4.12 FINANCIAL, ECONOMIC AND SOCIAL ANALYSIS

4.12.1 Basis of Financial Analysis

A financial model has been constructed, focusing on cash-flow forecasting, to conduct a financial analysis of the proposed project. Tariff required to recover the operating and too pay back the loan (both the principal and the interests) has been projected in comparison with financing sources with different costs.

4.12.1.1 Methodology of Financial Analysis

Cash flow (net profit plus depreciation) model was run to calculate the FIRR (Financial Internal Rate of Return) and for the proposed sewerage project. It is the best base and start point to analyze the financial feasibility of the project, because of the following features:

- The cash flow based method considers fully the time value of all cash outflows and inflows.
- The minimum tariff required to insure a positive FIRR is projected.
- FIRR is calculated under given tariff conditions. Financial feasibility of the project is evaluated from the FIRR calculated;
- The calculated FIRR will be a "hurdle rate" in valuing the project financially in the following aspects:
    - If the average total cost of the project is higher than the predicted FIRR, the project is evaluated not financially feasible.
    - FIRR is used to compare with certain required or a target level of the FIRR of the project.
    - It is an easily understandable standard in comparing and choosing among different financing sources.

Different leveraged cases (using some loan conditions) have been calculated and analyzed. The financial model established in this study has following features:

- It models only the sewerage collection and treatment division of the Water Company. Water supply and other business of the Water Company are not included in this model.
- The model generates a pre-forma cash flow statement, mainly based on the profit and loss account. Both the cash flow statement and profit and loss account have been calculated for 25-years from the beginning of the project.
- Income of the project is calculated from three groups of customers by multiplying the estimated chargeable volume of sewage and tariff.
- Domestic consumption (and supply) of water and discharge of sewage are estimated to increase 3-4 percent each year during the first 10 year period, and to maintain at the same level at the other 15 year period.

- Industrial users and the hospital will maintain their current consumption for water and discharge of sewage. No new industrial or other public establishments are planned or expected.
- Chargeable volume of the discharged sewage is based on the estimated daily water consumption.
- Tariff for each group of users is assumed to be the same. Tariff for the first year after the project begins operation will remain at the same level for the second year, then rise in the third year by 10 percent, and continue unchanged for the fourth year. After that, tariff will be raised once every three years by 10 percent each. As a result, at the end of the first 10 year period, the total increase in the tariff will be 33 percent.
- The basis used in calculating the operating costs are as follows:
  - Costs of energy and chemicals are assumed to increase at the assumed inflation rate used in this study.
  - The number of employees is assumed to stay at the same number during the entire repayment period. Although the sewage treated will increase every year, with the use of new equipment and managerial efforts, the project is assumed to be operated and managed without increasing the number of employees.
  - Salaries are assumed to increase at the inflation rate used in the study. Social security cost remains at 30 percent of the wages.
  - Salaries and social security of the administration and engineering sections are assumed to be shared evenly between the water supply and sewerage divisions, as it is at present.
- Depreciation is included and calculated using rates and terms in accordance with government regulations as shown below. Other initial investment fees are depreciated over 10 years after beginning operation.

Item	Rates (%)	Term (year)
Building with plant	0.025	40
Pipeline	0.025	40
Pump	0.125	8
Special equipment	0.11	9
Vehicles	0.10	10

- Maintenance includes the repairing of the equipment and vehicles, spare parts and materials needed for maintenance. The maintenance is estimated as 1.5 percent of the initial investment for pumps and equipment, and is assumed to remain at the same level during the whole term.
- Taxes include the Nature Protection Tax, Property Tax and Road Tax. Rates of these taxes are assumed to be raised once every 3 years, by 5 percent.

- Pollution charge is calculated and included as an operating cost . First, the real value of the charge is calculated from the load of pollutants. Then, the rate of the charge is assumed to be raised at the same rate as the tax.
- Other general administration fees are assumed to increase with the about same rate of the sewage treatment increasing, and will rise at the same rate as the inflation rates.
- Preparing for bad receivables is included for the purpose of healthy management. It is assumed at 3 percent of the total income for the whole repayment term.
- Corporate profit tax is charged from the year of the first profit at the accumulated base, at the current tax rate of 29 percent.
- Average yearly working capital is assumed equal to 1.5 month of the income.
- VAT is not included. All tariffs are stated in net price.

4.12.1.2 Objectives of Financial Analysis

Objectives of the financial analysis through running the financial model are as follows:

- To calculate the tariff required to cover the operating cost, to pay back the loan (both the principal and the interests) and to make certain that a desirable level of FIRR (around 5 percent level) is maintained, for the purpose of sustainable management of the project.
- To compare among financing sources with different cost (interest rates) and to recommend the desirable financial sources that will insure an acceptable level.
- To clear some important factors of the cost control in order to carry out the project.
- To evaluate some issues influencing the financial factors and tariff in the project.

4.12.1.3 Financial Resources Assumed

Main financial resources are assumed as follows:

State Grant/Subsidy

Considering the difficult financial situation of both the Skuodas Water Company and Skuodas municipality, some subsidy from the state budget may be necessary for financing the project implementation. The state subsidy is assumed at 50 percent of the total investment cost.

Loan from foreign official aid or commercial institutions

With the tight limitation of the tariff increasing, the feasibility of the Project will depend largely on the loan with the lowest cost and most favorable conditions (grace period, e.g.)

Cash reserve of the Skuodas Water Company is assumed not to be used for the initial investment, nor to be reinvested in any additional investments during the project period.

4.12.1.4 Effects of Inflation

Inflation will have a great effect on the project. In the analysis, all the costs, except for the depreciation, maintenance and spare parts, taxes, and preparation for bad receivables are assumed to rise at the inflation rates assumed.

All the initial investment costs have been calculated in the future price, using the inflation rates assumed.

Considering that the project will probably use a fixed interest rate loan, and also from the view point of real value for tariffs, the moderate (lower) rates are assumed as follows:

Period	Inflation Rate (see Section 2.3.4.2)
1998	6.1%
1999	5.9%
2000 and after	5.0%

The effects of variation in the inflation rates for the project have been simulated and analyzed in the Sensitivity Analysis.

4.12.1.5 Effect of Foreign Exchange Fluctuation

Effect of foreign exchange fluctuation will be mainly on the financial side, if the project borrows the loan in foreign currency. Its effect on the operating side is considered minor because few items in the operating cost will be paid in foreign currency.

For the foreign loans, the Ministry of Finance may become a borrower. The Ministry will then re-lend the money to the municipality or Water Company in local currency. In such case, the foreign exchange fluctuation will have no direct effect on the project.

4.12.1.6 Project Period

In the financial analysis, a 25-year period is used with following considerations:

- In accordance with the financial conditions of foreign aids, pay-back period is more or less 25-year including a grace period.
- This period seems reasonable from the facility life and depreciation period of the equipment.

4.12.2 Financial Performance

Using the financial model, the financial performance has been projected and analyzed, focusing the FIRR and tariff required to recover the total cost.

4.12.2.1 Financial Internal Rate of Return (FIRR)

FIRR was calculated for the case of the leveraged finance with a state subsidy/grant for 50 percent of the investment cost and with some soft loan (lower cost) financing for the balance of 50 percent. Conditions for the soft loan is assumed at an interest rate of 7 percent and 10-year grace

period such as Nordic Investment Bank (NIB) loan. Tariff is set at 2.27Lt/m^3 in the beginning. FIRR is then calculated at 5 percent, the hurdle rate which is considered by some official institutions as a benchmark for public projects.

4.12.2.2 Cost Recovery

In the model case using the leveraged finance (state grant 50 percent plus low cost loan 50 percent) as assumed above, the tariff level at the beginning for cost recovery is to be predicted at 2.24Lt/m^3. This means that from that tariff at the beginning of the operation and through 25-year operation, the project will just recover all the operation cost and pay back the loan (both the principal and interest).

To maintain the sustainable management, some plus FIRR should be assumed. If the benchmark of 5 percent FIRR should be applied, the sustainable tariff is predicted at about 2.27Lt/m^3. This is 26.1 percent higher than the current tariff (1.80Lt/m^3).

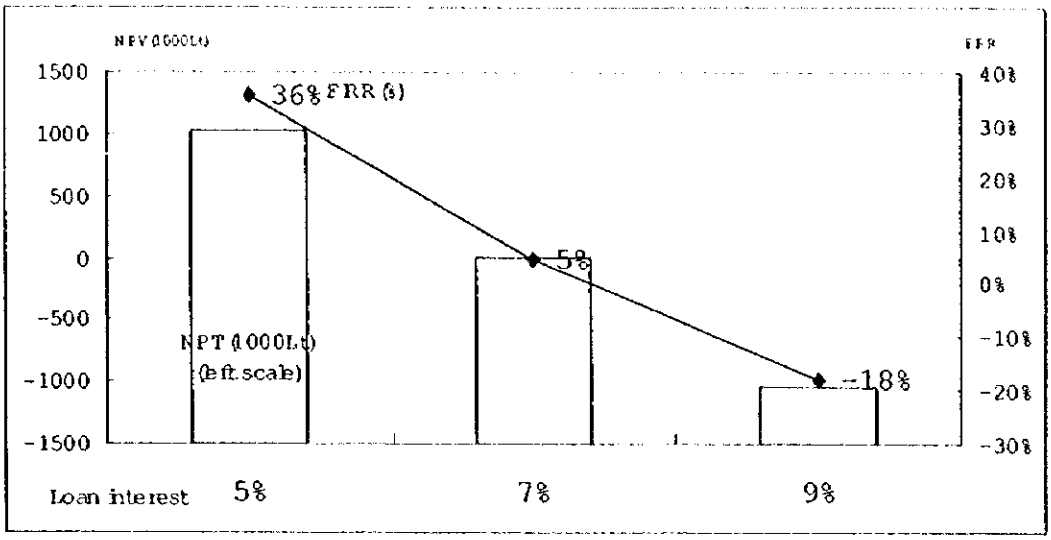
4.12.2.3 Sensitivity Analysis

Sensitivity of the tariff projections and FIRR (and net present value (NPV) with discount rate of 5 percent) with different assumptions was analyzed to examine the effects of various factors.

The result shows if the tariff be set at 2.27Lt/m^3, the loan with an interest cost of 7 percent will bring the project the 5 percent of FIRR and just the positive NPV, using discount rate of 5 percent. The loan with an interest cost of 5 percent will bring an high FIRR and NPV to the project.

The loan with an interest cost of 9 percent will bring negative FIRR and NPV to the project, meaning the project financially unfeasible.

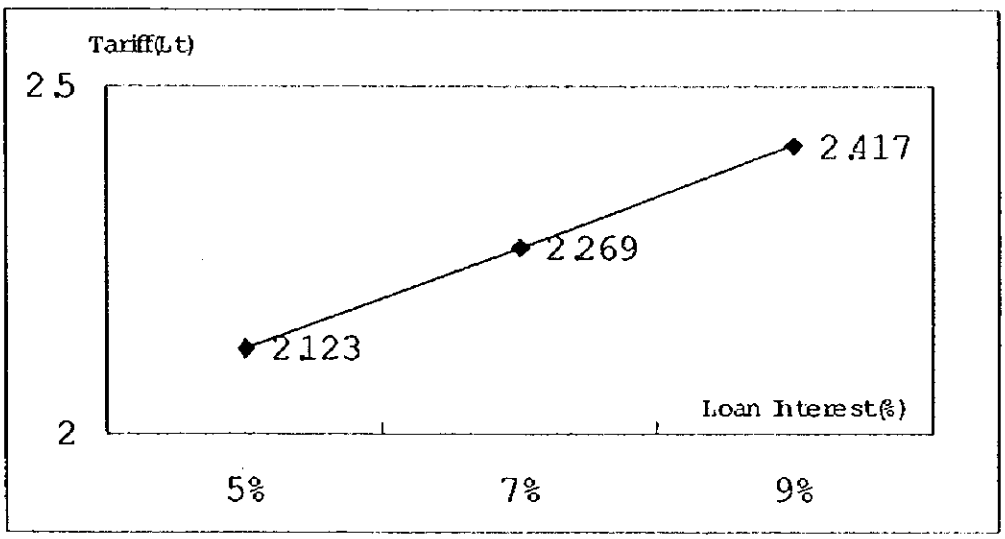
FIRR AND Net Present Value (NPV) of the Project for Different Loans (cost)



Assumption: 25year Loan with 10-year grace period for 50% of the total investment
State Grant: 50% of the total investment
Initial Tariff: 2.27Lt/m^3
Discount Rate:5%

Figure 4.15 Sensitivity of FIRR to Interest of Loan with Fixed Tariff

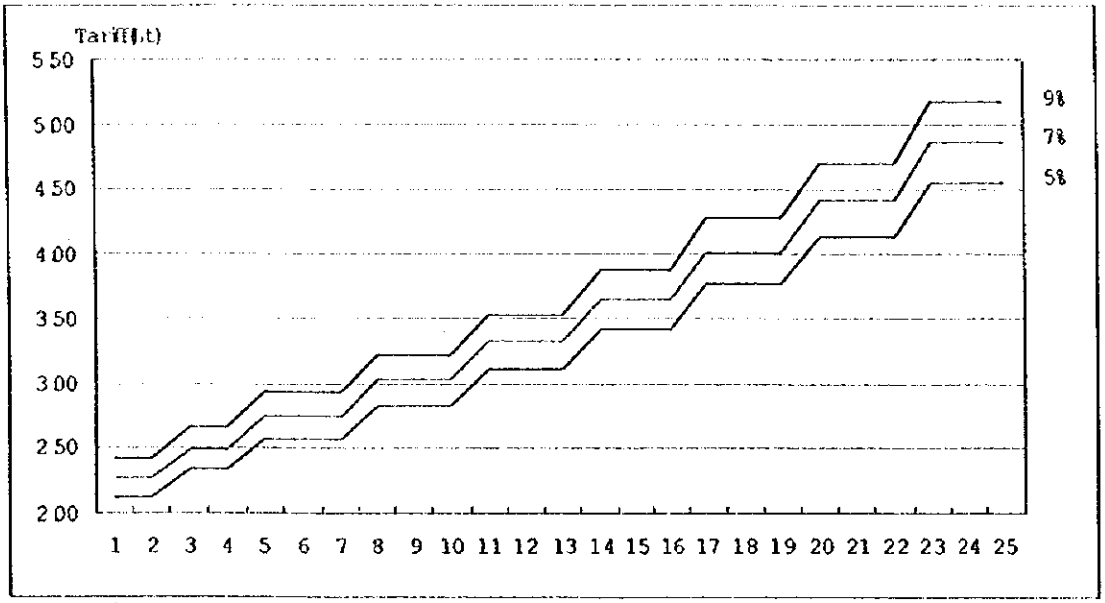
Tariff (Initial) Profile for Different Loan (cost)



Assumption: 25year Loan with 10-year grace period for 50% of the total investment
State Grant: 50% of the total investment
Target FIRR at 5%
In all cases, the tariffs increase at the same rate as explained in the test concerning the model

Figure 4.16 Sensitivity of Tariff to Interest Rates of Loan with Fixed FIRR

Tariff Profile for different loan(cost)



Assumption: 25year Loan with 10-year grace period for 50% of the total investment
State Grant: 50% of the total investment
Target FIRR at 5%
In all cases, the tariffs increase at the same rate as explained in the test concerning the model

Figure 4.17 Projection of Tariff to Variable Loan Interests with Fixed FIRR

The result shows if the project use the loan with an interest cost of 7.0 percent, then the tariff should be set at 2.27 Lt/m^3 to achieve 5 percent FIRR (and positive NPV using discount rate of 5 percent).

The result also shows that the interest cost has a effect on the initial tariff. The lower the interest rate is, the lower the tariff can be assumed. If the initial tariff be raised to the level about 2.27Lt, then the model shows the financing with interest cost of 5 percent will bring an high FIRR and NPV (with discount rate of 5 percent), and the financing with interest cost of 9 percent will bring an negative FIRR and NPV (it means the total project will lose more than 1 million litas at the present value using the discount rate of 5 percent, during the 25-year term).

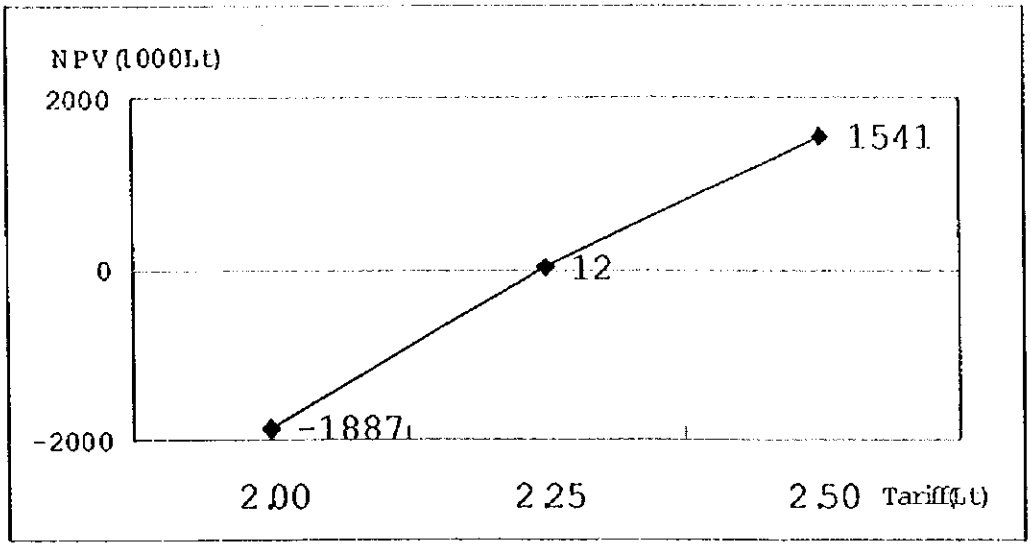
It shows the different interest cost will have effect on the tariff, from the beginning to the end of the repayment period as follow:

Tariff (Lt/m^3) predicted in different interest costs are presented below:

Table 4.51 Projected Tariff to Achieve 5% FIRR

Interest Rate of Loan (%)	Tariff (Lt/m^3)		
	First Year	10th year	25th year
5	2.12	2.83	4.55
7	2.27	3.02	4.86
9	2.42	3.22	5.18

NPV Profile for Different Initial Tariff



Assumption: 25year Loan with 10-year grace period for 50% of the total investment
State Grant: 50% of the total investment
Interest Rate of Loan: 7%
Discount Rate:5%

Figure 4.18 Sensitivity of FIRR to Initial Tariff with Fixed Loan Interest

The result shows that in the case of utilizing the loan with 7 percent interest, the initial tariff below the level of 2.25Lt/m^3 will make the project unfeasible financially .

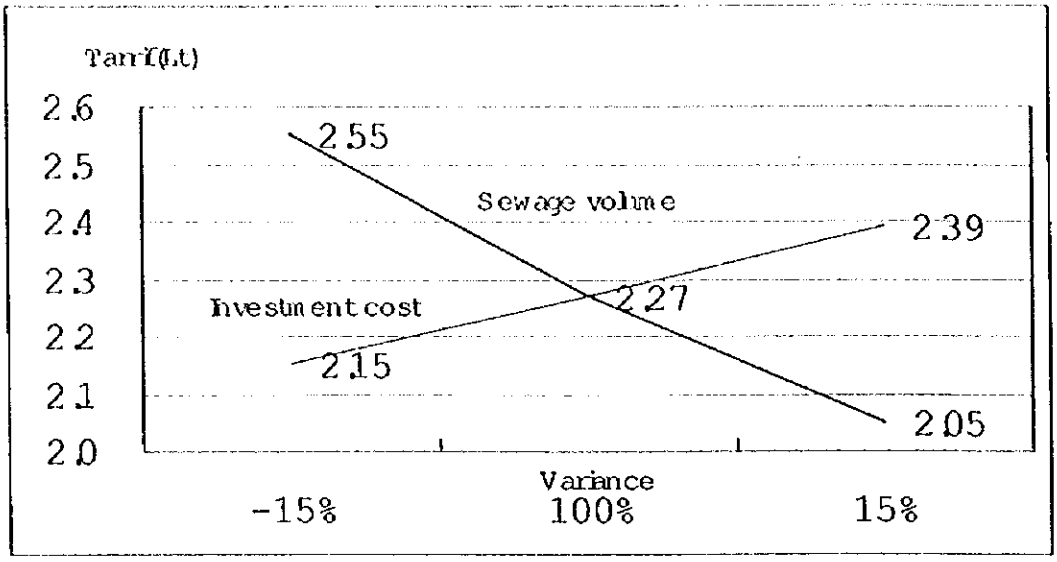
The positive NPV using discount rate of 5 percent means the project will be able to cover the operating cost and to pay back the loan (both the principal and the interest), when the total cost of the project is at or below 5 percent.

The negative NPV using discount rate of 5 percent means the project can not cover the operating cost and pay back the loan (both the principal and the interest), when the total cost of the project is at or above 5 percent.

The result shows that if the initial investment cost increases by 15 percent, tariff required to achieve the FIRR 5 percent should be 2.39Lt/m^3 at the first year. If the investment cost decrease by 15 percent, tariff required to achieve the FIRR 5 percent can decrease to 2.15Lt/m^3.

If the amount of sewage decreases by 15 percent, the tariff required to achieve the FIRR 5 percent should be 2.55Lt/m^3 at the first year. If the amount of sewage increases by 15 percent, tariff required to achieve FIRR 5 percent can be decreased to 2.05Lt/m^3.

The tariff profile for the initial investment cost and sewage volume variance



Assumption: 25year Loan with 10-year grace period for 50% of the total investment
State Grant: 50% of the total investment
Interest Rate of Loan: 7 %
Target FIRR at 5%

Figure 4.19 Sensitivity of Tariff to Investment Cost and Sewage Volume

4.12.3 Conclusions and Recommendations

Through the use of the financial model, the financial feasibility has been analyzed; the tariff required to recover the all cost have been predicted; and the sensitivity of the tariff and FIRR to the variance of some important factors have been studied.

As a conclusion of the financial analysis, the following recommendations are proposed.

(1) Tariff Structure

- Tariff should be set not only to recover the operating cost, but also to pay back the loan (both the principal and the interests).
- In setting the tariff, a certain level of the positive FIRR should be fully considered, in order to maintain a sustainable management of the Water Company.
- The bench marking of 5 percent of FIRR should be a standard for the project.
- If finance can be arranged for 50 percent from the state subsidy/grant and for 50 percent from the loan at the cost below the level of 7 percent, the required tariff is predicted at the 2.27 Lt/m^3 in the first year. It should then increase once every two years during the first 4-year period, and once every 3 years for the remaining period of the project, both by 10 percent.
- The above predicted tariff may be affordable to the users for the reasons as follows:

- Compared with the current level of the tariff, the predicted tariff will increase in 8.1 percent per year next 3 years.
- Increase in tariff is considered modest during the whole repayment period that is 10 percent in every three years, while inflation rates is 5 percent every year. This is equal to 15.7 percent every three years.
- Percentage of expense due to the sewage tariff in the family income will be maintained at the current level or rather improved (or decreased) if the family income is to catch up the inflation.

(2) Selection of Funding Source

With tariff limited within the acceptable level, selection criteria for funding source is recommended as follows:

- Tariff of Skuodas is already at the top (highest) level in the country.
- Economic development, family income and municipality budget is not expected to increase quickly.

As a result, feasibility of the project will largely depend on utilizing the loan with low cost and other favorable conditions. Grace period is also important for the project, considering the heavy financial burden in operation during the first ten years.

A funding source should be selected so that the project will be operated at the lower tariff while maintaining viable financial conditions to recover the total cost and reach a certain level of FIRR.

State subsidy/grant will be necessary in about 50 percent of the total investment cost.

Other funding is recommended to have an interest rate not above 7 percent and preferably with a 10-year grace period.

4.12.4 Economic and Social Analysis

4.12.4.1 Project Benefits

The value of the project will be viewed in terms of economics as well as financial values. A sewerage project provides the community with a wide range of economic benefits such as health, sanitation and overall living conditions. The various benefits are expected to be brought about by the project are discussed in the following sections.

Health Benefits

Health benefits are clear and one of the main reasons of installing a sewerage system. The health benefits that are brought about to the community by the sewerage system have two aspects. The first is the preventing effect which reduces the burden on the local and central governments in terms of disease prevention and patient treatment effect activity. The second

is the reduction of opportunities to contact with infected matters which reduces the incidence of diseases.

It is reported that skin diseases had been increasing by river water in the Bartuva, from 1,315 cases in 1990 to 1,381 cases in 1997. It is however difficult to make causality of sewerage clearer and it is said that the number is decreasing.

Environment Benefits

One of the purposes of the Project is the enhancement of the living conditions in areas where water quality has been worsening. This will be achieved by the construction of this project. This project will reduce water pollution that has large impacts on living conditions. The people may be able to enjoy swimming in the river and fishes will come back into the river. Especially Latvia will be able to enjoy quality improvement of river water in the Bartuva.

The Water Company will be able to pay adequate pollution charge. This change indirectly contributes to improvement of environment in Lithuania.

Local Economic Benefits

The construction of the sewerage project will contribute to the local economy in several ways. The first is the input-output effect of construction and procurement of materials during the construction period in the regional economy. The local economy will benefit from the employment of individuals for construction work and through the sale of locally made products and services. If the company uses foreign materials, the effect would decrease. The cost of construction should be as low as possible when we think of healthier management. This effect therefore should not be expected too much. The second is the public revenue benefits and it is expected to increase even if the amounts are not large. The company will pay more than two times today's real estate tax.

Increase in real estate tax covered by business improvement contributes to local economy.

International Relation Benefits

Lithuania decided to join the EU and has to build environment facilities, such as sewerage, to meet the environmental standard of the EU. Besides this, Latvia is complaining of inflow of wastewater into the Bartuva River from Lithuania. This project contributes to the improvement of these international relations.

4.12.4.2 Economic Analysis

Regarding the economic valuation of the project, the most preferable approach would be the quantification of the economic benefits and costs. In many cases, however, there are many factors which can not be quantified. The concept can be shown as follows.

Table 4.52 Concept of Economic Analysis

Category	Indicators	Improvement of Indicators	Economic Units	Economic value (1998 price)
Health benefits	Generally speaking, it is difficult to specify and quantify the effect.			
	(example) Number of skin disease	(example) If the number decreases to the level of 1000 from 1381 in 1997, Improvement number is 381	(example) Average yearly expenditure on health care and medical service per capita in 1996 is 109litas	(example) 381*109*1.131 *1.084 (1996-1998) = 51,000litas
Environment benefits	Pollution charge	The company will be able to pay adequate pollution charges from 0 to 4300 in 2002. Improvement is 4300	None	4,300 litas/year /(1.061*1.059* 1.05**2) =3,000 litas
Local economic benefits-1	Real estate tax	From 4000litas in 1997 to 8000litas in 2002 Increase of 4000litas	None	4,000 litas/year /(1.061*1.059* 1.05**2) =about 3,000 litas
Local economic benefit-2	Regional Input Output effects	Construction costs litas 6.66 million	A multiplier by I-O table 2.0-3.0 (in case of Japan)	6.66 million * 2.5 =16.7 million litas
International relation	Economic effect	Economic Growth	Contribution to environmental standard improvement	Contribution to environmental standard improvement

Regarding the economic valuation of the project, the most preferable approach would be the quantification of the economic benefits and costs. In many cases, however, there are many factors which cannot be quantified. When economic effects of infrastructure projects are estimated, the following aspects are generally quantified. It is necessary to set simple conditions to calculate benefits.

(1) Residents

1) Amenity benefits from a healthy environment after construction of the project are difficult to calculate.

2) Health benefits from reducing water related diseases and decreases in medical expenses after construction. For example, the beneficial effects equals the reduction in the number of decreases, i.e. number of patients times average cost for medical expenses per capita)

3) Leisure benefits such as boating, swimming, fishing or picnic in a clean river and clean lake, and sightseeing after construction, for example. The beneficial effects will be equal to the number of people typically using these facilities times the average recreation expenditure per capita.

(2) The Water Company

1) Efficient management from decreased operating costs after construction, for example. The beneficial effects equal the decrease in operating costs between the old sewerage system and improved system. The told operating costs would include, for instance, clearing up after a heavy storm from overflowing sewerage systems.

2) Increase in revenue after construction, for example, the beneficial effects will be equal to the increase in revenue between the old sewerage system and improved sewerage system).

(3) Municipality

1) Adequate pollution charges. For example, the beneficial effects will be equal to the decrease in pollution charges after the new system is constructed. The beneficial effects will also be equal to the increase in pollution charges in case that the Water Company doesn't pay pollution charges due to recording loses. The beneficial effects therefore equal the absolute number of changes in pollution charges after the new system is constructed.

2) Real estate tax in case of added value and expansion of the improved treatment plant site after construction. For example, the beneficial effects will be equal to the increase in real estate tax.

(4) The Government

1) Increase in corporate tax after construction.

2) Increase in VAT gained from construction, and its second effects from purchases during construction and operation, for example, the beneficial effects equals construction costs times VAT plus second effects times VAT plus operation costs divided by 1 plus VAT.

(5) Others

1) Employment of construction workers during construction. For example, the beneficial effects equal the wages per capita times workers, equal the wages per capita times construction costs divided by labor productivity of construction worker per capita.

2) Procurement of materials and others items during construction. For example, the beneficial effects equal second effects which equal the multiplier in an input-output-table times construction costs: the multiplier in Japan ranges from 2.0 to 3.0, for instance)

3) Employment of second effects. For example, the beneficial effects equal second effects workers salary which equals wages per capita times workers number which equals the wages per capita times second effects divided by average labor productivity per capita of all industries.

4) Attraction of new industries and employment of workers after construction, which is difficult to estimate. For example, the beneficial effects equals the construction plus its second effects plus the employment wages gained.

5) Increase in productivity of agriculture because of improvement of the soil is also difficult to estimate.

4.12.4.3 Social Analysis

The social aspects of the project, in other words how the project will directly affect the lives of the people in the area, must be considered with care. Analysis will consider unique characteristics of the area in terms of the relative affluence of the people and their requirements/desires in terms of the sanitation and income level.

According to the questionnaire survey, water and sewerage expenses to average monthly expenses in Skuodas is 2.2 percent and it seems to be higher than other areas considering the differences of the income level and the tariff level. Increase of the tariff should be discreet.

The average annual unemployment rate in Skuodas is higher than other districts. Reduction of employees may be necessary in order to manage the company and to cover the costs besides increasing the tariff. It may be difficult for the Water Company to reduce the number of staff members. The priority should however be given to efficient management. The public organizations or public service bodies might have to hire local people at the former Soviet Union era. This kind of custom management should be changed gradually. The Water Company is not responsible for unemployment problems in the region. The Water Company is responsible for efficient management and coverage of the costs as an independent organization. The municipality and the government are responsible for unemployment problems instead.

Table 4.53 Average monthly gross earnings

	1995		1996	
	Amounts (litas)	index	Amounts (litas)	index
Total	505	1.00	641	1.00
Klaipėda district	524	1.04	680	1.06
Skuodas	360	0.71	474	0.74

Table 4.54 Average annual unemployment rate

	1993		1994		1995		1996	
	rate	index	rate	index	rate	index	rate	index
Total	4.4	1.00	3.8	1.00	6.1	1.00	7.1	1.00
Klaipėda	4.5	1.02	4.4	1.16	6.6	1.08	7.0	0.99
Skuodas	8.1	1.84	10.1	2.65	9.6	1.57	10.2	1.44

4.13 IMPLEMENTATION PROGRAM

Implementation program of the proposed project will consist of the following stages:

- Detailed design
- Financial preparation
- Tendering
- Construction
- Commissioning

The schedule of each stage is assumed as shown in the figure below:

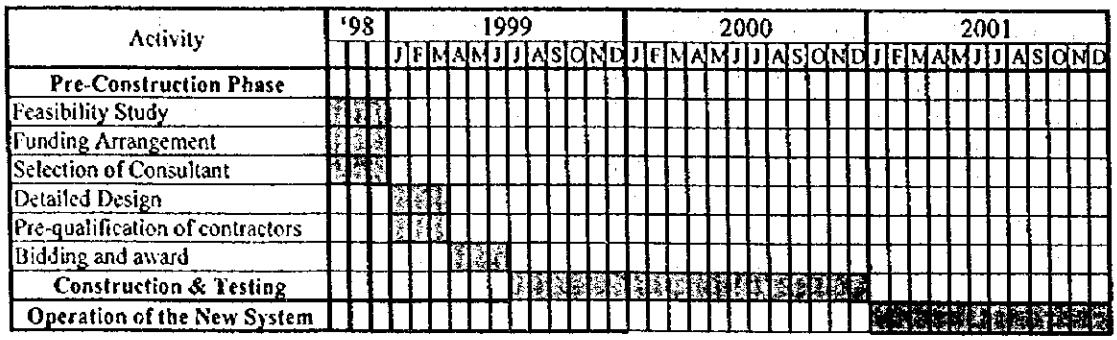


Figure 4.20 Implementation Schedule

4.14 RECOMMENDED ORGANIZATION AND MANAGEMENT OF THE WATER COMPANY

4.14.1 Recommended Organization

4.14.1.1 Reduction of Staff Members or Fixing Staff Levels

The Water Company has increased the tariff substantially over the past several years and the level is high in comparison to other companies. Consumers may have some legitimate complains on the increase in tariff and the high cost of service based on the questionnaire survey. In order to raise the tariff further to cover costs, the company has to make every effort to thoroughly review itself and show the consumers the serious efforts, being made to reduce costs. Two employees now operating the present sewage treatment plant can be eliminated once the new project is in operation.

The number of employees should be fixed or reduced further even though water and wastewater treatment usage increases in the future. The increases can be managed through personnel movement from other departments or units.

4.14.1.2 Adjustment of Organization for Billing and Collection

The function of a controller in charge of billing and collection of fees will become more important in the future after installation of the new project and increases in usage of the services. Billing and collection of the fees is similar to the sales department of general private companies. The Water Company, however, is not large enough to have a separate sales department. A controller department should be established and the number of controllers be increased by transferring engineering staff members. This function should be controlled by the director of the company. Recommended organization of the Water Company is shown in Figure 4.21.

4.14.1.3 Establishment of Clearer Business Units of Water and Sewerage Service

The income of the Water Company is only from charges for water supply and wastewater collection and treatment. It is natural that all common costs should be shared between the water supply department and the sewerage department. Administration costs and backup costs should be shared properly. Cost sharing ratios and a table for cost sharing should be established as shown below.

Table 4.55 Example of a Cost Sharing Table

Cost items	Sharing ratio for sewerage division	Sharing ratio for water division	Annual costs	Cost sharing of sewerage division	Cost sharing of water division
Personnel costs Name of person					
President					
Mr. A					
Ms. B					
-					
Operation costs					
Energy					
Fuel					
Total					

The managers of these two units have a responsibility to cover their costs just as does the director. The Water Company (the managers) should have discussions in setting of cost sharing ratios for all cost items.

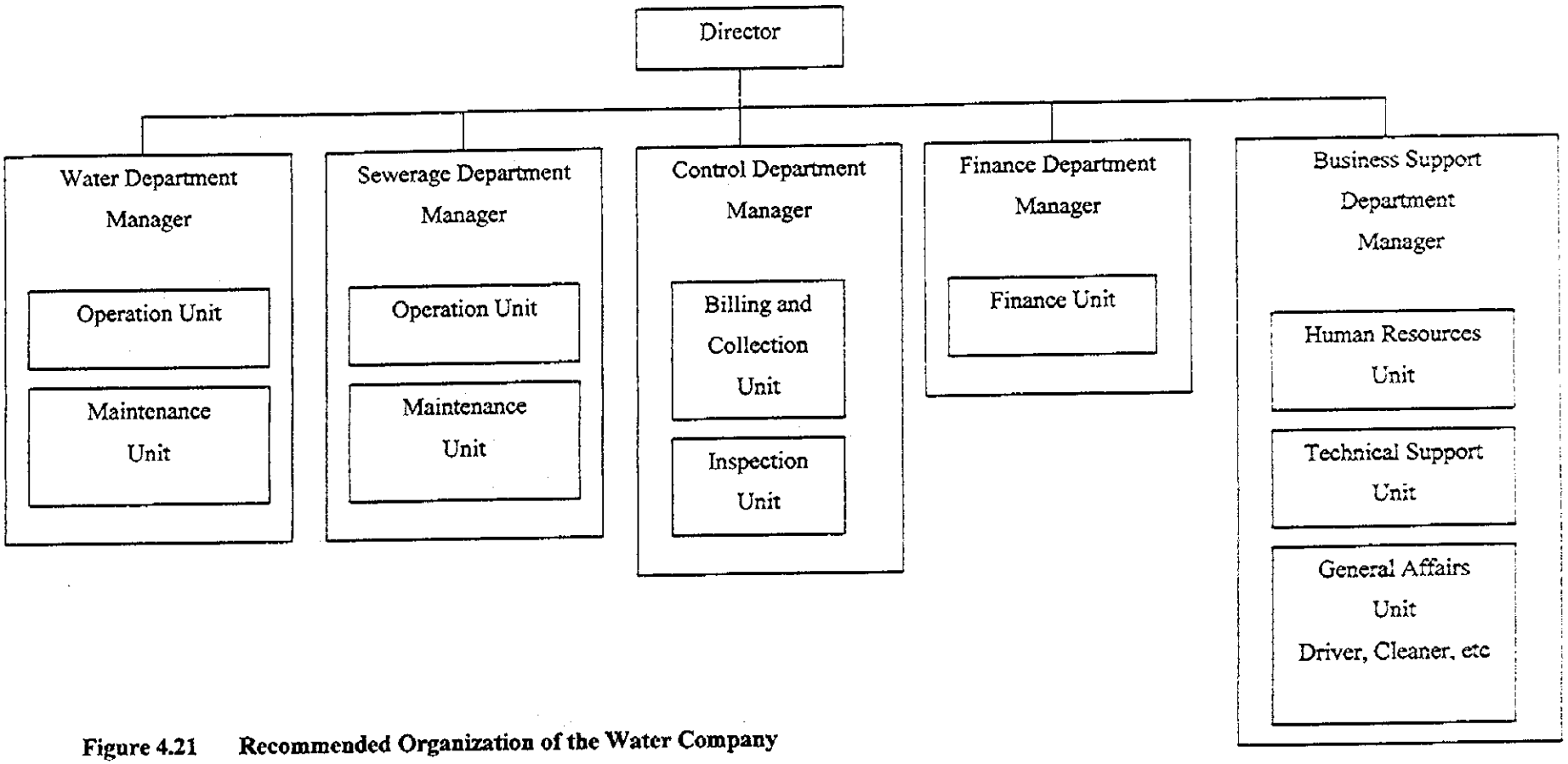


Figure 4.21 Recommended Organization of the Water Company

4.14.1.4 Introduction of part-time workers and the use of outside services in the future

Many companies in other countries have been using part-time workers and purchasing services outside the company for clerical workers, office cleaning, guards and janitorial services, etc. These service industries will appear as the society moves to market-oriented one. It is possible to cut personnel costs by introducing a part-time work system.

4.14.2 Recommended Enforcement of Management

4.14.2.1 Task Force Team for checking declarations

The Water Company should establish a task force team for checking the declarations of all consumers from spring to autumn. The team should be lead by the director, followed by the managers of the water and sewerage departments and employees of all units should join the team whenever possible. This team would contribute to the increase in income and become a method by which a deeper understanding between the company and consumers could be achieved.

4.14.2.2 Integrated Management Information System

An integrated management information system should be installed to manage the Water Company more efficiently.

A billing and collection control system, revenue accounting system, water and sewerage monitoring and maintenance system, stock and supply control system, procuring control system, operation costs accounting system, assets controlling system and cash controlling system, settlement accounting system and a budgeting system are recommended to be included in the information system.

Since the company is not large, all of the distinguished systems are not necessary at this time. However, the billing and collection control system and the cost accounting system should be introduced as early as possible. Monthly or quarterly assessment of the efficiency and the achievement of goals by personnel and by the company should be conducted.

Recommended information management system is presented in Figure 4.22.

4.14.2.3 Join the Water Company Association

The Lithuanian Water Company Association consists of water companies and related private companies such as engineering technical and consulting companies and provides the members with information on dealing with technical and managerial problems. The association holds seminars for these subjects and joining the association would benefit the company in its self-evaluation process.

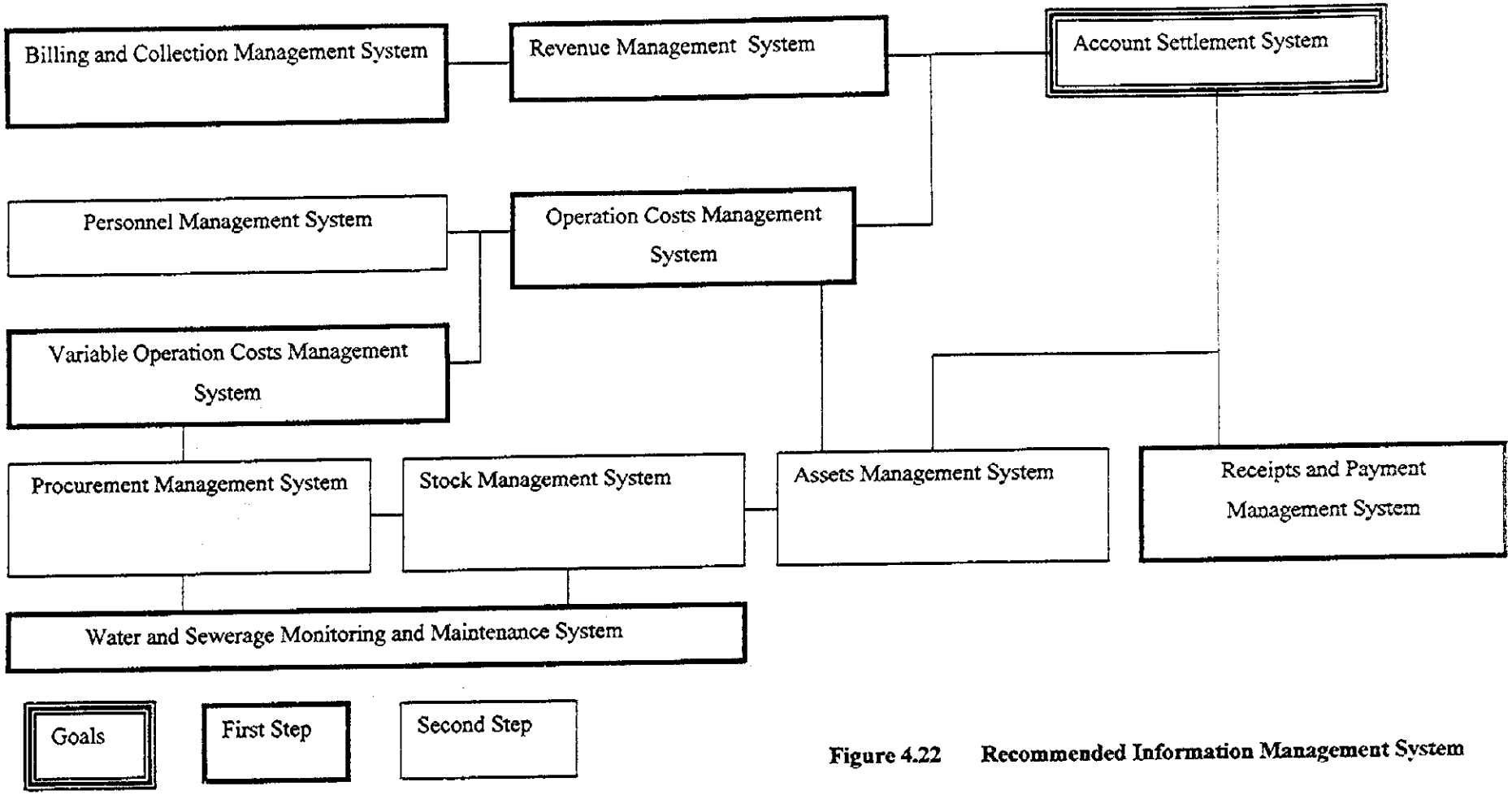


Figure 4.22 Recommended Information Management System

4.14.3 Performance Assessment System

4.14.3.1 Goals and Assessments for Business Units

The Water Company may not be familiar with the assessment system for business units. Private or self supporting companies should establish goals to achieve at the start of each fiscal year. Achievement ratio (actual over planned) should be evaluated every quarter or twice a year. The managers of the business units have a responsibility to meet the achievement ratio and staff members of the units share this responsibility when personnel performance is assessed. The company faces lots of problems everyday and this activity seems to be unrealistic because the company is kept busy solving their immediate troubles. The Water Company is however an on-going concern and this activity is important to solve long-term problems systematically and understand why these problems develop.

Goals, for example, could consist of 1) cost saving (resulting in reduction of the amounts of money spent, improvement in the ratio compared to previous years), 2) efficient operation (resulting in reduction of the numbers of breakdowns, improvement in the ratio compared to previous years), 3) safe operation (resulting in reduction of the numbers of accidents, improvement in the assessment ratio compared to previous years), etc.

4.14.3.2 Written Goals and Performance Assessments for Staff Members by Personnel Meetings

All staff members should have clear written goals every year and a performance achievement ratio should be assessed in discussion with each staff member once or twice a year. Goals for individuals are similar and contribute to the success of these of business units. Personnel meetings between the general manager (director) and his staff members should be held once or twice a year focusing on goals and assessments.

4.14.3.3 Incentives for Achievement of Goals

Based on assessment activities, special incentives for achievement of goals should be established.

These special incentives could be as follows, for example;

- Bonus (in accordance with cost savings generated after improvement in the loss)
- Remuneration (in accordance with achievement ratio, for the next years' remuneration)
- Training (in accordance with improvement in the achievement ratio for participating in training courses in their specialty)
- Awards (in accordance with improvement in the achievement ratio by giving an award from the company)

4.14.4 Other Issues in Organization and Management

4.14.4.1 Training and Education

Staff members should be given information on new operation skills and technologies. All staff members should participate in lectures and seminars on worthwhile concerns, especially staff members in the personnel unit of the business support department participating in courses on personnel management and personnel assessment process.

4.14.4.2 Continuation of Opinion Survey and Promotion of Understanding

Some people have complains about the tariff and further increases of the tariff. The Water Company should continue to obtain opinions of its consumers in order to wisely plan for needed tariff increases without regional political problems or a decrease in services. The continuation of opinion surveys and public announcements on improvements in service, outstanding employees, important projects (such as water or wastewater plants) and programs (reduction of costs, improvement of services, changes in billing and collection system, changes in the tariff structure, etc) are important and improve the management of the Water Company.

Recommended program structure is shown in Figure 4.23.

4.15 PROJECT EVALUATION

4.15.1 Rationale of the Project Implementation

As the Bartuva River basin extends from Lithuania to Latvia, pollution of the upstream river water has been raised as an international issue. Downstream on the river, Latvia is currently implementing the environmental protection scheme called "Bartava" in the Bartuva River Basin in cooperation with nine municipalities represented by Danilea and Barta. This scheme is supported by the Latvian Government as well as the Swedish Government to improve the environment of the downstream part of the Bartuva River and preserve the area for various purpose such as a recreation, protection of fauna and flora including Liepajas Lake and swamp area in its basin.

Environmental improvement schemes carried out at the Latvian side include the improvement of the existing sewage treatment plants that are not functioning efficiently. This improvement plan aims at the removal of nutrients (nitrogen and phosphorous) as well as BOD removal that is required to protect the sensitive area of the lake.

Delegations from Latvia consisting of the nine municipalities have visited Skuodas several times, and encouraged Skuodas Municipality to participate and cooperate in the scheme. For the effective improvement of the river basin environment, pollution loads emitted upstream should first be reduced while the similar efforts are being carried out at downstream. Skuodas is the largest community in the upstream basin of the Bartuva River and the Luova River that is a tributary and confluent with the Bartuva River at Skuodas.

Construction of the proposed sewage treatment plant will effectively contribute to the effort being carried out for the environmental protection in the Bartuva River Basin. Implementation of the project should have a high priority considering the present status of the discharge of effluent from the treatment plants in Skuodas.

4.15.2 Project Evaluation

4.15.2.1 Technical Evaluation

The project is evaluated as feasible in terms of technical aspects to meet the effluent standards set by the Ministry of Environment. The proposed oxidation ditch process requires minimal expertise in operation and maintenance so that the Water Company will not need to employ any highly experienced staff for operation.

Sludge treatment using a dewatering device and stockpiling composting will produce sludge that will be minimal in volume, easy to handle, and safe for fertilizing the agricultural land.

4.15.2.2 Environmental Consideration

Implementation of the proposed project will lead to improvement of the existing environmental pollution caused by the discharge of the effluent from the sewage treatment plant. Adverse impact on the Bartuva River basin will be substantially reduced by introducing the recommended treatment method and by properly carrying out the treatment operation. The Latvian water environment downstream on the Bartuva River is expected to improve.

The sewerage service ratio is scheduled to increase from the present 75 percent to 90 percent in 2010. With more houses connected to the sewerage system, the proposed project will reduce the amount of domestic wastewater that is currently discharged into the drainage channels and finally flowing into the Bartuva River.

Implementation of the project will not have a serious environmental impact either during the construction period or operation of the treatment plant.

4.15.2.3 Financial Evaluation

The financial analysis shows that the project is financial viable with a reasonable range of tariff setting and assumptions of financial sources in 50 percent of soft loan and 50 percent of state subsidy/grant.

4.15.2.4 Economic and Social Evaluation

The proposed project is expected to contribute to the upgrading of the local economic and social environment.

Living conditions of the residents will also be improved particularly when they have contact with the water of the Bartuva River through their amusement or hobby activities.

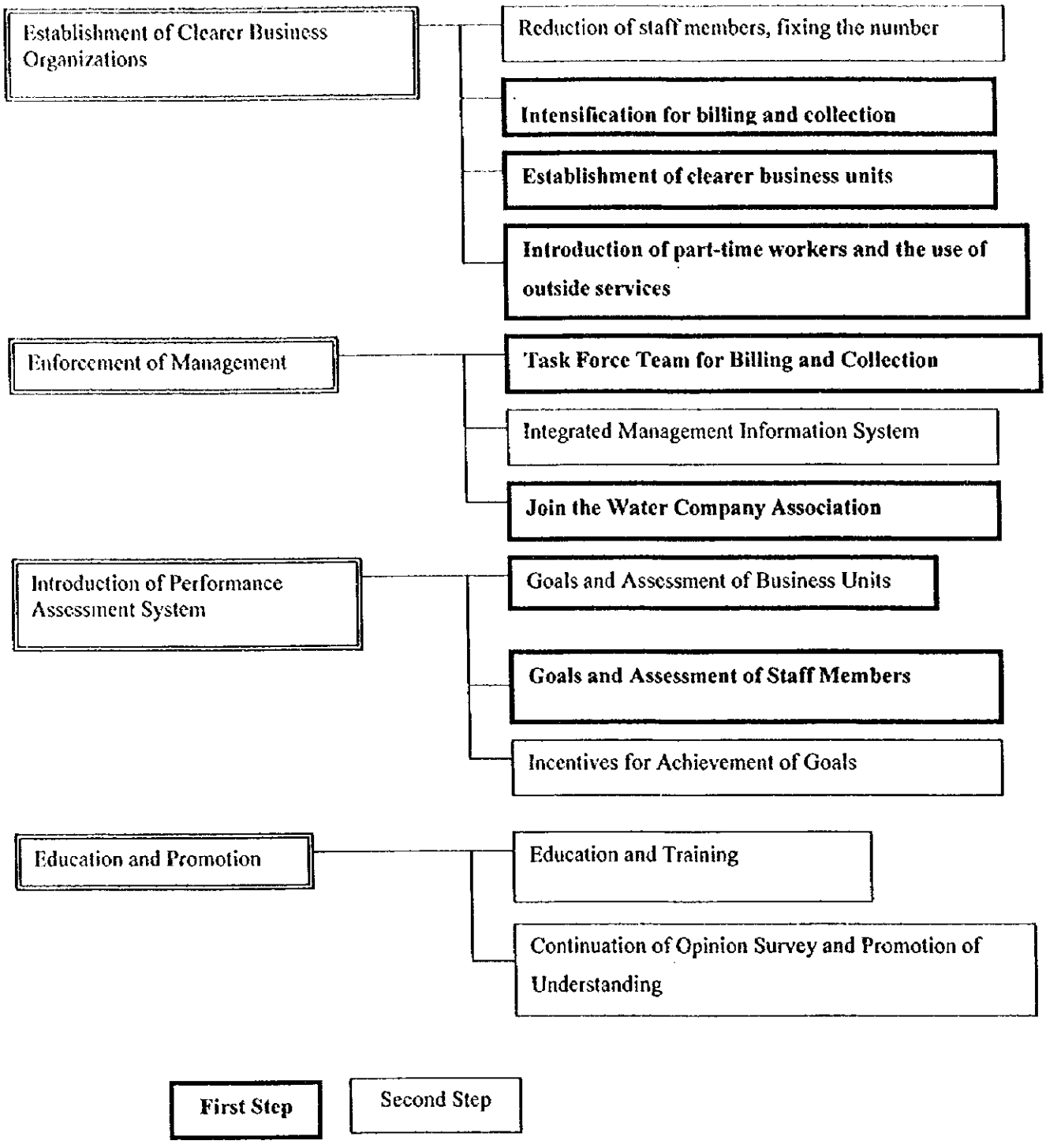


Figure 4.23 Recommended Program Structure for the Skuodas Water Company

CHAPTER 5

ENVIRONMENTAL IMPACT ASSESSMENT

5 ENVIRONMENTAL IMPACT ASSESSMENT

5.1 IDENTIFICATION OF ENVIRONMENTAL IMPACTS

5.1.1 Major Findings of the Preliminary Environmental Study

5.1.1.1 General

The JICA preliminary study mission arrived in Lithuania during November 1997 and carried out a preliminary environmental impact assessment (EIA). The preliminary EIA identified some items with probable adverse impacts and concluded that the project required an EIA.

The JICA study team arrived in May 1998 and reviewed the preliminary EIA after a period of field reconnaissance and data collection. The study team also conducted screening and scoping sessions for the following reasons:

(a) The preliminary EIA is appropriate in general, however there are many points which seem to be insufficient or not always appropriate. It is quite reasonable that there are some differences in the EIA between the preliminary mission and the study team as the survey period for the preliminary mission was too short to collect all necessary data and information.

(b) The preliminary EIA report was written only in Japanese. It is now necessary to present the results of this comprehensive EIA in English for review by the Lithuanian side.

Accordingly, the screening and scoping presented herein are based on the information and data collected during this study period.

5.1.1.2 Screening

The objective of screening is to determine if the project requires an environmental impact assessment.

Features of the project and its environment are summarized in Table 5.1 and Table 5.2 for a brief understanding of the project from the screening stage. The results of screening are shown in Table 5.3. The environmental components are categorized and selected to cover all probable cases. All general components are included in the list, although the sewerage projects, may in general, have impacts on some limited components such as the relocation of inhabitants, waste sludge treatment, fauna and flora, landscape, water pollution, noise and vibration, and odor.

It is concluded that an EIA is necessary at Skuodas.

5.1.1.3 Scoping

Objective of scoping is to find significant impacts among all probable impacts for the projects and to clarify the significant fields or components for the EIA survey. The overall

evaluations of the unknown, slight or significant environmental impacts are shown in Table 5.4.

The components selected by the preliminary mission are all included in the list impacts, although a few of them are not considered significant.

5.1.2 Components of EIA

Based on the results of the study conducted by the JICA preliminary mission and also referring to discussions with the Lithuanian side, the objective components of an EIA are selected for Skuodas as follows:

Item	Related Issues in the Project
(a) Relocation (and land acquisition)	Relocation of inhabitants in or near the construction site, land acquisition and compensation
(b) Vested Right	Water use right including any permission or customary use
(c) Health and hygiene	Contaminated water for drinking water source, sludge treatment/disposal
(d) Waste disposal	Sludge treatment/disposal
(e) Topography and geology	Change of natural topographic condition Change of geological conditions
(f) Groundwater	Contamination of groundwater
(g) River and lake	Changes caused by water quality pollution
(h) Fauna and flora	Conservation of significant or endangered species
(i) Landscape	Landscape of project facilities in harmony with the surrounding area
(j) Water pollution	Water quality deterioration of river water, groundwater and lake water due to effluent disposal from the STP
(k) Soil pollution	Soil contamination by effluent disposal from the STP and sludge disposal or storage
(l) Odor problem	Odor from the STP and sludge disposal site

5.2 ENVIRONMENTAL IMPACT ASSESSMENT

5.2.1 General

Environmental assessment is all about comparisons. The EIA is fundamentally a study to identify what is existing and to predict what changes will result from the project. Accordingly, the EIA only needs to compare the existing environment against the anticipated changes.

If the present environment is already polluted, the project does not have a responsibility to improve the condition to a level within the desirable environmental condition. It does not mean that the project makes an adverse impact as long as the environment is no worse on completion of the project than prior to the project.

The components included in the EIA are selected from the preliminary environmental study. The same categories of component are to be used for the EIA, although there are some common impacts among the various components.

In this report, the baseline data for the EIA is not attached, except for some selected items. It is necessary to refer to the supporting report of the EIA for more detailed and background information.

5.2.2 EIA of the Project in Skuodas

5.2.2.1 Environmental Impact Assessment

(1) Impact on Relocation (and land acquisition)

There are three alternative sites for the proposed STP as shown in Figure 5.1. The characteristics of these sites and the environmental impact on relocation and land acquisition are presented as follows:

(a) Site A : Kanyzelis district

This site is the one originally proposed for the STP located just outside the town area (Skuodo Miesto), approximately 200-300 m west from the boundary (railroad) of the town. The area is presently used for agriculture. There is a farm house located next to the proposed STP site. There is another house near but westerly of the site. The owner of this house lives in town and uses this house only from time to time.

The proposed area is within state lands although private land is located nearby, as shown in Figure 5.2. According to the information from the municipality, the state lands used for farming are leased but are to be returned to the state when necessary.

Concerning the relocation of land and house, the municipality says it could provide compensation and/or prepare another house, if required. The study team visited the farm house and had a brief interview. The family with four adults

have lived there for 19 years and has worked on his land (25 ha) as well as on leased land (3 ha). According to his comments on relocation, they do not wish to move to another place and want to stay at the same place even if a new STP is constructed adjacent to his house, or if a part of his land is required. They also added, however, that he would like to see the location and house provided by the municipality before an actual decision is made to move or not. He has no objection to the construction of the STP itself.

Beside the above, there is a newly constructed dam and reservoir west of the site. The reservoir area is rented to a private firm and currently used for fish breeding. No direct impact will be made to the reservoir operation either by construction or effluent discharge.

(b) Site B : Salomejos-Neries Gatve district

This site is an alternative for the STP and is located just south of the existing STP No.2 and inside the town area. The area is grassland and no intensive use is apparent. According to the municipality, it is state land and there is no planning for any use now. A residential area is located nearly 200 m south of this site as is the existing STP No.2. No structures are located in and around this alternative site, except the existing Pumping Station No.2.

(c) Site C: Laisues Gatve district

This site is another alternative for the STP located in the surrounding area near the confluence of the Bartuva and Luoba Rivers and inside the town area. This alternative site is located on the southern part of a large piece of vacant land, approximately 50 ha, in the town area. The whole area is owned by the state although a part is rented for farming. The area is mostly grassland and partially used for agriculture.

The municipality has a project planned for the central part of this vacant area. The project aims at providing lands to residents in a part of old town instead of returning their land to the town for compensation. This project would require 11.7 ha.

The alternative STP site is located in a portion along the southern side of this area required for the project.

As shown above, no adverse impact could occur in any of the alternatives in regard to relocation, as well as land acquisition.

However, special care should be taken at Site A, as this is the most probable site. The farmer living nearby the proposed new STP may not show strong opposition against the project or relocation. Advance information and communication will be essential, not only with this farmer but also with the other farmers renting or using farm land near the site.

In regard to an influent pipeline route, a new dual pressure pipeline has already been extended to Site A. The other two sites are located along the route of this pipeline. Accordingly no adverse issue is expected.

Concerning the route of an effluent discharge pipe from the STP, the pipeline will pass grazing or farm land to the Bartuva River. No adverse impact on relocation or land acquisition is predicted.

(2) Impact on Vested Right

As far as known, there is no official vested right to guarantee a certain quantity of surface or groundwater. There is a government regulation regulating permission for water intake, utilization and transmission and discharge of pollutants to natural waters. This permission, however, does not always mean a vested right on water use. It can be said that no impact may arise on vested rights, however, it would be better to consider that the permission is also a type of vested right.

Detailed data on any present permissions to use natural waters were not obtained. It seems that there is no remarkable water use from either the Bartuva River or from the Luoba River. These rivers are listed as non-leasable rivers and are also within a reserve area defined by the government. No water intake is allowed from these rivers. Agricultural farming in this region generally does not require irrigation water since rainfed farming is common. The source of water supply for the town is groundwater. Therefore, no impact on vested water rights.

No impact on vested rights pertains only to the Skuodas side. It is, however, necessary to consider the downstream stretch in the country of Latvia. It was not possible for the study team to visit Latvia to carry out surveys for some issues including vested rights. If there is a water intake for water supply downstream in Latvia, water pollution may cause an adverse impact to the rights of using clean water. Accordingly, consideration has to be taken of water quality in the Bartuva River. The rights to water use may be hindered if the water is contaminated.

It should be an easy matter to make definite evaluations. The impact should be compared between the cases with, and without, the project. In other words, the project may not need to have a responsibility for treating the water to a required standard if the river is already contaminated to a level above the standard.

The Bartuva River, at present, receives effluent from the existing two Skuodas sewage treatment plants. The effluent contains large volumes of pollutants due to its deficiency in treatment capability. It would be reasonable to assume that a new plant would discharge well-treated effluent, comparing with the present condition. The water quality in the river, therefore, will improve after the new plant starts operation. This means no adverse impact is expected in this case. It would be, however, necessary to verify the vested rights in the

Bartuva River and also monitor the water quality of the river.

(3) Impact on Health and Hygiene

The effluent water quality from the proposed STP will be improved from the present conditions with the existing STP facilities.

Attention should be paid to the impact on groundwater, which is the source of drinking water as well as production water for a dairy. It is, however, not expected that the groundwater will be contaminated because of the effluent of the proposed STP. The Skuodas area is not located in a karstic zone, so that the contamination of groundwater is not a matter of serious discussion. It would be probable that the contaminated water may infiltrate into a local groundwater source, although such an occurrence would be rare.

Accordingly, no adverse impact is predicted on health and hygiene. Regular inspection and monitoring of wastewater discharge and water quality will be required to verify the safety of the public health.

(4) Impact on Waste Disposal

Sludge treatment would be the center of attention for this component. Presently no sludge treatment facility is provided in Skuodas. At the proposed STP, dewatered sludge (3.0 m^3/day) will be dried and stored inside the STP site for six months on a concrete slab. The waste sludge will then be used for agriculture. The local farmers will take the sludge by themselves as it is presently.

The environmental issue will not be serious. However, an analysis of the actually produced sludge should be conducted to examine its suitability for use as a low level agricultural fertilizer.

(5) Impact on Topography and Geology

No significant change of landform will be made by the project. The project site is located in flat land. There is no adverse impact concerning the topography except the inlet end of the plant will be about 6 m higher than the surrounding area to allow sewage to flow by gravity through the treatment plant.

Impact on geology also may be negligible. The project site is not located in a geologically significant area such as the active karst area, where sink holes develop with higher speed if the effluent infiltrates underground.

The treated effluent will be better than the level of water quality required for a treated sewage discharge. The adverse impact, therefor, may not happen to the geological condition, if the project facilities are well designed and operated.

(6) Impact on Groundwater

This item is similar to that already described under the items of "health and hygiene" and "topography and geology". There is no possibility of further degradation of the groundwater by the project.

The runoff rate of precipitation to the Bartuva River is 56 percent. The remaining balance evaporates, is taken up by plants, or infiltrates into the ground. Although there is no definite data about infiltration, it is probable that the infiltration rate in Skuodas is much less than that in Birzai. The rate of infiltration into the groundwater means that less impact is predicted from a surface water source to the groundwater.

Treated effluent is below the required level of water quality. Adverse impacts therefore will not happen to the groundwater component.

(7) Impact on River and Lake

There are two reservoirs in and around the Skuodas town. One is the Skuodas Lake located on the south side of the town. Another is a small reservoir (to be named the Duobupis reservoir, from the name of river) located near the proposed STP site. The river system and lakes in and around Skuodas are shown in Figure 5.3.

Skuodas Lake is a popular recreational site, through which the Bartuva River passes. Discharge of the Bartuva River can be regulated here. The project site is located downstream of the lake; therefore, no impact to Skuodas Lake is anticipated. The Duobupis reservoir is used for fish breeding by a private firm. The reservoir is located close to the proposed site; however, there is no direct connection of treated effluent between the project and the reservoir. At present, there is no definite plan for recreational use. No impact is anticipated on the Duobupis reservoir.

The STP facilities will not be located in or along rivers or lakes so that no direct impact is predicted to the landscape, natural disaster, erosion of banks, etc. of the river.

The only concern will be an impact related to water quality. If the effluent from the treatment plant contaminates the surface water, it will cause water pollution. River waters then will become inappropriate for recreational use. Some species living in and along the river may be endangered. Water quality will be improved from the present condition; therefore, no adverse impact is expected.

It is, however, required to monitor changes in conditions in the river or the lake during the operation and maintenance period.

The project is located some distance from the coast. The Bartuva River reaches the sea after flowing nearly 48 km from the project site. Only approximately 2 km of this length is located in Lithuania with the remaining 46 km in Latvia.

There will be almost no change in the river discharge or soil runoff into the river by the proposed project. Accordingly no impact to the coast, no scouring or river mouth silting will be caused by the project.

Impact on this international river is however, a sensitive matter. Careful monitoring and exchange of information is recommended in cooperation with Latvia.

(8) Impact on Fauna and Flora

There is no significant or endangered species in or around the proposed STP site and the other two alternative sites. There are, however, significant species in the Bartuva River, where the treated effluent will be discharged. In addition, there is a significant protected area for the study called "Bartuva ichtiological reserve". The protected area in Skuodas is shown in Figure 5.4. The protected area is 40.6 ha in area and distributed over a length of 40.6 km. There are three zones in the reserve as follows:

(a) The Bartuva River between the confluence points with the Luoba River and the Apse River (2.6 km long).

(b) The Luoba River from the confluence with the Bartuva River to a point 31.5 km upstream.

(c) The Sate river from the confluence with the Luoba River to a point 6.5 km upstream.

The main objectives of this protection are to preserve the spawning places of trout and taiman. Accordingly, it is necessary to pay special attention to this protected area with significant species.

As already explained, the existing two treatment plants discharge poorly treated effluent to the Bartuva River. The new STP will discharge treated effluent better than the existing effluent, so that the water quality of the Bartuva River will be improved from its present condition.

No adverse impact is predicted on fauna and flora in the Bartuva River.

Although a survey of fauna and flora has been carried out locally, it is recommended to regularly monitor changes in the river from the treated water discharge.

(9) Impact on Landscape

The STP is the main facility of the project. There are three alternative sites as described in (1) as follows:

(a) Site A : Kanyzelis district

(b) Site B : Salomejos-Neries Gatve district

(c) Site C: Laisues Gatve district

Among three alternative sites, Site A is most desirable from the viewpoint of landscape. Site B would be the next and Site C is less desirable. All three sites are located in an area surrounded by grassland or farm land. Only Site A is located outside the town. Site B is located inside the town, however, at the west side. Site C is located more or less in the central area of the town, although the site area is now vacant. A large facility, like a STP, is better not located inside town in consideration of future development of the town area.

The STP is recommended to be constructed in Site A. No adverse impact is anticipated on the landscape component. It is, however, recommended to have architecturally pleasing structures and landscaping of the site to be harmonious with the surrounding landscape

(10) Impact on Water Pollution

As the project aims at the improvement of sewage treatment, an adverse impact may not be anticipated on water pollution. Concerning the impact on river water quality, an explanation has already been discussed in the component of "vested right", "topography and geology", "groundwater" and "river and lake".

The effluent is discharged into the Bartuva River and the water quality will be improved from the present condition. Therefore, no adverse impact is expected.

Groundwater contamination may not exceed the level already existing. Treated effluent is better than the level of water quality required for wastewater discharge so that the geological formations in Skuodas are not significant. Therefore groundwater contamination should not happen.

Accordingly, no adverse impact on water quality is predicted by the project. It will be, however, necessary to monitor the change in water quality conditions in the rivers, lake and groundwater during the operation and maintenance period.

(11) Impact on Soil Contamination

Soil contamination might happen when contaminated effluent or hazardous substances run-off, or are dispersed into soil. In case of this project, effluent from the STP will be treated to better than the level of effluent standard required. Sludge from the STP will be thickened and dried in the STP for use as a low-level fertilizer. Accordingly, no adverse impact on soil contamination is anticipated.

(12) Impact of Odor

Odor is one of the significant issues in sewage treatment. Odor from the STP will surely be emitted. The point is how strong, how often it may happen, and how wide an area it affects. Of the three sites previously discussed, Site A is the best. The next is Site B while Site C is not desirable from the viewpoint of odor. The main reasons are as follows:

(a) It is better to be far as possible from the town area and the town center.

(b) An easterly wind direction prevails in Skuodas almost all year. Site A is located on the west side, but some distance from the town/residential area. The town area is somewhat below the east-west direction from the proposed treatment plant. Site B is also located on the west side of town but closer to the town center. Site C is located near the central area but on the west side of the residential area.

Site A was originally proposed as the site for the STP. The municipality requests the other two alternative sites for the purpose of comparison. It is recommended that Site A be selected from the viewpoint to prevent, or reduce, odor nuisance, which may be the most representative item of nuisance caused by the sewerage project. .

The proposed STP site (Site A) is located in a rural area surrounded by agricultural land and grassland. There is only one house located near the site. Accordingly, no serious impact of

odor will be created, except possibly for the family of this house. The local government will propose to relocate the family. The head of the family informed the study team that the odor may not be a problem for them so that they could remain in the same place.

Beside the people surrounding the STP site, it is also necessary to consider the people working at the plant and visitors.

According to the inhabitants living next to the existing treatment plant No.1, the odor is not a nuisance matter for them. They are discomforted only during the time of cleaning or transporting sludge. They say it is a usual smell. Visitors temporarily smell the odor.

In Lithuania and especially in rural towns or villages, the odor from the STP may not be an adverse issue. It is recommended, however, that monitoring of odor problem be carried out to verify actual conditions.

5.2.2.2 Summary of EIA and Mitigation Measures

(1) Summary of EIA

The EIA carried out in the previous section concluded that there might be no component having any significant impact. The conclusion of the EIA on every component is briefly shown in Table 5.6. In a final assessment of the environmental impact, the impact level is categorized as follows:

A:	Significant impact anticipated
B:	Slight impact anticipated
C	Unknown (subject to further verification)
D1:	Almost no impact anticipated
D2:	Almost no impact anticipated, but to be verified
D3:	Almost no impact anticipated, but monitoring will be required

The category D, "Almost no impact anticipated" is divided into D1, D2, and D3. It would be reasonable to make such division because, in some cases, a component categorized as D needs to confirm an issue in greater detail or to monitor actual conditions during the operation and maintenance stage.

As seen in the table, none of the environmental components are considered in A, B or C category. All selected components are categorized as D, "Almost no impact anticipated". It would be reasonable to conclude that the project may not cause any adverse impact on the environment, due to the following reasons:

(a) The sewerage improvement project is also an environmental improvement project. This kind of project generally does not make an adverse impact or has only a slight impact.

(b) The environmental issues generally caused by a sewerage improvement project are limited to the following components:

- Relocation & land acquisition
- Waste disposal
- Fauna and flora
- Landscape
- Water pollution
- Noise & vibration
- Odor

The project site is located outside the central town area, so that most of the above impact items are not serious in comparison with a site located closer to an urban area. The water related problems may not happen, as the river receiving the treated effluent is already receiving effluent from two existing treatment plants. Upon project completion, the existing sewage plants will be abandoned, so that the river water quality will be improved from the present condition. In addition, the project preliminary design takes into account environmental countermeasures as follows:

- Sludge treatment at the STP
- A buffer zone surrounding the STP facilities
- Site selection
- Landscaping
- Architectural design
- Relocation

(c) Concerning the issues during the construction, ordinary countermeasures will be sufficient for preventing environmental nuisances. There are no particular long-term significant conditions from construction.

(2) Mitigation Measures

Mitigation measures need to be adopted into the final project plan, to either moderate or forestall potential environmental impacts. Mitigation measures generally consider the following:

(a) Changing the project site, layout, transportation routes, disposal routes or locations, timing, or engineering designs;

(b) Introducing pollution controls, waste treatment, phased implementation and construction, engineering measures, monitoring, landscaping or social services;

(c) Compensation for loss or damages and/or resettlement

In defining mitigation measures, it is essential to make clear links with the project activities and effects. Rather than simply detailing measures that must be taken, the EIA should define the project activities, the effect arising from that activity, and the specific measures designed to mitigate the effect. In this way, residual impacts and effects that will not be mitigated, will be identified clearly. However, as explained in the previous sub-section (1), no adverse impact is anticipated at this stage in the study. Accordingly, no mitigation measures will be required.

The EIA, however, is only a result of prediction. It will be necessary to make a survey to

verify the prediction of an impact before the construction, and/or to continue the monitoring survey during the operation period.

The necessary activities for verification as well as monitoring are already shown in the previous sections of the EIA and in Table 5.6. The results, however, are summarized below:

(a) Verification of relocation (if necessary) of a family located next to the proposed STP site.
(b) Verification of vested right in the Bartuva River, including the Latvia side if possible.
(c) Verification that the STP is landscaped especially during the design stage.
(d) Monitoring water quality in the Bartuva River and groundwater in and around the project site.
(e) Monitoring sludge disposal conditions including the location and method.
(f) Survey and monitoring of fauna and flora in and along the Bartuva River, including the Latvian side if possible, and the Luoba River.
(g) Monitoring the actual condition of odors of the STP and the waste sludge disposal site.

It is noted that the EIA was conducted without classification of project stage. This means that no separate EIA was carried out for pre-construction and post-construction stages. The site is located in a rural area and no significant environmental restriction is foreseen for construction. There is no particular reason to make such a detailed classification for this project.

Among the selected environmental components, the relocation of residents and land acquisition is a matter for the pre-construction stage. The other components are basically a matter during the post-construction stage. For the construction stage, it would be sufficient to take the usual care for the environment. Examples of such cares or mitigation are listed as a reference as follows:

(a) Employment of local labor where possible to prevent social conflict;
(b) Safety and health control should be strictly followed;
(c) Land clearing should be minimized for access roads;
(d) Non-toxic chemicals should be used for construction especially in the drilling of deep wells.
(e) Waste (solid and/or liquid) disposal anticipated during construction should be carried out in accordance with the planning and schedule approved by the supervising engineer (burial, burn, hauling away, etc.)

5.3 RECOMMENDATION ON ENVIRONMENTAL MANAGEMENT

The results of the EIA study further suggest that careful attention should be paid in the future during the operation and maintenance stage to assure the environmental status as predicted.

Environmental management is concerned with the implementation of the measures necessary to minimize or offset adverse impacts, if any, and to enhance beneficial impacts. Unless environmental management is implemented sufficiently, it is possible that an unexpected adverse impact may be caused.

The EIA also concluded that the project implementation will not cause a definite adverse impact. The project will rather contribute significantly to improve the overall environment of the project area. It is, however, recommended to ascertain the environmental improvement by proper environmental management. General recommendations for management are briefly described for Skuodas as follows:

(a) Establish a program for surveying and monitoring the environmental conditions of all the necessary sectors as listed below:
   - Verification of relocation (if necessary) of a family located next to the proposed STP site;
   - Verification of vested right in the Bartuva River, including the Latvian side, if possible;
   - Verification of landscape at the STP site especially during the design phase;
   - Monitoring water quality in the Bartuva River and groundwater in and around the project site.
   - Monitoring sludge disposal conditions including the location and method.
   - Survey and monitoring of fauna and flora in and along the Bartuva River, including the Latvian side, if possible, and the Luoba River.
   - Monitoring actual condition of odors at the STP and the waste sludge disposal site.

(b) Follow up based upon the results of monitoring and the survey and to take countermeasures, if necessary;

(c) Identify pollution sources, draw up the inventories of the pollution sources, and establish early warning and alarm procedures for reducing the pollutants discharged;

(d) Submit the records of environmental conditions (water quality, fauna and flora, odor, etc.) to the MOE for their review, when any change occurs;

(e) Prepare a plan and take measures for any wastewater sources that are not connected to the sewerage system of the project;

(f) Prepare a sufficient annual budget for environmental management;

(g) Invite school children and students to the project facilities and educate them in the importance of environmental protection and conservation;

(h) Regulate the use of the areas surrounding the STP sites;

(i) Carry out regular inspections of the facilities not only at the STP but also along the pipeline routes.

(j) Cooperate and participate in the project on the environmental protection of the Bartuva River established by the municipalities on the Latvian side.

Recommendation to the MOE

(k) Prepare and ratify the bilateral agreement with Latvia on the environmental protection of trans-boundary waters and the international boundary zone.

(l) Complete the preparation or revise the necessary environmental standards (especially for water quality) as well as the definite guideline for an EIA (for individual sectors) as early as possible. For example, the effluent standards for discharge into surface waters was revised and approved in 1997, but no other standards have been updated. In addition, it is suggested to prepare detailed effluent standards for major pollution sources, especially for industries (with classification).

Table 5.1 Project Features

Item	Description
Project Name	Sewerage System Improvement for Birzai and Skuodas Town in the Republic of Lithuania
Background	In both towns of Birzai and Skuodas, the existing sewerage systems are deteriorated and the treatment capacity is not sufficient. The existing treatment plants are not properly operable at present and the insufficiently treated effluent is released to the rivers, which causes water pollution not only in rivers but also in groundwater. The water pollution problem also becomes an international claim as the rivers run down to the Baltic sea through the neighboring country, Latvia. The government of Lithuania had prepared sewerage improvement plans for both towns to solve the problems and construction works have been partially started. However, the contents of the plans are not definite enough and the construction was suspended. It was decided to review the existing conditions and reformulate the plans.
Purpose of this study	To conduct a feasibility study for improvement of sewerage system that will contribute to the upgrading of sanitary and environment conditions in Birzai and Skuodas towns for the target year of 2010.
Location	Town of Birzai is located close to the northern border with Latvia and approximately 200km away in a north-northwest direction from Vilnius. Town of Skuodas is located facing Latvia, close to the Baltic Sea on the west, and approximately 350km away from Vilnius in a northwest direction.
Executing Agency	Ministry of Environment, Municipality Government of Birzai, and Municipality Government of Skuodas
Population of Beneficiaries	Population served (2010) : 11,720 in Birzai and 8,340 in Skuodas
Project Features	
-Objective Structures	Treatment plants to be newly constructed. (the existing sewer systems are to be used as it is)
-Objective Areas	Town areas of Birzai (1,783 ha) and Skuodas (596 ha). Additional areas may be included if the town areas are to be expanded before the year 2010.
- Sewerage Type	Separate Sewer System (in both towns)
-Treatment Plant	Birzai : Area of 2.7 ha with 5,000 m^3/d in daily max. capacity. Skuodas : Area of 1.8 ha with 1,600 m3/d in capacity.
-Treatment Method	Birzai : Anaerobic-anoxic-aerobic (A2O) method Skuodas : Oxidation ditch method
-Sewer Length	Birzai:27km (existing) , Skuodas : 23 km (existing)
-Effluence Release	Birzai: Juodupe river (2km new discharge pipe), Skuodas: Bartuva river (0.6km new drainage pipe)
-Effluent water quality (Average)	Birzai (to Juodupe) : BOD7 4mg/l, SS 30mg/l, TN 8mg/l, TP 1.0mg/l Skuodas: BOD7 15mg/l, SS 30mg/l, TN 20mg/l, TP 1.5mg/l
Others	Latvian government requests that Skuodas improve the water quality of the Bartuva River.

Table 5.2 Project Environment

Item		Description
Project Name		Sewerage System Improvement of Birzai and Skuodas towns in the Republic of Lithuania
Social Environment	Inhabitants	The beneficiaries are primarily living in town. At the proposed treatment sites, there are no houses in Birzai, but one in Skuodas. Both areas are owned by the state.
	Land use	In Birzai, the STP site is vacant and covered with grass. The surrounding area is a rural area of grassland and farming land. In Skuodas, the STP site and the surrounding area is used for farming.
	Economy/ Traffic	No remarkable economic activity is found at the proposed STP sites, but agricultural use nearby. The rural roads have little traffic. The residential area is located in town. In Birzai, there are some middle-scale factories near town. In Skuodas, only one middle-scale factory.
Natural Environment	Topography and Geology	Generally flat land. The geological condition in Skuodas has no significant issues. But, in Birzai the active karst zone is widely located.
	Coastal zone condition	Nothing special.
	Endangered Fauna & Flora	No significant fauna & flora is at the STP sites. In the rivers, however, some protected species of fish and animals are recorded, although they are not endangered species.
Pollution	Significant Claim	Latvia claims Skuodas is polluting the surface waters. Groundwater pollution in Karst area of Birzai.
	Counter measures	Necessary to improve the sewerage treatment plants in both towns.
Other matters		In Birzai, the treatment plan was previously established, however the construction was suspended. For Skuodas, an initial design was prepared, but construction was not started.

Table 5.3 Screening

Item			Description	Impact	Remarks
Social Environment	1	Relocation	Relocation due to land acquisition.	Yes	There is one farm house, in or next to the STP site.
	2	Economic activity	Decrease of production. Change of economic structure.	No	State land rented for agricultural use, but the area is limited in size.
	3	Traffic/Public facilities	Traffic congestion, Accident, Effect on public facilities	No	No particular inrease. Only rural roads.
	4	Division of Communities	Separation of local communities due to blocking of transportation system.	No	Not applicable
	5	Archaeological/ Cultural Heritage	Decrease or deterioration of archaeological/cultural sites.	No	No such sites.
	6	Vested Right	Right for fishery, water use, logging ,etc.	Yes	No impact in quantity. But, water contamination may cause water use problems.
	7	Health and Hygene	Degradation of hygienic conditions caused by waste disposal and vector insects.	Yes	Depending on the disposal of wastes. Contamination of groundwater from effluent disposal is possible.
	8	Waste Disposal	Construction waste/debris, contaminated mud, sludge, general wastes, etc.	Yes	Sludge disposal is a common environmental issue for sewerage project.
	9	Disaster/Accident	Increase of danger from ground collapse, land sliding, traffic accident, etc.	No	No such danger is worth consideraction from the viewpoint of small scale of structures and topographic condition.
Natural Environment	10	Topography & Geology	Change of significant land forms and geological features caused by earthwork, etc.	Not sure	The site is flat. The geological condition is to be confirmed.
	11	Soil erosion	Soil erosion originated by runoff through earthworks, logging , etc.	No	The rainfall intensity is low. No remarkable scale of earthworks.
	12	Groundwater	Water contamination caused by excessive pumping, decreasing seepage capacity, etc.	Not sure	Depending on the disposal of wastes and contamination of groundwater from effluent disposal.
	13	River & Lake	Change of discharge, velocity, riverbed due to reclamation, new channel construction , etc.	Yes	Probable impacts due to effluent disposal from the plant.
	14	Coast	Scouring or sedimentation at coastal area due to change of drifting sands and waves.	No	The river is not large and the coast is located far from the site.
	15	Fauna & Flora	Reduction of breeding and extermination of endangered species.	Yes	Fish species are generally protected in Lithuania. There is a preseave area in the Bartuva River.
	16	Climate	Climate change arising by implementation of large scale development of earthworks and structures	No	No change due to small scale. Sewerage project is not a type to give an impact to climate.
	17	Landscape	Change of landscape due to earth works and new structures.	Not sure	It is necessary to consider the harmony with the present landscape and preserve the natural zone.
Pollution	18	Air pollution	Air pollution caused by exhaust gas and poisonous gas from vehicles and factories.	No	No burning facility.
	19	Water pollution	Water contamination caused by inflow of soil, chemical substances, oil, etc.	Yes	No burning facility. Construction period is short term.
	20	Soil contamination	Soil contamination caused by runoff and diffusion of effluent, poisonous substances, etc.	Yes	The effluent from factories is generally organic and very limited in toxic substances. But the effluent may cause water pollution if not treated well.
	21	Noise/Vibration	Noise and vibration caused by running vehicles, pumping operation, etc.	No	Waste sludge disposal may contaminate the soil.
	22	Ground Subsidence	Ground surface subsidence caused by change of foundation condition and lowering of groundwater level.	No	No facilities with noise or vibration. The equipment is small in scale. The site is located in a rural area.
	23	Odor	Occurrence of exhaust gas and odor.	Yes	No pumping of groundwater. Foudations are not deep except for a small potable water system for the plant
Necessity of EIA				Yes	Already confirmed by MEP

Table 5.4 Scoping

		Item	Impact	Remarks
Social Environment	1	Relocation	B	There is a farm house,located next to the STP site. The proposed STP site is located on state land (rented now). Private land is located next to the site.
	2	Economic activity	D	State land rented for agricultural use, but the area is limited.
	3	Traffic/Public facilities	D	No particular increase which hinder traffic. Only rural roads.
	4	Division of Communities	D	No structure to separate the local community.
	5	Archaeological/ Cultural Heritage	D	No such sites in or nearby the project site.
	6	Vested Right	C	No impact in quantity. But, water contamination may cause of water use problems. The existence of vested right is not known.
	7	Health and Hygiene	C	Depending on the disposal of wastes and contamination of groundwater from effluent disposal. Drinking water is taken from the groundwater.
	8	Waste Disposal	B	Sludge waste and effluent disposal cause adverse impact from odor, soil contamination, etc., if not properly treated.
	9	Disaster/Accident	D	No such danger is worth consideration from the viewpoint of the small scale structures and topographic condition.
Natural Environment	10	Topography & Geology	C	The site is flat. The geological condition is to be confirmed.
	11	Soil erosion	D	The rainfall intensity is low. No remarkable scale of earthworks.
	12	Groundwater	C	Depending on the disposal of wastes and contamination of ground water due to the effluent.
	13	River & Lake	B	Probable impact due to effluent disposal from the plant.
	14	Coast	D	The river is not large and the coast is located far from the site.
	15	Fauna & Flora	C	Fish species are generally protected in Lithuania. There is a preseave area in the Bartuva river. The existing fish in Bartuva river and tributaries generally prefer very clean water.
	16	Climate	D	No change due to small scale. Sewerage project is not a type to impact climate.
	17	Landscape	C	It is necessary to consider harmony with the present landscape and to preserve the natural zone. However, the STP site is not a significant site from the landscape viewpoint.
Pollution	18	Air pollution	D	No burning facility. The location is in a rural area.
	19	Water pollution	B	The effluent from factories is generally organic and very limited in toxic substances. But the effluent may cause water pollution, if not treated well.
	20	Soil contamination	C	Waste sludge disposal may contaminate the soil. The impact may depend on the treatment of sludge.
	21	Noise/Vibration	D	No facilities with noise or vibration. The equipment is small in scale. The site is located in a rural area.
	22	Ground Subsidence	D	No pumping of the ground water. Foudations are not deep.
	23	Odor	B	Depending on the site location and the wind direction from the treatment plant and waste disposal sites. The impact due to the treatment method of sludge should be considered.

Score: A-Significant impact anticipated.
B-Slight impact anticipated.
C-Unknown (subject to further verification)
D-Almost no impact anticipated and not subject for IEE and EIA.

Table 5.5 Overall Evaluation

Item		Impact	Necessary Survey	Remarks
1	Relocation	B	Existing houses and other structures at the proposed site. Land ownership of the proposed project site.	Necessity and difficulties of relocation as well as the land acquisition. There is only one house located next to the proposed STP site.
6	Vested Right	C	Vested right, especially for water use. Information of Latvia side, if possible.	Water contamination may impact the present use of water.
7	Health and Hygiene	C	Location of treated effluent release. Possibility of contamination of groundwater. Location and method of waste sludge disposal.	Health problems may happen from contamination of groundwater due to effluent or waste disposal. Drinking water is taken from the groundwater.
8	Waste Disposal	B	Location, volume, contents/quality and method of waste sludge disposal.	Location as well as method of disposal is important.
10	Topography & Geology	C	Data collection on topography and geology of the project site. Field survey , if required.	Significant conditions of topography and geology may cause an adverse impact by the project.
12	Ground water	C	Present conditions of groundwater, especially the water quality. Geological condition in the project area.	The influence of contaminated surface water to the groundwater is studied.
13	River & Lake	B	Present conditions of river & lake including the surrounding area. Water quality and runoff to a river & lake which may receive the effluent.	The impact to Latvia must be considered. Bartuva river enter to Latvia at 1 or 2 km downstream of the project site.
15	Fauna & Flora	C	Fauna & flora in and around the project site. Endangered, significnat, protected species. Survey including the Latvia side,if possible.	Fish species are generally protected in Lithuania. There may be protected animals in rivers. Bartuva river and its tributaries are reserved area and there may be reserved area in Latvia side.
17	Landscape	C	Landscape in and around the project area. Natural reserve or park.	It is necessary to consider harmony with the present landscape and natural area.
19	Water pollution	B	Present water quality and runoff to a river and lake which may receive the effluent.	The results of a water quality survey are an important factor as well as the other environmental components. Latvian government claims Skuodas has polluted the Bartuva River.
20	Soil contamination	C	Proposed location and method of waste sludge disposal. Present treatment of sludge.	Treatment method of sludge is significant to the level of impact.
23	Odor	B	Collection of weather condition including wind. Odor condition of the existing STP. Interview inhabitants near the STP.	Impact on odor depends on the site location , the wind direction from the treatment plant and waste disposal site. The impact due to the treatment method for sludge has to be considered.

Score: A-Significant impact anticipated.
B-Slight impact anticipated.
C-Unknown (subject to further verification)
D-Almost no impact anticipated and not subject for IEE and EIA.

Table 5.6 Brief Results of EIA for the Selected Components

No.	Component	Impact	Remarks
1	Relocation	D2	Necessity of land acquisition and relocation of a house is to be verified.
6	Vested right	D2 & D3	Vested right in Bartuva river is to be verified. Monitoring of water quality will be required. The water use rights on the Latvian side needs to be verified.
7	Health and Hygiene	D1	No monitoring will be required.
8	Waste disposal	D3	Monitoring of actual conditions of the sludge treatment and its disposal will be required.
10	Topography and Geology	D1	No monitoring will be required.
12	Groundwater	D1	No monitoring will be required.
13	River & Lake	D3	Monitoring of water quality in the Bartuva River including the Latvian side will be required
15	Fauna & Flora	D3	Monitoring of water quality in rivers will be required. A regular survey/monitoring of fauna & flora in the Bartuva River and its tributaries , including the Latvian side, if possible, will be necessary.
17	Landscape	D2	It will be required to landscape the proposed facilities.
19	Water pollution	D3	The monitoring of water quality in rivers and groundwater will be required.
20	Soil Contamoination	D1	No adverse impact is expected if the sludge is treated as planned.
23	Odor	D3	Monitoring of actual condition of odor will be required. Containment of odors at the STP should be considered.

Score: cant impact anticipated
B- Slight impact anticipated
C- Unknown (subject to further verification)
D1- Almost no impact is anticipated
D2- Almost no impact is anticipated, but to be verified.
D3- Almost no impact is anticipated,
but monitoring will be reqiured.

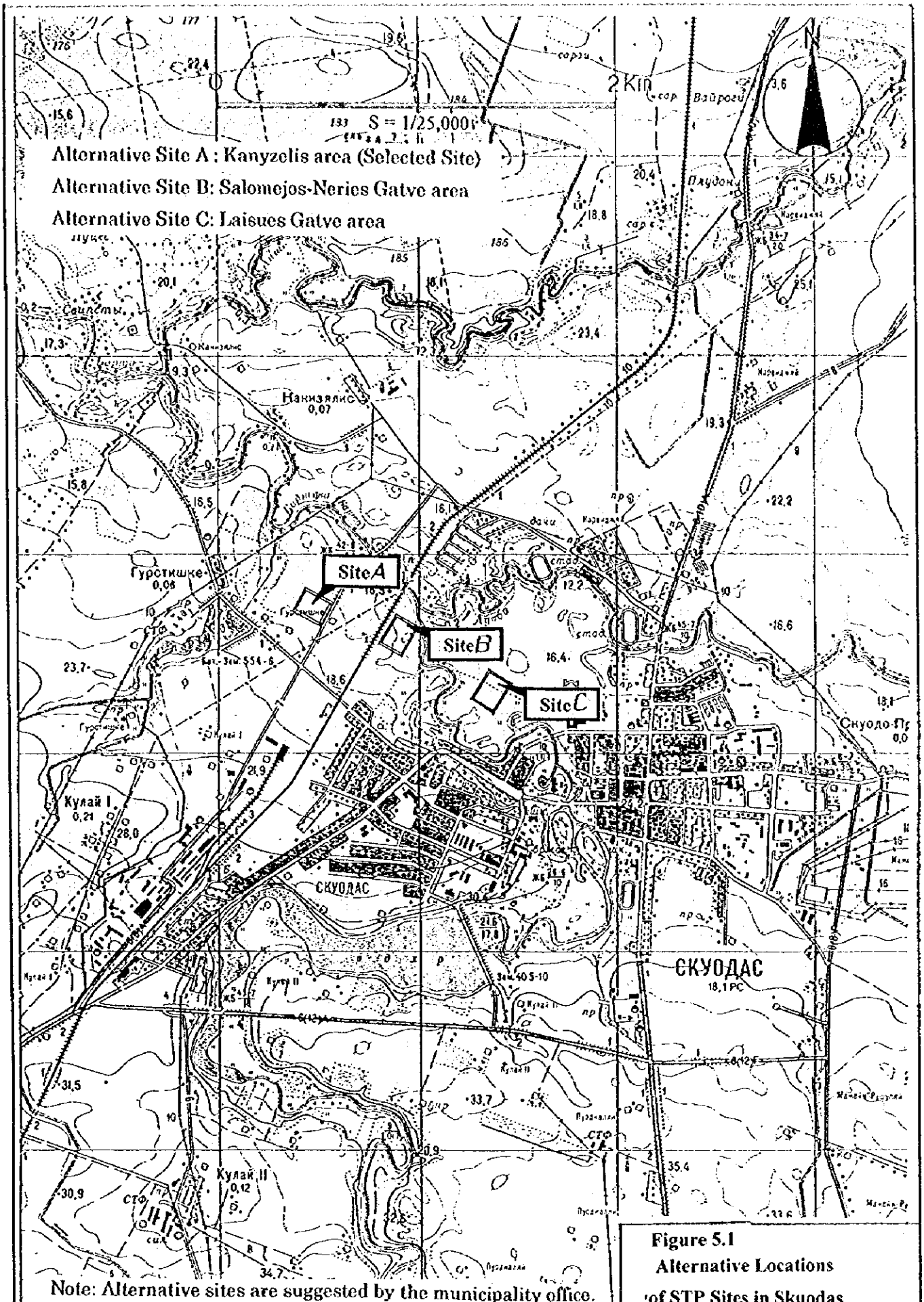


Figure 5.1
Alternative Locations of STP Sites in Skuodas

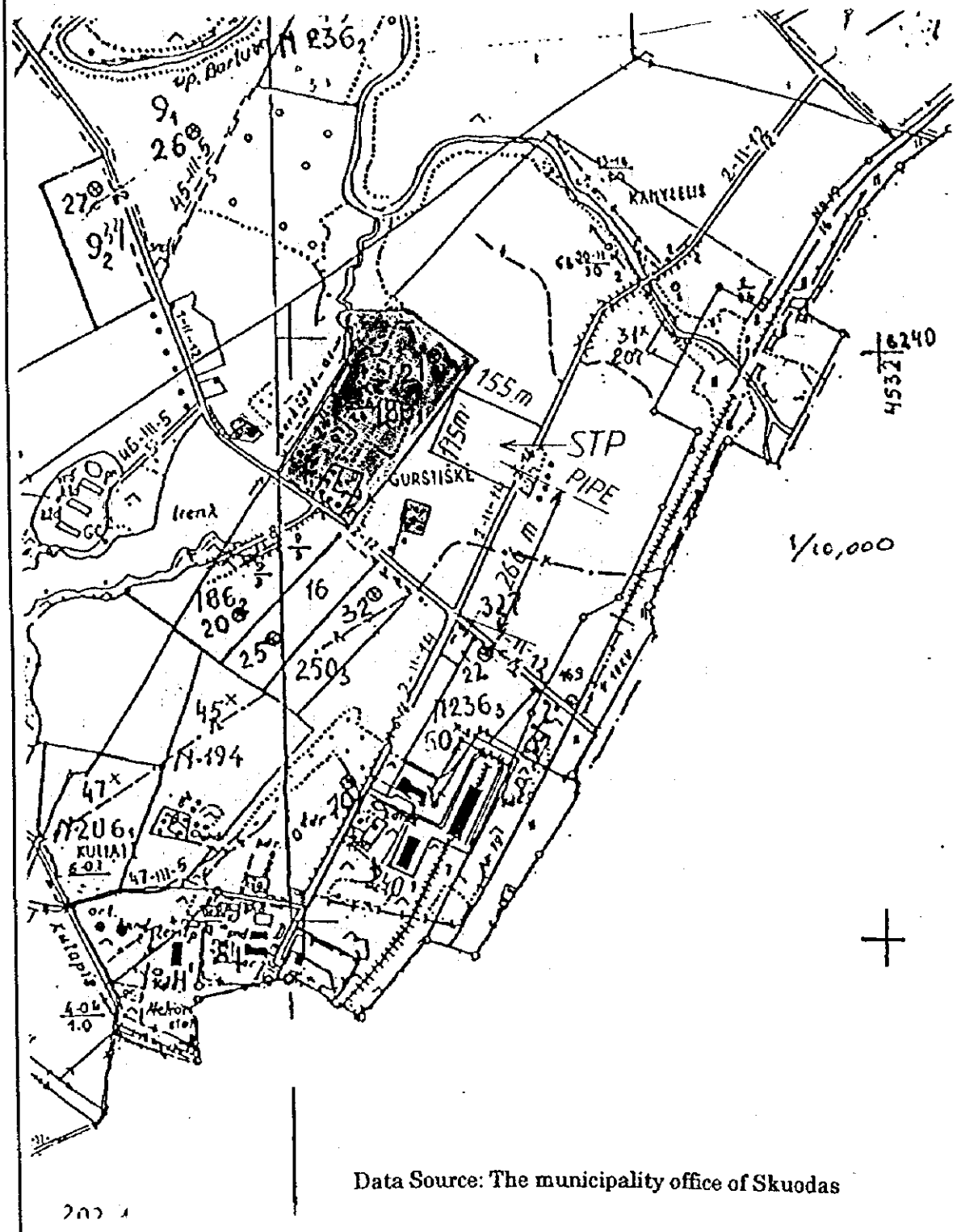


Figure 5.2 **Location Map of Private Land in and around the Proposed STP Site (Skuodas)**

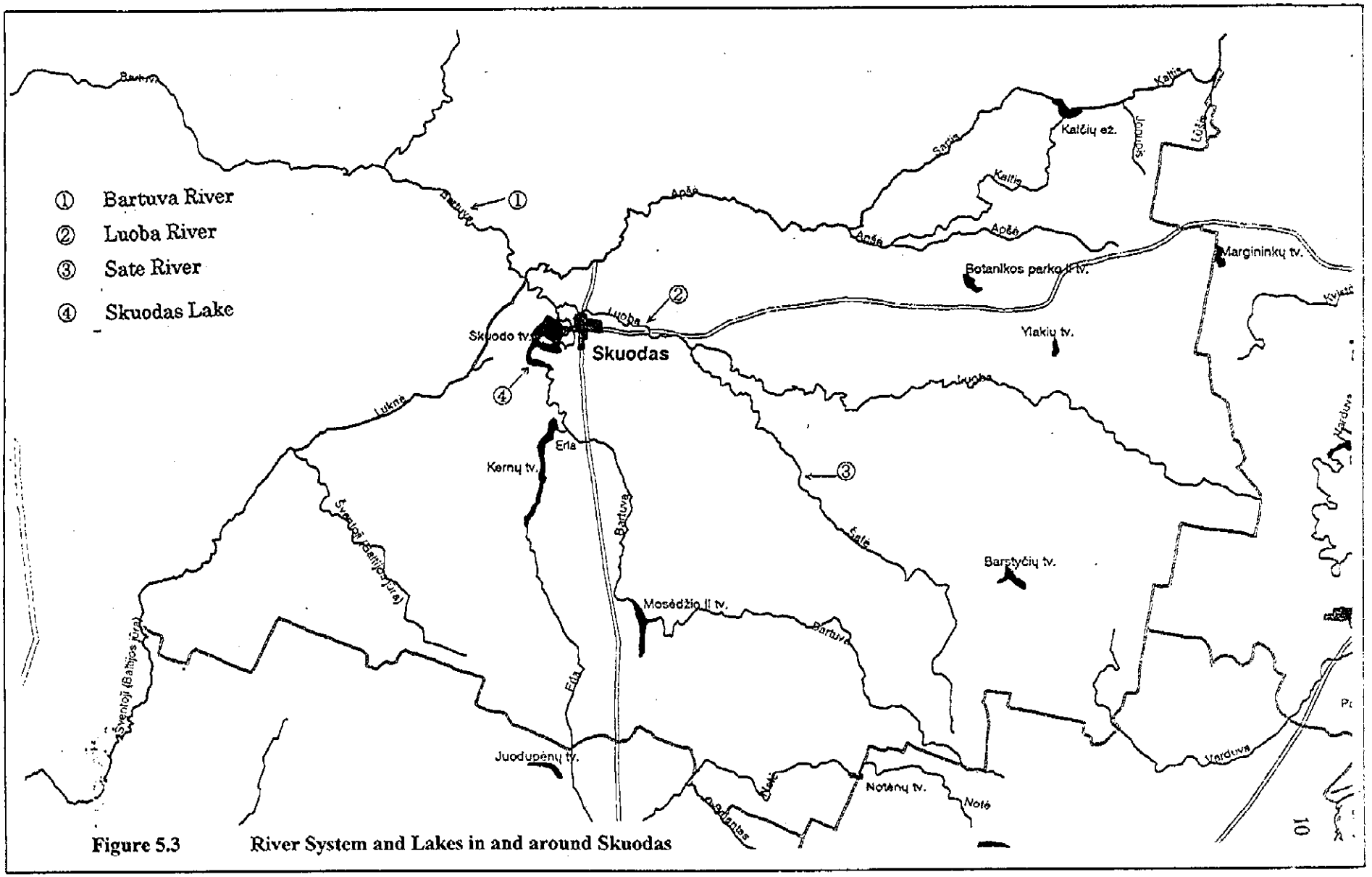


Figure 5.3 River System and Lakes in and around Skuodas

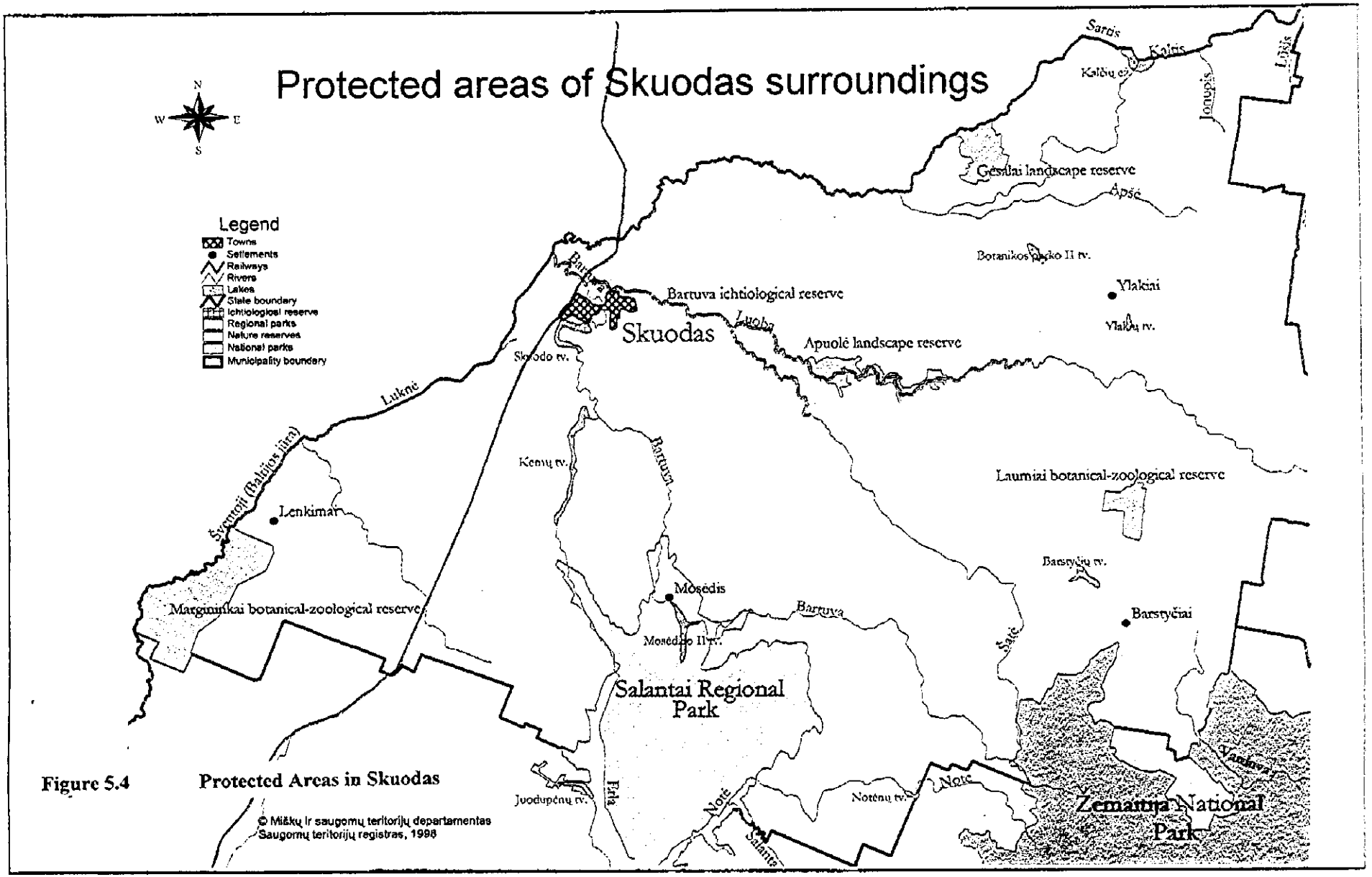


Figure 5.4 **Protected Areas in Skuodas**

CHAPTER 6

CONCLUSIONS AND RECOMMNDATIONS

6 CONCLUSION AND RECOMMNDATIONS

6.1 CONCLUSION

The proposed Skuodas Sewerage System Improvement Project is evaluated feasible in terms of technical, economical, financial and environmental aspects.

Project components for the Birzai Project consists of the following:

- 1,600 m^3/day Sewage Treatment Plant
  secondary treatment: oxidation ditch system and sedimentation
  sludge treatment: mechanical dewatering and composting
- Connection of 100 mm ductile iron pipe from the Pump Station No.2 to the existing pressure main from the existing treatment plant No.1 to the new treatment plant site.
- Demolition of the two existing treatment plants

Project cost: LTL. 7.7 million

6.2 RECOMMENDATIONS

6.2.1 Recommendations for Implementation

6.2.1.1 Recommendations for Construction of Project Facilities

For the implementation of the proposed project, there are several measures to be addressed in prioritizing the construction. The following options should be considered in the construction program of the recommended facilities

- Dosage of chemical coagulant will be provided at the new treatment plant. Installation of the chemical coagulation system may be differed to reduce the construction cost. Construction cost may be reduced by 200,000 litas with this option. Operation cost will also decreased by 18,000 litas per year.

6.2.1.2 Recommendations for Industrial Wastewater Control

At present, there are no requirements for BOD levels in industrial wastewater discharged from the factories into the sewerage system. Only the ratio of BOD to COD is specified at 2.5 as shown in Table 3.4 in Chapter 3.

For maintaining stable operation of the treatment plants, BOD in the industrial wastewater must be controlled below a certain level. For example, in Japan, BOD in the industrial wastewater is not allowed to exceed 600 mg/l.

Optimum pre-treatment system for the industrial wastewater should be dependent on the type of industry and characteristics of wastewater. The recommended concept for pre-treatment systems is as follows:

Sedimentation

Sedimentation is useful for reducing suspended solid in wastewater. Organic matters contained in the solids will also be removed. Sedimentation is a very effective and economical measure when the wastewater contains high level of suspended solids. When the wastewater contains small amount of solids, most of organic substances are in liquid form. In such case, sedimentation will not be so effective.

Biological Treatment

Biological treatment must be applied when the wastewater contains high level of organic substances after sedimentation. There are several types of biological treatment options for strong organic wastewater as follows:

Anaerobic pond: Anaerobic pond is used for very strong organic wastewater (BOD of thousands mg/l) to reduce its BOD to less than 1,000 mg/l.

Aerated lagoon: Aerated lagoon consists of only shallow basins and surface aerators. This method is broadly applied for wastewater discharged from food industries because of the advantage that little amount of excess sludge is produced from the process. Ease of operation is also one of the advantages of this process. Disadvantage of this process is that it needs wide area due to a large volume of basin.

Oxidation ditch: Oxidation ditch is an effective treatment process for both industrial wastewater and domestic sewage of medium organic contents. As influent must be pre-treated to reduce BOD to around 500 mg/l, this process is not applied to high BOD wastewater without some pre-treatment.

Flow regulation

When a large amount of high BOD wastewater is discharged in short time, there may be a serious impact on the sewage treatment. When such an impact is anticipated, a balancing tank must be provided at a factory for flow regulation. The balancing tank can be a small tank with a retention time of a few hours with some outlet mechanism such as an orifice or an adjustable weir.

Control of the industrial wastewater should require the government to establish a legislative formation that could restrict discharge of high organic wastewater into the sewerage system. Without clear standards for effluent from the industries, it is difficult and uneconomical to design the pre-treatment process at each industry.

6.2.1.3 Recommendations for the Tasks of Consultant

In various stages in the implementation of the project, emphasis should be given to the

engineering services normally provided by the consultants. Such service should include the activities as follows:

- detailed design of facilities including topographic survey, soil investigation etc.;
- preparation of technical specifications for both construction and equipment supply;
- preparation of tender documents;
- assistance for the Water Company or Ministry of Environment in pre-qualification of contractors, tendering, and award;
- construction supervision at site and shop testing;
- testing of the plant and commissioning;
- training for the Water Company in the operation of the treatment plant;

6.2.2 Recommendations for Future Development

6.2.2.1 Future Expansion of the Treatment Plant

When the treatment plant will need to treat larger amount of sewage than its design capacity in future, after 2010, the plant can increase its capacity by constructing an additional biological treatment unit.

For Skuodas, sewage transmission pipelines have sufficient capacity to convey larger amount of sewage than the design capacity of the treatment plant. Comparison of capacity of transmission and treatment facility is as follows:

Facility	Skuodas
Transmission pipeline	dia. 300 mm x 2 lines max. flow = 6,000 m^3/day
Treatment plant	1,600 m^3/day

Note: Maximum capacity of transmission pipeline is estimated assuming the maximum velocity at 1.0 m/sec.

As shown above, transmission capacity of the pipeline is more than three times the capacity of the treatment plant. Capacity of the entire system can therefore be increased only by increasing the treatment capacity.

6.2.2.2 Reduction of Groundwater Infiltration

Reducing the amount of infiltration will directly contribute to prolonging the life of the treatment plant. Prior to repair work for the sewer pipeline, investigation for the infiltration should be conducted. Priorities in the repair work will then need to be established based on the amount of infiltration and cost of repair of pipes. Economic study for the pipe repair and increase of the plant capacity should also be conducted to achieve the effective investment.

6.2.2.3 Control of Industrial Wastewater

As discussed in Section 6.2.1.2, control of the industrial wastewater will be required for the

efficient management of the sewerage system as well as environmental protection. A proper legislation system for control of the industrial wastewater should be established at the earliest stage.