JAPAN INTERNATIONAL COOPERATION AGENCY

MINISTRY OF ENVIRONMENT
THE REPUBLIC OF LITHUANIA

STUDY ON THE SEWERAGE SYSTEM IMPROVEMENT OF BIRZAI AND SKUODAS TOWN IN THE REPUBLIC OF LITHUANIA

FINAL REPORT

VOLUME II

MAIN REPORT (BIRZAI)

FEBRUARY 1999

NIPPON JOGESUIDO SEKKEI CO., LTD.

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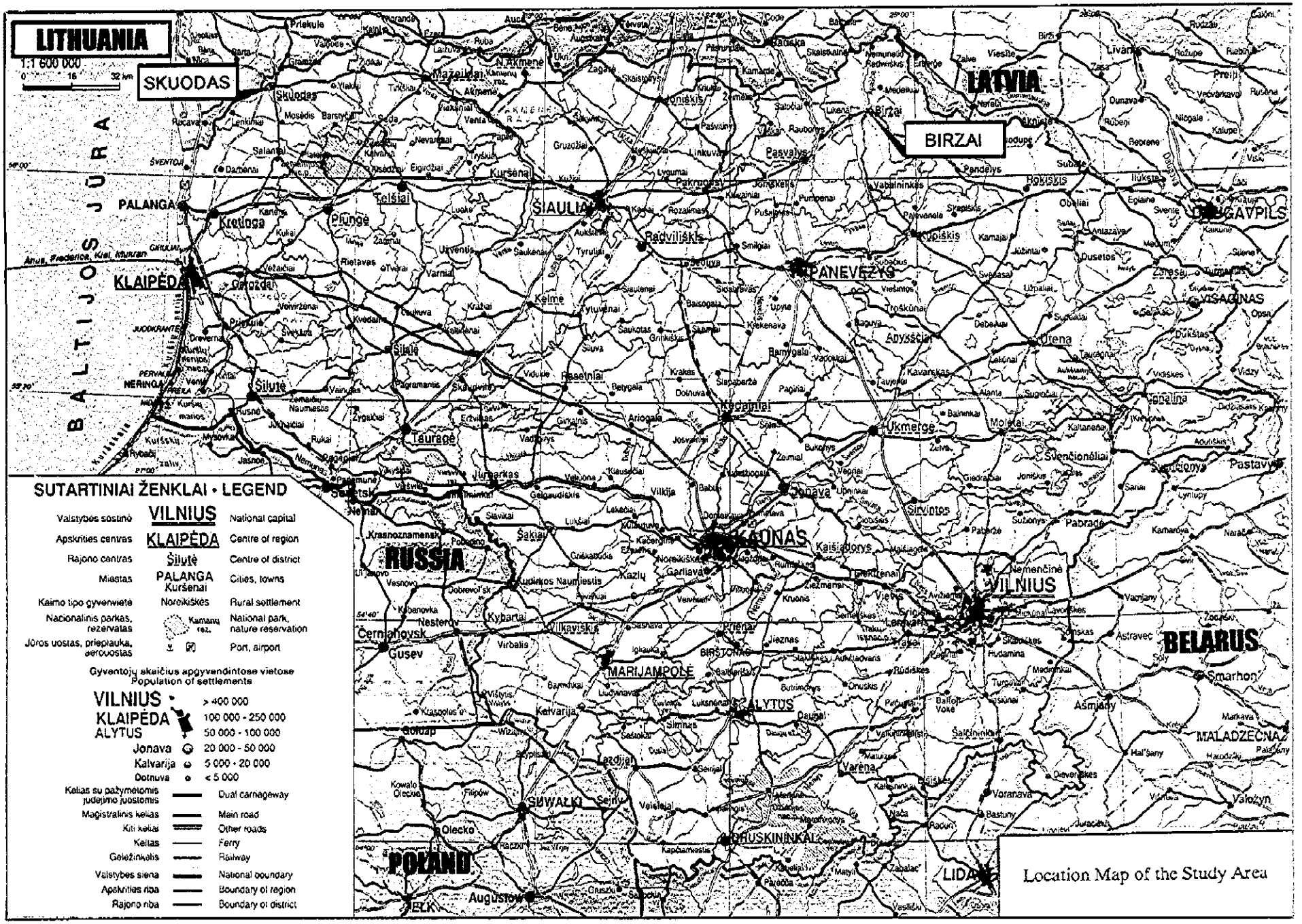

Location Map of the Study Area

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INTRODUCTION

Nippon Jogesuido Sekkei Co., Ltd.
Tokyo, Japan

1 INTRODUCTION

1.1 BACKGROUND

The towns of Birzai and Skuodas are located in the north and northeastern parts of Lithuania, respectively. Both towns face the country border with Latvia. The districts of Birzai and Skuodas have populations of 38,500 and 27,800, respectively. The sewerage facilities of these towns were developed in 1960's, an outline of which is shown below:

Table 1.1 Existing Sewerage Facilities in Birzai and Skuodas

Sewerage Facility	Birzai Town	Skuodas Town
Total Sewer Length	27 km	23 km
Pumping Station	3 nos.	4 nos.
Sewage Treatment Plant	1 no.	2 nos.

As these facilities are old and do not functioning well, they have been creating environmental problems which lead to water pollution in the receiving water bodies. In Birzai particularly, effluent causes groundwater contamination in the karst formation which has a high permeability. As well as other domestic problems, pollution is becoming an international issue with Latvia, which is complaining about pollution in the river flowing from Lithuania.

To cope with this situation, these towns have each prepared a rehabilitation plan for a sewage treatment system. Birzai started construction in 1995 based on the plan, but suspended it after a part of the structures had been constructed. The construction work was suspended since the subsidy from the central government ceased due to financial constraints. In 1995, the government requested the government of Japan to provide a loan for rehabilitation of the sewerage facility in the two towns. The government of Japan, however, evaluated the application and determined it as lacking essential information such as a basis of definition of major design criteria, service areas and treated sewage quality, and institutional and managerial improvement for operation of the Water Company (Vandenys). To meet the requirements for securing financial aid, an additional study was needed immediately.

Under these circumstances, the government of Lithuania requested the government of Japan, in May 1997, to conduct a feasibility study on the sewerage system improvements for Birzai and Skuodas Towns.

In response to this request, the government of Japan dispatched a preparatory study team and signed the scope of work for this project in January, 1998. The study team, consisting of engineers and specialists, was formulated by the Japan International Cooperation Agency (JICA) and commenced the study work in May 1998.

1.2 OBJECTIVES OF THE STUDY

Objectives of the study are defined as follows:

1. To conduct a feasibility study for improvement of the sewerage system that will contribute to the upgrading of sanitary and environmental conditions in Birzai and Skuodas towns for the target year of 2010 after reviewing current existing plans; and
2. To transfer technology on planning methods and skills to counterpart personnel during the course of study.

1.3 STUDY AREA AND DESIGN YEAR

The study covers the extent of the town area within the districts of Birzai and Skuodas as follows:

Birzai Town:	Area 1,783ha
Skuodas Town :	Area 596ha

The feasibility study will be prepared for the design year 2010.

1.4 SCOPE OF WORK OF THE STUDY

The scope of work to be covered by the study is shown below:

1. Review present plans
2. Prepare preliminary designs for the proposed facilities
3. Formulate construction plans
4. Formulate operation and maintenance plans
5. Formulate organizational, institutional and human resource development plans
6. Prepare cost estimates
7. Formulate financial plans
8. Conduct an environmental impact assessment
9. Conduct comprehensive project evaluations
10. Formulate implementation plans

Extent of the study is as follows:

1. The karst area in Birzai will not be included in the scope of work.
2. The study will cover both the domestic and industrial wastewater discharges.
3. Stormwater drainage will not be included in the scope of work.
4. The feasibility study will cover the following items:
    a. Construction plans for new sewage treatment plant
    b. Construction plans for the discharge pipelines
    c. Institutional and management (including billing and collection system) strengthening plan and a practical finance plan.

1.5 FORMATION OF THE STUDY TEAM

The Study Team and JICA Advisory Committee consisted of the following members:

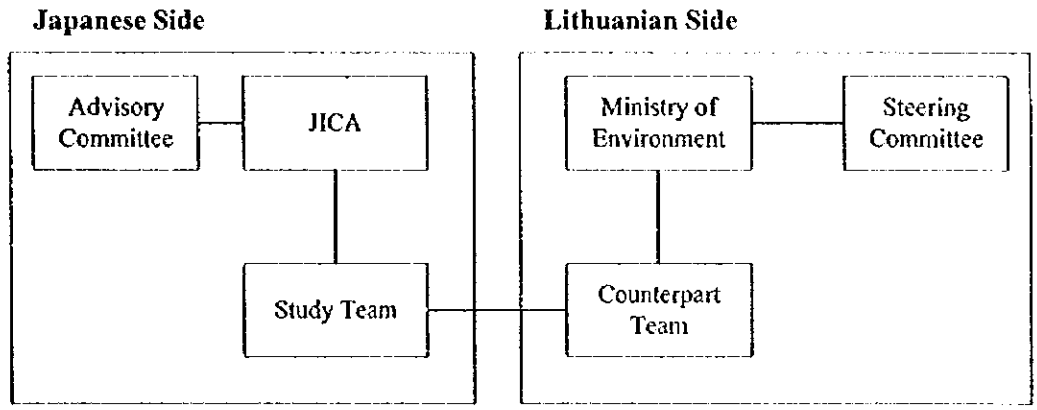
Study Team

Kuniaki Onishi	Team Leader, Sewerage Planning
Takashi Watanabe	Sewerage Facility Design (1), Survey Supervision
Raymond Merritt	Sewerage Facility Design (2), Survey Supervision
Naoji Kumagai	Economic and Financial Analysis
Taku Ogata	Institutional and Financial Planning
Richard Deussen	Construction Planning and Cost Estimates
Satoshi Shibasaki	Operation and Maintenance Planning
Hiroshi Okada	Water Quality and Environment
Hiroki Fujiwara	Equipment Planning

JICA Advisory Committee

Yoshio Oshima	Chairman, Sewerage New Technology Promotion Organization
Kazumi Suzuki	Member, Sewerage Operation Management Center
Hiroyuki Mori	Member, Overseas Economic Cooperation Fund of Japan (OECF)

An organization diagram showing the relationships between the Lithuanian side, JICA and the Study Team is presented in Figure 1.1.



JICA: Japan International Cooperation Agency

Figure 1.1 Organization Set-up of the Study

1.6 FORMATION OF THE LITHUANIAN SIDE

The organization of the Lithuanian side consists of the counterpart team of the Ministry of Environment, and Steering Committee as follows:

Counterpart Team

Ministry of Environment

Mr.A. Dragūnas	Director of the Environmental Strategy Department
Mr.V.Bernadišius	Deputy Director of the Environmental Strategy Department
Mr.R.Sakalauskas	Head of the Water Division
Mr.S.Ulinskas	Chief Economist
Mrs.E.Levulienė	Sr. Engineer of the Water Division
Mr.K.Mastauskas	Head of the Economic Division
Ms.A Plančiūnaitė	MOE Panevėžys Regional Department
Mr.V.Balionis	MOE Klaipėda Regional Department
Birzai Municipality	
Mr.B.Zurba	Mayor of Birzai Municipality
Mr.R.Šaltauskas	Administrator
Mr.P.Januškevičius	Head of the Local Economy Division
Mr.B.Klastauskas	Director of the Stock Company "Birzai Vandenys"
Skuodas Municipality	
Mr.L.Žukauskas	Mayor of Skuodas Municipality
Mr.K.Viršilas	Vice Mayor
Mr.A.Paulikas	Administrator
Mrs.J.Joskaudienė	Head of the Local Economy Department
Ms.L.Jurevičiūtė	Head of the Financial Division
Mr.R.Kungys	Director of the Stock Company "Skuodas Vandenys"
Mr.R.Polikas	Chief Engineer of the "Skuodas Vandenys"
Mr.A.Ciunka	Stock Company the "Skuodas Vandenys"

Steering Committee

Chairman	
Mr.A.Daubaras	Vice Minister of Environment
Vice Chairman	
Mr.V. Bernadišius	Deputy Director of the Environmental Strategy Department
Ministry of Environment:	
Mr.K. Mastauskas	Head of the Environmental Strategy and Investment Unit
Mr.G. Tiškus	Director, Territorial Planning Department
Mrs.E. Levulienė	Chief Engineer of the Water Division
Ms.A. Plančiūnaitė	Deputy Director, MOE Panevėžys Regional Department
Municipalities of Birzai	
Mr.B. Zurba	Mayor of Biržai Municipality
Mr.B. Klastauskas	Director of the Biržai Water Company
Municipalities of Skuodas	
Mr.L. Žukauskas	Mayor of Skuodas Municipality

1.7 ORGANIZATION OF THE REPORT

The Final Report consists of three volumes, as follows:

Volume I. Summary Report

Volume II. Main Report (Birzai)

Main Report (Skuodas)

Volume III. Supporting Report (Birzai)

Supporting Report (Skuodas)

Volume IV Preliminary Design Drawings (Birzai)

Preliminary Design Drawings (Skuodas)

CHAPTER 2

DESCRIPTION OF THE COUNTRY

2 DESCRIPTION OF THE COUNTRY

2.1 HISTORY IN BRIEF

Lithuania was first mentioned in recorded history in the 13th Century. In the 15th Century, the Lithuanian lands extended from the Baltic Sea to the Black Sea. Lithuania lost its independence from 1940 to 1990 under the Nazi, followed by the Soviet Union, regimes. On March 11, 1990, the Supreme Council declared Lithuanian's independence restored. The United Nations admitted the three Baltic countries in 1991. Lithuania joined the Council of Europe in May 1993 followed by withdraw of the last former Soviet military unit in September 1993.

In 1995, Lithuania signed an association agreement with the European Union and the European Treaty between the European Community and Lithuania. The Lithuanian Parliament ratified the European Agreement that is expected to bring the country one step closer to becoming a member of the European Union.

2.2 NATURAL CONDITIONS

2.2.1 General

Lithuania is located in the Baltic Sea region at latitudes from N-54°00' to N-56°15' and longitudes from E-21°00' to E-27°00'.

The language is Lithuanian, of the Indo-European family, and is said to be as ancient as Sanskrit in its grammatical forms. More than 90 percent of the population are Roman Catholics.

2.2.2 Topography and Geology

Lithuania has a total land area of 65,301 km^2 and is literally characterized by flat land. The elevations in the country range from 0 m to 294 m above sea level. Land is generally higher in the eastern part and slopes towards the west. The sea-bed of the Baltic Sea off the Lithuanian coast is gently sloping, while the coast is low and sandy with long beaches and coastal dunes. Approximately 5,000 years ago, winds and sea currents shaped a long and narrow peninsula named Kurðio Nerija which is separated from the open sea by a lagoon called Kurðio Marios. The lagoon connects with the Baltic Sea through a 390 m wide strait.

Lithuania lies on the East European Plain in the middle and lower basin of the Nemunas River. The relief is a meridian-oriented alternation of lowland plains and hilly uplands. Rivers and lakes are dispersed almost all over the country. The major rivers in Lithuania are listed below.

Table 2.1 Major Rivers

	Length (km)	Catchment Area (km^2)
Nemunas	937	98,200
Neris	510	24,933
Venta	350	11,800
DeDupë	298	6,105
Minija	213	2,978
Dubysa	139	2,033

Lithuania lies in one of Europe's most abundant lake districts. There are 2,833 lakes exceeding 0.5 ha. They occupy an area of 876 km^2 (1.5 percent of the country's territory).

Groundwater yields are very high throughout Lithuania. Groundwater is found at a depth of 1-15 m, while the aqueous horizon is 10-60 m deep. Underground fresh-water also lies at a depth of 300-400 m with an estimated potential resource of 3.2 million m^3 per day.

Lithuania is among the few countries which have rock belonging to all geological systems although their strata do not completely cover the country. At depths of 2,300 m to a few hundred meters, there are commercial oil deposits in the west of the country. In northern Lithuania, dolomite strata reaches the land surface. Limestone makes up about 10 percent of Lithuanian sedimentary rock. A 40 m layer of anhydrite lies at a depth of 145-600 m on the southwest side of the country. Six percent of Lithuanian territory is covered by peat bogs.

2.2.3 Meteorology

The climate of Lithuania changes from maritime to continental. Average monthly temperatures range between 20°C in summer and -5°C in winter. In Vilnius, the recorded annual average temperature is 6.3°C, the annual highest temperature is +31.0°C, and the annual lowest temperature is -28.8°C. Average monthly temperatures in Vilnius in 1997 are as follows:

January	-0.7°C	February	0.2°C
March	-0.6°C	April	3.7°C
May	11.5°C	June	15.9°C
July	18.0°C	August	18.8°C
September	11.4°C	October	5.1°C
November	1.7°C	December	-4.3°C

Most often, the wind speed is 2-5 m/s. There may be about 30 days a year when the velocity of the wind exceeds 15 m/s with the coastal area being the windiest.

The highest precipitation (75 percent rain) is observed in the west (up to 930 mm) and the smallest in the south (about 600 mm).

The vegetation season is shortest in the east (169 days) and longest in the coastal area (202 days).

2.2.4 Land Use

Of a total land area of 65,300 km^2, about 35,000 km^2 is agricultural land. The amounts of warmth and humidity are sufficient for growing corn, potatoes, sugar beet, flax and maize of medium-early sort (for silage). Lithuanian soils have a very diverse pattern. The farmland consists of 25 percent sand, 33 percent sandy loam, 34 percent clay loam, 2 percent clay, and 6 percent turf. The majority of the farming land is formed from natural wood soils. The most fertile soils are in the middle Lowland.

Lithuania is located in a mixed forest sub-zone. There are over 2,000 species of higher plants. There are 18,000 separate plots of woodland that cover 28 percent of Lithuania's territory and set the scene for the hunting for elk, deer, wild boar, fox, rabbit, lynx and wild duck. Roach, bream, ruff and perch make up the bulk of game fish in inland waters.

2.3 SOCIO-ECONOMIC CONDITIONS

2.3.1 Political System

The Republic of Lithuania is a sovereign democratic state. State power is exercised by the President, the Seimas (Parliament), the Government, and the Court. The President is the highest state official and represents the Republic of Lithuania in international relations. The Seimas appoints the Prime Minister on the nomination of the President. Ministers are appointed by the President on nomination by the Prime Minister. Local self-government is organized on the basis of the administrative-territorial division of Lithuania. Administratively, Lithuania is divided into 44 districts which, in their turn, are divided into 423 areas with 11 cities of national jurisdiction.

2.3.2 Administrative Structure

2.3.2.1 Central Government

In May 1998, there was a reorganization of the central government of Lithuania. After the reorganization, government consists of 12 Ministries, one Department, and nine state authorities as follows:

Ministry of Agriculture and Forestry
Ministry of Culture
Ministry of Economics
Ministry of Education and Science
Ministry of Environment
Ministry of Finance
Ministry of Foreign Affairs
Ministry of Health Care
Ministry of Justice
Ministry of National Defense
Ministry of Social Security and Labor Protection
Ministry of Transport

Department of Statistics

State Control of Competition and Consumer Rights
State Energy Control Committee
State Nuclear Power Safety Inspection
State Land Cadastre and Register
State Inventory Bureau
State Patent Bureau
State Privatization Agency
State Council of Youth Affairs
State Tourist Board

2.3.2.2 Local Government

The local government system consists of the following hierarchy:

District (apskritis): The Country is divided into ten districts. Each district has an administrative body.

City : There are 11 cities in Lithuania. Cities are not subordinate to the districts, but are independent administrative bodies at the same level as the districts. The leader of each city is a mayor who is selected by election.

Region/Municipality (rajonai). Administrative bodies other than the City are defined as Region or Municipality. Presently there are 44 regional governments. Head of the municipality is also a mayor and is selected by election.

Town (misestai): Each Region/Municipality has a number of towns in its territory. These towns are populated areas, in the Region and have designated boundaries.

2.3.3 Population

2.3.3.1 Historical Population

In 1997, Lithuania had a population of 3.70 million broken down to 2.53 million and 1.17 million in urban and rural areas, respectively. Ethnic composition of the population is as follows:

Lithuanians	81.3 %
Russians	8.4 %
Poles	7.0 %
Byelorussians	1.5 %
Ukrainians	1.0 %
Others	0.8 %

Population is concentrated in the large cities and urban areas of the municipalities. The 15 largest cities are listed as follows:

Table 2.2 **Population of 15 Largest Cities and Municipalities (Urban Areas)**

City/Municipality (Urban Area)	Population	Percentage of Country Population
Vilnius	635,000	17.12%
Kaunas	470,000	12.67%
Klaipėda	203,933	5.50%
Šiauliai	146,564	3.95%
Panevėžys	132,817	3.58%
Alytus	77,522	2.09%
Marijampolė	52,615	1.42%
Mažeikiai	45,948	1.24%
Jonava	36,845	0.99%
Utena	36,624	0.99%
Telšiai	34,816	0.94%
Kėdainiai	34,393	0.93%
Visaginas	33,290	0.90%
Tauragė	32,961	0.89%
Ukmergė	30,701	0.83%
Total of above	2,004,029	54.04%

Populations of urban and rural areas in the past 15 years are tabulated as follows:

Table 2.3 Population in Lithuania

Year	Total Population	Urban Population	Rural Population
1983	3,470,700	2,211,200	1,259,500
1984	3,499,700	2,256,100	1,243,600
1985	3,528,700	2,298,400	1,230,300
1986	3,560,400	2,341,600	1,218,800
1987	3,597,400	2,390,400	1,207,000
1988	3,635,300	2,440,200	1,195,100
1989	3,647,800	2,486,800	1,188,000
1990	3,708,200	2,526,900	1,181,300
1991	3,736,500	2,549,000	1,187,500
1992	3,746,900	2,568,200	1,178,700
1993	3,736,500	2,549,000	11,87,500
1994	3,724,000	2,533,400	1,190,600
1995	3,717,700	2,526,400	1,191,300
1996	3,711,900	2,518,400	1,193,500
1997	3,707,200	2,543,500	1,172,700

Source: Department of Statistics

Natural increase/decrease and migration in recent years are as shown below:

Table 2.4 Natural Increase and Migration

Year	Natural Increase	Migration
1994	-3,654	-2,582
1995	-4,126	-1,753
1996	-3,727	-915

Source: Department of Statistics

2.3.3.2 Population in Future

The latest projection of the future population was prepared and issued in June 1998 by the Department of Statistics. The projection was made in five scenarios; namely, the optimistic scenario, three medium scenarios and a pessimistic one. Total populations projected under these five scenarios are presented in Figure 2.1 and Table 2.5.

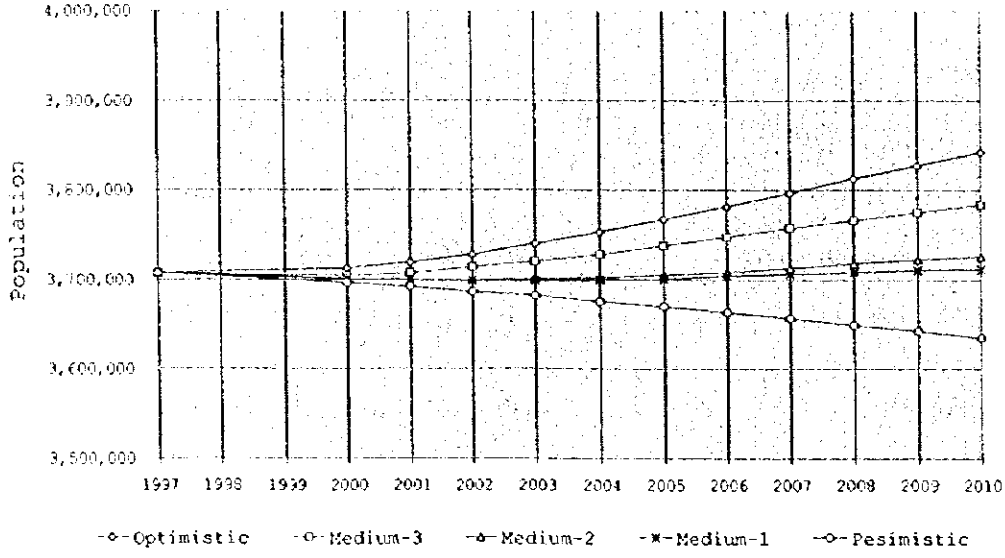


Figure 2.1 Projection of Country's Total Population

Table 2.5 Projection of Country's Total Population

	Optimistic	Medium-3	Medium-2	Medium-1	Pessimistic
1997	3,707,200	3,707,200	3,707,200	3,707,200	3,707,200
2000	3,713,000	3,704,490	3,700,809	3,700,379	3,697,000
2001	3,719,000	3,707,951	3,700,090	3,699,336	3,692,000
2002	3,728,000	3,713,904	3,700,139	3,698,905	3,687,000
2003	3,740,000	3,720,803	3,700,910	3,699,034	3,682,000
2004	3,753,000	3,728,681	3,702,495	3,699,827	3,676,000
2005	3,767,000	3,737,656	3,705,026	3,701,384	3,670,000
2006	3,782,000	3,747,785	3,708,615	3,703,767	3,664,000
2007	3,797,000	3,757,392	3,713,317	3,706,030	3,657,000
2008	3,813,000	3,766,524	3,717,855	3,708,206	3,650,000
2009	3,828,000	3,775,140	3,722,210	3,710,217	3,643,000
2010	3,843,000	3,783,704	3,726,272	3,711,964	3,635,000

In the three medium scenarios, projections were made separately for the urban and rural areas. Projected urban population is shown in Figure 2.2

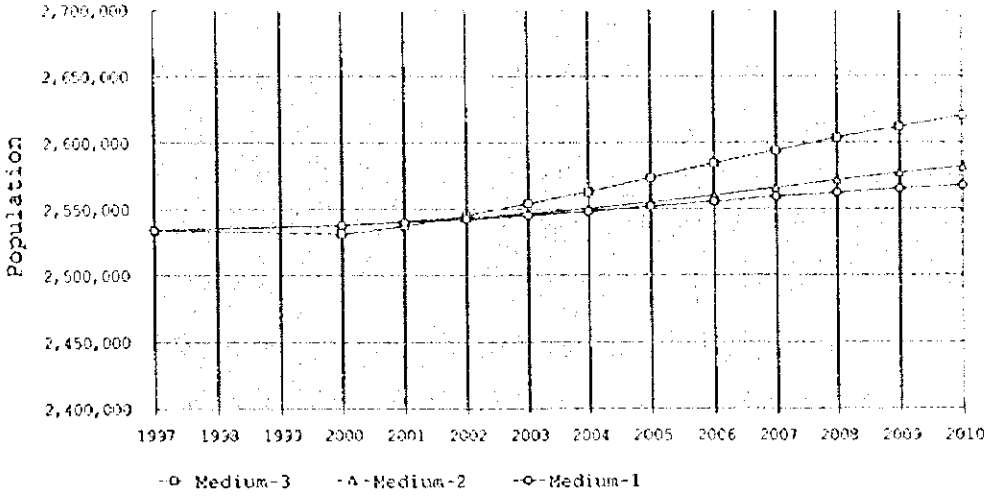


Figure 2.2 Projection of Urban Population

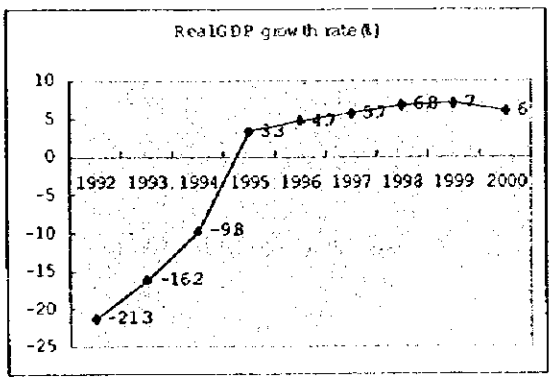
2.3.4 Economy

2.3.4.1 Current Status and Trend (Successful Market Oriented Reform)

(1) Economic Growth

Lithuania's economy recovered in 1995 with an increase in GDP of 3.3 percent, in constant prices, and recorded an increase of 4.7 percent in 1996 and 5.7 percent in 1997.

The recovery has been brought about by the pro-market policy and programs. Export industries in fields such as machinery and mechanical equipment, textiles and mineral products have expanded over the past three years.



Note) Projection in 1998, 1999, 2000 based on source material by the Bank of Lithuania

Figure 2.3 Real GDP Growth Rate

(2) Inflation

The CPI (Consumer Price Index) reached 1,162.6 percent by the end of 1992 mainly from an increase in fuel prices. However, the CPI fell to 45.1 percent in 1994, 35.7 percent in 1995, 13.1 percent in 1996, and 8.4 percent in 1997. The decline of the CPI is due to the adherence to the currency board arrangement that fixed the value of the Litas at LTL 4.00 = US$1.00 and the strict fiscal policy followed by the Republic. The year on year CPI in April 1998 was 6.9 percent.

(3) Current Account

The current account deficit increased from US$896.20 mil (9.2% of GDP) in 1996 to US$1,147.49 mil (10.3% of GDP) in 1997 because of an increase in imports due to strong consumer demands and increasing investments, similar to other countries in transition.

(4) National Budget

The national budget deficit decreased from LTL 883.8 mil (2.8% of GDP) in 1996 to LTL 430.4 mil (1.1% of GDP) in 1997. This improvement was achieved by tightening revenue collection, widening the tax bases on the consumer taxes (including VAT and excises) and cutting expenditures.

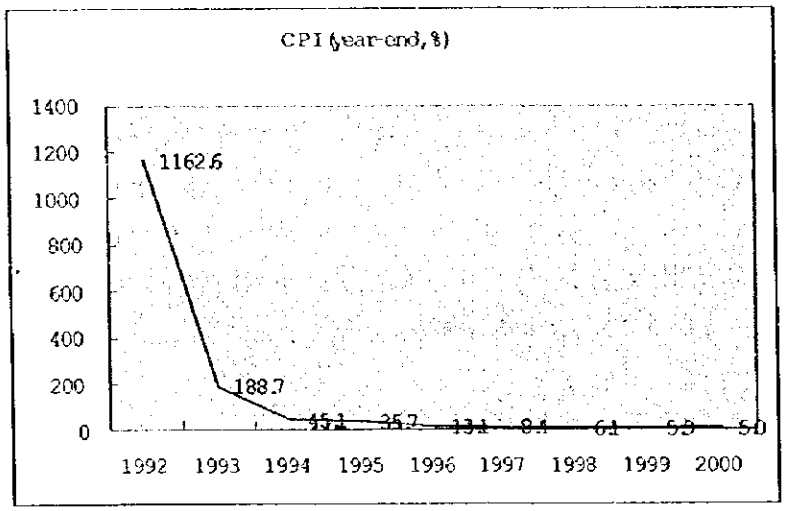


Figure 2.4 Consumer Price Index (Actual and Projection)

(5) Foreign Debt

The Government's guideline in setting the annual ceiling for foreign disbursement is a maximum of 25 percent of revenue, as approved in the National Budget.

Foreign debt increased to US$1,407 million as of 31 December 1997 and its percentage of GDP increased to 14.7 percent. In addition to direct foreign debt, the Republic extends guarantees

for foreign loans raised by state enterprises in cases where it deems such guarantees to be in the national interest.

Lithuania's scheduled direct debt service is modest by international standards. External direct debt service for the year ended 31 December 1997 accounted for approximately 5 percent of the Republic's exports of goods, services and net transfers for the year. It is said that there may be no concern about debt service in the future because of the strong economic recovery.

The country's foreign reserves may be low but have increased consistently since 1992, reaching US$1,165.6 mil by 31 March 1998. As of 31 December 1997, the Republic's foreign reserves represented 2.7 months coverage of imports of goods and services.

(6) Industry and Trade

Lithuania's GDP is mainly created in the services and industries sectors (utilities, mining and manufacturing) which account for 81.5 percent of the GDP in 1996.

Refined petroleum products, food products and beverages, chemicals, textiles and apparel are the main industrial products which account for more than 70 percent of the industrial production. Some manufacturing industries such as textiles, apparel, food, wood and wood products have been recovering faster since the restoration of independence.

Main export products are mineral products, textiles and machinery which, respectively, accounted for 17.8 percent, 16.3 percent, and 12.2 percent of exports in 1997. Main import products are machinery, mineral products and transport equipment which respectively accounts for 18.4 percent, 18.2 percent, and 11.4 percent of the import.

The former Soviet Union and CIS are still the main foreign trade partners with Lithuania. Trade with these partners accounted for 46 percent of exports and 31 percent of imports, followed by European Union (EU) which made up 33 percent of exports and 45 percent of imports in 1997. Russia still remains the main trade partner accounting for 25 percent of exports and imports respectively. Germany became the second largest trade partner making up 11 percent of export and 18 percent of import.

Table 2.6 Changes in the structure of the GDP (in current prices :%)

	1992	1993	1994	1995	1996
Agriculture and forestry	11.6	11.0	7.3	9.3	11.4
Industry	39.4	30.4	25.8	29.7	28.3
Construction	9.3	7.8	8.0	6.7	7.1
Services	39.7	50.8	58.9	54.3	53.2

Table 2.7 Trade partners with Lithuania (%)

Import	1996	1997	Export	1996	1997
by country			by country		
Russia	29.0	25.3	Russia	24.0	24.5
Germany	15.4	17.5	Germany	12.8	11.4
Poland	4.4	4.9	Belarus	10.2	10.3
Italy	3.8	4.1	Latvia	9.2	8.6
Denmark	3.6	3.8	Uklane	7.7	8.8
Other countries	43.8	44.4	Other countries	36.1	36.4
by region			by region		
CIS	36.2	30.7	CIS	45.4	46.4
EU	39.8	44.3	EU	32.9	32.5
Other districts	24.0	25.0	Other districts	21.7	21.1

Table 2.8 The export and import structure of main commodities (%)

Import	Mineral products	Machinery	Vehicles, etc	Chemicals	Textiles, etc	Others
1994	32.8	16.5	6.0	8.8	7.4	28.4
1995	20.6	15.2	8.1	9.4	8.7	38
1996	19.3	15.8	9.9	9.4	7.9	37.7
1997	18.3	17.1	11.4	9.4	7.9	35.9
Export	Mineral products	Textiles, etc	Machinery	Chemicals	Vehicles, etc	Others
1994	16.7	12.3	12.0	10.6	3.7	44.7
1995	11.9	14.7	10.8	12.2	5.1	45.3
1996	15.5	15.6	11.8	11.0	7.3	38.8
1997	17.8	16.2	12.2	9.2	8.0	36.6

2.3.4.2 Economic Outlook

(1) Fears on Future Economy

World financial markets have been fluctuating due to the Asian financial crisis since July 1997. Asian economic turmoil began to have an impact on world economic growth and stability since that date. There are several concerns about the future economy in Asia as follows:

- It may take two or three years for the East Asian economies to start recovering although they are in the midst of adjustment.
- China may have difficulty on sustaining its economic growth but will achieve a relatively higher economic growth than other Asian countries.
- It is not clear whether the Japanese economy will reverse its course although Japan has been trying to revitalize the economy, but economic programs of the government may not take effect in the near future.

It is reasonable to believe that the bottom of the Asian economy has been reached, or is approaching, and it should not be any worse at the time of the commencement of construction of this project.

Another concern is the Russian economy which may be another trigger to send the world economy into a downward spiral. As mentioned above, Russia is still the biggest trade partner of Lithuania. So, the Russian financial crisis will have negative effects on the export of products to Russia such as dairy, meat, furniture and textile goods. The trade balance will likewise turn down if new export products or new export countries cannot be found. On the other hand, Lithuanian foreign currency reserves and foreign direct investments have increased recently and Lithuania is not dependent on short-term capital as are some Asian countries. There is no bubble economy in the Lithuanian real estate industry since it is not directly dependent on exports. Therefore, given that the appropriate restructuring programs are overcoming the problems and economic transition continues, it is believed that the Russian financial crisis should not cause heavy damage to the Lithuanian economy and may only have a slight negative impact. The other concern is the volatility of the U.S. capital market and the unclear outlook of Latin America's economy. In this study, it appears that the present crises in these areas will not influence this project.

International investment position of Lithuania is shown in the table below.

Table 2.9 International Investment Position of Lithuania

(million US dollar)

	01 Jan.1997	01 Jan.1998
Balance of International Investment Position	-1,120.63	-1,817.46
Assets	1,692.66	2,148.65
Direct investment abroad	2.81	25.99
Portfolio investment	38.07	29.7
Other investment	817.51	1,030.23
Reserves assets	834.27	1,062.73
Liabilities	2,813.29	3,966.11
Direct investment in Lithuania	**700.31**	**1,040.65**
Portfolio investment	306.83	491.08
(Equity)	31.53	61.36
(Long-term debt)	**185**	**350**
(Short-term debt)	90.3	79.72
Other investment	1,806.15	2,434.38
(Short-term trade credits)	453.2	670.95
(Long-term foreign loans)	**1,009.98**	**1,434.75**
(Short-term foreign loans)	639.42	806.44
(Currency and deposits)	127.61	148.95
(Other short-term liabilities)	29.14	44.24

(2) Key Indicators

Some key economic indicators, forecast by the Ministry of Economy until the year 2000, are now being reviewed in the longer term such as a ten year outlook from 1999. These future indicators are moderate and show a soft-landing scenario of the Lithuanian economic recovery because of the success of economic restructuring and the appropriate market oriented policies and programs of the government.

Therefore, the inflation rate after 2001 should be around 4 or 5 percent, taken in the light of the IMF forecast of 6 percent and 3 percent in another feasibility study. It is also reasonable to expect that the exchange rate will be controlled at the same level by the government in light of the recent steady decrease of the CPI.

Various economic figures and predicted inflation rates are summarized in the tables below.

Table 2.10 Economic Figures in Lithuania

Economic Growth

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total GDP									
% change over previous periods(real)	-21.3	-16.2	-9.8	3.3	4.7	5.7	6.8	7	6

Current account (U.S.$millions)

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total Current Account	102	-86	-94	-614	-723	-981	-1120	-1126	-1083
Trade Balance	101	-155	-205	-698	-896	-1147	-1456	-1607	-1677
Exports	1142	2026	2029	2706	3413	4192	4792	5559	6392
Imports	1041	2181	2234	-3404	-4309	-5340	-6248	7166	8069
Current account deficit % of GDP	+	-3.2	-2.2	-10.2	-9.2	-10.3	-10.3	-9.0	-7.8

Other economic data

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Exchange Rate	177	4.349	3.978	4.0	4.0	4.0	4.0	4.0	4.0
CPI(end period : %)	1163	188.7	45.1	35.7	13.1	8.4	6.1	5.9	5.0

Table 2.11 Predicted Inflation Rates

(unit: %)

Year	Applied for this study	IMF figures	Panevezys Feasibility Study
1998	6.0	9.0	6.0
1999	6.0	8.0	5.0
2000	5.0	7.0	4.0
2001-	5.0	6.0	3.0

2.3.5 Social Conditions

2.3.5.1 Education

A decree requiring primary education for all was passed in 1922 while compulsory secondary education was introduced in 1978. In 1990, the types of general education schools were primary (4 years), partial secondary (9 years) and secondary (12 years). Education begins at the age of six. In 1990, there were 778 primary, 590 partial secondary, 674 secondary, 109 vocational, 64 higher schools and 13 universities and colleges. A national system of education is being created in the restored Republic of Lithuania and education for ethnic minorities has started.

2.3.5.2 Social Security

Social security and welfare are the responsibility of the Ministry of Social Security and at a municipal level through local town and district bodies of social welfare. In addition welfare schemes have been developed by public and religious organizations. In 1996, there were 709,000 pensioners (19.2 percent of the total population), and 25,000 old age (men over 60 and women over 55) and disabled people. There are 12 boarding houses in Lithuania where about 2,200 single, old and disabled people are living.

2.3.6 Infrastructures

2.3.6.1 Electric Power Supply

Lithuania is the most nuclear-dependent country in the world. Approximately 83 percent of the total power demand is supplied by a nuclear power plant located in Ignalina some 120 km north of Vilnius. The power plant works at only about 86 percent of capacity and generates 14 billion kWh of power per year.

2.3.6.2 Transportation

In 1997, Lithuania had a total of 4,853 km of roads, of which 3,478 km are paved. The national highway network connect the major cities with first class highways. The main route is Highway A1 which runs 330 km from east to west connecting Vilnius and Klaipėda.

Secondary national roads are well developed and maintained to provide access to municipalities in all districts.

2.3.6.3 Water Supply and Sewerage

In Lithuania, most of the urban population has access to safe drinking water supplied by the Water Companies. Water Companies, called "Vandenys" in Lithuanian, are formulated as joint stock companies with the municipality as a major shareholder.

Generally, groundwater is the source of water in Lithuania where aquifers with high yields are common. Groundwater, however, often contains iron and requires treatment for iron removal.

Water supply in the country and major cities is summarized in the table below:

Table 2.12 Water Supply Service in Lithuania

	Total Length of one direction street water supply lines (km)	Water Supply Amount ('000 m^3/day)		
		Amount directly into the Systems	Amount through Treatment	Domestic Use
Country Total	5,265.8	283,557	84,436	195,101
Major Cities				
Vilnius	588.4	60,885	7,641	59,278
Kaunas	449.0	45,914	1,490	27,288
Klaipėda	220.5	27,680	13,644	17,718
Šiauliai	204.0	9,330	0	5,918
Panevėžys	194.1	10,732	10,671	5,211

Sewage treatment is not sufficient to prevent pollution caused by wastewater. Table 2.13 presents an overview of sewerage services for the major cities in Lithuania.

Table 2.13 Sewerage Service in Lithuania

	Total Length of one direction street sewer pipes (km)	Amount of Sewage ('000 m^3/day)			
		Discharge of Wastewater	Discharge of Wastewater through Treatment Facilities		Through Biological Treatment
			Total Amount	% of Total Wastewater discharged	
Country Total	2,765.8	248,565	181,223	73%	107,978
Major Cities					
Vilnius	355.5	55,009	54,633	99%	26,825
Kaunas	290.0	32,955	0	0%	0
Klaipėda	149.3	47,451	25,584	54%	0
Šiauliai	135.0	7,569	7,550	100%	6,795
Panevėžys	98.1	12,498	12,296	98%	12,261

2.3.6.4 Solid Waste Management

Solid waste collection and disposal is under the responsibility of each municipality. Municipal solid wastes are collected by each municipality and disposed of at waste disposal sites that are normally located far from the urban area. Dumping sites consist of either sanitary landfills or open dumping. No incineration is practiced.

2.3.6.5 Community Heating

In Lithuania, hot water heating services are operated by private companies at each city. These companies own the facilities for water storage, heating, and distribution that are separated from the public water supply system for drinking water. Hot water is used not only for heating but also for domestic use such as bathing, washing etc.

Normally, the source of hot water is the public water supply which complies with the drinking water standard. Hot water companies buy water from a water supply company and sell it adding the cost of heating and distribution.

Most of the households in the cities and towns have hot water services but some individual houses have their own heating and hot water systems.

CHAPTER 3

SEWERAGE IN LITHUANIA

3 SEWERAGE IN LITHUANIA

3.1 GENERAL

Construction of sewerage facilities in Lithuania commenced in the 1960's. In the early phase, pipeline facilities were constructed and connected to each house and building. As of 1997, a total of 2,765 km of sewers have been laid.

The existing sewage treatment facilities are not adequate to treat the wastewater discharged from domestic and industrial sources. Approximately 43 percent of wastewater is treated by a biological treatment method that can remove organic matter. Other fractions of the wastewater are discharged to the environment without removal of the organic matter. Such wastewater causes the pollution of water and soil systems in the country.

Many industries are connected to the sewer network, and currently discharge wastewater without proper pre-treatment. This is because there are no proper standards in Lithuania to control discharge of industrial wastewater. Only a limited number of factories have pre-treatment facilities to reduce the pollution load before discharge to the sewers. The industrial sector is required to pay a pollution charge based upon the quantity and quality of wastewater discharged.

3.2 ORGANIZATION AND LEGISLATION

3.2.1 Ministry of Environment

Environmental protection in Lithuania started with formation of the Nature Protection Committee in 1957. The Department of Environmental Protection was formed under the Seimas (Lithuanian Parliament) in 1992. The Ministry of Environmental Protection (MEP) was then established on June 15, 1994 replacing the Department of Environmental Protection. The MEP is authorized as the main organization responsible for environmental management and use of natural resources.

In the re-organization of the government in May 1998, the MEP merged with the Ministry of Construction and Urban Development, and was named the Ministry of Environment (MOE). The new organization of the MOE consists of 11 departments as shown in Figure 3.1.

The MOE has eight Regional Departments to supervise and monitor the environment and activities related to environmental protection. Each Regional Department covers an area as shown in Table 3.1.

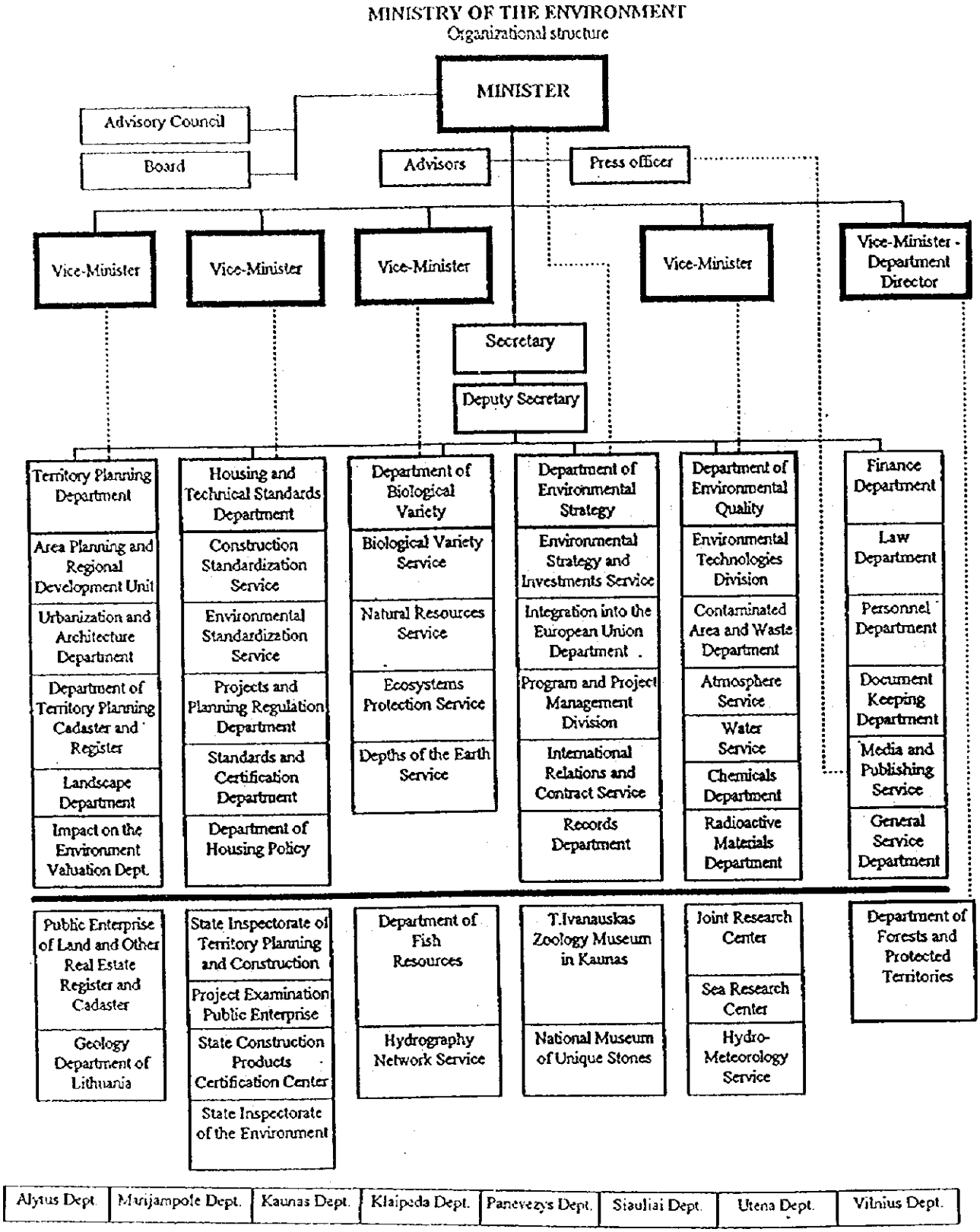


Figure 3.1 Organization of the Ministry of Environment

Table 3.1 Coverage of the MOE Regional Departments

Regional Department	Administrative Region
Vilnius	(Vilniaus District) Šalčininkai, Širvintos, Švenčionys, Trakai, Ukmergė, Vilniaus
Kaunas	(Kaunas District) Jonava, Kaišiadorys, Kaunas, Kėdainiai, Raseiniai
Klaipėda	(Klaipėda District) Klaipėda, Kretinga, Skuodas, Šilutė (Tauragė District) Jurbarkas, Šilalė, Tauragė
Šiauliai	(Šiauliai District) Akmenė, Joniškis, Kelmė, Pakruojis, Radviliškis, Šiauliai (Telšiai District) Mažeikiai, Plungė, Telšiai
Panevėžys	(Panevėžys District) Biržai, Kupiškis, Panevėžys, Pasvalys, Rokiškis
Alytus	(Kaunas District) Prienai (Alytus District) Alytus, Lazdijai, Varėna
Marijanpolė	(Marijanpolė District) Marijanpolė, Šakiai, Vilkaviškis
Utena	(Utena District) Anykščiai, Ignalina, Molėtai, Utena, Zarasai

3.2.2 Water Company

Before independence in 1991, water supply and sewerage service were managed by each Municipality. After 1991, at each city and municipality, water supply and sewerage services are managed, and operated by a Water Company that is a joint stock company, called "Vandenys" in Lithuanian. In 1992, fourteen large Water Companies started the service as joint stock companies. Since then, these large Water Companies have split into smaller companies for each City and Municipality.

The Water Company is an organization responsible for planning, construction, operation and maintenance of the water supply and sewerage works. The Water Company is operated on an equity contribution from municipality, revenue from the tariff collections, loans from various funding sources and subsidy from the central government, etc. The major shareholder of most of the Water Companies is the local Municipality.

3.2.3 Legislation Related to Water and Sewerage

Laws and regulations of Lithuania related to the water and sewerage management are listed as follows:

Laws related to the Water Management

- Environmental Protection Law, 1996
- Law on Water, 1997
- Law on Underground Resources (Entails of the Earth), 1995
- Law on Protected Areas, 1993
- Marine Protection Law, 1997

- Law on Monitoring, 1997
- Law on Taxes on State Owned Natural Resources, 1991
- Law on Pollution Tax, 1991 (revision under through Parliament)

Regulations related to the Water Management

- Ministry Order: Wastewater effluent standards, 1997 (LAND 10-96)
- Ministry Order: Standard of Usage of Sewage Sludge, 1997 (LAND 20-96)
- Ministry Order: Regulations for the obtaining of permits for use of material resources and emissions (air, water, waste), 1994
- Ministry Order: Regulations on the establishment of rain water collection systems and discharge standards, application of taxes for rainwater discharge and laboratory monitors, 1995 (LAND 3-95)
- Ministry Order: Regulations on use and maintenance of water reservoirs, 1995 (LAND 4-95)
- Ministry Order: Directions for the construction and sealing of individual wells, 1995 (LAND 4-95)
- Ministry Order: Water use estimates for different activities, 1991 (RSN 26-90)
- Regulations on the scaling of regulations temporary closing of wells, 1996 (LAND 17-96)
- Regulations for the maintenance, first time dredging and river bed maintenance of inland waterways of state importance, 1996 (LAND 13-95)
- Regulation on protection of surface water against pollution by effluents, 1975 (valid until 2000)
- Government Order: Special conditions for land and forest use, 1996

3.3 APPROXIMATION WITH THE EU LEGISLATION

Since the signing of the Association Agreement with the EU in June 1995 and a formal application for EU membership at the end of 1995, Lithuania needs to adjust its legislation to meet the various regulations of the EU in terms of legal, administrative, and financial frameworks. The environmental legislation of Lithuania will also need to be amended in line with these requirements.

Approximately, the Lithuanian Government must carry out the following two major activities:

1. amendment of its laws and regulations
2. construction of sewerage facilities (sewage collection, treatment, and disposal)

To achieve smooth implementation, the Ministry of Environment, the responsible organization for environmental aspects, established the "Water Approximation Strategy" in August 1997.

The strategies, following directives in the EU legislation, were identified for revision, particularly for water and sewerage facilities as follows:

1) Overall Water Management

- Framework Directive on Water Resources (COM (97/49)

2) Water Quality Directives

- Surface Water Directive: z

  Directive concerning the quality of surface water intended for the abstraction of drinking water in the Member States (75/440/EEC)

- Bathing Water Directive:

  Directive concerning the quality of bathing water (76/160/EEC)

- Freshwater Fish Directive:

  Directive on the quality of freshwaters needing protection or improvement in order to support fish life (78/659/EEC)

- Shellfish Directive:

  Directive on the quality of shellfish waters (79/923/EEC)

- Groundwater Directive:

  Directive on the protection of groundwater against pollution caused by certain dangerous substances (80/68/EEC)

3) Wastewater Directives

- Urban Waste Water Treatment Directive:

  Directive concerning urban waste water treatment (91/271/EEC)

The gaps existing between the EU and Lithuanian legislation were also identified in detail in the "Water Approximation Strategy". Actually, a number of amendments are being prepared, proposed, or are currently under implementation by the Ministry of Environment for the laws and regulations as described in Section 3.2.3.

Along with the amendments required in the legal system, construction of sewerage facilities is a major concern to Lithuania because of the heavy financial burden. The EU Directive (91/271/EEC) stipulates the requirements and time limit for implementation of the urban wastewater facilities as summarized below:

- Development of sewage collection system

Area	Size (p.e.[1])	Time limit
Normal areas	> 15,000 > 2,000	31 Dec.2000 31 Dec. 2005
Sensitive areas[2]	> 10,000	31 Dec. 1998.

1) p.e. = population equivalents
(1 p.e.- organic biodegradable load having a BOD_5 of 60 g/day)

2) EU Directive (91/271/EEC) requires the member states to identify the sensitive areas and less sensitive areas by 31 December 1993 according to the criteria in its Annex II.

- Development of sewage treatment system

Area	Water	Size (p.e.)	Time limit	Treatment
Normal areas	all waters all waters fresh and estuary	>15,000 10,000 – 15,000 2,000 - 10,000	31 Dec. 2000 31 Dec. 2005 31 Dec. 2005	biological treatment
Sensitive areas	all waters	>10,000	31 Dec. 1998	nutrient removal
Less sensitive areas	coastal waters estuary	10,000 - 150,000 2,000 – 10,000	31 Dec. 2005	less stringent standards
All areas	fresh and estuary coastal waters	<2,000 <10,000	31 Dec. 2005	appropriate treatment [1]

1) "appropriate treatment" means treatment of urban wastewater by any process and/or disposal system which after discharge allows the receiving waters to meet the relevant quality objectives and the relevant provisions of this and other Community Directives

3.4 ENVIRONMENTAL STRATEGY AND POLICY

3.4.1 Environmental Strategy and Action Program

The Lithuanian Environmental Protection Program was developed in 1992. The program included all major environmental problems, and established implementation priorities. Since then, most of the measures proposed in the program have been implemented while others are still underway.

Further, to include the national economic and development policies and to address urgently some environmental problems, the Ministry of Environmental Protection developed a new Environmental Protection Program in 1995. The program was approved by Parliament in September 1996. This program presented a long-term strategy, as well as short and medium-term action programs related to environmental protection. Recommendations were also made for funding of environmental protection in the program.

3.4.2 Environmental Protection Goals

The 1995 program sets environmental protection goals in two major categories: (1) Environmental Quality Protection, and (2) Protection of Natural Resources, Landscape and Biodiversity. More specific goals have been established for each category as follows:

Environmental Quality Protection by Sector

Water Protection

- reduction of surface water pollution from municipal and smaller settlements wastewater;
- reduction of pollution from industrial and agro-industrial wastewater;
- reduction of groundwater pollution;
- reduction of non-point source pollution to water bodies;
- reduction of pollution from surface (storm water) run-off;
- reduction of pollution loads into the sea;

- reduction of seawater pollution from oil products transportation; and
- reduction of polluted water crossing the borders from other countries.

Air Pollution

- reduction of pollution from transport exhaust gases;
- reduction of volatile organic compounds emissions from point sources;
- reduction of the use of ozone depleting substances and their emissions;
- reduction of pollution with suspended solids; and
- reduction of SO_2 and NOx long-range transboundary pollution.

Protection of Soil from Pollution

- reduction of soil pollution from organic and mineral fertilizers and other agricultural chemicals;
- reduction of soil pollution from oil products;
- reduction of soil pollution from cities and industrial areas; and
- reduction of soil pollution with heavy metals.

Waste Management

- waste management system creation;
- reduction of environmental contamination from industrial and hazardous wastes;
- reduction of pollution from domestic wastes;
- eliminating prohibited and old pesticides; and
- regulation of radioactive wastes.

Protection from Physical Pollution

- reduction of noise levels in cities;
- prevention of radioactive releases posed by Ignalina Nuclear Power Plant; and
- reduction of radioactive environmental pollution.

<u>Protection of Natural Resources, Landscape and Biodiversity</u>

Land Use Structure Formation

- optimization of the general land use structure;
- prevention of further natural landscape degradation in nature from other territories and those under protection, in cities and towns;
- prevention of depletion of the soil layer structure;
- prevention of further karst region and wetland landscape degradation; and
- optimization of protected areas network.

Biota Protection

- prevention of further plant, animal and fungi species and populations degradation;

- optimization of forest structure;
- optimization of the use of wildlife resources; and
- prevention of further degradation of river valleys and lakes as well as marine biocenoeses.

Protection of Recreational Environment

- prevention of further degradation of recreational agrarian environment;
- prevention of further sea beaches and sand dunes degradation; and
- prevention of further urban development in the most picturesque natural areas, primary construction activities in the coastal zone, namely, along beaches, dune chain, or on the front and back lines of the dunes and the cliffs.

Lithosphere Protection

- re-naturalization of used quarries;
- reduction of a negative impact upon the environment from oil extraction, from transportation of oil and oil products and their sales;
- prevention of a negative impact upon the environment from the use of geothermal energy; and
- prevention of a negative impact upon the environment from the exploitation of other mineral resources.

Water Resources Protection

- protection of fresh resources from over-use while extracting water from in-take sites; and
- prevention of further changes of the natural hydrographic network structure.

3.4.3 Priority of Wastewater Projects

Out of the environmental protection goals listed above, the Environmental Protection Program established the priority in implementation of various schemes. The highest priority was given to the following three subjects:

- Water and air quality
- Waste management
- Preservation of natural resources, landscape and biological diversity.

Wastewater treatment and reduction of discharge is given the highest priority in the program; in allocation of investments, particularly for funds from the State budget, and loans and subsidies received by the State. The program also encourages restructuring the financial mechanism for the wastewater sector by introducing the "polluter/consumer pays" principle and development of water protection laws.

3.4.4 Environmental Policies Principles

The Environmental Protection Program takes into consideration the importance of the principles in implementing the action programs and in achieving the environmental protection goals. The principles of environmental protection policies are described in the Program as follows:

Sustainable Development. This principle requires the direction of the country's economic and social development so that the meeting of current demands does not reduce the possibilities for future generations meeting their demands. The Rio de Janeiro Declaration which embodies this principle at the world level was signed in 1992 by Lithuania together with other countries of the world.

Consistent development. This principle maintains that goals can be achieved only by consistent development without omission of any stage. Lithuania's economic sectors are at unequal development stages, therefore, these inequalities need to be taken into account when viewing achievable sustainable development.

Environmental policy integration. This principle is closely linked with the implementation of the sustainable development principle. Environmental policy should be an integral part of all national economic and territorial development strategies. Aiming at sustainable and consistent development environmental protection measures must become an integral part of the whole process, they cannot be separated.

Precautionary principle. Often it is impossible to forecast the impact of human activities upon the environment. To protect the environment, a state must, to the extent possible, follow a precautionary principle. In case of a threat of irrecoverable damage, all (even most costly) measures for the prevention of environmental damage are justifiable. Precautionary principle applications must be based on forecasting, consistency and caution in consequences.

Polluter/User pays principle. This principle means that every responsibility, including cost, for pollution or for environmental damage while using natural resources falls on polluters/users, i.e. all social and economic losses due to pollution or use of resources must be covered by polluters/users. This principle must, in the near future, be fully implemented in the water supply and treatment sectors.

Prevention. In almost all cases, environmental damage recovery costs are higher than those for damage prevention. Sometimes damage can never be recovered. Therefore, prevention is a more rational action technique than attempts to solve a problem after it has occurred.

Use of best available technology not entailing excessive costs. This principle maintains that whenever possible, even if the set limits are not exceeded, environmentally advanced and most effective technologies, which do not entail excessive costs, are to be used.

Subsidiarity principle. The main point is democracy and partnership strengthening in the process of decision making. Only problems which cannot be locally resolved should be addressed at a higher level. This principle is targeted at:

- assistance to local communities in their environmental matters;
- enhancing the value of program and action plans;
- promoting opportunities for the selection of actions and measures.

The principle recognizes the diversity of environmental problems and opportunities in various regions and the necessity to take this into account in delineating environmental policies.

Partnership and sharing of responsibilities. Balanced society goals can be achieved only by joint activities and co-operation of all interested parties: governmental and international organizations, local authorities, non-governmental organizations, and economy branches through their associations, companies, consumers, members of society, etc. Each one of the partners recognizes their own responsibility for implementation of environmental goals and acts by all means available. Partnership development through shared responsibility is the essential task which cannot be implemented without recognition of opinion diversity and respect of different interests and well-founded opinions.

Information availability. The principle is aimed at developing a mechanism for public participation in the decision-making process and at involving people in the formation of environmental protection policies. Environmental information availability would encourage public interest and promote its activity for the implementation of environmental protection goals.

Assessment of sustainable development. Before sustainability criteria are adopted and applied it will not be possible to precisely delineate any long-term objectives and goals or adapt actions to ever-changing conditions. Criteria and indications should be set to show environmental protection progress and the level of development sustainability.

3.4.5 Strategy Implementation Instruments

3.4.5.1 Legal/Administrational Regulation

Legal Environmental Regulation

The Government of Lithuania puts the highest priority on an immediate review of environmental protection laws to implement the action programs, and consequently to meet the goals. Analysis and assessment of the existing laws and regulations are being conducted in line with the requirements of the EU, as Lithuania is undergoing an integration to the EU process.

Enforcement

To improve the enforcement efficiency of environmental protection laws and regulations, the following actions are proposed:

- strengthening of subdivisions responsible for enforcement and paying more attention to their preventive function;
- improvement of permitting procedure for better co-ordination of relations between institutions performing economic activities and enforcement institutions;
- improvement of the technical base, particularly by supplying laboratories in the regional departments with better analytical equipment;
- improvement of enforcement officials' education and training and preparation of literature to aid them in their duties; and
- more publications for the general public informing them of environmental protection requirements.

Standards for basic nutrients and metal content in surface water and seawater and for hazardous pollutant contents in bottom sediments in water bodies will be reviewed.

The National Environmental Quality Standardization Program envisages a review of the basic standards for analytical determination of the environmental quality as well as their harmonization with the EU, and international standardization organizations' (ISO, DIN etc.) analytical standards.

Environmental Impact Assessment

The law on Environmental Impact Assessment was approved by the Parliament in 1996. Before any development activity is begun, the potential impact of such activity should be assessed in accordance with the procedures of the environmental impact assessment. Negative or adverse effects of the development activity on the environment should be prevented or minimized. Environmental impact assessment is therefore expected to act as a major preventive measure to avoid irrevocable changes in the environment.

This law was established to consolidate the principles for environmental impact assessment with the country situation; international requirements of the EU directives and the Convention on Environmental Impact Assessment in a Transboundary Context.

3.4.5.2 Territorial Planning

Proper territorial planning is an essential role in the environmental management at the national and regional levels. Territorial planning includes, but is not limited to planning for protected areas, land use, natural resources' use, and urban development.

The Environmental Protection Program envisages the importance of territorial planning with consideration of environmental requirements.

3.4.5.3 Economic Measures

The Environmental Protection Program takes into account the importance of economic measures to help the Government achieve environmental protection goals. Economic measures instruments include: taxation on use of natural resources, pollution charges and penalties, user charges, and product charges.

Out of these measures, pollution charges/penalties and user charges will be mostly related to the successful implementation of sewerage projects.

Currently, pollution charges are enforced on industries and facilities that are discharging wastewater exceeding the required standards. The charge system is being revised to make it more efficient and effective for environmental protection. Modification will likely lead to changes in the list of pollutants and charges.

3.4.5.4 Financial System

It is essential to establish a proper financial system for successful and sustainable implementation of the environmental protection program. However, the conditions of financial arrangements can vary depending on the financial sources and availability of funds. From this situation, the Action Program defines only the fundamental policy as follows:

Funding from User Charges. Currently, most sewerage projects are granted government subsidies to cover the construction cost. Further, a number of the Water Companies cannot afford to pay back the loan used for the construction. Amortization of loans is then backed by the central government as a guarantor. This is derived from the current tariff structure proposed, and is not based on the financial requirements. The principle of users/polluters-pay should be introduced to improve the current financial situation.

Environmental Investment Fund. The Action Program recognizes the importance of the establishment of an "Environmental Investment Fund" as an incentive to encourage the environmental protection projects. The Environmental Investment Fund will likely be a form of loan to be paid back from revenue of each implementing agency.

3.5 STANDARDS RELATED TO SEWERAGE SYSTEM

3.5.1 Laws and Regulations for Effluent and Environmental Standards

3.5.1.1 Effluent Standards

In Lithuania, the standards applied to sewage are set in the "Sewage Pollution Norms LAND 10-96". Effluent standards are specified (1) for effluent discharged into surface waters, and (2) for effluent discharged into public sewerage systems. Details abstracted from the LAND 10-96 documents are as follows:

(1) Principal Pollution Norms for Sewage discharged into Surface Waters

Sewage discharged into surface waters must meet the following general requirements:

- Temperature: less or equal to +30°C
- Color: less or equal to 20 units for sewage that has been diluted by 1:3
- Smell: less than 2 grades for sewage that has been diluted by 1:3
- Transparency: equal or over 20 cm for sewage that has been diluted by 1:3
- Toxicity: must be harmless (non-toxic). At least two tests on acute toxicity must be performed. The type of a test shall be established by the License of the Use of Natural Resources depending on the type of discharge, the condition of an inlet, etc. The following tests on toxicity may be used:
  - toxicity for fish;
  - toxicity for Daphnia;
  - toxicity for luminescent bacteria;
  - toxicity for green silt;

  The acute toxicity of wastewater shall be established by a control test and by at least five tests at different concentrations.

  The objective of tests is:
  - to determine the lethal concentration of wastewater;
  - pH of sewage discharged must be 6.5 – 8.5
  - In addition to these requirements, sewage must meet the requirements of Principal Pollution Norms presented in Table 3.2 and Table 3.3.

Table 3.2 Principal Pollution Norms of Sewage discharged into Surface Waters (1/2)

Pollutants	Permissible Concentration (mg/l)	
	Average annual concentration (Cave)	Maximum instantaneous concentration (Cmax)
BOD_7[2]		
< 5 m^3/day	30[1]	50
5 m^3/day – 5,000 PE[3]	25[1]	40
5,000 – 10,000 PE	20[1]	30
>10,000 PE	15[1]	25
COD		
< 10,000 PE	100[1]	150
≥10,000 PE	75[1]	120
Total-P		
≥10,000 PE	1.5[1]	2.5
Total-N		
10,000 – 100,000 PE	20[1]	35
≥100,000 PE	15[1]	25
Suspended Solid		
<100,000 PE	30[1]	45
≥100,000 PE	25[1]	35

1) If the factual average concentration of pollutants (Cave) from a treatment facility, or the average concentrations of pollutants (Cave) of the treatment facility that is under design is less than the values established by these norms, to calculate Cave concentration for maximum permissible pollution shall be taken in accordance with a

project that has been approved or in accordance with the data of laboratory research, whereas the maximum instantaneous concentration (Cmax) shall be taken in accordance with Table 3.2 and Table 3.3.

2) $BOD_7 = 1.15 \times BOD_5$

3) PE (population equivalent): the relative number of population calculated according to the amount of pollutants in sewage (70g-BOD_5/cap/day, 70g-SS/cap/day, 12g-N/cap/day, 2.7g-P/cap/day)

Table 3.3 Principal Pollution Norms of Sewage discharged into Surface Waters (2/2)

Pollutants	Concentration in mg/l
Biological	
Nitrites-N[2)]	1 [1)]
Ammonium-N[2)]	5 [1)]
Non-Organic	
Cadmium, Cd	0.04 [3)]
Chromium, Cr	0.5 [3)]
Chromium, Cr^{6+}	0.1 [3)]
Copper, Cu	0.1 [3)]
Mercury, Hg	0.002 [3)]
Nickel, Ni	0.2 [3)]
Lead, Pb	0.1 [3)]
Manganese, Mn	1 [3)]
Tin	1 [3)]
Vanadium, V	2 [3)]
Zinc, Zn	0.3 [3)]
Aluminum, Al	0.5 [3)]
Cyanides, Cn	0.1 [3)]
Active Chlorine, Cl	0.6 [3)]
Chlorides	500 [4)]
Fluorides	8 [4)]
Sulphides	0.5 [4)]
Sulphates	300 [4)]
Arsenic, As	0.05 [4)]
Organic	
Synthetic active surface substances (detergents)	
anionic	1.5 [4)]
non-ionic	2 [4)]
Oil products	1 [3)]
Phenols	0.2 [4)]
Fats	1 [3)]

1) Permissible average annual concentration.
2) Applies for wastewater amount of 1,000m^3/day or more.
3) Maximum spot sample concentration.
4) Permissible concentration of 24-hour composite sample. In case of absence of automatic sampling, maximum spot sample concentration shall be applied.

(2) Pollution Norms of Sewage Discharged into Communal Sewerage System

This document regulates only those materials (substances) that are not removed by a communal treatment facility or may be harmful to the process of purification of sewage and to the further use of sludge. The norms applied to other materials (substances) shall be

established by the organization that operates the treatment systems after contracting with a user of the sewerage system.

The main requirements applied to sewage discharged into the sewerage system:

- Temperature: less or equal to +30°C
- pH: 6.5 -- 8.5
- Sewage must be free of mechanical particles that may block or damage parts of a system.
- Sewage must be free of compounds that may cause a fire or explosion.

The Principle Pollution Norms of Sewage Discharged into the Sewerage System (sewage treatment plant) are presented in Table 3.4.

Table 3.4 Principal Pollution Norms of Sewage discharged into Sewerage System*

Pollutants	Concentration in mg/l
General	
COD/BOD_7**	<2.5
pH	6.5 - 9
Non-Organic	
Cadmium, Cd	0.1 [1]
Chromium, Cr	1 [1]
Chromium, Cr^{6+}	0.2 [1]
Copper, Cu	1 [1]
Mercury, Hg	0.01 [1]
Nickel, Ni	0.5 [1]
Lead, Pb	0.5 [1]
Manganese, Mn	10 [1]
Tin	2 [1]
Zinc, Zn	1 [1]
Cyanides, Cn	0.5 [1]
Active Chlorine, Cl	0.6 [1]
Fluorides	10 [1]
Sulphides	2 [1]
Arsenic, As	0.1 [1]
Organic	
Absorbing organic halogens	0.1 [1]
Synthetic active surface substances (detergents)	
anionic	10 [1]
non-ionic	15 [1]
Oil products	5 [1]
Phenols	3 [1]

1) Permissible concentration of 24-hour composite sample. In case of absence of automatic sampling, maximum spot sample concentration shall be applied.
2) Permissible average annual concentration.
* If the sludge formed in treatment facility does not meet the requirements for use, the Ministry of Environment may establish more stringent standards.
** $BOD_7 = 1.15 \times BOD_5$

For reference, the EU standard for urban wastewater treatment is presented as follows:

Table 3.5 EU Standard for Urban Wastewater Treatment

("Council Directive 91/271/EEC concerning urban wastewater treatment")

(Table 1) Requirements for discharges from urban wastewater treatment plants

Parameters	Concentration	Minimum percentage of reduction (1)
Biochemical oxygen demand (BOD_5 at 20°C) (2)	25 mg/l 40 mg/l (3)	70-90
Chemical oxygen demand (COD)	125 mg-O_2/l	75
Total suspended solids	35 mg/l (4) 35 (3) (more than 10 000 p.e.(5)) 60 (3) (2,000-10,000 p.e.)	90 (4) 90 (3) (more than 10,000 p.e.) 70 (3) (2,000-10,000 p.e.)

(1) Reduction in relation to the load of the influent.
(2) The parameter can be replaced by another parameter: total organic carbon (TOC) or total oxygen demand (TOD) if a relationship can be established between BOD_5 and the substitute parameter.
(3) Standards for high mountain regions over 1500 m above sea level)
(4) This requirement is optional.
(5) p.e. (population equivalent) means the organic biodegradable load having a five-day biochemical oxygen demand (BOD_5) of 60 g of oxygen per day;

(Table 2) Requirements for discharges from urban wastewater treatment plants to sensitive areas which are subject to eutrophication

Parameters	Concentration	Minimum percentage of reduction (1)
Total phosphorus	2 mg/l P (10,000 – 100,000 p.e.) 1 mg/l P (more than 100,000 p.e.)	80
Total nitrogen (2)	15 mg/l N (10,000 – 100,000 p.e.) 10 mg/l N (more than 100 000 p. e.) (3)	70-80

(1) Reduction in relation to the load of the influent.
(2) Total nitrogen means: the sum of total Kjeldahl-nitrogen (organic N + NH_3), nitrate (NO_3)-nitrogen, and nitrite (NO_2)-nitrogen.
(3) Alternatively, the daily average must not exceed 20 mg/l N. This requirement refers to a water temperature of 12°C or more during the operation of the biological reactor of the wastewater treatment plant. As a substitute for the condition concerning the temperature, it is possible to apply a limited time of operation, which takes into account the regional climatic conditions.

3.5.1.2 Standard for Sludge Disposal

The Ministry of Environment has a national standard named "LAND 20-96 Standard of Usage of Sewerage Sludge" that has been prepared in compliance with the EU standard 86/278/EEC. This standard shall be applied to the sludge from domestic and combined sewage

treatment plants. Before use, all sludge shall receive treatment by biological, chemical, thermal, or composting method to reduce microbiological and parasitological pollution.

LAND 20-96 defines the categories and classes of the sludge produced in a sewage treatment plant as follows:

Table 3.6 Sludge Category by Heavy Metal Contents

Sludge category	Amount of heavy metals (mg/kg)						
	Pb	Cd	Cr	Cu	Ni	Zn	Hg
I	≤60	≤1.0	≤60	≤60	≤45	≤200	≤0.8
II	61-165	1.1-2.0	61-130	61-200	45-100	201-660	0.8-2.0
III	166-250	2.0-3.0	201-300	201-300	101-150	661-1000	2.0-3.0
IV	251-500	3.0-6.0	301-600	301-600	151-300	1001-2000	3.0-6.0
V	>500	>6.0	>600	>600	>300	>2000	>6.0

Table 3.7 Sludge Category by Pathogenic Organisms

Sludge class	Escherichia coli (no./g)	Clostridium perfringens (amount/g)	Helminth eggs and larvae (amount/g)	Pathogenic enterobacteria (amount/g)
A	≤1 000	≤100 000	0	0
B	1 001-100 000	100 001-10 000 000	1-100	0
C	>100 000	>10 000 000	>100	>1

With the category and class of sludge above, various restrictions are set for use of sludge as summarized below.

Table 3.8 Restriction for Use of Sludge

Sludge category class	fertilize fields and re-cultivate quarries	fertilize vegetable	fertilize sensitive areas[1]	fertilizing intensive karst area
I	O	X	X	O
II	O	X	X	X
III	O	X	X	X
IV	O	X	X	X
V	X	X	X	X
A	O	O	X	X
B	O	X	X	X
C	X	X	X	X

1. Sensitive area = sensitive zones designated in Lithuanian hygienic standard 'the standards and regulations of design and supervision of a sanitary protection zone of underground water (HN 44-1993).'

3.5.1.3 Quality Standard of Surface Water

At present, there is no water quality standard for surface water. The Ministry of Environment has classification criteria for evaluating the surface water quality as shown below.

Table 3.9 Classification of Surface Water (Ministry of Environment)

Quality grade	I	II	III	IV	V	VI
Classification	very clean	clean	slightly contaminated	medium contaminated	very contaminated	super contaminated
BOD_7 (mg/l)	< 2.3	2.3-4.0	4.1-5.8	5.9-9.2	9.3-20.7	>20.7
Nitrogen (mg/l)	< 0.3	-	-	-	-	>15.0
Phosphorus (mg/l)	< 0.03	-	-	-	-	>0.50
Coliform no./l	≤ 1,000	≤ 10,000	≤ 100,000	≤ 1,000,000	≤ 10,000,000	>10,000,000

3.6 PRESENT STATUS OF THE SEWERAGE SYSTEMS

As briefly noted in Chapter 2, approximately 249 million m^3/year (682,000 m^3/day) of domestic wastewater is discharged into surface water. Out of this amount, 73 percent is receiving some kind of treatment. Biological treatment is applied to only 108 million m^3/year or 43 percent of the total amount of domestic wastewater.

In 1997, some 84 cities and municipalities have a treatment facility in operation. The Ministry of Environment is implementing construction projects for sewage treatment plants and sewerage systems in the major cities and municipalities. As of 1998, there are various sewerage projects under implementation with financial assistance from foreign or international donor agencies as follows:

Table3.10 Ongoing Sewerage Projects

	City	City Population	Project Cost	Local Budget	Donor	Foreign Finance	
						Grant	Loan
A	Vilnius	580,099	11,232		PHARE	732	
					Denmark		10,500
A	*Kaunas*	418,707	98,850	67,550	EBRD	0	14,800
					NEFCO	0	3,000
					Sweden	3,800	0
					Finland	1,700	0
					PHARE	8,000	0
A	*Klaipėda*	203,269	23,100	7,213	World Bank	0	7,000
					PHARE	887	0
					Finland	3,000	0
					Sweden	5,000	0
A	*Šiauliai*	146,996	22,850	8,000	World Bank	0	6,200
					Sweden	2,100	0
					Norway	1,500	0
					Sweden	4,650	0
					Other	400	0
C	Kelmė	43,296	2,043	765	Denmark	0	1,278
C	Lazdijai	32,817	1,484	720	Denmark	0	764
C	Molėtai	26,640	1,482	735	Denmark	0	747
C	Pakruojis	30,992	1,802	830	Denmark	0	972
C	Raseiniai	46,674	2,293	755	Denmark	0	1,538
C	Šilalė	33,303	1,567	720	Denmark	0	847
C	Anykščiai	38,031	2,120	620	Denmark	0	1,500

Table3.10 Ongoing Sewerage Projects (continued)

	City	City Population	Project Cost	Local Budget	Donor	Foreign Finance	
						Grant	Loan
B	Alytus	77,362	3,120	620	Denmark	0	2,500
C	Širvintos	21,716	1,840	640	Denmark	0	1,200
B	Ukmergė	51,453	3,010	10	Denmark	0	2,500
B	Utena	53,981	3,040	540	Denmark	0	2,500
C	Vilkaviškis	53,117	950	450	Denmark	0	500
A	Panevėžys	133,347			Denmark	0	313
A	Panevėžys	133,347			Denmark	0	195
A	Šiauliai	146,996			Denmark	0	173
C	Anykščiai	38,031			Denmark	0	2,400
B	Tauragė	56,088			Denmark	0	352
B	*Palanga*	19,716			PHARE	1,625	0
B	Pavojingu				PHARE	1,375	0
	Total					34,769	61,779

unit: thousand US $
city in Italic: Project of the highest national priority
A: Large scale Water Company
B: Medium scale Water Company
C: Small scale Water Company

3.7 FINANCE FOR SEWERAGE DEVELOPMENT

3.7.1 Public Investment Program of the Government

Each year, the Ministry of Finance develops an annual budget and the Ministry of Economy plans and revises the three-year investment projects to fit within the annual budget, under the title "Public Investment Program" (including projects of more than 3 million litas). All ministries, and some municipalities, request budgets for their projects from the Ministry of Economy. The Ministry of Economy prioritizes the projects from the viewpoints of national importance and necessity. Water and sewerage projects are part of the Public Investment Program.

Almost all water and sewerage Public Investment Program projects are based on the National Environment Program. Wastewater treatment projects are a top priority in this program. The Ministry of Environment makes comments on the projects from the viewpoint of environmental protection to the Ministry of Economy. Projects are then finally determined by the Ministry of Economy together with the Ministry of Environment.

3.7.2 Financial System for the Sewerage Projects

Finance sources for projects are the state government budget, the municipality budget (small), profits of the water companies (many of them unprofitable), grants and/or loans from foreign countries and international financial institutions like the World Bank, EBRD, etc. The Ministry of Finance, in some cases, acts as a borrower to the World Bank, Nordic Investment Bank (NIB), European Investment Bank (EIB) and the EBRD, and can guarantee loans from foreign countries for the borrowers, if requested.

The Ministry of Environment and municipalities have environment protection funds, which are used for the protection of the rivers, sea and forests. These funds are not sufficient to cover sewerage projects in every district. Many water and sewerage projects are presently financed by foreign countries. All of them are guaranteed or funded by the Government. All important projects must be included in the Public Investment Program if they wish to be included in the state budget, or receive a state guarantee. According to the list of environmental projects prepared by the Ministry of Environment, there are 23 projects, which used, are using, or planning to use foreign grants or loans in the near future.

These projects are financed by the EBRD loans of 14.8 million US dollar, NEFCO loans of 3 million US dollar, Swedish Government grants of 3.8 million US dollar, Finnish Government grants of 1.7 million US dollar, and PHARE grants of 8.0 million US dollar. These account for 32 percent of the total project costs of 98.85 million US dollar. The remainder was financed by the budget of the State Government (48.3%), the municipality (8.3%) and the Water Company (11.4%). Budgets and grants account for about 70 percent of the total project costs. The Danish Government is very active in supporting sewerage projects through export credit loans. The Molėtai plant is already working, and 11 other plants are under construction.

The first project receiving a Danish export loan for a sewerage project was the Molėtai sewerage project. The Lithuanian side (borrower) was not familiar with foreign country support and, as such, did not conduct a detailed investigation of the feasibility of this project. As a result, the system is too large and has excess capacity. The Water Company annually generates a loss and cannot recover the operating costs. Now, the Lithuanian Government checks the feasibility of candidate projects to ensure that sizes and equipment be suitable for local conditions.

Foreign loans for public infrastructure are strictly regulated by the Ministry of Finance. The following statements can be found in Decree No. 511, 28 April 1998, of the Government of the Republic of Lithuania.

Reference from the Articles of the Decree No. 511

2.1 The general loan (total debt) of the municipality cannot exceed 20 percent of the approved revenues for that year (excluding grants for special purpose to municipality from the state budget of the Republic of Lithuania). In exceptional cases, the Ministry of Finance may allow an increase in the limit to 50 percent.

2.2 The annual borrowing limit of the municipality is 10 percent, including the short-term borrowing annual limit of 5 percent of approved revenues of that year (excluding grants for special purposes to the municipality from the state budget of the Republic of Lithuania).

2.3 The total sum of debt to be repaid by the municipality that year, for interest and other expenses related to borrowing cannot exceed 10 per cent of the approved revenues.

9. Municipalities and their enterprises can receive loans from foreign loans received on behalf of and with the guarantee of the Government according to the order established by the Government of the Republic of Lithuania and the Executive Board of the Bank of Lithuania in Decree of 30 October 1997, No. 1200/8 'Concerning foreign loans received on behalf of and with the guarantee of the Government'.

10. Municipalities or their enterprises seeking long-term loans to finance an investment project shall apply to the Ministry of Finance and Ministry of Economy.

11. The commission, formed by the Decree of the Minister of Finance, after analyzing the documents not later than one month after the presentation of application (given that the municipality has not exhausted annual and total borrowing limits, also indicated in this Decree), gives permission to receive the loan or to receive the loan under certain conditions and to announce the tender.

CHAPTER 4

BIRZAI TOWN
SEWERAGE SYSTEM IMPROVEMENT PLAN

Nippon Jogesuido Sekkei Co., Ltd.
Tokyo, Japan

4 BIRZAI TOWN - SEWERAGE SYSTEM IMPROVEMENT PLAN

4.1 DESCRIPTION OF THE STUDY AREA

4.1.1 General

Birzai is located 210 km north of Vilnius and 20 km from the Lithuanian-Latvian border. Birzai was first mentioned as a settlement in 1455, and has been a frontier town of Lithuania. In the late 16th century, Birzai was granted the right to force all merchants en route to Riga in Latvia, to stop first in Birzai. Birzai was then an important town on the main trading route in the Baltic Sea region.

Birzai is now famous for its cultural and natural assets that include 110 cultural monuments, 17 lakes, nine landscape preserves, and six state-preserved parks. The town is situated at the confluence of the Apascia and Agluona Rivers. In the 16th century, the two rivers were dammed to make a reservoir having a 340 ha surface area. The reservoir, Sirvenos Lake, is the oldest man-made lake in Lithuania.

The area around Birzai is a karst geological area with a high gypsum content and numerous underground rivers and caves. As a result, the Birzai area has over 2,000 sinkholes. The holes range in size from small to as big as a house. Sinkholes are still developing every year.

4.1.2 Natural Conditions

4.1.2.1 Topography, Geology and Hydrogeology

Birzai is located on relatively flat land with an elevation between 55 to 65 m above sea level. Ground slopes gently downward from south to north.

Birzai is surrounded by a large karst geological area that extends to southern Latvia over an area of about 1,000 km^2. This area is referred to as the Gypsum Karst Region as it is formed with mature gypsum karst at the land surface and the subsurface.

Around Birzai, superficial karst-forms are seen mostly covered by silt or peat deposits. The karst formation consists of two layers: namely, the Narva Formation of the Middle Devonian age and the Tatula Formation of the Late Devonian (Frasnian) age. The gypsum in the Narva Formation occurs at a depth of 100 m or more. The Tatula Formation contains the Late Devonian (Frasnian) gypsum consisting of two layers. The lower layer is called the Pasvalys of about 20 m thick while the upper layer is referred to as the Nemunelis which is about 15 m thick. These gypsum layers are underlain by the dolomites and marls of the Pliavinias Formation that is underlain by the thin Jara clays and marls. Under these layers, there are thick sandstone layers forming good aquifers.

The Gypsum Karst Region has a high potential yield of groundwater and forms part of the Baltic Artesian Basin. Devonian and Quaternary formations are the main aquifers and provide the source of domestic and industrial water in northern Lithuania.

Water for domestic and industrial use is being drawn from the lowest aquifer composed of Middle Devonian sandstone. This aquifer contains high quality groundwater. However, since this aquifer is connected with the upper layers, it also has a potential of contamination from above.

4.1.2.2 Meteorology

Temperature and precipitation in the Birzai area are shown below:

Table 4.1 Temperature and Precipitation in Birzai

Month	Temperature (°C)			Precipitation (mm)		
	Minimum	Average	Maximum	Minimum	Average	Maximum
January	-35.1	-5.7	8.4	9	32	80
February	-35.5	-5.2	13.0	6	24	69
March	-29.5	-1.2	18.8	4	34	87
April	-16.7	5.5	26.1	6	40	102
May	-4.1	12.1	30.7	14	52	150
June	0.1	15.7	33.3	21	58	197
July	3.5	16.7	33.7	25	77	183
August	0.4	15.9	33.3	15	71	220
September	-5.3	11.4	28.9	0	64	157
October	-10.8	6.7	22.7	4	55	136
November	-20.4	1.5	16.2	8	52	135
December	-31.4	-3.2	10.5	9	46	90
		5.9		434*	609	921**

source: Meteorology Station
* : minimum annual total precipitation (1928)
** : maximum annual total precipitation (1975)

Wind data shows that the dominant direction of wind is west and southwest in summer and southeast in winter.

4.1.2.3 Surface Waters

Birzai has a big manmade lake just north of town. The dam was constructed in the 16th century. The area of the lake is 340 ha. In the Municipality area, there are four major rivers, all of which flow from south to north. The rivers Tatula and Obelaukias bypass the town to the west and east respectively, while the Apascia and Agluona Rivers flow through the town into the lake.

4.1.3 Socio-economic Conditions

4.1.3.1 Administrative Territory and Population

Birzai Municipality has a total area of 1,476 km^2 including the town of Birzai (urban area) as the capital of the Municipality. The town of Birzai has an area of 1,783 ha. The Municipality is governed by the council and mayor. The Administrator is assigned for management of the administrative works. The administrative structure of the Municipality includes eight local authorities (towns), 12 Departments/Bureaus/Offices and advisors as shown in Figure 4.1.

Population of Birzai is shown in the table below:

Table 4.2 Population of Birzai

Year	Municipality Population	Population in Birzai Town (urban area)
1991	38,301	16,373
1992	38,520	16,349
1993	38,701	16,308
1994	38,772	16,364
1995	38,991	16,252
1996	38,933	16,326
1997	38,908	16,183

As shown above, the population of the town has been decreasing slightly while that of the municipality has been almost stable. There has been limited migration in and out of the municipality.

4.1.3.2 Economy

Commercial and Industry

The main industry in the Birzai Municipality is agriculture similar to the other local areas in Lithuania. In Birzai town, there are also several factories producing food, beer, and textiles.

Local Investment

Recently, a Swedish company announced a plan to invest in a famous beer brewery factory in Birzai Town.

Employment

Statistics Department shows the unemployment in Birzai Municipality as follows

Table 4.3 Unemployment Rate in Birzai

Year	Birzai	Lithuania
1993	8.1 %	4.4 %
1994	3.6 %	3.8 %
1995	5.0 %	6.1 %
1996	5.1 %	7.1 %
1997		

Unemployment in Birzai is relatively low except for 1993 compared with the overall country's average figure.

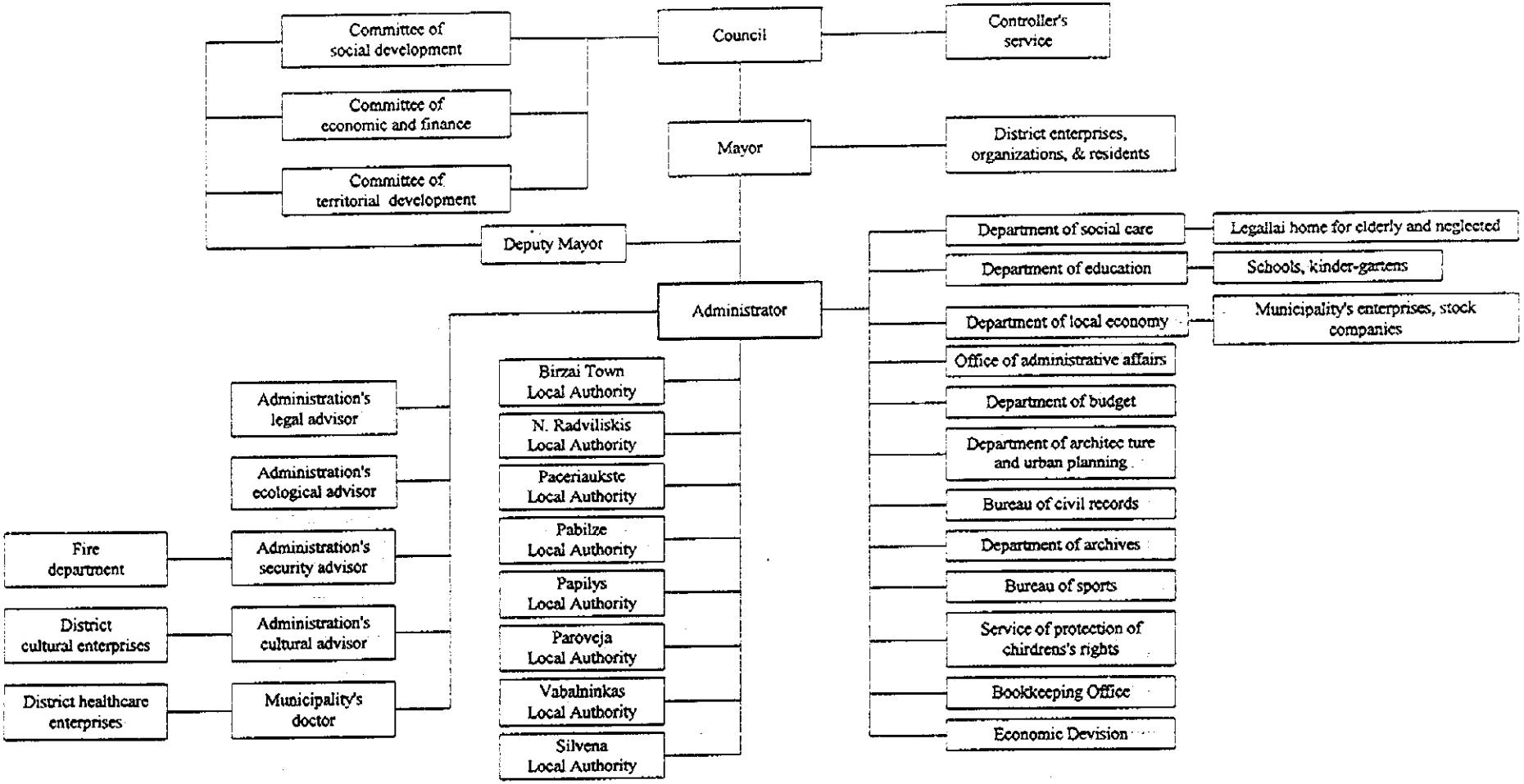


Figure 4.1 Organization Chart of Birzai Municipality

4.1.3.3 Social Conditions

Education

Birzai Town has one elementary school, four secondary schools, and one agricultural and technical school.

Culture

Birzai area has its own dialect of the Lithuanian language. This is one of the four major dialect groups in the country.

4.1.3.4 Social Infrastructures

Electric Power Supply

In Birzai Municipality, electric power is supplied by the private Joint Stock Company "Elektros Tinklai". The power supply system is connected with the national grid of the power transmission system through three power stations nearby.

Transportation

The town of Birzai is located east of, and about 30 km from, the A10 Highway that is the main route connecting Panevėžys and Riga in Latvia. A local paved road connects Birzai with A10 and extended further east to the A6 Highway.

Communication

Birzai Municipality is connected to the national telephone communication network. The communication system is well maintained throughout the year.

Solid Waste Management

The Municipality is responsible for collecting garbage once a week to every day a week. Solid waste is collected and disposed of at a dumping site located at Dirvonakiai.

The dumping site is located 4 km south from the Birzai Town, and has an area of approximately 4 ha surrounded by agricultural land. The dumping site is not designed for sanitary landfill.

Community Heating and Hot Water Supply

Community heating and hot water supply is available in Birzai Town as it is in most other cities and towns in Lithuania. A Special Purpose Joint Stock Company called "Silumos Tinklai" provides this service, buying source water from the Birzai Water Company. Water is heated by Silumos Tinklai and supplied to individual houses and buildings. Hot water is used both for heating and domestic use.

4.1.3.5 Public Investment Program

As of the beginning of 1998, the sewerage system improvement project is the only program for Birzai Municipality proposed in the Public Investment Program of the Government.

4.1.4 Land Use

4.1.4.1 Present Land Use

There is no clear data for the land use of the Birzai Municipality. Most of the town area is however designated as a developed area which consists of residential, public, and industrial areas, and parks. Agricultural land use is minimal within the town area.

4.1.4.2 Development Plan for Future Land Use

Currently there is no definite plan to develop or expand the present urban area.

4.2 WATER COMPANY (VANDENYS)

4.2.1 History

Birzai Water Company was established in 1994 as a joint stock company from the former Panevėžys Water Supply Department. Shareholders of the Water Company are the Municipality (90.6 %) and an oil company (9.4 %). The oil company invested in the Water Company when the Water Company became a joint stock company separated from one division of the Municipality.

4.2.2 Organizational Structure and Responsibility

In 1997, Birzai Water Company had a total of 52 employees in its organization. The number of employees is broken down as follows:

Administration	5
Technicians	9
Other Workers	38
Total	52

Organization of the Water Company and the number of staff of each division are shown in Figure 4.2.

4.2.3 Service Area and Population Served

At present, the Birzai Water Company supplies water to 7,400 people, approximately 46 percent of the total population in the town. The total number of service connections is 286, including the corporate houses. The network of the water supply system covers almost the entire town area. People not connected to the water supply system use deep wells as their own water sources.

For sewerage, the Water Company has 560 connections covering a population of 8,240 in 1997, some 51 percent of the total population. The sewerage system network also covers almost the entire town area. Service connections for water supply and sewerage are broken down as follows:

Table 4.4 Service Connection of Water Supply and Sewerage

Category	Water supply		Sewerage	
	1996	1997	1996	1997
Residential (individual house)	133	137	391	405
Residential (corporate house)	98	97	95	96
Commercial/industrial	1	1	3	3
Government	44	49	47	56
Total	253	262	536	560

Populations served in 1996 and 1997 are tabulated as follows:

Table 4.5 Population Served – Water Supply and Sewerage

Year	Water Supply	Sewerage
1996	7,570	8,280
1997	7,400	8,240

The tables above show that more people are connected to the sewerage system than the water supply system. For major industries, only one factory (brewery) uses water from the Water Company while two firms (dairy and canned food factories) use their own wells for water supply. All of these three factories discharge wastewater to the sewers of the Water Company.

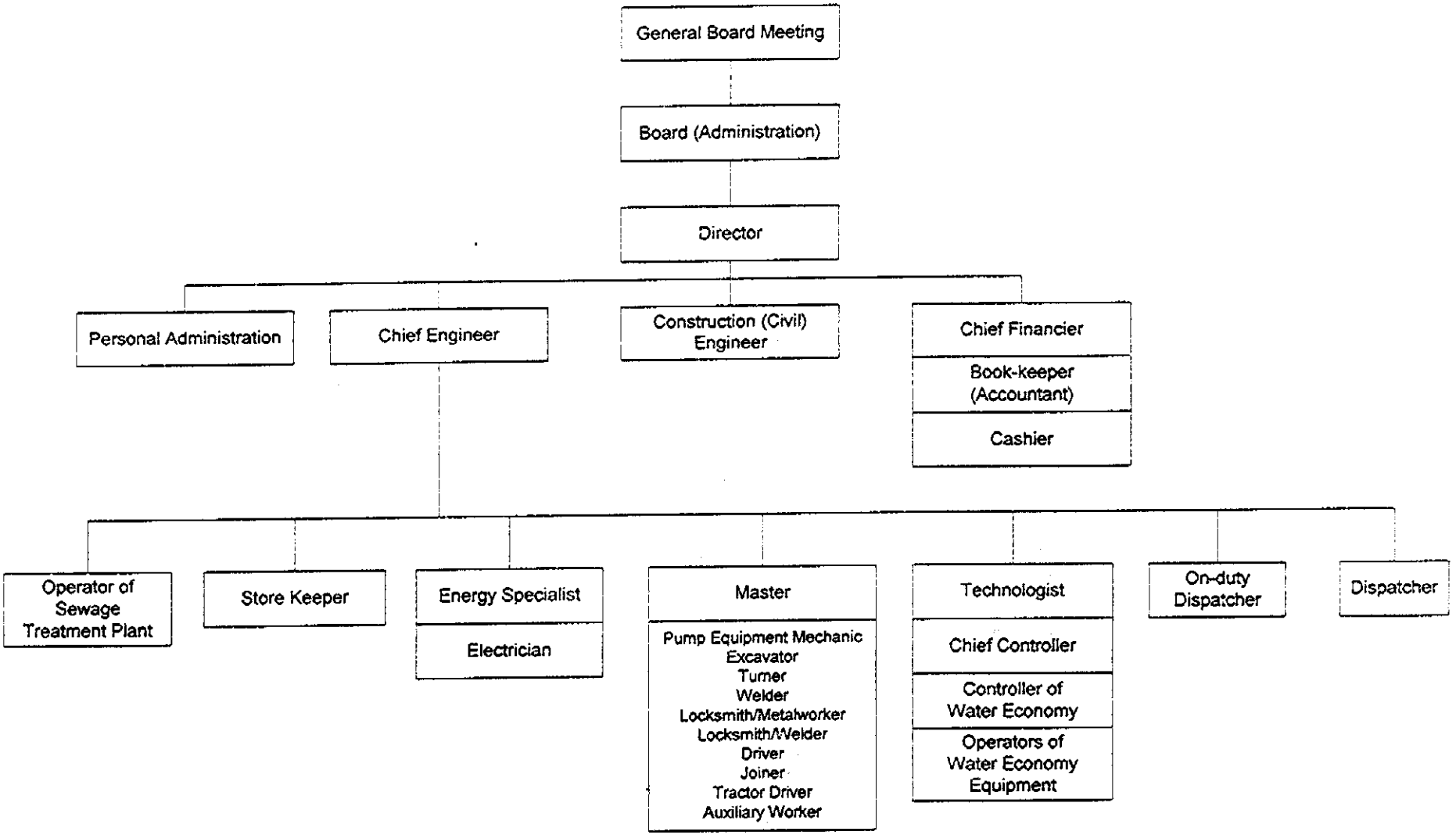


Figure 4.2 Organization of Birzai Water Company

4.2.4 Tariff Structure

Tariffs for water supply and sewerage are set up as follows:

Table 4.6 Tariff Schedule

User Type	Water Supply	Sewerage
Residential use	1.46 Lt/m^3	1.37 Lt/m^3
Enterprise	2.54 Lt/m^3	1.38 Lt/m^3

4.2.5 Billing and Collection of the Water and Sewerage Fees

The billing method of the Water Company is a self-declaration (honor) system by the users and property owners. Owners of each house or designated personnel for cooperative houses are responsible for identifying the amount of usage, and for the payment of the tariff.

The owner of each house is required to identify and declare the amount of water used every month by reading the meter installed at his house. The owner must then complete the billing form in the subscription booklet, and make payment at the bank designated by the Water Company. The bank issues a receipt to payers.

To determine the amount of sewage, the amount of water used is the basis of calculation of the charge. Where a house has its own well source, each well must be installed with a meter to measure usage. Payment for sewerage is made using the water supply charge at the bank.

In case a house does not have a water meter, water and sewerage charges are calculated by standard norms.

For the cooperative houses where a number of units are accommodated in a single building, one person in the building must be assigned in charge of checking water usage of the building. He must then collect the charge from each unit, and make the payment for the entire building at the bank.

4.2.6 Financial Performance

4.2.6.1 Overview

Because the year 1997 was the only full accounting year since separation from the regional Water Company, any exact comparison with previous years is not possible. However, the Birzai Water Company made losses both in 1996 and in 1997. Operating losses against sales increased from –5.8 percent in 1996 to –9.2 percent in 1997. Current losses to sales increased from –4.2 percent in 1996 to –5.7 percent in 1997.

Table 4.7 Outline of the P/L Statement of Birzai Water Company (in litas)

	1997	1996 (6M)
Sales	1,588,120	555,336
Cost	1,734,455	587,707
Operating Profit or Loss	-146,335	-32,371
(adjustment)		5,857
Financial Investment Income	56,283	3,621
Financial Investment Income	88,383	1,010,485
Financial Investment Expenses	32,100	1,006,864
Current Profit of Loss	-90,052	-22,893
Special Loss		-50,476
Income before Tax	-90,052	-73,369
Income Tax	0	0
Net Profit or Loss	-90,052	-73,369

In the Birzai area, some users, and particularly industrial users, use private wells for their supply of water. In this case, the user does not pay for the water used, but still must pay the charge for sewage disposal. That is why the Company received 58 percent of its sales revenue from the sewage tariff. The Company derives 3 percent of its sales from other businesses, mainly rental of machine and equipment and related services.

The sewage tariff has increased 20 percent over the past three years, while the water tariff increased 2.78 times for home use and 4.16 times for other uses.

Table 4.8 The Breakdown of Sales (1997)

	Sales (litas.)	Percent (%)
Total	1,588,120	100
Water	623,923	39
Sewerage	922,478	58
Others	41,719	3

The sewerage division of the company actually made a profit on the operating basis. The tariff increased by 20 percent in 1997, but will be kept at the same level in 1998.

Table 4.9 Operating Profit of the Sewerage Division (1997)

Sewerage Division	litas
Income	922,478
Cost	770,129
Profit	152,349

The water division had a large loss in operation. The operating cost is 50 percent higher than income. After the large increases (56 percent for residential use, 194 percent for other use) in the

tariff in 1997, the tariff is scheduled to be increased again (77 percent for residential use, 53 percent for other use, from July 1998).

Table 4.10 Operating Loss of the Water Division (1997, litas)

Water division	litas
Income	623,923
Cost	941,382
Profit	-317,459

4.2.6.2 Cost Analysis

Operating cost for the sewerage division is 1.25 litas/m^3. While the standard sewage tariff is 1.16 litas (for residential use) and 1.17 litas (for other uses), the effective tariff was estimated at about 1.50 litas (some enterprises pay a special tariff as a penalty for pollution).

The operating cost of the water is 1.71 litas/m^3. The standard tariff is 1.24 litas for residential use and 2.15 litas for other use.

Table 4.11 Operating Cost of the Birzai Water Company (1997)

Operating Cost	Sewerage Division			Water Division		
	litas	Composition	litas/m^3	litas	Composition	litas/m^3
Cost of Energy Usage	55,840	7.2%	0.09	95,365	10.13%	0.17
Energy Usage /Average Unit Price			0.00		0.00%	0.00
Cost of Chemicals			0.00		0.00%	0.00
Administration, Engineers and Technicians	266,564	34.4%	0.43	266,564	28.32%	0.48
Taxes	76,693	10.4%	0.13	68,041	7.23%	0.12
Nature Protection Tax	71,800	9.6%	0.12	64,643	6.87%	0.12
Property Tax			0.00		0.00%	0.00
Road Tax	4,894	0.8%	0.01	3,397	0.36%	0.01
Wages, Social Security (13/12P)	106,828	13.6%	0.17	238,280	25.31%	0.43
Salaries	82,202	10.4%	0.13	183,292	19.47%	0.33
Social Insurance	24,626	3.2%	0.04	54,988	5.84%	0.10
Depreciation, Fuels & Others	264,204	34.4%	0.43	273,133	29.01%	0.50
Depreciation	179,233	23.2%	0.29	152,553	16.21%	0.28
Parts, Materials	966		0.00	85,272	9.06%	0.16
Fuel	5,451	0.8%	0.01	8,028	0.85	0.01
Analysis Cost	26,540	3.2%	0.04	4,006	0.43%	0.01
Others	52,015	6.4%	0.08	23,273	2.47%	0.04
Total (litas), (litas)/m^3	770,129	100.0%	1.25	941,382	100.0%	1.71

4.2.6.3 Ratio Analysis

(1) Efficiency Analysis

Last year, the company increased its long-term assets, mainly equipment (+6,261,601 litas) and equipment under manufacturing (+6,121,755 litas). This lengthened the assets turnover period to 13.26 years.

Table 4.12 Efficiency Ratio

	1997
Total Sales (litas)	1,588,120
Total Assets (litas)	21,063,902
Asset Turnover Ratio (Times)	0.08
Asset Turnover Period (Years)	13.26
Long Term Asset (litas)	19,909,387
Current Assets (litas)	1,154,515
Long Term Asset Turnover (Times)	0.08
Current Assets turnover (Times)	1.38
Long Term/Total Assets Ratio (%)	0.95
Current/Total Assets Ratio (%)	0.05

(2) Liquidity Analysis

The current liability ratio is 7.95 percent and company has no outstanding bank loans.

The current liability consists only of the wages and social insurance payables and short-term payables to suppliers.

The sum of the current liability was 145,096 litas at the end of 1997, a very small figure.

Of the current liability, wages and social insurance payables totals 87,933 litas, or 1.97 months worth of the wages and social insurance of all employees.

The equity ratio is 99.31 percent and since the company has no long-term bank loans or other long-term liabilities, the equity ratio is nearly 100 percent.

4.3 EXISTING WATER SUPPLY SYSTEM

4.3.1 Existing Facilities

The Water Company has five deep wells inside the town proper as a source as listed in the table below:

Table 4.13 Production Well of the Water Company

Well Certificate No.	Year of Drilling	Depth (m)	Capacity (m^3/h)
4729/I	1982	130-140	63
966/3	1964	130-140	63
5700/3	1990	130-140	63
4574/4	1979	130-140	63
5380/2	1987	130-140	63

The total capacity of the five wells is 7,560 m^3/day when operated continuously.

Groundwater taken from these wells is collected at a treatment plant, located in the center of town for iron removal. This plant was newly constructed in 1997. The treatment process consists of aeration, rapid sand filtration, and disinfection using gaseous chlorine. The plant was designed to have a centralized monitoring and control by a SCADA (system control and data acquisition) system.

Treated water is then stored in a underground reservoir located inside the treatment plant and is pumped to an elevated tank for pressure regulation. The elevated tower has an elevation of 55 m above the ground and storage volume of 500 m^3.

The existing water supply network has approximately 13 km of pipeline of diameters ranging 150 to 300 mm.

4.3.2 Water Production and Sales

In 1997, the Water Company supplied 455,000 m^3 of water to consumers. Water consumption is broken down by category as follows:

Table 4.14 Water Sales

unit: m^3

Year	Residence	Public Utilities	Industry	Total
1996	326,917	216,205	30,404	573,526
1997	263,870	162,792	28,404	455,066

4.3.3 Future Development Plan

There is no development plan for the water supply system since the existing deep wells have sufficient capacity to meet the anticipated demand increase in the near future.

The Water Company expects the service ratio will increase to 70 percentage of the total population by the year 2010.

4.4 EXISTING SEWERAGE SYSTEM

4.4.1 Existing Facilities

4.4.1.1 General

The sewerage system of Birzai has been developed since the 1960's to collect, transfer and treat the sewage discharged in the town proper. The existing system consisting of pipelines, pump stations, and a treatment plant was completed in 1962. Currently, the existing system collects sewage totaling about 2,200 m^3/day. The layout of the existing sewerage system is presented in Figure 4.3.

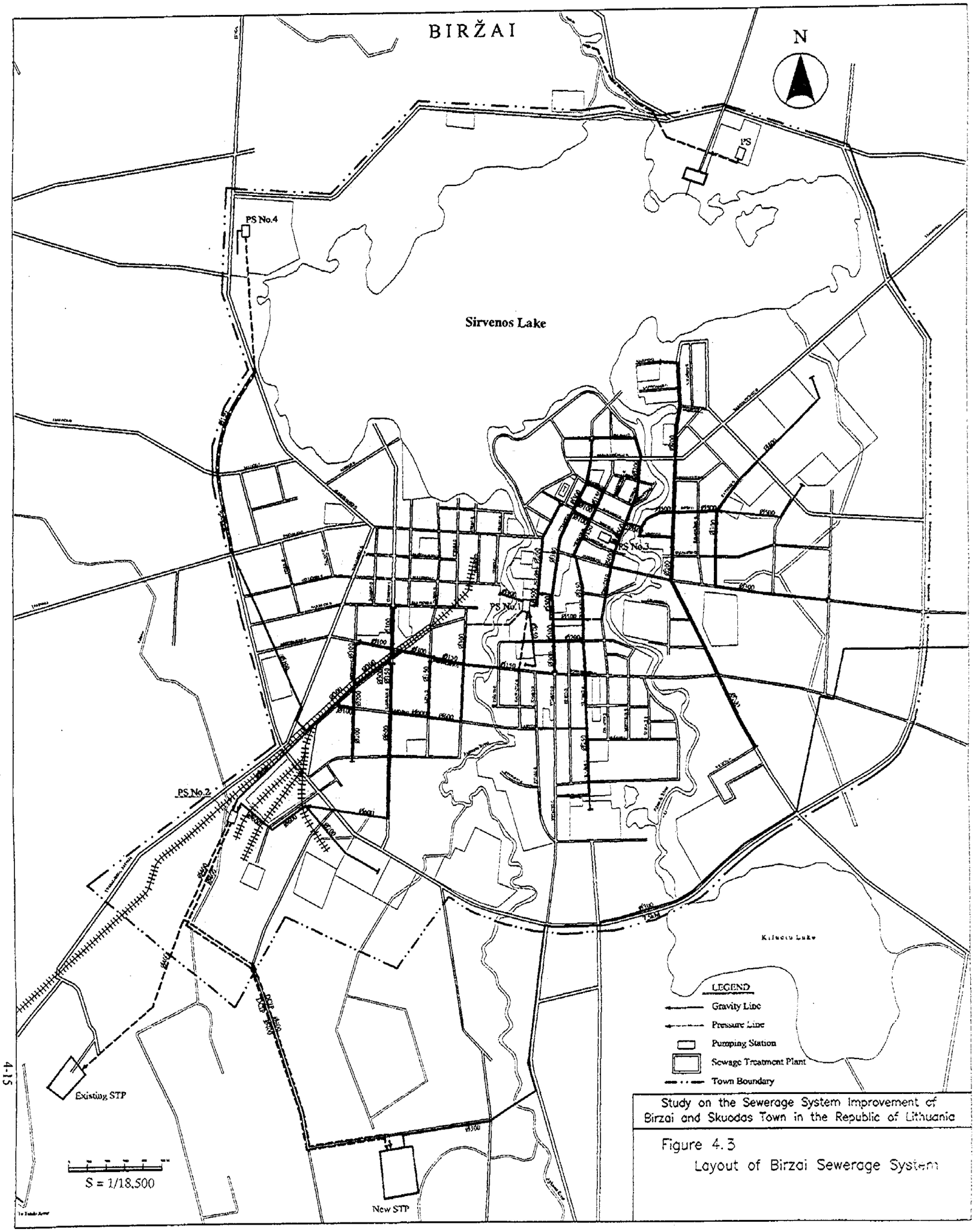
4.4.1.2 Sewage Collection

The sewage collection system of Birzai is a separate system in which only sewage is collected. Rainwater is drained into the rivers or the lake through open channels. The sewerage collection system consists of sewer pipelines and pump stations. The total length of sewers is 28,070 m with diameters ranging 100 to 600 mm broken down as follows:

100 mm	670 m
150 mm	3,595 m
200 mm	5,640 m
250 mm	1,730 m
300 mm	4,110 m
400 mm	7,590 m (including 7,110 m pressure line)
500 mm	1,830 m
600 mm	1,905 m

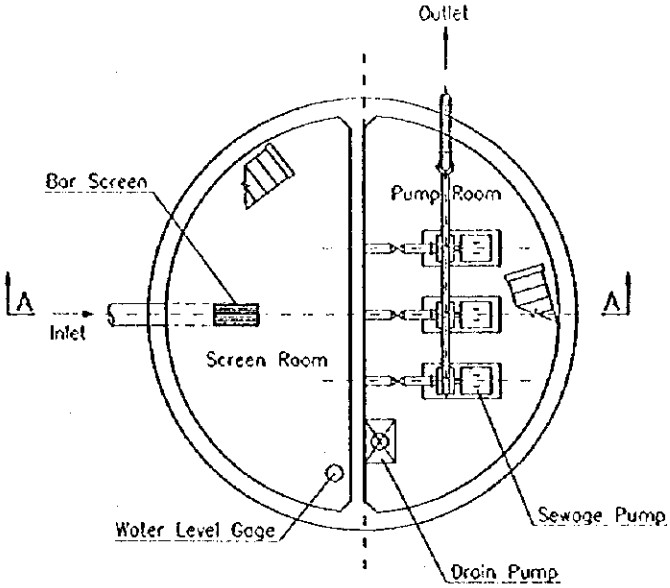
Pressure line of 300 mm pipe included above consists of 3,180 m line from Pump Station No.2 to the existing treatment plant and 3,930 m line from the branch point to the new treatment plant site.

Pipes are made of several types of material such as clay and concrete for gravity lines, and cast iron and ductile cast iron for pressure lines.

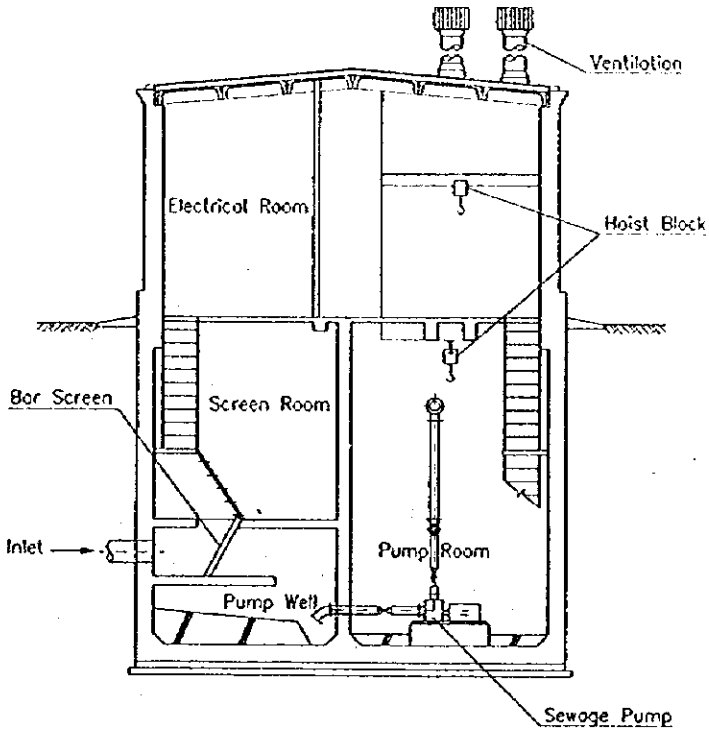


Study on the Sewerage System Improvement of Birzai and Skuodas Town in the Republic of Lithuania

Figure 4.3
Layout of Birzai Sewerage System



Plan



Section A-A

Figure 4.4
Typical Structure of
Pumping Stations

There are three major transfer pump stations and one local pump station. The details for the pump stations are shown in table below:

Table 4.15 Existing Pump Stations

No.	Pumps Installed		Discharge to
	Pump Capacity	Type of Pump	
1	no.1: 140 m^3/h = 38 l/sec (exis.) no.2: 140 m^3/h = 38 l/sec (exis.)	horizontal shaft, single suction centrifugal pump	to No.2 P.S.
2	no.1: 200 m^3/h = 56 l/sec (exis.) no.2: 200 m^3/h = 56 l/sec (exis.) no.3: 200 m^3/h = 56 l/sec (exis.)	vertical shaft, submersible type pump installed in a pump room	to the existing treatment plant
3	no.1: 140 m^3/h = 38 l/sec (exis.) no.2: 140 m^3/h = 38 l/sec (exis.)	horizontal shaft, single suction centrifugal pump	to No.1 P.S.
4	no.1: 6.3 m^3/h = 2 l/sec (exis.) no.2: 6.3 m^3/h = 2 l/sec (exis.)	horizontal shaft, single suction centrifugal pump	to a gravity sewer

The structure of the pump stations is a typical design. It has a reinforced cylindrical barrel that is vertically split into two parts: namely, a sump for receiving and storing sewage and a dry well for accommodating the pumps installed at the bottom slab level. The motor control units are installed on the ground level floor. Power receiving and transfer facilities are provided in a building outside each pump station.

The typical structure of the pump stations is presented in Figure 4.4.

Pumps are switched on and off according to liquid level in the sump. An automatic on-off system using a liquid level detector operates in each pump station.

Pump station No.2 has a large storage chamber that is provided for emergency in case of pump stoppage. A non-covered storage chamber is also located beside the pump station and connected with the sump through a pipe. In case the pumps do not operate and the sump becomes full, incoming excess sewage would flow into the adjacent storage chamber so that the pump station may be protected from inundation.

Pump Station No.4 was recently constructed to receive and pump sewage from the Road Management Department which is unable to discharge its sewage into a nearby sewer pipe by gravity. This pump station is also planned to accept sewage from a residential sub-division nearby having about 240 households.

4.4.1.3 Sewage Treatment

Existing Treatment Plant under Operation

The existing treatment plant is located about 2 km southwest of the town boundary. It is estimated that the plant has a treatment capacity of approximately 2,600 m^3/day. The plant receives sewage from Pump Station No.2. The plant system consist of the following facilities:

1) Receiving Box and Inlet Channel

Pumped sewage is discharged to the receiving box and flows into the inlet channels. The inlet channels are reinforced concrete consisting of two parallel lines of narrow channels. Each channel is 10 m long and has a width of 100 cm and depth of 100 cm.

2) Sedimentation Tanks

The sedimentation tanks are located at a ground elevation of 164.5 m, about 7 m higher than the average ground level in the plant. This area was formed by the earth fill. The sedimentation tanks are also of reinforced concrete and consist of three rectangular chambers. Each chamber has a horizontal dimension of 4.5 m by 7.5 m. The tank depth is 8 m.

3) Biological Filters

Two units of biological filters are provided after the sedimentation tanks. These units were constructed in 1984 to improve the treatment efficiency. Each unit is rectangular in shape with dimensions of 2.5 m by 6.0 m and 5 m high. The surface area of each unit is 15 m^2. Steel sheet piles are used for the wall of the filters.

One of the two units is filled with pieces of corrugated plastic tube. The other unit is filled with the same pieces of tube above a half full gravel layer. Effluent from the sedimentation tanks is dripped into these filter units via horizontal inflow pipes installed above each unit.

These biological filters appear to be capable of treating an amount of about 1,300 m^3/day. Any excess amount of sewage bypasses the biological filters and is taken directly to the aerated lagoon.

4) Aerated Lagoon

The lagoon is a single excavated pond, having a rectangular shape of 16 x 42 m. The depth is 2 m below the ground surface. At present, this aerated lagoon has no aeration system, and therefore no longer functions as an aerated lagoon. There used be air diffuser pipes extended from one end to another. This lagoon receives effluent from the biological filters and effluent from the sedimentation tanks that bypass the biological filter.

5) Stabilization Pond

A stabilization pond is provided after the non-functioning aerated lagoon. The pond is merely a excavated pond with earth bank. The pond is L-shaped with a longer section of 100 m and a shorter one of 46 m. The depth of the pond is about 1.2 m. The total surface area is about 1,730 m^2.

This pond was originally designed as a polishing pond to further improve quality of the effluent.

6) Sludge Lagoons

Two units of sludge lagoon are provided to store sludge extracted from the sedimentation tanks. Each lagoon has a rectangular shape of 13 x 37 m, and about 2 m deep.

Sludge placed into this lagoon is stored until it is sufficiently dry for easy handling. Supernatant is drained and discharged into a drainage channel together with the effluent from the stabilization pond.

7) Blower Building

A building is provided beside the aerated lagoon to house the blower equipment. The building is brick made with dimensions of 7 by 18 m.

Layout of the existing treatment plant is presented in Figure 4.5.

New Treatment Plant partly constructed

Birzai Municipality began the construction of a new sewage treatment plant at a newly acquired site about 3 km east of the existing treatment plant. Construction of a new sewage treatment plant was approved by the Government in September 1993. This treatment facility was initiated as one of the measures for improving the ecological situation of the karst region in northern Lithuania. The project aimed at the prevention of groundwater pollution in the karst region caused by sewage disposal. The state government allotted budget for the project, of which 5.5 million Litas has been disbursed by 1996.

The treatment plant was designed in 1994 by a local consulting firm "UAB Ekoprojektas". The process design included nutrient removal using the A2/O system (anaerobic-anoxic-oxidation) in which the removal of organic matter and nutrients occur in a single basin activated sludge system.

Construction work was commenced in 1995 but ceased in 1997. At present, only the base slabs and walls of the reaction tank have been built. Concrete wall design used pre-cast concrete panels, a normal practice in Lithuania. Each wall panel is 6 m wide fabricated at the factory. They were installed on the base slab with a space of about 20cm between each section but they have not yet been connected with each other. No facility other than the reaction tank has been started so far.

Details of the treatment process of the original design of Ekoprojektas are discussed in Section 4.8.4.

4.4.1.4 Sludge Disposal

At present, sludge is stored in two ponds in the treatment plant site. Since the sludge is in liquid state due to absence of the dewatering devices, reuse for agricultural use is almost impossible. Because use of sludge for fertilizing the agricultural land is prohibited in the karst geological area, final disposal is a problem.