.97	(19,341)	(3)	(27)	(959)	(991)	(1,031)	(1,100)	(1,169)	(1,232)	(1,300)	(1,373)	(1,885)	(1,985)	(4,616)
Investments, domestic	0.97	(19,380)	(9,043)	(8,548)	(4,242)	-	-	-	-	-	-	-	-	-	-
Investments, imported	1.00	(5,059)	(2,747)	(2,501)	(376)	-	-	-	-	-	-	-	-	-	-
Reinvestment, domestic	0.97	(1,276)	-	-	-	-	-	-	-	-	-	-	(13)	(4,017)	-
Reinvestment, imported	1.00	(1,883)	-	-	-	-	-	-	-	-	-	-	(20)	(5,929)	-
correction unskilled labour during construction		2,709	1,198	1,198	664	-	-	-	-	-	-	-	-	-	-
correction unskilled labour during operations		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conversion from market to economic prices		**(12,737)**	**(10,579)**	**(9,808)**	**(3,239)**	**740**	**792**	**931**	**968**	**981**	**1,005**	**1,034**	**1,138**	**(8,757)**	**7,600**
Total cash flow		**21,786**	**(10,315)**	**(9,385)**	**(1,144)**	**2,764**	**2,930**	**3,186**	**3,345**	**3,485**	**3,639**	**3,804**	**4,625**	**(5,176)**	**13,003**
Cumulative cash flow			(10,315)	(19,700)	(20,843)	(18,079)	(15,150)	(11,963)	(8,619)	(5,134)	(1,495)	2,309	28,371	23,195	121,584
Discount rate	7.0%														
ENPV	21,786														
EIRR	14.0%														
B/C ratio	1.50														

6 INSTITUTIONAL AND LEGAL ANALYSIS

6.1 Introduction

In this chapter the following issues have been outlined and addressed:

- The overall regulatory framework including: i) roles and responsibilities of city and state authorities in the respective sector, ii) how supervision and enforcement are involved in the respective sector, and iii) description of how fees are determined and approved;
- An analysis of the relationship between the (new) W/WW company and the Municipality. This analysis shall include a specification of the rights and responsibilities of the company and to what extent it operates at an “arms-length” basis from the Municipality. A description of the legal status of the company and its statutory documents; and
- A proposal of measures for improvement/strengthening the institutional position of the company.

6.2 Regulatory Framework

6.2.1 Legislative framework

General background

In 2004, Serbia has launched an ambitious programme to modernise its environmental management and harmonise its environmental legislation with EU Directives. In addition, there is a number of water sector specific regulations which are also in process of being amended.

Legislative, executive and judicial powers are mostly practiced through the legally prescribed scope of competencies of the Authorities of the Republic. According to the law, certain competences are delegated to the Local Self-government units.

Environmental legislation includes laws and regulations on planning and construction; mining; geological survey; water, soil and forest protection; flora and fauna; national parks; fishery and hunting; waste management; production and trade of chemicals; trade and transport of explosive and hazardous materials; protection of ionizing and non-ionizing radiation; nuclear safety etc. A list of relevant legislation is given in Annex 6.1.

Law on Environmental Protection (OGRS No. 135/04)

This Serbian Law on Environmental Protection was adopted in December 2004. Its content was harmonized with the relevant EU legislation. It provides:

- Protection of soil, water, air, forest, biosphere and biodiversity, plants and animals;
- Mandatory environmental monitoring: the programmes have to be adopted and performed every second year (including air monitoring);
- Responsibility of the Serbian Government to establish criteria for environmental measurements and reporting of the results to the Serbian Parliament yearly;
- The important obligation to pay tax amounting to 1% of the value of the investment on all new facilities that could possibly be the source of environmental pollution, and which shall be used for environmental protection and promotion.

Law on Waters (OGRS No. 46/91, 53/93, 67/93, 48/94, and 54/96, and 101/05)
The Water Law of the Republic of Serbia is the most important legal basis for the protection of water bodies, water use, and water management. It governs the conditions for design, construction, operation and financing of water management activities. The law applies to all surface water and groundwater, including drinking water and thermal/mineral waters (Art. 1). The Law on Water of the Republic of Serbia regulates the protection of waters; the protection from the detrimental effects of waters, utilisation and management of the water as a wealth of general concern; the conditions and ways of carrying out water management and inspection over the implementation of regulations of this law. The regulations of this law address all surface and groundwater, including drinking water, thermal and mineral water, as well as the boundary and trans-boundary water courses between the Republic of Serbia and other countries in the vicinity. The law stipulates that water can be used only in a way that does not threat their natural characteristics, does not endanger the life and health of people, does not peril the wild plant and animal species, natural wealth and immobile cultural wealth.

Water management permits have to be obtained for the construction, modification and enhancement of sewage disposal facilities (collection, channelling, treatment, and discharge of (treated) wastewater). Water management permits are not required for discharge of unpolluted rainwater and domestic household wastewater (Art.15). The prerequisite for a water management permit is a “Declaration of Consent”, which is granted by the public authority that sets the requirements, i.e.:

- The Ministry responsible for water management, or
- The Municipality for small structures and properties.

The Declaration of Consent from the Ministry of Health and the Ministry of Environment is also necessary for sewage disposal facilities. Construction of the facility must begin within two years after the receipt of the Declaration of Consent. The permit also confirms that water management requirements are complied with.

The funding of water-related activities is outlined in Paragraph IX of the Water Law. Funding is provided from the following: fees for use of water, protection of waters, drainage, irrigation, fees for material extracted from water flows and fees for use of water management facilities and other services as well as the means of the budget of Republic of Serbia allocated for operations of public interest.

Funds acquired from fees for use of water, fees for water protection and fees for material extracted from water flows shall be paid to a dedicated account of the Ministry in charge of water management issues while funds acquired from drainage fees, irrigation fees and other services shall be the revenues of a water management company Srbija Vode.

In line with the Water Law, a Decree on level of fees for use of waters, protection of water and fees for material excavated from water flows is issued annually by the Ministry of Agriculture, Forestry and Water Management. The Decree for 2007 (RS Official Gazette 27/2007) envisages incentives ranging from 20% to 70% for decrease of pollution achieved by primary treatment and 50% to 90% for decrease of pollution achieved by secondary treatment.

Fees set by the Decree are paid to a dedicated account of the Ministry in charge of water management issues.

Communal services
Water supply and waste water collection are defined as communal activities (Law on Local Self-government 9/2002) which belongs in the realm of the Municipality. The Municipality may create to this purpose either a Public Utility Company (PUC) or entrust the activity to another enterprise. However, there are no examples of the latter in the Serbian water or wastewater sector.

The exploitation and development of public utility activities are financed from the sales of the products and services of the public utility. Other possibilities include compensations for the development and utilisation of construction land, voluntary local taxes, and other legally possible sources (grants and subsidies).
Public utility activities may be organised for two or more municipalities together. In this case the municipalities will regulate their internal rights and commitments in a separate agreement.

Public Companies
The set-up of a PUC is regulated in the Law on Public Companies and Activities of Common Interest ("Official Gazette of the RS", no. 25/2000, 25/02, 107/05 and 108/05). The Law deals with the establishment, the internal organisation, and the operation of Public Companies. A Company shall be established by a Founding Act and duly registered with the Serbian Business Registers Agency. Company regulations shall be defined in the Articles of Association/ Company Statute and any other documents required by Law.

Management is assured by a Manager who reports to the Management Board, which is the highest decision making body in the Company. The Management Board is supervised by a Supervisory Board who monitors the functioning of the Company, in particular the financial documents such as the annual report and proposals for the allocation of profits, and advises the Founders (the Municipality) accordingly.

The Law contains a numbers of provisions to protect the general interest in a Public Utility Company. The Municipality, in practice the People's Assembly, must approve the statute (and eventual changes) and major policy issues, i.e. tariffs, disposal of company assets, capital investments, etc, and nominates the Management of the PUC, i.e. the Supervisory Board, Management Board, and the Manager.

The Ministry of Finance may send instructions to limit the annual increase in salary mass and tariffs. The annual accounts are submitted to the National Bank of Serbia and audited by external auditors. The Ministry of Finance through its Treasury sector controls financial aspects of the work of Public Utility Companies, which are indirect budget users.

The collection fees are set to cover for operational expenditures yet do not provide for full cost recovery which would enable investments. There is no tariff setting formulae and the increase of tariffs has been under Governmental control as of 2006 and the PUCs are obliged to set tariffs upon the projected increase in prices and salaries as determined by the Government of Serbia for the following year. Tariffs are also subject to the approval of the Municipality.

The maximum annual increase for communal services is limited by the following acts: the Law on Public Companies and Performance of Operations of Public Interest, Article 22, and 22a and 22b; the Decree on Temporary Discontinuation of Proceedings regarding the Transfer of Budgetary Funds of the Republic of Serbia to Local Self-government Units, (Official Gazette 06/2006, from 23 January 2006); and the Decree on manner and control of calculation and payment of salaries in public companies (Official Gazette RS 5/06). According to the instruction no. 023-0263/2006, issued by the Ministry of Finance on 6th February 2006, the fees could be increased by 9,3% cumulatively for the whole year of 2006. In year 2007, the limit is set at 7,5% for the tariffs and 9% for salaries. In the event of introducing new activities the salaries for the newly recruited staff must not exceed the average salary levels in the Municipality.

6.2.2 Policy framework

National level

National environmental strategy and action plan
The draft National Environmental Strategy (NES) and the corresponding National Environmental Action Plan (NEAP) were prepared by the Directorate for Environmental Protection in 2005. The most relevant elements of the NES and NEAP which have a bearing on Leskovac WWTP Project comprise a.o.

- **Legislative:** the harmonisation of National water and wastewater legislation with the EU Water Framework Directive (2000/60/EC) and the Urban Wastewater Treatment Directive (91/271/EEC);
- **Economic instruments:** to adjust wastewater charges to reflect full cost recovery; introduction of volumetric charges;
- **Monitoring:** to review monitoring plan with optimum design of the network of station dealing with water quality analysis;
- **Financing:** to ear-mark environmental and water revenues, allocate state and municipal funds, provide loans from commercial banks;
- **Institutional:** to establish inter-ministerial coordination group, increase HR capacity in water management and water protection;
- **Infrastructure:** to provide primary and secondary wastewater treatment in agglomerations above 100,000 population equivalent and extend sewer systems to cover 90% of their population; upgrade or renew operation of existing municipal wastewater treatment plants;
- **Industry:** to expand treatment of industrial wastewater by reconstruction or building of new industrial WWTP's.

Water Management Master Plan
The Water Management Master Plan developed in 2001 by the Ministry of Agriculture, Forestry and Water Management stipulates three levels of priority activities which are relevant for the Leskovac project. These are:
Level 1:

- Rehabilitation of existing industrial and municipal WWTP;
- Construction of WWTP at industries with toxic waste waters, regardless of the type of receiving water body (these being water flows or sewers);
- Construction of facilities for large polluters which have a bearing on the quality of waters in "sensitive areas" , and

- Construction of WWTP's for large and medium size sources of pollution (population equivalent >15,000) whose wastewater has a major impact on downstream waters.

Level 2:

- Construction of WWTPs for polluters whose wastewater has a considerable impact on the directly receiving water body.

Level 3:

- Construction of all other WWTPs for settlements larger than 5,000 and all smaller settlements which have a centralised water supply and constructed sewer system.

In line with the aforementioned priorities, Leskovac is listed in the Water Management Master plan at the 1st level source of pollution.
Also, an increase of connection rate to the centralized public water supply system in order to provide chemically and bacteriologically adequate potable water to the population has been set as one of the top priorities in the Water Management Master Plan.

Local level
The Local Environmental Action Plan (LEAP) for the Municipality of Leskovac was developed in 2005 by the Municipal Directorate for Environmental Protection. LEAP is a comprehensive document encompassing 17 areas, analyses present status and also presents measures for improvement. The LEAP priorities in the area of wastewater are the following:

1. Facilities that are potential water polluters of groundwater resources have to be located in Urban development plans in line with the specified areas of groundwater resources
2. Connection to the central sewer system or construction of wastewater treatment plants for the polluters who discharge directly into rivers, subject to the level of pollution of wastewater,
3. Increased control of polluters who discharge toxic substances such as chemical industry, metal protection, pesticides production and car servicing,
4. Extension of master collector to the confluence of the Veternica and the Juzna Morava rivers,
5. Continuation of the activities on central WWTP;
6. Cleaning of the river beds;
7. Cleaning and rehabilitation of water drainage canals;
8. Rehabilitation and re-start of operation of existing wastewater treatment plants.

Second level of priorities would be the following:

1. Preparation of polluters' database;
2. Incentives for construction of primary wastewater facilities for industrial waters by method of co-financing and 'polluter pays' principle;
3. Construction of sewer networks in settlements in line with priorities of construction,
4. Regular control of industrial wastewater;
5. Legal measures/enforcement of persons who dispose of solid waste in river beds;
6. Increased inspection in the protected area of Barje reservoir.

With regard to potable water supply services, the LEAP sets out the following priorities, which are also relevant for this project:

1. Extension of water sources;
2. Control of water consumption;
3. Increase of connection rate to the central public water supply system;
4. Replacement of old parts of the distribution network with contemporary pipe materials.

In the water sector, 1st level of priorities is related to preserving water sources from pollution while the 2nd level of priorities is focused on extension of water coverage, optimising water consumption, extension of water sources and replacement of dilapidated water supply network.

A summary of the LEAP and present status of activities is given in Annex 6.2.

In line with Article 18 of the Law on Local Self Government (RS Official Gazette 9/2002), the Municipality is in charge with both preparation and monitoring of LEAP implementation and can impose fees for environmental protection in its territory. Such fees have not been imposed yet in the Municipality of Leskovac. An example of introduction of environmental protection fees can be seen in the City of Belgrade which has introduced the special fee for environment protection and enhancement (Official Journal of the City of Belgrade n. 22/99, 6/2001, 37/2004, 29/2005). The money collected through this fee belongs to the city budget. The fee payers on a monthly basis are landlords. A legitimate solution can be to introduce a similar fee in Leskovac.

The monitoring role of LEAP is granted to the Municipal Directorate for Environmental Protection which presently has 17 employees. The most recent activity of the Directorate (August 2007) is revision of the LEAP which in coordination with the municipal authorities should lead to enforcement towards the parties responsible which failed to act in line with the LEAP.

6.2.3 Institutional Framework

National Level

The Ministry of Agriculture, Forestry and Water Management is responsible for the entire water sector in Serbia. The Directorate for Water is part of the Ministry, and following departments:

- Department for Analytical Studies and Administrative Tasks in Water Management;
- Department for Water Supply and Protection;
- Department for Water-Related Inspections.

Supervision of the disposal of industrial wastewater is a task of the Ministry of Agriculture and Water Management. The Ministries of Health, Capital Investments, Energy and Mining, and Administration and Local Self-Government are also indirectly involved in water supply and treatment: The Directorate for Environmental Protection, within the new Ministry of Science and Environment Protection, is responsible for environmental protection in connection with water body and water management activities.

The Public Companies and State Aid Sector of the Treasury Department (Ministry of Finance) monitor the performance of the PUCs. The PUCs are monitored for salary levels and are given remarks and instructions on their annual plans.

Investments can be provided through the Ministry of Agriculture, Forestry and Water Management with their Directorate for Waters and waste waters. In 2006, the Ministry of Finance launched the National Investment Fund that is coordinated by line Ministries and the Ministry of Local Governments with its Municipal Infrastructure Agency in the sector of municipal infrastructure.

The Standing Conference on Towns and Municipalities (SCTM) serves as a Professional Association for all municipalities in the country. The members pay an annual fee in accordance with their size and their budget. The SCTM acts as a platform for exchange of best practices and advocacy. Municipal Water and Wastewater operators are united in professional associations, namely the Association for water technology and sanitary engineering and the Waterworks Association.

Regional level
The role of Government at Regional Level is mainly coordinative and for the rest very limited. At country level, there is only one regional water supply system “Rzav” in the region of Uzice, encompassing 5 municipalities. The system is operated by a regional Public Utility Company founded by the participating municipalities.

Local level
Municipalities are headed by elected Mayors and controlled by an elected Municipal Council. The Municipality is responsible for communal services and usually handles this by one Public Utility Company (PUC), regrouping all the various services concerned. The PUC usually is able to cover its costs of O&M but has to refer to the Municipality for investments. The Council will need to ratify the major decisions of the PUC, most notably tariffs.

6.2.4 The roles and responsibilities of Public Administration in Water and Waste Water Sector

<u>Planning</u>
Policy development by its very nature is the prerogative of the National Government. This applies for legislative and regulatory activities. The Ministry of Agriculture and Water Management is responsible for the Water Resources Development Master Plan of the Republic of Serbia and specifies water-related requirements by identification of main water resources in the country and allocation to certain areas with less water resources. Planning of water supply and wastewater services to and from the consumers is the responsibility of municipalities in their respective territories. The government may participate in investments in the sector through their Directorate for Waters by 50% while Municipalities provide for the other 50%; however, the republican funds are rather limited.

Operations

Municipalities are responsible for provision, operation, maintenance and investment for water supply and sanitation services. Municipal water supply and wastewater systems are operated and maintained by local Public Utility Companies. PUC's are basically state-owned companies, founded and managed by the Municipalities. The PUC's are responsible to the Municipalities for their performance.

Supervision and enforcement

The Republican Directorate for Waters has its inspectorate with 4 field offices covering the total of 19 regions with 18 inspectors Authorities of water management and sanitary inspectors are defined in the Water Law. While sanitary inspectors are in charge with control of potable water, water management inspectors are responsible for supervision and control of existing and new water management facilities including functioning and efficiency of wastewater treatment facilities, as well as the inspection of polluters. In the event that hazardous elements exceed limits set by Rule book on hazardous elements in waters (RS Official Gazette 31/82), inspectors may order closure of enterprises until the limits are met. This measure is however only applied in event of major environmental impact and is therefore reactive.

Supervision of environmental issues and larger polluters, namely industries, is carried out either by the Ministry of Environmental Protection (Environmental Inspection comprising 45 inspectors) or by the environmental Inspectors of the Municipalities. The republican inspectors supervise municipal inspectorates.

The total number of 10 environmental and communal inspectors operates at municipal level in Leskovac, while one regional water management inspector is employed in the region. Control of water and wastewater network and connections in the city is the responsibility of communal inspectors while master collectors, discharge into rivers, sewage network and flow measurement are controlled by republican water management inspectors and republican Hydro-meteorological Directorate. In the event of reported pollution, republican water management inspectors and environmental inspectors perform joint site inspection.

In 2007 republican inspectors ordered installation of flow meter in Vucje system while the Leskovac PUC paid RSD 30.000 fee for failing to test wastewater in line with the Rule book on manner and minimum number of conducting wastewater analysis (FRY official Gazette 47/83 and 13/84). In 2006 Republican water management inspectors also issued penalties to industries which do not meet quality standards for discharge. Due to low level of fees in water management sector, industries fail to implement measures for wastewater pre-treatment. According to Article 117 of the Law on Waters the highest fine is about EUR 37,500 (3,000,000 RSD) in line with the level of fees set 10 years ago.

Although no major pollution of water flows in Leskovac have been reported, the Republican water management inspectors reported difficulties in detecting polluters due to varying levels of pollution in discharged wastewater from the same facilities. Therefore, constant monitoring and sampling in a period of a minimum of six months would be required.
In the water sector, no penalties have been imposed at the PUC regarding water quality.

Planned activities in prevention of water pollution at Republican level

Toxic spills that killed large amounts of fish have occurred in several Serbian rivers this summer alone. It is a well known fact that the reason behind the pollution is usually irresponsible behaviour on the part of industrial facilities located near the rivers and public sewage system. Inspections confirmed that the fish plagues were a result of wastewater from various companies, which are temporarily shut down until their waste disposal practices are improved. In order to react in time and prevent environmental catastrophes, inspections will gain in frequency, while producers will have to obtain an integrated ecological license. The deadline for receiving an integrated ecological license is 2015, and the process lasts several years. Newly-established companies will not be allowed to start operations prior to obtaining the licence. Meanwhile the only measure would be to increase fees for polluters.

In an effort to decrease such incidents, the Ministry of Agriculture, Forestry and Water Management announced that 130 new inspectors will be hired to survey the field.

The Ministry's inspection has developed a list of the top 243 polluters in Serbia (according to Article 25 of the Law on Waters the Ministry keeps the record of water polluters). Recent events show difficulties in identifying polluters who can also be smaller and newly opened facilities.

Conclusion

The project and its institutional setting are in line with the relevant legislative framework in Serbia, in compliance with national strategies and policies and involve institutions that will continue to exercise their legal rights and duties in respective sectors such as the water and wastewater sector, environmental protection and provision of communal services. Compliance of environmental and technical documentation with legal requirements is reflected in chapters 3 and 4.

The Consultant did not identify flaws and potential risks related to lack of supervision and enforcement of the PUC. Enforcement of industries to meet standards of wastewater required for further treatment in the WWTP is a source of problems in between the PUC and industries. Measures for strengthening the position of the PUC are given in next section.

6.3 PUC's legal status and relations with the Municipality

Public Utility Company Vodovod Leskovac, ID No 07204752, was founded by the Municipality of Leskovac and is 100% state owned. Therefore, the Founder exercises its rights in line with those described in paragraph 6.2.1 section on Public Companies. The Treasury Department at local Level is in charge of controlling its performance on behalf of the Ministry of Finance.

The existing PUC is registered for the following services: production and distribution of water and maintenance of the city's water system, wastewater collection and treatment, supervision of the quality of the potable water, sanitary protection and securing of the water system plant, maintenance, reconstruction and expansion of the water and wastewater system. It is envisaged that the existing PUC will operate the wastewater treatment plant to be implemented by the project.

Statutory documents of a Public Utility Company

The Law on Public Utility Companies (Official Gazette of the RS No. 25/2000, 25/2002 and 107/2005 and 108/2005) envisages that the PUCs must have a Founding Act and the Statutes and defines its contents.

The **Founding Act** is the agreement to establish and operate the W/WW System by which the company rights and obligations to the Founder are defined. The Founding Act defines (i) the purpose of the Company, (ii) the resources (capital) put at the disposal of the Company, (iii) the rights and obligations of and to the Founder, (iv) decision making, and (v) eventual profit sharing (vi) measures for environmental protection

The **Statutes** are more detailed and determine roles and responsibilities of governing bodies of the PUC, lists general enactments of the Company such as rule books, books on procedures and role of labour unions.

The Consultant concluded that amendments of the statutory documents are not required for the purpose of project implementation as the company is duly registered for activities envisaged by the project and no changes are expected in terms of ownership or decision making.

Agreements on PUC operations

The set of abovementioned documents is prescribed by law, and is prerogative for a start of company operations; however it does not set performance levels for which the company would be responsible to its Founder. Legal background that may enable introduction of additional agreements relevant for PUC operations is stipulated in the Law on Public Utility Companies (Official Gazette of the RS, no. 25/2000, 25/2002, 107/2005 and 108/2005 hereinafter: the Law) states in Article 8 that in addition to the Founding Act and the Statutes a contract may be concluded between a public utility company and a local self-government unit. The Contract may contain specifically provisions regarding: 1) work and operations of the company; 2) rights and obligations regarding utilizing of the funds in state ownership for performing of the activities of common interest, in accordance with the Law; 3) company obligations regarding provision of conditions for continuous, tidy and quality satisfying of the consumers' needs for products and services; 4) mutual rights and obligations in case that economic and other conditions for performing of the activities of common interest have not been met; 5) rights and obligations in case of disturbances in company operations; 6) other rights and responsibilities deriving from the provisions of the Law regulating performance of individual activities of common interest and of this Law; 7) other questions important for resolving and protection of the common interest.

Although there is a legal possibility for this type contracts to be prepared, this is not common practice in Serbia. Internationally, defining financial, operational and managerial requirements in a contract is usually done through a management contract or a Service Level Agreement (SLA). The purpose of such agreement is to define responsibilities of a company while at the same time limiting authorities of the Founder in day-to-day management including tariff setting. Experience with a SLA has been gained in Serbia with the PUC of Subotica Municipality for drinking water and wastewater.

Municipal Decision related to tariff setting

At local level, the Municipality passed a Decision on manner of tariff setting and terms and condition of payment for communal services (Official Gazette of the municipality of Leskovac No 17/1994, December 1994). The Decision stipulates two basic criteria for tariff setting:

- Level and increase of expenditures required for functioning of communal services, and
- Level and increase of salaries in the Municipality.

In spite of its own Decision and the possibility to increase fees up to the limit set by the Ministry of Finance, in the years 2006 and 2007 the PUC Leskovac did not increase tariffs as it failed to obtain permission of its Founder which is the Municipality of Leskovac. Based upon this, the Consultant identified potential risk in the area of tariff setting and achieving cost recovery.

Municipal Decisions related to water and wastewater sector

Scope, method and responsibilities in performing communal activities as well authorities in enforcement and penalties are defined by Municipal Decisions on Communal Arrangements. These Decisions are in line with national legislation and are legally binding documents in municipalities in which they are endorsed.

The Decision on Sewage and the Decision on Water Supply (Official Gazette of Municipality of Leskovac, 10/93)

The Decisions were endorsed in Leskovac Parliament in 1993 and stipulate the obligation of real estate users and owners in the territory of Leskovac to get connected to the sewer and water supply network no later than 6 months following the date when the network was constructed. Such Decision forms sound legal grounds for enforcement of future connections to the water supply, sewer system and the WWTP.

Rule book on sanitary-technical conditions for wastewater discharge into sewer network and Amendments to the Rule Book (Leskovac Official Gazette No 14/1992 and 10/1993)

Article 56, paragraph 3 of the Law on Waters prescribes that municipalities define the sanitary and technical conditions for the discharge of wastewater to public sewer system. If some of polluters are already connected to the Leskovac public sewer system, one of the way how to lower the level of pollution is to amend the Rulebook and to make it more restrictive in line with EU standards, if applicable. In that way, the polluters would have to make significant improvements in wastewater quality. It is envisaged by the LEAP, see also Annex 6.2 that an updated Rule book introducing more strict criteria should be introduced at municipal level. However, draft of this document has not been prepared yet.

The present Rule book stipulates the following: maximum allowed concentrations of pollutants that may be discharged into the sewer; list of industrial 15 polluters with level of pollution of wastewater that they discharge, authority of the PUC to perform control of the quality of discharged wastewater, obligation of polluters to meet the limits set in level of pollutants discharged or to construct a primary treatment facilities and the methodology of fees for discharge calculation. The methodology includes quantity of quality of discharged wastewater.

Presently the level of industrial wastewater discharged from a number of industries does not meet the quality required for further treatment in the WWTP and it is therefore required that those industries construct or rehabilitate their own primary treatment plants.

The Consultant recommends the following activities:

1. Prepare a contract between the PUC and its Founder in which the PUC performance standards will be defined. The role of the Founder should be limited to control of standards with no direct interference with decision making and in particular with tariff setting. Such contract can have a form of Service Level Agreement referred to above.
2. The Local Environmental Action Plan requires enforcement and therefore the position of municipal Directorate for Environmental Protection should be strengthened followed by coordination of activities with inspection and other relevant authorities on local and republican level. Enforcement in the line with the Law on Environmental Protection (OGRS No. 135/04) can be executed on the grounds of causing environmental pollution by acting or non-acting of legal entities and physical persons.
3. Preparation of individual contracts in between the PUC and the industries connected to the sewer network. The contracts should include conditions of acceptance of wastewater, planned dates, level of tariffs and terms and conditions of payment, penalties for breach of stipulation of contract and body responsible in event of dispute. A support of the municipality is required to enable the PUC to enter into such contract.
4. Prepare amendments to the Rule book on sanitary-technical conditions for wastewater discharge into the sewer network and Amendments to the Rule Book (Leskovac Official Gazette No 14/1992 and 10/1993) which would as a minimum include the following
   - Change of criteria for wastewater discharge into the sewer by setting stricter limits;
   - Updated list of polluters with results of level of pollution of discharged wastewater after a constant period on six months of monitoring and sampling;
   - Increased level of wastewater drainage tariffs for industries, based upon level of pollution;
   - Wastewater treatment tariffs;
   - Penalties in event of discharge of wastewater that exceeds the levels set by the municipality

Conclusions and follow up

Leskovac has a solid legal background to implement the project which some amendments of local legislation are required. The implementation of regulatory and policy framework created at local level is rather limited. Support of both municipal and republican authorities is required to strengthen institutional setting. The institutional development plan is given in chapter 8.

7 OPERATIONAL EFFICIENCY ASSESSMENT

7.1 Introduction

In this chapter an assessment is made of the operational performance of the PUC Vodovod Leskovac in performing the tasks of providing drinking water to and collecting wastewater from consumers in and around Leskovac town. Furthermore, an assessment was made of the organizational structure and the capabilities of staff and management. This included, among others, number and skills of employees, operational planning and control, administrative systems and procedures, accounting practices and record keeping, customer services and management information systems, and general human resources policies.

A few identified operational indicators have been compared with international indicators from countries in the near region.

In the light of the proposed extension of services, of the new technical facilities that are being constructed and of the efforts made by the PUC to become a more professional organisation, recommendations have been formulated for improvement of services and enhanced capacities.

7.2 Assessment of operational performance of PUC

This section gives the results of the assessment of the financial and operational performance of the PUC Vodovod Leskovac in the current situation, and an overview of the future situation when additional activities and responsibilities are foreseen. For the financial data reference is made to chapter 5, where the complete financial analysis is presented.

In the last section, the conclusions and recommendations of this paragraph are presented.

7.2.1 Current situation

7.2.1.2 Operational performance of the PUC Vodovod Leskovac

In chapter 3 an assessment has been made of the operational performance of the PUC Vodovod Leskovac. In the table below a set of benchmarks is presented in order to compare the performance of the PUC with water/wastewater companies in neighbouring countries.

Table 7-1 Comparison between operational indicators in the PUC Vodovo - Leskovac with some \national indicators from neighbouring countries

	Bosnia Herzegovina *	Czech Republic CZE*	Croatia HRV*	Hungary HUN*	Romania ROM*	**Leskovac Municipality**
Collection ratio (drinking water and wastewater bills)%	N/A	98	60	100	106	**71**
Drinking water coverage%	72	91	93	99	93	**56**
Sewerage coverage %	8	77	76	42	73	**37**
Wastewater Treatment (at least primary treatment) %	97	97	54	80	98	**0**
Non revenue drinking water %	62	20	19	20	40	**28**
Residential water consumption (l/c/d)	134	102	261	114	112	**155**
Staff/1000 DW&WW connections	N/A	8,3	6,6	5,4	3,9	**11**

* Data from website: ww.ib-net.org, the World Bank benchmarking programme, National averages 2004;

If we compare the indicators for Leskovac Municipality with National indicators for some surrounding countries we can draw the following conclusions:

- For the rate of drinking water connections the percentage is (at municipal level) rather low and needs to be increased, which is in line with one of the objectives of this project;
- The collection rate can further be improved;
- There is a low coverage in wastewater collection for the Municipality as a whole, and wastewater treatment is becoming urgent;
- Non revenue water is relatively high: 28 %, and needs to be reduced;
- The average household unit consumption is 155 l/person/day, which is within reasonable limits;
- The number of staff per 1000 connection of drinking water and wastewater is very high.

<u>The responsibilities of the PUC are the following:</u>

Drinking water provision:

- Operation and maintenance of the Barje reservoir;
- Design and development of new projects (extensions, new buildings), preparation of tender procedures for selection of suitable contracting companies, construction supervision, and rehabilitation of the existing infrastructure;
- The operation and maintenance of the well fields consisting of groundwater wells of which 12 exclusively for drinking water production in the town of Leskovac. For water supply to the other villages belonging to the Municipality other well fields are in use. Water from the wells is treated by chlorination before being pumped into the distribution network;
- Maintenance of the drinking water distribution network: repair of the pipes of the transport and distribution network;
- Drinking water quality sampling and laboratory analysis;
- Replacement and repair of failing water meters;
- Reading of water meters and fee collection.

Wastewater:

- Maintenance of existing sewer network and expansion to new areas. Currently up to 92% of houses of Leskovac towns are connected to the existing sewer. The percentages of house connections in the smaller villages vary from one village to another;
- Water quality sampling and analysis.

The technical responsibilities and activities consist mainly of civil works: repair and extension of sewers (concrete) and water pipes (Asbestos, PVC) and mechanical-electrical works: well pumps, booster pumps, filter and chlorination units.

The PUC Vodovod - Leskovac consists currently of three sectors (departments) falling under the direction of the General Manager. The tasks of these departments are described in more detail in section 7.3.

7.2.2 Future situation

7.2.2.2 Expected changes for operations

Effective operations and maintenance concern the assets of the drinking water and wastewater systems and will be an extension of the assets currently in use. Extensions for the water infrastructure of Leskovac will mainly consist of wastewater facilities (new WWTP) and transport mains for drinking water to the smaller villages within the municipality, see below.

While presently reactive activities are recognized practice in wastewater/water companies, the PUC Vodovod-Leskovac will have to develop plans for the operation and maintenance strategies covering also proactive activities. The activities shall include operational efficiency control, proactive maintenance, monitoring wastewater, residue quantity and quality of treatment plant(s), troubleshooting and development of documentation. The documentation may include job descriptions, operating instructions, test records and records of maintenance.

In the previous section the activities of the Operational units for water supply and wastewater are described. With the proposed extension the work load of the units will be the following:

Drinking water:

- Currently the construction of the new drinking water plant in village Gorina some 20km from Leskovac has reached the final stage, where mechanical-electrical equipment will be installed. The PUC is generally preparing an extended drinking water system for all communities belonging to the Municipality;
- This means that the existing groundwater wells will be used in the future as a supplementary/stand-by source for drinking water. Improved efficiency, guaranteed quality of the distributed drinking water and a more rational system are the main objectives of this upgrading of the water supply;
- The construction of two (intermediate) storage tanks has reached its final stage.

Wastewater:

- A new wastewater treatment plant will have to be operated, meaning technically and technologically a more demanding responsibility for the PUC;
- A larger wastewater collection system with specifically longer transport mains from the smaller villages will be in operation in the short term;
- Some large industries will be connected to the existing sewer system, meaning that in addition to the domestic wastewater, dealing with industrial wastewater and quality monitoring of this wastewater will be new duties for the PUC;
- As further extensions of the sewer network to the neighbouring villages are foreseen in the short-mid term, this will require additional attention for planning, design, tendering, construction of extensions and administrative changes;
- Initiatives have been taken to reduce unaccounted for water. From the Management Information System there is a considerable knowledge on technical and administrative losses. The following actions are foreseen: gradual replacement of outdated asbestos pipes by PVC pipes, installations of leakage detection devices, installation of sector meters, etc. Unfortunately the availability of funds for these initiatives restricts swift action.

7.2.3 Conclusions and recommendations

Based on the assessment made of the operational and financial work of the PUC, we have formulated the following conclusions and recommendations:

Operational activities:
The changes in work load are the direct consequence of the operational changes on the short and middle-long term. In brief it can be concluded that:

- Requirements for technical qualifications of technicians working in the field of drinking water will change considerably with the introduction of the new treatment plant for drinking water. As on-the-job training will be provided as part of the construction contract, the staff will be prepared for the operation of the new plant.
- Requirements for staff responsible for the distribution of drinking water and the maintenance of the transport mains and distribution network will have an extension of their responsibilities and of a physical service area;
- The needed technical qualifications of the technicians who will be working in the operation and maintenance of the WWTP will be higher than available at the moment. Currently, the only experience is available with civil works (construction, modification and repair of sewers) and to a lower degree with mechanical-electrical (booster pumps, valves) equipment. Operational, technical and process knowledge will have to be acquired or by specific training, before putting in operation of the WWTP and on regular intervals after its introduction, or by contracting specialised personnel.

7.3 Assessment of organization and management of PUC Leskovac

This section gives an overview of the organisational structure of the PUC Vodovod Leskovac. It assesses the organisation and the capabilities of management and staff, in relation to the future developments of the PUC. Furthermore, required changes in both organisation and management are discussed and in the last paragraph recommendations have been formulated.

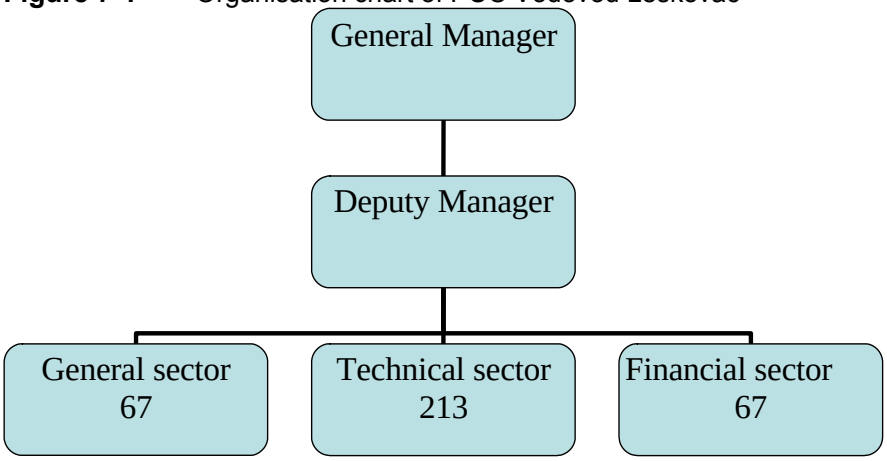
7.3.1 Current situation

7.3.1.1 Organization of PUC Vodovod - Leskovac

Management of the PUC Vodovod Leskovac has provided the organization chart as presented below. The Units currently responsible for drinking water production and distribution, for wastewater collection and discharge onto surface water and for maintenance of the water supply distribution and the sewerage networks has been indicated. The PUC has got two general managers (General Manager and his deputy) who are responsible for three departments (see Figure 7.1 below):

- The General Sector;
- The Technical Sector; and
- The Financial Sector.

Figure 7-1 Organisation chart of PUC Vodovod Leskovac



The different departments (consisting of sectors and operational units) of the PUC Vodovod Leskovac have the following duties:

1. The **General Sector** consists of three units and has the following scope of work: Legal and administrative affairs, HRM, management of properties and general operations, security and maintenance of property;
2. The **Technical Sector** consists of four units and is responsible for the production; distribution; delivery; control of quality, quantity and minimum delivery pressure; repair and maintenance of water meters for domestic and industrial drinking water; Collection; transport; discharge; quality monitoring for domestic and industrial wastewater; for maintenance of the drinking water distribution network as well as the collection network for wastewater;
3. The **Financial Sector** is in charge of all financial operations and planning, book-keeping, data processing and water meter reading and fee collection. The sector consists of four units;

Distribution of staff over the three sectors is as given in Table 7.2:

Table 7-2 Total Personnel by employed by PUC Vodovod Leskovac

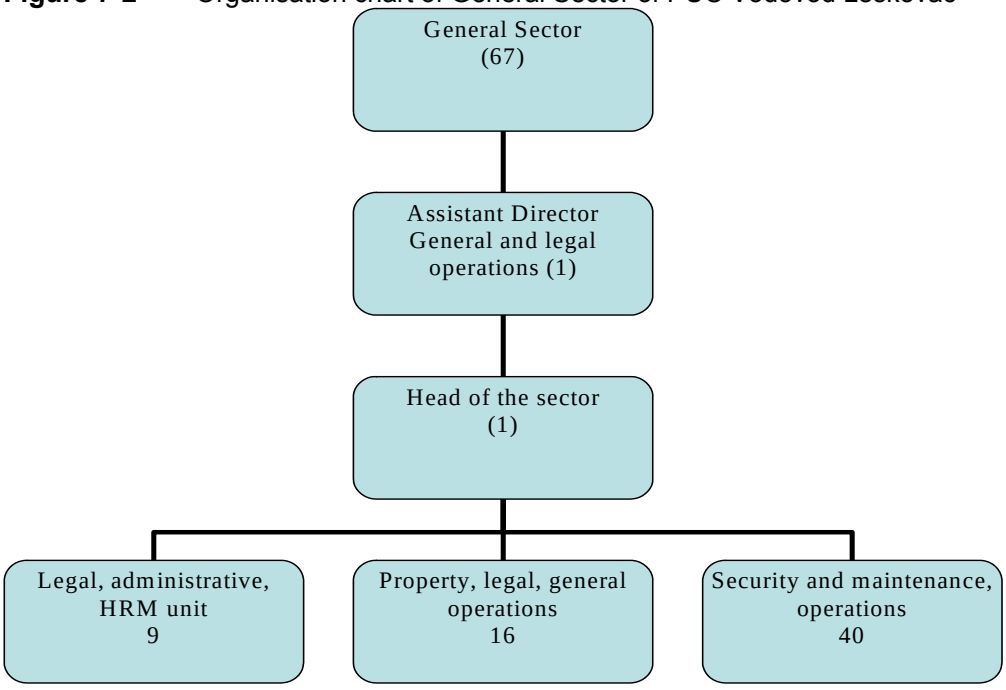
Category	May 2007	
	No.	%
General Management	2	0.6
General Secto r	67	19.2
Technical Sector	213	61.0
Financial Sector	67	19.2
Total	**349**	**100**

Source: PUC Vodovod - Leskovac

General Sector

In total some 67 persons are employed by the General Sector, under the direction of the Assistant Director and Head of the Sector. In Figure 7.2 the organization chart of this sector is given.

Figure 7-2 Organisation chart of General Sector of PUC Vodovod Leskovac



Technical Sector

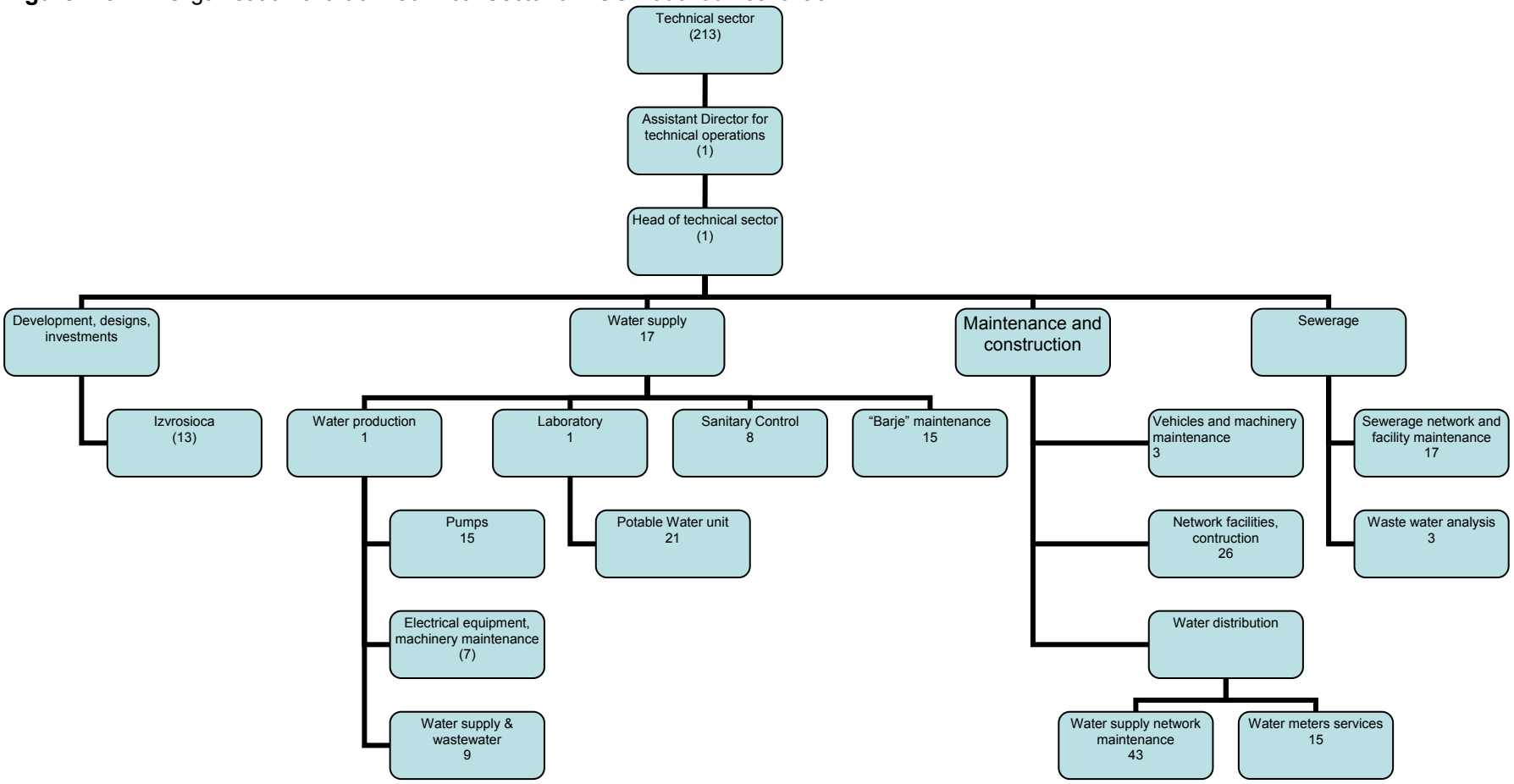
Under the direction of the Assistant Director and the Head of the Sector, in total some 213 persons are employed by the Technical Sector, Figure 7.3 gives the organization chart of the Technical sector.

As can be noted from the figure below this department consists of four (4) main units, further divided in another sixteen (16) sub-units. The main division into four units is as follows:

- Unit for design and development;
- Operational unit for drinking water production;
- Operational unit for maintenance and construction;
- Operational unit for sewerage.

There are separate units for drinking water and wastewater, but general tasks as technical development and maintenance are undertaken in different sub-units without clear division.

Figure 7-3 Organisation chart of Technical Sector of PUC Vodovod Leskovac



Distribution of staff among the units of the technical sector is as follows:

Table 7-3 Total Personnel in Technical Sector

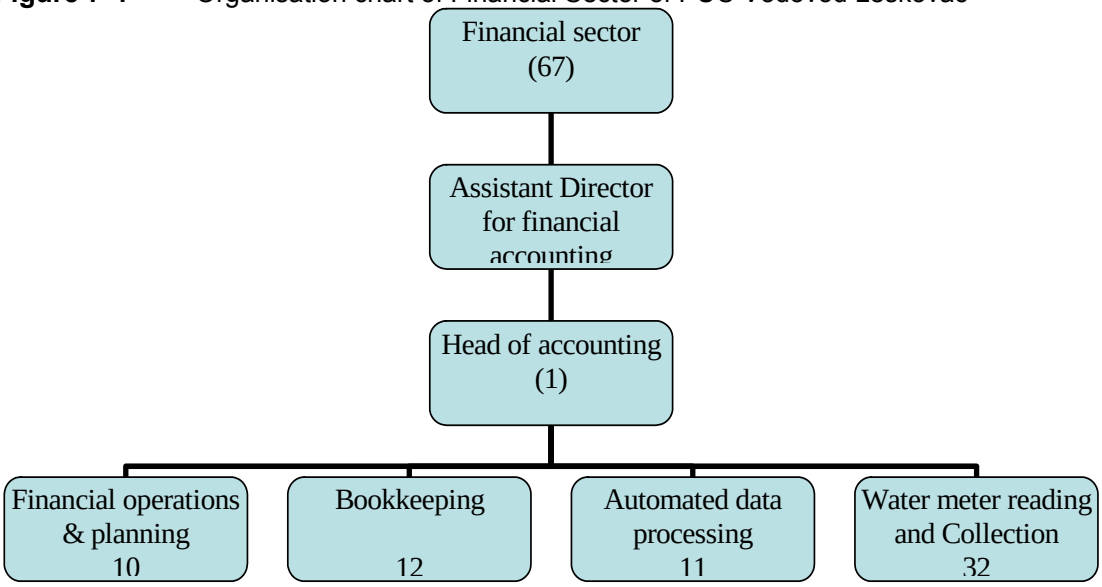
Category	May 2007	
	No.	%
Unit for design and development	13	6
Operational unit for drinking water production	94	44
Operational unit for maintenance and construction	87	41
Operational unit for sewerage	20	9
Total:	**213**	**100**

Source: PUC Vodovod Leskovac

General Sector

In total some 67 persons are employed by the Financial Sector, under the direction of the Assistant Director and Head of the Sector. In Figure 7.4 the organization chart of this sector is given.

Figure 7-4 Organisation chart of Financial Sector of PUC Vodovod Leskovac



Employee Skills

In order to assess the qualifications and structure of the PUC's workforce, management of the PUC Vodovod Leskovac provide the information given ion the tables below.
The staff distribution by age is given in Table 7.4:

Table 7-4 Staff age structure in PUC, May 2007

	Total personnel	
	Number	**%**
Younger that 25 years	10	3
Between 26 and 30 years	26	7
Between 31 and 35 years	41	12
Between 36 and 40 years	51	15
Between 41 and 45 years	50	15
Between 46 and 50 years	53	15
Between 51 and 60 years	110	32
Over 60 years	8	2
Total	**349**	**100**

Source: PUC Vodovod Leskovac

The staff distribution by academic qualifications in J.K.P. Vodovod Leskovac is currently as indicated in the following tables:

Table 7-5 Education Level of PUC Vodovod Leskovac, May 2007

Education level	**VSS**	**VS**	**VKV**	**SSS**	**KV**	**PKV**	**NK**	**OŠ**	**Total**
Financial sector	6	2	1	12	19			29	67
General sector	7	8		45	11		9		67
Technical sector	30	8	10	50	74			35	213
Numbers	43	18	11	107	103	0	9	64	349
Total%	**12.1**	**5.0**	**3.1**	**30.1**	**28.9**	**0**	**2.5**	**18.0**	**100%**

Source: PUC Vodovod Leskovac

Table 7-6 Education Level of PUC Vodovod Leskovac, May 2007

Education level	VSS	VS	VKV	SSS	KV	PKV	NK	OŠ	Total
General Director	?								
"Water distribution and construction" sector	3	3	4	18	49			22	99
Financial sector	7	8		43	11				69
"Water supply" sector	17	2	5	17	18			2	61
General sector	6	2	1	11	19			23	62
Technical sector	5	1		9					15
Sector water system Barje and investments	4	1	1	2	4				12
Wastewater sector	1	1		4	2			9	17
Public toilet sector								5	5
Difference									16
Numbers	43	18	11	104	103			61	356
Total %	**12.1**	**5.1**	**3.1**	**29.2**	**28.9**	**0**	**0**	**17.1**	**100%**

Source: PUC Vodovod Leskovac, legend : VSS = University; VS = College; VKV = secondary school; SSS = 4 years of secondary school; KV = 3 years of secondary school; PKV = primary school; NK = primary school.

Although minor differences are given between the numbers in the tables above the following general observations can be made:
It can be observed that 37% of the employees are younger than 40 years of age, while 34% of the staff are older than 50 years, employees that will be entitled to retirement the coming 10 years or so. It can be concluded there is an overrepresentation of older staff. Specifically looking at the three categories of youngest staff, respectively representing 3, 7 and 12 % of the total staff, one can observe there has been in recent years a tendency of recruiting **less** new staff.

The resulting inequality means there the average age for several functions within the PUC is relatively high, but at the same time there are limited possibilities for deploying experienced staff in relatively new functions that require an advanced technical background and specialised training. Furthermore there is an abundance of candidates for promotion within lines of work within the PUC, which require job experience. This might lead to fewer possibilities for young people to make promotion, and possibly loss of young potential for the PUC as consequence.

It can also be noted that a management team of 8 Directors and Sector Heads, supervising 16 sub-units (each of them with a unit leader) with a total of 350 staff seems to be too heavy. In future reorganisations attention should be given to downsizing the management layer.
Analysing the distribution of academic qualifications, it can be observed there is a percentage of about 17% with university or college degree employed by the PUC. Although it is not known if staff members with academic degrees are equally distributed

over the age categories, the given percentage indicates that sufficient academically qualified staff is available to run the operations and its related administration.

With future changes in both sectors, drinking water supply and wastewater treatment, the academic staff will be much needed to prepare and organise new procedures, new technologies and new responsibilities. Also preparation and on-the-job training of staff will be the responsibility of the academically qualified staff.

7.3.1.2 Management of PUC Vodovod Leskovac

Presently, the PUC Vodovod Leskovac is managed by the General Manager, his deputy Manager, and for each Sector an assistant Director and a Sector Head, making up a management team of 8 persons of the PUC ad s a whole. Bodies of the PUC and their authorities are described in the previous section. So far, the PUC works under direct responsibility of the Municipal Assembly (the Founder). The position of the General Director is mainly executive and partly advisory to the Municipal Assembly. His position is linked to the political party in charge of the Municipality.

The Governing organs in the PUC comprise the Management Board, the Director (General Manager), and the Supervisory Board. The management of the Company is ensured by the General Manager and the Management Board (the Administration). The Statutes clearly define the mandates of both the General Manager and the Management Board. Day-to-day management, including personnel management is handled by the General Manager. The Management Board decides among others on general policies, approves financial reports, budgets, investments, and tariffs, decides on the allocation of profits, coverage of losses (considering the advice of Supervisory Board), and strategic planning (long term as well as medium term). The Management Board comprises members nominated by the Municipality and could also include a representative of the Employees.

The General Manager is appointed under the responsibility of the Municipal Assembly based on the procedures for the appointment of new staff (the rule book). This will include a detailed job description.

The Supervisory Board monitors on behalf of the Founders the general functioning of the Company and ensures that the Company operates within the Law. The Board advises on the allocation of profits. The decision of the Management Board, however, is binding. Major decisions, i.e. annual report, budgets, and tariff revisions have to be ratified by the Assemblies of all Municipalities.

In the PUC, management is ensured by the General Manager, appointed with the support of the political party in charge of the Municipality. He is supported by his deputy Manger who will direct the assistant Directors and sector Heads of the three Sectors.

General Manager: responsible for general management, external relations, corporate planning, will be appointed by the Municipal Assembly (and Mayor);

1. **Deputy Manager**: deputy to the General Manager, responsible for the daily operation of the Technical, the Financial and the General Sectors;
2. **Assistant Director of the PUC's Sectors**: responsible for general management of the Sectors;
3. **Head of General Sector**: responsible for Legal and administrative affairs, HRM, management of properties and general operations, security and maintenance of property;
4. **Head of Technical Sector**: responsible for all operations related to drinking water supply and the collection and transport of domestic and industrial wastewater, and maintenance and repair of water distribution and sewer network;
5. **Head of Financial Sector**: responsible for all financial operations and planning, book keeping, data processing and water meter reading and fee collection;

7.3.2 Future situation

The main objectives of this investment project are the following:

- To construct a new WWTP for treatment of combined domestic and industrial wastewater at a new site near the river Juzna Morava and the National highway to Skopje. The total capacity will be approximately 129.000 population equivalent;
- To extend the existing drinking water distribution network in Leskovac town to twelve villages within the Municipality of Leskovac. With the introduction of the newly built drinking water plant in Gorina and two storage clean water tanks, enough water will become available for the mayor part of the population of Leskovac Municipality;
- To increase the wastewater collection service coverage by extension of the sewerage collection system in around 20 suburbs and villages.

7.3.2.1 Expected changes for PUC Vodovod Leskovac organisation

In meetings with representatives of both the PUC and the City Council, it was indicated that no plans existed to carry out mayor changes within the current organisational set-up of the PUC. Nevertheless overstaffing was mentioned as one of changes that should and would be addressed in the future.

Due to operational changes, the question of an adequate organisational set-up fulfilling its tasks properly imposes itself and is necessary to:

- (Re)define the power structure of the PUC (final decision-making, mandate of the Management, role of the Founder/Owner/Local Government);
- Ensure accountability of the management and transparency;
- Limit the liability of the founders;
- Enable effective relations with external parties.

Discussions have been held with the General Director of the present PUC and other staff members on the above mentioned topics.

The PUC Vodovod - Leskovac will remain the responsible operator of all infrastructure for water storage (Barje), drinking water production at the new WTP Gorina and distribution, and wastewater collection, treatment (at new site along the National Highway E75) and discharge. Future operation of the WWTP and the WTP will become new responsibilities.

In analysing the existing organisation set-up of the Technical Sector the following observations can be made:

- Activities related to drinking water supply are distributed over at least 7 sub-units falling under the units “Operational unit for water supply” and “Operational unit Construction and Maintenance”;
- Laboratory services are carried out under the responsibility of two Units;
- Maintenance of equipment and machinery is found in at least three sub-units;
- Maintenance and operation of the Barje reservoir falls under the responsibility of the Operational Unit for Water Supply, although the daily duties are distinct from those of other sub-units.

Based on the above given observations on the current organisation chart of the Technical Sector we have formulated the following recommendations:

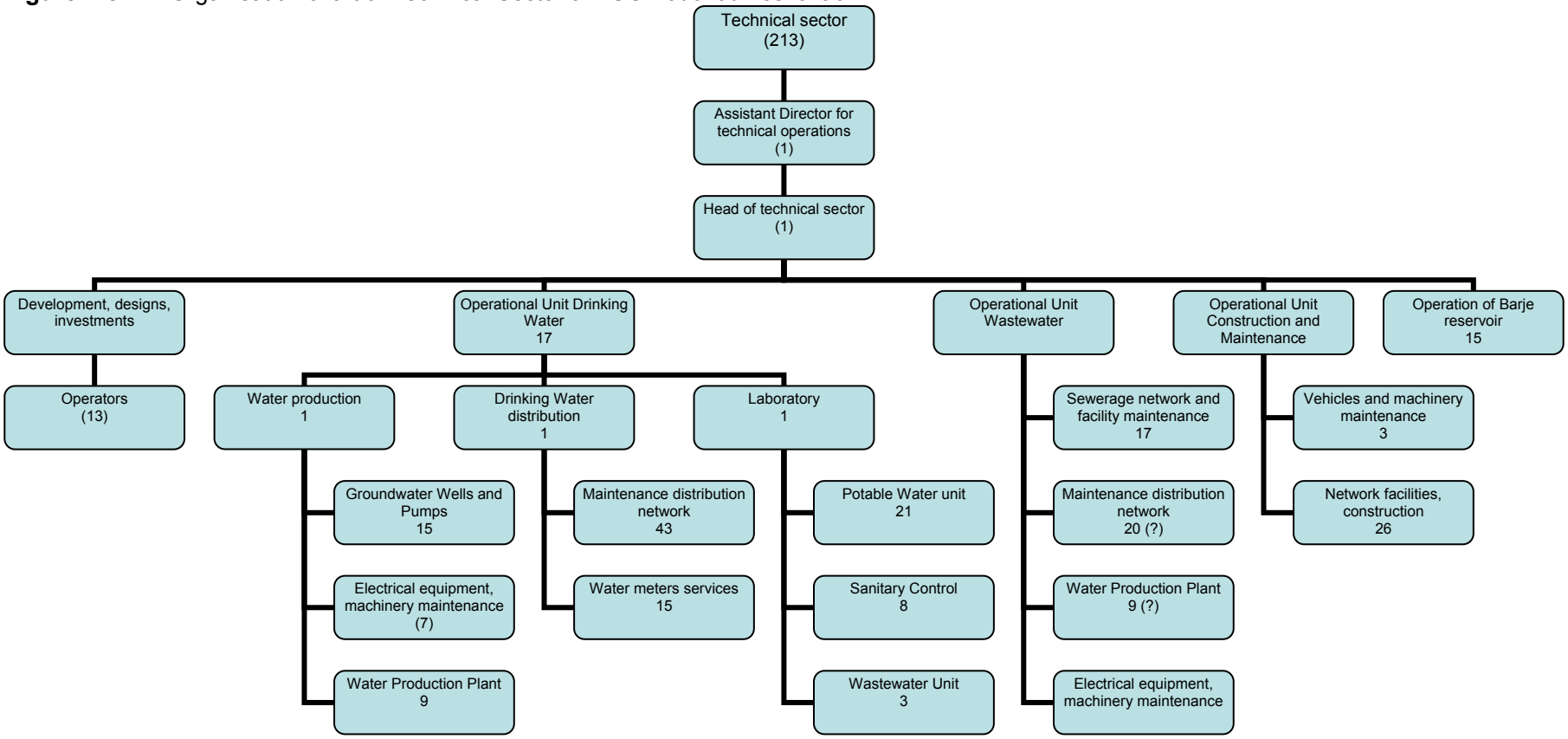
Organise the Technical sector into five (Operational) Units:

1. For design and development;
2. For Drinking water operations;
3. For Wastewater operations;
4. For Constructions and (constructional) Maintenance;
5. For Operation and Maintenance of the Barje reservoir.

Following these recommendations the Technical Sector will become more streamlined, organised along fields of competence and disciplines, and with a stricter division between technical responsibilities (e.g. the Barje reservoir maintenance will be separated from the general tasks of the unit for water supply, its performance will gain importance because of more extensive use of its water storage and management). Furthermore, we recommend combining the organisation of the laboratories, although the work itself might still be done in physically separated rooms, laboratories or sites.

The proposed organisation for a future set-up of the PUC is as follows:

Figure 7-5 Organisation chart of Technical Sector of PUC Vodovod Leskovac



Basically the organisation set-up of the General and the Financial Sectors will remain the same. More attention should be given to Public Relations, provision of information and handling of complaints.

The introduction of a Service Level Contract between the Municipality and the (future) PUC has not yet been subject to discussion but could be a future solution. It will assist in defining with increasing degree of detail the level of service to be provided by the PUC, and gradually stricter operational criteria can be achieved. The latter one refers to higher efficiency of the processes and stricter quality criteria of both drinking water and treated wastewater in the future.

7.3.2.2 Expected changes for PUC management

The future management system should focus on improvements of quality management, financial management and effective management of environmental issues all of which should be included in an integrated management system in various fields such as:

- Appropriate operation and maintenance of assets (including depreciation and planning);
- Management of resources (human resources, equipment, financial);
- Information system (keeping records, management information system);
- Customer relations (billing, collection, complaints, public relations);
- Activities and processes (policy making, internal and external relations);
- Management of environmental issues (alignment with legal requirements and policies).

These functions can further be organized in the following areas:

- Managerial: general management, external relations, contracting, planning;
- Technical: protection of water (re)sources, water production and distribution; wastewater collection, treatment and discharge; network maintenance; quality control of both drinking water and (un)treated wastewater;
- Financial-commercial: accounting and customer relation (billing, fee collection and complaints), financial planning, budgeting;
- General operations: administration, legal, personnel.

More specifically:

<u>General Sector</u>
This Sector should be directed by the Sector Head and will comprise the following operations:

- Establishment and control of legal operations of the company;
- Preparation of contracts with external parties;
- Preparation of legal set-up of environmental legislation compliance;
- Supervision of human resource policies;
- General support;
- Daily responsibility for assets security and maintenance of real property.

The staff will include a.o. the following positions:

- Head of Sector;
- IT-expert;
- HRM assistant;
- Assistant on Environmental protection and safety measures;
- Administrative assistants;
- Support staff.

Development, designs and investments Unit

The role of this Unit will remain of importance as long as new constructions and mayor rehabilitations are prepared and carried out. On the long term their tasks will concentrate more on regular maintenance and rehabilitation.

Operational Unit Drinking Water

All operational activities in the field of drinking water supply will be carried out under the responsibility of the Unit leader of the drinking water supply unit. Three sub-units are proposed: water production (both surface and groundwater), water distribution, and laboratory services (drinking water and wastewater), each sub-unit with its foreman. A work force of 30 to 50 people will make up the sub-unit divided in functional groups (see organisation chart). Current staff can make up most of the needed staff in the future, accept for positions in the new treatment stations, where specific technical qualifications will be needed (knowledge of treatment systems, chemicals, quality monitoring).

Operational Unit Wastewater

All operational activities in the field of wastewater will be carried out under the responsibility of the Head of the operational unit for Wastewater. The workforce will be about 50 to 60 people. There will be a further division into functional groups directed by a group leader or foreman.

Management of the new WWTP is a new component to the existing operations in the wastewater sector. The demands on the managerial skills of management will therefore be higher.

The following points need special attention:

1. Training should be provided to management in WWTP operations to be provided by the contractor or by having staff members taking specialised courses;
2. Training or consultancy provided by a qualified advisor on specific fields of interest: sludge digestion and handling, introduction of maintenance programs, etc.

Laboratory for water quality

It is proposed to combine the laboratory services for both drinking water and wastewater quality monitoring. In practice facilities can and will be separated over different rooms and laboratories (p.e. at WWTP, at Barje reservoir, at new drinking water production plant). Advantages will be improved and more efficient sampling programs, improved procurement, and more flexibility with laboratory staff.

Operational Unit Construction and Maintenance

It is proposed to concentrate even more than in the current situation all work forces for constructional maintenance and new buildings within one sub-unit which will be carrying out constructions and will be responsible for all maintenance of (heavy) equipment and machinery. Specific process and laboratory equipment will be maintained in the other sub-units. Also maintenance and cleansing of distribution and sewer networks will remain the specific sub-unit's responsibility.

Operational Unit Barje reservoir

With the extension of technical responsibilities of the units for drinking water and wastewater, it is proposed to bring maintenance and operation into a new unit. As the use of the stored water in the Barje reservoir will become more important (up till now the only mayor reasons for operating the sluices at the reservoir were guaranteeing downstream provision of water, maintaining the reservoir's level below maximum and for maintenance) there is enough reason to make this sub-unit a more independent unit within the Technical Sector.

Financial Sector

The Financial Sector is directed by the Head and comprises the following operations:

- Accounting;
- Financial planning;
- Data collection and processing, billing and fee collection, preparation of tariff setting, provision of information.

The staff should consist of:

- Sector Head;
- (Financial) planner
- Accountants;
- Complaints/information officer;
- Support staff

An overview of staff for the future PUC is given distinguishing between existing PUC staff and additional staff is given in the table below.
Table 7.7:

Table 7-7 Number of staff for PUC in current situation and after restructuring

Position	Technical Sector		General Sector		Financial Sector	
	Currently	Future	Currently	Future	Currently	Future
General Management			2	2		
Assistant Director for Sectors	1	-	1	-	1	-
Sector Heads	1	1	1	1	1	1
Unit leaders	4	5	3	3	4	4
IT-manager		1	1	1		
HRM-manager			1	1		
Environmental assistant		5	1	1		
Drinking water	61	45				
Wastewater	17	40				
Laboratory staff	25	30				
Constructions/maintenance	30	40				
Barje reservoir	15	15				
General support staff	59	25	57	41	61	45
Total:	213	207	67	50	67	50

7.3.3 Conclusions and recommendations

The consultant assessed existing organisation structure and staffing and concluded that it was characterised by elevated numbers of employees as well as dysfunctional departments. Furthermore, the consultant presented a proposal on an organisational structure of the PUC Vodovod Leskovac that would lead to higher efficiency and lower staffing costs. The issue of restructuring that would involve downsizing cannot be raised without the approval of the government and strict adherence to legal procedure. This would include preparation of a social programme and reimbursement to the redundant staff. Therefore, this issue may be addressed at some point in the future. Meanwhile, the recommendation would be to stop filling the positions which become vacant due to retirements and to implement internal reorganisation of departments.

7.4 Assessment of administrative systems and procedures

This section gives an overview of record keeping and the management information system in use in the PUC. Vodovod - Leskovac. In relation to the future developments of the PUC and the required changes in the last paragraph some recommendations have been formulated.

7.4.1 Actual situation

7.4.1.1 Administrative systems and procedures of the PUC Vodovod - Leskovac

Management Information System and Planning

The Financial Sector is responsible for the preparation of the planning (investments, year plans) and for data collection and processing. Based on the available data different kind of reports can be put together for the needs of the various departments within the PUC (and the Municipality). The used program for the database is not known. Some 11 people work at the section for data collection and data input into the system.

Based on the available data and needs of the PUC, the department develops the planning with input from the technical development department. The plans are developed for three years period and are based upon the technical needs. Implementation of such plans is however subject to the approval of the Founder and available funding.

Annual operational programs are prepared as prescribed by the Ministry of Finance.

Quality Control Systems
The quality of the distributed drinking water is controlled on a daily basis, and also at the productions fields. The quality of the water is controlled at the well field for Leskovac and at several points in the distribution network. They only treatment given to the groundwater is chlorination/disinfection before pumping into the distribution network. Concentrations of iron, manganese, ammonia and residual chlorine are checked.

Occasional check analyses are done by the Institute for Public Health Protection. The sampling is done at several points in the town of Leskovac, at several points in the villages and at the well fields. Control intervals are 15 days in Leskovac and 30 days in the villages.

The quality of the Water is controlled according to the Rulebook on hygienic soundness of drinking water for human consumption.

According to the law, the laboratory sends the results of the analysis to the sanitary inspectors and to the water supply company which takes further actions depending on the analysis results. If any irregularity is found, the Institute suggests how to solve it. Samples are taken by the Institute representatives and by the laboratory technician from the PUC Vodovod Leskovac.

Sanitary inspectors can ask for supplementary controls.

Future situation

In the future situation the PUC will remain responsible for all activities related to the provision of drinking water and the collection and treatment of wastewater.

7.4.2.1 Expected changes for record keeping and management information system

Management Information System and Planning

In an improved PUC organisation the responsibility for the preparation of the planning (investments, year plans) and for the development and maintenance of the information system will remain with the Financial Sector. A staff of about 10 people will be responsible for billing and collection for the services.

The Management Information System should combine financial, technical, and commercial information, both short-term and long-term. It should be structured as a Business Plan with clearly defined operational targets and monitored regularly (monthly) for its realisation. The system should allow benchmarking and should facilitate the application of performance-based schedules for staff members.

The department will have to develop and apply adequate models for financial planning which will be able to cope with capital planning as well as revenue planning. Development of multi-year financial plans is required. All information shall have to be prepared by management to both the Supervisory Board and the Management Board.

Quality Control Systems
It can be foreseen that the volume of sampling will have to be increased. Not only more intensive sampling of raw water (at Barje reservoir), of drinking water and of wastewater is to be foreseen, but it can also be foreseen that at the National level requirements for quality control will be tighter in the future.

This probably means for water quality control, the same frequency of sampling but possibly more samples from more sampling points. Probably, also the total number of laboratory analysis will have to be increased. At least bacteriological analysis will be necessary, and probably also more chemical parameters (maybe up to 20 individual parameters).
For wastewater sampling, not only the quality of collected, untreated wastewater is important, as is the quality of treated, to-be-discharged water, but also sampling of water at different stages of treatment will be necessary for control and adjustment of the several unit operations. This will also lead to a larger volume of both samples and analysis.

Conclusions and recommendations

Based on the assessment made of the administrative systems and procedures of the current PUC and the Operational unit for water supply and wastewater, we have formulated the following conclusions and recommendations:

Record keeping and management information system:
- Make a data base system available for the PUC with updating links to the existing data base, with included options for Business Plan uses and performance indicators;
- Improve financial planning, in order to pursue on the (middle-) long term full cost recovery and financial independence from the Founder.

Quality Control Systems
- Improve the laboratory facilities both in terms of facilities and in human capacity.

8 IMPLEMENTATION SCHEDULE

8.1 Sub projects

The following sub-projects have been identified:

- Extension of the communal water supply system to the northern villages;
- Extension of the sanitary sewerage collection system in the suburbs and villages adjoining Leskovac;
- Construction of the WWTP Leskovac to cater for all collected communal wastewater and pre-treated industrial wastewater;
- Technical Assistance.

Extension of the communal water supply system to the northern villages

This project component should enable safe and stable potable water supply of the residents in the villages located in the northern part of the municipality. As mentioned earlier in the report, the prerequisite for connection of this sub-system to the existing communal water supply system is finalisation and putting in operation of the regional water supply scheme Barje. This was taken into account in formulating the implementation schedule. In fact, works on the construction of the sub-system can start as soon as the corresponding technical documentation and appropriate permits are ready, while the sub-system can not be connected to the main system until the regional scheme Barje becomes operational.

In accordance with the proposed implementation schedule, it is planned that all required technical documentation and permits for construction are ready by autumn 2008, while the construction is to be carried out into several smaller lots, starting from the connection point to the main system.

Beginning of the construction activities is foreseen for early 2009, while the works are to be finished by the end of 2011. The regional scheme Barje is expected to be operational by the end of 2009.

It is suggested that the most downstream lots to be implemented first, which would further enable immediate connection to the system a number of the consumers, meaning efficient provision of the required services, and additional revenues from the billed water to the PUC.

Extension of the sanitary sewerage collection system in the suburbs and villages adjoining Leskovac

This project component is essential for provision of wastewater collection services to about 20.000 inhabitants in the suburbs and villages surrounding Leskovac, and very important from the prospective of achieving the overall environmental objectives.

Similarly, the period till autumn 2008 is reserved for completing detailed technical documentation and providing all necessary permits, required for the construction. The construction is tentatively scheduled for early 2009, and is expected to be finished by the end of 2011. Normally, the construction phase should also include corresponding construction supervision.

Construction of the WWTP Leskovac

Construction of the WWTP Leskovac should ensure that collected communal and (pre-treated) industrial wastewater is treated in accordance with the prescribed local criteria

(set by the relevant authority) and also in accordance with the relevant EU regulation – Wastewater Treatment Directive.

The WWTP design capacity recommended in this study for the ultimate design horizon is 129.000 PE.

At this stage it has been assumed that the complete WWTP would be constructed at once, as one single contract lot.

The construction could be planned as soon as the technical documentation and tender are finalized, all permits necessary for construction are acquired, and the financing secured.

At this stage it has been assumed that the construction could start in early 2009, and be completed by the end of 2010. However it is recommended to investigate in detail and reconsider possibilities of the WWTP phased implementation (in relation to the actual pollutant and hydraulic loading specifically from industrial origin) and its potential financial effects. The phasing could be considered both in terms of capacity (for instance two thirds of the capacity can be implemented in 2009 – 2010, and the remaining third when required) and of the applied treatment technology (primary and secondary treatment in the phase one, tertiary treatment – nutrient removal in the phase two).

The phasing can release some of the heavy financial burden on the project in the initial years of the project life – while providing the required services at the same time.

In this light it is recommended to include clear milestones in the project's phasing. The achievement of such milestones should be the prerequisite for further interrelated investments and construction activities. Such an approach will ultimately result in optimisation of investment and O&M costs.

Technical assistance

The Feasibility Study has identified the following Technical Assistance (TA) elements:

Table 8-1 TA elements identified in MIASP Feasibility Study

Project	Time frame	Assessed costs (€ * 1000)
Leskovac WU Project Tendering and Supervision of the scheme Financing EU-IPA	January 2009 – December 2011	1.627
Leskovac WU Project Master Plan for Water Supply of the municipality Financing unidentified	March 2008 – September 2008	200
Leskovac WU Project Financial Operation and Performance Improvement Program (FOPIP) Financing unidentified	July 2009 – December 2010	400
Leskovac WU Project Environmental Impact Assessment follow-up Financing unidentified	March 2008 – September 2008	100
Leskovac WU Project Industrial monitoring plan & management Financing unidentified	Mid 2008 – Mid 2010	100
Leskovac WU Project Public awareness campaign Financing unidentified	June 2010– December 2010	100

8.2 Time schedule

A preliminary time schedule of the above sub-projects is given in Annex 8.1.

As shown in the attached Project Implementation Schedule the works, are grouped in the following major contracts:

- Extension of the communal water supply system;
- Extension of the sanitary sewerage collection system;
- Construction of the WWTP Leskovac;

Institutional and operational development plan

Action	Body responsible	Deliverable output	Time frame
Amendments to sanitary-technical conditions for connections sewage with determine level of penalties, increase fines	PUC, Municipality of Leskovac	Amendments to the Rule book on sanitary-technical conditions for wastewater discharge into sewage network endorsed at municipal level	ASAP
Enforcement of LEAP-industrial wastewater quality constant monitoring	Republican water management and environmental protection inspectorates; municipal Directorate for environmental protection, municipality, PUC	Prepared updated database of polluters	Start ASAP
Enforcement of LEAP	Municipal Directorate for Environmental protection, municipality, inspectorates	Revised LEAP under implementation; activities for pre-treatment facilities of industries assured	Start ASAP to finish 12 months before the planned start of WWTP operations
Prepare individual contracts with the industries	PUC, Municipality	Signed individual contracts with major polluters	10 months before planned start of WWTP operation
Internal (re) organisation of departments	PUC	Departments for new functions established, staff appointed	6-2 months before the planned start of operations of new functions
Conduct training of PUC staff	Contractor, consultants as per need, staff employed in existing PUC	Staff trained	As of start of trial run, 12 months for WWTP training by Contractor, 3 months before staff deployment to new PUC functions. Training by existing senior staff, external consultants for new functions.
Draft Service Level Agreement (SLA), endorse SLA	External Consultants, Municipality, PUC	SLA endorsed and being implemented	ASAP

9 RISK ANALYSIS

Table 9-1 summarizes the most important financial, environmental, operational, institutional and socio-economic risks associated with the project and the project implementation. The probability that these risks will occur has been assessed, the severity of the effects has been indicated and mitigation measures have been proposed.

Table 9-1 Risk matrix

Risk	**Category** Financial, Environmental, Operational, Institutional Socio-economic	**Probability**	**Adverse effect** From: 1 (Severe) To: 5 (None)	**Mitigation measures** (for effects 1, 2 and 3 only)
PROJECT PREPARATION				
Failure of key industries to comply with their obligations set forth in the Action Plan	Institutional	High	2	Coordinate actions with relevant municipal authorities and Republican Inspectorate
PROJECT IMPLEMENTATION				
Limited management capacity available	Operational/ Institutional	High	1	Project management support provided by means of technical assistance package *tendering & supervision*
OPERATION				
Lack of enforcement measures towards industries to comply with required quality standards for waste water discharge	Institutional	High	2	Strengthen position of Municipal Directorate for Environmental Protection; introduce high penalties at municipal level, Coordinate inputs with inspectorates; introduce continuous monitoring
Inadequate tariff policies and payment discipline	Institutional, Financial	High	2	Ensure adequate tariff policy or introduction of separate charge for WWT or environmental protection tax, provide support for improvement of billing and collection procedures

Risk	**Category** Financial, Environmental, Operational, Institutional Socio-economic	**Probability**	**Adverse effect** From: 1 (Severe) To: 5 (None)	**Mitigation measures** (for effects 1, 2 and 3 only)
Higher operational costs due to Increased staff	Institutional, Financial	Moderate	3	Promote internal staff movements/job rotations and (re)train staff, include milestones/targets and monitoring mechanism of staff numbers in financing memorandum, increase efficiency of company by means of improved/streamlined structure and procedures
Limited WWTP management experience	Institutional/ Operational	Moderate	1	Strengthen the institutions; include training in WWTP treatment in tender documents; introduce FOPIP