# CHAPTER 8 COST ESTIMATE

## 8.1 BASIS OF COST ESTIMATE

The project cost consists of construction cost, equipment cost, engineering service cost, government administration cost, and physical contingency. The project cost is estimated under the following conditions.

- All base costs are expressed under the economic conditions that prevailed in June 1999.
- The exchange rates of currencies are US$1 = ROL 15,756 = ¥122, Euro1 = ROL 16,539 and DM1 = ROL 8,364.
- Equipment cost for WWTP is classified into foreign and local currency portions and rates of them are 70 % and 30 % respectively.
- Engineering service cost is including all services for detailed design, tendering assistance and construction supervision. The cost is assumed at 10% of the construction cost.
- Government administration cost is costs that should be prepared by government and/or executing agency (*e.g.* cost for personnel and organization for the project management, cost for commission for external loan, etc.). The cost is assumed at 2 % of the construction cost.
- All percentages mentioned above are assumed from former example of the same kind of projects.
- Physical contingency allowance is assumed to be 10% of the total of construction, equipment, engineering service, and government administration cost.
- Price escalation is not counted.

## 8.2 CONSTRUCTION COST

The construction cost consists of followings.

- Mobilization and demobilization cost (5% of main works)
- Cost for preparatory works (5% of main works)
- Cost for main works (direct cost and indirect cost)
- Cost for miscellaneous works (10% of main works)

The direct cost for main works (cost for civil work, mechanical/electrical equipment cost, mechanical/electrical equipment installation cost, and construction cost for administration building) are estimated based on the results of preliminary engineering design. Both indirect costs of site expenses and, overhead and profit are estimated at 10% of main works.

The cost for civil and architectural work is estimated by multiplying the quantity of works by unit construction costs. However, since there are no published standard market price list for mechanical/electrical equipment for wastewater treatment, the appropriate price of equipment are determined by obtained quotation from manufacturers that have experience in Romania and/or neighboring countries.

## 8.3 PROJECT COST

Estimated total project cost is about ROL 321,054 million, and its breakdown is shown in *Table II.8.1*. Of the total project cost, ROL 107,265 million or 33% is foreign currency portion, and remaining ROL 213,789 million or 67% is local currency portion.

**Table II.8.1 Project Cost for Tulcea Project**

| | Item | Cost | Foreign currency | Local currency |
|---|---|---|---|---|
| I | **Construction Cost** | **260,596** | **94,235** | **166,361** |
| | Mobilization and Demobilization | 9,307 | 0 | 9,307 |
| | Preparatory Works | 9,307 | 0 | 9,307 |
| | Main Works | 186,140 | 94,235 | 91,905 |
| | Wastewater Treatment Plant | 181,372 | 93,238 | 88,135 |
| | Wastewater Treatment Process | 92,805 | 46,392 | 46,413 |
| | Sludge Treatment Process | 62,486 | 35,045 | 27,441 |
| | Discharge Pumping Station | 20,015 | 11,426 | 8,589 |
| | Power Receiving Facility | 2,565 | 0 | 2,565 |
| | Administration Building | 3,502 | 375 | 3,127 |
| | Interceptor | 4,768 | 998 | 3,770 |
| | Miscellaneous Works | 18,614 | 0 | 18,614 |
| | Site Expenses | 18,614 | 0 | 18,614 |
| | Overhead and Profit | 18,614 | 0 | 18,614 |
| II | **Engineering Service Cost** | **26,060** | **13,030** | **13,030** |
| III | **Government Administration Cost** | **5,212** | **0** | **5,212** |
| IV | **Contingency** | **29,187** | **0** | **29,187** |
| V | **Project Cost** | **321,054** | **107,265** | **213,789** |

(Unit: million ROL)

## 8.4 OPERATION AND MAINTENANCE (O/M) COST

Major portions of O/M cost of the WWTP are electric power charge for the equipment and cost for personnel. The O/M cost for the Tulcea project is estimated at ROL 3,820 million as sown in *Table II.8.2*.

**Table II.8.2 Operation and Maintenance Cost for Tulcea Project**

| Item | Unit | Unit price | Quantity | Total (million ROL) |
|---|---|---|---|---|
| Personnel | ROL/month/ person (average) | 2,000,000 | 40 | 960 |
| Electricity | ROL/kwh | 500 | 449 | 1,938 |
| Chemical | ROL/kg | 5,000 | 342,000 | 171 |
| Excess Sludge Disposal | ROL/$m^3$ | 20,000 | 7,000 | 140 |
| Repairing | 0.5% of Mechanical cost | | 52,660 | 263 |
| Others | 10% of above | | | 347 |
| Total | | | | 3,820 |

# CHAPTER 9 IMPLEMENTATION PROGRAM

## 9.1 IMPLEMENTATION SCHEDULE

The project will be completed within four (4) years from 2000. Pre-construction stage of one (1) year is assumed for the detailed design period and tender process followed by three (3) years' construction works.

Proposed implementation schedule is as shown below.

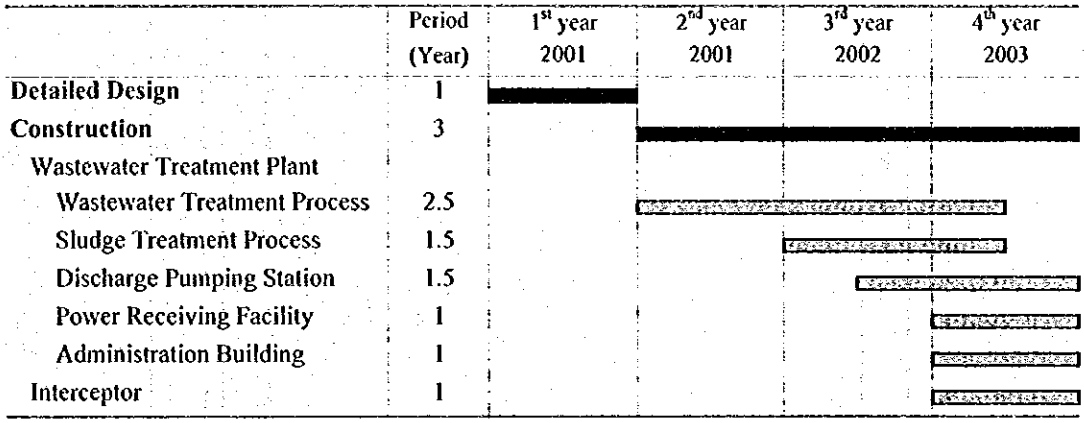



**Figure II.9.1 Implementation Schedule of Tulcea WWTP Project**

## 9.2 DISBURSEMENT SCHEDULE

Proposed annual cost disbursement schedule of the Tulcea WWTP project during entire project period is shown in *Table II.9.1*.

## Table II.9.1 Disbursement Schedule of Tulcea WWTP Project

| | | Total | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Detailed Design | Total | 13,030 | 13,030 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | FC | 6,515 | 6,515 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | LC | 6,515 | 6,515 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Construction | | 266,396 | 0 | 42,242 | 103,453 | 114,901 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mobilization and Demobilization | | 9,307 | | 4,653 | | 4,653 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WWTP Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Wastewater Treatment Process | Total | 92,805 | | 27,843 | 37,122 | 27,839 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | FC | 46,402 | | 9,278 | 18,557 | 18,557 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | LC | 46,413 | | 18,565 | 18,565 | 9,283 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sludge Treatment Process | Total | 62,486 | | 0 | 29,976 | 32,510 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | FC | 35,045 | | 0 | 11,682 | 23,363 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | LC | 27,441 | | 0 | 18,294 | 9,147 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Discharge Pumping Station | Total | 20,015 | | 0 | 9,534 | 10,480 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | FC | 11,426 | | 0 | 3,809 | 7,617 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | LC | 8,589 | | 0 | 5,726 | 2,863 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Power Receiving Facility | Total | 2,565 | | 0 | 0 | 2,565 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | FC | 0 | | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | LC | 2,565 | | 0 | 0 | 2,565 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Administration Building | Total | 3,502 | | 0 | 0 | 3,502 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | FC | 375 | | 0 | 0 | 375 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | LC | 3,127 | | 0 | 0 | 3,127 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Interceptor Construction | Total | 4,758 | | 0 | 0 | 4,758 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | FC | 988 | | 0 | 0 | 988 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | LC | 3,770 | | 0 | 0 | 3,770 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Other Costs | Total | 65,149 | | 9,745 | 26,821 | 28,583 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | FC | 0 | | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | LC | 65,149 | | 9,745 | 26,821 | 28,583 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Construction Supervision | Total | 13,030 | | 4,345 | 4,343 | 4,343 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | FC | 6,515 | | 2,172 | 2,172 | 2,172 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | LC | 6,515 | | 2,172 | 2,172 | 2,172 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Government Administration | | 5,212 | | 845 | 2,069 | 2,298 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Contingency | | 29,197 | 1,303 | 4,743 | 10,007 | 12,154 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| O/M Cost | Total | 374,316 | | | | | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 96,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 96,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 96,666 | 3,666 | 3,666 |
| | FC | 279,000 | | | | | | | | | | | | 93,000 | | | | | | | | 93,000 | | | | | | | | 93,000 | | |
| | LC | 95,316 | | | | | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 |
| Total Disbursement | | 805,270 | 14,333 | 52,173 | 120,852 | 133,696 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 96,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 96,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 96,666 | 3,666 | 3,666 |
| FC | | 386,265 | 6,515 | 11,450 | 36,219 | 53,081 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 93,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 93,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 93,000 | 0 | 0 |
| LC | | 419,105 | 7,818 | 40,723 | 84,633 | 80,615 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 | 3,666 |

# CHAPTER 10 FINANCIAL PLAN AND ANALYSIS

## 10.1 GENERAL

The construction of the WWTP requires huge amount of investment cost which is far beyond the city's affordability. Consequently, soft loan or grant schemes of international financial sources should be introduced to realize the construction. It is quite usual that an application of those schemes require certain portion of the investment cost to be covered by own sources, which would be an evidence of self-assistance efforts of the recipient. In general, the ratio of this self-financed portion is 20 to 40 %, which varies according to the international financial sources.

The problem is that even the amount of the self-financed portion of the investment cost will be far beyond the financial capacity of Tulcea City. It means that during the construction period of the WWTP a considerable part of the self-financed portion should be procured by a subsidy from the state, or by private sector loans. The Study strongly recommends the former solution because of the following reasons.

- Beneficiaries of direct benefit of the project are rather inhabitants downstream of the recipient watercourse than users of sewerage who have already enjoyed the service.
- The recipient watercourse of treated wastewater is the Danube River. The Danube is an international river and the Danube Delta, which is located at the most downstream of the Danube, is listed in the World Natural Heritages. The state should share the responsibility to prevent such international natural resources from degradation.
- The construction is necessary to comply with the relevant EU directives. This compliance will contribute to Romania's EU membership accession, which is one of political goals of the state. Thus, the state is also one of the beneficiaries of the project.

It seems practically and theoretically reasonable to solve the above problem by applying the state subsidy. In this financial plan, the financial arrangement after the start of plant operation will be intensively discussed.

## 10.2 EXTERNAL FINANCIAL SOURCES

As mentioned in Chapter 2 of Part I, there are three external financial sources which may be applicable to the project as shown in the table below.

**Table II.10.1 Assumed Financing Terms for Possible External Financial Sources**

| Financial Organs | Financing Ratio (%) | Loan/Grant | Interest Rate (%) | Repayment Period (Years) | Grace Period (Years) |
|---|---|---|---|---|---|
| EBRD | 70 | Loan | 6.5 | 15 | 3 |
| ISPA | 75 | Grant | - | - | - |
| JBIC | 70 | Loan | 2.7 | 30 | 10 |

Supposing, EBRD, ISPA, or JBIC agreed to finance the project, the terms and conditions would be like in *Table II.10.1*. However, they are nothing other than an example or assumption. It is necessary to make quantitative assumptions regarding financing to evaluate financial feasibility of the project. In the case of EBRD, financing ratio depends on the circumstances and interest rate fluctuates in parallel with LIBOR (London Inter-bank Offered Rate).

## 10.3 APPROACHES TO PREPARE FINANCIAL PLAN

### 10.3.1 FRAME OF FINANCIAL PLAN

The financial plan was studied based on the operational structure of the sewerage service explained in Chapter 2 of Part I. In brief, S.C. ACET S.A. renders operation and maintenance of the sewerage service based on a concession contract with Tulcea City. Tulcea City procures necessary investment cost and pays principal and interest of loans, if any. The city owns facilities including the WWTP, and depreciates them.

#### (1) Account of S.C. ACET S.A.

S.C. ACET S.A.will collect the sewerage charges, bear the operation and maintenance cost, and pay the lease fee to the city. Financial indicators of S.C. ACET S.A.were set as follows.

- Cumulative working capital, as an indicator of company's sustainability
- Profit rate, as an indicator of possibility of privatization

The cumulative working capital means summation of working capitals of precedent years. Unless the value falls minus, the company can escape from insolvency.

In this financial plan, the profit rate is defined as the rate of average profit after tax to average revenue over the project period. A certain level of profit rate may be required to drive a private sector's investment will in the privatization.

#### (2) City's Sewerage Service Account

This financial plan introduced a concept of city's sewerage service account in order to examine a financial burden of the city accrued by the project, though it was not clear for the concept to be materialized.

The city's sewerage service account will receive a lease fee, depreciate the facilities including the WWTP, and pay principal and interest of loans, if any. If the lease fee can not cover the total amount of depreciation cost and payment of principal and interest of loans, the account needs subsidies from the city's general account budget.

#### (3) Financial Capacity of the City

Following two (2) financial indicators of the city's general account are very important for realization of the project.

- The ratio of an annual payment of principal and interest to a current revenue of each year
- The ratio of subsidy to the sewerage service account to a current revenue of each year

The former is one of the major criteria for obtaining the state guarantee for external loans. If the ratio in any year will exceed 20 %, the ministry of finance will not agree to issue the state guarantee.

The latter shows whether the required subsidy is within the city's affordability.

### 10.3.2 MAJOR PRECONDITIONS AND ASSUMPTIONS

Following preconditions and assumptions were applied in the financial plan.

- The financial plan deals with only the cost and the revenue accrued by the project.
- Currency unit is ROL and the value of ROL is expressed as the June 1999 prices.
- Projection period is 30 years since the start of project implementation.
- Target year is 2010. From 2010 on the values of variables related to revenues and O & M cost are assumed to keep the 2010 level.
- Implementation period is 4 years from 2000 to 2003.
- 38 % of profit before tax is levied as a corporate tax.

Depreciation period is assumed as follows.

**Table II.10.2 Depreciation Period**

| Item | Mechanical equipment | Civil works and sewer pipes |
|---|---|---|
| Depreciation period | 8 years | 40 years |

## 10.4 REVENUE

### 10.4.1 ESTIMATION METHOD

The revenue of S.C. ACET S.A. consists of collected domestic and non-domestic sewerage charges. In this financial plan, both charges were estimated based on following assumptions.

- The tariff of each charge is set as a unit price per $m^3$.
- The unit price of domestic sewerage charge is determined based on the proportion to average household income.
- The unit price of non-domestic sewerage charge is determined in proportion to that of domestic charge.

Based on the above assumptions, the unit prices and revenue of S.C. ACET S.A. were calculated as follows.

- $UP_d = X \times Income / Q_d / H_{serv}$
- $UP_{nd} = b \times UP_d$
- Annual Revenue = $( UP_d \times Q_d + UP_{nd} \times Q_{nd} ) \times$ Charge Collection Rate

where,

$UP_d$ : unit price of domestic sewerage charge,
$UP_{nd}$ : unit price of non-domestic sewerage charge,
$X$ : ratio of domestic charge to household income,
$b$ : coefficient,
*Income* : average annual household income,
$Q_d$ : quantity of domestic sewerage per year,
$Q_{nd}$ : quantity of non-domestic sewerage per year, and
$H_{serv}$ : number of sewerage served household.

In above equations, all independent variables and coefficients except $X$ were estimated as mentioned in following sub-sections. Subsequently, the revenue of S.C. ACET S.A. can be estimated when the variable $X$ is given.

### 10.4.2 SERVED POPULATION

As mentioned in the chapter 3, the sewerage served population in 2010 was estimated 73,000. It was assumed that the present population increases linearly until 2010 and ever since remains 73,000. In addition, the household size was assumed to be constant at present value of 3.2 persons/household.

The numbers of served population and served household were estimated as follows.

**Table II.10.3 Number of Served Population and Household**

| Year | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | from 2011 |
|---|---|---|---|---|---|---|---|---|
| Served population | 71,000 | 71,333 | 71,667 | 72,000 | 72,333 | 72,667 | 73,000 | 73,000 |
| Served household | 22,188 | 22,292 | 22,396 | 22,500 | 22,604 | 22,708 | 22,813 | 22,813 |

### 10.4.3 QUANTITY OF WASTEWATER

Similar to the served population, the quantity of wastewater was assumed to increase linearly from the present value to the estimated value in 2010, and since ever to remain at the level in 2010. Non-domestic wastewater is composed of commercial, institutional and industrial ones.

The estimated quantities of domestic and non-domestic wastewater are as follows.

**Table II.10.4 Quantity of Domestic and Non-domestic Wastewater**

(Unit : 1,000 $m^3$/year)

| Year | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | from 2011 |
|---|---|---|---|---|---|---|---|---|
| . Domestic | 5,682 | 5,895 | 6,111 | 6,328 | 6,547 | 6,767 | 6,990 | 6,990 |
| Non-domestic | 4,711 | 4,832 | 4,953 | 5,075 | 5,198 | 5,322 | 5,446 | 5,446 |

The coefficient *b*, the ratio of non-domestic sewerage charge to domestic one, was estimated 2.20 based on the values in 1998 and 1999.

### 10.4.4 HOUSEHOLD INCOME

The average monthly household income was estimated at ROL 2,088,267 as of 1999 based on the result of the people's awareness survey conducted in this study. It was assumed to grow 3 % per year until 2010, and to remain the level of 2010 whereafter. The annual household income was calculated by multiplying the monthly value with 12.

The estimated average annual household income is as follows.

**Table II.10.5 Average Annual Household Income**

(Unit : 1,000 ROL/year)

| Year | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | from 2011 |
|---|---|---|---|---|---|---|---|---|
| Annual Household Income | 29,050 | 29,922 | 30,820 | 31,744 | 32,697 | 33,677 | 34,688 | 34,688 |

### 10.4.5 COLLECTION RATE

The charge collection rate was assumed to linearly increase from 81.4 % in 1999 to 95% in 2010, then remain 95% ever since.

The collection rate of sewerage charge was estimated as follows.

Table II.10.6 Sewerage Charge Collection Rate

| Year | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | from 2011 |
|---|---|---|---|---|---|---|---|---|
| Collection Rate | 87.6 % | 88.8 % | 90.1 % | 91.3 % | 92.5 % | 93.8 % | 95.0 % | 95.0 % |

## 10.5 PREPARATION OF ALTERNATIVES

### 10.5.1 EXTERNAL FINANCIAL SOURCES

Following four (4) alternatives of external financial sources were analyzed.

- Alternative I: EBRD covers 70 % of the total investment cost.
- Alternative II: EBRD covers 50 % of the total investment cost, and ISPA does 50% of that.
- Alternative III: EBRD covers 30 % of the total investment cost, and ISPA does 70%of that.
- Alternative IV: JBIC covers 70 % of the total investment cost.

### 10.5.2 LEVEL OF LEASE FEE

Following two (2) alternatives of lease fee level were analyzed.

- Alternative A: 100 % of repayment of principal and interest, and depreciation cost
- Alternative B: 50 % of repayment of principal and interest, and depreciation cost

The alternative A is equivalent to be the case in which all the cost related to the construction and large scale rehabilitation will be borne by the users. Under the alternative B, Tulcea City should absorb 50 % of the cost related to the construction and large scale rehabilitation.

### 10.5.3 LEVEL OF SEWERAGE CHARGE

The people's awareness survey conducted in this study revealed that the average household's monthly willingness to pay for sewerage services was ROL 14,019 as of 1999, equivalent to 0.68 % of the average monthly household income. On the other hand, the World Bank recommends 2.00 % of a household income as the affordability limit for sewerage charge. The adequate level of the charge seems between the former and the latter.

Currently, the monthly sewerage charge per household is equivalent to 0.38 % of the income. According to the preconditions and assumptions mentioned before, this portion was deducted from the revenue of this financial plan. It means that the following charge levels are increment values of sewerage service charge.

Following three (3) alternatives of sewerage charge level were analyzed.

- Alternative 1: Minimum level. 0.30 % ( = 0.68 % – 0.38 %) of the income
- Alternative 2: Mean level. 0.96 % of the income
- Alternative 3: Maximum level. 1.62 % ( = 2.00 % – 0.38 %) of the income

### 10.5.4 PREPARED ALTERNATIVE CASES

In total 24 alternative cases, which were combination of the abovementioned alternatives, were analyzed. The case code was assigned like 'Case IA1', 'Case IIIB2', and so on. For example, Case IA1 means a combination of the alternative I for external financial sources, the alternative A for lease fee, and the alternative 1 for sewerage service charge.

## 10.6 PROPOSED FINANCIAL PLAN

### 10.6.1 RESULT OF ALTERNATIVE STUDY

The financial statements were prepared for the abovementioned 24 alternative cases. The structure of applied financial statements is as follows.

**Table II.10.7 Structure of Applied Financial Statements**

| S.C. ACET S.A. account | |
|---|---|
| Revenue | A |
| Operation and maintenance cost | B |
| Lease fee | C |
| Profit before tax | D = A – B – C |
| Corporate tax | E = D × 0.38 |
| Profit after tax | F = D – E |
| Working capital | G = F |
| Cumulative working capital | H = Σ G |
| City's sewerage service account | |
| Revenue from lease fee | I = C |
| Depreciation | J |
| Payment of interest | K |
| Profit | L = I – J – K |
| Loan | M |
| Subsidy from general budget | N |
| Depreciation | O = I |
| Sources | P = L+M+N+O |
| Investment cost | Q |
| Payment of principal | R |
| Applications | S = Q + R |
| Working capital | T = P – S |
| Cumulative working capital | U = Σ T |
| City's general account | |
| City general revenue | V |
| Corporate tax from S.C. ACET S.A. | W = E |
| Revenue from lease fee | X = I |
| Total current revenue | Y = V + W + X |
| Subsidy | Z = N |
| Subsidy ratio | AA = Z/Y |
| Repayment ratio | AB = (K + R)/Y |

The result of the alternative study is shown in *Table II.10.8*. Major findings are as follows.

- It is not possible for S.C. ACET S.A. to run the service with the minimum level of sewerage service charge.
- If Tulcea City can shoulder 50 % of repayment and depreciation, S.C. ACET S.A. can run the service with the mean level of sewerage service charge.
- The maximum charge level enables S.C. ACET S.A. to render a sustainable WWTP operation even with the lease fee covering 100 % of repayment and depreciation.

## Table II.10.8 Result of Financial Alternative Study for Tulcea WWTP Project

| Case I: EBRD 70% | | | S.C. ACET S.A. | | Tulcea City | |
|---|---|---|---|---|---|---|
| Lease fee | Sewerage charge level | Case code | Sustainability | Profit rate | Repayment criterion | Max subsidy ratio |
| 100% of depreciation and repayment | Minimum (0.30 % of income) | Case IA1 | × | -441.9% | × (ave. 25.9%) | |
| | Mean (0.96 % of income) | Case IA2 | × | -69.4% | × (ave. 25.9%) | |
| | Maximum (1.62 % of income) | Case IA3 | × | -1.1% | × (ave. 25.8%) | |
| 50% of depreciation and repayment | Minimum (0.30 % of income) | Case IB1 | × | -202.2% | × (ave. 29.9%) | 38.6% |
| | Mean (0.96 % of income) | Case IB2 | × | 3.0% | × (ave. 29.8%) | 38.6% |
| | Maximum (1.62 % of income) | Case IB3 | ○ | 27.3% | × (ave. 28.3%) | 36.8% |

| Case II: EBRD 50% + ISPA 50% | | | S.C. ACET S.A. | | Tulcea City | |
|---|---|---|---|---|---|---|
| Lease fee | Sewerage charge level | Case code | Sustainability | Profit rate | Repayment criterion | Max subsidy ratio |
| 100% of depreciation and repayment | Minimum (0.30 % of income) | Case IIA1 | × | -367.5% | × (ave. 19.3%) | |
| | Mean (0.96 % of income) | Case IIA2 | × | -46.1% | × (ave. 19.3%) | |
| | Maximum (1.62 % of income) | Case IIA3 | ○ | 8.2% | × (ave. 19.0%) | |
| 50% of depreciation and repayment | Minimum (0.30 % of income) | Case IIB1 | × | -165.0% | × (ave. 21.9%) | 30.6% |
| | Mean (0.96 % of income) | Case IIB2 | ○ | 10.6% | × (ave. 21.6%) | 30.4% |
| | Maximum (1.62 % of income) | Case IIB3 | ○ | 31.6% | × (ave. 20.5%) | 28.9% |

| Case III: EBRD 30% + ISPA 70% | | | S.C. ACET S.A. | | Tulcea City | |
|---|---|---|---|---|---|---|
| Lease fee | Sewerage charge level | Case code | Sustainability | Profit rate | Repayment criterion | Max subsidy ratio |
| 100% of depreciation and repayment | Minimum (0.30 % of income) | Case IIIA1 | × | -293.1% | ○ | |
| | Mean (0.96 % of income) | Case IIIA2 | × | -22.9% | ○ | |
| | Maximum (1.62 % of income) | Case IIIA3 | ○ | 16.9% | ○ | |
| 50% of depreciation and repayment | Minimum (0.30 % of income) | Case IIIB1 | × | -127.8% | ○ | 22.1% |
| | Mean (0.96 % of income) | Case IIIB2 | ○ | 17.9% | ○ | 21.8% |
| | Maximum (1.62 % of income) | Case IIIB3 | ○ | 35.8% | ○ | 20.7% |

| Case IV: JBIC 70% | | | S.C. ACET S.A. | | Tulcea City | |
|---|---|---|---|---|---|---|
| Lease fee | Sewerage charge level | Case code | Sustainability | Profit rate | Repayment criterion | Max subsidy ratio |
| 100% of depreciation and repayment | Minimum (0.30 % of income) | Case IVA1 | × | -405.4% | ○ | |
| | Mean (0.96 % of income) | Case IVA2 | × | -58.5% | ○ | |
| | Maximum (1.62 % of income) | Case IVA3 | × | 1.5% | ○ | |
| 50% of depreciation and repayment | Minimum (0.30 % of income) | Case IVB1 | × | -183.9% | △ (ave. 18.3%) | 17.1% |
| | Mean (0.96 % of income) | Case IVB2 | ○ | 6.5% | △ (ave. 18.3%) | 17.1% |
| | Maximum (1.62 % of income) | Case IVB3 | ○ | 29.4% | ○ | 16.2% |

Legend :
○ = Meet the requirement, △= Slightly fail to meet the requirement, × = Not satisfy the requirement.
Sustainability : Cummulative working capital in any year > 0
Profit rate : Ratio of an average profit after tax to an average revenue over the project period
Repayment criterion : Total repayment of each year should be less than 20% of current revenue of the city (ave. means average of the ratio over the project period)
Subsidy ratio : Ratio of subsidy (depreciation + repayment - lease fee) to current revenue of the city

- If more than 50 % of the investment cost is covered by EBRD, the ratio of the repayment to the city's current revenue will exceed 20 %, which may jeopardize an issuance of the state guarantee for the loan.
- The maximum ratio of the city's subsidy to the city's current revenue is dominated by the external financial source. The higher interest rate and shorter repayment period of EBRD make it difficult for the City to subsidize S.C. ACET S.A.

### 10.6.2 PROPOSED FINANCIAL PLAN

Accessibility to the external financial sources of each city council highly depends on the Government's policy and the policy of the external financial sources. Those policies also vary time to time. If the study proposes a financial plan with fixing a financial source and a city council fails to access to the proposed financial source, the proposed financial plan does not work any longer. Thus, it would not be realistic to propose a financial plan with a fixed financial source.

Therefore, the study proposes the financial plans by the financial arrangements discussed in the previous section. In the preparation of the financial plans, following general rules were set out:

- To secure a sustainability of a private company, the lease fee and sewerage charge level are set out so as to keep the cumulative working capital being over zero in any year.
- To secure the progress of the privatization, the lease fee and sewerage charge level are set out so as to generate a profit more than 5 %.
- As far as the case does not require an exemption of the repayment criterion, the lease fee is set at 50%. This reflects an idea that users paying all the costs including the investment costs is a grinding charge system as beneficiary of the wastewater treatment are not limited to the users.
- In case where the exemption is required, the 100 % lease fee is adopted to show efforts of the user side to convince the state to apply the exemption.
- Satisfying above rules, a sewerage charge is set at a milder level.

The proposed financial plan for each financial arrangement is summarized in *Table II.10.9*. Since the repayment period of the EBRD loan is rather short and its interest is high, the annual repayment exceeds the repayment criterion when EBRD loan is applied, except Case III. In case of Tulcea, even if the JBIC loan is applied, the repayment criterion slightly exceeds 20 %. Therefore, a flexible application of the repayment criterion is recommended.

**Table II.10.9 Proposed Financial Plan**

| Case | Financial arrangement | Lease fee | Sewerage charge | Remarks |
|---|---|---|---|---|
| I | 70% EBRD<br>+ 30% Self-financing | 50% of depreciation and repayment | Maximum level<br>(1.62 % of income) | Over repayment criterion |
| II | 50% EBRD<br>+ 50% ISPA | 100% of depreciation and repayment | Maximum level<br>(1.62 % of income) | Over repayment criterion |
| III | 30% EBRD<br>+ 70% ISPA | 50% of depreciation and repayment | Mean level<br>(0.96 % of income) | |
| IV | 70% JBIC<br>+ 30% Self-financing | 50% of depreciation and repayment | Mean level<br>(0.96 % of income) | Slightly over repayment criterion |

### 10.6.3 FINANCIAL ANALYSIS BY CONVENTIONAL METHOD

The proposed financial plans were prepared to be feasible from the viewpoints of financial sustainability and privatization possibility of S.C. ACET S.A., financial capacity of the city's budget, and the applicability of the state guarantee for external loans. For the preparation of feasible financial plan, profit and loss statements and cash flow statements were prepared for alternative cases. This method makes financial analysis more realistic and more detail.

Conventional method of financial analysis requires only the revenue and expenditure of the project. For the comparative purpose, FIRR (Financial Internal Rate of Return), which is one of indicators of conventional financial analysis, was calculated.

The revenue of the project is collected sewerage charges, which vary according to a level of the sewerage charge. FIRR was calculated with the maximum and the mean levels of the charge.

The calculated FIRRs are as follows.

- FIRR is 2.7 % at the maximum level of sewerage charge.
- FIRR is not available at the mean level of sewerage charge.

The result reveals the difficulty in implementing sewerage services with full financial independence. In other words, it shows the necessity of a certain level of financial assistance from public sector such as a subsidy for construction cost.

# CHAPTER 11 ENVIRONMENTAL IMPACT ASSESSMENT

## 11.1 OBJECTIVES

A preliminary Environmental Impact Assessment (EIA) has been conducted under the Study based on the Romanian regulations.

The objectives of the EIA are as follows:

- To review the existing environmental conditions in EIA study area;
- To assess environmental impacts of the proposed projects; and
- To propose countermeasures for mitigating impacts and environmental monitoring plan.

The existing environmental conditions in/around the project site and the evaluation of impacts due to the proposed project are summarized in *Table II.11.1*. The countermeasures for mitigating and environmental monitoring plan are recommended in *Table II.11.2*.

## 11.2 NATURAL/ENVIRONMENTAL IMPACTS

**Water Quality Improvement:** Poor wastewater disposal practices are one of the major causes of pollution in the region. The disposal of raw wastewaters to the Danube River and reliance on on-site wastewater disposals have resulted in pollutant loads in the waterways and the Danube River. Improvement in the quality of water in the Danube River will reduce the level of pollutants significantly, including heavy metals and other hazardous materials. Because of the expected reduction of the major pollutant loads from the sewerage system, the public living conditions, as well as fauna and flora in the area, will be improved.

**Topography, Geology and Hydrological Impacts:** Construction of the WWTP and relating facilities may not affect adversely to natural conditions of the surrounding areas. Topographic and geological changes due to the construction works will be minimal, and may not cause significant adverse impacts to the surrounding areas.

**Temporary Hazards:** Although during the construction stages, some limited areas near the construction sites or along the major roads may be affected by dusts, noise or vibrations to some extent, but these can be prevented by careful controlling measures.

## 11.3 ECONOMIC AND SOCIAL IMPACTS

As summarized in *Table II.11.1*, each of environmental parameters has been assessed and evaluated from the viewpoints of economic, socio-economic, physical-chemical, ecological, and aesthetic aspects.

**Domestic Users:** Residential areas will be served by a combination of interceptors and sewerage. This, in combination with the collection and treatment of industrial wastewater, will reduce the amount of pollutants flowing into the waterways and finally to the Danube River. The major benefits for residents will be a reduction in noxious odors and, if combined with improvement of public health, a reduction in water-related disease.

**Industrial Users:** An improved wastewater system will result in reduced overall costs for factories in comparison to onsite treatment, although it will mean higher operating costs for factories that are currently spending inadequate amounts on treatment or have no treatment facility at all. Factories and commercial operations will also be required to pay for the costs of their connection to the sewers. Overall, however, operating costs are likely to comprise a relatively small proportion of factory turnover.

**Negative Impacts:** Although every effort has been and will be made for the planning, design and construction of an optimum system, and proper methods and schedules for the construction works of the project facilities, it may not be possible to completely eliminate the impacts due to the project implementation. Such residual or unavoidable impacts in the future, although not significant, may include as follows.

- Increase in traffic volume along the roads connecting the new WWTP,
- Increase of demand for electricity of WWTP operation, and
- Loss of agricultural production due to conversion of the agricultural lands to the new WWTP site.

## 11.4 OVERALL REMARKS

As shown in *Table II.11.1*, the assessment has resulted that the overall project appears to be well planned to achieve maximum benefits for the local people, which will surely enhance socio-economics and quality-of-life values of the region.

The assessment results can be summarized as follows:

- The proposed project as a whole has positive environmental impacts in the area's water environment and the public health of the residents in the City through the improved service standards for the wastewater management;
- Construction or improvement activities for sewers, pumping stations and wastewater treatment plant throughout the project area may cause nuisances to the residents, but such hazards could be limited by giving careful considerations on the methods of construction and proper management of the sewerage system; and
- Connection of the wastewater currently being discharged to the public waterways to the sewer system will significantly improve the water quality in the Danube River;
- The beneficial effects of the project outweigh the adverse effects; and
- As certain items in the preliminary EIA need to be further clarified from engineering viewpoints, further studies will be made on the extent of impacts, mitigation and remedial measures, including the impacts possibly caused by the construction, operation and maintenance works of the WWTP and related facilities.

## Table II.11.1 Existing Condition and Evaluation of Impacts by Proposed Project in Tulcea (1/2)

| Item | Survey Results | Evaluation of Impacts |
|---|---|---|
| 1.Resettlement | At present the number of illegal inhabitants is limited (7 small houses, under 35 inhabitants), and resettlement will be solved before starting the construction by Tulcea Municipality. It is estimated that total resettlement costs will be about 767 millions Lei (or 48,000 US $). | ○ |
| 2.Noise, Vibration and Traffic | Based on the noise measurements the present noise level at proposed WWTP site is under Romania Standard [65 dB(A), (STAS 10009-88] , however, during the construction stage heavy equipment and vehicles (bulldozers, power shovels and dump trucks etc.) will be put in operation. The countermeasures for noise should be considered.<br>Concerning the vibration, no significant vibration sources exist.<br>The results of traffic-flow survey at present access road indicate that the traffic-flow is around 16 to 20 vehicles/hr during the period of 7 a.m. to 4 p.m., therefore, traffic congestion problem could be negligible. | △ |
| 3.Water Rights and Rights of Common | The survey results revealed that there are no impacts on fishing rights, water rights and rights of common. | ○ |
| 4.Public Health Condition | The results of wastewater characteristics survey at existing outfall revealed that the number of total Coliform Group in raw wastewater, which now is discharged directly into Danube River without any treatment, is about $1\times10^7$ no./100ml to $1\times10^8$ no./100ml. While the number of total Coliform Group in Danube River (1 km downstream from the outfall of proposed WWTP) is $2.4\times10^3$ no./100ml to $3.5\times10^3$ no./100ml, which exceeded the standard ($1\times10^2$ no./100ml, STAS 12585/1987) of water for swimming purposes.<br>According to the F/S Study after WWTP being put into operation the existing outfall will be closed and wastewater will be collected and treated at WWTP. The number of total Coliform Group in WWTP effluent will be meet the standard ($1\times10^6$ no./100ml, NTPA 001) of wastewater discharged in water resources. Hence, during WWTP operation stage the public health condition will be improved certainly. | ○ |
| 5.Waste | At present the capacity of solid waste disposal site in Tulcea is enough for disposing excess sludge (19 $m^3$/d or 3.8 t/d) generated from WWTP. However, the concentrations of the organic substances ($BOD_5$: 2,988 mg/l, $COD_{Mn}$: 6,770 mg/l), $NH_4$-N (548 mg/l) and oil (278 mg/l) etc. in the leachate from the solid waste disposal site exceeded the standard (NTPA 002/1997) of wastewater discharged into municipal sewage system substantially. In addition, the number of total Coliform Group is relative high ($5.4\times10^8$ no./100ml). All of these may contribute a negative impact on groundwater. | △ |
| 6.Hazards (Risk) | Based on the results of geological survey, a careful aseismatic structure design will be considered in the planning and design of the wastewater treatment facilities. | ○ |
| 7.Topography and Geology | Based on the results of geological survey, a careful aseismatic structure design will be considered in the planning and design of the wastewater treatment facilities. | ○ |
| 8.Groundwater | Because it was not possible to take groundwater samples in/around the solid waste disposal site, the situation of groundwater quality is not clear. However, from the results of groundwater and leachate survey in Braila, Galati and Constanta, the groundwater in these cities is polluted at some extent, especially for the Coliform Group. Considering the facts that the concentrations of $BOD_5$, $COD_{Mn}$, $NH_4$-N and oil etc. in the leachate from the solid waste disposal site in Tulcea exceeded the standard of NTPA 002/1997 substantially, it is conjectural that the groundwater is polluted at some extent similar to Braila, Galati and Constanta. Hence, the countermeasures are considered to be necessary. | △ |

**Table II.11.1 Existing Condition and Evaluation of Impacts by Proposed Project in Tulcea (2/2)**

| Item | Survey Results | Evaluation of Impacts |
|---|---|---|
| 9.Hydrological Situation | The effluent flow of WWTP is insignificant comparing with the flow of Danube River, so the effects of effluent on hydrological situation of the River are negligible. In addition, the pollutant diffusion and dilution characteristics are analyzed using "MIKE 11" model, the calculation results indicated that complete mixing is achieved at a distance of 2,2 km downstream of WWTP outfall in all cases studied here. | ○ |
| 10.Fauna and Flora | Now the raw wastewater is discharged directly into Danube River, after the WWTP being put into operation, there will be no change about flow rate. In addition, as mentioned in Water Pollution Item the pollutants load will be reduced substantially. Therefore, it is expected that the living conditions of fauna and flora will be improved by implementing the Project. | ○ |
| 11.Water Pollution | The results of industrial wastewater survey revealed that the concentrations of toxic materials, which may effect biological process for wastewater treatment, are under the standard of NTPA 002/1997. This can leads the conclusion that industrial wastewater will don't contribute a significant impact on WWTP influent characteristics.<br>According to the F/S Study 1,513 tons of $BOD_5$ and 1,621 tons of SS per year (2010) will be no more discharged into Danube River, so the impacts on the water quality during WWTP operation will be a positive one.<br>Moreover, 243 tons of $BOD_5$ and 270 tons of SS per year (2010) will be discharged into Danube River with WWTP effluent. Based on the results of simulation the maximum concentrations of $BOD_5$ and SS at downstream of complete mixing section (about 2.2 km downstream from the outfall of proposed WWTP) will be under the Maximum Allowable Concentration (MAC) of second quality category in STAS 4706/1998 (surface water quality). | ○ |
| 12.Soil Contamination | According to the analysis results of soil (WWTP site, solid waste disposal site and agricultural field) and sludge generated in existing WWTP of Roman and Constanta, the heavy-metal concentrations in soil samples and sludge samples are under the Romania Standard. This creates a possibility to utilize excess sludge in agriculture. | ○ |
| 13.Offensive Odor | The survey results revealed that the concentrations of $H_2S$ (0 mg/m³), $NH_3$ (0.115 mg/m³) and odor level (Level 1) on the WWTP boundary fence are under Romania Standard 12574/1987 ($H_2S$: 0.015 mg/m³, $NH_3$: 0.3 mg/m³ and odor level: Level 5). The results of existing WWTP survey in Constanta are presented as following:<br><br>Item — WWTP boundary fence — 150 m from WWTP boundary fence<br>$H_2S$ — 0.35 mg/m³ — 0.033 mg/m³<br>$NH_3$ — 0.3 mg/m³ — 0.10 mg/m³<br>Odor — Level 4 — Level 3<br><br>Finally it is evaluated that the offensive odor levels at adjacent areas to the WWTP site would generally be within acceptable levels, considering the facts that the distance from WWTP site to the housing areas is more than 300 m and there are no inhabitants on the leeward of WWTP site. | ○ |

○: nothing or negligible

△: not serious or minor

## Table II.11.2 Countermeasures for Mitigating and Environmental Monitoring Plan in Tulcea

| Impact Item | Countermeasure |
|---|---|
| 1.Noise, Vibration and Traffic | The use of such heavy construction equipment as bulldozers, power shovels, pile drivers, etc. will be prohibited in early morning or late night. Construction works will be prohibited on Sundays and holidays.<br><br>Installation of acoustic walls and plant buffer zones around construction site.<br><br>It is recommended to use low noise and low Vibration equipment as possible during construction.<br><br>Dump trucks and other heavy vehicles should also be operated at reasonably low speed so as to prevent unnecessary vibration along the routes.<br><br>During construction works, noise and vibration levels should be checked at least once a month at fixed observation points along the site boundary.<br><br>Before construction the Contractor shall prepare the detail plan to mitigate impacts on noise, vibration and traffic, then submit the plan to the Municipality. |
| 2.Groundwater and Waste | Groundwater insulation-type landfill disposal plant is recommended to protect groundwater from polluting. In this case it is recommended to install the leachate collecting system and to discharge leachate after to be treated, especially disinfection treatment.<br><br>The groundwater quality (at least $Cl^-$, $COD_{Mn}$, Coliform Group and typical heavy metals) should be checked 2 to 4 times per year in order to understand the change of groundwater quality.<br><br>With the background that an increase in agricultural utilization and incineration and a reduction of landfill for sewage sludge is forecast, it will be recommended to consider incineration or the utilization of sewage sludge in agriculture. In this case the load limiting values of EU Sewage Sludge Directive can be applied as alternative to sewage sludge limiting values in order to maintain the soil limiting values of heavy metals.<br><br>The characteristics (Cd, Cr, Cu, Pb, Hg, Ni and Zn) of dewatered sludge from WWTP should be checked at least 4 times per year. |
| 3. Water Pollution and Public Health Condition | It is recommended to establish a monitoring system to check the water quality of Danube River at main swimming area, intake for water supply as well as the downstream and upstream reaches of WWTP outfall.<br><br>The detail plan (such as monitoring point, analysis items and sampling frequency etc.) should be made in cooperation with the Tulcea Municipality. |

# CHAPTER 12 PROJECT EVALUATION

## 12.1 TECHNICAL FEASIBILITY

Of the present Tulcea City's administrative population of 96,000, about 69,000 rely on the sewerage system (as of 1998). The existing separate sewerage system covers most of the urban built-up districts of the City to collect domestic, commercial, institutional and industrial wastewater, and during wet weather, portion of stormwater. All the collected raw wastewater is currently being discharged to the Danube River through collector mains and outfalls.

The wastewater system discharges $BOD_5$ and SS of about 4,631 kg/day and 4,915 kg/day, respectively, which are Tulcea City's major pollutants discharged to the River. Under the circumstances there is an urgent need to implement a comprehensive WWTP program to treat all the wastewater in a manner that will meet the stringent discharge water quality standards adopted to the Danube River.

In order to select the most desirable strategic wastewater management plan for the City, various alternative options are prepared and evaluated for their costs, socioeconomic and technical relevance, and environmental impacts. The strategy option thus selected, comprising one central WWTP servicing the whole sewerage districts, represents the optimum long-term strategy that can achieve the desired water quality objectives, with minimal negative environmental and social impacts.

The recommended strategy plan envisages collection and treatment of industrial, domestic, commercial, and institutional wastewaters, and small portion of stormwater inflow during wet weather. The proposed WWTP facilities will treat the maximum daily flow up to the secondary process taking the possible future expansion and upgrading into account. To collect and transport the wastewater to the WWTP, the existing sewers and pumping stations will be fully utilized.

The WWTP located in a remote area comprises a conventional activated sludge treatment process, to minimize adverse impacts to the existing and future urban areas. The Project forms the least-cost and long-term strategy plan up to 2010, serving a total population of 73,000 by 2010 and treating the wastewater of 43,000 $m^3$/day, including the industrial wastewater of 10,700 $m^3$/day.

Upon completion of the program the WWTP could remove more than 90 percent or 4,170 kg/day $BOD_5$, which would otherwise be discharged to the Danube River. Such a high rate reduction of the waste loads to the River will no doubt improve the quality of water environment and life for those living in the area near the waterways and the River.

Improving the disposal of the wastewater will also contribute to the improvement in the beneficial uses from the waterways, such as freshwater fisheries and acquaculture, water transport and use of water for irrigation and industrial purposes.

## 12.2 ECONOMIC FEASIBILITY

### 12.2.1 ECONOMIC BENEFITS

In general, expected benefits of wastewater management projects are as follows.

- Sanitary improvement by eliminating untreated wastewater from roadside ditches
- Additional water uses due to water quality improvement of sewage recipient watercourse
- Amenity improvement due to water quality improvement of sewage recipient watercourse

In the Study, however, it is difficult to expect these benefits. First, sewer networks have been installed in the study area and there are no sanitary problems caused by wastewater. Second, flow quantity of Danube River downstream reach is so huge that expected positive impact of the Project could not result in additional water use.

A positive impact of the Project is supposed to be contribution to nature conservation and environmental protection of Danube Delta. Therefore, the study adopted a method to estimate the project benefits by a value of the positive impact to the nature conservation.

To estimate the value of the impact, questionnaire surveys were conducted in ten cities in Romania. The surveys asked the people about their willingness to pay (WTP) for the implementation of policies to contribute to the protection of the Danube Delta. The obtained WTP can be considered to represent the value of the positive impact, that is project benefits.

The economic benefits of the project are estimated as follows.

**Table II.12.1 Estimated Economic Benefits**

| | Annual distribution | Total distribution |
|---|---|---|
| Economic benefit | 121,720 million ROL | 608,598 million ROL |

### 12.2.2 Economic Analysis

Based on the economic benefits calculated above and the cost estimated hereunder, economic analysis was performed.

Preconditions and assumptions applied are as follows:

- Currency unit is ROL and the value of ROL is expressed at the June 1999 prices.
- Project Life: 30 years since the start of project implementation.
- Target Year: 2010. From 2010 on the values of O & M cost variables are assumed to keep the 2010 level.
- Implementation Period: 4 years 2000 to 2003.
- OCC (Opportunity Cost of Capital): 10%.
- Conversion factor: 98.4% to capital cost (initial and replacement cost) taking account of customs duty for foreign components.

The economic costs, which comprises of three types of costs, were determined as follows.

**Table II.12.2 Economic Costs**

| Initial Cost | | | | | Replacement Cost | O & M Costs |
|---|---|---|---|---|---|---|
| 2000 | 2001 | 2002 | 2003 | Total | | |
| 14,333 | 52,173 | 120,852 | 133,696 | 321,054 | 93,000 | 3,666 |

(Unit: million ROL)

Economic criteria, EIRR (Economic Internal Rate of Return), NPV (Net Present Value) and B/C (Benefit Cost ratio) were calculated as shown in *Table II.12.3*.

**Table II.12.3 Calculated Economic Indicators**

| NPV (million ROL) | B/C | EIRR (%) |
|---|---|---|
| 9,523 | 1.03 | 12.5 |

Results of the sensitivity analysis are as shown in *Table II.12.4*.

**Table II.12.4 Result of Sensitivity Analysis**

| Conditions | EIRR (%) | NPV (million Lei) | B/C |
|---|---|---|---|
| Costs: +20% | NA | - 57,906 | 0.86 |
| Costs: +10%, Benefits: -10% | NA | - 58,859 | 0.84 |
| Benefits: -20% | NA | - 59,811 | 0.82 |

### 12.2.3 EVALUATION

For the base conditions, the project is judged economically feasible, while the results of the sensitivity analysis indicate it vulnerable. Considering nature of the project, that is, it does not have direct benefits, the study judges the project to be economically feasible.

## 12.3 FINANCIAL FEASIBILITY

The study proposed the financial plans that make the operation of the projects financially feasible, on condition of a certain level of subsidy to the investment costs. This is because that financial affordability of the users and the city council have not become yet high enough to pay all the investment costs for the wastewater treatment plant. Therefore, conventional financial analysis, in which a total of the investment costs and operation costs, despite that some portions of the investment costs to be subsided, is compared to the revenue, a total of sewerage charge collected, did not indicate the financial feasibility.

However, the proposed financial plans showed financial soundness and operational sustainability of the private company and the city council. Therefore, the study judged that the project is financially feasible on condition of the provision of subsidy.

## 12.4 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

The preliminary EIA has resulted that the overall project appears to be well planned to achieve maximum benefits for the local people, which will surely enhance socio-economics and quality-of-life values of the region, thus it is judged the project is environmentally feasible.

The assessment results can be summarized as follows.

- The proposed project as a whole has positive environmental impacts in the area's water environment and the public health of the residents in the City through the improved service standards for the wastewater management;
- Construction or improvement activities for sewers, pumping stations and wastewater treatment plant throughout the project area may cause nuisances to the residents, but such hazards could be limited by giving careful considerations on the methods of construction and proper management of the sewerage system; and
- Connection of the wastewater currently being discharged to the public waterways to the sewer system will significantly improve the water quality in the Danube River;
- The beneficial effects of the project outweigh the adverse effects; and
- As certain items in the preliminary EIA need to be further clarified from engineering viewpoints, further studies will be made on the extent of impacts, mitigation and remedial measures, including the impacts possibly caused by the construction, operation and maintenance works of the WWTP and related facilities.

# CHAPTER 13 CONCLUSION AND RECOMMENDATION

## 13.1 CONCLUSION

The study proposed the construction of the WWTP together with the installation of interceptors necessary to convey wastewater from existing sewered areas to the proposed WWTP. The proposed wastewater treatment employs a conventional activated sludge method, which is one of the basic biological treatments, and could treat the wastewater currently discharged into the Danube River without treatment, to the water quality levels to meet the international requirements, except T-N and T-P.

The feasibility study brought out the technical, economic, and environmental feasibility of the proposed projects, however, the Study revealed financial difficulty in the implementation of the projects. The initial investment cost for the construction of the wastewater is too heavy financial burden for the present city's financial conditions. Therefore, the Study evaluated the financial feasibility, premising the following financial and institutional supports from the state:

- Acceptance of the utilization of state guaranteed external loans.
- Exceptional provision for the aforementioned repayment criterion.
- Application of special subsidy to sewerage development projects

These supports seem to run counter to the spirit of the recent legislative reform that encourages financial independence of local public works from the state. It would be a quite right direction to expand the autonomy of local municipalities and to entrust local public works to the local municipalities' initiative as much as possible.

On the other hand, the state faces to necessity of the development of the wastewater treatment in the country to meet the EU Directives as the EU applicant country, and is internationally responsible for the development of the wastewater treatment along the Danube River. The development of the wastewater treatment could be one of the higher priority policies of the state. As revealed in the Study, the development of the wastewater treatment is too heavy financial burden for the local municipalities of which economy has not grown up enough. If the development is left in the local municipalities' initiative without any guidance and supports by the state, no considerable progress would be expected.

As long as the affordability of the local municipalities remains not enough to develop their wastewater treatment by themselves, the state should take the initiative in order to realize the state policy. Therefore, the Study considered it justifiable to provide the support as tools of the state initiative for the wastewater treatment development, despite of the sprit of the legislative reform.

## 13.2 RECOMMENDATION TO THE CITY COUNCIL

The Study concluded that the construction of the wastewater treatment plant is feasible. While the state support is essential, the city council should take the first action to realize the project.

The first action would be to take a decision of the implementation of the project. As mentioned above, the project would cause a heavy financial burden and would limit the implementation of other new projects. Every effort to squeeze out the self-financing sources should be done. Process and results of the efforts could be one of means to convince the state to provide the supports. While it is a matter of fact that the project would not work out without the state supports, it should be reminded that the project is not started by the state support but by the city council's initiative.

The Study proposed several options of financial plans by the financial arrangements. Availability of the foreign financial sources depends on the policy of the both recipient country and financing agency. To start seeking for possible finical source will be one of the city council's initiatives. It is suggested that ISPA fund may be the most preferable as it is a grant. The Study provided the city councils with information necessary for the application of such financial sources.

## 13.3 RECOMMENDATION TO THE STATE

As long as Romania is the EU applicant country, the state should take an initiative to develop the wastewater system in the country. The Study considers that the state supports in terms of financial and institutional assistance are essential for the city council to implement the proposed project, comparing required project costs and the city council's financial capability.

The state is required to provide an arrangement for the state guaranteed external sources, because terms of external loans without the state guarantee are far exceed the city councils' affordability. Also, the state is required to provide exceptions of repayment criterion that is one of conditions for the state guarantee external loans. As explained in the financial plan in this report, the Study proposed a sustainable financial plan that proves capability of a operation company to pay lease fee, which covers all repayment amount and depreciation, to a city council. The Study considers that it is possible to exempt the repayment criterion on security of the financial plan.

Furthermore, the state should provide a subsidy that supplements a self-financing portion of the investment cost. Even if the city council can utilize the state guaranteed external loan, most of the city councils would have a great difficulty in procuring the self-financing portion. A source of such subsidy may be very limited in the state budget. Therefore, the state should have a plan to prioritize city councils for the sewerage development. The proposed subsidy could work as a tool for the state to exert the initiative for the sewerage development. The seven (7) cities in the study area are to have higher priority in the development plan because of their location, which is along the Danube River.

# *PART II-2: FEASIBILITY STUDY FOR GALATI WWTP PROJECT*

# CHAPTER 1 EXISTING CONDITIONS

## 1.1 STUDY AREA

The City of Galati is situated on the left bank of the Danube River at the confluence with the Siret River. The area has particular topographic features, comprising hills, combs and de-pressed lowlands, running from north to south and descending toward the Danube River.

Of the present administration area of 24,642 hectares the urban built-up districts cover about 2,300 hectares. The area consists of two distinct zones, highland and lowland areas. The highland areas occupy totally 1,845 hectares, whereas the low-lying areas cover 865 hectares. Major industries are mostly located in the low-lying areas, while residences are generally located on the highland areas. The City's general map is shown in *Figure II.1.1*.

The ground elevation in the city area varies from +4 to +55 m above the mean water level (MWL) of the Black Sea. The eastern zone lies between the Brates Lack Dam and Danube River, at the altitude from +4 to +7 m MWL. The central and western parts of the City are bordered by Siret and Catusei Valleys to the west, whereas the eastern side bordered by low-lying districts at ground elevations of +10 to +50m, which comprises the largest portion of the old town area.

## 1.2 NATURAL CONDITIONS

### 1.2.1 TEMPERATURE

The climate of the Galati City is characterized as continental climate. The annual average temperatures is 10.5℃, with the highest monthly temperature of 22.6℃ in July and the lowest in January at 3.1℃. The minimum and maximum temperatures are -28.6℃ and +39℃ respectively.

### 1.2.2 WIND

The dominant local winds are north-east icy winds and the south-west winds. The wind speeds are from 14 to 16 m/sec, generally higher in winter and spring. Winds of northwest-north-northeast directions occur at 45 percent frequency, but in wintertime, the north winds prevail at an average occurrence frequency of 92 percent.

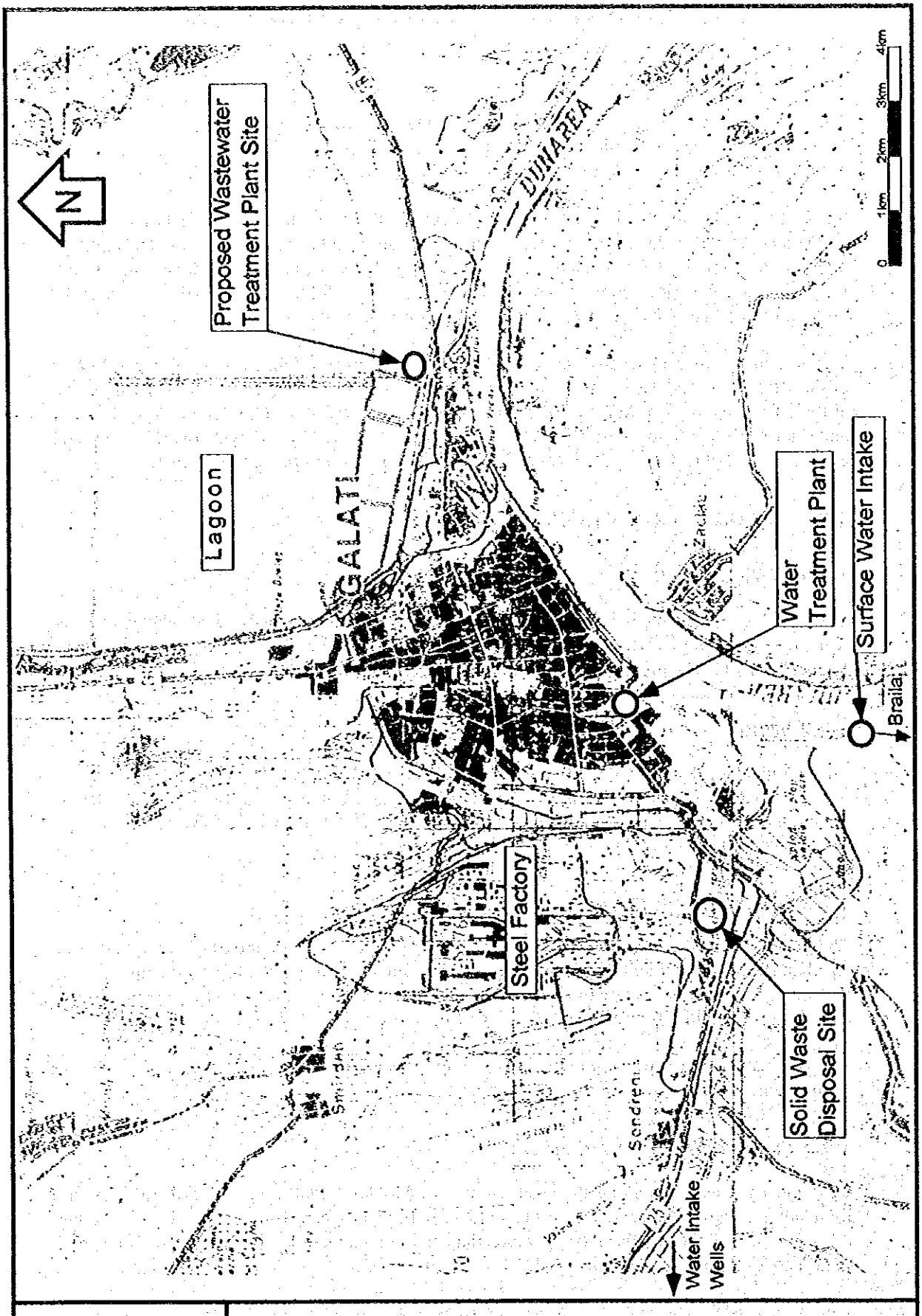
### 1.2.3 PRECIPITATION/SNOW

The average annual precipitation is about 426 mm, with the average monthly precipitation in April and July are 34.9 and 47.7 mm, respectively, which are among the lowest precipitation in Romania. The maximum daily rainfall ever recorded is 79.5 mm. The annual average number of days with snowfall is 16.8 days, and 41.3 days with snow covers.

The yearly average relative humidity 72 %, being higher than 80 % in wintertime and 65 % in summertime.

### 1.2.4 GEOLOGY/GEOMORPHOLOGY

Geologically, Galati lies along the southern area of Moldavia Platform, within the area where foundation is getting deeper and meets that of Northern Dobrogean. The sediment layer covering the rigid soil of the platform being more than 3 m thick consists of Paleozoic formations (wheststones, limestone's, diorite sand, schist, argillaceous).




| Figure II.1.1 | General Map of Galati City |
|---|---|

The latest Neocene formations, Pliocene and quaternary respectively, are reported to appear nowadays. The Pliocene, opened along the valleys, consists mainly of sand and clay with thin layers whetstones, as for quaternary spreading along inner river platforms, consists of fluviolacuster grave ground deposits covered of loess-type-clays. The grave grounds make up terraces, underground stream as well as the present day of the Siret and Danube Rivers.

The geotechnical researches performed by the Galati City reveal that the medium and inferior terraces of the Siret River consists of a yellow leossoid soil layer (with 15-30 m thick) with clay dust insertions. Due to the continuous rising of underground water levels, the yellow leossoid layers present different moisture contents and are sensitive to moisture.

Along the slopes of Malina and Catusa valleys surface erosion phenomena appear. The superficial water that flow on the surface of two terraces created precipices and ravines, which Onlarges forming valleys, many of them with natural clogging. The inferior Siret Plain presents periodical flooding.

There are important soil slides between Galati and Tulcea, due to:

- the effect of the first underground water layer in the leossoid base of the cliff that periodically break down, and
- under the overloading effect, the material in the area came back to the Brates Lake blank and push the soil.

There are affected areas even in the inner city.

### 1.2.5 HYDROLOGY

The hydrology network related to the Galati City consists of the Danube in southeast, the Siret in the south, the stream Catusa in the west, Brates Lake in northeast and the Prut River in the east. The Siret and Prut Rivers flow into the Danube.

The minor river beds have 600～1,000 m widths with depths of 15～16 m in the navigable watercourse. At the Galati County entrance the valley is wide, the Galati City being located between the 2,705 km and the 2,715 km, at the county exit (confluence with Prut River) being the 2,725 km.

The main hydrological characteristics of the Danube River are:

- Longitudinal slope varies between 0.0005% (0.5 cm/km) at the absolute minimum and 0.03% (3 cm/km) at the absolute maximum level.
- Absolute values of the characteristic water levels, corresponding to the Black Sea, are;

  Maximum level (registered in 1967) = 7.44 m,
  Average level (1934, 1970) = 3.87 m, and
  Minimum level (1921, 1947) = 0.38 m.

On the left bank of the minor river bed, Braila-Galati Dam now being used for agricultural purposes protects this area from major floods in the past.

- The Danube River characteristic flows are;

  Minimum flow; 2,000 $m^3$/sec,
  The multi-yearly average flow; 6,000 $m^3$/sec, and
  The maximum flow; 17,500 $m^3$/sec.

- Frost phenomena frequency is 80% during winters, with an average period of 38 days (minimum 3 days and maximum 87 days).
- Ice bridge forms in 50% during winters, with an average period of 37 days (minimum 3 days and maximum 84 days).

The Siret River flows into the Danube River, at the upstream of Galati City. The tributary area is 44,811 km$^2$ with a length of 686 km.

The main hydrological characteristics of the Siret River in Galati County area are:

- Average slope = 0.05%;
- Multi-yearly average flow increased in the last 30 years to 230 m3/s at the confluence with the Danube River, upstream of Galati City. The maximum flow (that can increase with 1% once in 100 years) is higher than 4000 m3/s at the river mouth. The average daily flow is of 35 m3/sec;
- Multi-yearly average flow of suspended alluvial soil highly increases on the county territory, from 159 kg/s at the entrance to 500 kg/s at the river mouth; and
- Frost appears every winter with an average period of 70 days.

The Prut River forms the frontier between Romania and Moldova Republic. The tributary area is 28,396 km$^2$ and its length is of 953 km.

The main hydrological characteristics of the Prut River in Galati County area are:

- Medium slope 0.5%;
- Multi-yearly average flow in the last 30 years is 110 m3/s at the river mouth; and
- Sea flows, (that can increase with 1% once in 100 years) are not higher than a few hundred m3/s, and the average daily flows, minimum per year with 80% probability, are of 13 m3/s.

The Catusa River is a small river in the Siret Basin flowing into Catusa Pool that flows in the Siret River, through a concrete collector. The river tributary covers an area of 60 km$^2$ having a total length of 17 km. There is an earth dam at the middle of the Catusa valley that forms an upstream lake to attenuate the freshet waves from the hydrographic basin. Brates Lake has a present surface area of 24 km$^2$.

### 1.2.6 HYDROGEOLOGY

The underground waters are contained within spongy rocks, in local aquatic layers or uncontinuous existent in alluvial rocks of the Siret and Prut Rivers. There are meets as extended aquatic layers and with high productivity in alluvial rocks and sands of Candesti strata or in the sands of Covurlui Plain.

The underground waters of Covurlui Plateau are located in quarterly deposits, consisting of sands mixed up with clays, at some place as trapped in descendent waters. On the large fields, the underground water depth is at around 10-30 m. The underground waters can be frequently intercepted in valleys and in wells. Between rivers, especially ound water can be detected due to small streams that appear on different levels along the municipal platform, between the Danube River and Brates Lake. The latest research shows an increment of 10 to 20 m of the level within the leossoid structure as compared with the 1950 levels.

The Danube River flow rates and water surface elevations fluctuate at the different probabilities of occurrence, for example, + 7.2 m MWL at 2 % probability of occurrence.

### 1.2.7 DANUBE RIVER WATER QUALITY

The river water qualities as measured at Galati City are as shown in the following table.

**Table II.1.1 Average, Minimum and Maximum Values of River Water Qualities**

| No. | Constituents | Average | Minimum | Maximum |
|---|---|---|---|---|
| 1 | Water temperature (℃) | 13 | 1 | 27 |
| 2 | PH | 8.1 | 7.9 | 8.3 |
| 3 | Suspended solids (mg/l) | 48 | 18 | 131 |
| 4 | Oil and fats | - | - | - |
| 5 | Heavy metals | - | - | - |
| 6 | Dissolved oxygen (mg/l) | 9.7 | 7.52 | 11.55 |
| 7 | BOD5 (mg/l) | 2.35 | 1.22 | 3.75 |
| 8 | Organic substance SO | 15.55 | 12.87 | 20.47 |
| 9 | Ammonium | 0.106 | 0 | 0.28 |
| 10 | Nitrogen | 7.16 | 3.9 | 9.6 |
| 11 | Nitrites | 0.117 | 0.048 | 0.192 |

Source: R.A.Romania-Isai Branch-WMC Galati

### 1.2.8 SEISMIC CONDITIONS

Earthquake in this area is of Moldavian monocinetic type. The Galati City lies on the tectonic fault Focsani-Namoloasa-Galati, and perceived the tremors by the earthquake in the Vrancea County, at a depth of 150 km and at eight degrees on the Richter's scale of magnitude.

Earthquakes are important factors to the ground and underground facility planning. In the area with alluvial soil and high hydrostatic level, the dynamic coefficient of structure constructions increases and the earthquake forces that affect the structures increase to 8.5 degrees on the same scale.

## 1.3 SOCIOECONOMIC CONDITIONS

### 1.3.1 POPULATION

As shown in *Table II.1.2*, during the 8 years 1982 to 1989 the population of Galati grew from 277,839 to 311,907 at the average annual rate of 1.7%. For 9 years since 1990 up to now, however, it has persistently kept the 330,000 level. The population of Galati was 330,276 at the end of December, 1998. It is projected to increase to 382,000 in the target year of 2010. It means that it will grow at the average annual rate of 1.8%. The existing number of houses is estimated at 103,990. The number of persons per house is calculated at 3.1.

**Table II.1.2 Trend of Populations**

| Year | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|
| Population | 277,839 | 284,673 | 285,690 | 292,346 | 294,109 | 298,576 | 309,110 | 311,907 | 324,615 |
| Year | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | |
| Population | 324,223 | 322,248 | 324,234 | 326,728 | 328,058 | 327,975 | 331,360 | 330,276 | |

Source: Galati City

### 1.3.2 INDUSTRIES

The number of employees totaled 185,045 in 1996 as shown in *Table II.1.3*. It appears to be on the downward trend these years. Out of it, the primary, secondary and tertiary sectors accounted

for 10.1%, 51.8% and 38.1% respectively. The predominance of the secondary sector is to be noted. Especially, the number of workers in the manufacturing industry reached 71,999, occupying 38.9% of the entire work force.

The city of Galati grew in parallel with the growth of the steel industry. Since 1989, however, the manufacturing industry has stopped growing like in other cities. There are many kinds of manufacturing industry there, including the above-mentioned one, food manufacturing and shipbuilding.

**Table II.1.3 Number of Employees by Type of Industrial Activities**

| Type of Industry | Employees | | | | |
|---|---|---|---|---|---|
| | 1993 | 1994 | 1995 | 1996 | % |
| Primary Industry | 20,867 | 21,032 | 22,218 | 18,728 | 10.1 |
| Secondary Industry | 102,746 | 97,261 | 96,748 | 95,865 | 51.8 |
| Mining Industry | 1,436 | 1,427 | 1,572 | 1,686 | 0.9 |
| Manufacturing Industry | 79,916 | 73,925 | 73,654 | 71,999 | 38.9 |
| Electricity, Gas and Water | 4,319 | 4,524 | 4,873 | 5,164 | 2.8 |
| Construction | 17,075 | 17,385 | 16,649 | 17,016 | 9.2 |
| Tertiary Industry | 69,510 | 67,390 | 70,731 | 70,452 | 38.1 |
| Total | 193,123 | 185,683 | 189,697 | 185,045 | 100.0 |

Source: Galati City

### 1.3.3 ORGANIZATION

The organization chart of Galati city office is shown in *Figure II.1.2.*

Sewerage service is operated by S.C. APATERM S.A. S.C APATERM S.A. is a commercialized company and the local council of Galati is the only shareholder.

S.C. APATERM S.A has 3,051 personnel in total and operates water supply, sewerage, and district heating services. Technical part of the company consists of the following departments.

- Water and sewerage department with 1,502 personnel
- District heating department with 1,105 personnel

Among 1,502 personnel of water and sewerage department, 229 employees are engaged in sewerage service. The organization chart of S.C. APATERM S.A is shown in *Figure II.1.3.*

### 1.3.4 FINANCIAL CONDITIONS OF THE CITY

It is stipulated in the law that the expenditure budget shall be equal to the income budget.

As shown in *Table II.1.4*, during 7 years 1992 to 1999, the local budget of Galati grew 139 times from ROL 2,520 million to ROL 350,376 million. Its average annual growth rate is calculated at 102.4%. During the same period, prices increased at the average annual rate of 76.9%. That is to say, the local budget increased in real terms by 14.4% per year on average.

**Table II.1.4 Total Amount of Local Budget**

| 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|
| 2,520 | 11,482 | 23,301 | 56,223 | 81,028 | 159,052 | 176,064 | 350,376 |

Source: Galati City (Unit: million ROL)

The local budget of Galati for 1999 totals ROL 350,376 million, which is by 99.0% greater compared with the budget for 1998, ROL 176,064 million.

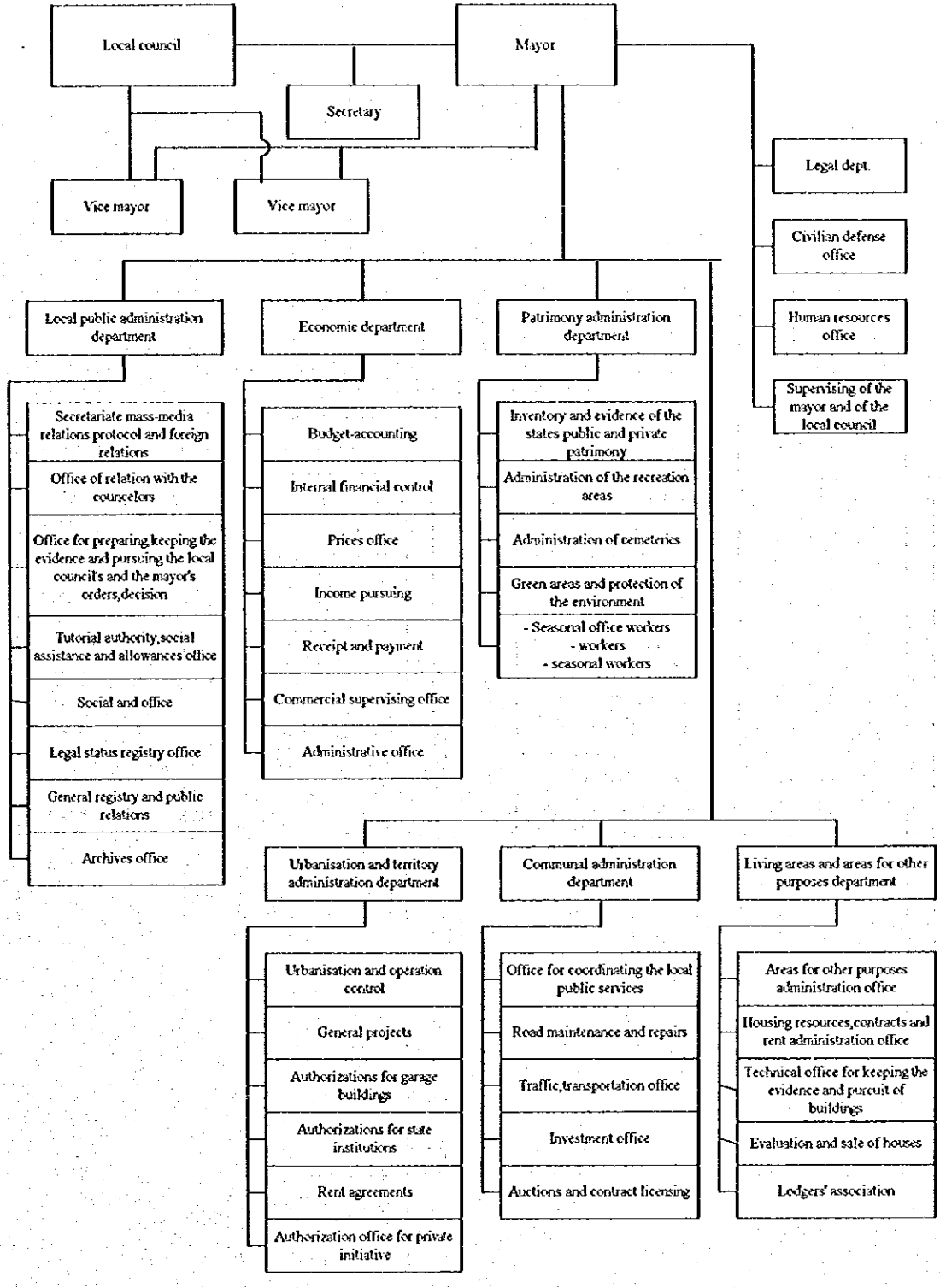



**Figure II.1.2** | **Organization Chart of Galati City Office**

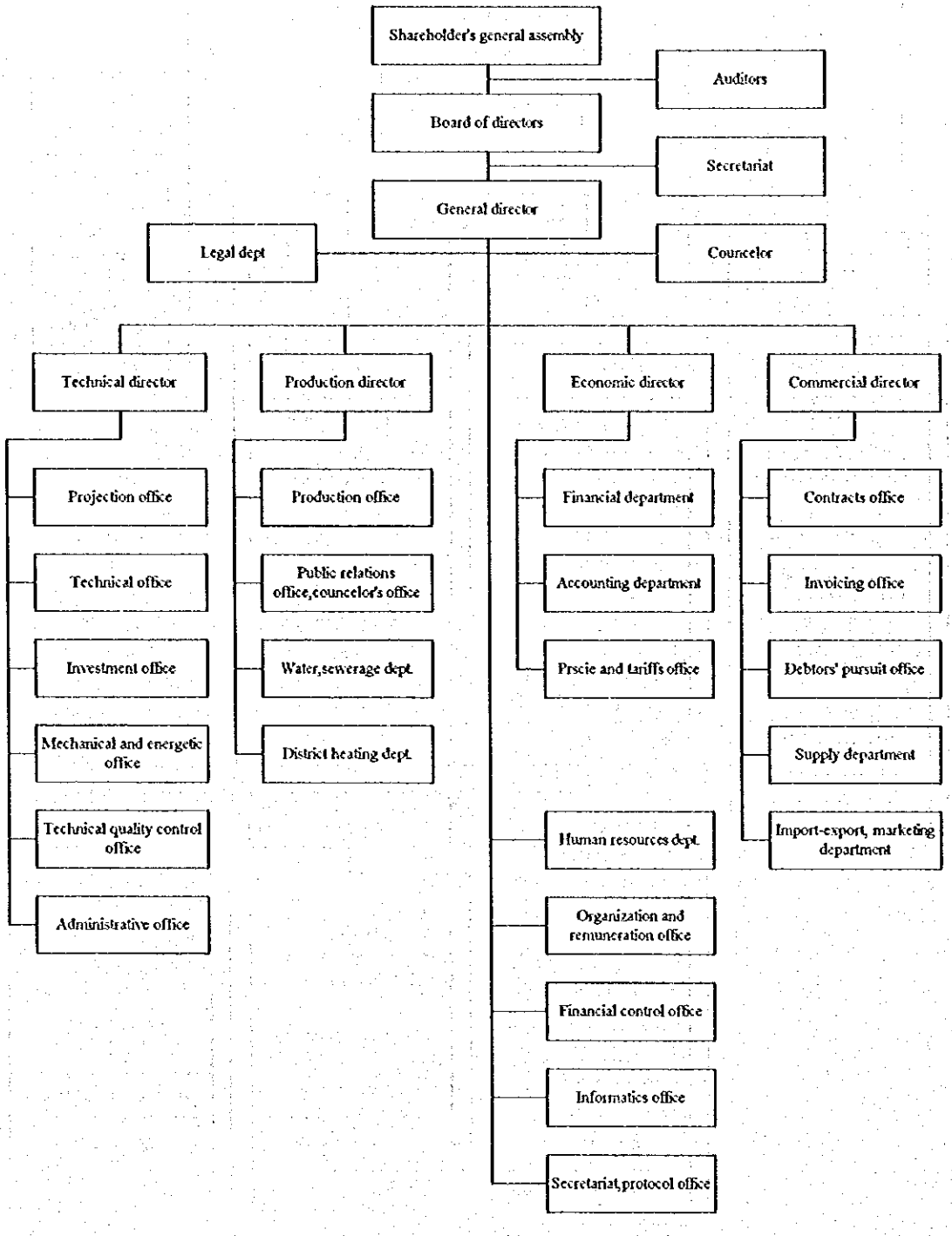



**Figure II.1.3** | **Organization Chart of S.C. APATERM S.A.**

Since enactment of the new local finance law in January 1999, there is no subsidy from the central government any longer. That is, in principle almost all the income of the local budget now derives from its own sources. It in turn gives freedom to the local governments to use the income in whatever way they deem proper. Under the local public finance law, a part of income tax allocated for the state income budget is transferred to the local government through the county government as the quota.

*Table II.1.5* shows that out of the total income of ROL 350,376 million in 1999, 54.2% came from its own sources and the balance of 45.8% was the transfer from the central government, most of which is the abovementioned quota. The table shows that capital expenditure, which is spent for the economic development of the City, accounted for 40.6%. This rate is on the high side.

**Table II.1.5 Breakdown of Local Budget for 1999**

| Item | Amount | Ratio (%) |
|---|---|---|
| Total Income | 350,376,000 | 100.0 |
| 1. Own Income | 189,797,623 | 54.2 |
| 2. Money from State Income Budget | 160,578,377 | 45.8 |
| 3. Subsidy | 0 | 0.0 |
| Total Expenditure | 350,376,000 | 100.0 |
| 1. Current Expenditure | 205,009,800 | 58.5 |
| *1) Personnel* | *24,921,000* | *7.1* |
| *2) Services and Materials* | *103,175,490* | *29.4* |
| *3) Subsidies* | *73,130,000* | *20.9* |
| *4) Transfer* | *3,783,310* | *1.1* |
| *5) Interest* | *0* | *0.0* |
| 2. Capital Expenditure | 142,178,400 | 40.6 |
| 3. Financial Operations | 187,800 | 0.1 |
| 4. Reserves | 3,000,000 | 0.9 |

Source: Galati City (Unit: 1,000 ROL)

**Table II.1.6 Breakdown of Local Expenditure for 1999**

| Item | Amount | Ratio (%) |
|---|---|---|
| Total Expenditure | 350,376,000 | 100.0 |
| 1. General Public Services | 23,500,000 | 6.7 |
| 2. Social-Cultural | 64,134,000 | 18.3 |
| 3. Services and Public Development, Dwellings, Environment and Water | 187,255,000 | 53.4 |
| 4. Economic Activities | 34,673,000 | 9.9 |
| 5. Other Activities | 1,812,200 | 0.5 |
| 6. Guarantee and Redistribution Funds | 0 | 0.0 |
| 7. Transfer | 0 | 0.0 |
| 8. Loans Granted | 0 | 0.0 |
| 9. Payment of Interest | 800 | 0.0 |
| 10. Repayment of Loans | 187,000 | 0.1 |
| 11. Reserve Funds | 3,000,000 | 0.9 |
| 12. Special Destination Expenditure | 35,814,000 | 10.2 |
| 13. Surplus/Deficit | 0 | 0.0 |

Source: Galati City (Unit: 1,000 ROL)

*Table II.1.6* shows that 53.4% or the majority of the expenditure budget went to "Services and Public Development, Dwellings, Environment and Water" which includes the sewerage sector. 18.3% was allocated for "Social-Cultural".

## 1.3.5 FINANCIAL CONDITIONS OF S.C. APATERM S.A.

### (1) Water and Sewerage Charges

Since the beginning of 1998 up to now water and sewerage tariffs were revised only 2 times. It shows that there has been little urgent need on the part of S.C. APATERM S.A. to raise them. The level of the tariffs stays on the low side compared with other cities concerned. The tariffs are shown in *Table II.1.7*.

As of April 1, 1999 the sewerage charges for domestic and industrial customers are ROL 161 and ROL 547 respectively. Water tariffs are nearly 10 times greater than sewerage tariffs.

**Table II.1.7 Water and Sewerage Tariffs**

| Item | Water Supply | | | Sewerage | | |
|---|---|---|---|---|---|---|
| | Domestic | Industrial | Average | Domestic | Industrial | Average |
| Feb. 1, 1998 | 1,400 | 4,185 | 1,913 | 140 | 470 | 199 |
| Apr. 1, 1998 | 1,525 | 4,555 | 2,083 | 150 | 510 | 227 |
| Apr. 1, 1999 | 1,525 | 4,555 | 2,083 | 161 | 547 | 233 |

Source: S.C. APATERM S.A. (Unit: ROL/m³)

### (2) Income from Water Supply and Sewerage Services

The total volume of wastewater discharged into sewerage was 48,145,000 m³ in 1998. It occupied 74.5% of the total volume of water supply. The income from sewerage services came to ROL 10,649 million in the same year. It corresponded to 9% of the income from water supply.

**Table II.1.8 Income from Water Supply and Sewerage Services for 1998**

| Item | Total Volume (1,000 m³) | Total Income (1,000 ROL) |
|---|---|---|
| Water | 64,591 | 117,211,230 |
| Sewerage | 48,145 | 10,648,548 |

Source: S.C. APATERM S.A.

The total volume of wastewater discharged into sewerage was 21,936,000 m³ in the 1st half of 1999. The volume of sewage was 76.5% of that of water in the same period. The income from sewerage services came to ROL 4,820 million. It corresponded to 8.2% of the income from water supply.

**Table II.1.9 Income from Water Supply and Sewerage Services for 1st Half of 1999**

| Item | Total Volume (1,000 m³) | Total Income (1,000 ROL) |
|---|---|---|
| Water | 28,669 | 59,049,440 |
| Sewerage | 21,936 | 4,819,845 |

Source: S.C. APATERM S.A.

### (3) Financial Performances for Water Supply and Sewerage Services

S.C. APATERM S.A. earned ROL 10,649 million, while it spent ROL 8,851 million, begetting a surplus of 16.9% in sewerage services in 1998. It made a substantial profit in the preceding two years too. In addition, both water supply and hot water supply sectors were on the whole financially fine so far as the income statement is concerned.

S.C. APATERM S.A. earned ROL 4,820 million, while it spent ROL 4,890 million, resulting in a loss of ROL 70 million or 1.5% in sewerage services in the 1st half of 1999. However, as it begot a substantial surplus in water supply in the same period, the combined results were solidly positive as shown below.

**Table II.1.10 Financial Performances for Water Supply and Sewerage Services**

| Item | | 1996 | 1997 | 1998 | 1st Half of 1999 |
|---|---|---|---|---|---|
| Water Supply | Income | 29,307,494 | 80,778,843 | 117,211,230 | 59,049,440 |
| | Expenditure | 29,041,085 | 76,976,233 | 89,574,240 | 51,342,081 |
| | Profit | -5,311 | 3,802,610 | 27,636,990 | 7,707,359 |
| | Profit Rate (%) | 0.0 | 4.7 | 23.6 | 13.1 |
| Sewerage | Income | 4,012,954 | 9,561,583 | 10,648,548 | 4,819,845 |
| | Expenditure | 2,516,937 | 8,724,392 | 8,851,109 | 4,889,790 |
| | Profit | 1,496,017 | 8,37,191 | 1,797,439 | -69,945 |
| | Profit Rate (%) | 37.3 | 8.8 | 16.9 | -1.5 |
| Total | Income | 33,050,448 | 90,340,426 | 127,859,778 | 63,869,285 |
| | Expenditure | 31,559,742 | 85,700,625 | 98,425,349 | 56,231,871 |
| | Profit | 1,490,706 | 4,639,801 | 29,424,429 | 7,637,414 |
| | Profit Rate (%) | 4.5 | 5.1 | 23.0 | 12.0 |

Source: S.C. APATERM S.A. (Unit: 1,000 ROL)

### (4) Unit Operation and Maintenance Cost for Sewerage Services

*Table II.1.11* shows the unit operation and maintenance (O & M) cost of sewerage services per $m^3$ of sewage.

**Table II.1.11 Breakdown of O & M Cost**

| Item | 1996 | 1997 | 1998 | 1st Half of 1999 |
|---|---|---|---|---|
| 1. Expenditure for Materials | 14.2 | 111.8 | 70.7 | 94.8 |
| Electricity | 1.2 | 5.0 | 6.7 | 8.5 |
| Wastewater Collection Charge | 0.0 | 0.0 | 14.5 | 15.3 |
| Other Services by Other Companies | 1.5 | 9.7 | 0.0 | 2.1 |
| Repairs | 1.0 | 12.0 | 8.1 | 20.5 |
| Raw Materials and Other Materials | 0.6 | 2.6 | 2.7 | 3.8 |
| Depreciation | 7.2 | 60.2 | 18.3 | 1.5 |
| Concessions | 0.0 | 0.0 | 14.5 | 39.3 |
| Other Expenditure | 2.7 | 22.4 | 6.0 | 3.8 |
| 2. Personnel Expenditure | 29.1 | 54.1 | 72.3 | 96.7 |
| Salaries | 22.5 | 41.4 | 54.2 | 68.0 |
| Social Insurance and Unemployment | 6.7 | 12.7 | 18.1 | 28.7 |
| 3. Other Expenditure | 8.7 | 17.0 | 41.8 | 31.4 |
| Total | 52.0 | 182.9 | 184.9 | 222.9 |
| Wastewater Volume | 48,370 | 47,704 | 48,145 | 21,936 |

Source: S.C. APATERM S.A. (Unit: ROL/$m^3$)

The unit cost was ROL 184.9 in 1998. It consisted of "Personnel Expenditure" (ROL 72.3 or 39.1%), "Expenditure for Materials" (ROL 70.7 or 38.2%) and "Others" (ROL 41.8 or 22.6%). "Personnel Expenditure" was broken down to "Salaries" (29.3%) and "Social Insurance and Unemployment" (9.8%). "Expenditure of Materials" was broken down to "Depreciation" (9.9%), "Wastewater Collection Charge"(7.8%), "Concessions" (7.8%), etc.

Important cost items somewhat change from year except "Salaries" and "Social Insurance and Unemployment": they always keep major positions.

The cost of sewerage services per $m^3$ of sewage was ROL 222.9 in the 1st half of 1999. It consisted of "Personnel Expenditure" (ROL 96.7 or 43.4%), "Expenditure for Materials" (ROL 94.8 or 42.5%) and "Others" (ROL 31.4%). "Personnel Expenditure" was broken down to "Salaries" (ROL 68.0 or 30.5%) and "Social Insurance and Unemployment" (ROL 28.7 or 12.9%). "Expenditure of Materials" was broken down to "Concessions" (ROL 39.3 or 17.6%), "Repairs"

(ROL 20.5 or 9.2%), "Wastewater Collection Charge"(ROL 15.3 or 6.9%), "Electricity" (ROL 8.5 or 3.8%), etc.

So far as the 1st half of 1999 is concerned, personnel, concessions and repairs are the three most important cost items.

### (5) Income and Expenditure Budget of Water Supply and Sewerage Services

During the three years 1996 to 1998 the combined income budget of water supply and sewerage services of APATERM grew 4.1 times from ROL 34,685 million to ROL 142,229 million at the average annual rate of 102.5%, as shown in *Table II.1.12*.

These three years it compiled the budget in such a way that it could make a certain amount of profit each year. It appears that APATERM has succeeded in it., although the collection efficiency of water and sewerage changes has been at the 70% level, as shown in *Table II.1.13*.

**Table II.1.12 Budget for Water Supply and Sewerage Services**

| Item | 1996 | 1997 | 1998 | 1st Half of 1999 |
|---|---|---|---|---|
| Total Income | 34,685 | 79,854 | 142,229 | 69,181 |
| Total Expenditure | 32,863 | 73,773 | 130,198 | 65,853 |
| Materials | 3,208 | 4571 | 11,081 | 8,147 |
| Energy | 16,832 | 42,324 | 51,584 | 27,925 |
| Depreciation | 1,654 | 766 | 4,855 | 1,800 |
| Services Provided by Third Companies | 181 | 2,727 | 3,000 | 995 |
| Salaries | 7,408 | 14,984 | 22,373 | 15,068 |
| Social Protection | 2,222 | 4,659 | 7,607 | 6,479 |
| Others | 1,358 | 3,742 | 29,698 | 5,439 |
| Profit | 1,822 | 6,081 | 12,031 | 3,328 |
| Profit Rate (%) | 5.3 | 7.6 | 8.5 | 4.8 |

Source: S.C. APATERM S.A. (Unit: million ROL)

**Table II.1.13 Collection Efficiency of Water and Sewerage Charges**

| Item | 1996 | 1997 | 1998 | 1st Half of 1999 |
|---|---|---|---|---|
| Collection Rate | 77 % | 73 % | 74 % | 72 % |

Source: S.C. APATERM S.A.

### (6) Required Actions for Sustainable Financial Plan

The following things are essential to work out a sustainable financial plan on sewerage services.

- Estimation of the willingness and affordability of the households to pay sewerage charge to clarify the extent and limit of household income allocable to it.
- Incorporation of the actual collection efficiency in formulating income budget and cost analysis to realize proper level of cost per unit volume of sewage.
- Preparation of funds statement and balance sheet besides income statement in order to assure a long term profitability and solvency.

## 1.4 WATER SUPPLY SYSTEM

At present, the City water supply system produces the daily average water of 236,226 $m^3$/day. The major water sources of the system are the Danube River and groundwater.

Currently, the groundwater is being taken from the following two fields: Vadu Rosa; 84 wells, located at the right bank of the Sileto River, extracting 95,040 $m^3$/day water; and Salcia-Liesti; 70

wells, located at the left bank of the Sileto River, extracting 69,120 $m^3$/day.

The surface water is taken from the Danube River, and transmitted to the Tiglina Water Purification Works (WPW) through three raw water transmission pipelines consisting of 2 x 800 mm and 1 x 1,200 mm diameter.

The WPW consists of two trains of treatment facilities, each producing daily 120,960 and 69,120 $m^3$ water, respectively. The WPW process comprises pre-filtration, coagulation/sedimentation, rapid sand filtration, 40,000 $m^3$ capacity treated water reservoir, and post chlorination.

The surface water quality has gradually been deteriorated, and now apt to exceed the permissible limits of STAS standards, and that chemical use for the process has significantly been increasing. Two industrial WPWs were completed in 1994 and started supplying water to major industries.

Percentages of water use by categories are; 84 % for flats, 10 % for national factories; 3% for hospitals, schools and homes for aged people; and the rest for individual houses and private companies. Presently, about 55 % of the houses are metered.

There are three different groups for the distribution pipe networks depending on the ground elevations of the districts wherein pipes are laid. The highest elevated distribution network districts are those on the ground elevations of about 53m above MWL, while the lowest district is 5 m above MWL.

## 1.5 SEWERAGE SYSTEM

The first combined sewerage system was constructed in 1878 within the old urban area, which is one of the oldest wastewater systems in Romania. The main sewers were constructed either of egg or of semi-elliptical section, the crowns of which being made of bricks placed on the concrete bases. The total sewer length so far constructed is about 480 km, which is about 52 % of the total road length in the City.

The existing sewers by type and size are:

- Circular sewers of 30 to 200 mm diameter;
- Egg-shape of 2,000 mm wide x 3,000 mm high; and
- Horse-shoe from 2,000 x 1,270 mm to 4,000 x 2,500 mm.

Because of the particular topographic features of the area, the wastewater can flow by gravity down to the outfalls or wastewater pumping stations. The sewer service area is divided into the four major sewer districts. The wastewater is finally disposed of to the Danube River through the five outfalls or four pumping stations when the river water elevation rises.

The major existing wastewater outfalls are as follows:

- The Siret River (Micro 20, 21),
- The water treatment plant,
- Danube halting place,
- "Liberty" ship restaurant,
- "Danube Waves,"
- SP3 and 13 June (Gravity in summer at the level lower than 300 cm, and in winter at the level lower than 250 cm. For the river levels higher than the above).

About 40 % of the existing sewers are considered old and obsolete, some of which cannot properly function, thus at many locations throughout the City clogging and hampering the wastewater flows are observed. The sewers in low-lying areas are not in good working conditions

too, due mainly to the low pipe capacity, physical damage, and low pumping capacities (*e.g.* SP 13 June).

There are two major wastewater pumping stations to discharge the wastewater to the Danube River. The wastewater coming down from the central district is discharged through the pumping station "13th June" to the River during storms or when the river water surface rises.

The major features of the pumping stations are as follows:

- SP 13 June
  Location: Street Portului
  Capacity: 6,500 $m^3$/hr
  Operation started: 1954

- SP 3
  Location: Street Basarabiei
  Capacity: 5,600 $m^3$/hr
  Operation started: 1975

- SP Vulcan (Stormwater)
  Location: the railway station area
  Capacity: 350 $m^3$/h
  Operation started: 1960

- SP Nordului (Stormwater)
  Location: Street Nordului
  Capacity: 200 $m^3$/hr
  Operation started: 1960

The western industrial zone includes shipyards and other industries, but the industrial wastewaters are separately disposed of to the Danube River after being treated with their own treatment works.

## 1.6 OTHER SANITATION SYSTEM

Domestic and streets wastes are periodically collected by two companies, SALUBRITATEA SA, and RWE ECOLOGIC SERVICE which is Romanian-German associated company. The first company collects the wastes in sporadic and undifferentiated manner. The wastes collection from the residential areas with blocks of flats is, for instance, made more frequently than from the peripheries because of the fact that the blocks associations have agreements with this company. The families living in private households have no agreements with this company, thus storing the wastes on the margins of roads. Under the present situations, when the wastes are weekly collected in the central districts, whereas in the peripheral the wastes will be collected three times a month.

The collected wastes are transported and disposed of to the municipal landfill site near the railway station in Tirighina, which was constructed in 1998. The landfill site has a storing capacity of 4,700 $m^3$ and already 2,000 $m^3$ has been filled so far. The landfilling appears not to be properly managed from the environmental viewpoint. The people still use the old landfill site at Gura Siret that has already been covered with soil and closed.

The industrial wastes are generally transported by their own vehicles to the nearby landfill sites. Particular wastes from hospitals are incinerated in the facilities provided by them. The houses in unsewered districts rely their human waste disposals on septic tanks or cesspits.

## 1.7 INDUSTRIAL WASTEWATER GENERATIONS

### 1.7.1 GENERAL

Totally 50 manufacturers and companies within the area are discharging wastewaters after pretreatment. These manufactures are subject to the periodical wastewater quality monitoring. The Environmental Section of the City Council has monitored the wastewater discharged into the public sewers twice a year since 1990. About 90% of the factories or companies wastewaters are complying with permissible limits of the discharge quality.

The quantities of industrial wastewaters are 12,068,000 $m^3$/year. The qualities of the industrial wastewaters are shown in *Table II.1.14*.

### 1.7.2 TYPE OF FACTORIES

Types of major industries within industrial districts are as follows.

| | |
|---|---|
| - Machine-building industry: | SNG, SC MENAROM, SC ELNAV, SC INTFOR, SC FAM, SC MEHID, SC TREFO, SC ROMCOMET |
| - Metallurgic industry: | SC SIDEX SA |
| - Food industry: | SC MORARIT PANIFICATIE, SC AVICOLA, SC BERE MALT, SC GALVIN, SC GALACTA, SC GRAU, LABORATOR PATISERIE, SC PRUTUL, SC MORARIT DUNAREANA, COCA COLA SA, SC CALIN MARY, HORTIGAL, SC SALBERO SRL |
| - Light industry: | SC GALFIRTEX, SC SF TEX, SC APOLLO, SC PLASE PESCARESTI, INTREPRINDEREA POLIGRAFICA PORTO FRANCO, COOPERATIVA MUNCA SI ARTA, FIROMEX |
| - Timber processing industry: | SC GAMA SA (the 2 units) |
| - Transports: | SC TRANSGAL, SC INTERTRANS, RATU, NAVROM, REGIONALA CFR, ROMTRANS, AGROTRANSPORT SA, SC PETROM |
| - Public services units: | AUTOSERVICE, DACIA SERVICE, SC GEVAL STAR SRL (car washing), SC AUTOUNIVERSAL SA (car washing), SC CONNICOL SRL (car washing), SC BERIN PROD SRL (car washing), BJATM |

## Table II.1.14 Quality of Industrial Wastewater in 1998

| No | Collector Denomination | Test numbers | Temp. °C | pH | Organic subst. mg $O_2$/dm³ | $CBO_5$ mg/dm³ | Total suspensions mg/dm³ | Extractibile subst. mg/dm³ | Sulphurs and sulfurate hydrogen mg/dm³ | Synthetic detergents mg/dm³ | Residual chlorine mg/dm³ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SC APOLLO -SA-detergent | 25 | 20 | 7.6 | 541 | 455 | - | 7,5 | 0,2/0,02 | 0,08 | 0,03 |
| 2 | S.C.APOLLO- S.A.-sapun | 12 | 20 | 7.4 | 833 | 734 | - | 8 | 0,33 | 0,12 | 0,03 |
| 3 | S.C.DRAIGAL -S.A.-Suc.FNC | 26 | 17 | 7.3 | 72 | 54 | 207 | 11 | 0,1/0,03 | - | 0,01 |
| 4 | S.I..COCA-COLA- S.A. | 25 | 20 | 8.0 | 179 | 133 | 87 | - | - | 0,08 | 0,04 |
| 5 | DEPOUL CFR | 23 | 17 | 7.2 | 82 | 65 | 81 | 118 | - | - | 0,03 |
| 6 | SC FAM -SA Sect.1 | 17 | 16 | 7.6 | 22 | 17 | - | 6 | 0,04/0,004 | - | 0,03 |
| 7 | SC FAM-SA-Sect.2 | 29 | 20 | 7.2 | 35 | 27 | - | 3 | 0,1/0,02 | - | 0,04 |
| 8 | SC ERNAV-SA | 20 | 16 | 7.6 | 29 | 19 | 61 | 7 | - | - | 0,03 |
| 9 | SC GALACTA-SA | 33 | 20 | 7.4 | 268 | 204 | - | 11 | - | 0,04 | 0,08 |
| 10 | SC GALFIRTEX –SA | 19 | 20 | 7.7 | 162 | 123 | 152 | 6 | 0,19/0,016 | 0,15 | 0,02 |
| 11 | SC GAMA –SA | 10 | 15 | 7.2 | 25 | 17 | 91 | 13 | - | - | 0,03 |
| 12 | SC HORTIGAL –SA | 19 | 16 | 7.4 | 44 | 35 | 120 | 4 | - | 0,130 | 0,03 |
| 13 | SC INTERTRANS –SA | 25 | 20 | 7.1 | - | - | 138 | 30 | 0,11/0,01 | 0,105 | 0,01 |
| 14 | SC MPG- SA Atelier 1 | 32 | 19 | 7.4 | 78 | 55 | 244 | 8 | - | 0,06 | 0,02 |
| 15 | SC MPG-SA Atelier 2 | 31 | 19 | 7.5 | 77 | 59 | 112 | 11 | - | 0,12 | 0,02 |
| 16 | SC MPG-SA –Dunareana | 33 | 20 | 7.1 | 328 | 249 | 115 | 9 | - | 0,13 | 0,02 |
| 17 | SC MARTENS-SA | 30 | 19 | 7.2 | 254 | 200 | 470 | - | - | 0,04 | 0,03 |
| 18 | SC MEHID-SA | 31 | 21 | 7.8 | 95 | 79 | 156 | 9 | - | - | 0,01 |
| 19 | SC MENAROM-SA | 20 | 19 | 7.3 | - | - | 65 | 3 | - | - | 0,03 |
| 20 | SC PLASE PESCARESTI-SA | 31 | 20 | 7.3 | 72 | 54 | 147 | - | - | 0,105 | 0,03 |
| 21 | SC PRUTUL SA | 30 | 21 | 7.5 | 62 | 43 | 132 | 35 | - | 0,03 | 0,05 |
| 22 | SC TRANSURB-SA-Depoul 1 | 21 | 19 | 7.5 | - | - | 111 | 9 | 0,14/0,02 | 0,03 | 0,03 |
| 23 | SC TRANSURB-SA-Depoul 2 | 26 | 19 | 7.3 | - | - | 178 | 7 | 0,11/0,01 | 0,07 | 0,02 |
| 24 | SC SALBERO-SRL-preparat | 25 | 20 | 7.4 | 123 | 86 | 130 | 12 | - | 0,16 | 0,03 |
| 25 | SC SALBERO-SRL-Abator | 9 | 19 | 7.7 | 138 | 109 | 161 | 18 | - | 0,27 | 0,28 |
| 26 | SNG-SA | 22 | 18 | 7.3 | - | - | 134 | 3 | 0,1/0,02 | - | 0,02 |
| 27 | SCSFTEC | 21 | 20 | 7.3 | 40 | 31 | 135 | 4 | 0,10/0,01 | - | 0,03 |
| 28 | SC TREFO SA | 25 | 20 | 7.5 | - | - | 61 | 4 | - | - | 0,03 |
| 29 | SC TRANSGAL SA | 25 | 17 | 7.5 | - | - | 137 | 8 | 0,55/0,09 | 0,16 | abs |
| 30 | SC TRANSCOM –SA | 22 | 17 | 7.3 | - | - | 113 | 7 | 0,15/0,01 | 0,12 | 0,02 |
| 31 | SC VINIFIC.BAUT AICOOLIC | 32 | 24 | 7.6 | 433 | 321 | 249 | - | - | 0,06 | abs |
| 32 | SC INTFOR-SA | 26 | 17 | 7.4 | - | - | 88 | 5 | 0,09/0,02 | - | 0,03 |
| 33 | SC AUTOUNIVERSAL-SRL | 31 | 18 | 7.4 | - | - | 448 | 19 | - | 0,043 | abs |
| 34 | SC BERIN PROD-SRL | 33 | 17 | 7.1 | - | - | 654 | 31 | - | 0,78 | abs |
| 35 | SC GEVAL STAR-SRL | 31 | 17 | 7.4 | - | - | 594 | 14 | - | 0,40 | abs |
| 36 | SC CONNICOL-SRL | 34 | 18 | 7.3 | - | - | 194 | 7 | - | 0,20 | 0,03 |
| 37 | SC AUTOMECANICA -SA | 31 | 19 | 7.5 | - | - | 317 | 39 | - | - | abs |
| 38 | SC MPG-SA-Radu Negru | 27 | 20 | 7.2 | 27 | 19 | 80 | 8 | - | 0,08 | 0,07 |
| 39 | SC CALIN MARY-SRL | 23 | 20 | 7.0 | 177 | 104 | 182 | 21 | - | 0,07 | 0,02 |
| 40 | SC MPG SA-Dunarea | 25 | 23 | 7.3 | 86 | 67 | 125 | 18 | - | 0,13 | 0,03 |
| 41 | SC REPCOM-SRL | 27 | 18 | 7.5 | - | - | 543 | 14 | - | 0,20 | qbs |
| 42 | SC PETROM SA | 5 | 12 | 7.3 | 48 | 35 | 83 | 11 | 0,06/0,01 | - | 0,09 |
| 43 | SC CONNER PRODUCT-SRL | 5 | 14 | 7.3 | 380 | 309 | 282 | 55 | - | 0,07 | 0,03 |
| 44 | SC RAZBOIENI SRL | 6 | 12 | 6.5 | 1545 | 409 | 144 | 14 | - | 0,15 | 0,02 |
| 45 | SC ROMCOMET-SRL | 3 | 9 | 7.5 | 32 | 24 | - | 5 | - | - | 0,03 |
| 46 | SC TIFAREX EXIM-SRL | 12 | 16 | 7.4 | - | - | 261 | 16 | - | 0,29 | abs |
| 47 | SC SALT-SRL | 7 | 17 | 6.8 | 326 | 201 | 212 | 22 | - | 0,11 | abs |
| 48 | SC FIROMEX –SA | 6 | 12 | 7.5 | 98 | 69 | 276 | 13 | 0,8/0,008 | 0,05 | 0,03 |
| 49 | DEVERSARE SIDEX-M.18 | 6 | 15 | 7.6 | 80 | 63 | 76 | 10 | 0,13/0,02 | 0,06 | 0,03 |

Source: Galati City