



State Committee of Water Economy and
Ministry of Finance and Economy of the
Republic of Armenia in cooperation with the
EAP Task Force

**Financing Strategy for Urban
Wastewater Collection and
Treatment infrastructure in
Armenia**

Final Report

2004

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Used abbreviations and acronyms

AMD	Armenian dram (national currency), in calculation exchange rate was assumed at 1 USD = 565 AMD
BOD	Biochemical oxygen demand
CEE	Central and Eastern Europe
CIS	Commonwealth of Independent States
DANCEE	Danish Cooperation for Environment in Eastern Europe
EAP TF	Environmental Action Plan Task Force
EBRD	European Bank for Reconstruction and Development
EECCA	Eastern Europe, Caucasus and Central Asia (region)
EUR	Euro (the currency of the European Monetary Union)
EU WI	Water initiative of the European Union
FEASIBLE	Financing for Environmental, Affordable and Strategic Investments that Bring on Large-Scale Expenditure (computerised tool)
FS	Financing Strategy
FSU	Former Soviet Union
GoA	Government of Armenia
GDP	Gross Domestic Product
HCS	Housing and Communal Services (sector of the economy)
IDA	International Development Association (in the World Bank group)
IFIs	International Financial Institutions
KfW	Kreditanstalt für Wiederaufbau (German bank)
LWWTF	Local Wastewater Treatment Facilities
lcd	litres/capita/day
MAC	Maximum Allowable Concentration (of toxic pollutants)
NEAP/ REAP	National / Regional Environmental Action Plan
NIS	Newly Independent States (republics of the FSU, except Baltic states)
OECD	Organization of Economic Cooperation and Development
RA	Republic of Armenia
SMART	Specific, Measurable, Affordable, Realistic, Time-bound (about targets)
UFW	Unaccounted for water
USD	United States dollar
VAT	Value-added Tax
Vodocanal	Water utility
WB	The World Bank
WHO	World Health Organisation
WSS	Water supply and sanitation (wastewater collection and treatment)
WS / WW	Water supply / Wastewater
WWPS	Wastewater pumping station
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

General context

1. Over the 1990s, the water supply and sanitation (WSS) sector in Armenia faced three inter-related challenges:
 - Poor infrastructure. Existing WSS infrastructure is highly deteriorated, often substantially over-sized and therefore inefficient. On the other hand, some municipalities lack the WSS infrastructure and wastewater treatment plants (WWTPs). In 2002, the unaccounted-for-water (a combination of leakages and unbilled water) amounted to 66% of the water abstracted. All the wastewater treatment plants in Armenia were either not operational, or did not provide even proper (rated) mechanical purification, not to speak about disinfection of discharged water or sludge treatment;
 - Poor service. During 1992-2002 drinking water supply was scheduled for only 4-8 hours per day. Access to piped water did not necessarily mean access to safe water: the sanitary conditions in the WSS sector in Armenian have notably deteriorated over the period and Armenia experienced a rise in the number of outbursts of mass acute intestinal water-related infections (52 cases with 15,508 people infected compared to single cases before 1992). As for sanitation, some 55% of the collected wastewater was discharged into water bodies without any treatment, in turn affecting the quality of the raw water;
 - Financial distress. Financial problems were closely linked to the sharp economic decline and low household income¹. Over the period, the energy crisis and the consequent rise of energy prices added to the difficulty of the financial situation.
2. These problems cohere in a vicious circle. Poor service impairs *the willingness to pay*: indeed, collection of user charges was as low as 10-30% of the billing; and this was not mainly due to low level income, since, in 2001, the lowest collection rate (10%) was recorded in Yerevan, where the household income notably exceeds the country average.

Priority setting

3. In its Poverty Reduction Strategy Paper (PRSP), the Government of Armenia (GoA) set rehabilitation of water supply infrastructure and gradual recovery of 24-hour water service, as two priorities. This led to a sharp increase in public funds and international loans (World Bank, KfW) for rehabilitation of water supply infrastructure, amounting to 3-4% of public expenditure budget in 1999-2003 (a very high level for EECCA countries). Significant progress has been made in introducing metering and meter-based billing, and improving collection of user charges. These developments confirm the strong political will that the Government has demonstrated to improve the WSS sector.
4. Progress in rehabilitating sanitation has been more modest. The Government of Armenia only recently started developing a rehabilitation programme for sanitation. To support this effort, the EAP Task Force Secretariat cooperated with the Armenian authorities to develop a

¹ In spite of recent fast economic growth, Armenia still is among the poor countries of the former Soviet Union with *per capita* GDP and household income amounting to only USD 790 and USD 385, respectively.

realistic Financing Strategy (FS) for urban wastewater collection and treatment infrastructure, that would set feasible and affordable targets for WSS services, and demonstrate how the related expenditures could be funded until 2015.

5. This report presents the main conclusions and key recommendations of the Financing Strategy developed for the selected 19 urban areas (see section 2), with a population of 1.7 million people (60% of total population in Armenia).

To set realistic targets for urban sanitation infrastructure, and to implement a feasible financing strategy

6. Following the Financing Strategy methodology, two scenarios were developed.
 - **The Baseline scenario.** It anticipates the implementation of the ongoing programme on WSS rehabilitation in Yerevan, and maintaining the service level and condition of infrastructure at the base year level in the other urban areas. If the pre-2003 financial trend continues over the entire 2003-2015 period, the annual financing deficit (cash flow gap) would amount to AMD 29 billion. However, the package of policy measures suggested in para 13 would gradually bridge the annual cash flow gap.
 - **The Development scenario.** Since it seemed possible to bridge the financial gap in the Baseline scenario, more ambitious targets have been considered for the rehabilitation and development of the urban sanitation infrastructure. The resulting Development scenario was elaborated, following discussions with representatives of the Ministries and agencies in Armenia. It is based on the sector development targets, i.e., **to substantially increase connection of households to sewerage system, and to provide effective mechanical treatment of the collected wastewater in all urban areas** under consideration. To achieve these targets by 2015, all existing WWTPs need to be rehabilitated, while some new WWTPs should be built (see Annex 5).
7. FEASIBLE model simulations have shown that, in principle, it is feasible to reach the Development scenario targets by 2015. The scenario would require substantial capital investments in WSS in the urban areas under consideration, amounting to a total AMD 176.2 billion over 2002-2015 (AMD 12.6 billion per annum). These estimates generally are in line with the volumes of investment envisaged for the whole water sector for 2004-2015 in the Poverty Reduction Strategy Paper (AMD 18.1 billion per year).
8. According to the FEASIBLE model simulations:
 - in 2003-2005, the WSS sector in Armenia would still lack funds for maintenance, major repairs and renewal of the fixed assets to compensate for their depreciation;
 - from 2006 onwards, the two Vodocanals would have some own resources to rehabilitate existing WWTPs, and to resume the civil works on the WWTPs which are at an advanced stage of construction;
 - in 2009-2011, projects ranked as second order priority could be started;
 - from 2011 on, the Vodocanals would generate some resources for further development of the WSS infrastructure to achieve the said targets.

Rationale for a feasible sanitation policy

9. The implementation of the Development scenario requires that a National Strategic Programme is worked out by the SCWE and the **Ministry of Finance and Economy**, for rehabilitation of existing sanitation infrastructure and construction of new WWTPs. The

Programme could also consider alternative scenarios, as for households connection rate to sewerage (in line with water-related Millennium Development Goals), or for the provision of effective mechanical purification of collected wastewater. The *Financing strategy* developed in this report provides financial reference points for such a programme.

10. Development of such a Programme could start from:
 - the preparation of water mass balances and a more precise assessment of, and forecast for, the actual demand for sanitation infrastructure, and for the capacity of WWTPs in each city and town settlement in Armenia; and
 - a complete inventory and technical audit of the wastewater collection and treatment infrastructure, to assess their technical condition and rehabilitation/replacement needs.
11. A review of the conditions of the present infrastructure and capital investments optimization could be launched at an early stage, followed by feasibility studies, the design and construction of specific facilities. Donor funds and technical assistance from international organizations could be attracted for the Programme development and implementation. Major sources of capital investments would be public budget and international loans, though private sources could also be involved.

Main conclusion

12. The calculation made with the FEASIBLE model and in-depth analysis of the data with Armenian experts confirm that, by 2015, it is realistic to achieve the targets mentioned in paragraph 6 above. However, more ambitious targets would not be reached, such as the provision of effective mechanical-biological treatment of wastewater in all urban settlements.
13. The following policy package could fully cover the operation and capital expenditures, amounting to some AMD 689.4 billion (equivalent of USD 1.2 billion) over the 2002-2015 period.
 - To improve user charges collection rate up to 94% by 2006 (from some 70% in 2003);
 - To increase the water bill for households to the affordability threshold (4% of the average household income) by 2006; to increase the tariffs for other consumers by 150% by 2007;
 - To undertake energy and cost saving measures at the Yerevan and Armenian Vodocanals;
 - To allocate public funds and international loans to WSS in the urban areas under consideration, to a total amount of 2.2% of public expenditure budget for the 2005-2011 period, then gradually decreasing to 1% by 2016.
14. This package entails some pitfalls. In particular, maintaining the water bill at the level of 4% of average household income - over 2006-2015, and allocating public funds and international loans amounting to 2.2% of the public expenditure budget in 2005-2011 are challenging targets. However, all individual policy measures in the package are substitutes, so if there is a problem in utilization of one of them to its full capacity, more ambitious targets could be considered for the other policies.
15. Financial autonomy of water utilities could and should be set as a long term (post 2015) goal in Armenia. It is defined as the situation where user charge revenues fully cover operation, maintenance and rehabilitation costs related to the provision of an agreed-upon level of service and to infrastructure rehabilitation and maintenance (incl. assets renewal in line with the depreciation rates), while the water bill is affordable for most households.

Simulations with FEASIBLE model suggests that financial autonomy in Armenia requires that households' annual per capita income stands at some USD 1100-1450. Since this is three times the level of 2002 income (USD 385), the objective of full financial autonomy might not be realistic at the 2015 horizon. Therefore, the GoA will have to finance the capital expenditure in WSS sector and part of the maintenance cost, from the public budget and by attracting international loans. Besides, the government will have to provide income support to the poor.

Key recommendations

16. Key recommendations are as follows:
- To set priorities according to some integrated strategic plan;
 - A more rational use of the existing resources;
 - The mobilisation of additional resources;
 - Adapting tariff policy to metering.

To set priorities according to some integrated medium term strategic plan

17. Simulations suggest that, before 2006, it will be extremely difficult for Armenia to simultaneously finance two large-scale programmes, one on water supply, and another on sanitation. Because of the expected financial gap, for the inception period, it would be wise to focus on rehabilitation of water supply and on implementation of a water demand management programme aimed at reducing the unaccounted for water (UfW).
18. The targets would be best achieved if the governance of the WSS sector is improved. Key recommendations for decision-making and implementing agencies are:
- The strategic development programme for WSS and the related Financing Strategy should be integrated into the budgetary process, by improving a set of procedures and routines (including planning and approval of public capital investments and public subsidies, of the tariff policy and rates, etc.). This involves, in particular, the **Ministry of Finance and Economy**, the **State Committee of Water Economy and water utilities**, the **Commission for the Public Services Regulation**, the **Ministry of Labour and Social Affairs**, and the **Ministry of Environment**.
 - New instruments for managing WSS should be introduced, including instruments for water demand assessment and management (water mass balance, water audit and systematic leaks detection, identification and prevention of illegal water consumption, water abstraction fees and quotas, tariff policy and tariff rates for end-users, etc.), for energy savings (energy balance and auditing), incentives to efficiently manage water utilities.

A more rational use of the existing resources, by giving priority to actions that save on subsequent capital and O&M costs

19. Reducing the UfW. The **State Committee of Water Economy** (SCWE) and the **vodocanals** could develop a comprehensive *Water Demand Management Programme* (WDMP), as a key element of the *Integrated Water Resource Management* (IWRM) plan. Indeed, a thorough assessment of actual demand and a clear understanding of the forces that drive the demand for water and sanitation would help to better match the demand with the capacity of the WSS infrastructure, thus saving on operation and capital expenditures². The

² FEASIBLE model simulations revealed that as a result of implementing the ongoing water supply rehabilitation programme in Yerevan, from 2005 onwards, the annual operational cost would be lower

measures already taken by the Government of Armenia to reduce water losses by rehabilitating water supply infrastructure and promote a more rational use of water by metering need to be complemented by systematic leaks detection and by prevention of illegal or unpaid water consumption.

20. **Zoning.** Thanks to the geographical feature of the country, appropriate zoning of the water distribution and sewer systems might exploit gravity flow in such a way that most of the water in Armenia is delivered without extensive pumping, thus saving extensively on energy consumption and operation costs, while improving service by providing water to the upper floors in the apartment buildings.
21. Implementation of economic **incentives for savings**, in line with the previous actions. They include water abstraction fees and tariff policy (see below). It is also recommended to create appropriate incentives for water utilities, e.g. by introducing *performance-based contracts*, with the remuneration of the staff and management dependant on the achievement of agreed upon performance targets.

The mobilisation of additional resources from all sources

22. Calculations made with the FEASIBLE model have established that, should the pre-2003 financial trend continue over the whole period, then, the total amount of funding allocated to WSS would not cover even operation expenditures. Accordingly, additional resources have to be attracted into the WSS sector. The **Ministry of Finance and Economy**, the **SCWE** and the **Commission for Regulation of Public Services** could explore the following avenues.
23. **International loans and Budgetary funding.** Recognizing the urgency of a drastic increase of funding for WSS, the Government of Armenia has already attracted a number of international concessional loans from the World Bank (IDA) and the KfW, and expects to attract several more loans on privileged conditions in the future. The overall borrowing is expected to amount to EUR 41.5 million and USD 121 million. In addition, budgetary funding of the WSS increased from 0.7% to 1.2% of the public expenditure budget – these figures do not include the foreign loans. These efforts need to be continued over 2005-2011, to maintain financing of WSS sector in the cities and towns under consideration from public funds and international loans at the level of **2.2%** of public expenditure budget in 2005-2011. This would require attracting additional international loans and donor funds after 2005, including EC TACIS funds due to support the EECCA component of the EU WI.

Adapting tariff policy to metering

24. For volumetric tariff, the shift from consumption norms to meter-based tariff gives a critical importance to the estimation of water sold, whereas the uncertainty about this variable remains huge. On the one hand, if the forecast for the water sold is substantially overestimated, the water utility does not get sufficient revenues and suffers from the cash flow gap. On the other hand, if the variable is underestimated, the water utility extracts the rent. When setting the tariff, the water utility will tend to underestimate the forecast for the water sold (to avoid the risk of lower than expected revenues), while the Regulator will tend to overestimate it (trying to protect consumers' interests by setting lower tariff).

by AMD 3.2 billion, while maintenance cost could be reduced by AMD 2.07 billion per annum – compared with the base year 2002. These savings would release additional resources for rehabilitating sanitation infrastructure

25. In Yerevan, and in other cities, metering has revealed that the consumption norms were highly overestimated. Thus, meter-based billing has generated a sharp decline in the Vodocanal's volume of water sold, which was not compensated by a tariff increase. Indeed, in 2003, Yerevan Vodocanal's billing was 20% less than in 2002, though the revenue increased because households repaid old debts. In another OECD demonstration project³, it was established that a tariff increase by 100% in 2004 would guarantee that Yerevan Vodocanal's revenues fully cover operation expenditures (assuming that the collection rate remains at 2003 level); accordingly, the 60% increase in April 2004 would not be sufficient to attain financial balance in 2004.
26. It is of outmost importance to further improve tariff policy, to ensure high user charges collection rates, to provide water utilities with sufficient and predictable revenues, while addressing social concerns.

To set a formula that serves policy purposes

27. A more appropriate tariff formula should provide full coverage of both fixed and variable costs⁴, irrespectively of the uncertainty about, and variation in, the amount of water sold. In the same time, it should prevent water utilities from any rent seeking behaviour.
- We recommend a two-tier tariff, where the consumers pay a fixed connection fee (per inlet to apartment or building) that covers Vodocanal's fixed costs, and a variable fee based on metered consumption (in m3), that fully covers variable costs.

To address the affordability issue

28. The affordability of new tariffs is not systematically checked in Armenia. However, when developing investment programmes, the international Financial Institutions (IFIs) often recommend, and even insist (EBRD) on the affordability check for the future tariffs resulting from the implementation of the programme.
- We recommend building the affordability assessment into the tariff approval procedure. The affordability check could be the joint responsibility of **water utilities**, the Regulator (the **Commission for Regulation of Public Services**), and the **Ministry of Labour and Social Affairs**. The methodology applied in the aforementioned OECD demonstration project could be further adjusted and used for this check.
29. The OECD demonstration project established that a tariff increase by 100% in 2004 would put the water bill in Yerevan at **3%** of average household income (a levy considered as affordable), while it will be over **4%** (the affordability limit) of the revenues of only some 15% of the households. These households would then need a targeted income support.

³ "Consumer Protection in Urban Water Sector Reforms in Armenia: Ability to Pay and Social Protection of Low Income Housholds", implemented in 2003 in co-operation with the State Committee of Water Economy and the Ministry of Labour and Social Affairs of Armenia.

⁴ Where fixed costs include depreciation, salary, general internal expenses and overheads, and variable costs include energy, etc.

To keep on improving user charges collection rate

30. User charges collection rate has radically improved in 2002-2003; in Yerevan, it has reached 65-70% in 2003 (compare to 10% in 2001). This resulted mainly from the new regulation that allows writing-off an essential part of the households' debt for WSS services, provided that the interested households sign an agreement with the Vodocanal, install a water meter, repay a part of the previous debt, and pay the recent bills on time. Additional efforts would be needed in 2004-2006 to further improve collection efficiency to the target level of 94%.
31. The willingness to pay, and therefore collection efficiency, could be further improved by continuing the public information and awareness campaign, explaining basic water economics to the population, so that households better understand the reform in WSS sector. Improved services also increase willingness to pay.

1. BACKGROUND AND ACKNOWLEDGEMENTS

In July 2000 the Ministry of Environment of Armenia requested OECD EAP Task Force support to develop a national financing strategy for the urban water supply and sanitation (WSS) sector.

In May 2001, at a meeting in Yerevan, Mr. Merujan Mikaelyan, Deputy Minister of Finance and Economy (MoFE) asked Mr. Brendan Gillespie, Head of the Non-Member Countries Division at the OECD Environment Directorate and Head of the EAP Task Force Secretariat, to undertake efforts to develop a financing strategy for WSS in Armenia. High level officials from the Ministry of Foreign Affairs of Armenia also strongly supported the idea.

In response to this request, the EAP Task Force Secretariat has raised donor funding to implement a demonstration project in Armenia. The **Ministry of Environment of Germany** provided a grant through the EAP Task Force Secretariat, which could be used to develop a financing strategy for urban water supply and sanitation in Armenia.

The work programme has taken into consideration that:

- The Government of Armenia (**GoA**), together with its international partners (mainly the World Bank and KfW), have started to implement a comprehensive portfolio of projects and activities, and
- The investment and financing programs for the urban *water supply* infrastructure were already well developed.

Accordingly, it was decided to focus on a realistic analysis of costs and further development of the financing strategy for urban sanitation.

A Steering Committee (**SC**) was formed to manage and supervise the project. The SC consisted of representatives from key government ministries and agencies at the national level. A Working Group (**WG**) of experts was directly involved in the project; it consisted of representatives of the Ministry of Finance and Economy, the State Committee of Water Economy and other relevant ministries of the RA, of representatives of Yerevan Vodocanal (Yerevan municipal water utility) and Armenian Vodocanal (which provides WSS services for the rest of Armenia), Armenian experts and international experts.

Mr. Ruben Davtyan, Head of the Department of macroeconomic programs at the Ministry of finance and economy of Armenia, was the local Project Manager; Mr. Grzegorz Peszko was the Project Manager from the EAP TF Secretariat, while Mr. Alexander Martoussevitch headed the Working Group of experts.

Armenian stakeholders and the EAP TF Secretariat are grateful to all organisations, officials and experts, who contributed to the report, and to the German Government for financial support to the project.

2. INTRODUCTION

Methodology and the scope of work

The financing strategy (FS) *stricto sensu* is a set of strategic sector development goals and a scenario to achieve them, for which the (aggregated) expenditure needs are balanced with the total finance available to the sector from all sources.

The financing strategy methodology is supported by the *FEASIBLE model*, a computerized calculation and simulation tool. Both the methodology and the model were developed by the OECD EAP Task Force Secretariat, together with COWI A/S, a Danish consulting company, with financial support from the Danish Government. Brief description of the FS concept and methodology, including FEASIBLE model is appended (see Annex 6); for more details, see (COWI, 2000) and (COWI, 2001).

The present financing strategy was developed for 19 large and medium size cities and towns in Armenia, including residential areas located by Lake Sevan. Rural WSS and irrigation are out of the scope of the present project. The financing strategy was developed in order to identify an agreed upon, feasible and affordable level of WSS services, and to demonstrate in what way the related expenditures can be funded over the period of projection.

The selected localities and their population (# of persons) are presented in the table 2.1 below. Some 1.7 million people (60% of total population in Armenia) are covered. Following recommendations from the Steering Committee, the cities of Armavir and Metzamor, and the service zone of *Nor Akunk* company (WSS services provider) were not included in the analysis, as a separate program for these areas is being implemented with the financial support of KfW bank.

Table 2.1 Cities reviewed under the project, and their population

City, town	Population	City, town	Population
Yerevan	1 103 500	Echmiadzin	56 390
Alaverdi	16 6490	Gavar	26 629
Aparan	6 610	Gumri	150 950
Martuni	12 500	Masis	21 375
Ararat	20 480	Razdan	52 815
Artashat	25 070	Sevan	21 420
Ashtarak	20 640	Sisian	16 840
Berd	8 810	Tsakhkadzor	1 620
Dilijan	16 200	Vardenis	12 760
		Vanadzor	107 400

Source: Armenian Statistical Agency (preliminary results of the population census 2002)

Year 2002 was chosen as a **base year**, for it was the latest year for which complete financial reporting was available. All money variables were projected and calculated in base year (2002) prices. *The forecast period was 2002-2015.*

Though the project focused on sanitation, simulations were made for urban WSS as a whole (in the 19 cities and towns under review), for the following reasons:

- water utilities in Armenia provide both water supply and sanitation services, which are financed from and compete for the same funds (user charges, public funds and loans);
- expenditure needs in sanitation very much depend on water demand and coverage by water supply;
- the FEASIBLE model can not simulate sanitation separately from water supply.

Project implementation stages

As agreed between the Armenian stakeholders and the OECD, the development of the financing strategy for urban wastewater collection and treatment infrastructure of Armenia was divided into two stages:

- Analysis of a **Baseline Scenario**. It included the following tasks:
 - Collection and analysis of detailed data on the WSS organisation and regulatory framework, infrastructure performance indicators, and some technical, economic and financial indicators of water utilities. These include data on tariffs, billed and collected payments, accounts payable and receivable, operation and capital expenditures, and financing sources (user charge revenues, public budget, loans and grants). The data was collected using questionnaires specially developed for the project. Besides, the experts of the Working Group visited and visually assessed the condition and performance of the WWTPs and other sanitation infrastructure in some 10 (out of 19) localities under review;
 - Training of Armenian experts on the FEASIBLE-1 model (first version);
 - Data entry into the model and analysis of the Baseline Scenario, including measures aimed at gradually eliminating the financing gap.
- Elaboration of a feasible and affordable **Development scenario**. It included:
 - A mission of Armenian experts to the wastewater treatment facilities in Novgorod, Pskov, Moscow (Kouryanovo WWTP), and a presentation of a new experimental low cost wastewater treatment technology currently tested in Istra (Moscow oblast). The mission outputs were detailed in the mission reports of the Armenian experts;
 - Setting the targets for rehabilitation and development of the wastewater collection and treatment infrastructure in the selected cities of Armenia, and elaboration of scenarios to meet these targets;
 - Simulation of the scenarios with the FEASIBLE computer model, and discussion of their financial viability. That was an interactive procedure, where targets were revised and potential measures were analysed to reach a sound financial strategy for the sector. This report presents the set of targets and the realistic development scenario which were elaborated according to this procedure.
 - Training for Armenian experts on the application of a new version of the FEASIBLE model.

All ministries and agencies participating in the project sent their comments on the draft final report. The final report was officially presented and discussed by the SC, and at the final workshop in Yerevan.

Structure of the report

Chapter 3 provides a brief description of the existing condition of, and key problems facing by the WSS sector in Armenia.

Chapter 4 discusses the main approaches to improve funding of WSS sector in Armenia.

Chapters 5 and 6 present the definitions and results of the analysis of the Baseline scenario and the Development scenario, respectively, while chapter 7 presents main conclusions and recommendations.

Note: in each chapter: the tables are numerated from 1 on (e.g. Tables 3.1, 3.2, etc. in chapter 3), while diagrams, figures and photos form another cluster which is also numerated from 1 on in the chapter (e.g. Photos 3.1-3.4 followed by Diagrams 3.5-3.6 and the Figure 3.7 in chapter 3).

3. BRIEF DESCRIPTION OF THE EXISTING CONDITION OF WSS SECTOR IN ARMENIA

This chapter briefly presents the current environmental situation and main problems in WSS in Armenia. It provides with key indicators of service levels. WSS organisation and management system in Armenia are described in Annex 2; Annex 3 contains a more detailed description of the situation, and major technical, sanitary and environmental problems.

Water resources and water consumption

Water resources

The Republic of Armenia ranges on average among Eurasian countries, as for the quantity of available water resources. There are 56 open water bodies in Armenia, including 50 rivers and 6 lakes. The largest rivers are Araks and Akhurian, while the biggest lake is Sevan.

Surface water resources amount to some 6,500-7,000 million m³ per annum (2,260 m³/capita/year). Compare with Eastern Kazakhstan (Kazakhstan Republic), where surface water resources are 32,600 million m³ per annum (12,700 m³/capita/year), and with Yaroslavl oblast (Russia), where available surface water is 38,800 million m³ per annum (32,770 m³/capita/year).

Water consumption

The **water demand** has reduced substantially over the last decade due to the economic decline and increase labour migration abroad. According to statistical sources⁵, total water abstraction in Armenia in 2002 was 1,733 million m³, i.e. almost 1.5 m³ per capita per day, while some 338 million m³ of water is lost during transportation⁶. Water consumption in 2002 was 1,312 million m³.

In 2002, total water abstraction by Yerevan and Armenian Vodocanals (water utilities) amounted to 540 million m³, while water sold amounted to only 177 million m³. The difference represents an impressive rate of 66% unaccounted-for-water (UFW)⁷.

Key sources of surface water contamination

Surface water contamination is one of the key environmental problems in Armenia. Main sources of contamination of surface water reservoirs are:

⁵ Source: The Statistical Yearbook: CIS 2002. – the CIS Interstate Statistical Committee.- Moscow, 2003, p. 268

⁶ Losses in 2001 was reported twice higher - 696 mil. m³ with 1726 mil. m³ abstracted – these discrepancies in statistical data requires clarification. Such discrepancies existence necessitates preparation of the more exact water mass balance for each urban settlement and for Armenia as a whole.

⁷ The data was provided by water utilities.

- Discharges of untreated or insufficiently treated effluents collected in municipal or industrial wastewater systems, and
- Effluents from areas close to water bodies (melted snow, storm and irrigation water).

According to statistical data⁸, discharges of untreated or poorly treated wastewater to surface water bodies amounted to 91 mil. m³, including 18 mil. m³ without any treatment, in 2002 for the whole country.

Over the past 10 years, the share of industrial discharges in the total discharges of untreated or poorly treated wastewater has reduced. This results from a drastic reduction in industrial water consumption, which follows the general recession.

General features of urban water and wastewater sector in Armenia

Water supply and sanitation services – connection rates

The data collected showed that the rate of connection to centralised (piped) water supply services reaches 98-100% in the 19 urban areas under review. This includes households that receive water from tap at home, and from street water posts.

The connection rate to sewerage systems is shown in Table 3.1 below (for more details see table 2 in Annex 4).

Table 3.1 Average level of centralised wastewater collection coverage of the population in Armenia

	Cities with population above 50 000	Cities with population below 50 000
Coverage by sewerage	88%	52%

Source: Yerevan Vodocanal, Armenian Vodocanal

Current situation – urban water supply

Water supply sources and water quality

The distinctive feature of water supply in Armenia is that 95.5% of water abstracted from ground sources has a stable composition and a good quality, which meets the comfort (taste and hardness), toxicological and microbiological norms and standards established locally and by the World Health Organization (WHO).

Ground water in Armenia is characterised by low mineralization, softness, constant chemical composition, low fluorine content. But there are some water sources with deviation of hardness parameters (basically in the Ararat Valley).

Water treatment

Groundwater is usually pumped into the distribution networks without any treatment or disinfection (*e.g.* chlorine). In many cases, the quality of the raw resource permits to supply water without preliminary treatment. Nevertheless, some settlements face problems related to the lack of water disinfection.

The main concern comes from the fact that a number of settlements located above a drinking water source lack wastewater collection systems, and thus their discharges of wastewater endangers the sources of drinking water supply (in some sources the non-compliance with colon bacillus index was detected, which varied from 4 to 46).

⁸ Source: The Statistical Yearbook: CIS 2002. – the CIS Interstate Statistical Committee.- Moscow, 2003, p. 268

Water distribution and water supply services quality

Water is often delivered to consumers directly from the wells or from the 2nd-lift pumping station. Such direct water delivery results in unstable and wasteful water supply. The absence of clear water reservoirs, water towers and zoning practices causes a poor quality of services.

The major part of water mains and pumps is worn out, and should be replaced. During the last decade, almost no funds were allocated to replace pumping equipment. Considerable water losses derive from inappropriate infrastructure maintenance and outdated water networks. Again, water losses and unaccounted-for water amount to some 60-75% of the total water pumped into the network. This is 4 to 5 times as much as the «normal» rate, typical of accurately operated and hydraulically optimised networks in Western European cities; it is at least 1.5 to 2 times higher than the average level of water losses in urban water supply systems in the CIS.

In-door distribution networks in the apartment buildings are also worth paying special attention: household apparently consume an unreasonably high amount of water. Among other reasons, this is a consequence of leaking valves and fittings. A general lack of pressure into the network follows; this is particularly consequential in multi-storeyed building, where low pressure prevents water supply in higher storeys.

A catch 22 situation

According to the data collected, all settlements experience irregular water supply - usually 2 to 4 hours in the morning and the 2 to 4 hours in the evening - whereas a sufficient volume of raw water is available for abstraction. Frequent interruptions of service, which occasionally last for several days, are due to a large number of accidents and breaches of the networks, caused by poor replacement of the deteriorated pipelines and valves. This contributes to deteriorate the quality of service. At the same time, consumers are not willing to pay for a poor service.

The «scheduled» water supply leads to a number of additional problems, including:

- Increased maintenance cost and shortened service life of water mains, distribution network and valves; this results from frequent water hammers (“hydraulic blows”) and accelerated corrosion processes;
- An increased risk for microbiological contamination and for the intrusion of polluted ground water into the network; this comes from the existence of areas of low pressure and water stagnation in the pipelines; the risk is even higher when there is no disinfection of the water pumped into the system.

Sanitary and hygienic condition of the infrastructure

Access to piped water does NOT necessarily mean access to safe water. The sanitary conditions in the WSS sector in Armenia have notably deteriorated in the 1990s: water delivered to the consumers often fails to reach microbiological and other norms and standards. This shows that serious problems prevail, with water transportation and distribution, from the catchments and/or the water production plants to the consumers.

Big cities in particular experience that the quality of water deteriorates during transportation and distribution. This mainly results from the poor condition of the water supply network (serious deterioration of pipes). Secondary contamination of water in the networks accounts for 98-99% of the samples that do not comply with GOST (state standard) drinking water norms by microbiological indicators.

Moreover, sanitary and hygienic condition of water pipelines is continuously deteriorating. The share of non-complying water pipelines increased from 21% in 1990, to 39.3% in 1993, and to 57% in 2000.

The share of tap water samples non-complying with the drinking water norms by microbiological indicators has increased from 9,4% (in 1990) to 11.6% (in 2000). There are obvious consequences on the people's health: until 1992, mass water-related acute infections were scarce, whereas 52 cases, with 15,508 people infected with acute intestinal water-borne infections, were registered over the 1992-2001 period (see Table 3.1 Annex 3).

Registered infections are basically dysentery and acute enteric infections, and in single cases - salmonellosis, typhoid fever, gastroenterocolitis and viral hepatitis. Sanitary statistics show a definite need for taking relevant measures, including water pipelines rehabilitation and disinfection of drinking water.

Current situation – wastewater collection and treatment

All urban and about 20% of rural areas are equipped with wastewater collection and treatment systems. There are 20 wastewater treatment plants (WWTPs) in Armenia, which were designed and constructed for mechanical and biological treatment, and for disinfection of effluents. A number of basic and low effective wastewater treatment facilities exist as well.

Wastewater is collected through municipal centralised sanitation systems, and in most cases goes to WWTPs by gravity flow, thanks to the geographical features of Armenian territory. However, not all collected wastewater goes to WWTPs. For example, one of the districts in Yerevan is connected to a wastewater collection system, but the construction of sewer mains and of the wastewater pumping station was never completed; thus, wastewater collected in the district is discharged into the river without any treatment.

All collected and treated wastewater is discharged to surface waters, with the exception of a several settlements, where biological ponds are in operation. In urban areas,

- when there is no WWTP, collected wastewater goes directly to surface water bodies, usually through a number of outlets that are located within the urban area (e.g. in Gavar);
- when there is a WWTP, only mechanical treatment of wastewater applies (Ashtarak, Echmiadzin). In many cases, wastewater is discharged either through emergency outlets (bypassing the WWTP), or after passing through the plant without any treatment (since facilities are not operational or have even lost part of their equipment, as one can see from Table 2.6 and photos in Annex 3).

Indeed, all wastewater treatment facilities have been built before 1990, and their technology is outdated. Moreover, the technology was invented in a time when electricity and natural gas were almost free of charge. Today, such technologies are very inefficient and would generate high operating cost.

In Armenia, energy prices have remained high after the 1992-1994 energy crises. This, combined with the overall lack of finances, affected almost all WWTPs. Treatment processes have been interrupted, and the pipelines have clogged-up. Lack of funds for rehabilitation caused complete shutdown of many WWTP. Today, **all** WWTPs in Armenia either are not operating or fail to provide expected (design level) treatment, let alone disinfection of effluents. In the best case, a WWTP provides inefficient mechanical treatment of wastewater (Vanadzor, Ashtarak, Echmiadzin, WWTP at Kakhsi village, Yerevan WWTP), while disinfection is provided only in single cases.

Water supply and sanitation infrastructure in other cities and towns is also in very poor condition: many facilities are outdated and collapsing; the equipment is completely worn out and partly lost (see pictures below). Some facilities have been under construction (and therefore not operational) for more than decade, as the civil works were stopped due to financial problems in 1990s.

Annex 3 provides a more detailed description of current situation as regards wastewater collection, transport and treatment in Armenia.

Photo 3.1 Grid with mechanical rakes, Vanadzor



Photo 3.2 Primary sedimentation tank, Masis



Photo 3.3 Air blowers unit, Aparan



Photo 3.4 Drainage trays of sedimentation tank, Yerevan



Present state of urban WSS financing

Tariff calculation and approval procedure

The Armenian Water Code refers to a concept of regulated tariff. It explains that the necessity of tariff regulation originates in scarcity of water resources in Armenia, and in the need to provide consumers with some predetermined amount of quality water.

Until 2003, there were no special regulation on rules and procedures for tariffs setting. However, the tariff planning principles were the same for all Vodocanals, i.e. tariffs were established separately for water supply and sanitation services, and when metering was not used, monthly user charges were calculated on the basis of norms for water consumption; the norm was 250 liter/capita/day (lcd) for households in Yerevan, 200 lcd for households supplied by the Armenian Vodocanal.

The Water Code (Article 14) anticipated that the responsibility for tariff setting will be transferred to an independent regulating agency (the Regulator). Indeed, in 2003, the WSS tariffs regulatory functions were transferred to the Commission for Public Services Regulation.

Water and wastewater tariffs – historical data for 2000-2002

WSS tariffs for households in Armenia have not been changed during 1998-2003: current structure and level of tariffs for water supply and sanitation services were set by:

- the Governmental Decision No. 256 dated July 9, 1997, for Armenian Vodocanal
- the Yerevan City Administration together with the Ministry of Finance and Economy of Armenia, for the capital city of Yerevan.

In the base year in Yerevan, price for 1 m³ of drinking water was 46 AMD; price for 1 m³ of wastewater discharge was 10 AMD/m³. So, in total, the WSS tariff was AMD 56/m³ (incl. VAT)⁹. Average monthly payment based on the consumption norm amounted to 420 AMD per person.

In other regions of Armenia, the average water tariff was AMD 41.33/m³ for households, and AMD 45.5/m³ for other consumers; the price for wastewater discharge was AMD 10.51/m³ for either type of consumer. Average monthly user charges based on the consumption norms was AMD 311 per person.

Table 3.2 Domestic water and wastewater tariffs, 2002, AMD/m³ including VAT

	Water supply	Sanitation		Water supply	Sanitation
Gumri	45,14	11,14	Cician	39,00	7,46
Yerevan	46,00	10,00	Vanadzor	50,00	10,00
Alaverdi	40,00	10,00	Artashat	40,00	10,00
Metsamor	N/A	N/A	Macis	39,62	9,84
Alaran	37,33	7,67	Dilizhan	42,48	7,52
Ararat	49,60	12,40	Tsakhadzor	39,60	10,40
Gavar	50,00	7,46	Ashtarak	50,00	13,33
Razdan	38,00	12,00	Echmiadzin	55,00	12,00
Sevan	55,00	11,00	Berd	30,00	7,46
			Vardenis	32,65	9,10

Source: Data provided by the utilities

From 1998 through 2003, tariffs for WSS services remained below USD 0.12 per m³ – quite low by international standards. But the tariffs for WSS services did not account for depreciation based on replacement values. Indeed, had depreciation been included in full, tariffs would have increased manifold (*e.g.* this happened after Yerevan Vodocanal revaluated its assets). Note that, theoretically, the ancient tariffs incorporated operation expenditures and even provided some surplus; however, poor user charges collection and large water losses actually generated a financing deficit (cash flow gap).

User charges collection

Before 2003, all utilities have experienced a low rate of user charges collection. Table 3.3 presents data on WSS charges collection in 2001 from households, industries and budget-financed institutions.

⁹ with the exception of the settlements in Armenian Vodocanal service area supplied from the Yerevan network (where the total water price is AMD 30 per 1 m³)

Table 3.3 User charges collection rates (repaid old debts, current year bills and advance payments) for WSS services in selected cities and towns in Armenia, 2001

	Households	Industries and commerce	Budgetary organisations
Yerevan	10%	89%	69%
Gumri	21%	114%	128%
Alaverdi	47%	111%	57%
Metsamor	20%	31%	115%
Alaran	14%	128%	56%
Ararat	33%	102%	113%
Gavar	34%	104%	132%
Razdan	29%	181%	68%
Sevan	25%	134%	188%
Cician	44%	126%	93%
Vanadzor	30%	81%	55%
Artashat	23%	75%	111%
Macis	19%	118%	108%
Dilidjan	35%	107%	98%
Tsakhkadzor	32%	108%	24%
Ashtarak	18%	62%	81%
Echmiadzin	27%	109%	56%
Berd	63%	177%	119%
Vardenis	11%	102%	37%

Source: Working group experts' own calculations based on the data provided by Yerevan and Armenian Vodocanals

Note: The collection rate is calculated as a ratio (in per cent) of billed amount for WSS services provided in current year to actual user charges collected. Collection rate exceeds 100% when consumers repay debts accumulated in previous years.

As can be seen from the table above, the user charges collection rate in 2001 was very low. And this was not mainly a matter of affordability. Indeed, in 2001, households' expenditures on WSS services amounted to approximately 2.2% of average per capita income, and monthly charges/bills for WSS services were quite affordable for at least 50% of population. Nevertheless, the collection rate varied from as low as 10% (in Yerevan) to 63% (in Berd); note that the collection rate in Berd exceeded the average level for the three consumer categories. Moreover, Table 3.3 shows that there was no positive correlation between income and collection rate: the latter was lowest in Yerevan where incomes were notably higher than in other areas of Armenia.

Such a low level of collection rate can be explained by many reasons: low incomes, poor quality of service, and the absence of penalties when bills are not paid for. Other factors still amplify the situation: weak contacts between the service provider and the final consumers and debtors, unwillingness of most of consumers to pay for poor quality service (especially if they were not provided with the service at all, as, very often, at the upper floors in multi-storey apartment buildings). Apparently, the idea, inherited from the Soviet mentality, that WSS services should be provided for free, played its part as well.

Collection rates from budgetary organisations is also quite low in many cities (*e.g.* in Tsakhkadzor, Vardenis, Vanadzor, Alaran, Alaverdi and even in Yerevan) which is a clear signal of either poor financial discipline among budgetary organisations, or of deficient budgetary planning in the public sector. Low collection rates for business customers (*e.g.* those located in Metsamore, Ashtarak and Artashat) can be explained only by the lack of effective enforcement mechanisms, including disconnection and property-for-debt swap.

Measures aimed at improving user charges collection rate in 2002 and 2003

In 2002, the situation with user charges collection improved substantially, especially in Yerevan (collection from all consumer categories jumped to 47.7%, compared to 27.5% in 2001, including households – it grew up to 27.5% compared to 10% in 2001). This positive dynamic mainly resulted from initiatives taken by top management of the State Committee of Water Economy, under the GoA, that urged Yerevan and Armenian Vodocanals to work actively with debtors, reinforced public awareness, and campaigned in the mass-media.

That campaign in Yerevan included materials, articles and special booklets in which it was clearly explained that it would be possible to recover 24 hours water supply in Yerevan only if water was rationally used and WSS bills regularly paid. New external management at Yerevan Vodocanal contributed to the dynamics as well; indeed, in 2000, Acer & Company Armenian Utility S.C.AR.L., an Italian company, was awarded a 4-year management contract, under a World Bank agreement.

In order to improve user charges collection rates and Vodocanals financial performance indicators (including *inter alia* reducing and restructuring receivable and payable accounts), and also to promote metering, a special regulation was adopted by the GoA which made it possible to write off a considerable portion of the outstanding households' debts, if:

- interested household sign an agreement with the Vodocanals,
- install water meters, and
- pay current bills on time.

The deadline for signing such an agreement was 9 April 2003, which was further extended to April 1, 2004.

This regulation helped to establish a clear contractual relationship between Vodocanals and the households that consume WSS services. In future, this should bring both parties to stronger commitments, including improved quality of services and timely payments. Writing a substantial part of accumulated debt off has proved to be a strong incentive for most of the households; e.g. in Yerevan, by November 2003, about 246 000 consumers, out of a total 276 000 (83%), had already signed such agreements. If these agreements are effectively implemented, the collection rate is expected to jump up to 80-83% (compare with a 65-70% forecast for 2003).

Revenues of Yerevan and Armenian Vodocanals

Data on Yerevan and Armenian Vodocanals' revenues from collected user charges were provided by the utilities. The data includes information on billed amounts, collection rates and user charges, for each group of consumers (households, industries and commerce, budgetary organisations). Besides, the data on the share of cash payments and on real value (per cent of a nominal) of non-monetary settlements was obtained. We present below data for the base year 2002 (table 3.4).

Table 3.4 Yerevan and Armenian Vodocanals' revenues from WSS user charges (in 000' AMD, VAT included), 2002

Consumer category	Billed amount	Collected user charges	Collection rate, in per cent of the billed amounts
Households	7 335 100	2 306 120	31,4%
Industries and commerce	563 500	577 760	102,5%
Budgetary organisations	1 182 000	1 524 200	129,0%
TOTAL	9 080 600	4 408 080	48,5%

Source: Yerevan and Armenian Vodocanals

Note: above 100% collection rates indicate payment of the debts accumulated in the previous years, therefore, given that this situation is temporary, the model calculations accepted collection rate equal to 100%.

Unfortunately, the tariff structure was not adapted to account for the fact that billing was now based on metered consumption. It turned out that the metered water consumption was more than twice lower than the established norm. For that reason, the sum of the bills issued by Yerevan Vodocanal in 2003 amounted to a mere 80% of the 2002 figure. The outstanding growth of payments collection rate in 2003 more than compensated this decline. However, this episode confirms that a radical change in the billing system should be reflected in the tariff structure to avoid problems in the future.

Indeed, experience of other CIS countries shows that, under certain circumstances, a very fast shift to the billing based on metering, not supported by adequate changes in tariff policy, tariff structure or rates, may lead the utility to bankruptcy within a rather short time.

The reasons "why" are quite clear. Variable costs of Vodocanal depend on the amount of water sold, and, therefore¹⁰, are covered by the bills issued, whatever the fluctuations are in the volume of water sold. But for the *volumetric tariff* the recovery of fixed costs depends on the level of precision of the forecast for the *water sold*. If billing is based on consumption norms, and if these norms are highly overestimated, as in Armenia, the amount of water sold is big enough, and the portion of fixed cost in the tariff per m3 is relatively small. But, when the population shifts to metering, Vodocanal sells less and less water, and, if the collection rate remains constant, collects less and less user charges. Under such circumstances, the operator may not recover fixed costs, even if collection rate stands at 100%.

But obviously, during the transition from billing based on consumption norms to meter-based billing, and for some time after the transition, the amount of water sold will substantially vary and will be difficult to forecast. Thus, if the tariff formula remains unchanged, the same applies to Vodocanal's billing and collected revenues. Improved *collection efficiency* would have a beneficial impact (but it has a natural limit), while factors which might have an adverse effect on billing and collected revenues would be: (a) the difference between consumption norms and the actual consumption; and (b) price elasticity of water consumption patterns. Uncertainty about these factors will not allow for sufficiently precise forecast for revenues.

If the forecast for the water sold is substantially overestimated in the tariff setting then the water utility would not get sufficient revenues and suffer from the cash flow gap, if on the contrary the variable is underestimated the water utility will enjoy the rent. When facing uncertainty, Vodocanal will tend to use most conservative forecast for the amount of water sold, while the Regulator, in its effort to protect the interests of households, will tend to overestimate this variable. This situation will result in either rent or cash flow gap for Vodocanal. If revenues are not sufficient, the Regulator might be urged by Vodocanal to raise the tariff. The increased tariff will result in lower-than-expected amount of water sold (price elasticity), thus promoting further tariff increase, etc.

This upward trend is exactly what the population does not like much. Households have invested money in meter's installation, expecting that payments for water will decrease (against the overestimated consumption norm), but if in practice the tariff often increases, the situation may lead to conflicts between the general public and the government.

To prevent such a problem, it is recommended:

- first, to invest in public information and awareness campaign, explaining basic economics of the sector to the population thus improving their willingness to pay, and
- second, to make adequate adjustments in the tariff policy; *e.g.* introducing other tariff formulae; an appropriate formula should provide full coverage of both fixed and variable cost, irrespective of the uncertainty about, and variation upon time in the amount of water sold, while preventing water utilities from the rent seeking behaviour; for instance, it could be a two-tier tariff, designed so that the consumers pay a fixed connection fee (per inlet to apartment/building), sufficient to cover Vodocanal's fixed cost (including depreciation,

¹⁰ provided that the tariff is not subsidised and the collection rate is 100%

salary, general internal expenses and overheads), and a variable fee equal to the consumption metered, times a rate sufficient to fully cover variable costs.

However, the introduction of a two-tier tariff requires that the adequate regulation is designed and implemented, and that the authority in charge of setting tariff makes a decision. It also requires to inform the general public about the reasons why a new tariff structure is devised; this could be done as part of the public awareness campaign.

In any tariff reform, the affordability of the new tariff for the population at large needs to be carefully checked, assuming that the poorest households will get an income support (subsidy) from the state. At present when setting new tariffs their affordability for the population is not checked in Armenia. However, when developing investment programmes, the international Financial Institutions (IFIs) often recommend, and even insist (EBRD) on the affordability check for the future tariffs resulting from implementing the suggested investment programme and/or other measures which would affect costs (including fixed assets revaluation).

Such affordability check, under different scenarios on tariff growth, has been done in the context of another OECD demonstration project, namely “Consumer Protection in Urban Water Sector Reforms in Armenia: Ability to Pay and Social Protection of Low Income Households”, implemented in 2003 by PADCO, in co-operation with the State Committee of Water Economy and the Ministry of Labour and Social Affairs of Armenia.

The analysis established that fast installation of individual water-meters¹¹ has relieved the burden of WSS bill levied on households. And, in July 2003, the water bill had been reduced from 3% to 2.5% of the average household’s income. It was also established that a tariff increase by 100% in 2004 would put the water bill in Yerevan at **3%** of average household income (a levy considered as affordable), while it will be over **4%** (the affordability limit) of the income of only some 15% of the households. These households would then need a targeted income support (or subsidy). On the other hand, assuming that collection rate is maintained at 2003 level, this tariff would guarantee that Yerevan Vodocanal’s cash revenues would be sufficient to fully finance current expenditure needs, and the Vodocanal would not need public operational subsidies to bridge the cash flow gap anymore.

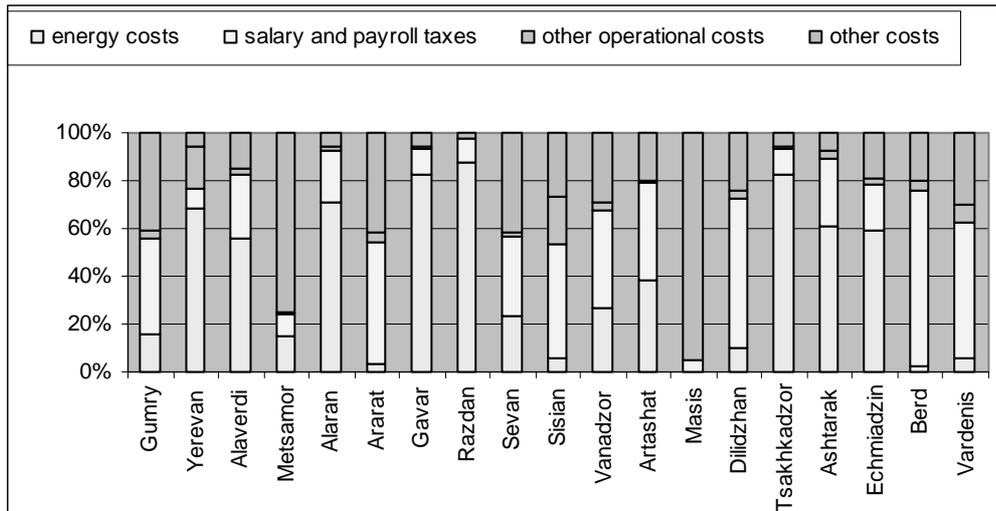
In April 2004, a new tariff was introduced in Armenia. Compared to the previous tariff it was increased by some 60% in Yerevan and by some 94% in the cities served by Armenian Vodocanal. Since the tariff in Yerevan was increased in a lesser degree than expected, it is likely that during the period April-December 2004, the Yerevan Vodocanal does not get sufficient revenues, and needs public subsidy to bridge the cash flow gap. However, such a subsidy was not anticipated in the 2004 State public budget, as the budget was made assuming that the new tariff would secure sufficient billing and revenues (on cash basis) for the Yerevan Vodocanal.

Production costs structure

Diagrams 3.5-3.6 show the water supply and sanitation costs structure.

¹¹ at the end of 2003, 80% of apartments in Yerevan were equipped with meters, and 40% in other areas.

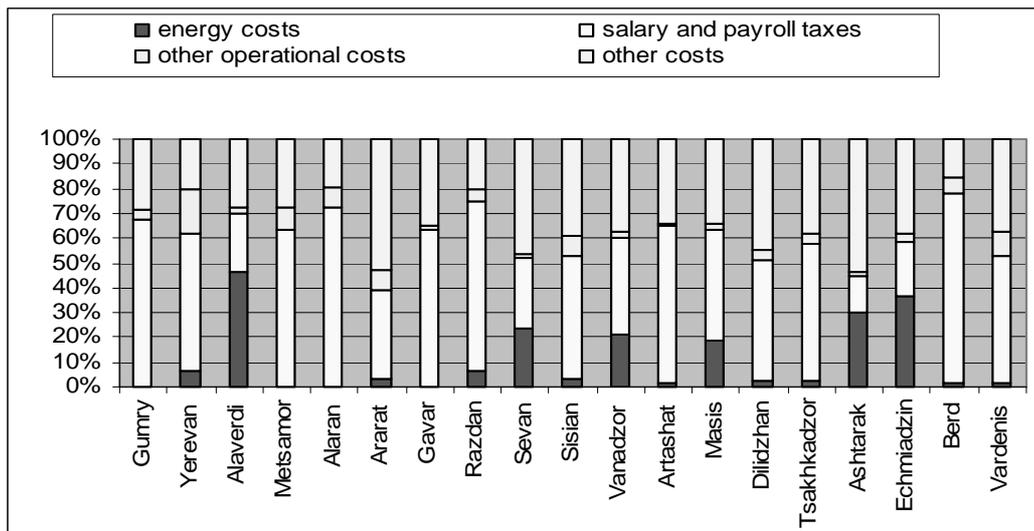
Diagram 3.5 Water supply cost structure by Armenian towns in 2001



Source: Yerevan and Armenian Vodocanals

Key cost items are electricity and wages. Electricity costs in 2001 amounted to about 62% of total costs of Yerevan and Armenian Vodocanals.

Diagram 3.6 Sanitation service cost by towns in Armenia in 2001



Source: Yerevan and Armenian Vodocanals

Note that the share of the cost of electricity in many towns is almost zero, while labour cost amounts to 50%! This is a clear indication that in fact, WWTPs are not operating properly (at best, wastewater just goes through the WWTP with minimum treatment), but guards and key technical staff are paid in order to save equipment and key specialists until the WWTPs resume with normal operations.

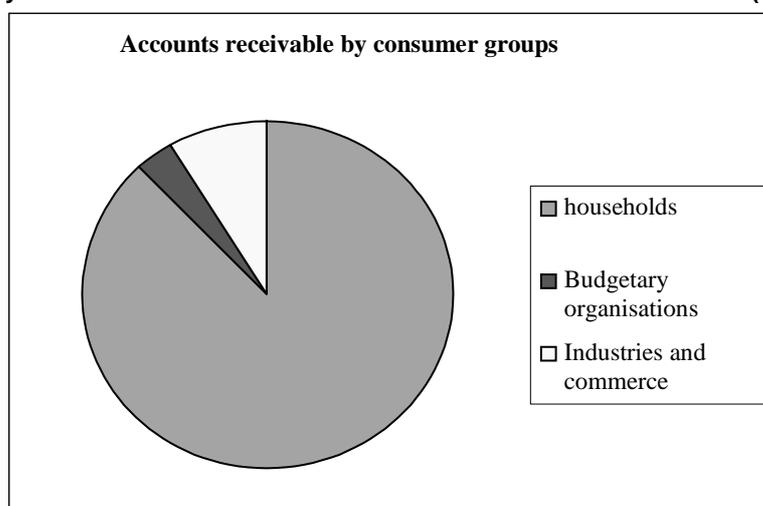
Financial liabilities

Accounts receivable and payable

Nominal value of the accounts receivable for the water utilities in Armenia is very high, and had been growing very fast until 2003. In general, by the end of 2002, the accounts receivable accumulated in water supply and sanitation sector exceeded more than 10 times the user charges collected in 2002. The total accounts receivable for Yerevan and Armenian Vodocanals as of 01.01.2003 amounted to

AMD 46.8 billion. Households' total debt accounted for more than 80% of total accounts receivable. These are mainly old debts (more than 3 months old). Share of other consumers (industry, commerce, etc.) in the accounts receivable is not so big (see the Figure 3.7).

Figure 3.7 Key debtors to Yerevan and Armenian Vodocanals as of 01.01.2003 (by consumer groups)



Source: Yerevan and Armenian Vodocanals

The accounts payable for Yerevan and Armenian Vodocanals amounted to AMD 31.5 billion by the beginning of 2003. The main share of accounts payable is the debt to electricity suppliers.

Huge accounts receivable, combined with the necessity to pay the bills for electricity, first have a negative effect on the cash flow. In this situation, the limited funds that might be used for capital investments are often used for paying wages and immediate energy bills. Expenditures which may bring long-term benefits due to more efficient operations (especially maintenance, capital repair and rehabilitation) lack financing. The main reasons for insufficient financing of those expenditures were (1) full depreciation was not included into the tariff, (2) the tariff did not follow the growth in prices for inputs (electricity in particular), and (3) the collection rate remained low.

It should be mentioned, that as soon as the law on debt restructuring is adopted, a considerable part of the households' debts will be written off, under condition that before April 1st, 2004, interested households sign the agreement on the outstanding debt write-off, install water meters, and timely make current payments. At the same time, the State will write off a part of the utilities' accounts payable, including a part of the debt for electricity. These measures will certainly decrease considerably the accounts payable and receivable and therefore improve the financial indicators of the utilities.

Public financing of current and investment expenditure in urban water sectors

Financial support to communal services from the RA budget has changed considerably over the last decade. For instance, subsidies are not provided to gas suppliers any more, as this sector was recently privatised. There are no mechanisms to subsidise municipal solid waste collection and other communal services, as they operate on the basis of agreements concluded with the municipalities (communes).

Subsidies to **Vodocanals** can be granted first by municipalities, depending on their financing capacity, i.e. communities themselves decide upon subsidies to be granted to the utilities. The amount of the subsidies provided to WSS utilities from the State public budget derives from an assessment of the current year performance and cash flow forecast. The relevant public fund to bridge the cash flow gap (if any) is then reserved for allocation to the particular authorities in charge of the sector.

As there was no WSS tariff revision in 1998-2003, the estimated revenues did not cover actual prime costs, as it should have been the case, would the depreciation of the asset be fully included.

(This increased considerably after the 2002 revaluation of Yerevan Vodocanal's fixed assets). Moreover, **due to low collection rate**, the cash revenue cannot cover the expenditures for electricity, wages and settlements with the other resources' suppliers – there was a cash flow gap, which required considerable allocations from the state budget (see Table 3.8). In 2002, their volume amounted to some AMD 1.5 billion. (0.6% of total public expenditure budget), and increased up to AMD 2.7 billion in 2003 (0.8% of budget expenditures). In 2004, the Government plans to reduce operating subsidies to the utilities was estimated at AMD 1.7 billion. Data on public budget financing of HCS and WSS sector in Armenia is presented below in the Table 3.8.

Table 3.8 Subsidies for WSS from the state budget of the RA in 2000-2003, in million AMD

	State budget of the RA			
	2000	2001	2002	2003
Total expenditure budget:	222,900	249,400	263,900	334,300
Subsidies to bridge cash flow gap and finance current expenditure of water utilities, total	1,277	837	1,499	2,745
in per cent of the total expenditure budget	0.6%	0.3%	0.6%	0.8%
Allocated to JSC "Armenian Vodocanal"	721	560	1229	810
Allocated to CJSC "Yerevan Vodocanal"	556	227	270	1,935

Source: the Ministry of Finance and Economy of the RA

The greater part of capital investments in WSS sector is financed from foreign loans. In particular, the Government of Armenia has attracted and is going to attract more external "soft" loans (World Bank/IDA and KfW) for implementation of the target programs for WSS sector development. In particular:

- **EUR 35 million** – a KfW loan to implement two programs on WSS systems rehabilitation in Armavir, Shirak (Gumri) and Lori (Vanadzor) regions;
- **USD 36.5 million** – a World Bank loan to implement municipal WSS systems rehabilitation program in Armenia (outside Yerevan city);
- **above USD 80 million** – two World Bank loans to implement two municipal development programs, one on water supply infrastructure rehabilitation in Yerevan, the other to anticipate rehabilitation of wastewater collection and treatment infrastructure).

4. MAIN APPROACHES TO IMPROVE FUNDING OF WSS SECTOR IN ARMENIA

To change the present situation in WSS, it is necessary to substantially improve the funding of the sector. The basic approaches, that are not mutually exclusive, are the following:

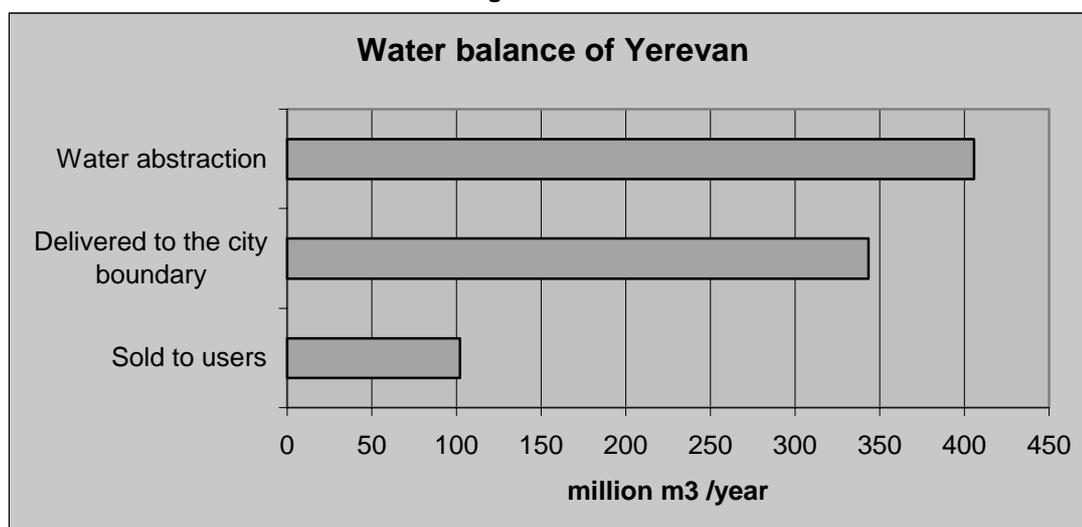
- To ensure a more rational use of available sources of finance;
- To mobilize additional financing for the sector;
- To set realistic targets with regards to the volume and quality of services provided by the WSS sector, and to develop a sound financing strategy.

These opportunities are discussed in more detail below.

To ensure a more rational use of available sources of finance

For more rational use of available financial resources, it is required, first, to ensure a substantial reduction in unaccounted-for water (in particular, reducing losses, stopping practice of unaccounted and unpaid use of potable water for irrigation, etc.), which remains very high; the chart below shows an example of the water balance of Yerevan city.

Figure 4.1



Source: Estimates based on Yerevan Vodocanal's data for 10 months of 2003

Analysis of the figures above shows that:

- the amount of water supplied to Yerevan from mountains by gravity is in practice sufficient to meet the existing needs. Accordingly, there is opportunity to save a significant part of electricity used by Yerevan Vodocanal (14 million kW*h a month), which today is used mostly to pump water from the Ararat valley;
- the capacity required for wastewater treatment in Yerevan is much less than the design capacity of the existing WWTP (aeration station with capacity 600,000 m³ per day), which

requires rehabilitation. Hence, there is an opportunity for substantial saving on capital expenditure for rehabilitation of the WWTP.

In general, the capacity of many existing WWTPs in Armenia exceeds the current demand for water and the volumes of water discharged to the sewerage system.

Ways for reducing UFW and ensuring more rational water use include:

- systematic leak detection and prevention;
- metering water use, and billing on the basis of water meters reading,
- eliminating illegal connections and terminating practices of unpaid use of potable water for irrigation purposes,
- when required, introducing limits on water use and application of increased (penalty) rates for water use in excess of the limits.

The measures already taken by the Armenian government to reduce water losses include the rehabilitation of the water supply infrastructure, and the creation of economic incentives for more rational use of water, by introducing billing based on metering. These actions need to be complemented by systematic leaks detection, and prevention of illegal or unpaid water consumption, applying specific equipment and set of technical, administrative and economic instruments.

Recommendation here is to develop and to implement a comprehensive Water Demand Management Programme (WDMP), as a key element of the Integrated Water Resource Management (IWRM).

Implementing the measures aimed at reducing UFW and assessing actual (metered) water consumption could help to achieve the following:

- **in the medium term**, to optimize water supply and to assess more precisely actual demand for sanitation infrastructure, before starting its rehabilitation and/or construction;
- **in the longer term**, to save substantially on capital and operation expenditures, when rehabilitating and operating WSS infrastructure.

In particular, calculations based on the FEASIBLE model have shown that, from 2005 onward, rehabilitation of water supply systems operated by the Armenian and Yerevan Vodocanals will reduce water supply-related costs by more than 8 billion drams a year, as compared to the situation where no rehabilitation is undertaken at all.

To mobilize additional financing

This could be achieved through:

- a radical improvement of users fee collection, which was very low in Armenia before 2003;
- an increase in water tariffs;
- allocation of significant public funds for investments in WSS infrastructure, combined with loans from international financial institutions and possible grants from international donors.

The GoA has already undertaken certain measures in this direction:

- the public funds allocated to WSS sector have increased substantially (from 0.7% to 1.2% of the expenditure budget in 2004¹²), in line with the growth of GDP and public revenue budget;

¹² these figures do not include foreign loans secured by the Government

- the Government of Armenia has already attracted, and in the near future plans to secure, more foreign loans (from the World Bank and KfW) on preferential terms. the total borrowings devoted to implement targeted programmes in WSS will amount to EUR 41.5 million and over USD 121 million;
- a law was adopted, to restructure the households' debts for WSS services; it resulted in a sharp increase of the collection rate; in Yerevan, the rate has risen from 27.5% in 2002 to 65-70% in 2003, while individual water meters have been installed in 80% of private apartments;
- new tariffs were implemented in April 2004, that are some 60-94% higher than the rates effective in 2000-2003.

To assess whether this would be sufficient, the supply of finance should be compared to expenditure needs, as they are related to specific targets that Armenia would like to achieve in the WSS sector.

To set realistic targets for WSS sector and to develop a financial strategy

As it was noted in the introduction, the development of the **financial strategy** helps the relevant bodies to set realistic strategic targets for sector development, that meet the priorities of Armenia and that are technically and financially feasible and affordable. It also helps to devise scenarios to reach these targets.

The subsequent sections present the main assumptions and results of FEASIBLE model simulations for the **Baseline scenario** and the **Development Scenario**, as well as main conclusions and recommendations.

5. ANALYSIS OF THE BASELINE SCENARIO

Basic assumptions of the Baseline scenario

The main target of the baseline scenario over the planning period (2002-2015) is to maintain infrastructure and service at their current level (year base: 2002), with a gradual restoration of continuous water supply. As for infrastructure development and upgrading, the scenario only includes rehabilitation of the water supply system in the city of Yerevan in 1999-2004, funded by the first WB/IDA loan for the Municipal Development Programme in Armenia.

In FEASIBLE, **calculation of the financing needs** assumes proper operation, maintenance, capital repair, and timely replacement of worn-out fixed assets. However, this does not mean that the full amount of depreciation is included into the tariff, for the State budget is an alternative source of funding for capital costs.

International practice demonstrates the following alternative approaches to fund communal services provided to the population:

- full funding at the expense of the users (users-pay, or cost recovery principle);
- full funding at the expense of the budget (from tax revenues or targeted taxes); and
- a combination of both approaches, when services are paid in part by the user and in part from the budget.

Even in EU countries, some communal services are initially paid by the government from the public budget (for example, services for removal of municipal solid waste in Denmark), that is epyt compensated at the expense of tax payers, sometimes from non-targeted taxes.

Costs related to capital repair, rehabilitation and modernisation of fixed assets and new constructions shall be borne by the owner of the water supply and sanitation infrastructure. In Armenia, the State is the owner of major assets. The users ultimately compensate for these costs through inclusion of depreciation item and maintenance cost into the tariff, if such a tariff is deemed affordable. However, the State may prefer to assume the burden of funding of capital costs, until household incomes achieve a level at which that tariff that ensures full financial autonomy of Vodocanals becomes quite affordable for the majority of population.

Armenia has chosen this option. The main issue, then, is whether all per-conditions for full financial autonomy of the Vodocanals are already in place, and if not, when we can expect to have them in place. The answer to this question is given below, in the analysis of financial indicators for alternative scenarios.

Calculations of the available funds were based on a number of forecasts for macroeconomic indicators: GDP and income of population growth rates, receipts and expenditures of the national budget as per cent of GDP, expenditures for the WSS as per cent of the national revenue budget (see Table 5.1); as well as a revenue forecast of the Vodocanals.

As for foreign loans, only the first WB loan for the Municipal Development Programme was included into the scenario.

Table 5.1 Forecast of macroeconomic variables

Variables	2002	2003	2004	2005	2006 - 2015
Real GDP growth rates	12.90%	16.90%	10.00%	8.00%	6.00%
Expenditure Budget of RA, in per cent of GDP	19.45%	21.00%	19.00%	19.20%	19.00%
Budgetary expenditures for the WSS in the 19 cities and towns under review (international loans are not included) – in per cent of the national expenditure budget of the RA	0.70%	1.20%	0.85%	0.85%	0.40%

Source: Suggestions of the developers based on the data provided by the Ministry of Finance and Economy of RA

As regards the tariff policy and incomes of the Vodocanal enterprises, the Baseline scenario assumes that the amount of fees for the WSS services paid by the population will increase in real terms at the same rate as the real income of population. For the rest of the users, the model assumes that the tariff remains stable. According to official statistical data, the average available income per capita in 2002 was 254,000 drams a year. (Mind that all money variables were predicted or calculated in base year prices).

Given the significant progress attained in 2003 with regards to improving collection of user charges from the population, the model calculations were made assuming that the collection rate for 2003 (average rate for Armenia) will further grow up to 85% by 2006, and then stabilize at this level.

Results for the Baseline scenario simulation

Table 5.2 shows the results of calculation of the expenditure needs in WSS sector in the 19 cities and towns under review for 2002-2015 in the Baseline scenario.

Table 5.2 Expenditure needs for the WSS in the analysed towns for 2002-2015, in base year prices of 2002

	Million drams
WSS, total	547 110
including:	
Water supply, total	213 832
including:	
Rehabilitation	14 975
Operational costs	89 759
Costs of maintenance, major repairs and replacement of worn-out fixed assets in line with the depreciation rates	122 364
Wastewater collection and wastewater treatment, total	331 786
including:	
New construction and rehabilitation	0
Operational costs	127 061
Costs of maintenance, major repairs and replacement of worn-out fixed assets in line with the depreciation rates	204 725

Source: Calculations based on FEASIBLE model

Based on Vodocanals' data, the actual costs for wastewater collection and wastewater treatment (including pollution fees for discharges) in the sampled towns in 2002 amounted to some 2 billion drams. Compare to the average annual expenditure needs, amounting to **23.7** billion drams, according to FEASIBLE. That is, the funding of sanitation represents 8.5% of the total expenditure needs calculated by the model, including the needs for maintenance, capital repair, and replacement of

worn-out fixed assets in line with depreciation rates (under condition of proper operation and maintenance of the fixed assets). This rate amounts to 22% for operation expenditure only.

Table 3 (see Annex 4) shows the results of the calculation of available funds and of yearly financial gap for the Baseline scenario. As derives from this table, should the pre-2003 financial trend continues over the entire 2003-2015 period, the total amount of funding for the 2002-2015 period will reach only 167.9 billion drams, and the financing gap will be at 379.2 billion drams.

Moreover, cash revenues of the Vodocanal enterprises will not be sufficient, even to cover the costs for proper operation and maintenance of the WSS infrastructure. The annual financing gap for these costs will be 4 billion drams in 2004 and will gradually reduce to zero by 2015.

It is important to note that, according to the model-based calculations, implementation of the programme for rehabilitation of the WSS in Yerevan would help, already by 2005, to reduce the need for funding of current operational costs in the water supply sector (by 3.2 billion drams a year), and of costs for maintenance and replacement of worn-out fixed assets (by 2.07 billion drams a year), as compared to the base year of 2002. This will make it possible to save resources to increase the funding for the wastewater collection and wastewater treatment sector.

Opportunity for gradual elimination of the financial gap

Despite its magnitude, the financial gap, however, could be gradually eliminated, for example through the implementation of the package of policy measures presented below (or a similar package aimed at increasing financing and/or cost savings).

1) Increasing payment for WSS services (in prices of the base year)

- for households – the water bill should be increased so that spending on WSS services reaches 4% of the average household income by 2006, and remains at this level until 2015;
- for other users – in 2004, the tariff should be twice as high as in 2002; it should increase by 25% in 2005, and stabilise afterwards.

2) Improving collection rates from the population

The rate should reach 90% by 2005 and remains at this level afterwards.

3) Achieving high level of public funding and attracting additional loans for WSS

Public funding and foreign loans for WSS should represent **2.2%** of the national expenditure budget **in 2005-2011**, with a gradual decrease down to **1%** by 2016 (the figures represent only the funds allocated to WSS in the analysed 19 cities and towns; this indicator would be higher, should the entire country be taken into account).

4) Electricity saving

The scenario acknowledges that the amount of water delivered to Yerevan by gravity from the mountains is sufficient to meet the demand, and that there is almost no need to pump water from the Ararat valley. This provides for substantial energy saving, the monetary value of which is estimated at 1.8 billion drams per year from 2006 on.

Social aspects of implementation of the proposed package of policy measures

Before discussing the results of modelling of financial impacts of the above-mentioned policy package, it is necessary to comment on the social aspects of such a package.

In general, users should pay in full and in time the charges for the WSS services (User-Pays Principle). However, the regulatory authorities should take into consideration the fact that there are affordability limits to tariffs for WSS services. These limits are usually expressed as percentage of

households' income (gross or disposable) or of the so-called "residual" income (*i.e.* what is left after vital expenditure on food). Although economists and sociologists ardently dispute what this limit should be, the majority shares the opinion that 3% is a sound affordability limit, whereas a 5% rate means that WSS becomes too heavy a burden, which should be compensated by social protection mechanisms for poor households.

However, since the volumetric tariff is usually identical for both poor and better-off households, the average (the so-called macro-affordability) limit of acceptability is often set also in a percentage of the average household income; whereas micro-affordability analyses also check if the water bill exceeds the affordability threshold for low income groups.

We choose 4% (average between 3 and 5) as the affordability threshold. When discussing the social impacts of increasing tariffs up to this level, it is also necessary to take into account the results of an OECD demonstration project, which was implemented in parallel with the Financing Strategy: "*Consumer Protection in Urban Water Sector Reforms in Armenia: Ability to Pay and Social Protection of Low Income Households*". This project was implemented in 2003 by PADCO, a consultancy, in co-operation with the State Committee of Water Economy and the Ministry of Labour and Social Affairs of Armenia.

The data collected by the project team revealed that metering mitigated the burden of paying for WSS services. Indeed, as of 1 July 2003, the charges paid by Yerevan citizens for WSS decreased on average to 2.5% of overall household spending, down from almost 4% in 2002. This was due, mainly, to the fact that the tariff was not changed, while metered consumption turned out to be much less than the consumption norm used for billing.

The micro-affordability check under different tariff growth scenarios have established that a 100% tariff increase in 2004 will set average spending for WSS services by Yerevan households at 3% of their income (data on consumer expenditure was used as a proxy for the disposable income). This would be quite affordable for most of the population. Only 15% of the population will then have to spend more than 4% of their income for WSS services, and the project team did suggest alternative options for income support and social protection of such families. Should the tariff increase by an additional 50% in 2005, the households in Yerevan will spend, on average, 4.3% of their income for WSS services; and more than 50% of the population will spend more than 4% of their income for WSS services. Such a high share of candidates eligible for social protection is hardly acceptable.

Therefore, the policy package referred to above includes a raise in tariffs in such a way that the charges for WSS services gradually reach 4% of the average household's income, by 2006. Nevertheless, even with this soft scenario, a substantial share of the population will spend more than 4% of its income for WSS services, and thus would actually need social support.

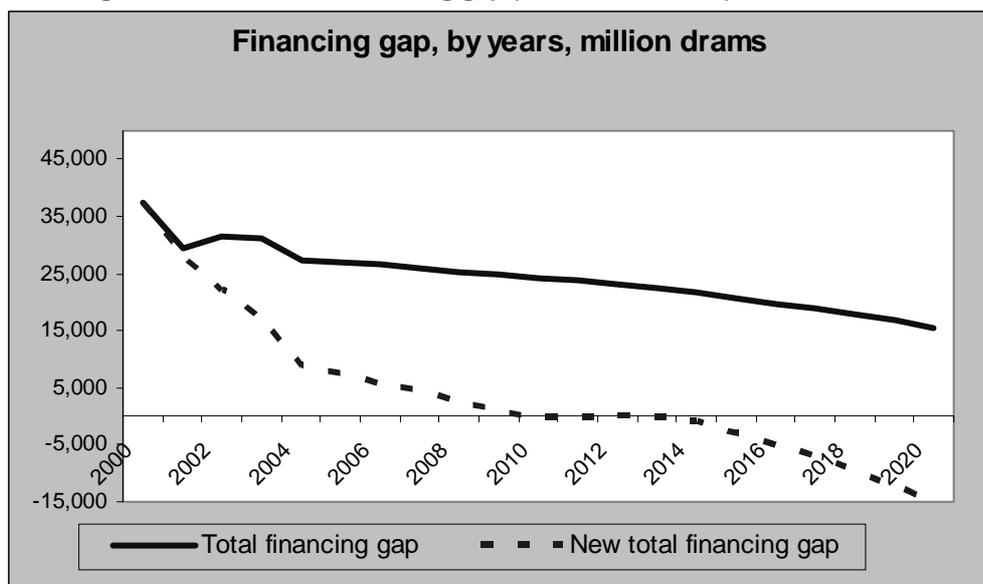
Modelling results

Table 4, Annex 4, presents

- the estimated amount of additional resources resulting from the implementation of the proposed policy package;
- the effect of each individual measure
- the profile of the annual total financial gap.

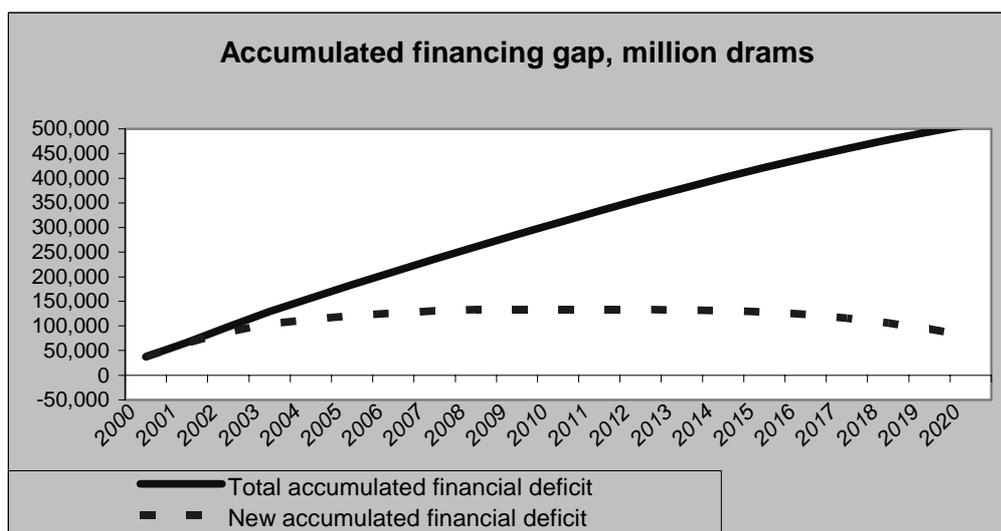
The calculations are also shown in the figures below, where the solid line on Figure 5.1 shows the initial total annual financial gap and the dotted line shows the new reduced financial gap that would result from the implementation of the policy package. The Figure 5.2 shows the initial (solid line) and the new (dotted line) accumulated financial gap, from 2002 onwards.

Figure 5.1 Total annual financing gap (Baseline scenario), in million drams



Source: FEASIBLE model simulations

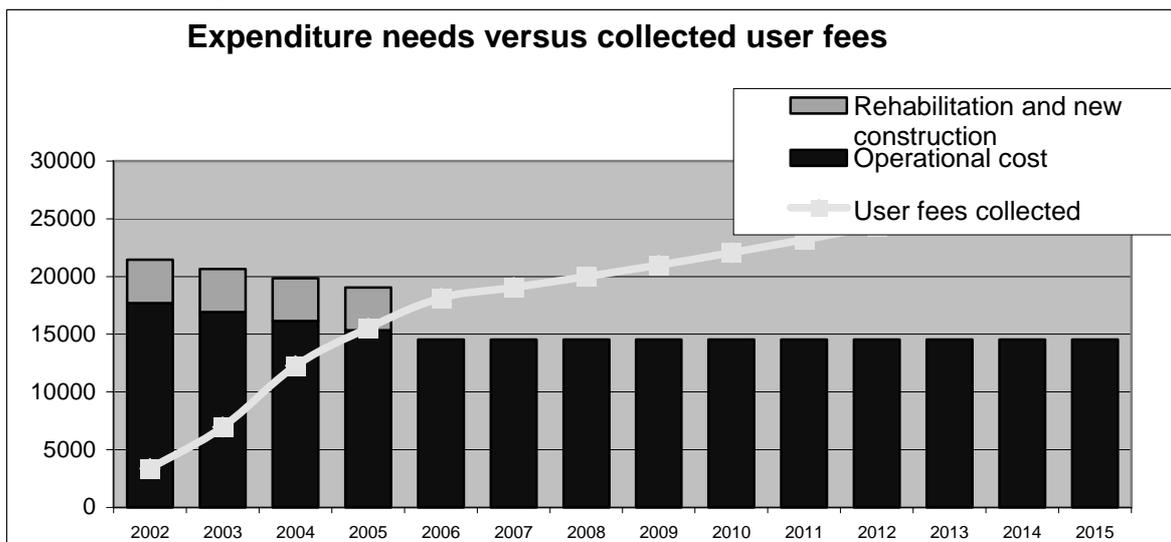
Figure 5.2 Accumulated financing gap (Baseline scenario), million drams



Source: FEASIBLE model simulations

As can be seen from Fig. 5.1, the annual total financial gap will be eliminated only in about 2011. However, from 2005 onwards, the increased revenues of the Vodocanal enterprises will fully cover operation expenditures, and even raise some additional funds for capital repair, rehabilitation and replacement of worn-out fixed assets, or for new construction (see Fig. 5.3).

Figure 5.3 Expenditure needs versus collected user fees, Baseline scenario, in million drams



Source: calculations based on FEASIBLE model

Calculations have established that rehabilitation of water supply systems and actions to save electricity, to reduce leakages and UfW, incentives for a more rational use of water in Armenia (similar actions which are being implemented in Yerevan) should bring significant savings of operational costs and reduce the need for extra funding to maintain fixed assets. The decision of the Government of Armenia to rehabilitate water supply infrastructure in other towns of Armenia is therefore justified and timely.

Indeed, only after implementation of water demand management measures (including tariff policy) aimed at reducing water losses and unaccounted-for water in the networks, water use will be rationalized, and it will be possible to assess more accurately actual water consumption (by metering). Hence, the infrastructure needed for wastewater collection and treatment and its capacity could be assessed more precisely.

This will provide opportunities to optimise the infrastructure, and to decrease both capital costs (due to rehabilitation and development of the wastewater collection and treatment infrastructure), and operation costs (in a second stage).

Here, we assume that water supply systems will be rehabilitated mostly during 2005-2009. The options for WSS sector development, the associated costs and possible sources of financing are discussed in the Development scenario (see next chapter).

6. ANALYSIS OF THE DEVELOPMENT SCENARIO

Assumptions for the Development Scenario

This scenario assumes that rather ambitious targets are achieved for the WSS infrastructure development in all 19 cities and towns of Armenia under review. On top of the ongoing rehabilitation of water supply infrastructure in Yerevan, included in the Baseline scenario, these targets include¹³:

- in Yerevan: rehabilitation of WWPT (aeration station), with adjustment of its capacity to actual volumes of water consumption and wastewater discharges, construction of new sewer mains and WWPS, rehabilitation of worn-out sewer networks – in 2005-2009;
- outside Yerevan City: rehabilitation of water supply infrastructure – in 2005-2009;
 - priority construction of new WWTPs in Vardeniz, Gavar, Martuni, and rehabilitation of existing WWTPs in other town settlements located on the Sevan Lake shore – in 2006-2009;
 - (second stage) – rehabilitation of WWTPs (or finalisation of WWTPs under construction since 1990) where it would require relatively little funds (Ashtarak, Echmiadzin) – in 2007-2010;
 - rehabilitation of existing WWTPs in other cities and towns under review – in 2009-2015;
 - rehabilitation of wastewater collection infrastructure (sewer pipelines, WWPS, etc.) – up to 10% of its total length, on top of annual replacement of worn-out pipes, in line with the depreciation rates; and substantial increase in coverage by sewerage – in all cities and town simultaneously with WWTP rehabilitation in respective towns.

The last target *inter alia* anticipates priority construction of sewerage systems in the urban settlements located close to sources of water supply for Yerevan (in Kotaik *marz* (region), in Garni, Goht, Karnis and Arzni), since the lack of sewerage in these settlements results in ground water contamination, which threatens water supply sources (a preliminary cost estimate by experts amounts to USD 2.3-2.5 million of investments).

These targets entail that effective mechanical treatment of collected wastewaters is provided in all 19 cities and towns under review.

As for finance, the Development scenario takes into account the loan programmes that are already being implemented in Yerevan, Armavir, Metsamor and other communities within the services area of the Nor Akunk company, using resources of WB and KfW, respectively. The scenario also anticipates that the following loan programmes, currently under study, are implemented:

- In Yerevan: the second Municipal development programme - in 2005-2009 using WB resources;
- The programme for rehabilitation of the WSS infrastructure in the Shirak (Gyumri) and Lori (Vanadzor) *marzes* (regions)- in 2005-2006 using KfW resources;
- The municipal WSS rehabilitation programme for the other towns of Armenia – in 2004-2009 using WB resources.

¹³ The targets, the schedule, and the estimated budget (as a percentage of the replacement value of respective assets) are presented in more detail in Tables 1-6, Annex 5.

Accordingly, the scenario takes into account the loans envisaged to implement these programmes, down payment for them, and the required co-funding by the Government of Armenia. It is anticipated that additional resources will be mobilised as well, if such resources are needed to reach the targets set in the Development scenario.

When simulating the Development scenario with FEASIBLE model, expenditure needs as well as supply of finance were calculated only for the 19 cities and towns under review.

Although the focus of this report is the wastewater collection and wastewater treatment sector, the financial strategy cannot ignore the expenditure needs for water supply systems rehabilitation, since this part of the programme for WSS, a) competes for the limited financial resources that are available and allocated to the WSS sector in Armenia, and, b) has a substantial impact both on the selection of the optimum capacity of the wastewater collection (sewerage) and wastewater treatment installations (WWTP), and on the financial position of the WSS sector enterprises (water utilities). This is the reason why relevant expenditures on water supply were also taken into account.

When assessing the availability of finance resources, it was assumed that the financial gap in the Baseline scenario would be gradually eliminated through implementation of the policy package suggested in the Baseline scenario. As for the loans, in cases when the loan disbursement schedule was not determined, it was assumed that an equal share of funds would be disbursed each year, with smaller shares in the first and the last years of the programme.

Results of the Development Scenario simulation

Table 6.1 compares the calculations made for the Development and Baseline scenarios, for the total expenditure needed in the cities and towns under analysis for the 2002-2015 period.

Table 6.1 Expenditure needs for the WSS in the analysed towns for 2002-2015, in base year prices of 2002

Million drams (in 2002 prices)	Scenarios	
	Baseline	Development
WSS, total	547 110	689 389
In that:		
Water supply, total	213 832	193 639
Including:		
Operational costs	89 759	64 539
Rehabilitation	14 975	28 961
• Costs of maintenance, major repairs and replacement of worn-out fixed assets in line with the depreciation rates	122 364	100 085
Wastewater collection and wastewater treatment, total	331 786	493 288
including:		
Operational costs	127 061	138 539
New construction	0	41 795
Rehabilitation	0	104 438
• Costs of maintenance, major repairs and replacement of worn-out fixed assets in line with the depreciation rates	204 725	208 515

Source: calculations based on model FEASIBLE

The calculations are presented in more details in tables 7 and 8, Annex 5. They show that the estimated funds needed for investments in the WSS of the 19 towns totally amount to 176.2 billion drams for the 2002 through 2015 period (some 12.6 billion drams per year).

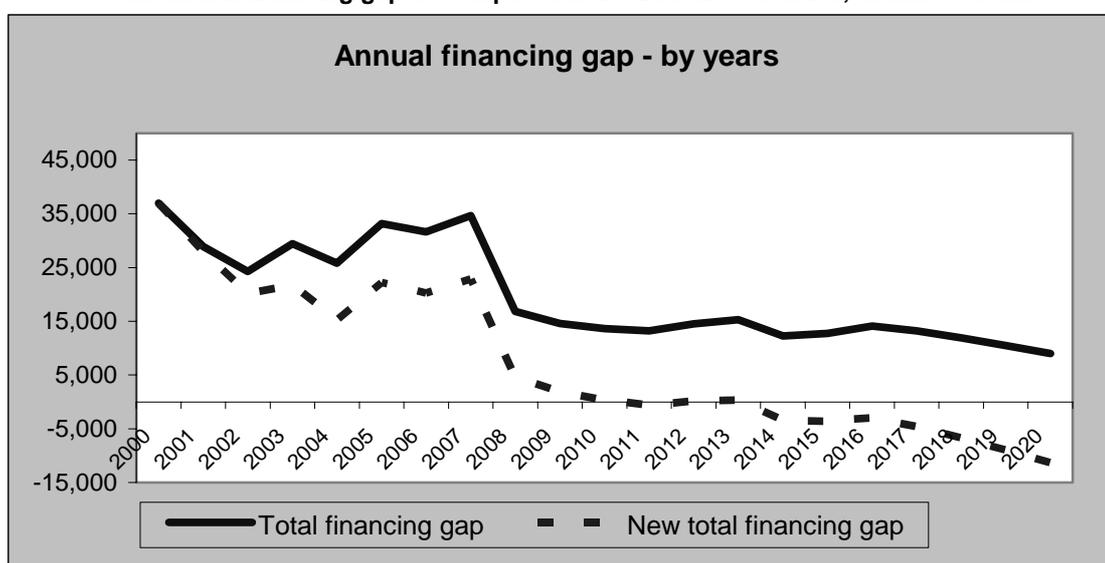
Note that this is in line with the amount of capital investments in the WSS sector anticipated in the Governmental Poverty Reduction Strategy Paper for 2004-2015 (a total 18.1 billion drams a year (on average), with a clear focus on the water supply sector). However, the Poverty Reduction Strategy

Paper does not set rehabilitation of the sanitation infrastructure as a priority and, hence, the financing needs in this sector were not estimated.

Calculations based on the FEASIBLE model demonstrate that more money is needed to finance rehabilitation, maintenance and operation of the wastewater collection and wastewater treatment infrastructure, than in the water supply sector.

A special interim calculation was made with the model to assess the effects of the part of the investment programme related to water supply that includes measures to reduce leaks, to stimulate a more rational use of water, and to save on energy. The results turned out to be very impressive, and established a strong positive financial effect of this part of the programme. Although in the initial period (2003-2007), the financing needs in the Development scenario are higher than in the Baseline scenario, ultimately the water saving measures and, hence, electricity savings, significantly cut costs in the later period. From 2008, these saving amounts to 5.2 million drams per year, 20 billion drams for the entire period, as compared to the Baseline scenario (see figure 6.1 where the solid line refers to the Baseline scenario and the dotted line to the Development scenario). These savings would significantly help funding the investment programme for sanitation.

Figure 6.1 Positive effect of the implementation of the water supply rehabilitation programme – reduction of the annual financing gap as compared to the Baseline scenario, in million drams



Source: FEASIBLE model simulations

In addition, in the Development scenario, significantly reduced water consumption, and the related decrease in the volumes of wastewater discharged, loosens the stress for capacity extension, thus further saving on both capital and operation expenditures, as compared to the Baseline scenario.

Possible gradual elimination of the financial gap

The calculations show that the policy package devised for the Baseline scenario is not sufficient to cover the financial gap in the Development scenario. Therefore, it is recommended that this package is enhanced and supplemented.

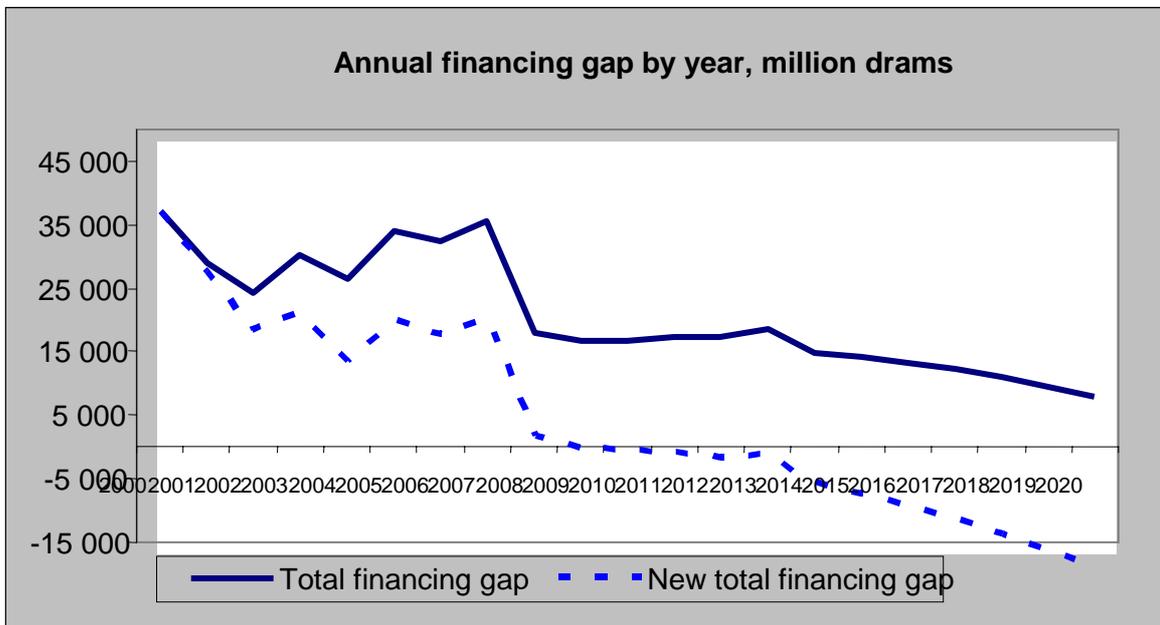
The tentative package of additional measures includes:

- To improve the collection rate of user charges from households up to 94% (from 2006);
- To save costs. In addition to the saving of electricity in the Yerevan Vodocanal, it is assumed that the Armenian Vodocanal will also save 40% of current electricity consumption (75 million kW*h/year). The following should contribute to this aim:

- Construction of gravity water mains, for the Vodocanal's branches in Abovyan, Alaverdi, Stepanavan; gross estimates anticipate that this would cost some USD 8.2 million, and save some 20.0 million kW*h/year;
- Use of turbine pumps in stations located directly on the river banks; in the branches in Abovyan, Razdan, Tsakhkadzor, Stepanavan and Ashtarak, this would cost some USD 1.2 million, and would save 10.0 million kW*h/year.
- To raise the tariff for wastewater collection, from 2007 onward, so that the total tariff for the WSS services increases by 150% against the 2002 rate.

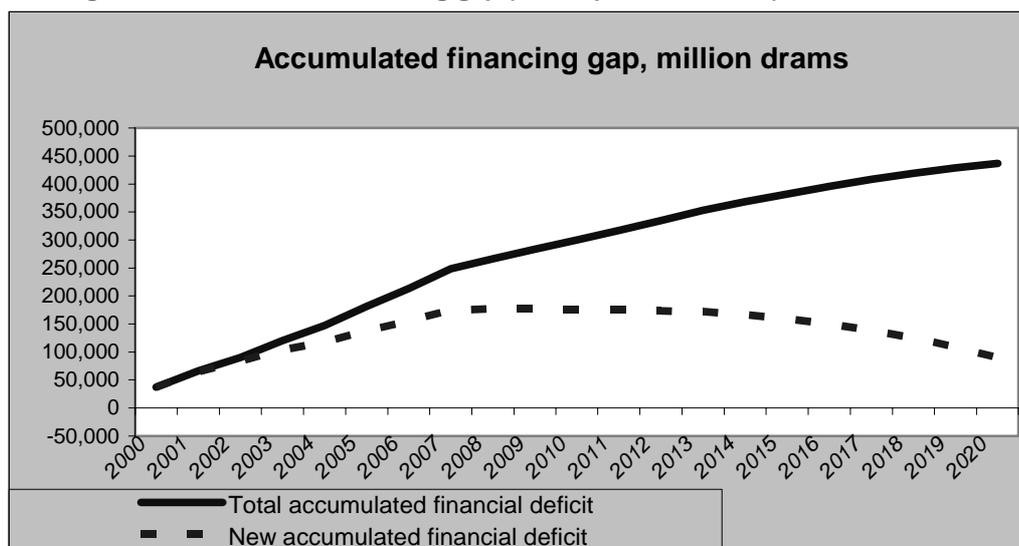
Table 8 in Annex 5 shows the new estimated amount of funds which will be received as a result of the implementation of this extended policy package. Annex 5 also presents the funds that should be available and the annual financial gap for 2002-2015, as they result from the calculation for the Development scenario. The results of the simulation are also shown in the figure 6.2-6.3 below, where the solid line refers to the Baseline, and the dotted line to the Development scenarios.

Figure 6.2 Total annual financing gap (Development scenario), in million drams



Source: FEASIBLE model simulations

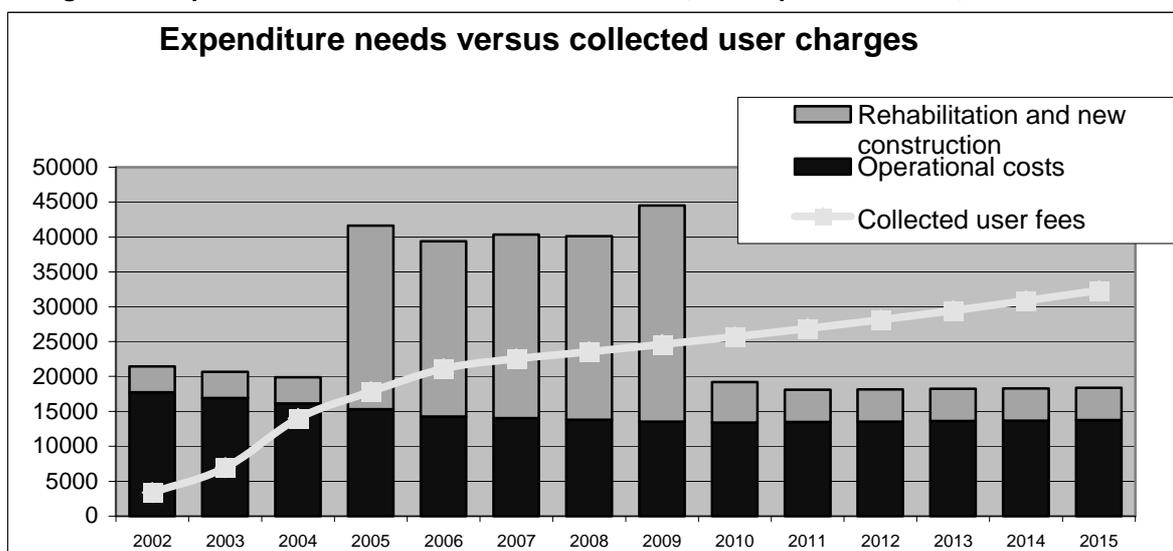
Figure 6.3 Accumulated financing gap (Development scenario), in million drams



Source: FEASIBLE model simulations

As can be seen from fig. 6.2, the total annual financial gap will be eliminated by about 2011. However, the revenues of the Vodocanal enterprises will increase through the implementation of the extended policy package, and this will allow full coverage of the operational costs, from 2005 onwards, and even some additional funds for capital repair and rehabilitation, new construction and replacement of worn-out assets (see fig. 6.4).

Figure 6.4 Expenditure needs versus collected user fees, Development scenario, in million drams



Source: calculations based on FEASIBLE model

The user charges revenues in excess of operation expenditures express the amount of resources which can be used for maintenance, capital repair, rehabilitation, and new construction.

As can be seen from Fig. 6.4 and the Table 8 in Annex 5, the revenues (*i.e.* own resources of the Vodocanal enterprises) will not be sufficient for implementation of the capital investment programme, which has to be implemented to achieve the targets of the Development Scenario. In the full cost recovery hypothesis, (*i.e.* all costs are covered by user charges, except those required for rehabilitation

and new construction), it is necessary to introduce tariff rates at a level of 1350 drams per person per month (on average, for the period of 2002 -2015), which would amount to 7.3% of the average household income (base year 2002). This is far beyond the affordability limit for the population.

Accordingly, it will not be possible to ensure full funding of the costs for maintenance, capital repair and replacement of worn-out assets, using only user charges.

Therefore, it is necessary to retain significant budgetary and/or loan financing for the WSS sector, over the entire 2003-2015 period.

A special calculation was made of the minimum level of average household income that allows to fully covering operation and capital costs of WSS from the user charges, under the assumption that the charges for WSS services do not exceed the affordability limit for the population.

The calculations showed that, depending on the affordability limit (4 or 3%); the average household *per capita* income should be USD 1100 and USD 1450 per annum, respectively. Compare to USD 385, the average household per capita income in Armenia in 2002. Consequently, the financial autonomy of water utilities requires that the average household income is multiplied by 3. In the Baseline scenario, this will only be reached by 2019. Therefore, budgetary and loan financing of the WSS sector in Armenia remains necessary for period under review.

Sensitivity Analysis

A sensitivity analysis of the model has established that the strongest relationships are as follow:

Outcome variable	Key determining variable
Expenditure needs	The costs of rehabilitation of the sewer networks The costs of rehabilitation of the aeration station in the city of Yerevan
Availability of financial resources	The level of the budgetary and loan funding of WSS (in % of the national expenditure budget) The level of fees for WSS services billed to the population (in % of the average per capita income)

7. MAIN CONCLUSIONS AND RECOMMENDATIONS

1. Calculations made with the FEASIBLE model demonstrate that if the financing trend that was formed before 2003 continues over the entire period of 2003–2015, **the total amount of funding allocated to WSS would not be sufficient even to cover current operational costs**, including payment for electricity (assuming that water is supplied 24 hours per day, as planned). To improve the situation in the WSS sector, it is necessary to radically increase funding to the sector. Otherwise it will be impossible, either to implement the plan of restoring 24-hour water supply to the population, or to finance rehabilitation of WWTPs.

2. Understanding the urgency of the problems that have accumulated in the WSS sector, the Government of Armenia has taken a range of measures to improve the financial situation of Vodocanals, and to increase capital investments in the WSS sector. In particular, funding of the WSS from the national budget has been notably increased. The Government of Armenia has already involved, and is planning to involve, in the near future, more foreign loans. It has also taken effective actions to develop metering in households, shifting to billing based on metering and radically improving the collection rate of users' fees.

3. But the transition to payment for metered water consumption was not supported in due time by adequate changes in the structure and level of tariffs, which remained unchanged until April 2004. As a result, installation of water meters has had a negative impact on the total annual billing of the Vodocanals. This resulted from the actual water consumption being much lower than the consumption norms; as a consequence, in Yerevan the amount of current year user charges billed to the population in 2003 were 20% lower than in 2002.

4. On the basis of different tariff scenarios developed in another OECD demonstration project¹⁴, it can be argued that if the tariff increases by 100% 2004, the water bill in Yerevan would stand at 3% of the average household income; it would reach 4% of the income of some 15% of households, but these households would get an income support (or subsidy). On the other hand, assuming that collection rate is maintained at 2003 level, this new tariff rate would guarantee that Yerevan Vodocanal's cash revenues are sufficient to fully finance operation expenditure needs, and Vodocanal would not need public subsidies to bridge the cash flow gap any more.

5. In April 2004 a new tariff was introduced in Armenia, with a 60% rise in Yerevan and 94% in other cities and towns served by the Armenian Vodocanal. Since the tariff in Yerevan was increased less than expected, there is a risk that, during April-December 2004, the Yerevan Vodocanal does not get sufficient cash revenues, and needs public subsidy to bridge the cash flow gap. But such a subsidy was not anticipated in the 2004 State public budget, as the budget was based on the assumption that the tariff increase would secure sufficient billing and revenues (on cash basis) for the Yerevan Vodocanal.

6. It is likely that during the transition from the billing based on consumption norms to the billing based on metering, and for some time after the transition is over, water sold and therefore Vodocanals' billing and collected revenues substantially vary upon time. For that reason, they will be difficult to forecast. Improved collection efficiency would be a positive factor, while factors

¹⁴ "Consumer Protection in Urban Water Sector Reforms in Armenia: Ability to Pay and Social Protection of Low Income Households" (OECD, 2004)

which might have an adverse affect on the billing and collected revenues would be: (a) the difference between consumption norms and actual consumption; and later on (b) price elasticity of demand for water. Uncertainty about these factors will be huge and unavoidable. In order to preserve Vodocanals' revenues (counted on a cash basis) from possible deterioration during the transition period, adequate adjustments in the tariff policy are needed. Otherwise, there is a risk that Vodocanals' fixed costs are not fully covered, even if variable costs are. If revenues are not sufficient, the Regulator might have to increase the tariff further, etc.

7. To prevent such problems, it is recommended, first, to continue public information and awareness campaign, explaining basic economics of the sector to the population (this will improve their willingness to pay), and second, to consider introduction of other tariff formulae. An appropriate formula should provide full coverage of both fixed and variable costs irrespective of the uncertainty about, and variation in, the amount of water sold upon time, while preventing water utilities from the rent seeking behaviour; *e.g.* it could be a two-tier tariff, designed so that the consumers pay a fixed connection fee (per inlet to apartment), sufficient to cover Vodocanal's fixed costs, and a variable fee, equal to metered consumption (in m³) times a rate that assures full recovery of the variable cost.

8. In the WSS of Armenia, there is a significant potential to improve the efficiency of operations of the Vodocanal enterprises. In particular, it is possible to significantly reduce water losses and unaccounted water use, which now amounts to 60-75% of abstracted water. It is also possible to favour a more rational use of water (in particular, stopping the practice of unpaid use of potable water for irrigation), and to save on electricity related costs. FEASIBLE simulations revealed that, from 2005, the ongoing water supply rehabilitation programme in Yerevan may result in a reduction of annual operational cost by AMD 3.2 billion, and of maintenance cost by AMD 2.07 billion (reference year is 2002). This savings will release additional resources to rehabilitate sanitation infrastructure.

9. The measures already taken by the Armenian government to reduce water losses by rehabilitating water supply infrastructure, and to create economic incentives for more rational water use by introducing billing based on metering, need to be complemented by systematic leaks detection and prevention of illegal or unpaid water consumption, applying specific equipment and set of technical and administrative instruments. Recommendation here is to develop and implement a comprehensive Water Demand Management Programme (WDMP) as a key element of the Integrated Water Resource Management (IWRM). Implementing the measures aimed at reducing UFW and assessing actual (metered) water consumption could help to achieve the following:

- **in medium terms** – to optimize water supply and more precisely assess actual demand for the sanitation infrastructure, before starting its rehabilitation and/or construction;
- **in longer term** – to save substantially on capital and current expenditures, when rehabilitating and operating WSS infrastructure.

10. **The Baseline scenario** considers only, in Yerevan, the implementation of the program already launched on rehabilitation of the water supply system, and, in the remaining cities of Armenia, simple maintenance of the service level and condition of infrastructure at the base year level. Calculations made with FEASIBLE model showed that if the financing trend that was formed before 2003 continues over the 2003–2015 period, the annual financing deficit (cash flow dap) would amount to AMD 29 billion. However, the gap could be gradually bridged if, along with the measures currently taken by the Government of Armenia, some additional measures on savings and increasing financing of the sector are implemented. **The package of policy measures** suggested in the report includes: a gradual increase of water bill for households to the affordability threshold (4% of average household income) and an increase of tariffs for other consumers by 125%; the improvement of user charges collection rate **up to 90% by 2006**; the allocation of public funds and international loans to WSS in the said 19 cities and towns, totally amounting to

2.2% of public expenditure budget in 2005-2011 (then gradually decreasing to 1% by 2016); and economies on energy at Yerevan Vodocanal. Annex 4 presents the effect of each individual measure.

11. According to the FEASIBLE model simulations, this package of policy measures would additionally provide some AMD 130 billion over 2004-2015, and, from 2011 would eliminate the annual financing deficit. However, in 2003-2005 the WSS sector would still lack funds for maintenance, major repairs and compensation for depreciation of the fixed assets. But starting from 2006, the two Vodocanals would have some resources that could be invested in rehabilitating existing WWTPs and completing the civil works on some WWTPs.

12. The policies that would be the most difficult to implement would likely be: maintaining the water bill at the level of 4% of average household income - over 2006-2015, and allocating public funds and international loans amounting to 2.2% of the public expenditure budget in 2005-2011. But each individual policy measure in the package is a substitute to the others; accordingly, if any of them cannot be implemented fully, more ambitious targets might be considered for the others. It is important to note, that implementation of the suggested package of policy measures would require strengthening social protection of the population, *e.g.* following the recommendations of the said OECD demonstration project on consumer protection.

13. Since the Baseline scenario suggests that it is possible to bridge the financing gap, more ambitious targets may be set for rehabilitation and development of the urban sanitation infrastructure. Following the discussions with representatives of the Ministries and agencies in Armenia, the following targets for 2015 were identified and formed the basis of the Development Scenario: to substantially increase coverage of sewerage infrastructure and service; and to provide effective mechanical treatment of collected wastewaters in all 19 cities and towns under consideration. To achieve these targets, all existing WWTPs need to be rehabilitated; while some new WWTPs should be constructed, following the schedule presented in Annex 5.

14. Simulations of the Development scenario with FEASIBLE model revealed that its implementation would require substantial capital investments in WSS in the 19 cities and towns under consideration, amounting to a total AMD 176.2 billion over 2002-2015 (that is some AMD 12.6 per annum). These estimates generally are in line with the volumes of investment into the WSS envisaged for 2004–2015 by the Poverty Reduction Strategy Paper, amounting to 217.5 billion drams (AMD 18.1 billion per year), with a clear emphasis on the water supply sector.

15. Results of the calculations made with the FEASIBLE model demonstrate that, for 2003-2006, it will be extremely difficult for Armenia to simultaneously finance two large-scale programmes, one focused on water supply and another on sanitation. Considering the expected financing gap in 2003-2005, it is worthwhile to focus on rehabilitation of water supply systems and implementation of a water demand management programme aimed at reducing UFW. It will bring substantial savings on investment in the wastewater collection and treatment infrastructure in the future, due to a more precise assessment of the capacity required for sewer mains, pumping stations, and wastewater treatment plants.

16. The calculations have also established that, to eliminate the deficit of financing in the Development scenario, in addition to the package of policy measures discussed above, it will be necessary to undertake additional measures on electric power saving at the Armenian Vodocanal; and to improve collection efficiency up to 94% by 2006. Expenditure needs and finance available over 2003-2015, as well as contribution of each source of finance and policy measure, are presented in Annex 5. As a consequence of this package, the revenues of Vodocanal will allow, from 2005, to fully recover the operational costs, and to provide some resources to cover a part of the capital repairs, rehabilitation, new construction and replacement of worn-out fixed assets, in line with the depreciation rates. However, the annual total financial gap in the WSS sector will be eliminated only about 2010.

17. The possibility to gradually bridge the financing gap under the Development scenario proves that, in principle, it is feasible to achieve the set targets for 2015, including restoration of effective mechanical treatment of wastewater in the 19 cities and towns under review, and increased coverage of the population by sewerage. Nonetheless, achieving these targets would be a very challenging task for Armenia, which would require substantial efforts and optimal utilization of all sources of finance.

18. **Financial autonomy** of Water utilities can be set as a long term goal in Armenia; where financial autonomy is defined as the situation where user charge revenues are sufficient to fully cover O&M cost related to the provision of agreed upon levels of services and to the maintenance of existing infrastructure, while the water bill is affordable for an overwhelming majority of households. FEASIBLE model simulations revealed that household annual per capita income at some EUR 1100-1450 is a precondition for financial autonomy of water utilities in Armenia. With this level of income, which exceeds base year 2002 level (EUR 385) by factor 3, the water bill that would ensure full coverage of O&M cost by user chargers would be affordable for an overwhelming majority of households. Achieving this level of income will take quite some years and might not happen before 2015. Therefore, on the review period, the GoA will have to finance capital expenditure in WSS sector from the public budget and from international loans. Besides, the government will have to provide income support to the poor.

19. It is worthwhile to work out a national strategic Programme for rehabilitation of existing sanitation infrastructure and construction of new WWTPs. It would elaborate specific scenarios to increase the coverage by sewerage, and the provision of effective mechanical purification of collected wastewater. The present Financing Strategy provides financial reference points for such a programme.

20. Development of such a target Programme could start from: preparation of water mass balances and a more precise assessment of and forecast for the capacity needed for the sanitation infrastructure in each city and town settlement; and a complete inventory of the wastewater collection and treatment infrastructure, and an evaluation of its technical condition. Research aimed at optimizing the infrastructure and capital investments could be conducted at an early stage, followed by feasibility studies on the design and construction of specific facilities. Donor funds and technical assistance from international organizations could be attracted for the Programme development and implementation. Major sources of capital investments would be public budget and international loans, though private sources could also play a role.

21. Two more recommendations on improving the governance of the WSS sector could help in achieving the targets:

- to improve existing (and to introduce new) instruments and mechanisms for WSS sector management, including **instruments for water demand assessment and management** (water mass balance; water audit and systematic leaks detection; identification and prevention of illegal water consumption; use of water abstraction fees and quotas; water metering and billing; tariff policy and tariffs for end-users, etc.), as well as for energy saving (energy audit); application of these instruments either helps to mobilize additional financing for the WSS sector or brings substantial financial savings, reducing current and capital expenditure needs;
- to integrate a strategic development programme for WSS sector and the related Financing strategy into internal procedures and routines (incl. planning and approval of the tariff policy and rates, of public capital investments and public subsidies, etc.) of the relevant government ministries and agencies, specifically: the Ministry of Finance and Economy, State Committee of Water Economy, the Commission for Public Services Regulation, Ministry of Environment, Ministry of Labour and Social Affaires, etc.

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