No.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

GENERAL DIRECTORATE OF WATER SUPPLY AND SEWERAGE (DPUK)
MINISTRY OF PUBLIC WORK, TRANSPORT AND
TELECOMMUNICATION (MoPWTT), THE REPUBLIC OF ALBANIA

THE STUDY ON THE DEVELOPMENT PLAN FOR SEWERAGE SYSTEM AND SEWAGE TREATMENT PLANT FOR GREATER TIRANA IN THE REPUBLIC OF ALBANIA

FINAL REPORT

Volume II : Main Report

MARCH 2007

NIHON SUIDO CONSULTANTS CO.,LTD.

TOKYO ENGINEERING CONSULTANTS CO.,LTD.

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Exchange Rate

Exchange Rate Applied for Master Plan (Date of Application: November 1, 2005)
1 US Dollar = Lek 107.23 = Yen 115.74
1 Euro = Lek 129.463

Exchange Rate Applied for Feasibility Study (Date of Application: June 21, 2006)
1 US Dollar = Lek 96.28 = Yen 115.13
1 Euro = Lek 122.96

Final Report

Volume I:	**Executive Summary**
Volume II:	**Main Report (This volume)**
Volume III:	**Supporting Report**

PREFACE

In response to a request from the Government of the Republic of Albania, the Government of Japan decided to conduct a study on "The Study on the Development Plan for Sewerage System and Sewage Treatment Plant for Greater Tirana in the Republic of Albania" and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Harutoshi Uchida of NIHON SUIDO CONSULTANTS Co., LTD. and consisted of experts from NIHON SUIDO CONSULTANTS Co., LTD. and TOKYO ENGINEERING CONSULTANTS CO., LTD. between July 2005 and August 2006. In addition, JICA set up an advisory committee headed by Ms. Hiroko Kamata, Senior Advisor, Institute for International Cooperation, JICA, which examined the study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of the Republic of Albania and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Albania for their close cooperation extended to the study.

March 2007

Ariyuki Matsumoto
Vice President
Japan International Cooperation Agency

March, 2007

Ariyuki Matsumoto
Vice President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

Dear Sir,

We are pleased to submit this Final Report on the Study on the Development Plan for Sewerage System and Sewage Treatment Plant for Greater Tirana in the Republic of Albania. This report incorporates the views and suggestions of the authorities concerned of the Government of Japan, including your Agency. It also includes the comments made on the Draft Final Report by General Directorate of Water Supply and Sewerage and Ministry of Public Work, Transport and Telecommunication of the Government of the Republic of Albania and other government agencies concerned of the Republic of Albania.

The Final Report comprises a total of three volumes as listed below.

Volume I:	Executive Summary
Volume II:	Main Report
Volume III:	Supporting Report

The report contains the Study Team's findings, conclusions and recommendations derived from the two phases of the Study. The main objective of the Phase 1 was to collect data and analysis and formulate a master plan and to identify a priority project, whilst that of the Phase 2 Study was to examine the feasibility of the priority project which had previously been identified in Master Plan during the course of the Phase 1 Study.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Land, Infrastructure and Transport of the Government of Japan for their valuable advice and suggestions. We would also like to express our deep appreciation to the General Directorate of Water Supply and Sewerage and Ministry of Public Work, Transport and Telecommunication, and other agencies of the Republic of Albania for their cooperation and assistance extended to us throughout our Study.

Very truly yours,

Harutoshi UCHIDA, Team Leader
Study on the Development Plan for Sewerage
System and Sewage Treatment Plant for
Greater Tirana in the Republic of Albania

Location Map

The Study on the Development Plan for Sewerage System and Sewage Treatment Plant for Greater Tirana in the Republic of Albania

Final Report

Volume II: Main Report

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Abbreviations

AL	Aerated Lagoon
ATP	Affordability-to-pay
AWSSA	Association of Water Supply and Sewerage Enterprises of Albania
BOD_5	Biochemical Oxygen Demand
BWI	Berlin Water International
BMZ	German Federal Ministry for Economic Cooperation and Development
C/P	Counterpart
COD	Chemical Oxygen Demand
DPUK	General Directorate of Water Supply and Sewerage
DWF	Dry Weather Flow
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EU	European Union
FC	Foreign Currency
F/S	Feasibility Study
GoA	Government of the Republic of Albania
GoJ	Government of Japan
GTW&SA	Greater Tirana Water & Sewerage Authority
IEE	Initial Environmental Examination
JICA	Japan International Cooperation Agency
LC	Local Currency
LG	Local Government
M/M	Minutes of Meeting
M/P	Master Plan
MDGs	Millennium Development Goals
MIS	Management Information System
MoE	Ministry of Economy
MoEFWM	Ministry of Environment, Forests and Water Management
MoF	Ministry of Finance
MoI	Ministry of Interior
MoPW	Ministry of Public Works
MoPWTT	Ministry of Public Works, Transport & Telecommunications
MoTAT	Ministry of Territorial Adjustment and Tourism
MWWP	Municipal Water and Wastewater Project
NEAP	National Environmental Action Plan
NGO	Non Government Organization
NRA	National Regulatory Agency (Water Sector)
NWC	National Water Council
PIU	Project Implementation Units
PSP	Private Sector Participation
RAWSS	Rural Agency for Water Supply & Sanitation
REAs	Regional Environmental Agencies
SAp	Stabilization & Association Process
SC	Supervisory Councils
SSI	State Sanitary Inspectorate
STP	Sewage Treatment Plant
TAC	Territorial Adjustment Council
UKK	Water Supply and Sewerage Enterprise of Kamza

UKT	Water Supply and Sewerage Enterprise of Tirana
VWSE	Village Water Supply Enterprise
WTP	Willingness-to-pay
WWF	Wet Weather Flow

PART I: MASTER PLAN

CHAPTER 1
INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 Background

The Municipality of Tirana, the capital city of the Republic of Albania, is Albania's political, cultural and economic center. As a result of the economic reforms in 1991 the Tirana municipality and its surrounding municipalities are growing rapidly. This has led to the formation of the Greater Tirana area.

The Tirana Municipality has had a sewage collection system since the 1960s, however there is no sewage treatment system. Central governments, donors and international agencies investing in the water sector, have mainly invested in water supply system improvements to date. The existing sewerage system has not been improved to meet the demands from increasing urbanization, except for repairs of the sewers. Rapid increases in population, unregulated urbanization in the Greater Tirana area, and improvements in the water supply system may accelerate pollution of waters in the local rivers (Lana River and Tirana River) as a result of discharge of untreated sewage and industrial wastewaters, as well as dumping of garbage.

The Government of Albania (GoA) has requested technical assistance from the Government of Japan (GoJ) for the development of a Sewerage System Improvement Master Plan (M/P) and preparation of a Feasibility Study (F/S) for selected priority project in the M/P. The GoJ has also been requested to assist with the review and updating of the 1998 JICA study on the Sewerage System in Metropolitan Tirana. The aim is to reduce pollutant loads being discharged into the rivers from various pollution sources and to improve the sanitary and water environment in the Greater Tirana area.

In response to the GoA's request, JICA (on behalf of the GoJ) dispatched a study team to the Republic of Albania to conduct a study on the Sewerage System and Sewage Treatment Plant for Greater Tirana.

1.2 Study Objectives

The objectives of the Study are as follows:

(1) To prepare a M/P for improving the sewerage system for Greater Tirana through to the target year 2022 (extended from 2017 to 2022 during the course of the study);

(2) To conduct a F/S for Priority Projects identified in the M/P; and

(3) To transfer technology to the Albanian counterpart personnel.

1.3 Study Area

The study area is limited to the area in the Greater Tirana that is expected to be developed by the year 2017. The study area includes the areas in the municipalities of Tirana and Kamza, and Kashar

commune (as shown in *Figure 1.3.1*) that are serviced by a piped water supply. These areas are identified in the urban development plan called "Strategic Plan for Greater Tirana (2002)".

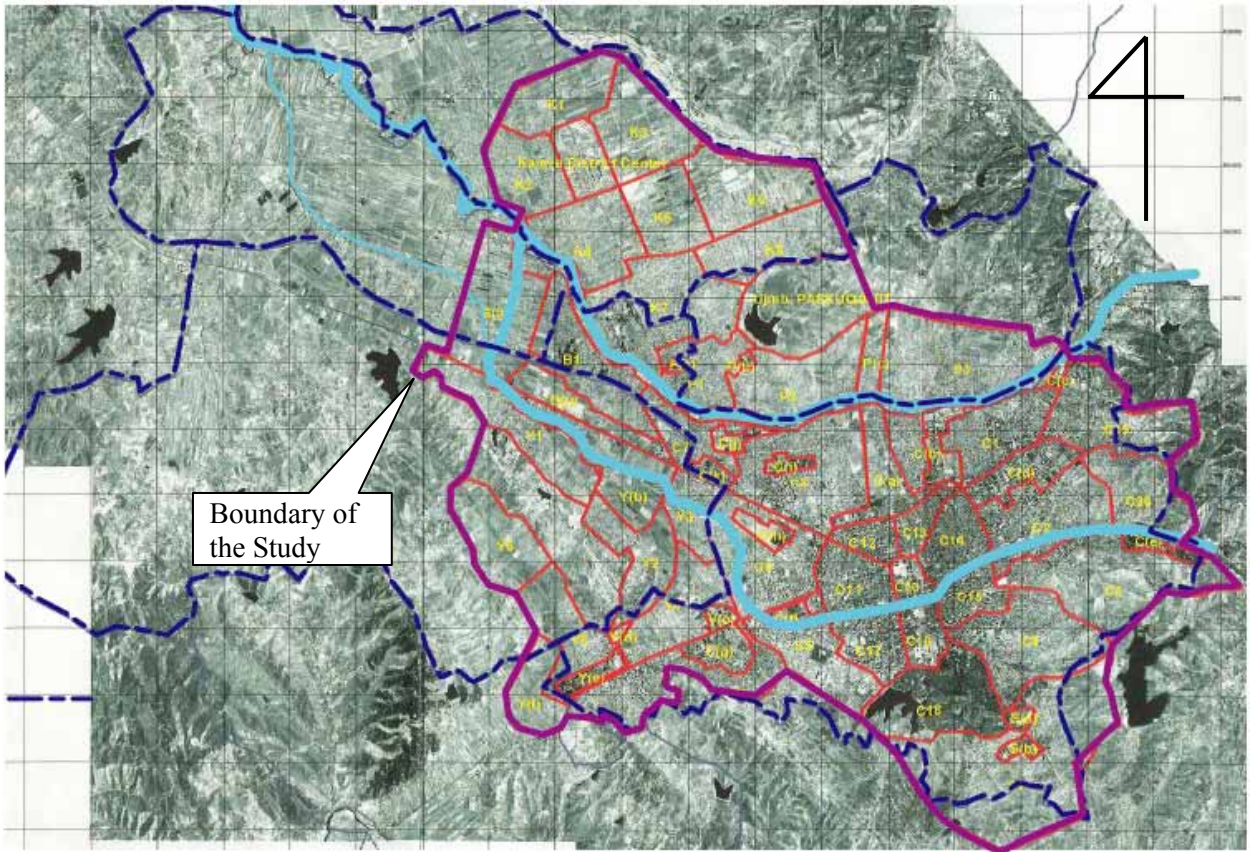


Figure 1.3.1 Study Area

1.4 Study Organization and Staffing

1.4.1 Study Organization

The organizational structure for the Study is shown in *Figure 1.4.1*.

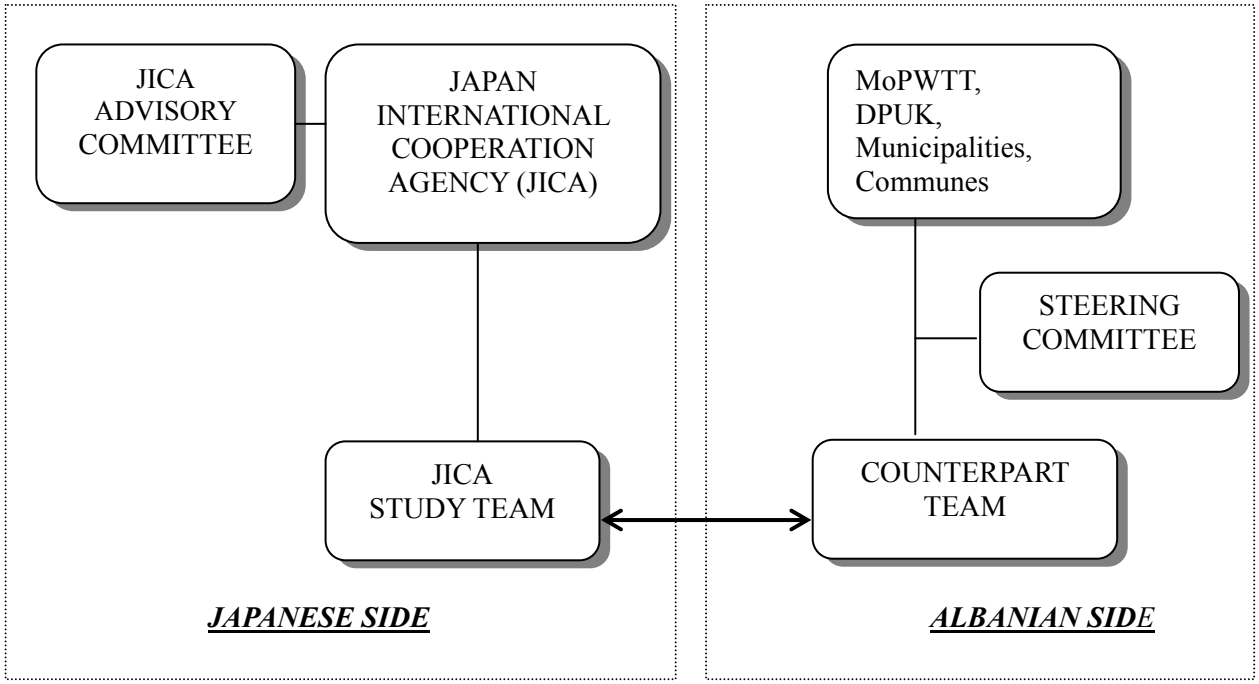


Figure 1.4.1 Organization Chart of the Study

The role of the JICA Advisory Committee is to provide advice to JICA.

1.4.2 Albanian Side

The field work is being undertaken in cooperation and consultation with the counterpart members. The following counterpart staff has been involved in the study.

(1) Counterpart Staffs

The Counterpart Staffs are shown in *Table 1.4.1*.

Table 1.4.1 Counterpart Staffs

Task		Name	Organization	Position
1)	Coordinator	Mr. Petrit KOCI	DPUK	PIU Director
2)	Sewerage Planning and Design (1)	Mr. Arjan SKENDERI	DPUK	Director of Public Relations Directorate
3)	Sewerage Planning and Design (2)	Mr. Mihal CICO	Municipality of Tirana	Director of Projects financed by foreign donors
4)	Sewerage Planning and Design (3)	Mr. Namik SIMIXHIU	DPUK	PIU Director
5)	Hydraulic and Hydrological Analysis and	Ms. Vjollca XHULI	UKT	Division Head, Sewerage Section

	Drainage (1)			
6)	Hydraulic and hydrological analysis and Drainage (2)	Mr. Sadik ZOTAJ	DPUK	Specialist
7)	Hydraulic and hydrological analysis and Drainage (3)	Mr. Ismail BESHI	UKK	Head, Engineer
8)	Environmental and Social Consideration	Mr. Bashkim LUSHAJ	MoEFWA	Former Chairperson, Regional Environmental Agency
9)	Institutional and Organizational Strengthening	Mr. Sadetin LIMANI	MoPWTT	Management Project Director
10)	Economic and Financial Analysis	Ms. Gelardina Prodani	MoF	Director of budget management and implementation, General Directory of Budget
11)	Economic and Financial Analysis	Ms. Jolanda Gjeci	UKT	Director of Economic Department, UKT
12)	Sewerage O/M planning (1)	Mr. Ismail Beshi	UKK	Chairman of technical branch
13)	Sewerage O/M planning (2)	Mr. Petrit BALLA	UKT	Specialist
14)	Economic and Financial Analysis	Ms. Natasha SHEHU	UKT	Former Director of Economic Department, UKT

(2) Steering Committee

Table 1.4.2 lists the Steering Committee members for this study.

Table 1.4.2 Steering Committee Members

Name	Position and Organization
1) Mr. Stavri RISTANI	Vice Minister, MoPWTT
2) Mr. Fahri MAHO	Director General, DPUK
3) Mr. Llir Bala	Chairperson, Regional Environmental Agency of Tirana, Ministry of Environment
4) Ms. Albana DHIMITRI	Deputy Mayor, Municipality of Tirana
5) Mr. Korab LITA	Vice Mayor, Municipality of Kamza
6) Mr. Faik FEJZO	Mayor of Kashar Commune
7) Mr. Jashar HOXHA	Mayor of Paskuqan Commune
8) Mr. Ymer Marku	Mayor of Beruxlle Commune
9) Mr. Mehmet HASALAMI	Director, UKT
10) Mr. Pjerin PALUCA	Director, UKK
11) Mr. Arben DEMETI	Former Vice Minister, MoTAT
12) Mr. Donard STRAZIMIRI	Former Director General, DPUK
13) Mr. Bashkim LUSHAJ	Former Chairperson, Regional Environmental Agency of Tirana, Ministry of Environment

1.4.3 Japanese Side

(1) Study Team

All the staff involved in this study traveled to the Republic of Albania to undertake field work. The study team members are listed in *Table 1.4.3* and in *Figure 1.5.1*.

Table 1.4.3 Study Team Members

Name	Designated Task
1) Mr. Harutoshi UCHIDA	Team Leader/ Sewerage Planning
2) Mr. Masakazu NAKAO	Sewage Treatment Facilities Planning
3) Mr. Kunji AKINAGA	Sewage Collection Facilities Planning and Design
4) Mr. Yasuo MOTO	Sewage Treatment Facilities Design and Cost Estimate
5) Mr. Tetsuji KAWAMURA	Water Quality and Water Pollution Analysis
6) Mr. Seiichi HANAFUSA	Hydrology and Hydraulic Analysis
7) Ms. Shouko YAMADA	Environmental and Social Considerations
8) Mr. Jack BANNISTER	Organizational and Institutional Strengthening, and Operation and Maintenance Plan
9) Mr. Yoshiaki ISHIZUKA	Economic and Financial Analysis
10) Mr. Isamu SATO	Study Coordinator
11) Mr. Yoshifumi MIYATA	Study Coordinator

(2) JICA Advisory Committee

The members of the JICA Advisory Committee are listed in *Table 1.4.4.*

Table 1.4.4 JICA Advisory Committee Members

Name	Designated Task
1) Ms. Hiroko KAMATA	Chairman/Organization & Institutional Planning/O&M Planning
2) Mr. Yutaka SUZUKI	Member/Sewerage Planning/Sewage Treatment
3) Mr. Senro IMAI	Member/ Environmental and Social Considerations

1.5 Study Schedule

The study consists of two phases as shown in Figure 1.5.1. Phase I included data collection and analysis and formulation of the M/P for the sewerage system for the Greater Tirana area (to the target year 2022). Phase II of the study is to conduct the F/S for the priority projects selected in the M/P.

1.6 Reports

Throughout the study period, the study team prepared a series of documents and reports, in consultation with the counterpart personnel, other relevant agencies, and the Albanian JICA assistants. The reports were prepared in English. The reports have been submitted throughout the project to DPUK, JICA and other relevant agencies. The major reports submitted to date are:

(1) Inception Report; August 2005

(2) Interim Report; January 2006

(3) Progress Report; March 2006

(4) Draft Final Report; August 2006

This document is the Final Report and presents the results of the entire study, including the M/P, the Preliminary Engineering Designs, and the F/S for the Priority Projects. The Final Report is prepared, incorporating any comments on this report that are received from DPUK and other relevant agencies.

Title	Name	2005							2006								
		FY 2005							FY 2006								
		Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Team Leader/Sewerage Planning	Harutoshi UCHIDA					4.70				2.0				1.9		0.4	
Sewage Treatment Facilities Planning	Masakazu NAKAO				2.1									1.9			
Sewage Collection Facilities Planning and Design	Kunji AKINAGA					3.0				1.0				1.9			
Sewage Treatment Facilities Design and Cost Estimate	Yasuo MOTO					3.0								1.9			
Water Quality and Pollution Analysis	Tetsuji KAWAMURA					2.9											
Hydrology and Hydraulics	Seiichi HANAFUSA					2.8											
Environmental and Social Considerations	Shouko YAMADA						2.0			1.4				1.9			
Organizational and Institutional Strengthening	Jack BANNISTER						2.3							1.9			
Economic and Financial Analysis	Yoshiaki ISHIZUKA						2.0							1.9			
Study Coordinator	Yoshifumi MIYATA				(2.0)												
	Isamu SATO														(1.1)		
Study Output (Reports)	Submission			△ IC/R						△ IT/R	△ PR/R					△ DF/R	△ F/R
Study Schedule		First Study in Albania							Second Study in Albania			Third Study in Albania					
		Prepartory Work										First Work in Japan					
		Phase I: Basic Study and M/P Formulation							Phase II: F/S on Priority Projects								

Legend: ■ : Work in Albania □ : Work in Japan FY: Japanese Fiscal Year (Apr. to Mar.)

Figure 1.5.1 Study Schedule and Assignment Schedule for Study Team Members

CHAPTER 2

PHYSICAL AND SOCIO-ECONOMIC CONDITIONS AND INFRASTRUCTURES

CHAPTER 2 PHYSICAL AND SOCIO-ECONOMIC CONDITIONS AND INFRASTRUCTURE

2.1 Physical Conditions

2.1.1 Topography and Geology

(1) Topography

The Republic of Albania is situated on the western portion of the Balkan Peninsula, and is bordered to the north by Montenegro, to the northwest by Serbia, to the east by Macedonia, and by Greece to the south and southeast. The country also has coastline along the Adriatic Sea and the Ionian Sea.

Albania is mostly mountainous, with mountains and hills covering about 77 % of the total land area (28,748 km^2). The medium altitude of the country is about 710m which is about two times higher than that of Europe. Albania can be characterized into four topographic regions: the Albanian Alps; the central mountain region; the southern mountain region; and the western plain. The western plain is low lying and leads to medium mountainous areas in the northeast. The southern coast (Vlora-Saranda) is characterized by steep slopes. The highest mountain is Mt. Korabi (altitude of 2,751 m) and is located in the northeast of the country.

Half of the Tirana Municipality is located on the western plain next to the Adriatic Sea and the other half is located on the mountainous and hilly area. The altitude of the study area ranges from 80 m to 130 m and the center of Tirana is situated at about 110 m. The ground surface gradient ranges form 1 to 5 %, with the western area being less steep. To the east of Tirana, the area is hilly and includes Mr. Dajti, which has an altitude of 1,612 m.

(2) Geology

This section is reproduced from the previous JICA study in 1998.

There are two distinct geological formations in Albania. The western area consists of Monotonous Permian to Mesozoic Sediments and the eastern area is characterized by Paleozoic to Mesozoic basis, acidic volcanic rocks and ultrabasic massifs.

The country has a range of mineral sources, namely chromium, copper, nickel, and bauxite. Other less abundant minerals include kaolin, phosphorized limestone, rock salt, gypsum and stones (limestone dolomite and marble).

Tirana overlies a big syncline which dips to the north west towards the Adriatic Sea. The lower part of the Tirana syncline consists of Cretaceous and Palaeogene carbonate formations and a Paleogene flysch formation. The Tirana plain is located on the upper part of the central area of this syncline. This area

is mostly filled with Quaternary alluvial deposits that were formed by the Tirana and Lana Rivers.

Tirana can be categorized into the following two geologic zones.

Zone 1: The fields of Tirana are located in this first zone. This zone extends from the hospital area in the west, Kombinat in the south, Kamza in the north and to Elbasan Road in the south. This zone is made of terrace deposits formed by the Tirana and Lana Rivers.

The Tirana River has formed three terraces. The first terrace of the Tirana River is the lowest one. In the north-eastern periphery of Tirana municipality it is partially a strath terrace, and in the north-western periphery of Tirana municipality it is partially an accumulative terrace. This terrace outcrops along the left bank of the Tirana River and is elevated about 6-8 m above the river. The second terrace is an accumulative terrace. This terrace is in the central part of Tirana municipality. This terrace is elevated approximately 60 to 70 m above the Tirana River.

The Lana River has formed two alluvial terraces which overlie the older alluvial deposits from the Tirana River. The largest part of this zone is located near the Tirana and the Lana Rivers. It is made of brown, sandy clay and has a thickness varying between 4-6 m to 8-9 m. Beneath this layer, there are gravel deposits combined with sandy clay and clayey sand. These deposits are up to 15 m thick. The groundwater table is located at the top of theses deposits. Underneath the lowest layer there is silt stone and clay stone.

The beds of the two nearby rivers are made of alluvial deposits consisting of gravel, clayey sand and sand. These deposits are about 15 m thick.

Zone 2: The second zone is located in the western and south-western part of Tirana municipality. This zone consists of brown sandy clay with a thickness of between 6 and 10 m. At the lowest part there are Aeolian sand stones and clay stones with a thickness of between 6 and 7 m.

There are two zones of silt stones and clay stones which contain layers of carbon. These are located in Valias, Mezes, Myshqeta, Krrabe and Prike.

2.1.2 Meteorology

The Republic of Albania is situated within the Mediterranean climatic zone. It is characterized by hot, dry summers, and moderately mild, wet winters. The western part of the country receives the warm wind coming from the sea and mountains protect the coastal area from cold eastern winds. The average atmospheric temperature during the summer ranges from 24 to 27 degree Celsius and during winter from 12 to 14 degree Celsius. Approximately 40% of the annual rainfall occurs during winter. Snowfalls occur mostly in the inland area and on the mountains.

The climatic data was not updated during the study period, therefore the following description is quoted from the former JICA study.

Tirana extends to the western side of Mt. Dajti, which is almost the center of Albania. This area consists of small rolling hills. The area is located within the Fieldly Mediterranean Climate Sub-zone and the Hilly Mediterranean Climatic Sub-zone. The area experiences humid and mild winters, and dry and hot summers.

The average annual atmospheric temperature is 15.2 degrees Celsius. The coldest month is January (the average temperature is 6.7 degrees Celsius) and the hottest month is either July or August (the average temperature is 24 degrees Celsius). The hottest temperature ever recorded was 41.5 degrees Celsius (this was during July) and the coldest recorded temperature was -10.4 degrees Celsius (this was during February).

The average annual rainfall is 1,270 mm (this fluctuates between 800 mm to 2,060 mm per year). The rainfall is not evenly distributed throughout the year. Approximately 60 % of the annual rainfall occurs during winter. The highest monthly rainfall (1,774 mm) was recorded in November and the lowest monthly rainfall (42 mm) was recorded during July.

The relative humidity is not high due to the atmospheric temperature. The average annual relative humidity is approximately 70 %. This varies between 60 % - 76 %. The evapotranspiration pressure is 12.5 hPa. This varies between 7.5 to 18 hPa.

2.1.3 Hydrology

The hydrographic basin of Albania has a total area of 43,305 km^2. Of this, only 28,748 km^2 is located within the state territory of Albania.

Several rivers flow through Albania. They generally flow from east to west. The main rivers are: Drini, Mati, Ishmi, Erzeni, Shkumbini, Semani, and Vjosa.

The average annual discharge of all of Albania's rivers is about 1300 m^3/s, which corresponds to a specific discharge of 29 $l/s.km^2$. This is one of the highest discharges in Europe. Surface water hydrology also includes the natural lakes of Ohrid, Prespa and Shkodra, a number of minor lakes, as well as the following reservoirs that are built along the main rivers: Fierza, Komani and Vau Deja along Drini River; Ulza and Shkopeti on the Mati River; and Banja on the Devolli River. Several lagoons are situated along the coast. The main lagoons are Karavasta, Narta and Butrinti.

The Erzeni-Ishmi basin includes the catchments of the Erzeni and Ishmi Rivers as well as other minor rivers and tributaries. The total surface area is 1 439 km^2. This catchment has an average elevation

lower than the adjacent catchments. Springs are not found at high altitudes and the water courses located on the plain are long.

The Ishmi catchment is particularly important for Albania because it includes Tirana, which is the capital of Albania and is the nation's biggest urban centre. The basic characteristics of the Ishmi catchment are listed here:

- annual discharge volume: 660 million cubic meters;
- specific discharge: 31.5 l/s.km^2 or the Ishmi River;
- the ratio of discharge during the wettest month (January-February) to the discharge during the driest month (August) is between 9 and 10;
- the 1 in 10 year flow is about 55 times the average river discharge; and
- there are no storages on either rivers.

2.2 Socio-Economic Conditions

2.2.1 Population

(1) Population in General

According to the 2001 population census, the Albanian population was 3,069,275 and the population of the Tirana District was 519,720, which includes the Tirana Municipality (341,453) as well as other communes.

The Tirana District is one of two districts in the Tirana Region (the other one is Kavaje District). It consists of the Tirana municipality and the following 16 communes: Baldushk, Berxull, Dajt, Kamez (Kamza), Kashar, Krrabe, Ndsroq, Parke, Paskuqan, Petrele, Peze, Serzhhite, Shengjergj, Vaqarr, Zall Bastar, and Zall Hell. Of these Tirana municipality, Berxulle, Kamza, Kashar and Paskuqan are included in the targeted area for this project.

Municipalities and communes register all the names of people living in each territory. *Table 2.2.1* shows the population of each municipality and commune that is included in the target area for this project. This data is based on the civic registration process.

Table 2.2.1 Population of Relevant Territories

Administrative Unit	2001	2002	2003	2004	2005
Tirana Municipality	478,424	494,904	518,243	552,336	581,414
Berxull Commune	6,693	6,898	7,379	7,669	8,439
Kamza Municipality	49,068	60,563	63,022	67,033	75,858
Kashar Commune	16,810	17,058	17,202	17,347	18,228
Paskuqan Commune	27,566	29,924	31,642	32,563	34,329

The population size differs, depending on the source of the data (i.e. either from the census or the civic

registration data). This is probably due to the different methodology used when collecting the data and/or the different reasons for the data collection. For the purposes of this project, the data from the civic registration process will be used because it is more reliable.

(2) Labor Force

According to the 2001 Census, the economically active population was 1,347,281 in 2001, and the nation had an unemployment rate of 22.68%. This unemployment rate is relatively high when compared to other developing countries.

The number of people working in agriculture was counted to be 823,156, with the share rate ranging from 50 % to 75 %, except in some districts, such as the Tirana district. This means that Albania's economy is supported by agriculture.

The economically active population in the Tirana district and the Tirana municipality are 235,482 and 160,450 respectively, and they have 25.31 % and 25.84 % of unemployment respectively. The unemployment rate for the Tirana district is higher than the national unemployment rate and the unemployment rate for the Tirana municipality is even higher than that of the district.

Table 2.2.2 summarizes these statistics.

Table 2.2.2 Economically Active Population and Unemployment Rates

Region	Economic Active Population	Number of Actual Employed People	Number of Unemploy-ed People	Inactive People	Employed in Agriculture (%)	Unemploy - ment Rate (%)
Whole Nation of Albania	1,347,281	1,041,775	305,506	823,156	56.45%	22.68%
Tirana District	235,482	175,877	59,605	145,619	22.19%	25.31%
Tirana Municipality	160,450	118,996	41,454	99,748	0.14%	25.84%

Source: INSTAT.

(3) Family Size

During 2005, in the Tirana municipality the average number of people per household (HH) was 3.76 persons/HH, and the average number of working household members was 1.76 persons/HH, as shown in *Table 2.2.3*.

Table 2.2.3 Average Family Size and Number of Working Persons per Household in the Tirana Municipality

Administrative Unit	Area (km^2)	Population Based on Data from Civic Registration					Family Size (Persons/ HH)	Number of House-holds as of 2005 (HHs)	Number of Workable Members per HH as of 2005 (Persons/ HH)
		2001	2002	2003	2004	2005			
Tirana Municipality	41.79	478,424	494,904	518,243	552,336	581,414	3.76	154,338	1.76
Mini-Municipality 1	2.85	69,024	69,550	69,854	55,242	49,844	3.71	13,453	1.79
Mini-Municipality 2	9.52	35,845	38,480	42,050	55,317	67,780	3.70	18,324	1.67
Mini-Municipality 3	2.16	30,848	31,508	32,472	40,403	42,135	3.75	11,242	1.85
Mini-Municipality 4	3.64	55,378	56,900	57,816	63,829	65,243	3.91	16,669	1.81
Mini-Municipality 5	2.98	52,248	54,164	57,362	63,994	70,389	3.62	19,428	1.73
Mini-Municipality 6	5.83	43,676	45,386	50,085	55,652	59,444	4.06	14,638	1.98
Mini-Municipality 7	3.54	43,862	46,712	49,776	54,608	57,541	3.67	15,689	1.70
Mini-Municipality 8	1.80	34,635	35,350	36,104	35,871	36,923	3.63	10,167	1.68
Mini-Municipality 9	2.81	39,178	40,835	43,768	44,647	48,162	3.69	13,050	1.77
Mini-Municipality 10	0.68	23,361	23,755	24,287	25,000	25,592	3.31	7,739	1.50
Mini-Municipality 11	5.98	50,369	52,264	54,669	57,773	58,361	4.19	13,939	1.91

Source: INSTAT and Data from Civic Registration of Tirana Municipality.

2.2.2 Economic Conditions

(1) Gross Domestic Products (GDP)

The gross regional domestic product (GDP) of Albania grew from Lek 315 billion in 1996 to Lek 683 billion in 2003, at the current market price. This gives an average annual growth rate of 11.93 % since 1996. The real average annual growth rate was 5.58 % during the same period, as shown in *Table 2.2.4*.

The per capita GDP, at current market price, was Lek 219,423 (equivalent to US$1,800) in 2003. The average annual growth rate since 1996 was 11.77 %, in local currency, and 10.79 %, in USD. The difference in growth rates between local currency and USD reflects the exchange rate between these currencies.

Figure 2.2.1 shows GDP by industry type as of 2003. This figure is based on *Table 2.2.4*.

Table 2.2.4 Gross Domestic Product by Economic Activities

(At current prises, millions leks)

Industry of Origin	Year							
	1996	1997	1998	1999	2000	2001	2002	2003
1 Agriculture, hunting and forestry	96,876	99,378	119,532	125,938	137,449	142,306	146,556	144,210
2 Industry	45,509	42,235	43,341	50,144	58,089	59,339	60,390	77,910
- Extracting Industry	3,222	3,025	2,758	3,634	4,092	4,615	4,135	3,736
- Manufacturing Industry	42,286	39,210	40,584	46,510	53,997	54,724	56,254	74,174
3 Construction	13,645	12,988	15,421	21,456	31,603	45,208	43,945	48,810
4 Trade, Hotels and Restorants	71,305	63,608	80,303	102,334	102,915	105,783	119,895	127,494
5 Transport	17,123	18,789	35,339	41,715	40,479	49,161	44,170	51,847
6 Post and communication	3,067	4,862	5,440	8,897	9,762	16,240	18,637	20,919
7 Other Services	53,872	64,863	87,987	97,719	110,046	127,850	142,737	149,852
8 FISIM (-)	8,058	11,148	20,731	21,424	18,508	17,926	19,328	20,073
9 GROSS VALUE ADDED AT BASIC	293,336	295,576	366,632	426,779	471,834	527,961	557,001	600,970
10 Taxes on products	23,164	28,020	48,059	49,578	63,936	67,166	73,711	86,714
11 Subsidies on products (-)	1,622	1,410	2,365	2,066	4,863	7,410	5,994	5,015
GDP AT MARKET PRICES (9+10+11)	314,878	322,186	412,326	474,291	530,907	587,716	624,718	682,669
Annual real growth of GDP at constant prices compared to previous year, in %	9.10	-10.21	12.73	10.12	7.34	6.99	2.88	5.69
Average annual population (in thousand inhabitants)	3,076	3,075	3,055	3,054	3,061	3,074	3,094	3,111
Gross domestic product per capita								
in Leks	102,383	104,783	134,954	155,312	173,448	191,208	201,945	219,423
in USD	980	704	896	1,128	1,207	1,333	1,441	1,800

Source: INSTAT.

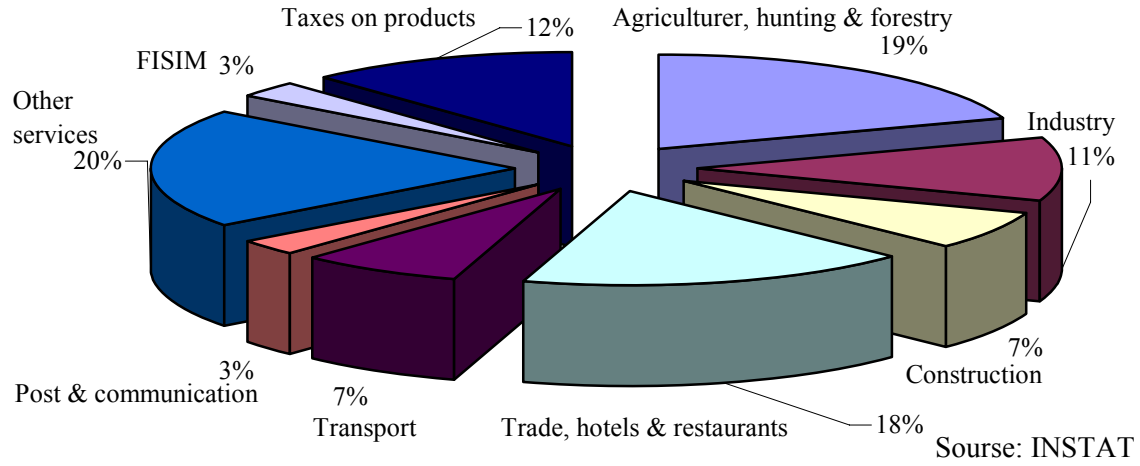


Figure 2.2.1 GDP Structure by Industry Type in Albania (2003)

(2) International Balance of Trade

Table 2.2.5 summarizes the international trade situation in Albania since 1993.

Table 2.2.5 International Trade Situation

(million Leks)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Export	12,499	13,387	18,710	22,001	21,044	31,104	48,430	37,037	44,096	47,490	54,487	62,121
Import	58,336	57,019	66,147	98,060	95,022	126,271	159,465	157,109	190,155	210,368	225,983	236,072
Balance	-10,506	-11,393	-16,715	-20,005	-19,047	-29,106	-46,431	-35,037	-42,095	-45,488	-52,484	-60,117

Source: INSTAT.

Table 2.2.5 shows that imports always exceeded exports between the years 1993 and 2004. *Figure 2.2.2* show the proportion of international trading for different types of goods and services (classified by CITS cost) during the year 2001.

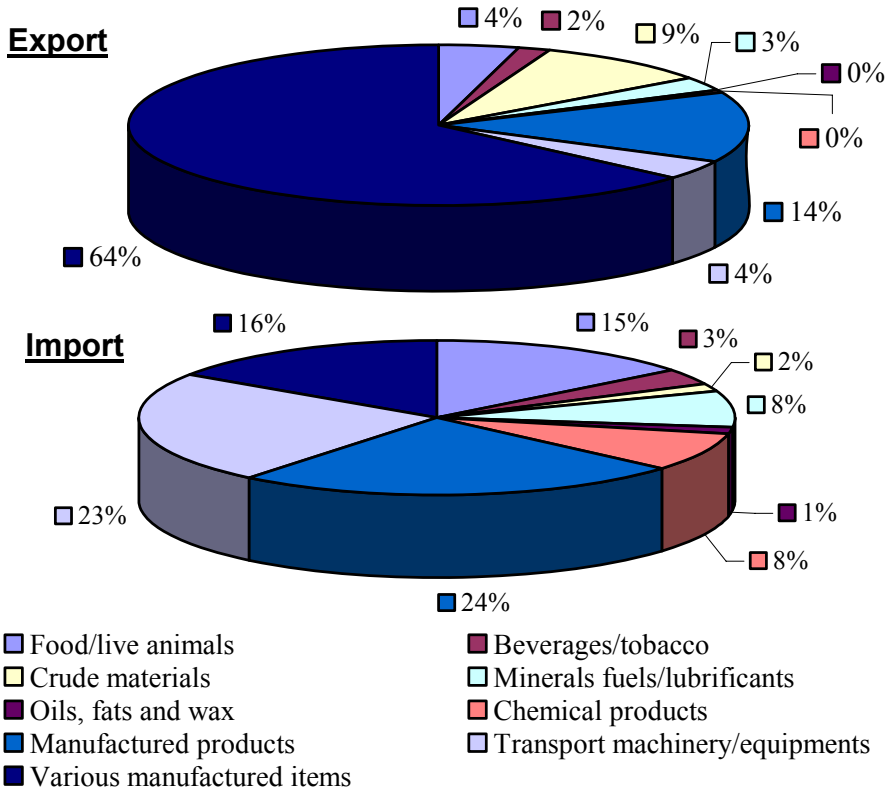


Figure 2.2.2 Structure of International Trading (classified by CITS code) for different Goods and Services during 2001

Figure 2.2.2 show that the main exports are "Various manufactured items" (these represent 64 % of total exports). The main imports are "Food/live animals" (15 %), "Manufactured products" (24 %), "Transport machinery/equipments" (23 %) and "Various manufactured items" (16 %).

(3) Industrial Perspective

Registered enterprises in Albania have grown from 34,182 during 1993 to 134,177 during 2003. Of these, active enterprises were only 51,945 during 2003. The statistics indicate that 48,117 registered enterprises are located in the Tirana district (of these 20,152 are active). *Table 2.2.6* shows the breakdown of economic activities for the registered enterprises.

In terms of the financial size of the enterprises, around 94 % are classified as micro-sized (during 2003) as shown in *Figure2.2.3*.

Table 2.2.6 Economic Activities of Registered Active Enterprises in Albania

(Number)

Economic activity	Year										
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Agriculture	95	189	229	270	298	325	349	390	424	462	513
Industry	821	1,563	2,087	2,667	2,985	3,451	3,836	4,407	4,892	5,497	6,278
Constructior	386	791	1,082	1,370	1,500	1,751	1,946	2,145	2,303	2,485	2,655
Transport	561	1,039	1,345	1,620	1,718	2,080	2,620	3,432	3,924	4,399	5,213
Trade	3,027	5,355	7,124	8,962	9,892	11,668	14,067	16,832	19,234	21,926	25,891
Services	1,397	2,491	3,119	3,945	4,360	5,013	5,871	6,899	8,045	9,397	11,395
Total	6,287	11,428	14,986	18,834	20,753	24,288	28,689	34,105	38,822	44,166	51,945
Of which: Tirana	2,148	3,774	5,106	6,598	7,591	9,020	11,144	13,279	15,242	17,496	20,152

Source: INSTAT

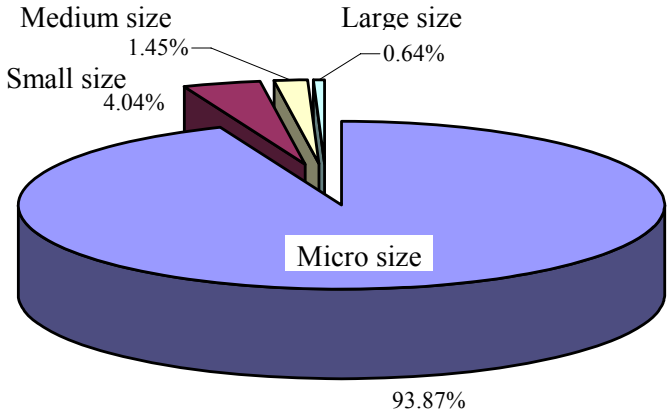


Figure 2.2.3 Size of Registered Enterprises in Albania

(4) Salaries and Wages

Salaries and wages in Albania fluctuate year by year, reflecting the socio-economic status at the time. *Table 2.2.7* shows this fluctuation pattern.

Table 2.2.7 Real Wage Growth in the Public Sector

(%)

Description	Year										
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Change of monthly average wage	54.90	34.10	34.80	10.60	20.40	10.40	17.70	15.10	14.20	8.50	14.40
Change of CPI	22.50	7.80	12.70	33.20	20.60	0.39	0.00	3.10	5.30	2.40	2.90
Real wage growth	26.40	24.40	19.60	-16.90	-0.17	9.90	17.70	11.60	8.10	6.00	11.20

Sourse: INSTAT.

Table 2.2.7 does not show a clear pattern for wage growth since the 1994. Comparing the annual growth rates for consecutive years indicates high growth rates. However, this is due to the increase in the consumer price index (CPI). Overall the wage growth rate has been gradually increasing since 1998 as shown in the following figure. Prior to 1998, there was significant fluctuation in the wage rate and CPI. This may have been a result of the international currency crisis at that time. Therefore, this period will be excluded from the study.

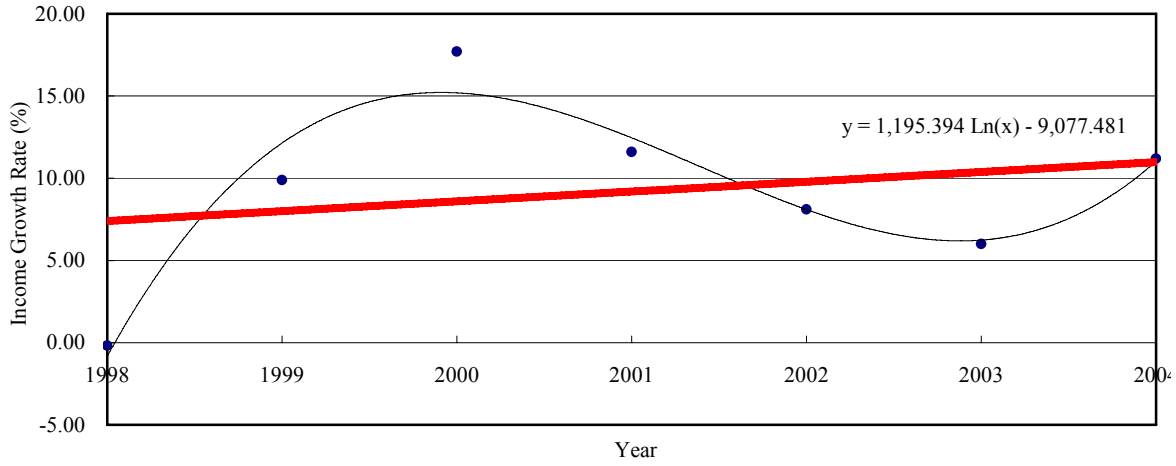


Figure 2.2.4 Fluctuation Pattern of Salaries and Wages in Albania Since 1998

(5) Family Economy

The average income per household (HH) in the study area is shown in *Table 2.2.8*.

Table 2.2.8 Average Monthly Income per HH Based on Average Expenditure

(Leks)

Description	Tirana Municipality	Berxull Commune	Kamza Municipality	Kashar Commune	Paskuqan Commune
Average Monthly Income Level per Capita (Based on Average Monthly Expenditure per Capita) as of 2002	9,003	6,939	7,236	7,542	7,288
Average Monthly Income Level per HH (based on Average Monthly Expenditure per Capita) as of 2002	33,889	26,122	27,239	28,391	27,435
Estimated Average Monthly Income Level per HH (based on Average Monthly Expenditure per Capita) as of 2005	42,245	32,562	33,955	35,391	34,200
Estimated Average Daily income Level per HH (Based on Average Monthly Expenditure per Capita) as of 2005	1,408	1,085	1,132	1,180	1,140
Estimated Average Dairy Income Level per Workable Person in a HH (Based on Average Daily Expenditure per Capita) as of 2005	662	510	532	554	536
For Referece: Estimated Average Monthly Income Level per HH (Based on Average Monthly Expenditure per Capita) as of 2005*	38,797	35,400	35,020	31,452	29,067
(Note) Average Working Members per HH:			3.76	Persons/HH	
Annual real growth of GDP at constant prices compared to previous year:			7.62	%	
Average Working Days per Month:			30	days/month	

Source: "Millennium Development Goals -Global Target-Local Approaches- Tirana Regional Report" UNDP Albania.
Remark: * Result of Public Awareness Survey made by JICA Study Team, January 2006.

In the Tirana District, expenditure on "Food, Tobacco and Beverage" (hereinafter referred to as the expenditure category of "Food") represented 55.5 % of the total HH income during 2000.

The expenditure on items being assessed as part of this project would be included in the category called "Rent, Water, Fuel, Electricity" (hereinafter referred to as "Water & Others"). During 2000, expenditure on this category represented 8.8 % of the total HH income, in the Tirana district.

(6) Price Indexes

Consumer Price Index (CPI)

As mentioned in section (4) above, the consumer price index (CPI) has fluctuated as *Table 2.2.9*:

Table 2.2.9 Variations in the Consumer Price Index over Recent Years in Albania

(%)

Description	Year										
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Change of CPI	22.50	7.80	12.70	33.20	20.60	0.39	0.00	3.10	5.30	2.40	2.90

Source: INSTAT.

Between 1994 and 1998 the CPI varied significantly due to political influences. Therefore, data after 1999 should not be used when estimating the annual average increase in CPI, when considering normal economic scenarios. The average annual CPI between 1999 and 2004 is estimated to be 2.35 %.

Construction Price Index

As a general rule, the construction price index may be applied to almost all construction works in this project. *Table 2.2.10* shows the variations in the construction price index in Albania.

Table 2.2.10 Construction Price Index in Albania

(%)

Description	2000	2001	2002	2003	Annual Average
Direct Expenditures	13.8	8.2	-3.0	3.1	5.52
Coplementary	17.0	11.0	-6.9	7.4	7.14
Anticipated Profit	-4.7	-1.3	0.8	-0.8	-1.48
Set-up Stock Site	-16.5	6.0	1.0	-1.0	-2.62
Turnover	0.0	0.0	0.0	0.0	0.00
Overall Average	9.8	6.3	-2.6	2.7	4.04

Sourse: INSTAT.

In this study, the overall average construction price index rate is assumed to be 4.04 %.

(7) Exchange Rate

The exchange rate for converting Albanian Leks to US Dollars is shown in *Table2.2.11*. This table shows that the exchange rate has gradually increased with time.

Table 2.2.11 Exchange Rate of Albanian Leks Against US Dollar for Last 8 Years

(As of Dec.31 in each year, Leks/US$)

Year	1997	1998	1999	2000	2001	2002	2003	2004
Exchange Rate	158.00	142.00	135.70	143.65	141.73	138.77	111.11	96.13

Source: Web Site Currency Converter: OANDA.com.

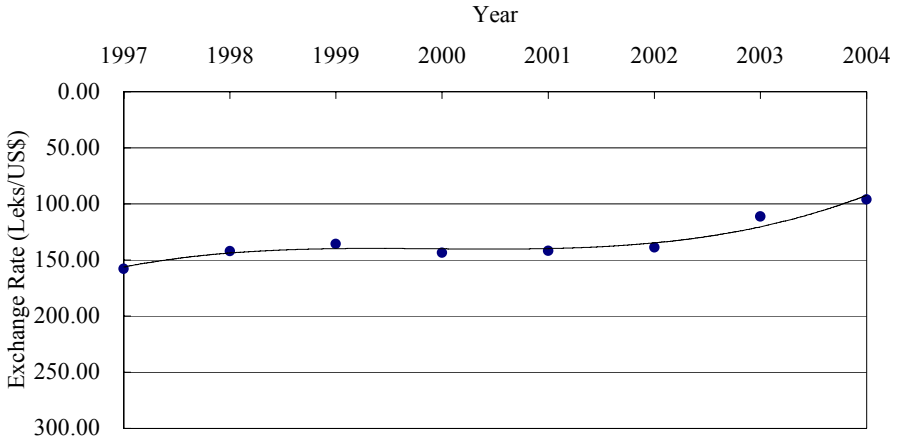


Figure 2.2.5 Exchange Rate of Albanian Leks against US Dollar - the Trend

The same data source indicated that the exchange rate reduced to 107.23 Leks/US$ during 1 November 2005. For reference, the exchange rate against the EURO was 129.463 Leks/Euro at the same time. This report assumes the above exchange rates unless specified otherwise.

2.2.3 Public Health Condition

Table 2.2.12 shows the status of health and medical care in Albania.

People in Albania are not required pay for services at public health and medical organizations (including hospitals, clinics and other facilities) because the Government subsidizes these facilities. According to a study by the World Bank[1], the GoA spends approximately 3% of the GDP on these health and medical facilities. This amount is relatively low compared to nearby countries (e.g. in Croatia it is 13 % of the GDP). The above table indicates that state government spent approximately Leks 16 billion in 2002and 2003 on these facilities.

However, most people wish to attend private hospitals and/or clinics because that quality of care in state operated medical facilities is poor. Also, patients sometimes need to make "informal payments" to doctors and/or nurses (e.g. cash, in kind payments, gifts) in these state operated facilities to receive better treatment.

The above table indicates that the government subsidies represent only 192 Leks/outpatient and 3,946 Leks/inpatient, per year. In the Tirana district, the actual personal expenditures for these services are 211 Leks/outpatient and 3,101 Leks/inpatient, meaning that the additional expenditure is borne by the patients' families.

On average, members of a household in the Tirana district visit a hospital and/or clinic 2.40 times (or

[1] "Albania Poverty Assessment" November 5, 2003, World Bank

days) each year. The average number of days the patient must remain in the hospital is estimated to be 7.62 days each year.

Table 2.2.12 Existing Status of Health and Medical Care

		1999	2000	2001	2002	2003
Total Number of Diseases in the Nation*		226,598	239,979	228,793	251,980	251,926
Number of Visits to Hospitals and Other Medical Entities in the Nation*		5,667,750	5,547,888	5,160,439	4,835,467	5,099,997
Number of Visits to Hospitals and Other Medical Entities in Tirana District*	- Total	1,612,155	1,547,706	1,283,524	1,267,083	1,308,624
	- Age 0 to 14	415,939	372,148	354,770	311,183	322,425
	- Age 15 and over	1,183,020	1,159,830	910,354	944,610	977,550
	- At home	13,196	15,728	18,400	11,290	8,649
1. Health Centers		155,573	123,002	204,203	203,156	195,552
- Age 0 to 14		72,880	48,934	89,105	83,702	86,163
- Age 15 and over		74,788	64,494	98,918	109,969	103,631
- At home		7,905	9,574	16,180	9,485	5,758
2. By Ambulances		39,340	54,654	12,835	11,767	17,103
- Age 0 to 14		14,024	24,307	4,771	5,087	6,557
- Age 15 and over		20,025	24,193	5,844	4,875	7,655
- At home		5,291	6,154	2,220	1,805	2,891
3. Policlinics		1,417,242	1,370,050	1,066,486	1,052,160	1,095,969
- Age 0 to 14		329,035	298,907	260,894	222,394	229,705
- Age 15 and over		1,088,207	1,071,143	805,592	829,766	866,264
Population in Tirana District*				522,259	532,938	552,867
Average Times to Visit to Hospitals per Visited Persons in Tirana District (Days/Person per Annum=times/HH per				2.46	2.38	2.37
Total Number of Hospitalized Persons in the Nation*		257,524	266,381	272,820	269,309	273,891
Number of Hospitalized Persons in Tirana District*		70,221	72,953	80,233	82,486	82,935
- General Hospitals		875	652	1,067	1,707	1,236
- Ins.Pneu-Ftiziatri		3,628	3,680	3,884	4,166	4,145
- Obset.Gjinekollogjik		17,086	15,913	17,128	14,577	14,630
- QSU Tirane		39,716	41,846	46,522	49,841	51,609
- Spitali Ushtarak		8,916	10,862	11,632	12,195	11,315
Total Days in Bed Realized in Tirana District*		569,934	556,858	606,153	625,145	600,206
- General Hospitals		4,984	6,032	4,123	10,788	12,465
- Ins.Pneu-Ftiziatri		64,414	63,541	66,058	66,831	59,066
- Obset.Gjinekollogjik		58,003	50,022	63,053	55,159	61,348
- QSU Tirane		345,565	341,494	371,327	395,428	386,230
- Spitali Ushtarak		96,968	95,769	101,592	96,939	81,097
Average Days in Bed per Hospitalized Person (Days/Hospitalized Person per Annum)		8.12	7.63	7.55	7.58	7.24
Amount of Subsidies from the Government to Medical Entities in Tirana Municipality (1,000 Leks)**					15,675,358	15,544,000
Public Expenditure for Health Care Average Amount of Subsidies per Day (Leks/Day)					42,946,186	42,586,301
Average Amount of Subsidies per Outpatient (Leks/Outpatient per Annum)					192	182
Average Amount of Subsidies per Inpatient (Leks/Inpatient per Annum)					3,946	3,716
Average Annual Personal Expenditure of Outpationet in the Nation (Leks/Outpatient per Annum)[1)]***					211	
Annual Total Hospital Expenditure per Inpatient in Tirana District (Leks/Inpatient per Annum)***					3,101	
Basic Annual Total Hospital Expenditure per Inpatient in Tirana District (Leks/Inpatient per Annum)					9,111	
Annual Informal Expenditure per Inpatient (Leks/Inpatient per Annum)[2)]					2,278	

Source: * "Health Indicators" (1999 - 2003), INSTAT.
** Ministry of Health.
*** "Albania Poverty Assessment"November 5, 2003, WB.

Remarks: 1) It consists of 360.9 Leks/4 weeks for Treatment, 163.2 Leks for Gifts, 1,368.9 Leks for Medicines, 294.0 Leks for Lab Tests, and 278.6 Leks for Transportation.
2) Informal payments including gifts to the doctors and/or nurses are around 25 % of total expenditure reported in the "Albania Poverty Assessment" issued by the World Bank.

2.3 Water Supply and Sanitation

(1) Water Supply

The following section describes the current conditions and issues relating to Albania's water supply as taken from the Albania Water Supply and Wastewater Sector Strategy (September 2003).

The water supply infrastructure in Albania is approaching a crisis state due to the old networks, significant leakage in all parts of the system, illegal connections, unstable supply pattern, uncontrolled rural-to-urban migration, and low maintenance due to lack of funds.

The percentage of the population that has access to piped water supply is not accurately known. Estimates vary considerably but are expected to be around 90 % in urban areas and 50 % in rural areas. This uncertainty is because there is no clear definition of water providing infrastructure. Government authorities have not done a complete census of old or new systems due to a lack of resources.

Although it is expected that more than half of the population has access to a piped water supply, the quality of service is very poor. On average, water is available only 3-4 hours per day, with certain areas receiving water only once every three days. Industries and business also suffer from unreliable water supply. Most of Albanian's water infrastructure is more than three decades old.

There are considerable differences between systems in terms of the number of hours that water is available, ranging from one hour every two to three days, to almost 24 hours per day. It is common for the supply pressure to be less than one bar at street level. Booster pumps are installed to raise water within multistory buildings.

Where piped systems are not available, rural populations mainly rely on natural springs and domestic wells to meet their needs.

There are currently 54 water supply enterprises in Albania. Approximately 75% of water consumption is for domestic use and approximately 25% is for non-domestic use. Unaccounted-for-water is about 60 % of all water produced (according to official data). Approximately 30 % of water production is billed and of this about 62 % is actually paid for. This means only 18 % of the total water production is actually paid for. The former MoTAT reported that only 8 out of 54 water enterprises show a positive financial balance.

By assessing availability of water at the source (in liters per capita for urban areas), it was found that there is more than enough water to satisfy demand. In many cities, water availability at the source is calculated to be around 500 liters per capita per day and in some cases even more. However, due to leakages and considerable wastage, only a small proportion of the water produced reaches the consumers.

Developing further water sources could affect the fragile water balances and result in future repercussions, as well as increase the cost of the water supply. In summary, Albania's problem is related to water distribution, not production. This study has found that most of the water scarcity problems could be considerably mitigated through metering, leakage detection and reduction, network improvements, disconnection of illegal connections and optimization of storage and supply patterns.

Albania mainly relies on groundwater for its drinking water supplies. Treated surface water has only recently been used for large scale human consumption. The Italian Government financed the construction of a modern surface water treatment plant for Tirana. This was completed in 1999 and can produce up to 1.8 m^3/s. This is the only situation where surface water is used for drinking purposes in Albania. Water supply systems in Albania mainly source water from natural springs, drilled boreholes, or a combination of both. Gravity systems are most common and are economical to operate and maintain. They are common in many rural and urban settlements, in hilly and mountainous areas.

Drinking water distribution systems in Albania, in cities as well as small villages, are predominantly branch-type with connected ends. This results in non-uniform pressure distribution and frequent disruption to the supply when there are problems in the main branches. Reliability of water supply from other branches is very low. The construction of a ring main from the Bovilla water treatment plant has improved the distribution patterns and pressures in most of the city areas. However further similar improvements are needed to optimize both supply and distribution of drinking water, due to the rapid urbanization and expansion in Tirana. The main factors causing the water supply to fail are:

a) insufficient maintenance;
b) illegal (unauthorized) connections in the supply systems;
c) over-consumption, misuse, inefficient use;
d) poor quality of materials and workmanship; and
e) incorrect management of systems.

This study has noted that accurate data on pipe breakages or supply failures is not available due to inadequate record keeping practices. Also, the water companies do not undertake consistent monitoring of the trunk mains or the distribution networks. Citizens report leakages and broken pipes, but the water companies can only respond to major breakdowns. It can take weeks or months before small defects are repaired.

The Kamza Municipality has a total area of 1,500 ha and a population of 100,000. It is a newly established municipality and construction of its water supply and sewerage was financed mainly by the World Bank. Groundwater is the main water source. The water supply facility has a capacity of 0.1 m^3/s (360 m^3/hr) and is operated for four hours each day. It supplies 1,440 m^3 in total a day. This

supply is serviced to 18,000 people; therefore unit supply is equivalent to 80 liters per capita per day. However, a further 18,000 people have no water supply. In addition, the people of 24,000 in Kamza municipality receive the water supply of 864 m^3/day (36 liters per capita per day) from the Bovilla Water Purification Plant. This is supplied at 0.06 liter/s (216 m^3/hr) for four hours each day. The municipality does not have any plans for increasing their water supply conditions, except to rehabilitate the aging pipes in the central part of the municipality.

The Kashar commune consists of ten villages and has a population of 25,000 and an additional 7,000 informal dwellers. The commune has a land use plan which allocates the 10ha of vacant land in the southeast for housing and commercial areas, the north eastern area for housing and a 575 ha industrial area (including a 52 ha residential area).

Groundwater is the source of water for the existing water supply system. There are four water tanks with a total capacity of 1,800 m3. The distribution pipes are managed by the Tirana Water Supply and Sewerage Enterprise (UKT). A plan and detailed design for rehabilitating and improving the water supply system has been prepared for the following three villages: Kashar 1, Kashar 2 and Kus (the total population is 5,500).

(2) Sanitation

The following section describes the present situation and issues associated with sanitation in Albania. The information presented here is reproduced from the Albania Water Supply and Wastewater Sector Strategy (September 2003).

There are more problems with the sanitation system, than the water supply system. Sanitation coverage in urban areas is almost the same as for drinking water coverage, however only a fraction of the areas that have piped water supply are also equipped with sewer networks. Upgrading of the sewer networks has not kept pace with the general development of infrastructure, and the types of materials and technology used have not improved with time. In general, the urban areas have combined sewage and stormwater collection networks that discharge into nearby surface water bodies. In general, the sewers are under sized and are often blocked which causes wastewater to seep and leak out of the networks, resulting in cross-contamination with drinking water. In many cases the sewers were built on top of the drinking water pipes, meaning sewage easily enters the water supply systems when the water supply system is not pressurized.

In general, rural areas have individual household sewage collection systems. These are usually simple pit-latrines with no drainage pipes. The villagers are responsible for the construction of their latrines. The construction does not follow appropriate technical criteria, meaning the latrines often malfunction.

2.4 Solid Wastes

Solid wastes in the study area are poorly managed. In particular, the Tirana and Lana Rivers look like a solid waste dumping site. Solid waste generated in the urban center of Tirana Municipality is collected and trucked to a landfill at Sharra. This is located in a valley in the Erzen River basin and is approximately five kilometers southwest of the center of the Tirana municipality. All types of wastes (household, commercial, industrial, institutional, and construction debris) are mixed together at the site. There is no processing of the wastes, meaning the waste volume is not reduced and recycling does not occur. Uncontrolled open burning of waste at the Sharra landfill site produces noxious clouds of smoke which pose a severe health hazard to local residents. The wind occasionally blows these noxious clouds to other parts of the Tirana municipality. No sanitary landfill practices occur at the Sharra landfill. Such practices could include lining the landfill and installation of a leachate collection system. The lack of such practices results in adverse environmental impacts. In 2000, the UNEP identified the Sharra landfill as one of five environmental "hot spots" in Albania and stated that the landfill poses "imminent risks to public health and the environment." The subsurface investigations conducted by the UNEP in 2001 indicated that the soils under the landfill are relatively impervious, silty soils with high clay content. Therefore, at that time there was no evidence that the Sharra landfill was posing an immediate threat to local groundwater quality, or to the shallow wells located downstream in nearby Peza e Vogel.

The World Bank's Strategic Plan (2002) projected that the total solid waste from the Greater Tirana planning area would be 591,000 metric tons in 2002, and would gradually increase to 808,000 metric tons per year by 2012. The Plan estimated that about 14.4 million cubic meters of landfill space (as net volume) would be required to accommodate this waste. This is equivalent to 15.8 - 16.6 million cubic meters if periodic landfill cover materials are included in the calculation.

Landfilling solid waste is the best least-cost option for solid waste disposal in Greater Tirana. It is recommended that sanitary landfill practices (such as installation of impermeable liners under the landfill, leachate collection and treatment, and measures to prevent the spread of fire within the landfill) are incorporated. Two sites (one to the north and one to the south of the area) have been identified for development but this has not yet been realized.

2.5 Other Infrastructure

2.5.1 Power Supply

"A. Balance of Electric Power" of *Table 2.5.1* shows the status of the power supply system in Albania, as well as the consumed volume of electrical power between 1993 and 2001.

Table 2.5.1 Status of Power Supply in Albania

A. Balance of Electric Power (GWh)

Description	Year								
	1993	1994	1995	1996	1997	1998	1999	2000	2001
Total Sources	3,516,297	3,955,269	4,616,805	6,271,430	5,895,144	6,137,199	6,509,112	5,962,092	5,511,373
Production	3,481,508	3,903,687	4,477,858	5,786,689	5,183,769	5,068,298	5,396,399	4,738,194	3,692,129
– Thermopower Plants	170,367	132,182	172,245	213,097	157,450	82,687	112,672	143,589	136,905
– Hydropower Plants	3,311,141	3,771,505	4,305,613	5,573,592	5,026,319	4,985,611	5,283,727	4,594,605	3,555,224
Import*	34,789	51,582	138,947	484,741	711,375	1,068,901	1,112,713	1,223,898	1,819,244
from which purchases:	-	-	-	-	-	1,068,901	334,138	1,072,312	1,736,729
Technical Losses	1,361,044	1,843,760	2,347,280	2,547,572	2,913,098	3,167,879	3,027,963	2,479,399	2,058,358
Technical Loss Rates	38.71%	46.62%	50.84%	40.62%	49.42%	51.62%	46.52%	41.59%	37.35%
Consumed by domestic users	1,908,301	1,837,548	2,024,784	2,283,879	2,116,514	2,256,993	2,678,150	3,192,767	3,350,575

B. Status of Power Supply (GWH)

Description	Year								
	1993	1994	1995	1996	1997	1998	1999	2000	2001
Industry	589,040	572,006	473,794	516,250	364,564	361,188	424,737	545,805	580,692
Agriculture	45,598	31,697	39,100	46,156	26,216	29,340	34,502	40,731	50,591
Domestic	774,086	779,994	882,530	1,093,458	1,104,851	1,239,163	1,481,238	1,663,892	1,997,560
Non-specified	499,577	453,851	629,360	628,015	620,883	627,302	737,673	942,339	721,732
Total	1,908,301	1,837,548	2,024,784	2,283,879	2,116,514	2,256,993	2,678,150	3,192,767	3,350,575
Non-Technical Loss	246,952	273,961	244,741	1,439,979	865,532	712,327	802,999	289,926	102,440
Power Supply in Grand Total	2,155,253	2,111,509	2,269,525	3,723,858	2,982,046	2,969,320	3,481,149	3,482,693	3,453,015

Sourse: INSTAT.

As shown in the above table, thermal power production represents only around 4 % of the total production. The remaining production comes from hydropower (since 1993). The total power supply volume has increased from 3.5 $\times 10^6$ GWh in 1993 to 5.5 $\times 10^6$ GWh in 2001. This includes imported power.

Table 2.5.1 also shows the transmission and distribution losses represent between 40 % and 50 % of the generated supply. These high power losses are the responsibility of the Albanian power supply enterprises. The consumed volume of power indicated in above table is used as shown in "B. Status of Power Supply" of *Table 2.5.1*.

In addition to the power supply losses mentioned above, it should be noted that the consumed volume in the "non-specified" category has been higher than that of the industrial category since 1995. Therefore, improvements in this power sector are also required.

2.5.2 Roads

There are no statistics on road length but there are some statistics on the number of vehicles and passengers using the international seaport, railway networks, and roads.

Table 2.5.2 shows the number of vehicles in Albania.

Table 2.5.2 Number of Road Vehicles by Type

(Numbers)

Items	Year											
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Audinary Cars	56,728	67,960	58,682	67,278	76,822	90,766	92,252	114,532	133,533	148,531	174,782	190,004
Buses/Minibuses	7,582	8,149	6,651	7,612	8,747	9,227	12,306	16,806	20,813	21,026	21,693	25,066
Trucks and Vans	31,084	42,271	25,790	27,774	30,105	34,378	35,266	43,301	49,600	51,960	53,900	46,809
Road tractors	8,251	8,842	3,334	2,838	3,151	2,731	1,860	2,274	2,721	2,670	2,957	1,966
Motorcycles	15,097	14,339	6,946	5,541	3,645	4,109	3,214	3,808	3,447	3,400	3,896	4,877
Trailers	10,965	12,325	12,671	3,497	3,788	3,990	4,250	5,261	6,436	6,367	6,673	5,930
Total Number of Vehicles	129,707	153,886	114,074	114,540	126,258	145,201	149,148	185,982	216,550	233,954	263,901	274,652

Since 1993, the number of vehicles in Albania almost doubled between 1993 and 2004 (from 130,000 to 275,000). *Table 2.5.3* shows the number of passengers and persons.kms in Albania since 1993.

Table 2.5.3 Number of Passengers and Persons.Kms

Items	Year											
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Passengers (number)	38,900	31,792	30,976	36,135	31,684	32,343	36,768	31,282	32,666	24,260	25,980	20,724
Passengers (persons.kms)	306,658	197,241	196,042	223,395	189,770	190,133	220,836	183,472	197,393	188,923	175,805	140,792

CHAPTER 3

DEVELOPMENT PLANS FOR EXISTING INFRASTRUCTURE GREATER TIRANA

CHAPTER 3 DEVELOPMENT PLANS FOR EXISTING INFRASTRUCTURE GREATER TIRANA

3.1 General

The following sections review previous infrastructure development studies for Greater Tirana.

3.2 JICA Study: Sewerage System (1998)

The master plan and feasibility study completed by JICA during 1998 are discussed in this section. The Figures in the parenthesis relate to the feasibility study.

- Target year for the master plan: 2010 (2001);
- Area covered by the master plan: 1,810 ha, of which 1,245 ha is existing and 565 ha in new (842 ha - 777 ha existing and 65 ha new);
- Population to be serviced: 525,200 (254,000);
- Sewage flow rate: 105,400 m3/day (50,800 m3/day);
- Treatment process: aerated lagoon with disinfection; and
- Major Sewage collection facilities to be constructed:
  - connecting sewers: 24.1 km (13.5 km);
  - separate trunk sewers for the new area: 28.2 km (3.3 km); and
  - renovation of interceptors: 10.6 km (6.6 km).

Financial analysis was undertaken for the required costs, including construction and O/M costs. However, no economic evaluation was undertaken. Tariffs, a tariff collection system, and institutional arrangements were proposed as a result of the financial analysis.

The 1998 JICA study identified that the existing combined interceptors are in reasonably good condition but have insufficient capacity to convey both sewage and stormwater, in compliance with Albanian Standards.

A field visit indicated that the site for the STP identified in the 1998 JICA study has since been intersected by the construction of a new road that leads to the airport.

3.3 Strategic Plan (World Bank 2002)

3.3.1 General and Current Status

Tirana, as the Capital of Albania and the social, cultural and economic centre for the country, experienced substantial urban migration from rural areas during the 1990s. This resulted in a rapid increase in the population growth rate and urban development was not well controlled.

To address this problem, a draft Strategic Plan for Greater Tirana (February 2002) was prepared as part of

the IBRD financed Urban Land Management Project (ULMP).

The Greater Tirana study area covers 400 square kilometers and covers all or part of the administrative jurisdictions of the following local governments:

- The municipalities of Tirana, Kamza and Vore; and
- The communes of Farke, Vaqarr, Kashar, Berxulle, Zall Herr, Paskuqan, Preze and Dajt.

The technical aims of the strategic plan are to:

- Maximize the contribution of urban development investment to economic growth in Greater Tirana;
- Promote more compact urban development by limiting growth primarily to the current development area;
- Promote higher density and infill development;
- Invest in city centre infrastructure to maintain and enhance existing assets; and
- Concentrate planning and development control efforts in priority development areas.

There are concerns about the continuing rapid development of Tirana, however a National Urban Strategy is some way from completion. Therefore, the preparation of a zoning code, regulatory plan and implementing framework (institutional strengthening and capacity building) is about to commence. The aim is to assist the municipality of Tirana promote improved urban management. Rather than restricting these initiatives to the municipality of Tirana, it is proposed to link them with the surrounding municipalities and communes, which will form Greater Tirana.

This consultancy service is financed by the Netherlands Government through trust funds granted to the IDA financed Urban Land Management Project (ULMP). This IDA assistance to the municipality of Tirana helps progress issues identified in the Strategic Plan for Greater Tirana. The Strategic Plan includes basic planning for the following infrastructure services:

- Water supply;
- Sewerage and storm water drainage;
- Solid waste management;
- Roads;
- Electrical power supply; and
- Telecommunications.

3.3.2 Water Supply Plan

The water supply report concludes that the main issue with the water supply system is due to poor management rather than lack of capital. In particular, the problem is poor management of water demand. Improvements could be realized by metering connections. This is currently being implemented using Italian cooperation funds.

Nine major water supply zones cover the Greater Tirana planning area. The population in this area is expected to be 949,792 by 2022. Based on an overall daily demand Figure of 150 lpcd, plus an industry demand of 50 cubic meters/hectare/day and assuming unaccounted for water is at 25%, the total water demand is 161,709 cubic meters per day for the planning area.

The study estimated that the available supply is 224,208 cubic meters per day. The total water supply cost is estimated to be Lek 311,087,000. This cost includes construction of additional primary and secondary transmission mains and storage reservoirs.

The study identified that improved system management and financial performance is critical to the provision of water services. This would require metering programs and programs to reduce illegal connections. Enforcement support from political authorities would be required to ensure customers comply with these programs.

Three institutional options for decentralizing management to local government were considered and analyzed. The study recommended that the bulk water supply function, operating at a regional or basin level, should be separated from the distribution functions. This would help ease the service delivery burden on local governments.

3.3.3 Sewerage Plan

(1) Planning Area and Population

The sewerage system is planned to be paralleled to the water supply system. Sewage flows were estimated from the water demand. Figures were projected through to 2022, based on population projections. Sewage flows were developed assuming that most of the water usage is returned as sewage. Therefore, the sewage flow was estimated by applying a sewage return factor to the estimated water demand. The following sewage return factors were used:

- Residential, institutional, and commercial: 95 % of water usage (water usage was assumed to be 150 liter/capita/day excluding unaccounted-for-water) is returned to the sewer; and
- Industrial: 95 % of water usage (water usage was assumed to be 50 cubic meters of the water demand per hectare in industrially-zoned areas).

(2) Sewage Collection System

The existing interceptor lines in Tirana are located along both sides of the Lana River and along the south side of the Tirana River. The interceptor lines receive sewage and some stormwater from the secondary sewers. The study recommends that the amount of stormwater and sewage entering the existing interceptors could be reduced by constructing separate sanitary and stormwater sewers to “relieve” the existing interceptors.

Three relief lines would be required: one on each side of the Lana River, and one on the southern side of

the Tirana River. Stormwater from these areas would be conveyed directly into the rivers via separate stormwater sewers. These relief sewers would reduce the sewage and stormwater flows reaching the exiting interceptors, allowing these existing interceptors to carry more flow from the existing areas meaning there would be less overflow into the rivers. The relief sewers would have diameters of 600 to 750 mm, and would be 5 km long, along both sides of the Lana River, and 4 km long, along the southern side of the Tirana River.

In addition to the relief sewers, an additional interceptor sewer would be required along the northern side of the Tirana River. This relief sewer would carry sewage generated from the populated areas located north of the river. The additional interceptor sewer would have a diameter of 900 mm and would be 10.5 km long.

The above sewers would join the other interceptors. These interceptors are box culverts, with dimensions of 2.0 m by 2.0 m, and a length of 8.6 km. This system would convey the sewage to the proposed STP.

During 2005 the JICA study team investigated this trunk sewer route. Most of the proposed route for the trunk sewer line is curved and narrow. The width of the road is not fixed and changes from time to time. The narrow width means that during construction of the sewer, the residents in the villages located along the Tirana River would find it difficult to move their livestock. Also, the proposed route traverses other watercourses which would make construction difficult and costly. These local issues mean the proposed route is not suiTable for construction of a large diameter pipeline.

The 2002 World Bank Report identifies two alternate routes to the STP (*Figure 3.3.1*): the North Tirana Interceptor and the Main Interceptor Sewer. The report indicates that the North Tirana Interceptor is located alongside the Tirana River. This means there are no suitable roads for this route. Therefore, some sections of the North Tirana Interceptor sewer should be constructed under the Tirana riverbed. This method of construction means maintenance is difficult and reconstruction may be required in the future. The presence of permanent water ways and the high groundwater Table would result in more infiltration/inflow to the sewer. Also, dewatering would be required during the construction phase. The other route identified in the report is the Main Interceptor Sewer, which is aligned along Durres Road, up to the point where the highway crosses a hill. The route then turns towards the north. Currently, there is no road going north from Durres Road.

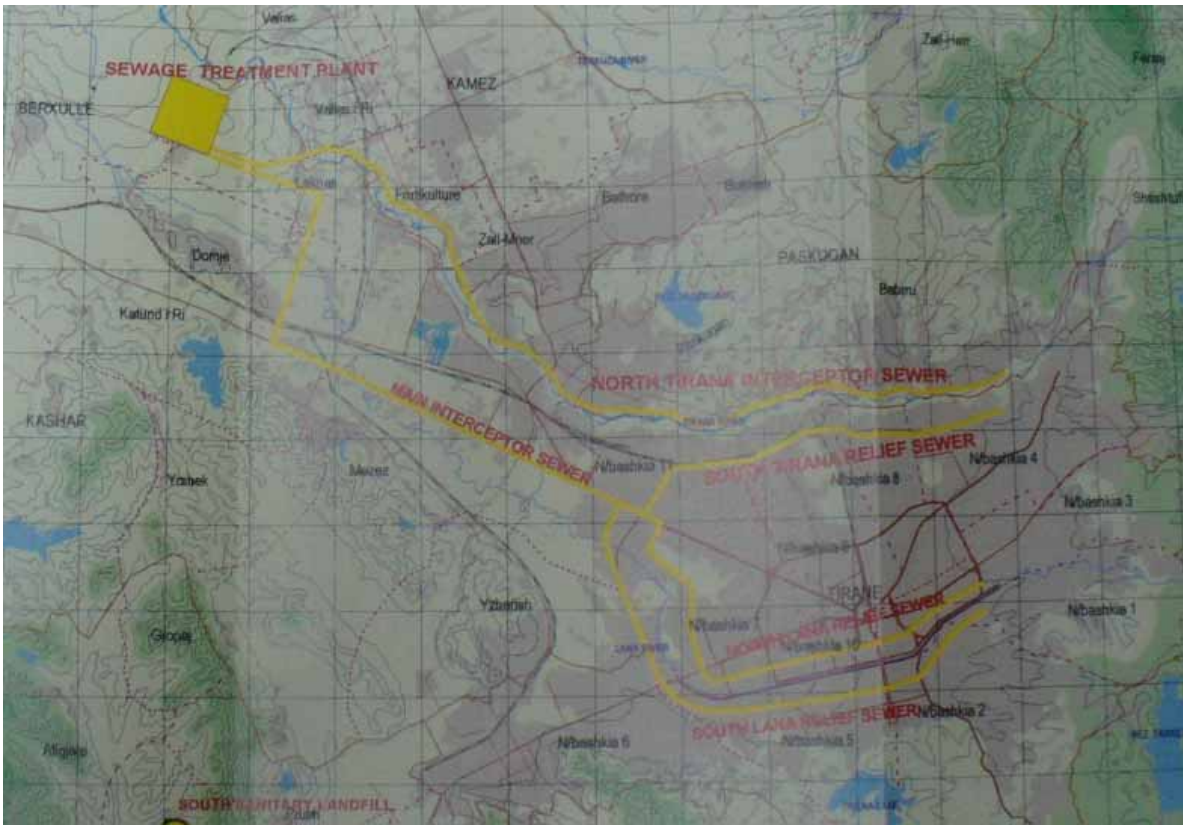


Figure 3.3.1 Interceptor Sewer Routes Identified in the 2002 World Bank Report

(3) Sewage Treatment Plant (STP)

The most efficient and cost-effective treatment methods for Greater Tirana would be aerated lagoons followed by non-aerated lagoons. The proposed STP would be located on agricultural land adjacent to the Tirana River, approximately 10 km northwest of the center of the Tirana municipality.

The STP would consist of a pumping station located at the inflow point to the plant. The pumping station would lift the sewage from the interceptor pipes, up into the sewage treatment process. The sewage treatment process units would consist of a screen followed by aerated lagoons, non-aerated lagoons, and finally a cascade re-aeration process, which would saturate the sewage with oxygen prior to discharge to the Tirana River. The size of the site would be approximately 60 ha. The major features of the STP as shown in *Table 3.3.1*.

Table 3.3.1 Features of the STP Design as Presented in the Strategic Plan

Parameter	2022
1. Design Figures	
Average Sewage Flow, m^3/day	156,266
Peak Sewage Flow, m^3/day	468,797
Influent BOD_5 Conc., mg/L	200
Infulent TSS Conc., mg/L	200
2. Influent Pumping	
Number of Pumps	4
Capacity, m^3/sec	6.8
3. Screening	
Type	Manual-Coarse Bar Rack
Number of Screens	5
4. Aerated Lagoons	
Required Effluent BOD_5 Conc., mg/L	30
Design Retention Time, days	1.75
Number of Basins	12
5. Aertors	
Type	Floating
Number per Basin, nos	4
Total Number of Aerators, nos	48
6. Facultative Lagoons	
Design Retention Time, days	4
7. Effluent Reaeration Structure	
Type	Cascade Re-Aeration
Number of Steps	14
8. Total Arear required, ha	56.8

3.4 Water and Sewerage Plans Produced with Italian Assistance

3.4.1 Background

Italian assistance has supported the water sector in Albania since 1995. The general objectives of the technical and financial assistance are to:

- improve the water supply service and to reduce the level of water leakage; and
- assist the information technology modernization of the water company, so that it can manage the water supply and sewerage system efficiently and sustainable, in terms of billing, projecting future interventions etc.

The activities funded by Italy include the construction of a water purification plant at Bovilla (130,000 m^3/day) for treating surface water; and various modifications to the water distribution network. The most recent changes, initiated two years ago, are listed here:

- A technical assistance program for the Tirana water company (UKT); and
- Other assistance for the rehabilitation of the water distribution network.

The Technical Assistance Program for the UKT was undertaken by the consortium Tirana Acque. This was awarded through an open biding process, overseen by the municipality of Genova.

The second component was initiated in December 2001. The aim was to provide a proper water supply service and to strengthen the technical and management capability of the Tirana water company. This project includes the following:

- Technical and managerial assistance in training and educating the personnel (including installation of a computerized billing system);
- Preparation of a water supply master plan including components to reduce water leakage;
- Supply of 30,000 water meters and other necessary equipment to automate the system and to assist with maintenance work;
- Provision of other assistance for rehabilitation work; and
- Management of the Bovilla water purification plant.

3.4.2 Proposed Sewer Improvement Plans

The study reviewed the existing sewer mains and sewer networks. The study states:

"Evaluation of the results derived from hydrodynamic stimulations identified two kinds of problems: the first one is connected with the hydraulic functioning of the network, i.e. problems overflows caused by low capacity, and the other is connected with water flows in sewers. In order to eliminate the verified anomalies some structural interventions are carried out".

The study recommended a plan for improving the existing sewer networks in the Tirana municipality. The plan was based on simulation results for a five year average return period, generated using "MOUSE" software. The main components of the plan are summarized below:

1) Installation of new interceptors (with cross-sections of 2000 mm×2000 mm) in the central zone;
2) Installation of new sewer mains (with diameters of 800mm to 1500mm) in the Southern Tirana zone;
3) Rehabilitation of existing weirs and construction of new weirs; and
4) Replacement of existing sewer mains with new sewers with larger diameters.

The report says that these modifications would significantly reduce overflows from the existing sewers and the number of "Hydraulic critical points" could be reduced from 137 to 69.

The plan also proposes the installation of eight rain reserve tanks with a total volume of 18,000m^3. These would be connected to the main weirs on Lana River. The capacities of rain reserve tanks were designed based on a unit volume ranging from 25 to 50 m^3 per hectare, depending on the collector classification.

3.4.3 Review of the Study Undertaken Using Italian Assistance

A review of the reports identified the following problems with the MOUSE analysis:

- The reliability of the analysis could not be confirmed because the parameters and assumptions used for the simulation were not documented in the report.
- Many incorrect connections (as shown in *Figure 3.4.1*) were noted. The connections in the model do not represent the actual sewer networks that have been confirmed by field surveys.
- Some existing sewers included in the flow calculations were not existed based on reconnaissance survey. There was no way to check this situation.
- The simulation results indicated many overflows would result from the inadequate sewer networks. However, the field investigation and interviews undertaken by the JICA study team in 2005 did not identify any overflows within the last 50 years.
- The assumed rainfall intensity documented in the report does not match the calculation sheets shown in Fig.5 Lettergram type "Chicago" (Final Report July 2000).
- The report did not show any calibration results.

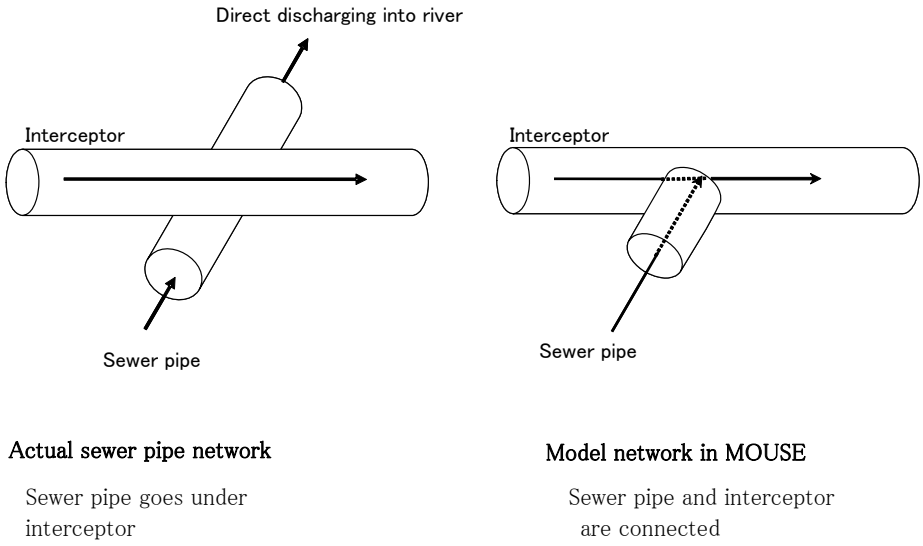


Figure 3.4.1 Example of Incorrect Connections Used in the MOUSE Model

The key sewer improvement would be to stop the infiltration of rainwater. Considering the mistakes identified in the modeling (documented above) the solution appears to be the enlargement of the sewer main diameters and installation of eight rain reserve tanks. However, construction of the proposed eight rainwater tanks would be impractical along the Lana River. The site visit identified that there are no appropriate sites.

3.5 Water Supply Plan for Kamza Commune - by France

In December 2000 Premiere Urgency awarded a consulting service contract to Austrian Water Technologies (of Vienna). The contract was to provide consulting services for the improvement of the

water supply system in the Kamza commune. An outline of the study results is presented in this section.

The review and evaluation of the existing water supply system in Kamza commune indicated that the existing water supply system is out of date and in very poor condition. The study concluded that a new water system needs to be constructed. The hydro-geological report recommended that water should be sourced from new well fields in Valias and Laknas. The proposed wells are expected to produce 30-35 L/s of potable water, with the dynamic level of water about 26m below the surface.

A summary of the design parameters is provided below:

- Target year: 2015;
- Service population in 2025: 99,000;
- Service area: 1,118.5 hectares;
- Average population density in 2025: 90 people per hectare;
- Design flow: 365 L/s in 2015 (the current flow rate is 81 L/s); and
- Design criteria:
  - Per capita domestic demand 140 L/cap/day,
  - Commercial and institutional demand 28 L/cap/day,
  - Industrial demand 28 L/cap/day,
  - Loss factor 20 %,
  - Total daily coefficient 1.3, and
  - Hourly coefficient 1.7

The study assessed various water supply schemes and options. The study included economic comparisons of the different options. The preferred option was identified to be a gravity water supply system with a reservoir located in the Kamza hills. The proposed solution included an emergency solution (pumping water directly from the wells into the distribution system) to be implemented as a first step.

3.6 Other Development Plans for the Greater Tirana Area

Tirana municipality is divided into 101 blocks. Trunk roads are currently under construction and are expected to be completed by the end of 2006. The current plans do not include construction of a road on the left bank of the Tirana River. Kamza commune has developed their own drainage plan and some drains have already been constructed. This plan specifies that the collected wastewater will be discharged at three points into the Tirana River. There is no official plan to discharge into the Lana River, but the concept is being considered. The commune also has plans for a large industrial development along the highway. There are no sewage system or drainage system plans for Paskuqan or Berxulle.

CHAPTER 4

WATER ENVIRONMENT

CHAPTER 4 WATER ENVIRONMENT

4.1 General

This chapter describes water environment in the study area: general information relating to Lana and Tirana Rivers, the current water quality monitoring system and presents its results. It also presents water quality survey results which were carried out by the JICA Study Team to gain an understanding of the current water quality and the expected impacts of sewage and industrial wastewater discharge on the river water quality.

4.2 Rivers in the Study Area

The study area is located in the upstream section of the Ishmi River Basin which shares approximately 50 % of the Erzeni-Ishmi River Basin (1,439 km^2). It is a relatively flat basin surrounded on three sides by mountains. It has an average altitude of approximately 120 m above sea level.

Lana and Tirana Rivers are the major rivers in the study area. The Lana River runs from east to west through the southern part of Tirana municipality. It joins the mid-part of the Tirana River. The Tirana River runs through the northern part of Tirana municipality and runs parallel with the Lana River. It joins the Ishmi River downstream of its confluence with the Lana River. The Ishmi River flows into the Adriatic Sea. Both the Lana and Tirana rivers are severely polluted by the direct discharge of untreated sewage and garbage disposal.

The Lana River is 29 km long and has a 3.5 km long concrete lined embankment where it passes through the central part of the Tirana municipality. This embankment was constructed under the "Clean and Green Project" by the Tirana municipality. This project has been undertaken with assistance from the UNDP since 2000. This project was instigated to address environmental issues that cause pollution in the Lana River. The upstream area of the Lana River is sparsely populated, and supports olive oil production activities. The mid-point of the river is lined with a concrete embankment and is surrounded by a densely populated urban area. Significant volumes of sewage are discharged directly into the river by households and small to mid-scale commercial operations in this urban area. Several industries (e.g. beverage and food processing industries) exist in the lower part of the river (after the intersection of the “Bruga Konferenca e Pezes” and “Bulevardi Bajram Curri”).

The upper parts of the Tirana River are unpopulated area. Sand, gravel and limestone quarrying is the major activity in the upper parts of the Tirana River. In addition to garbage and direct sewage discharge, unauthorized river bank landfill is a major environmental concern along the Tirana River.

4.3 Present River Monitoring System

4.3.1 Present System

The Ministry of Environment, Forest and Water Management (MoEFWM) is managing an environmental monitoring program (with input from several public institutes) defined in the "Updated National Environmental Action Plan 2001 (UNEAP 2001)", which was released in 2005. Financial assistance for this program is being provided by the state government in accordance with the "Decision of the Council of Ministers, No.541, Dated 25/09/1995". The UNEAP 2001 summarizes the major issues relating to the current environment monitoring system as being:

- lack of sufficient funds for monitoring the environment and biodiversity;
- a lack of professional and logistic capacity within environmental monitoring institutions; and
- no central body for record management.

Environmental monitoring campaigns have been conducted by several public institutes, including:

- Institute of Environmental Research, MoEFWM; and
- Institute of Hydrometeorology, Academy of Science.

Monitoring data is not always available due to poor record keeping systems. Also, the data is often not effectively used or shared between organizations.

4.3.2 Institute of Hydrometeorology

Table 4.3.1 and *Table 4.3.2* summarize the water quality items that the Institute of Hydrometeorology (IHM) measures in the Tirana and Lana Rivers.

Table 4.3.1 Water Quality Monitoring in the Tirana and the Lana Rivers Conducted by IHM

River	Sampling Station	Monitoring Period	Analysis Parameters
Tirana	Brari Bridge	1990 to 2005	pH, Ca^{2+}, Mg^{2+}, K^{+}, Na^{+}, Cl^{-}, SO_4^{2-}, CO_3^{2-}, HCO^{3-}, COD, BOD, EC, NO_2, NO_3, NH_4, PO_4, T-P
	Rinasi Bridge	1990 to 2005	
	Kamza Bridge	1990 to 2005	
Lana	Teknikumi	2001 to 2005	

Table 4.3.2 Flow Rate in the Tirana Lana Rivers, Measured by IHM

River	Sampling Station	Monitoring Period
Tirana	Shupal	up to 2005
Lana	Teknikumi	up to 2005

The measurement points used by the IHM for water quality and flow rate monitoring are shown in *Figure 4.4.1.* Flow and water quality data post 1985 was not available from the IHM. Therefore, the water quality prediction used the monthly flow rate information readily available for the Lana River (from 1966 to 1985) and for the Tirana River (from 1976 to 1985), as shown in *Table 11.4.4* in Chapter 11. This

flow information was presented in "The Study on the Sewerage System in Metropolitan Tirana in the Republic of Albania, Final Report" (former JICA study report).

4.3.3 Institute of Environmental Protection

Water quality monitoring for the major rivers in Albania was undertaken by the Institute of Public Health (IPH) until 2003. From 2004, the monitoring was carried out by the Institute of Environmental Protection (IEP) under the MoEFWM. The measurement locations for water quality testing carried out by the IEP (and IPH) are shown in *Figure 4.4.1*.

Since 2003, the IEP has been responsible for monitoring major industrial wastewater discharge. Prior to 2003 this function was carried out by the Ministry of Industry and Energy. Under current environmental regulation (i.e., "Law 59, No. 8934, 2002" and "Law 71, 2003), major industries have an obligation to monitor their own wastewater quality and are required to report this every three months to the Regional Environmental Office. However, this regulation is not being effectively enforced, which results in inadequate monitoring.

4.4 Water Quality

4.4.1 Existing Water Quality Data

Water quality monitoring data for the Lana and Tirana Rivers was provided by the IPH (2000 to 2003) and the IEP (2004 to 2005). The water quality data for Lana River is summarized in *Table 4.4.1* and *Table 4.4.3* and that for the Tirana River is summarized in *Table 4.4.2* and *Table 4.4.4*. BOD_5 concentrations of the Lana River and the Tirana River are presented in *Figure 4.4.2* and *Figure 4.4.3,* respectively.

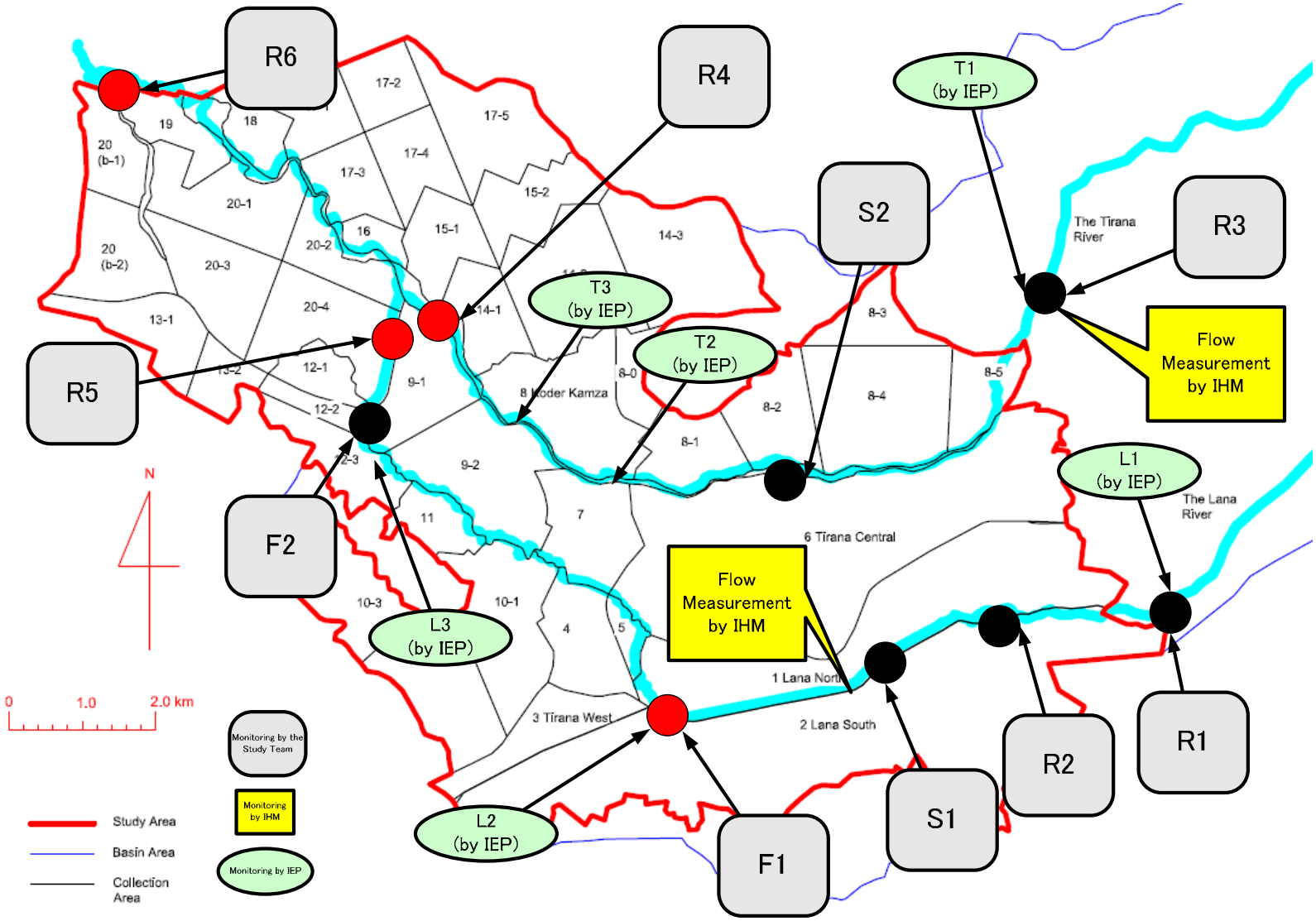


Figure 4.4.1 Sampling locations used by the JICA Study Team, Regular Sampling locations used by the IEP and Flow Measurement locations used by the IHM

Table 4.4.1 Lana River Water Quality Data, Monitored by IPH (2000 to 2003)

ID	Item	Unit	2000 (Jun to Dec)			2001 (Jun to Dec)			2002 (Jun to Dec)					2003 (Jun to Dec)			
			1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th
L1	Turbidity		9	67	48	6	7	10	42	12	29	38	30	58	52	25	68
L1	Water temperature	°C	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L1	pH		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L1	Alkanility	mg.eq/l	N.A.	N.A.	N.A.	5.0	5.2	4.8	3.9	4.8	3.7	4.2	5.0	9.8	4.2	5.0	4.2
L1	Alkalinity (HCO_3)	mg/l	240.0	250.0	245.0	305.0	317.2	292.8	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L1	Salinity	g/kg	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L1	SS	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L1	DO	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L1	COD	mg/l	4.2	6.0	3.8	8.0	9.0	13.6	33.6	23.5	20.0	45.6	30.4	36.0	44.8	69.6	37.6
L1	$BOD_{(5)}$	mg/l	2.0	3.1	116.0	4.0	4.4	6.6	16.1	12.0	9.9	22.3	15.2	18.0	23.1	34.8	18.0
L1	$NH4^+$	mg/l	0.4	0.4	0.4	0.3	0.2	0.3	0.5	0.0	0.2	0.1	0.0	1.9	3.5	2.9	2.9
L1	NO_2	mg/l	0.03	0.06	0.03	0.00	0.00	0.03	0.04	0.06	0.07	0.06	0.04	0.19	0.13	0.06	0.12
L1	NO_3	mg/l	0.9	0.4	0.8	0.1	0.2	0.7	0.4	0.4	0.5	2.6	0.9	2.2	2.6	2.2	2.2
L1	TP	mg/l	0.25	0.26	0.22	1.80	1.35	1.44	1.61	1.39	1.42	2.75	0.17	0.72	0.54	0.01	0.35
L1	PO_4	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L1	T-Coli	MPN	N.A.	N.A.	N.A.	113,400	560,000	1,260	875,000	11,340	7,260	201,600	26,800	2,000	6,800	6,000	1,600
L1	F-Coliform	MPN	N.A.	N.A.	N.A.	4,000	234,000	1,100	7,580	1,000	2,680	126,000	11,340	1,000	4,000	2,000	1,400
L1	F-Streptococci	MPN	N.A.	N.A.	N.A.	6,000	80,000	2,500	880	1,000	882	20,160	1,260	10	5,000	1,000	400

ID	Item	Unit	2000 (Jun to Dec)			2001 (Jun to Dec)			2002 (Jun to Dec)					2003 (Jun to Dec)			
			1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th
L2	Turbidity		67	125	115	78	81	60	38	34	62	160	52	33	52	43	63
L2	Water temperature	°C	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L2	pH		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L2	Alkanility	mg.eq/l	N.A.	N.A.	N.A.	6.5	5.7	5.3	5.2	5.2	5.2	5.4	6.5	9.9	4.2	4.2	5.2
L2	Alkalinity (HCO_3)	mg/l	280.0	300.0	310.0	395.5	347.7	323.3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L2	Salinity	g/kg	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L2	SS	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L2	DO	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L2	COD	mg/l	248.0	220.0	205.0	240.0	220.0	29.8	36.0	30.4	45.5	68.8	64.4	42.4	46.4	70.4	57.6
L2	$BOD_{(5)}$	mg/l	124.6	109.5	1.9	120.0	109.8	14.8	17.0	14.9	21.9	34.4	32.2	21.0	22.0	35.2	26.1
L2	$NH4^+$	mg/l	4.4	5.0	4.7	2.8	2.0	2.8	3.1	2.9	3.1	2.1	1.9	37.1	32.9	28.4	26.1
L2	NO_2	mg/l	0.26	1.09	0.88	0.00	0.00	0.20	0.11	0.34	0.38	0.25	0.23	0.90	0.54	0.47	0.36
L2	NO_3	mg/l	1.8	2.9	2.4	0.7	0.9	0.9	1.3	2.6	2.9	1.8	1.3	1.8	6.6	4.0	3.5
L2	TP	mg/l	0.84	0.92	0.87	3.25	3.06	3.36	2.40	1.85	1.93	2.53	1.64	0.25	2.11	0.96	0.74
L2	PO_4	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L2	T-Coli	MPN	N.A.	N.A.	N.A.	8,820,000	N.A.	7,560,000	4,230,000	2,560,000	5,620,000	2,800,000	1,520,000	1,500,000	4,800,000	5,000,000	1,600,000
L2	F-Coliform	MPN	N.A.	N.A.	N.A.	800,000	682,000	5,430,000	2,290,000	100,000	1,420,000	1,950,000	138,600	1,200,000	3,200,000	4,000,000	800,000
L2	F-Streptococci	MPN	N.A.	N.A.	N.A.	220,000	980,000	1,800,000	880,000	150,000	500,000	610,000	126,000	400,000	300,000	400,000	900,000

ID	Item	Unit	2000 (Jun to Dec)			2001 (Jun to Dec)			2002 (Jun to Dec)					2003 (Jun to Dec)			
			1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th
L3	Turbidity		50	140	155	64	73	64	42	29	50	44	57	51	50	33	44
L3	Water temperature	°C	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L3	pH		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L3	Alkanility	mg.eq/l	N.A.	N.A.	N.A.	6.7	5.7	6.0	3.9	4.8	5.5	5.1	6.3	11.7	4.2	5.0	5.5
L3	Alkalinity (HCO_3)	mg/l	305.0	320.0	335.0	408.7	347.7	366.0	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L3	Salinity	g/kg	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L3	SS	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L3	DO	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L3	COD	mg/l	256.0	235.0	241.0	265.0	240.0	36.8	39.2	37.2	60.0	65.6	60.3	40.8	43.2	73.6	49.8
L3	$BOD_{(5)}$	mg/l	126.6	116.0	120.3	132.0	119.6	18.8	19.1	17.6	29.9	32.9	30.1	20.0	22.0	36.8	24.9
L3	$NH4^+$	mg/l	4.7	5.3	5.2	2.9	2.7	2.7	4.3	4.1	4.3	3.1	3.0	34.4	36.1	23.5	26.1
L3	NO_2	mg/l	0.35	1.21	1.09	0.00	0.01	0.10	0.14	0.29	0.33	0.28	0.26	0.19	1.08	0.54	0.34
L3	NO_3	mg/l	2.6	3.0	3.0	0.4	0.6	0.7	1.5	2.2	2.6	2.2	2.4	1.3	2.6	4.0	3.1
L3	TP	mg/l	0.90	1.07	1.02	3.49	3.33	3.43	2.26	2.39	2.59	2.75	1.93	1.98	1.07	0.80	0.97
L3	PO_4	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L3	T-Coli	MPN	N.A.	N.A.	N.A.	5,040,000	N.A.	640,000	8,320,000	7,800,000	8,820,000	18,500,000	16,820,000	34,000,000	26,000,000	28,000,000	12,000,000
L3	F-Coliform	MPN	N.A.	N.A.	N.A.	300,000	740,000	430,000	50,400	170,000	2,520,000	11,000,000	15,600,000	20,500,000	23,000,000	22,000,000	6,000,000
L3	F-Streptococci	MPN	N.A.	N.A.	N.A.	1,560,000	1,500,000	6,300,000	860,000	70,000	420,000	2,000,000	8,320,000	2,000,000	2,800,000	2,400,000	1,600,000

Table 4.4.2 Tirana River Water Quality Data, Monitored by IPH (2000 to 2003)

ID	Item	Unit	2000 (Jun to Dec)			2001 (Jun to Dec)			2002 (Jun to Dec)					2003 (Jun to Dec)			
			1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th
T1	Turbidity		44	53	36	12	4	30	138	24	406	97	19	51	500	120	3
T1	Water temperature	°C	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T1	pH		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T1	Alkanility	mg.eq/l	N.A.	N.A.	N.A.	4.5	4.2	4.2	3.9	3.0	3.7	4.5	3.7	3.2	3.2	4.2	4.5
T1	Alkalinity (HCO_3)	mg/l	235.0	230.0	225.0	274.5	256.2	256.2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T1	Salinity	g/kg	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T1	SS	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T1	DO	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T1	COD	mg/l	8.0	9.5	8.6	9.6	16.8	24.8	12.4	5.6	6.2	16.0	14.0	29.6	29.6	49.6	21.6
T1	$BOD_{(5)}$	mg/l	4.0	4.6	4.2	4.8	8.8	12.5	7.0	2.8	3.1	8.0	6.9	14.0	13.9	24.8	10.1
T1	$NH4^+$	mg/l	0.0	0.3	0.2	0.5	0.3	0.2	0.3	0.1	0.3	0.1	0.1	0.9	5.8	2.3	2.9
T1	NO_2	mg/l	0.00	0.01	0.02	0.01	0.00	0.01	0.03	0.05	0.06	0.05	0.03	0.10	0.61	1.84	0.06
T1	NO_3	mg/l	0.4	0.5	0.5	0.1	7.9	4.9	0.9	0.4	0.5	1.8	2.2	1.8	10.1	2.6	0.4
T1	TP	mg/l	0.20	0.21	0.18	1.50	1.04	0.60	0.47	0.95	1.26	1.11	0.16	0.10	0.97	0.03	0.01
T1	PO_4	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T1	T-Coli	MPN	N.A.	N.A.	N.A.	2,800	1,000	756	760,000	6,000	8,000	13,700	13,860	3,280	14,000	26,000	50,400
T1	F-Coliform	MPN	N.A.	N.A.	N.A.	1,500	1,000	625	10,000	8,780	2,000	10,000	6,300	2,320	3,800	18,000	12,000
T1	F-Streptococci	MPN	N.A.	N.A.	N.A.	200	0	785	20,000	780	2,000	1,000	7,800	1,300	8,000	23,000	3,600

ID	Item	Unit	2000 (Jun to Dec)			2001 (Jun to Dec)			2002 (Jun to Dec)					2003 (Jun to Dec)			
			1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th
T2	Turbidity		330	105	203	17	14	50	12	10	279	23	96	14	461	80	11
T2	Water temperature	°C	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T2	pH		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T2	Alkanility	mg.eq/l	N.A.	N.A.	N.A.	5.5	5.2	4.8	3.5	5.1	4.5	4.7	4.8	10.1	3.5	4.8	3.7
T2	Alkalinity (HCO_3)	mg/l	267.0	285.0	290.0	335.5	317.2	292.8	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T2	Salinity	g/kg	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T2	SS	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T2	DO	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T2	COD	mg/l	180.0	160.0	175.0	182.0	66.0	53.6	16.8	200.0	130.8	71.2	62.0	40.0	43.2	69.6	29.6
T2	$BOD_{(5)}$	mg/l	90.1	80.1	87.3	91.6	32.9	26.3	8.1	96.9	64.9	35.9	30.9	19.6	22.0	34.8	14.8
T2	$NH4^+$	mg/l	3.1	4.1	3.8	1.8	2.8	3.0	2.7	2.9	0.5	0.4	0.3	10.3	31.0	1.9	8.1
T2	NO_2	mg/l	0.14	0.64	0.43	0.33	0.09	0.36	0.35	0.23	0.24	0.11	0.09	0.44	0.91	0.12	0.14
T2	NO_3	mg/l	4.4	4.8	4.9	0.5	8.4	3.1	1.3	2.6	2.9	3.1	2.8	4.4	13.6	4.0	1.3
T2	TP	mg/l	0.73	0.79	0.81	3.65	2.56	3.10	0.74	1.17	1.74	2.06	0.23	0.63	1.28	0.20	0.09
T2	PO_4	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T2	T-Coli	MPN	N.A.	N.A.	N.A.	252,000	7,500,000	1,250,000	10,080,000	200,000	1,510,000	1,670,000	2,260,000	2,300,000	1,700,000	1,800,000	6,300,000
T2	F-Coliform	MPN	N.A.	N.A.	N.A.	7,000	1,386,000	1,120,000	100,000	580,000	340,000	980,000	500,000	1,000,000	500,000	600,000	1,300,000
T2	F-Streptococci	MPN	N.A.	N.A.	N.A.	6,400	620,000	530,000	40,000	450,000	240,000	300,000	70,000	2,000,000	700,000	800,000	600,000

ID	Item	Unit	2000 (Jun to Dec)			2001 (Jun to Dec)			2002 (Jun to Dec)					2003 (Jun to Dec)			
			1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th
T3	Turbidity		210	122	235	23	47	32	13	14	112	37	39	25	50	19	20
T3	Water temperature	°C	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T3	pH		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T3	Alkanility	mg.eq/l	N.A.	N.A.	N.A.	5.7	5.7	5.3	4.9	4.4	4.5	6.2	5.5	9.3	3.7	4.6	4.5
T3	Alkalinity (HCO_3)	mg/l	325.0	350.0	340.0	347.7	347.7	323.3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T3	Salinity	g/kg	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T3	SS	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T3	DO	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T3	COD	mg/l	224.0	210.0	190.5	220.0	75.0	52.0	14.4	88.0	54.1	72.0	64.0	44.8	44.8	71.2	31.2
T3	$BOD_{(5)}$	mg/l	112.1	105.0	95.2	110.0	37.1	26.0	7.2	43.9	26.5	36.0	32.0	22.1	22.0	35.6	15.9
T3	$NH4^+$	mg/l	3.4	4.8	4.6	2.3	2.8	3.2	3.1	3.7	0.6	0.4	0.4	24.2	26.8	11.0	18.1
T3	NO_2	mg/l	0.50	0.67	0.70	0.25	0.03	0.33	0.66	0.59	0.06	0.20	0.16	0.21	1.03	0.23	0.22
T3	NO_3	mg/l	5.3	5.6	5.4	0.7	5.7	2.6	1.8	3.1	3.3	3.5	3.0	1.3	15.4	2.2	1.8
T3	TP	mg/l	0.91	0.98	0.94	3.83	2.75	3.22	1.19	1.46	1.10	2.75	0.30	1.29	1.54	0.10	0.23
T3	PO_4	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T3	T-Coli	MPN	N.A.	N.A.	N.A.	780,000	8,820,000	2,160,000	6,340,000	1,230,000	2,520,000	11,340,000	8,600,000	68,000,000	2,200,000	24,000,000	14,000,000
T3	F-Coliform	MPN	N.A.	N.A.	N.A.	360,000	1,280,000	1,720,000	3,790,000	1,120,000	610,000	6,300,000	3,200,000	63,000,000	8,000,000	12,000,000	8,000,000
T3	F-Streptococci	MPN	N.A.	N.A.	N.A.	70,000	250,000	390,000	420,000	340,000	900,000	880,000	500,000	2,500,000	500,000	800,000	3,200,000

Table 4.4.3 Lana River Water Quality Data, Monitored by IEP (2004 to 2005)

ID	Item	Unit	2004				2005			Min.	Avg.	Max.
			16/Mar	05/May	07/Jul	06/Oct	10/Mar	18/May	13/Jul			
L1	Turbidity		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L1	Water temperature	°C	8.5	12.5	16.5	13.5	6.0	15.0	15.5	6.0	12.5	16.5
L1	pH		8.0	7.8	8.0	7.5	7.3	8.1	7.2	7.2	7.7	8.1
L1	Alkanility	mg.eq/l	4.7	4.5	4.8	4.6	4.4	4.3	4.7	4.3	4.6	4.8
L1	Alkalinity (HCO_3)	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L1	Salinity	g/kg	N.A.	0.050	0.077	0.082	0.068	0.050	0.050	0.050	0.063	0.082
L1	SS	mg/l	38.0	48.0	55.6	21.2	38.0	14.0	63.0	14.0	39.7	63.0
L1	DO	mg/l	N.A.	N.A.	N.A.	N.A.	7.0	5.2	4.6	4.6	5.6	7.0
L1	COD	mg/l	2.9	3.4	9.0	3.0	5.1	12.0	1.2	1.2	5.2	12.0
L1	$BOD_{(5)}$	mg/l	0.9	1.8	6.4	1.6	2.0	9.0	1.0	0.9	3.2	9.0
L1	$NH4^+$	mg/l	0.5	0.6	0.7	1.1	0.1	0.3	0.4	0.1	0.5	1.1
L1	NO_2	mg/l	0.02	0.32	0.07	0.06	0.02	0.17	0.10	0.02	0.11	0.32
L1	NO_3	mg/l	1.2	1.2	3.2	6.0	4.2	3.0	3.5	1.2	3.2	6.0
L1	TP	mg/l	0.19	0.14	0.07	0.02	0.07	0.13	0.02	0.02	0.09	0.19
L1	PO_4	mg/l	0.15	0.10	0.05	0.02	0.05	0.12	0.02	0.02	0.07	0.15
L1	T-Coli	MPN	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L1	F-Coliform	MPN	240,000	210,000	9,300,000	1,400,000	N.A.	240,000	240,000	210,000	1,938,333	9,300,000
L1	F-Streptococci	MPN	14,000	11,000	6,400,000	900,000	N.A.	930	9,300	930	1,222,538	6,400,000

ID	Item	Unit	2004				2005			Min.	Avg.	Max.
			16/Mar	05/May	07/Jul	06/Oct	10/Mar	18/May	13/Jul			
L2	Turbidity		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L2	Water temperature	°C	13.0	17.0	23.0	18.0	10.2	18.0	21.0	10.2	17.2	23.0
L2	pH		7.8	7.5	7.5	7.2	7.1	7.8	7.1	7.1	7.4	7.8
L2	Alkanility	mg.eq/l	4.6	4.8	4.7	4.6	4.9	4.6	4.9	4.6	4.7	4.9
L2	Alkalinity (HCO_3)	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L2	Salinity	g/kg	N.A.	0.077	0.082	0.084	0.081	0.087	0.090	0.077	0.084	0.090
L2	SS	mg/l	154.0	120.0	95.2	62.4	155.0	261.0	60.0	60.0	129.7	261.0
L2	DO	mg/l	N.A.	N.A.	N.A.	N.A.	5.1	1.4	1.1	1.1	2.5	5.1
L2	COD	mg/l	91.8	72.1	147.0	138.0	83.2	131.0	82.0	72.1	106.4	147.0
L2	$BOD_{(5)}$	mg/l	44.8	34.8	58.8	75.0	51.0	95.0	32.0	32.0	55.9	95.0
L2	$NH4^+$	mg/l	10.0	9.0	8.0	13.0	9.2	14.0	16.4	8.0	11.4	16.4
L2	NO_2	mg/l	0.44	0.48	0.36	0.36	0.40	0.36	1.02	0.36	0.49	1.02
L2	NO_3	mg/l	1.0	2.3	0.8	3.0	4.1	1.8	0.3	0.3	1.9	4.1
L2	TP	mg/l	1.21	1.20	1.14	2.23	0.93	4.00	4.30	0.93	2.14	4.30
L2	PO_4	mg/l	0.74	1.00	1.10	2.20	0.90	3.98	4.28	0.74	2.03	4.28
L2	T-Coli	MPN	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L2	F-Coliform	MPN	240,000,000	110,000,000	240,000,000	240,000,000	N.A.	1,100,000	4,600,000	1,100,000	139,283,333	240,000,000
L2	F-Streptococci	MPN	240,000,000	15,000,000	110,000,000	110,000,000	N.A.	9,300	240,000	9,300	79,208,217	240,000,000

ID	Item	Unit	2004				2005			Min.	Avg.	Max.
			16/Mar	05/May	07/Jul	06/Oct	10/Mar	18/May	13/Jul			
L3	Turbidity		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L3	Water temperature	°C	14.0	17.0	21.0	17.0	10.0	18.0	20.0	10.0	16.7	21.0
L3	pH		7.7	7.5	7.5	7.3	7.1	7.8	7.7	7.1	7.5	7.8
L3	Alkanility	mg.eq/l	4.9	4.9	4.9	4.7	4.4	5.0	4.2	4.2	4.7	5.0
L3	Alkalinity (HCO_3)	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L3	Salinity	g/kg	N.A.	0.100	0.106	0.100	0.094	0.100	0.080	0.080	0.097	0.106
L3	SS	mg/l	96.0	128.0	84.0	62.4	61.0	103.0	84.0	61.0	88.3	128.0
L3	DO	mg/l	N.A.	N.A.	N.A.	N.A.	4.0	0.4	0.8	0.4	1.7	4.0
L3	COD	mg/l	100.8	74.6	149.0	147.0	89.6	177.0	83.0	74.6	117.3	177.0
L3	$BOD_{(5)}$	mg/l	58.8	35.2	59.6	95.0	52.0	125.0	21.0	21.0	63.8	125.0
L3	$NH4^+$	mg/l	14.0	10.0	11.0	12.0	13.6	15.2	17.4	10.0	13.3	17.4
L3	NO_2	mg/l	0.38	0.52	0.16	0.12	0.46	0.40	0.76	0.12	0.40	0.76
L3	NO_3	mg/l	1.0	1.5	3.5	3.3	2.0	0.5	1.7	0.5	1.9	3.5
L3	TP	mg/l	2.28	1.83	1.24	2.70	1.60	5.06	3.70	1.24	2.63	5.06
L3	PO_4	mg/l	1.92	1.71	1.20	2.40	1.30	5.02	3.67	1.20	2.46	5.02
L3	T-Coli	MPN	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
L3	F-Coliform	MPN	240,000,000	110,000,000	240,000,000	240,000,000	N.A.	1,100,000	11,000,000	1,100,000	140,350,000	240,000,000
L3	F-Streptococci	MPN	240,000,000	12,000,000	110,000,000	110,000,000	N.A.	11,000	110,000	11,000	78,686,833	240,000,000

Table 4.4.4 Tirana River Water Quality Data, Monitored by IEP (2004 to 2005)

ID	Item	Unit	2004				2005			Min.	Avg.	Max.
			16/Mar	05/May	07/Jul	06/Oct	10/Mar	18/May	13/Jul			
T1	Turbidity		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T1	Water temperature	°C	8.8	13.0	20.0	13.0	6.0	17.0	19.0	6.0	13.8	20.0
T1	pH		7.9	7.9	7.8	7.9	7.5	7.9	7.8	7.5	7.8	7.9
T1	Alkanility	mg.eq/l	3.6	3.5	3.5	3.6	4.0	2.0	3.2	2.0	3.3	4.0
T1	Alkalinity (HCO_3)	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T1	Salinity	g/kg	N.A.	0.052	0.057	0.058	0.049	0.043	0.040	0.040	0.050	0.058
T1	SS	mg/l	54.0	76.0	29.2	10.8	88.0	3.0	99.0	3.0	51.4	99.0
T1	DO	mg/l	N.A.	N.A.	N.A.	N.A.	6.7	5.4	4.6	4.6	5.6	6.7
T1	COD	mg/l	2.2	4.0	0.6	1.8	5.4	1.5	1.2	0.6	2.4	5.4
T1	$BOD_{(5)}$	mg/l	1.2	1.7	0.2	0.4	2.2	1.0	0.5	0.2	1.0	2.2
T1	$NH4^+$	mg/l	0.4	0.1	0.4	1.0	0.1	0.1	0.1	0.1	0.3	1.0
T1	NO_2	mg/l	0.02	0.00	0.02	0.02	0.01	0.01	0.01	0.00	0.01	0.02
T1	NO_3	mg/l	0.8	1.3	3.0	2.0	1.8	1.0	1.7	0.8	1.6	3.0
T1	TP	mg/l	0.11	0.08	0.02	0.13	0.07	0.02	0.02	0.02	0.06	0.13
T1	PO_4	mg/l	0.10	0.07	0.02	0.10	0.05	0.02	0.02	0.02	0.05	0.10
T1	T-Coli	MPN	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T1	F-Coliform	MPN	9,000	1,500	4,300	900	N.A.	460	11,000	460	4,527	11,000
T1	F-Streptococci	MPN	700	700	700	300	N.A.	3	230	3	439	700

ID	Item	Unit	2004				2005			Min.	Avg.	Max.
			16/Mar	05/May	07/Jul	06/Oct	10/Mar	18/May	13/Jul			
T2	Turbidity		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T2	Water temperature	°C	11.0	16.0	23.0	16.0	7.0	18.5	19.5	7.0	15.9	23.0
T2	pH		8.1	7.9	7.8	7.7	7.5	7.9	7.7	7.5	7.8	8.1
T2	Alkanility	mg.eq/l	3.9	4.0	4.4	4.3	4.2	3.6	3.5	3.5	4.0	4.4
T2	Alkalinity (HCO_3)	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T2	Salinity	g/kg	N.A.	0.059	0.140	0.094	0.068	0.068	0.060	0.059	0.082	0.140
T2	SS	mg/l	124.0	56.0	58.0	63.2	46.0	65.0	93.0	46.0	72.2	124.0
T2	DO	mg/l	N.A.	N.A.	N.A.	N.A.	6.5	4.2	3.4	3.4	4.7	6.5
T2	COD	mg/l	9.9	50.1	29.0	53.0	5.8	36.0	20.8	5.8	29.2	53.0
T2	$BOD_{(5)}$	mg/l	6.1	24.0	11.6	31.0	2.3	20.0	16.0	2.3	15.9	31.0
T2	$NH4^+$	mg/l	3.0	5.0	5.0	9.0	1.2	4.6	4.2	1.2	4.6	9.0
T2	NO_2	mg/l	0.12	0.32	1.20	0.68	0.06	0.64	0.83	0.06	0.55	1.20
T2	NO_3	mg/l	1.6	2.8	1.5	3.0	3.0	2.0	1.5	1.5	2.2	3.0
T2	TP	mg/l	0.38	0.49	0.67	0.88	0.18	1.30	0.95	0.18	0.69	1.30
T2	PO_4	mg/l	0.31	0.43	0.65	0.85	0.15	1.22	0.92	0.15	0.65	1.22
T2	T-Coli	MPN	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T2	F-Coliform	MPN	240,000,000	24,000,000	21,000,000	48,000,000	N.A.	1,100,000	11,000,000	1,100,000	57,516,667	240,000,000
T2	F-Streptococci	MPN	24,000,000	4,300,000	4,300,000	9,300,000	N.A.	4,600	460,000	4,600	7,060,767	24,000,000

ID	Item	Unit	2004				2005			Min.	Avg.	Max.
			16/Mar	05/May	07/Jul	06/Oct	10/Mar	18/May	13/Jul			
T3	Turbidity		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T3	Water temperature	°C	12.0	17.0	24.0	17.0	7.2	20.0	20.0	7.2	16.7	24.0
T3	pH		8.1	7.8	7.8	7.4	7.4	7.9	7.7	7.4	7.7	8.1
T3	Alkanility	mg.eq/l	4.0	4.0	4.4	4.1	4.1	4.2	3.7	3.7	4.1	4.4
T3	Alkalinity (HCO_3)	mg/l	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T3	Salinity	g/kg	N.A.	0.018	0.084	0.080	0.068	0.062	0.070	0.018	0.064	0.084
T3	SS	mg/l	60.0	36.0	42.0	50.4	41.0	33.0	114.0	33.0	53.8	114.0
T3	DO	mg/l	N.A.	N.A.	N.A.	N.A.	6.4	3.9	3.0	3.0	4.4	6.4
T3	COD	mg/l	6.4	13.2	48.0	42.0	19.5	43.0	33.9	6.4	29.4	48.0
T3	$BOD_{(5)}$	mg/l	3.9	6.0	19.2	28.0	8.0	28.0	19.0	3.9	16.0	28.0
T3	$NH4^+$	mg/l	1.5	2.8	6.0	11.0	2.4	2.0	6.8	1.5	4.6	11.0
T3	NO_2	mg/l	0.07	0.20	1.65	0.80	0.10	0.80	0.83	0.07	0.64	1.65
T3	NO_3	mg/l	1.4	2.0	1.7	2.5	4.0	1.6	1.6	1.4	2.1	4.0
T3	TP	mg/l	0.36	0.35	0.78	0.99	0.25	2.00	1.25	0.25	0.85	2.00
T3	PO_4	mg/l	0.32	0.30	0.75	0.95	0.22	1.96	1.22	0.22	0.82	1.96
T3	T-Coli	MPN	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
T3	F-Coliform	MPN	110,000,000	110,000,000	15,000,000	110,000,000	N.A.	460,000	4,600,000	460,000	58,343,333	110,000,000
T3	F-Streptococci	MPN	46,000,000	15,000,000	2,800,000	24,000,000	N.A.	4,300	110,000	4,300	14,652,383	46,000,000

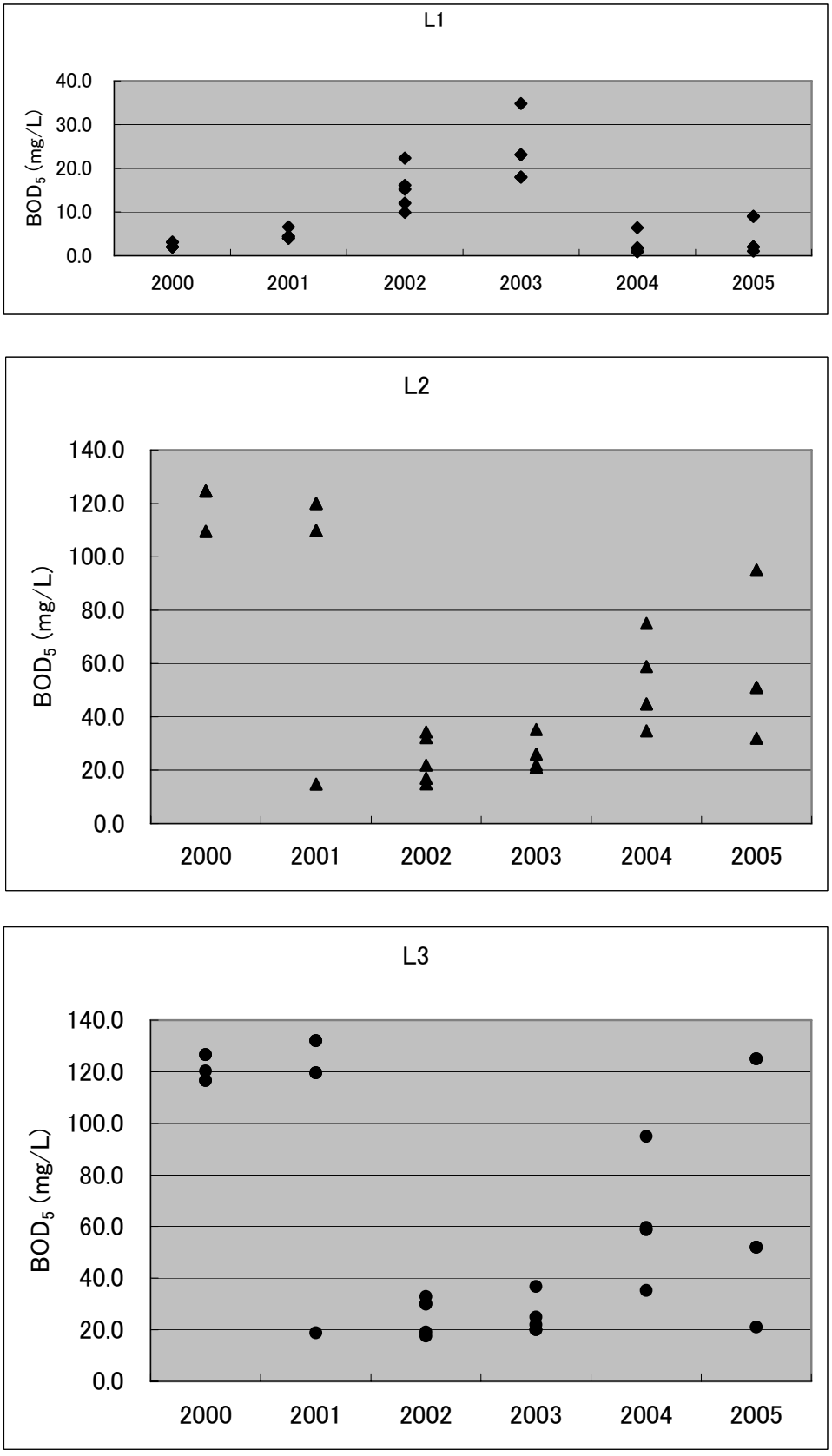


Figure 4.4.2 Existing BOD_5 Data in the Lana River

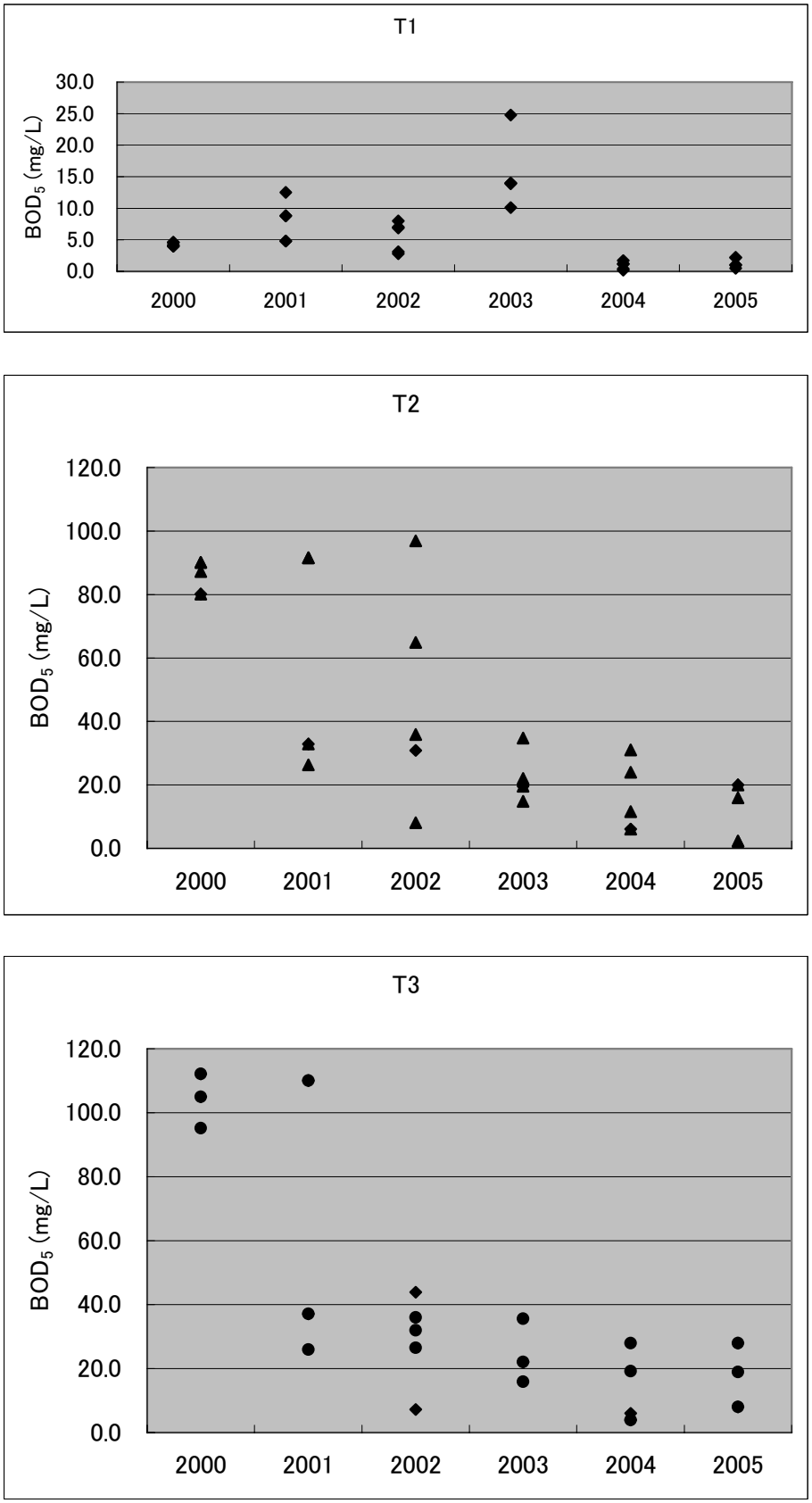


Figure 4.4.3 Existing BOD_5 Data in the Tirana River

(1) Lana River

The data in *Table 4.4.1* and *Table 4.4.3* indicates:

- At the upstream point 'L1', there were three different characteristics in the water quality: first, the BOD_5 concentrations were lower than three mg/L and the MPN (Most Provable Number) of Coliform was very low (data in 2000,2004, and 2005); second, the BOD_5 concentrations were higher than 10 mg/L and the MPN of Coliform were high, but the inorganic nitrogen concentrations were lower than one mg/L (data in 2001 and 2002); third, the BOD_5 concentrations were higher than 18 mg/L, the maximum concentration was 35 mg/L and the inorganic nitrogen concentrations were high as 4 to 6 mg/L, but the MPN of Coliform were low (data in 2003).
- At 'L2' the middle reach of the Lana River, the MPN of Coliform was high in all samples, the BOD_5 concentrations were varied in a range of 20 mg/L to 120 mg/L, those were higher than 50 mg/L in 7 samples out of 21 samples in 2000, 2001, 2004, and 2005, but those were lower than 35 mg/L in all samples in 2002 and 2003. The ammonium nitrogen concentrations were high during 2003 and 2005, in particular in 2003 they were five to ten times as high as those between 2000 and 2002 even though the parameters of BOD_5 and Coliform were remained at the same magnitude.
- At 'L3' the low reach of the Lana River, the MPN of Coliform was high in all samples, the BOD_5 concentrations were varied in a range of 20 mg/L to 132 mg/L, those were higher than 50 mg/L in 10 samples out of 21 samples in 2000, 2001, 2004, and 2005, but those were lower than 37 mg/L in 2002 ad 2003. The ammonium nitrogen concentrations were high in 2003, 2004 and 2005, in particular in 2003 they were five to ten times higher than those in 2000, 2001 and 2002 even though the parameters of BOD_5 and Coliform were remained at the same magnitude.

Based on the above, a pollution level of the Lana River could be summarized but there are some results uncertain or hard to explain as follows:

A series of reconnaissance surveys on the upper area of the point "L1" were conducted but did not identify any specific water pollution sources other than natural sources. The upper area of the point "L1" is a hillside where trees including olive are planted and small number of goats is pastured. The survey results could help understand that the water quality should be in good conditions: the BOD_5 concentrations were lower than 2 mg/L in five out of seven samples in 2004 and 2005. But questions remain why the high BOD_5 concentrations were recorded and why different results were revealed in the MPN of Coliform and the inorganic nitrogen concentrations even though the BOD_5 concentrations were high. In a case that the inorganic nitrogen concentrations were high as 4 to 6 mg/L but the MPN of Coliform were low, it could be explained by a discharge of some inorganic compounds such as industrial wastewater or agrichemicals. However, in another case that the MPN of Coliform was high but inorganic nitrogen concentrations were low in 2002 and 2003 it would be difficult to explain why only inorganic nitrogen concentrations were low.

In the middle and low reaches of the Lana River, the river water were deteriorated by the human wastes and other wastewaters: the high values in the MPN of Coliform indicated the water was polluted heavily by a discharge of human waste (night soil), the variations in BOD_5 concentration indicated that the water was heavily polluted between 2000 and 20001, then improved well during 2002 and 2003, but deteriorated again during 2004 and 2005. But questions remain why very high ammonia nitrogen concentrations were measured in 2003 even though the parameters of BOD_5 and Coliform were remained at the same magnitude. It could be explained by a discharge of some inorganic compounds such as industrial wastewater or agrichemicals. However such kind of information was not available during our study.

(2) Tirana River

The data in *Table 4.4.2* and *Table 4.4.4* indicates:

- At the upstream point "T1", from 2000 to 2003, the BOD_5 concentrations in almost all of samples were over 3 mg/L and the maximum values in each year were 10 mg/L in 2001, 8 mg/L in 2002, and 25 mg/L in 2003. The ammonium nitrogen (NH_4^+-N) indicated that the concentrations were lower than 0.5 mg/L in 2000, 2001 and 2002 but increased to 5.8 mg/L in 2003 and the inorganic nitrogen were lower than 0.8 mg/L in 9 samples out of 11 samples in 2000, 2001 and 2002 but increased to 16.5 mg/L in 2003. However, in 2004 and 2005, the BOD_5 concentrations were decreased between 0.1 and 2.2 mg/L and half of samples were less than 1.0 mg/L and the ammonium nitrogen concentrations were also decreased to lower than 1.0 mg/L (more than half samples were about 0.1 mg/L).
- At 'T2' and 'T3' the middle reach of the Tirana River, the BOD_5 concentrations were higher than 80 mg/L in 2000, but in 2001 and 2002 the BOD_5 concentrations were varied between 8.1 and 96.9 mg/L at T2 in 2001 and 2002 and between 26.0 and 110.0 mg/L at T3 in 2001. The BOD_5 concentrations were lower than 34.8 mg/L at T2 from 2003 to 2005 and lower than 43.9 mg/L at T3 from 2002 to 2005. The ammonium nitrogen concentrations were high in 2003 both at T2 and T3. The Coliform were generally very high as 10^5 to 10^8 MPN/100mL.

Based on the above, a pollution level of the Tirana River could be summarized but there are some results uncertain or hard to explain as follows:

In the upper reach of the Tirana River, the BOD_5 concentrations indicated the water were polluted gradually between 2000 and 2003 but drastically improved during 2004 and 2005. A series of reconnaissance surveys on the Tirana River upper basin identified no pollution sources of agricultural and human wastes other than natural sources because the basin area was mountainside. The survey results could explain the good water quality results in 2004 and 2005 by considering the major pollution sources are natural ones. But questions remain why the high concentrations were recorded for the BOD_5 from 2000 to 2003 and ammonia nitrogen in 2003, respectively. These high concentrations could be explained by a discharge of human wastes and/or industrial wastewater and agrichemicals but no

information on such discharge was available during our study.

In the middle reaches of the Tirana River, the river water was polluted by the human wastes and other wastewaters. The BOD_5 concentrations indicated organic pollution was serious during 2000 and 2002 and improved during 2003 and 2005. But questions remain why the BOD_5 concentrations were varied at T2 during 2002 and at T3 in 2001 even though the locations of T2 and T3 are closed and why the ammonium nitrogen concentrations were increased in 2003 when the BOD_5 concentrations were decreased.

4.4.2 Water Quality Survey Conducted by JICA Study Team

Water quality testing was undertaken on 30 November 2005 (dry weather) and 6 December 2005 (wet weather). This sampling work was carried out by a local NGO. The samples were analyzed at the laboratory of the Institute Public Health.

The locations for sampling are selected in order to comprehend:

- the current water quality in the rivers in the study area;
- quality of raw sewage; and
- the impacts of the nearby industrial areas.

The sites were selected with consideration of the accessibility of the site. *Table 4.4.5* summarizes the sampling points used in the survey.

Table 4.4.5 Sampling Locations and Sample Numbers

Sampling Location			Sample Number
1. Six (8) locations along the river			
Upper stream, confluent, and downstream of the outfalls to the rivers	R1	One (1) location at the upstream area of Lana River. (same location as the 1st sampling point of Lana River monitored by the Institute of Environment)	2 (1 location × 1 sample × 2 events)
	R2	One (1) location at the upstream of the sewage inflowing point in Lana River. (near Shyqyri Ishimi Street along Lana River)	2 (1 location × 1 sample × 2 events)
	R3	One (1) location at the upstream of Tirana River. (same location as the 1st sampling point of Tirana River monitored by the Institute of Environment)	2 (1 location × 1 sample × 2 events)
	R4	One (1) location in Tirana River, at the upstream of the confluence point of Lana River and Tirana River.	2 (1 location × 1 sample × 2 events)
	R5	One (1) location in Lana River, at the upstream of the confluence point of Lana River and Tirana River.	2 (1 location × 1 sample × 2 events)
	R6	One (1) location at the downstream of the proposed sewage treatment plant.	2 (1 location × 1 sample × 2 events)
Upstream and downstream of	F1	One (1) point at the upstream of industrial area in Lana River. (Same location as the 2nd sampling point of Lana River monitored by the Institute of Environment)	2 (1 location × 1 sample × 2 events)

industrial area	F2	One (1) point at the downstream of industrial area in Lana River.(Near the crossing of railway and Lana River, just after the discharging point of Stera Beer Factory)	2 (1 location × 1 sample × 2 events)
Sub-Total		8 locations	16 samples
2. Two locations in the existing combined sewers			
Influent wastewater quality to propose sewage treatment plant	S1	One (1) location at the sewage discharging point. (near Shyqyri Ishimi Street along Lana River)	2 (1 location × 1 sample × 2 events)
	S2	One (1) location at the sewage discharging point of Tirana Interceptor.	2 (1 location × 1 sample × 2 events)
Sub-Total		2 locations	4 samples
3. Total		10 locations	20 samples

Source: JICA Study Team

The water quality survey results are summarized in *Table 4.4.6*. *Table 4.4.6* showed that the BOD_5 concentration in the Lana River ranged from approximately 10 mg/L in upstream to 60 mg/L at the urban center. The BOD_5 concentration in the Tirana River ranged from approximately 10 mg/L in upstream to 50 mg/L at the urban center. At the confluence of the two rivers, the BOD_5 concentration reached approximately 60 mg/L.

The BOD_5 data reveal a wide range of concentrations at each sampling point. The data however indicated that pollution levels increase as the river progresses down stream. The data also show that levels of NH_4^+-N and Fecal Coliform increase in a downstream direction. The higher concentrations of BOD_5, NH_4^+-N, and Fecal Coliform, indicating sewage and fecal pollution, suggest that the water of the Lana River and Tirana River is polluted by the direct discharge of sewage generated from households and commercial activities.

A comparison of the BOD_5 concentrations measured either side of an industrial area, revealed some influence of industrial wastewater pollution, namely, 45 mg/L before industrial area (F1) and 62 mg/L after (F2). Some BOD_5 data at 'L2' and 'L3' in the *Table 4.4.3* also demonstrate such influence indicating higher BOD_5 concentration at 'L3', namely, samples of 16th March and 6th October in 2004 and of 18th May in 2005.

Table 4.4.7 presents the water quality data of samples (S1 and S2) taken at the outflows from the existing interceptor sewers. Compared with the sewage characteristics in the reference, the followings are identified:

- each sample of S2 discharged to the Tirana River shows that the water quality parameters have the same magnitude of weak raw sewage;
- each sample of S1 discharged to the Lana River shows that the BOD_5 and COD concentrations are the same as that of the weak sewage but also shows that concentrations of NH_4^+-N, T-N, and T-P, are two to three times higher than the reference values; and
- both samples (S1 and S2) show higher MPN values in Total Coliform than reference value, in

particular the S1.

Table 4.4.6 Result of Water Quality Survey by the JICA Study Team

Result of Water Quality Analysis (Sampled on 30th November, 2005)											
No.	Parameter	Tirana River				Lana River					
		R3	S2	R4	R6	R1	R2	S1	F1	F2	R5
		upstream	raw sewage	before conjunction	after proposed STP	upstream	before urban area	raw sewage	before factory area	after factory area	before conjunction
1	pH	7.8	7.2	7.4	7.8	7.6	7.6	7.8	7.6	7.4	7.6
2	Water Temp (℃)	9.3	15.6	11.0	11.5	11.0	11.0	14.5	12.6	11.6	12.4
3	Color (Hazen)	20	40	30	30	20	30	50	30	40	20
4	BOD_5 (mg/L)	12.8	70.0	46.2	53.1	10.2	20.2	87.0	45.3	62.3	63.6
5	COD (mg/L)	32.0	161.3	110.8	138.1	22.4	46.4	183.7	113.2	179.8	184.4
6	NH_4^+-N (mg/L)	0.2	8.1	2.0	2.9	0.5	3.4	24.8	6.8	21.9	19.7
7	T-N (mg/L)	0.66	19.63	3.50	14.64	1.85	8.11	47.24	18.34	40.19	31.24
8	T-P (mg/L)	0.14	6.50	0.30	3.75	0.25	0.42	18.25	10.50	32.00	6.75
9	Total Residuals (mg/L)	200	254	215	275	210	240	355	255	256	260
10	Total Coliform (MPN/100mL)	29,000	65,000,000	252,000	277,000	100,000	328,000	216,000,000	29,200,000	328,000	2,770,000
11	Fecal Coliform (MPN/100mL)	7,000	37,000,000	190,000	192,000	63,000	202,000	205,000,000	23,400,000	202,000	1,260,000
Sampled at:		8:45	11:40	12:55	14:15	9:35	10:00	10:15	10:40	13:25	12:40
Remarks			The sewage smell, garbage on the vicinity	Garbage on the vicinity	Garbage on the vicinity			The sewage smell	Film on the surface, fecal particules, sewage smell, garbage on the vicinity of the river		

Result of Water Quality Analysis (Sampled on 6th December, 2005)											
No.	Parameter	Tirana River				Lana River					
		R3	S2	R4	R6	R1	R2	S1	F1	F2	R5
		upstream	raw sewage	before conjunction	after proposed STP	upstream	before urban area	raw sewage	before factory area	after factory area	before conjunction
1	pH	7.6	7.2	7.6	7.6	7.6	7.6	7.8	7.6	7.6	7.6
2	Water Temp (℃)	11.5	15.6	12.5	13.0	12.0	12.0	14.5	12.0	13.5	13.0
3	Color (Hazen)	0	40	40	40	0	20	70	100	70	40
4	BOD_5 (mg/L)	8.1	76.3	47.8	59.7	9.6	24.0	96.0	49.7	56.2	58.4
5	COD (mg/L)	17.6	186.9	111.4	157.6	21.1	56.2	211.2	134.2	151.7	161.7
6	NH_4^+-N (mg/L)	0.2	4.2	3.0	4.8	0.2	3.2	37.1	2.6	23.9	0.8
7	T-N (mg/L)	0.64	15.44	4.85	15.99	1.12	6.42	49.07	16.27	57.43	8.61
8	T-P (mg/L)	0.39	2.14	2.51	1.99	1.08	1.96	13.75	1.49	16.25	12.25
9	Total Residuals (mg/L)	264	356	504	300	320	257	368	502	355	340
10	Total Coliform (MPN/100mL)	5,400	22,000,000	1,300,000	8,000,000	200,000	3,600,000	630,000,000	12,000,000	8,600,000	4,200,000
11	Fecal Coliform (MPN/100mL)	300	14,000,000	650,000	5,200,000	68,000	1,600,000	182,000,000	2,200,000	4,500,000	3,600,000
Sampled at:		9:00	10:30	12:30	13:40	9:30	10:00	10:10	14:25	13:00	12:20
Remarks			The sewage smell, garbage on the vicinity	Garbage on the vicinity	Garbage on the vicinity			The sewage smell	Film on the surface, fecal particules, sewage smell, garbage on the vicinity of the river		

Source: JICA Study Team

As it is discussed in Chapter 9, the design BOD_5 concentration of raw sewage is estimated and set at 200 mg/L based on the unit pollution load and the average sewage flow to the sewerage system, that is,

40g/capita/day and 200 liter/capita/day in 2005 (at present) and 50g/capita/day and 250 liter/capita/day in 2022 (target year). Therefore, the BOD_5 concentrations of samples of S1 and S2 are expected as high as 150 to 200 mg/L. But the results of samples of S1 and S2 show lower concentrations. One of possible reasons might be some influence by rain water (run-off water) into the interceptors, that is, the samples are diluted by the inflow of rainwater. The samples were taken at the beginning of the rainy season. The first sampling events were carried out under the dry weather (fine weather) condition and the second sampling events were carried out under the wet weather (rain weather) condition. But the results indicating no big difference in BOD_5 concentrations may not give any reasonable explanations why the results of samples of S1 and S2 show weak sewage strength.

Table 4.4.7 Water Quality of Samples Taken as Raw Sewage

Parameter	Lana River (2 Samples)	Tirana River (2 Samples)	Reference*	
			Concentration, Weak strength	Concentration, Medium strength
BOD_5 (mg/L)	87 and 96	70 and 76	110	220
COD (mg/L)	184 and 211	161 and 187	250	500
NH_4^+-N (mg/L)	25 and 37	4 and 8	12	25
Total Nitrogen (mg/L)	47 and 49	15 and 20	20	40
Total Phosphorus (mg/L)	14 and 18	2 and 7	4	8
Total Coliform (1,000,000 MPN/100ML)	216 and 630	22 and 65	1～10	10～100
Fecal Coliform (1,000,000 MPN/100ML)	182 and 205	14 and 37	Not available	Not available

Source: *:Wastewater Engineering, Treatment, Disposal and Reuse, Third Edition. Metcalf & Eddy, Inc.

The BOD_5 concentrations in the middle reaches of the Lana and Tirana River ranged from 50 mg/L to 60 mg/L. These high BOD_5 concentrations indicate that the water quality in the middle and lower part of the Lana and Tirana River is almost same as that of the samples of interceptors (S1 and S2).

The samples taken at S1 may contain other water sources other than domestic sewage, such as wastewater from industries and markets including slaughterhouses because of high T-N and T-P concentrations.

4.4.3 Current BOD_5 Concentrations Used for the Future Water Quality Projection

The sewerage system development for the Greater Tirana area is expected to contribute the water quality improvements in the Lana River and the Tirana River as well as the improvement in the better living and sanitary environment. The effects of the sewerage system development on the water quality improvement for both rivers will be evaluated with the BOD_5 concentrations at several points of both rivers in the Greater Tirana area.

The effects of water quality improvements (as expressed in decreasing in BOD_5 concentrations) will be

examined in case of low flow rate conditions when the flow rates not exceeding a value: i.e. 25% minimum daily flow data. Under these low flow rate cases, in which the organic loads reaching the points where water quality measured are normal, the BOD_5 concentration would show high level. Such high level of BOD_5 concentrations would be selected among the existing and available data as a representative showing present conditions at low flow rates.

In the section 4.4.1, it was identified that a wide range of BOD_5 concentrations every year at different sampling locations as shown in *Figure 4.4.2* and *Figure 4.4.3*. It seems difficult to select data for the appropriate BOD_5 concentrations representing the present water quality. Because any supplemental data were not available for determine the appropriate BOD_5, for example, river flow rate data, weather conditions and sampling time when the samples were taken.

As it was noted that some data indicated that the Lana River and the Tirana River were polluted by other than domestic sewage, but it could be assumed that the major pollution sources would be domestic sewage in the Study area. The river water polluted by a domestic sewage (human wastes) would contain high values in BOD_5, NH_4^+-N, and Coliform among the quality parameters measured. The BOD_5 and NH_4^+-N concentrations are plotted for each reference point along Lana River and Tirana River, respectively as shown in *Figure 4.4.4* and *Figure 4.4.5*. Generally, the higher BOD_5 concentration is and the higher NH_4^+-N concentration is. Some data (BOD_5 concentration is lower than 40 mg/L but NH_4^+-N concentration is higher than 20 mg/L) may indicate other pollution sources other than domestic sewage, such as industrial wastewater. Some data (BOD_5 concentration is higher than 100 mg/L but NH_4^+-N concentration is lower than 5 mg/L) shows an unbalanced relationship compared to other data. The different characteristics could be found out in the data collected during 2000 and 2003. Therefore, the data collected during 2004 and 2005 will be used for the selection of representatives of current BOD_5 concentrations under the low flow conditions.

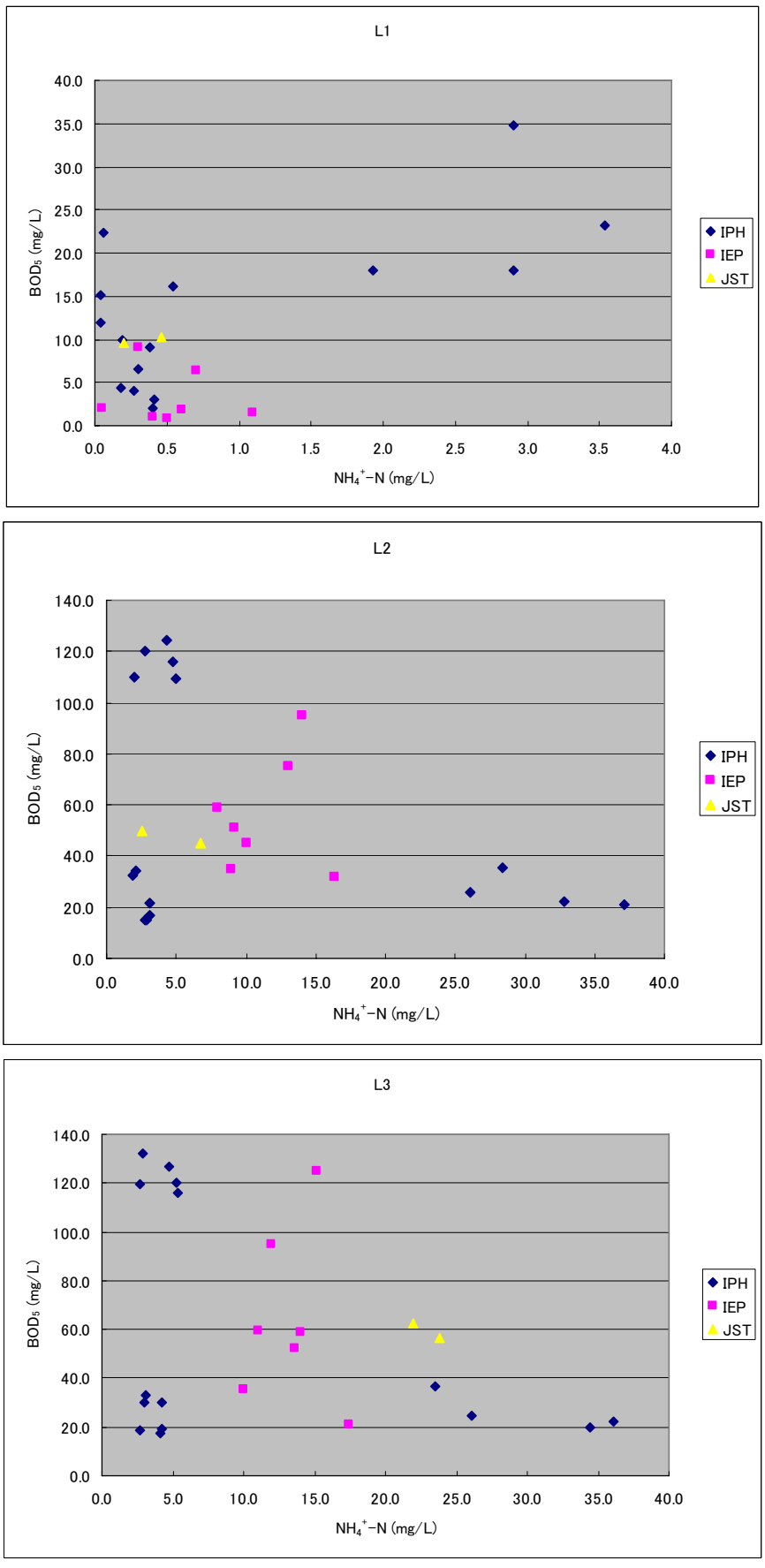


Figure 4.4.4 Relationship between BOD_5 and NH_4^+-N in the Lana River

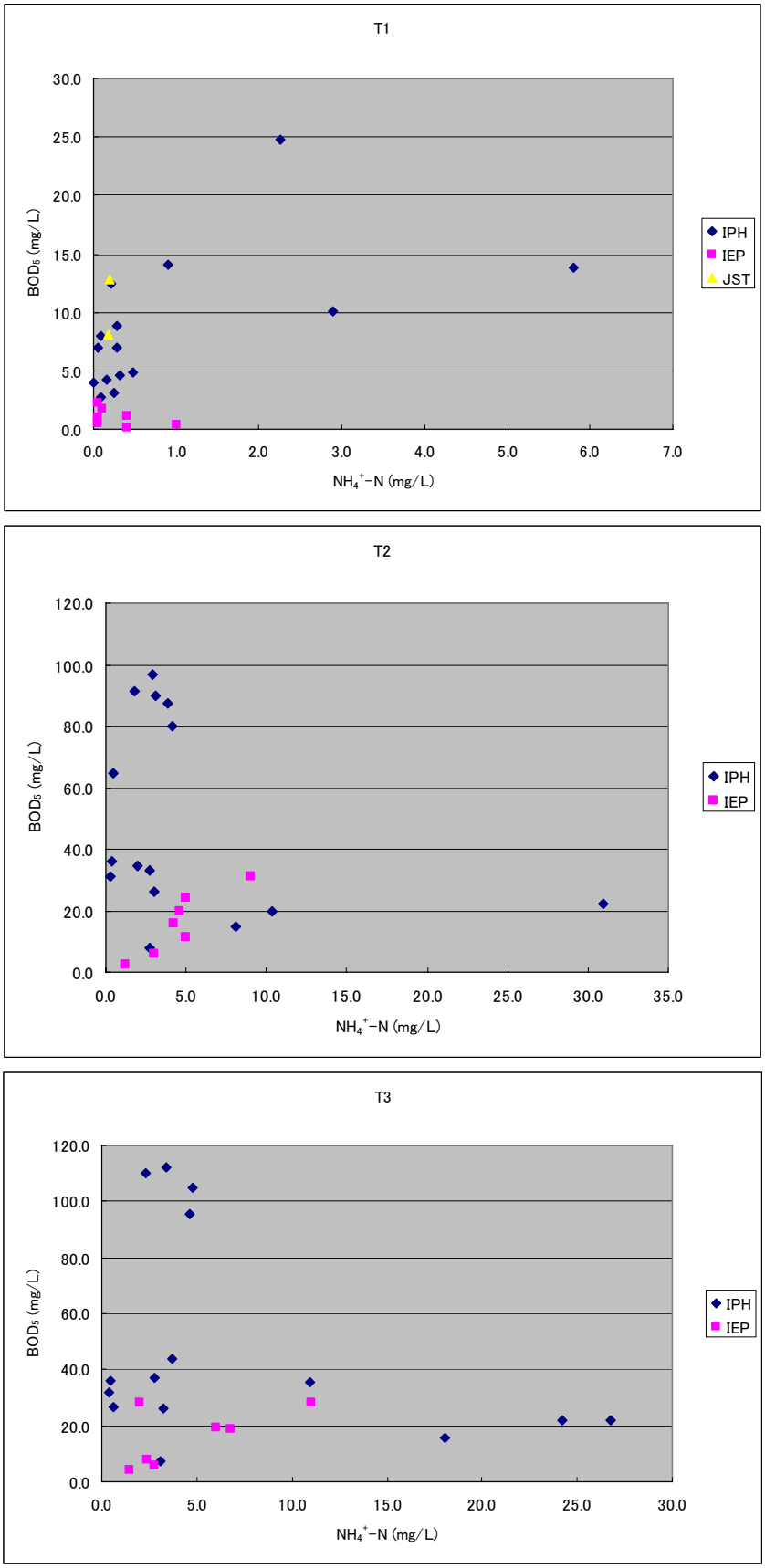


Figure 4.4.5 Relationship between BOD_5 and NH_4^+-N in the Tirana River

Table 4.4.8 present the selected BOD_5 concentration at each point in the Study area which will be used as the present water quality.

Table 4.4.8 Selected Present BOD_5 Concentrations at the Sampling Points

Sampleing Point	River (Reaches in the Study Area)	BOD_5 Concentration as the present water quality	Remarks
L1	Lana River, Upper	4.0 mg/L	Considering no human and industrial pollution sources were identified by field reconnaissances on tributary area, the average conceoncetration of data collected during dry season is applied. Data used: May, Jul, and Oct in 2004, and May and July in 2005 shown in Table 4.4.3.
L2	Lana River, Middle	95.0 mg/L	Because the water at low flow conditions would be polluted by the sewage, the data during dry season and highest concentration is selected for representing current pollution situation. Data used: May in 2005 shown in Table 4.4.3.
L3	Lana River, Low	125.0 mg/L	The higest cocentration data is selected because of the same reasons above. Data used: May in 2005 shown in Table 4.4.3.
T1	Tirana River, Upper	1.5 mg/L	Considering no pollution sources were identified by a field reconnaissances on tributary area, an average of 1.5 mg/L of 4 data between 1.0 and 2.2 mg/L is applied. Data used: March and May in 2004 and March and May in 2005 shown in Table 4.4.4.
T2 and T3	Tirana River, Middle	31.0 mg/L	The higest concentration of 31 mg/L at T2 on October 6 in 2004 was selected among the data collected at T2 and T3 locations. Data used: October in 2004 shown in Table 4.4.4.
R6 (Downstream of an effluent discharge point proposed for Berxulle STP)	Tirana River, Low	53.0 mg/L	Since there are no existng data, the data collected at dry weather condition by the JICA water quality survey was used. Refer to Table 4.4.6. The result of sample at R6 collected on 30th November, 2005.

Source: JICA Study Team

CHAPTER 5

EXISTING SEWERAGE SYSTEM

CHAPTER 5 EXISTING SEWERAGE SYSTEM

5.1 General

This chapter describes findings on the existing sewerage/drainage system in the Study area.

5.2 Existing Sewerage System and Drainage System

5.2.1 Existing Sewer Service Area

Figure 5.2.1 shows that existing sewers cover approximately 90% of Tirana municipality. In Kamza municipality, only a limited area in the city center is covered by the existing sewer/drainage system as shown in *Figure 5.2.2*.

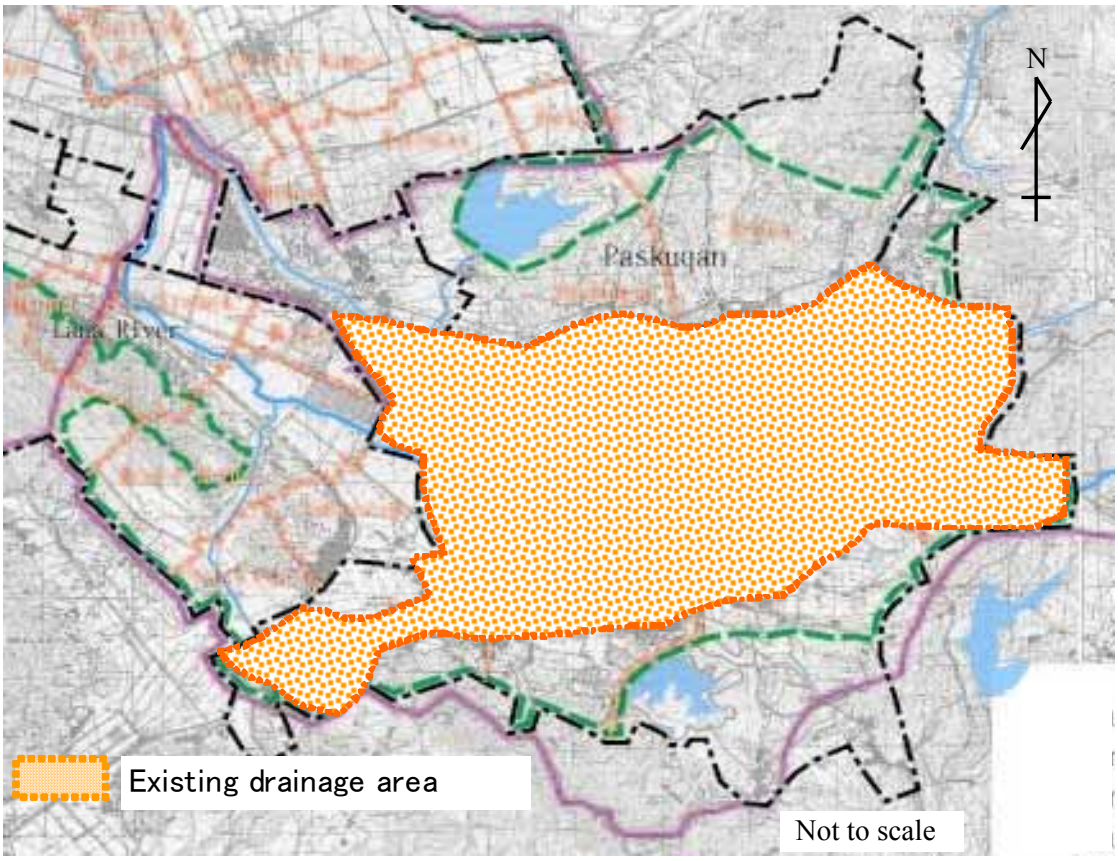


Figure 5.2.1 Existing Sewer Service Area in Tirana Municipality

Figure 5.2.2 Existing Sewer in Kamza Municipality

5.2.2 Sewer/Drainage Networks and Discharge Points

The JICA study team identified many discharge points along the Lana River that were not registered on the facility map. These points are shown in *Figure 5.2.3*. Five discharge points were found along the Tirana River in the Tirana municipality, as shown in *Figure 5.2.4*. Only three discharge points are officially registered on the facility map.

Figure 5.2.5 shows the three discharge points along the Tirana River within Kamza municipality.

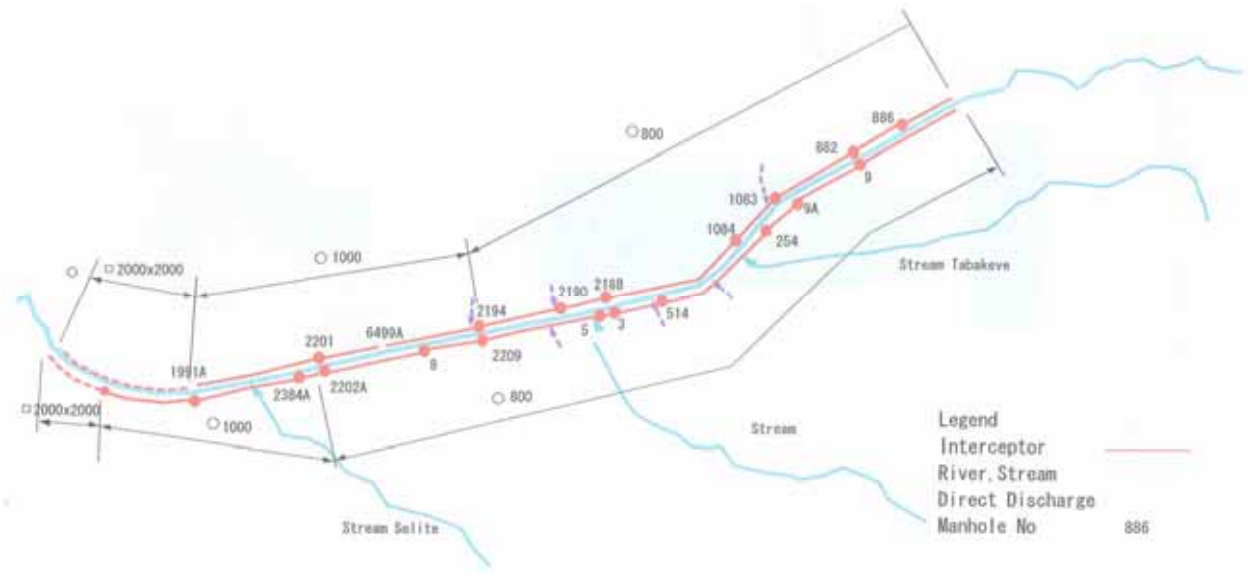


Figure 5.2.3 Discharge Points along the Lana River

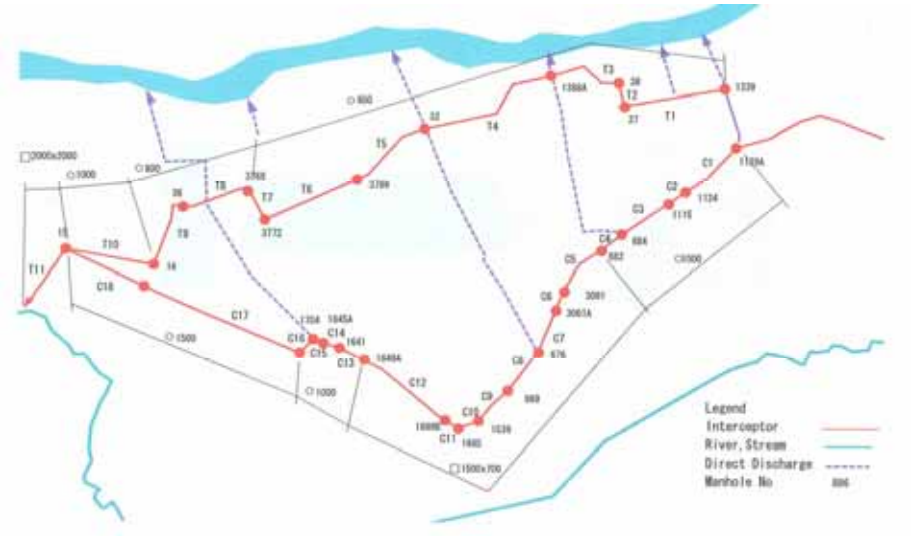


Figure 5.2.4 Discharge Points along the Tirana River

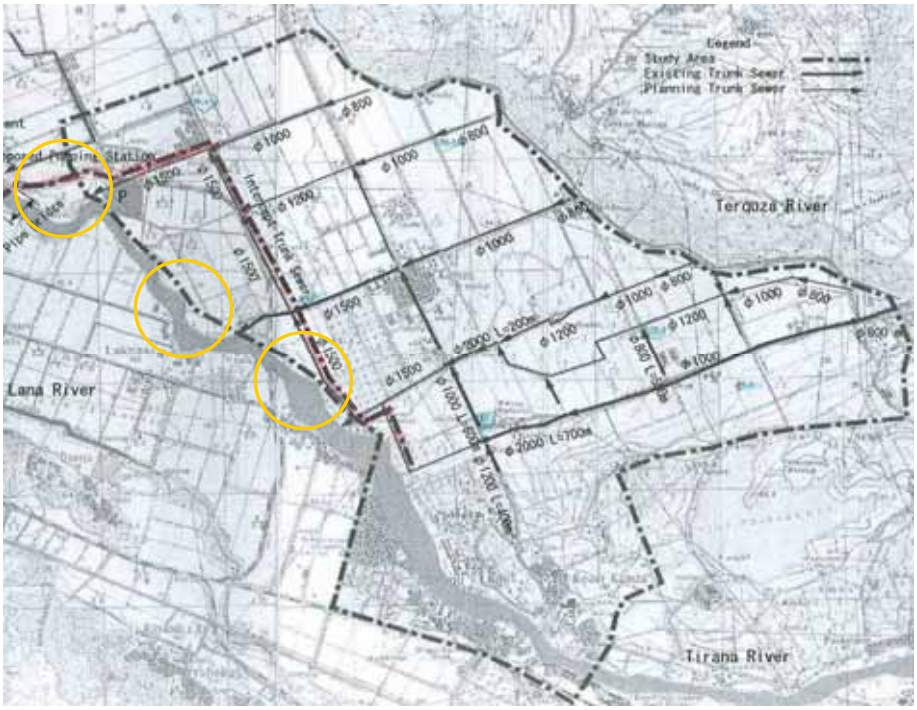


Figure 5.2.5 Discharge Points along the Tirana River from Kamza Municipality

5.2.3 Interceptors and Discharge Structure

There is no available information relating to the structure of the existing interceptors or discharging facilities. Therefore, a field survey was undertaken to identify the locations of these facilities and their functions. *Figure 5.2.6* shows the Lana North Interceptor discharge point, which is a 2.0m × 2.0m culvert. Half of the culvert structure is located under the river water surface even during dry weather conditions. On the opposite side of the river, the Lana South interceptor discharge is completely under the river water surface in dry weather conditions.

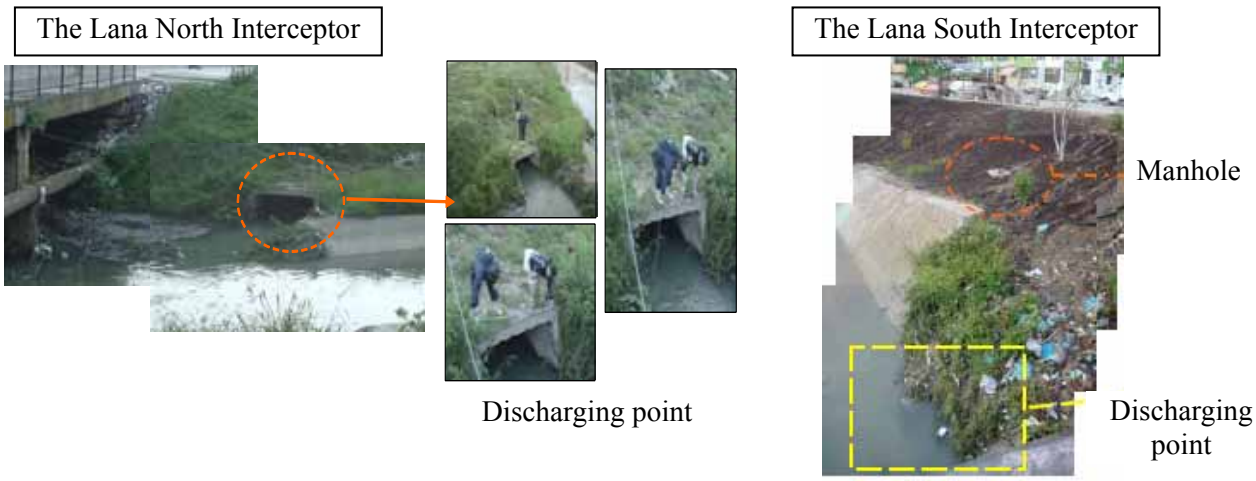


Figure 5.2.6 Weirs and Discharge Facilities at the Lana North and the Lana South Interceptors

5.3 Current Conditions

5.3.1 Flooding

It was reported that inundation had been often occurred in Tirana Municipality, and the highest water level was especially seen at the bridge at the discharging points of Lana North Interceptor and the Lana South Interceptor.

However, there are no official flooding records. Therefore the study team undertook an interview survey to gather flooding information. This survey revealed that no significant flooding has occurred over the last 50 years. Local flooding may occur due to the inadequate capacity of the existing drainage/sewers during heavy rain events or due to inadequate drainage/sewer system maintenance. There are many shops and business located along the Lana River. Many of these have semi-basements as shown in *Figure 5.3.1*.

Figure 5.3.1 Shops in the Buildings alongside of the Lana River

During the site visit, the study team noted that mud has accumulated beneath the bridge that crosses the

Lana River where the Lana North and Lana South interceptors meet. This can be seen in *Figure 5.3.2*. During wet weather conditions, the water level rises to the top of the culvert, but recedes quickly. *Figure 5.3.3* shows the high water level observed after a period of 10 consecutive days with significant rainfall (February to March 2006).

Figure 5.3.2 Mud Accumulated under Bridge at the Lana River

Figure 5.3.3 High Water Level at the Lana River after Significant Rainfall (Photograph taken on March 2nd 2006)

5.3.2 Physical Condition of Sewer/Drainage System

The existing sewer/drainage facilities were constructed in the 1960s. It seems that most of the existing facilities are in poor condition. The Italian Cooperation carried out an investigation in "Mihal Duri" Tirana area which reported the following:

- Residual inert material and sedimentary material is being discharged from building sites. Main and primary sewers are blocked;
- Manholes are blocked resulting in sewage overflows;
- Under-sized interceptors;
- Construction of buildings over the existing sewer network limits access for maintenance;
- Discharge points in the Lana and Tirana Rivers are obstructed by solid waste causing pressure along the up-hill network; and
- Unsuitable materials were used to construct the interceptors.

The registered map has been updated by adding new items onto the original map. Longitudinal

drawings were archived but structural drawings were not stored.

The Longitudinal drawings indicate that the pipes are connected but the slopes do not seem to be correct. *Figure 5.3.4* shows a plan where sewers are connected and divided at many points. It is difficult to determine the direction of sewage flow and the catchment areas for the sewers, using these plans.

Figure 5.3.4(a) Example of a Sewer Loop Network and Flow Directions

Figure 5.3.4(b) Example of a Sewer Network in the Central Area and Flow Directions

5.3.3 Hydraulic Capacity of Sewer/Drainage System

(1) Municipality of Tirana

The exiting interceptors are outlined in *Table 5.3.1*. These interceptors have excess capacity in dry weather conditions, however they are inadequate to carry both sewage and rainwater flows during wet weather conditions.

Table 5.3.1 Outline of Existing Interceptors

Interceptor	Diameter (m)	Covering Area
Lana north interceptor	ϕ 0.8 –□2.5 × 2.5	North of the Lana River
Lana south interceptor	ϕ 0.8 –□2.5 × 2.5	South of the Lana River
Tirana interceptor	ϕ 0.6 –□1.4 × 1.4	Southern part of the Tirana River
Dibres interceptor	ϕ 0.6 – ϕ 1.0	Central part of the Tirana city

(2) Kashar Commune

There are some existing pipes and watercourses that carry sewage and rainwater flows in residential areas. Drainage systems along the Rruga e Durresit have been used for agriculture. The latest development plan proposes to enclose most drains. Sewage flowing in these drains will be discharged directly into the Lana River. This drainage system has the capacity to carry sewage flows, but does not have sufficient capacity to carry the rainwater flows.

(3) Kamza Municipality, including Paskuqan Commune

There are many drainage structures installed for agricultural purposes. The drainage channels do not have adequate capacity to receive the rainwater, therefore, local flooding sometimes occur.

5.3.4 Other Findings

(1) Rivers and streams used as open sewer/drainage

Some small rivers and streams are used as drainage conduits for wastewater and sewage. These discharge into the Lana River as shown in *Figure 5.3.5*.

Figure 5.3.5 Small Rivers and Streams Used as Open Sewer/Drainage Channels

(2) Agricultural channels/watercourses

Figure 5.3.6 shows that there are numerous agricultural channels / watercourses that are not in use. Channels / watercourses within the industrial area of the Kashar Commune are covered with prefabricated concrete slabs that cover the conduit and are used as roadways. In the residential area of Kamza municipality channels / watercourses are not maintained. Based on the current sewerage plan, approximately 10 km of sewers (of diameters between 600mm to 1500mm) are being used to carry sewage and rainwater directly to the Tirana River without treatment.

In Tirana municipality, there are some streams (used as agricultural channels) and watercourses originating in the hills, which flow through residential areas and/or industrial areas and discharge into the Lana River.

If agricultural channels/watercourses are to be used as stormwater drainage facilities between the Lana River and the Tirana River, it will be necessary to investigate the direction, capacity and durability of the system. Then, suitable facilities can be selected. As these agricultural channels/watercourses belong to the Ministry of Agriculture, permission/agreement will be required to use them as stormwater drainage facilities.

Figure 5.3.6 Existing Channels and/or Watercourses

(3) Surface rights

An interview survey was conducted to counterpart members and consulting engineers to know surface rights, the following information was obtained:

- Municipality has the surface rights; and
- Any plan or design should be submitted to the municipality (commune) council for discussion, changes and amendments shall be agreed. The municipality can then give approval.

CHAPTER 6

EXISTING INSTITUTIONAL AND LEGAL FRAMEWORK AND ORGANIZATION

CHAPTER 6 EXISTING INSTITUTIONAL AND LEGAL FRAMEWORK AND ORGANIZATION

6.1 General

This chapter sets out the principle central government institutions, major items of legislation, the municipalities and communes comprising Greater Tirana, other related institutions and the organizations of the operators within the water supply and sewerage sector.

In recent years the water sector has been the subject of extensive reform which is still on-going. The heart of the reform is the Decentralization Policy of the GoA which is in the process of transferring the responsibility for the provision of water supply and sewerage services to Local Government.

Several such transfers have already been made and in some cases private sector participation has been introduced with donor funding. However, at this point in time, the Water Supply & Sewerage Enterprise of Tirana (UKT) remains under the control of central government through the General Directorate of Water Supply & Sewerage (DPUK) of the Ministry of Public Works, Transport & Telecommunications (MoPWTT).

6.2 Decentralization

The policy of decentralization is enshrined in the 1998 Constitution, Article 13 of which states:

"Local government in Albania is founded upon the basis of the principle of decentralization of power and is exercised according to the principal of local autonomy."

The new government elected into office in July 2005 is committed to an accelerated decentralization reform of the executive in full compliance with the European Charter on Local and Regional Autonomy, in partnership with local government and other interested parties.

The decentralization reform in the water supply and sewerage sector is linked with local government reform, through the transfer of authority from central to local government of several public services. Law No. 8652 (2000) "On the Organization and Functions of Local Government" establishes the responsibility of local government for the provision of public services, including water supply and sewerage, and enables the transfer of state property to local government, creating the platform for reform.

From 1992, laws have been enacted to transform state owned companies into self financing commercial companies with 100% state owned shares; to facilitate privatization of State Owned Companies (SOC); and to allow water companies to convert to commercially operated utilities owned by local government and to allow private sector participation in the form of concessions, management contracts and other agreements. Extracts from these laws are given in *Table 6.2.1.*

Table 6.2.1 Laws Relevant to Decentralization to Local Government

No. of Law, Decision & Directive	Year of Approval	Extract of Contents
Law No. 7582	1992	**"On State Owned Companies"**, Creates self financed commercial companies with 100% state owned shares. Local authorities decide on the separation and association of water utilities. The Supervisory Council (SC) of the water utilities decide on participation in capital, staff, contracts etc..
Law No. 7638	1993	**"On Commercial Companies"**, Defines the framework of activities for Private Companies and State Owned Companies (SOC). Water Companies were included to enable government to transform them into commercially run utilities owned by the local authorities; and to prepare them for Management Contracts, Concessions, or Joint Stock Companies.
Law No. 7926	1995	**"On Transformation of State Owned Companies into Commercial Companies"**, States that the activities of the water companies are supervised by a Supervisory Council (SC). Since 100% of shares are state owned, most of the seats on the council are occupied by central government.
Law No. 7973	1995	**"On Concessions and Participation of the Private Sector in Public Services and Infrastructure"**, Concessions, Management Contracts, and other agreements may be approved by local government.
Law No. 8099	1996	**"On the Approval of some Amendments to Decree No. 163 of 1 Nov. 1996 on some Amendments to Law No. 7926 Amended by Decree No. 1195 of 14 Aug. 1995 and Law No. 8099"**, States one third of the SC members are appointed by the Ministry of the Economy & Privatization, and two thirds by the Ministries, Departments, Directorates or other Institutions that report directly to the Council of Ministers, as well as to the relevant bodies of the Local Authorities.
Directive 204 of Min. of PW	1998	**"On the merging of Water Utilities and Municipal Wastewater Departments".**
Law No. 8652	2000	**"On Organization & Functions of Local Government"**, Establishes the duties, rights and functions of Municipalities and Communes. Gives responsibility to LG for the provision of public services including water supply & sewerage in Administration, Investment, Maintenance and Regulatory (Tariff based on cost recovery).
Law No. 8743	2001	**"On State Properties"**, Defines public rights over public property, including water sources as national public property.
Law No. 8744	2001	**"On State Public Real Estate Property Transfer to Local Government Units"**, Defines the rights of LG on assets, and regulates the transfer process through the MoLG & D for discussion by central government and eventual approval by the Council of Ministers for LG units to register the assets.
DCM No. 550	2002	**"On Approval of the Policy Document for the Decentralization of the Water Supply & Sewerage Services"**.

Source: Albania Water Supply & Wastewater Sector Strategy Sep. 2003; Water Sector Conference Mar. 2004.

The most significant recent event in the decentralization process was the "Spring 2006 Water Policy Conference." The objective of the Conference was to engage in a water sector specific, open dialogue on the need to balance the factors related to a rational aggregation or regionalization of water supply and sewerage services in Albania, within the context of the Country's efforts toward the decentralization of government. The Conference organizers were:

- Ministry of Public Works, Transport & Telecommunications (MoPWTT);
- Water supply & Sewerage Association of Albania (AWSSA); and

- Ministry of Interior (Local Government) (MoI).

The conference outcome was a national consensus of relevant stakeholders in the water sector in Albania as to how water supply and sewerage services should be structured within the implementation of the decentralization process.

The conference voiced a genuine belief that:

- The aggregation of water supply and sewerage services to reach the economy of scale and the cooperation between the local governments that will own the decentralized water supply and sewage facilities in general, has more advantages than disadvantages. The challenge, therefore, is to find a way to implement such a decision in a fair and equitable manner, respecting the principles of the decentralization process.
- Central Government should initiate a program of information dissemination aimed at increasing the awareness of local governments to the practical issues related to the sustainable delivery of water supply and sewerage services, and the global experience related to economies of scale.
- Central Government should move immediately to redirect the asset transfer process, as it relates to all the commercial water companies in Albania (Sh.a's), and transfer only the ownership shares in these companies to local government, providing assistance to local governments in the allocation of these shares to the units of local government served by that particular company. The government should consider this process as compulsory, pursuant to Law no 8652, dated 31.07.2000.

In addition the Central Government should take the following actions in providing incentives to encourage aggregation of water supply and sewerage service delivery:

- Set performance and quality standards for all water supply and sewerage systems (utilities) and monitor them through the current capacity being developed in the General Directorate of Water Supply and Sewerage/ Ministry of Public Works, Transport, and Telecommunication in close co-operation with the Ministry of the Interior.
- Condition financial assistance based on performance and quality indicators and practical business plans.

The above mentioned consensus was signed by MoPWTT, Ministry of Interior (Local government) and AWSSA. (See Volume III Supporting Report Appendix-11.

6.3 Water Supply and Wastewater Sector Strategy

The Albania Water Supply and Wastewater Sector Strategy was developed by the Ministry of Territory Adjustment and Tourism under a World Bank financed study and issued in September 2003. The strategy in this sector applies a two tiered approach:

(1) Short-Term Action Plan (2003-2006)

The overall objectives are to improve the efficiency and effectiveness of service provision; safe access to water services; and improve services to low income families and those without access to the service. This action plan is being implemented by the Albanian authorities and water utilities with support from

international donors. It is based on government's decentralization policy, and linked to the National Strategy for Socio-Economic Development (NSSED) for the actions and targets to be achieved in the water and sanitation sector.

(2) Medium-Term Action Plan (2007-2012)

The objective is to provide access to reliable and safe drinking water to all parts of Albanian society, including the poor. The GoA will continue to provide funds for the water and sanitation sector. The Millennium Development Goals (MDGs) are included in the GoA Water Supply and Sanitation Strategy. As part of goal 7 of the MGDs, "Ensure Sustainable Environmental Development", target No. 17 is to reduce the proportion of people without access to safe drinking water and proper sewage infrastructure to achieve the following by 2015:

- Population WITH access to safe drinking water (urban & rural) 98.0%; and
- Population WITH access to improved sanitation 94.7%.

Achieving these goals is considered to be crucial to poverty reduction in Albania. The MDGs have already been incorporated into the NSSED; both are linked to the Stabilization & Association Process (SAp) between GoA and the EU which provides strategic guidance towards integration with the EU.

The long term objective of the government's strategy is to achieve sustainability to EU standards in both urban and rural areas. The long term development strategy is linked with the overall objective of Albania to join the EU. To achieve this objective, the main focus of the reforms will be on:

1) Management Reform;
   - Demand Management,
   - Monitoring & Benchmarking,
   - Qualification of Personnel,
   - Capacity Building,
2) Legal & Institutional Reform;
   - Institutional Reform,
   - Legal Reform,
   - Public Awareness & Communications Program,
   - Private Sector Participation (PSP) Reform,
3) Financial Reform;
4) Poverty Mitigation Reform; and
5) Technical Reform.

6.3.1 The Role of Central government

When the decentralization process is completed, the institutional reforms change the role of government from a service provider to a policy maker, regulator and facilitator. Central Government will continue to play a vital role through various ministries and institutions as detailed below. (Regulation is detailed in

section 6.3.3):

(1) Ministry of Public works, Transport & Telecommunications (MoPWTT)

This is the line ministry responsible for the management of the water supply and sewerage sector through its Directorate DPUK (see section 6.4 of this report), until the sector is decentralized to local government.

(2) National Water Council (NWC)

The National Water Council (NWC) was created by Law No. 8093 (1996). It is headed by the Prime Minister and through its Technical Secretariat for administrative procedures it is linked to the ministry responsible for the environment. The NWC has the following responsibilities:

- Ensure the efficient use of Water Resources;
- Protection from pollution and misuse;
- Sustainable Management;
- Defines the Institutional Framework at National and Basin level;
- Issues permits for the abstraction of surface and groundwater for service providers; and
- Issues permits for wastewater discharge into the environment.

(3) Ministry of Environment, Forests and Water Management (MoEFWM)

The MoEFWM is the highest governmental body specializing in environmental protection. The duties and responsibilities of the MoEFWM are political and technical and deal with development of environmental policies and legislation, and enforcement control. MoEFWM coordinates environmental monitoring, determines policies and investment priorities for environmental protection and is the focal point for environmental programs and international agreements. The functions and responsibilities include:

- Protection of the environment;
- Monitoring the environmental situation;
- Reduction & prevention of pollution to water sources;
- Preparation of laws and bylaws; and
- Approval of EIA's done by others.

The Regional Environmental Agencies (REAs) operate at prefecture level, control and ensure the implementation of the environmental legal framework, supervise and apply the preliminary licensing, and collect and process data on the environmental conditions at prefecture and municipal level. The environmental inspectors also carry out control and enforcement of the law. The institutional framework for environmental matters is shown in *Figure 6.3.1*.

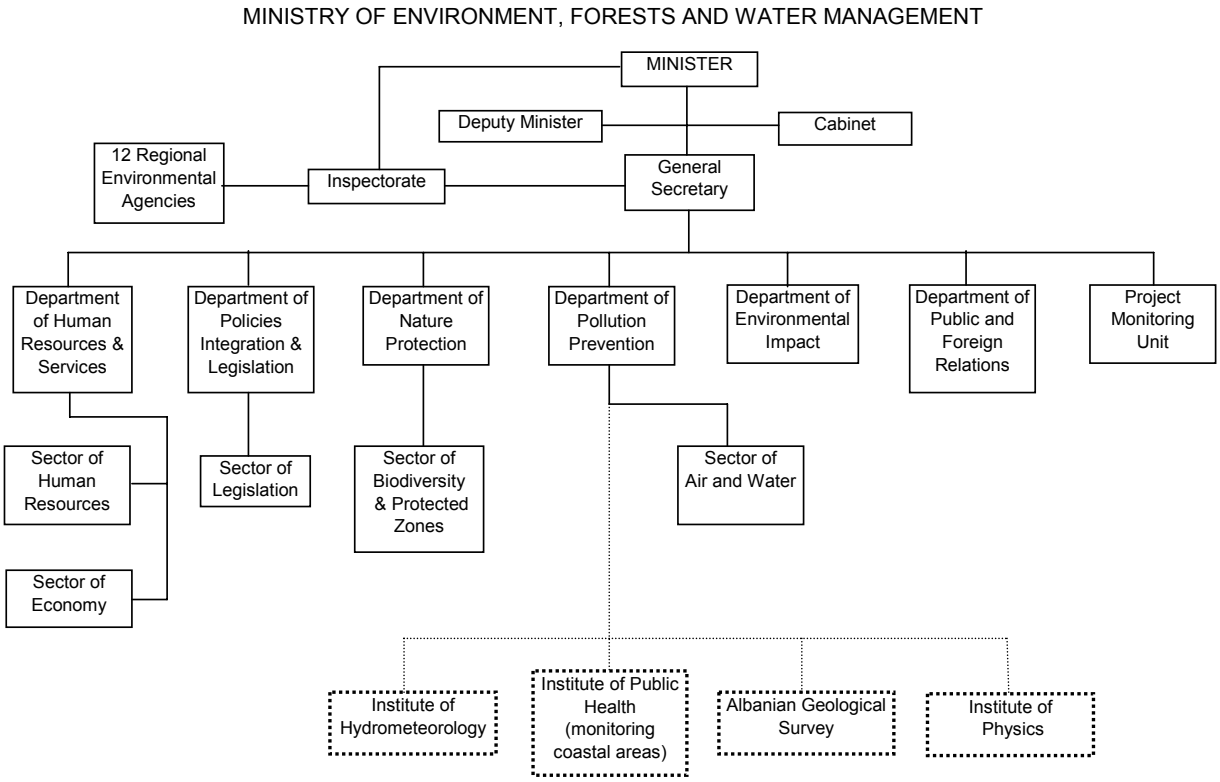


Figure 6.3.1 Institutional Framework for the Environment

Laws to regulate the use, management and protection of important components of the environment relevant to the water sector were developed in the 1990s. However, new environmental legislation evolved in 2002 from the National Environmental Action Plan (NEAP) of 2001 with important amendments. Environmental Laws relevant to the study are:

- Law No.8093, (21.03.1996) "On Water Reserves"; (as amended by Laws Nos: 8375 (15.07.98), 8605 (20.04.2000), and 8736 (1.02.2001));
- Law No.8094, (21.03.1996) "On Public Disposal of Waste";
- Law No.8102, (28.03.1996) "On the Regulatory Framework of the Water Supply Sector and of Disposal and Treatment of Wastewater";
- Law No.8934, (05.09.2002) "On Environment Protection";
- Law No.8990, (23.01.2003) "On Impact Assessment on Environment";
- Law No.9115, (24.07.2003) "On Environmental Treatment of Wastewaters"; and
- Law No.9010, (13.02.2003) "On Environmental Administration of Solid Waste".

Several Decisions of the Council of Ministers (DCM) were then passed to facilitate the application of the laws. In addition, Albanian environmental legislation is harmonized with EU Directives. Directives relevant to this Study are given in *Table 6.3.1*.

Table 6.3.1 EU Directives

EU Directive No.	Title
2000/60/EC	EU Water Framework Directive
96/61/EC	Integrated Pollution Prevention and Control(IPPC)
97/11/EC	Environmental Impact Assessment
91/271/EEC	Urban Wastewater Treatment
98/15/EEC	Amending Directive 91/271/EEC
86/278/EEC	Protection of the Environment, and in particular of the soil, when sewage sludge is used in agriculture
76/160/EEC	Bathing Water Quality
98/83/EC	Quality of Water Intended for human consumption

Chapter 12 of this report details the procedures, laws, regulations and standards for the Initial Environmental Examination (IEE) and the required Environmental Impact Assessment study (EIA) for this Master Plan.

(4) Ministry of Health

The Ministry of Health through its State Sanitary Inspectorate (SSI) under Law no. 7643 (1993, amended 1995) is responsible for the sampling and testing of water to ensure compliance by the water utilities. Minimum standards for both quantity and quality are the responsibility of the National Regulatory Agency (NRA). The NRA is detailed in section 6.3.3 of this report.

(5) Ministries involved in the Decentralization Process

The ministries involved in the transfer process are the Ministry of Economy which hold the assets on behalf of government awaiting transfer to local authorities; the Ministry of Public Works, Transport & Telecommunications as the line ministry for the water supply and sewerage sector which transfers the assets via the ministry of Local Government & Decentralization.

The process of finalizing asset inventories and approval by the Council of Ministers is said to be nearing completion. The government is committed to cover all financial obligations of the water and sewerage enterprises before the time of transfer in compliance with IMF policy. Central government will continue to assist the local governments by preparing various cost standards and methodologies to assist local governments with tariff setting. In addition, central government will provide annual funding from the state budget for capital investment programs, operation of costly pumped systems, and for a welfare support program in relation to water tariffs.

6.3.2 Responsibilities and Authority of Local Government

Both the previous and present government expressed their commitment to decentralization in the water sector. The passing of relevant laws in the 1990's and further laws after 2000 with amendments to rectify ambiguities, provide the legal framework for the transfer of responsibility and authority to empower local government in the water supply and sewerage sector. Local government units have the responsibility and authority to:

- Provide water supply and sewerage services with financial and property rights;
- Act individually or jointly to provide services by agreement or contract with other local government units; and
- Provide services with private sector participation.

The Service Contract (2002) establishes the obligation of Local Government units to supervise the water supply and sewerage companies in accordance with relevant laws on Standards of Compliance and Codes of Conduct, while establishing the principles of operation of the water company as:

- Commercially Oriented;
- Supervised by a Supervisory Council and managed independently by a Director General;
- Financial self sufficiency with the use of its own financial sources which may include financing from third parties, state budget transfers, donor finance and/or credit through banks as appropriate;
- Regulatory responsibility for tariff setting which may include support mechanisms for low income groups and the poor in line with NRA methodology; and
- Definition of the supply regime and quality in line with national standards.

During 2004, by three Council of Ministers Decisions (81/2004, 173/2004, 809/2004), eight water enterprises have been fully transferred to local authorities. In addition 136 networks have been separated out of regional utilities and have been transferred to 26 municipalities and 56 communes.

As stated in section 6.2 of this report, government now agree that aggregation of water supply and sewerage services to reach the economy of scale and the cooperation between the local governments that will own the decentralized water-supply and sewage utilities in general, has more advantages than disadvantages.

Regarding private sector participation (PSP) in the decentralization process, a Municipal Water and Wastewater Project (MWWP) is being implemented with financial and technical assistance through the World Bank for the Four Cities Program (Durres, Lezha, Fier and Saranda), under a Management Contract with Berlin Water International (BWI). All four cities remain autonomous in terms of financing and accounting and the project benefits about 350, 000 people. The following actions are being enacted:

- Involvement of Municipal Representatives on the Supervisory Councils (SC);
- The municipalities are the counterpart for preparing, signing, supervising and monitoring the Management Contract;
- The merging of Water Supply &Wastewater entities under one management system;
- Providing the opportunity to attract private operators by economies of scale; and
- Providing the opportunity for various service contracts between water supply entities and villages/communes for bulk supply and repairs & maintenance etc..

Other examples of PSP with assistance from the Federal Republic of Germany are:

- The Kavaja Management contract with Aquamundo Company;

- The Wastewater Program for Kavaja (including a wastewater treatment plant); and
- The Elbasan Concession Contract with Elber Company Ltd..

6.3.3 Regulation (National Regulatory Agency)

Regulation in the water supply and sewerage sector is a most important function. The role of a regulator is basically to act as an arbiter between the interests of the utility and the customers. This is of particular importance when utilities are commercial companies, may be subject to private sector participation, and they are progressing to a cost recovery tariff. A regulator should be independent from the parties involved in ownership and/or control of the utilities. The laws passed leading to the establishment of the Water Utilities Regulator (WUR) are given in *Table 6.3.2*.

Table 6.3.2 Laws to Establish the National Regulatory Agency (NRA)

No. of Law, & Decision	Year of approval	Extract of Contents
Law No. 8102	1996	**"On the Regulatory Framework of the Water Supply Sector & Processing and Disposal of Wastewater",** Appointment of Commissioners to the Regulatory Agency for Water Supply and the Collection & Treatment of Wastewater [approved by DCM 445] (1998)
Law No. 9352	2005	**"On some additions to Law No. 8102",** States that the LG units establish the tariff based on the methodology of calculation approved by the National Regulatory Agency. No tariff or part can be changed more than once in a year.
DCM No. 400	1998	**"On Licenses and Application Procedures for Operators & Water Services Providers",** Creates the basis for the establishment of the Water Regulatory Agency. Includes protection of public interests and tariff regulation provision to encourage private sector investment in the water sector.
DCM No. 445	1998	**"On Appointment of Commissioners to the Regulatory Agency for Water Supply and Collection &Treatment of Wastewater"** Sets forth the procedure for the appointment of Commissioners, and the authority of the Agency.
DCM No. 479	1998	**"On Liberalization of Tariffs for Drinking Water",** Liberalizes previous national tariff to allow water companies to calculate tariffs on cost of production, to be presented to local government for final approval by the Regulator.

Source: Albania Water Supply & Wastewater Sector Strategy Sep. 2003 & Water Sector Conference Mar. 2004.

By the Decision of the Council of Ministers (DCM No. 445 of 1998) five suitably qualified members are appointed as Commissioners to the Regulatory Agency by the Council of Ministers. The NRA may select its own staff, it gets its initial financing from government but this should change to a self financing entity from license fees. NRA will exercise control over:

- The use, administration, conservation and protection of water sources;
- Observance and guarantees of water quality standards;
- Environmental protection; and
- Monitoring of private operators.

The NRA will assist with problem resolution, draft methodologies for the basis of tariffs which will include social factors being support for the poor and differential fees for communities with no capacity to pay high tariff charges. Tariffs are no longer national and will be set by local government but in compliance with the methodology of cost calculation developed by NRA.

While water utilities remain under the control of central government the tariff will be calculated by the utility towards a cost recovery strategy for approval by NRA. This currently applies to the Water Supply and Sewerage Enterprise of Tirana (UKT).

6.3.4 Institutional Strengthening and Capacity Building

With the new responsibilities of local government units in the water sector comes the need for institutional strengthening and capacity building. Central government is providing support for the establishment and strengthening of local capacity for the management of water supply systems by assisting with capacity building as follows:

- Preparation of training modules under the National Training Strategy for Local Government (LG);
- Short and medium term plans for the training of political and technical staff of LG;
- Ensuring the commitment of all government institutions; and
- Liaison with current donors and potential new donors interested in training in LG.

Assistance by the government and donors is on-going through the General Directorate of Water Supply and Sewerage under MoPWTT, and with assistance from WB, KfW, GTZ, Italian Cooperation etc. The following are the major elements of capacity building.

- Understanding of the water sector legal framework;
- Selection of the best management alternative for specific LG conditions;
- Cost and tariff calculations towards cost recovery;
- Efficient practices for operation & maintenance;
- Billing and Collection;
- Community participation in decision making for distribution services; and
- Benchmarking.

GTZ through the financing and implementing agency BMZ are particularly active with a Project Coordinator resident in Tirana for "Support to Commercialization of Water Supply and Sewerage Enterprises." The project commenced in 2003 and is ongoing with the aims at making aware and strengthening various actors in the areas of commercialization and decentralization of the water supply and sewerage enterprises, with support to the development of a legal and institutional framework. The project endeavors to achieve the following results:

- Strengthening of the AWSSA to deliver services to its members and to represent the members in the on-going sector reform;

- Strengthening of the municipalities in their capacity to fulfill the responsibility for water supply and sewerage; and
- Increase awareness to key personnel in AWSSA and other major Albanian stakeholders in the water sector regarding the EU requirements in water and sewerage.

The target groups are municipalities, water and sewerage enterprises and their supervisory councils, the Water Regulating Agency and other relevant sector institutions.

This GTZ project works in close cooperation with KfW, WB, EC, and other donors active in the water sector. The project has covered 8 towns and cities in Albania (not including Tirana which is still a government enterprise).

Through a Cooperation Agreement and Contract between GTZ and AWSSA in September 2003 the Association provides project execution, as well as targeting its members as a group to receive institutional strengthening measures. The project extends through to November 2007, to support the GTZ commercialization program and is in partnership with the ministry of Local Government and Decentralization. Project activities are planned and executed in cooperation with the DPUK of MoPWTT, and MoEFWM.

In its role of capacity building AWSSA makes available various important publications on its web site and also provides hard copies free of charge. AWSSA also conducts professional development training courses which address critical issues of water utilities and the water sector as a whole. The aim is to improve the capacities of the water utility professionals; as an example the following courses will be held this year:

- Water Loss Management and Control;
- Strategic and Business Plan Development; and
- Customer Service-Billing and Collection.

6.3.5 Rural Agency for Water Supply & Sanitation (RAWSS)

As part of the Water Supply and Wastewater Strategy it is planned to establish a Rural Agency for Water Supply & Sanitation (RAWSS) at both central and regional level. The RAWSS will be closely related to MoPWTT through DPUK. DPUK has set up a unit to work on the legal framework for this new agency which is to be developed as an autonomous institution governed by an independent board headed by MoPWTT with representation on the board from the Ministry of Local Government and of locally elected associations.

The role of the RAWSS will be to assist communes and communities in the building and managing of their own water systems. The operational funds and budget will be received from government and international donors and the RAWSS will define investment priorities and the investment mechanism. Through its Regional Offices it will ensure that operational and investment funds are available, reporting

to the board on utilization of finance. The Regional Offices will provide technical support with supervision and performance monitoring and evaluation.

A major principle of this proposal is to develop grassroots participation and empowerment at commune or village community water association level. This is to ensure that decisions are demand oriented, sized appropriately to the needs, and affordability of the beneficiaries. Two methods are available for adoption as follows:

(1) The Community Water Association Model

The community will rehabilitate/build there own system and will be responsible to manage and maintain it.

(2) The Commune Model

The commune authorities will facilitate the beneficiaries' involvement in the planning, design, and financing of the scheme. This will cover the whole commune, and on completion, the commune authorities will be responsible for operation and maintenance.

This demand responsive approach for delivery of the services by the community relies on community participation; the involvement of NGOs and the private sector in the provision of services and assistance to develop and manage schemes efficiently; and training in operation and maintenance.

The beneficiaries themselves will be expected to contribute to the capital cost with at least 10% cash and 15% in kind. The remaining funds will be contributed by central government and/or donors through the RAWSS.

6.4 DPUK (General Directorate for Water Supply and Sewerage; Ministry of Public Works, Transport and Telecommunications)

6.4.1 General

During the course of the decentralization process in the water sector, the line Ministry responsible for the water sector changed from the Ministry of Public Works (MoPW), to the Ministry of Territory Adjustment & Tourism (MoTAT), and under the new government, to the Ministry of Public Works, Transport & Telecommunications (MoPWTT). Water Utilities will continue to be under the control of DPUK until they are decentralized to local government.

6.4.2 Organizational Structure

DPUK is responsible to MoPWTT for management of the water supply and sewerage sector and is headed by a General Director with two Vice General Directors responsible for separate functions. Technical and Economical matters are handled under one vice director, while donor coordination and Project Implementation Units (PIU) both internal and external are handled under the other vice director, including a unit for the legal formation of the RAWSS. DPUK has a staff of 30 and the organization chart is shown in *Figure 6.4.1*.

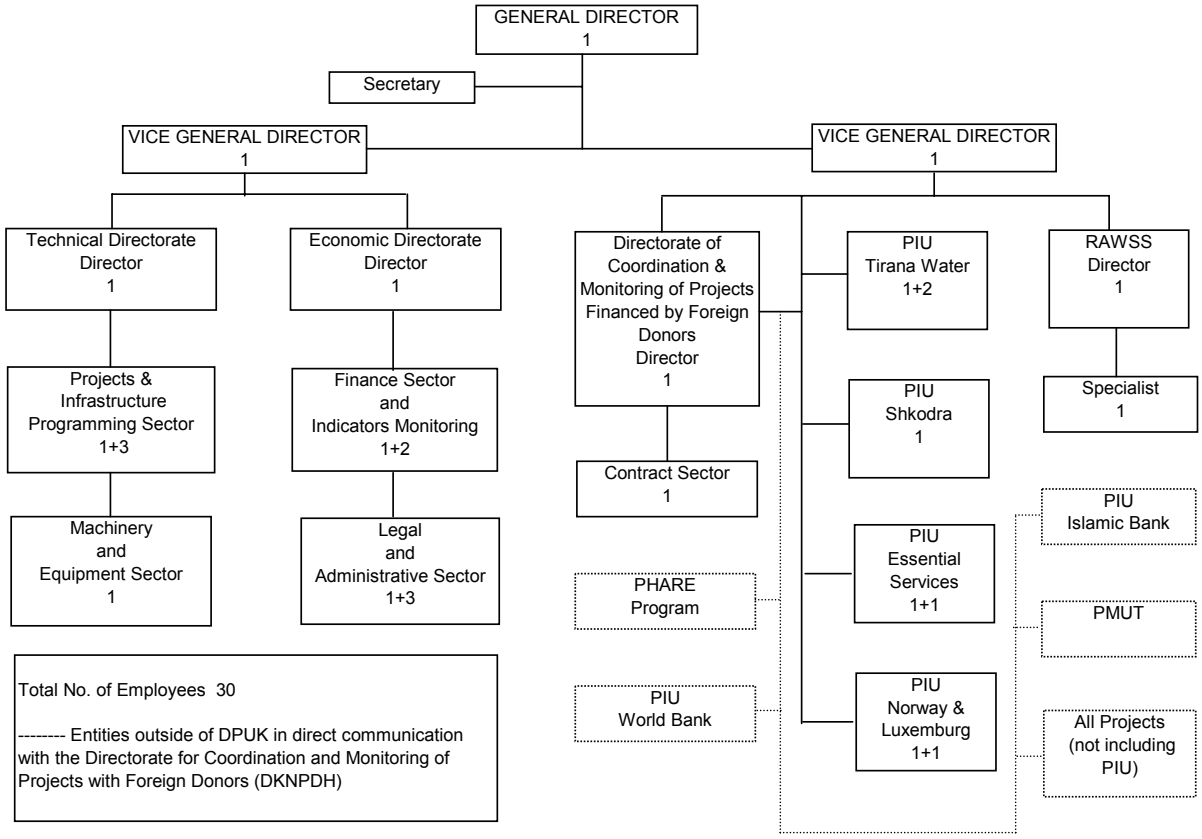


Figure 6.4.1 Organization Chart for DPUK

6.4.3 Roles and Responsibilities

The roles and responsibilities of the units relevant to this study are described hereunder:

(1) PIU Tirana Water Supply & Sewerage Enterprise

The role of this PIU is for the implementation of projects developed under the Cooperation Agreement between GoA and the Government of Italy for Financial and Technical Assistance to the Water Supply and Sewerage Enterprise of Tirana (UKT). The staff of the PIU includes a Senior Advisor for Water & Sanitation from the Italian Embassy, Development Cooperation Office. The company "Tirana Acque" was appointed to implement a Master Plan mainly for the water supply and has to date achieved the following.

- Improving the reliability of the Bovilla Water Treatment Plant;
- Improving the water distribution system;
- Modernizing the water pumping stations;
- Rehabilitating the enterprises' head office, stores and laboratory;
- Providing plant & equipment particularly for pipe laying and maintenance;
- Computerization of the commercial and administrative systems including MIS and training;
- Training courses for the technical and administrative staff; and

- Supply of equipment for the headquarters and Bovilla laboratory, and in particular automatic chlorine dosing equipment.

A new loan from the government of Italy is being finalized for about Euros 13 million and the DPUK PIU together with UKT are in the final stages of agreeing the items of work to be carried out.

(2) Benchmarking Unit

The role of this unit is for the "Benchmarking" Project, it is responsible for implementing a monitoring and benchmarking system, with World Bank assistance for 15 urban utilities (75% of the urban population) and 15 rural communes. The first report on these 30 entities has been produce and should be the forerunner of a full scale national system. The information should be invaluable to measure progress in the water sector, and detect weaknesses to assist in the use of scarce resources, and to provide local governments with a measure of the performance of their utility for action where necessary. The creation of the monitoring and benchmarking system should provide the basis for central government to better control its subsidies to the utilities to connect the subsidy to performance.

(3) Rural Agency for Water Supply and Sewerage (RAWSS)

This agency has initially been established within DPUK with the responsibility to prepare the legal framework for the Rural Agency for Water Supply & Sanitation (RAWSS) to be an autonomous institution. It is expected that this agency will be operating independently within 2006 but still in close cooperation with DPUK.

6.5 Municipality of Tirana

6.5.1 General

The municipality of Tirana is an important institution in terms of the decentralization process, the implementation of the Strategic Plan for Greater Tirana, and the protection of the environment. In early 2004 the Municipality of Tirana made enquiries regarding the decentralization of water supply and sewerage services but this is on hold pending further consideration of the implications. A consultant has recently been appointed, financed by GTZ, to look into the decentralization options for Tirana municipality in the water supply and wastewater sector. A brief report was submitted on the February 2006 mission recommending a workshop with all stakeholders to finalize the process.

The organization chart for the municipality is shown in *Figure 6.5.1*. The functions of the following three directorates have been expanded since they are of particular relevance to this study:

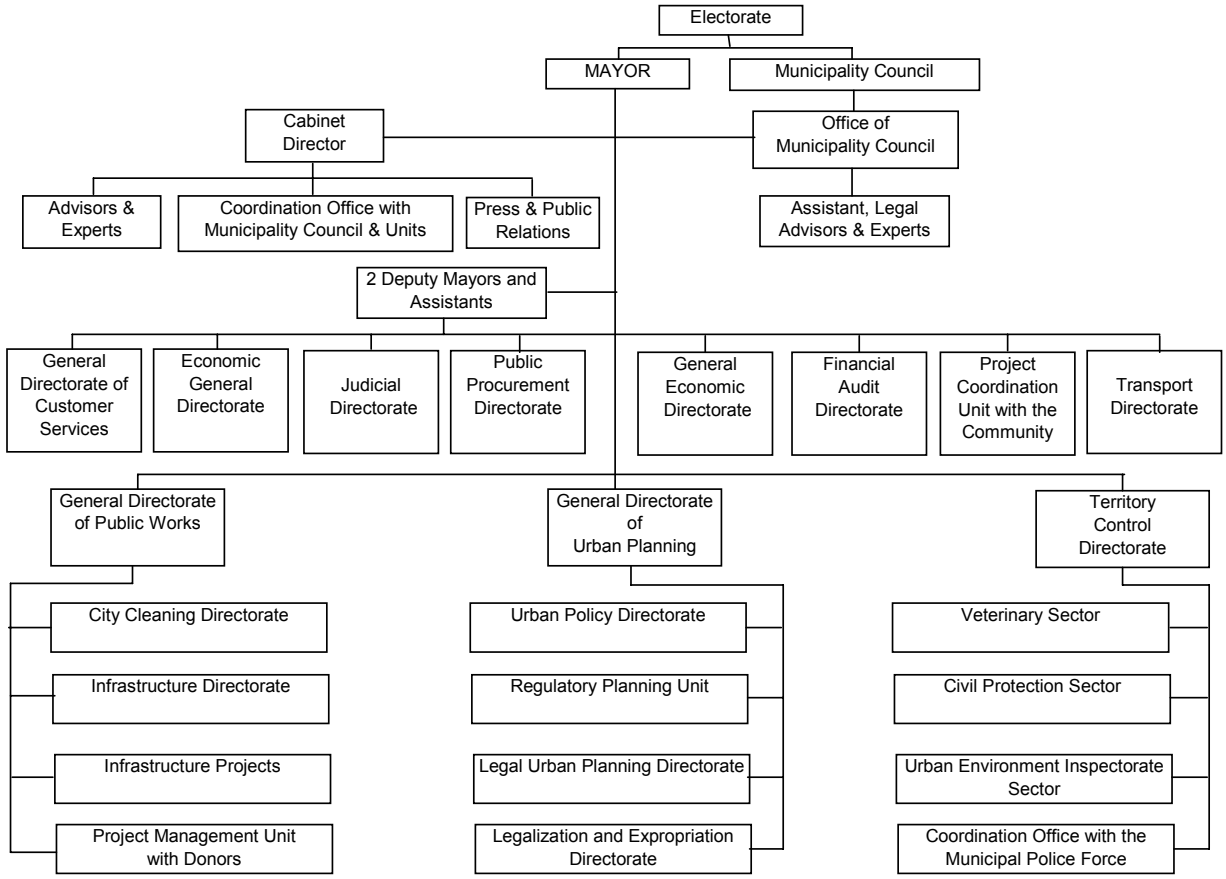


Figure 6.5.1 Organization Chart for Tirana Municipality

6.5.2 General Directorate of Public Works

This is an important directorate for the provision of public services since the decentralization of the provision of public services to local government. Law No. 8652 (2000) "On the Organization and Functions of Local Government" gives the responsibility for the provision of public services, including water supply and sewerage, to local government.

There are four directorates; the City Cleaning Directorate organizes and monitors the cleaning services provided by two private enterprises, "Ecoacqua" for the eastern part of the city and "Bruci" for the western part. The Directorate of Infrastructure is mandated to maintain the existing infrastructure and future infrastructure works when decentralization is implemented including water and sewerage. The Directorate of Infrastructure Projects is basically for the city roads. The Project Management Unit for Donors handles donor investment in various projects including World Bank, Italian Cooperation, ADF, and UNDP. Projects have included the reconstruction and overlaying of the Lana river bed, rehabilitation of the "Old Airport" area sewage and water pipelines, and reconstruction of the sewer network in the area of Alias.

6.5.3 General Directorate of Urban Planning

There are four directorates for; Urban Policy; Regulatory Planning, Legal Urban Planning, and Legalization/Expropriation. Law No. 8652 provides for urban planning, land management and housing to be the exclusive function of local government. Currently a new law on urban planning is being developed. Under the current IDA financed Zoning Code and Regulatory Plan consultancy for Greater Tirana, assistance will be given to promote better urban management by capacity building and institutional strengthening in the Urban Planning Directorate.

6.5.4 Territory Control Directorate

This Directorate has four sectors; the Urban Environment Inspectorate, Veterinary, Civil Protection, and a coordination office with the Municipal Police. The Environmental Inspectorate assists with environmental protection by identifying sources of pollution which affect the population of the city including interventions in water and sewerage pipelines by state and private entities. The institutional framework for the new Law on Urban Planning and Development currently being drafted will establish a Territorial Adjustment Council (TAC) in the municipality.

6.6 Other Local Governments

As stated elsewhere in this report, the area of the proposed Greater Tirana covers all or part of three municipalities and eight communes. At present, UKT is responsible for the sewerage system in Tirana City and all of the water supplies except Kamza.

The municipalities and communes covered by this Master plan are Tirana, Kamza, Kashar, Paskuqan and Berxulle. Most of the development envisaged in the Strategic Plan for Greater Tirana occurs in these municipalities and communes. Municipalities and communes on the fringe of the development area are Vora, Zall Herr, Preze, Vaqarr, Farke and Dajt.

Details of the institutional aspects of the municipalities and the communes in the Sewerage Master Plan (except Kamza, see section 6.8) are as follows:

(1) Kashar

Kashar is by far the most progressive and dynamic of the communes in its development program. Despite officially being in the supply area of UKT, due to the inability of UKT to provide services to Kashar, the Mayor has gone ahead with his development plan. This commune has developed, in house, a complete development program for the commune and a detailed project for part of this development which has received approval to go ahead.

Kashar has had no option but to go ahead with developing its own water supply and sewerage systems despite the fact that it not officially licensed as a water supply and sewerage authority by the National Regulatory Agency. This appears to be “accepted” by the authorities since UKT (the responsible authority) is simply not able to provide the services.

In view of the lack of action by others on decentralization, a proposal has been made by the Mayor of Kashar to establish a Water Supply and Sewerage Enterprise for the Northern part of Greater Tirana comprising of Vore, Berxulle, Kamza, Kashar, Paskuqan and Zall Herr. A draft Agreement exists for the six authorities to express their will to establish a joint water supply and sewerage authority and awaits signature. A draft statute has also been prepared and as and when all the authorities sign, the enterprise may have to be legalized through the Tirana court for the transfer of assets from central government. This is in line with the recent consensus on aggregation of small local governments to form larger water and sewerage authorities. It is likely that most if not all of the local governments involved would sign up to this proposed authority.

(2) Paskuqan

Water is provided by UKT who assign a workforce to operate and maintain the main supply system. The distribution network is left to the commune and the supply is far from satisfactory. There are no plans for development of a sewerage system. The mayor would prefer to be an independent water and sewerage authority but is aware of the lack of human and financial capacity to do so.

(3) Berxulle

Berxulle is not connected to the UKT main water supply system, but its own wells and pumping stations are operated and maintained by UKT. There are no plans for development of a sewerage system. The mayor would prefer the commune to operate the water system and not UKT.

6.7 Water Supply and Sewerage Enterprise of Tirana (UKT)

6.7.1 General

At this point in time UKT remains under the control of central government and has not yet entered the decentralization process except that the Municipality of Kamza, previously supplied by UKT, is now an independent enterprise. The line ministry is MoPWTT with supervision through its Directorate DPUK. UKT is a National Strategic Enterprise by decision of the government to safeguard this important service.

UKT is intended to be a commercially oriented Joint Stock Company with 100% of the shares owned by the state until such times as it is subjected to decentralization to local Government. The activities of the company are supervised by a Supervisory Council with most of the seats being occupied by central government, with one representative from Tirana municipality.

The financial resources of the enterprise are mainly derived from the tariff, and it is said that central government no longer provides subsidies. The tariff is low in terms of both national and worldwide entities. Hence, UKT must trim its annual work plan to suit the finance available.

UKT has since 2002 benefited from loans through Italian Cooperation both for capital works, urgent repairs and maintenance, and a component to improve the management of the organization. In accordance with the Master Plan most improvements have been directed to the water supply, with

essential repairs and maintenance to the sewerage system. Loan repayments are the responsibility of UKT, guaranteed by GoA through the MoF.

UKT provides water supply services to the whole of the Tirana district except for about 30 villages and the municipality of Kamza. The village water supplies were added to the UKT service area as a condition of the Italian loan. The sewerage system is mainly concentrated in the Tirana city centre area, and the Tirana and the North and South Lana River areas.

The guiding strategy of UKT for the operation of the enterprise was developed in 2004 and states the following:

"Achieving aims and goals, increasing human capability in water supply services; treatment of wastewater; performance at professional level; carrying out all relevant duties efficiently, effectively, and with productivity, is the strategy of the enterprise in the context of the Enterprise's integration."

In this regard there is a need for a collaboration attitude and effective work relations within UKT. Achieving these goals should result in:

- Greater transparency;
- A more direct consumer oriented focus; and
- More responsibility & professionalism in achieving the parameters & indicators of the enterprise.

The effects of cooperation will be evidenced by:

- Economies of scale;
- Lower operation costs; and
- Greater efficiency towards the enterprise's strategy.

Much has been achieved through the Master Plan developed by Tirana Acque under the Italian Cooperation Technical & Financial Assistance to UKT with the following improvements to the management systems:

- A water network GIS system updated to December 2004;
- Computer mathematical model MIKENET-EPANET for the water supply network of Tirana and the villages connected to the supply, including a training course on the overall model characteristics and the software installation;
- The provision of bulk meters and flow measuring devices in order to set up leakage district metering by creating District Metering Areas (DMA) or Leakage Control Zones (LCZ);
- The setting up of a Pilot Area for leakage determination and the creation of leakage control districts with monitoring systems;
- Leakage detection using acoustic equipment over 260 km of the village distribution network;
- A customer and connection survey with UKT staff;
- Customer Data Base;

- For the wastewater system, the use of the model MoUSe (Modeling of Urban Sewers) to detect critical areas and study possible solutions for programming and planning of the network;
- For the Commercial Sector, computers and MIS software, including training for the management of information on , purchasing, stores, accounts and finance;
- Ten training courses in Italy for both the technical and administrative staff; and
- Software program NAVISON ATTAIN and instruction on the use of this program for control of cost analyses on the basis of cost centres.

6.7.2 Organization Structure

UKT is governed by a Supervisory Council which basically acts as a Board of Directors. The organization is headed by a General Director. The organization structure was recently revised and the staffing level was reduced from over 1,074 in August 2005 to 950 in May 2006.

The headquarters of UKT in Tirana were refurbished under the Italian Cooperation Loan and houses all of the departments except sewerage. The General Directorate headed by the General Director with a secretary and 5 offices has a total staff of 17 as detailed below, with the current total staffing given in brackets for each office:

- General Director & Secretary (2);
- Internal Auditing (2);
- Human Resources (4);
- Public and Third Party Relations (4);
- Procurement (3); and
- Legal Office (2).

The are two main Departments reporting directly to the General Director these are the Technical Department and the Economic Department. The overall structure of UKT is given in *Figure 6.7.1*.

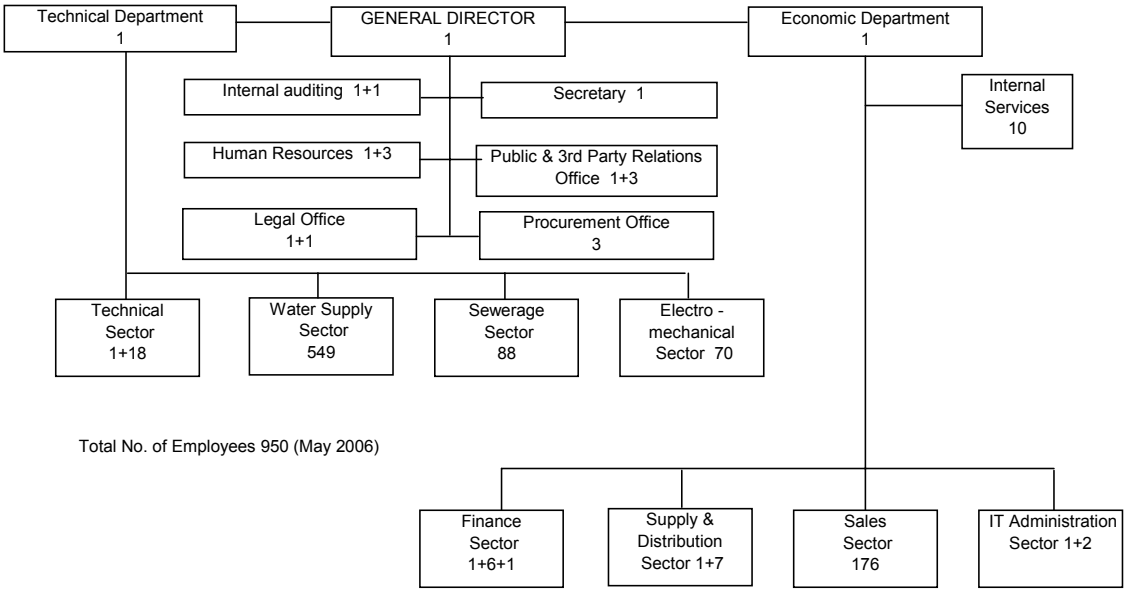


Figure 6.7.1 Organization Chart for UKT

A breakdown of the total number of employees in each sector is given in *Table 6.7.1*.

Table 6.7.1 UKT Overall Number of Employees

Directorate	Employees May '06
General Director & Secretary	2
Internal Auditing	2
Human Resources	4
Public &Third Party Relations	4
Procurement	3
Legal Office	2
General Directorate Total	**17**
Technical Department (Head)	1
Technical Sector	19
Water Supply Sector	549
Sewerage Sector	88
Electromechanical Sector	70
Technical Department Total	**727**
Economic Department (Head)	1
Finance Sector	8
Supply & Distribution	8
Sales Sector	176
IT Administration Sector	3
Internal Services	10
Economic Department Total	**206**
Total Number of Employees	**950**

Source: UKT Human Resources Office

The Enterprise has a comprehensive set of Internal Rules & Regulations which set forth the number of

employees required, job descriptions, qualification requirements and salary scales which is updated as and when necessary.

6.7.3 Financial Management

Financial management of the enterprise is achieved through the Economic Department which is responsible for all accounting and financial services for the operation of the Enterprise, all billing and collection services, new connections for water and sewerage, customer contracts and customer services, stores and stock control, and Information Technology. The organization chart for the Economic Department is shown in *Figure 6.7.2*.

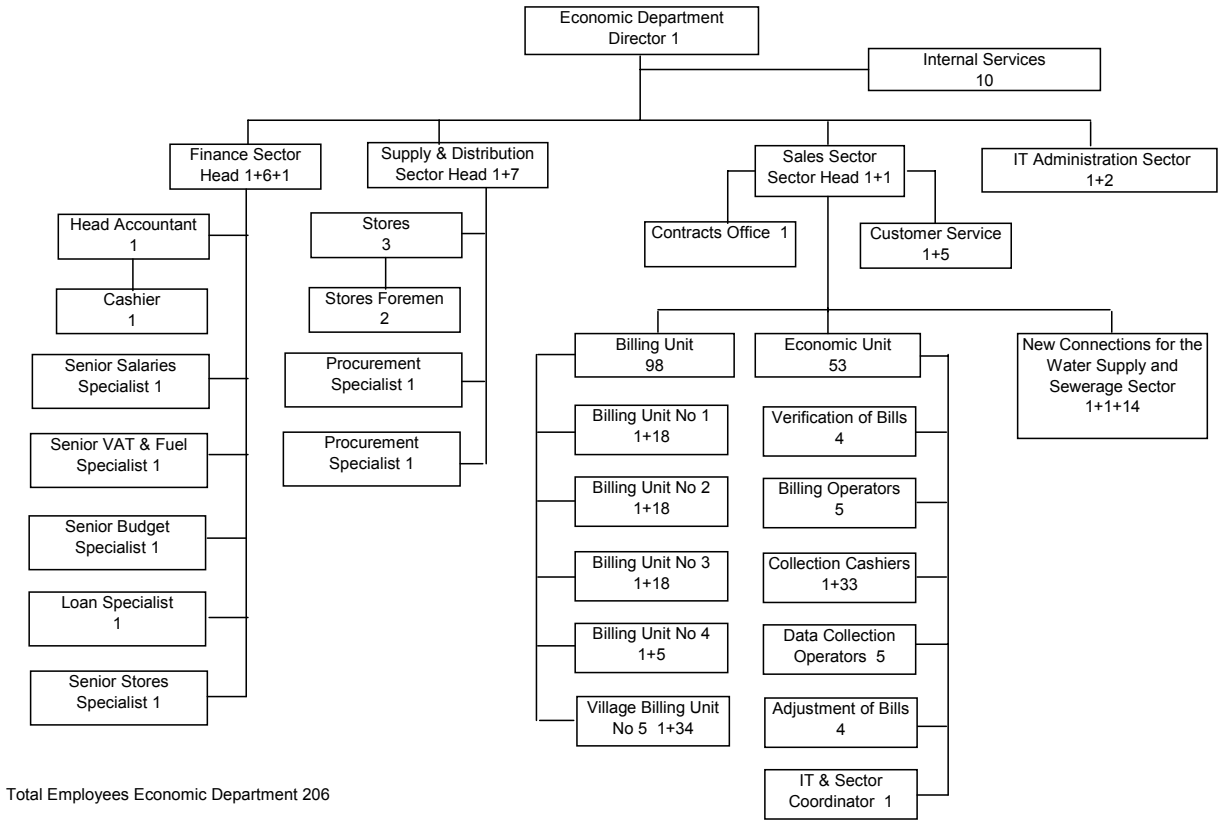


Figure 6.7.2 Organization Chart for UKT Economic Department

(1) Organization

The Economic Department has a Director and a total of 206 employees divided into four main sectors which are detailed below, with the current total staffing given in brackets for each sector:

- Finance Sector (8);
- Sales Sector (176);
- Supply & Distribution Sector (8); and
- IT Administration Sector (3).

The department also is responsible for Internal Services comprising of building maintenance personnel and drivers (10).

(2) Finance Sector

This sector deals with all financial matters and transactions of the enterprise through specialists for salaries, VAT and fuel, the budget, loans, and banking transactions for stock purchases. Account balances and financial statements are prepared as well as the annual accounts. Currently, only the budget for the next financial year is prepared but there are future plans to draw up financial policies for the short & medium term; financial plans for future investment; and financial projections for the medium & long term. This will be necessary to deal with long term loans for the construction of the planned sewerage facilities.

(3) Sales Sector

1) Billing Unit

The sales sector has a billing unit employing 98 staff which includes all of the water meter readers for the 4 geographic billing zones of Tirana. All water meters for domestic and private enterprises are read in each of the 4 zones with Billing Division 4 also being responsible for government department meters. Computerized bills are hand delivered by the meter readers. Billing Division No. 5 is for customer connections in the communes and villages surrounding Tirana.

2) Economic Unit

The economic unit employs 53 staff, of whom 33 are cahiers for the collection offices. Compiling of the bills in the head office comprises computer data entry, verification and adjustment of customer accounts, and coordination of information with the IT sector. The bills combine the water and sewerage charges. Collection is through 37 payment offices located in Tirana serving KESH as well as UKT customers and some municipal services. Collection in communes and villages is made by pre-arranged monthly visits to these locations by the collection staff using public transport. Information is shared with the IT Sector by a coordinator.

3) New Connections

The new connections unit is composed of 3 groups of 5 people who do everything from commencement to completion of new connections for both water supply and sewerage, particularly for new development.

4) Contracts Office

Under Italian Cooperation a customer and connection survey was carried out with the UKT staff and a Customer data base set up. The Customer Contracts Office records all new contracts to update the data base.

5) Customer Service Office

In the recent past a Customer Service Office with a staff of 6 was established at the entrance to the headquarters building. Customers are free to visit this office and discuss any problems or complaints they may have with service, and they will be directed to the appropriate person to assist with their problem or complaint. This system is now computerized.

(4) Supply & Distribution Sector

This is the stores department for stock of all necessary items. Under the head of sector there are two specialists for procurement, and a staff of 5 to control incoming stock and the issue of stock to the various departments

(5) IT Administration Sector

This sector coordinated and manages the whole of the IT system within UKT. There is an intranet and all sectors can readily access (except the Sewerage Sector whose office is remote from this facility). There are 4 basic activities:

- The program NAVION ATTAIN (Sales and later stores are to be added);
- An Economic program for debtors;
- A Customer Services program to trace complaint and action through the whole process and update the records on work done; and
- Automatic control (communications system) of all sources and major installations (depots) is for the future. Already, part of Bovilla is on the IT system.

Through the internal network the engineers in various departments have access to software programs such as MoUSE to carry out development of the systems.

The software is generally old Microsoft and needs upgrading when finance is available.

The future priorities in the Sales Sector are aimed at:

- Achieving satisfactory collection levels;
- Pursuing an appropriate tariff policy to achieve the enterprise's aims & objectives;
- Formulating and implementing policies to increase collection levels and the payment of arrears;
- Having all customers legally connected;
- Identifying and eliminating illegal water connections;
- Improving standards of service and ensuring a high degree of communication with customers; and
- Establishing a collaborative attitude with the public to increase the quality of service and ensuring a transparent environment at the workplace.

Under Italian Cooperation the following actions have been undertaken to help UKT meet its priorities:

- A customer and connection survey with UKT staff;
- Customer Data Base;
- For the Commercial Sector, computers and MIS software, including training for the management of information on , purchasing, stores, accounts and finance; and
- Software program NAVISON ATTAIN and instruction on the use of this program for control of cost analyses on the basis of cost centres.

6.7.4 Technical Management

Technical management is achieved through the Technical Department, the departmental director being responsible directly to the General Director.

(1) Organization

The Technical Department has a Director and a total of 727 employees (May 2006) divided into four main sectors which are detailed below, with the current total staffing given in brackets for each sector. The organization chart is shown in *Figure 6.7.3*:

- Technical Sector (19);
- Water Supply Sector (549);
- Sewerage Sector (88); and
- Electromechanical Sector (70).

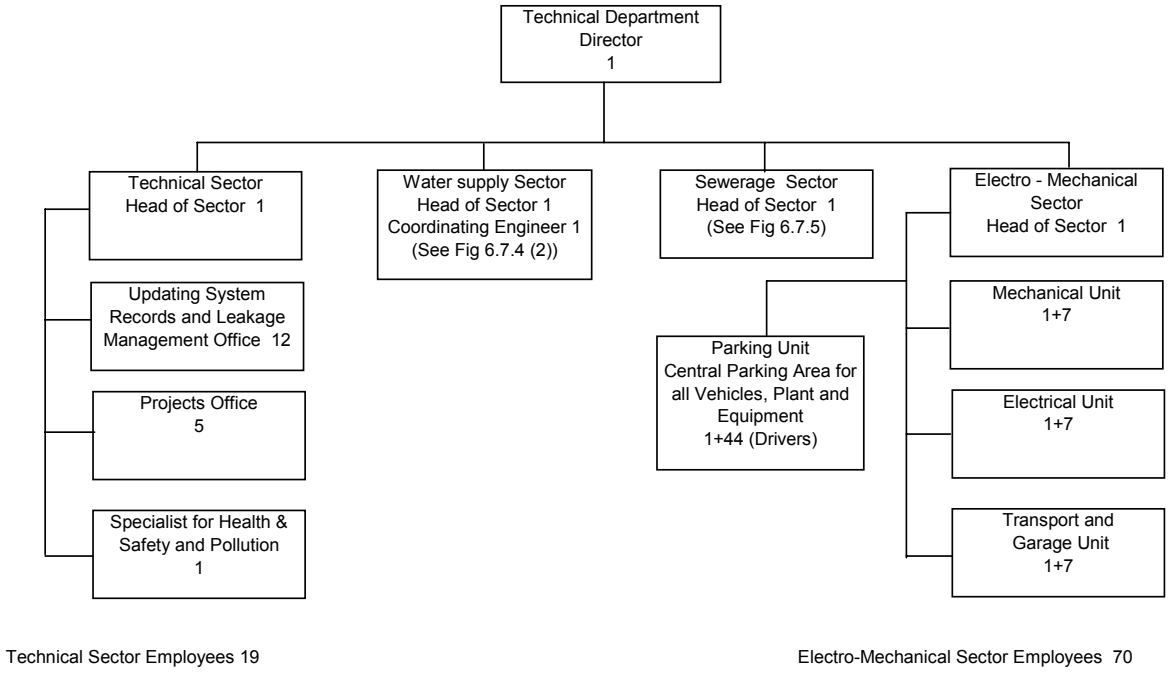


Figure 6.7.3 Organization Chart for UKT Technical Department

(2) Technical Sector

1) Record Updating & Leakage Control office

The updating task commences with information gathering in the field and updating the computerized records. Primary and secondary networks are currently being updated and this will eventually extend to the whole system. The leakage control referred to is a computer exercise to manage the leakage data and will soon be enhanced by new software connecting sales and technical information to rationalize unaccounted for water (UFW) and non-revenue water (NRW).

2) Projects office

This office draws up small projects on the water supply and sewerage network.

3) Heath & Safety Office

This office has a staff of one and is concerned with Health & Safety in the workplace, particularly in the following areas:

- Attending to pollution problems in the distribution network;
- Use of the Albanian Institute of P.I.E. procedures for electrical installations, for example in pumping stations and treatment plants; and
- Use of the manual produced by the MoPWTT on Health & Safety in Construction works.

Monthly lectures and instructions are given to various groups in the workforce once a month, and once a year all staff is checked to see if they have achieved the level of knowledge in Health & Safety in accordance with their job description. Every two years there are health checks on the workforce.

(3) Water Supply Sector

The Water Supply Sector is divided into the units described below and shown on *Figure 6.7.4*.

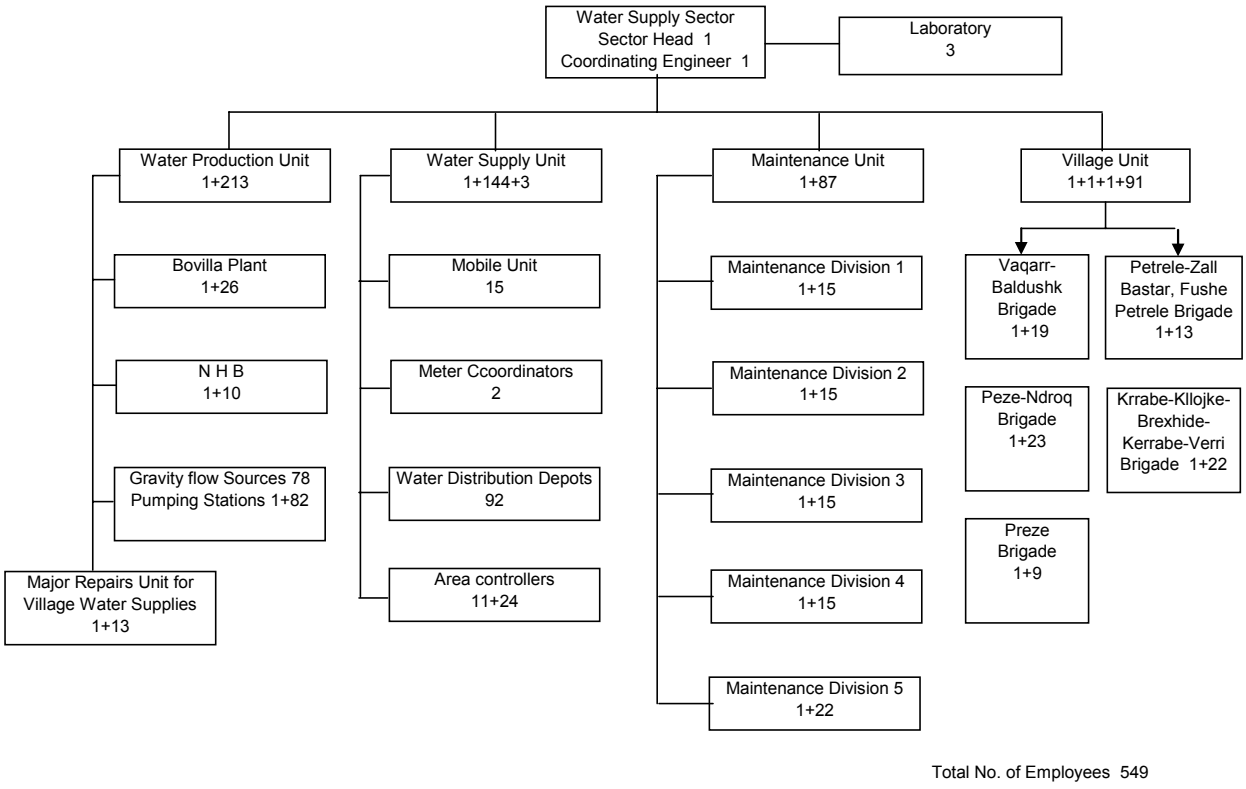


Figure 6.7.4 Organization Chart for Water Supply Sector of UKT

1) Water Production Unit

This unit has four divisions responsible for the operation of the main source works at Bovilla, Selita, Santa Maria, and other smaller sources including wells, and the gravity transmission mains, treatment plant and pumping stations at Laknas and Berxulle and pumping mains comprising the water production works. It also provides the staff for major repairs to the village water supplies.

2) Water Supply Unit

This unit has four divisions dealing with the distribution of water. There is a mobile division equipped with vehicles and mobile radios operating 24 hours a day connected to a controller at the UKT headquarters. The division is staffed with technical personnel and attends to reservoirs, pumping stations, the distribution network and the sources of supply. They are able to respond quickly to most emergencies and complaints.

The meter coordinator division is able to react to any problems with faulty meters in the service area.

The water Distribution Depots personnel operate from about 10 depots some with pumping systems, others supplying by gravity. They control the flow of water into the various areas of the network.

The area controllers' deal with all aspects of the network such as supply, losses, problems with water meters, illegal connections, and also supplies to new buildings and new connections etc.

A major problem with water supply is up to 40% of the water from the source works is illegally drawn from the transmission mains, mainly for irrigation in the dry season.

3) Maintenance unit

Maintenance and repairs are carried out on a zonal basis under the direction of the zonal engineer. Tirana is divided into four geographical zones and each has a workforce of fifteen to carry out necessary repairs and maintenance. There is no particular maintenance plan and most operations are confined to emergencies and urgent repairs and replacements within the limitation of the budget. There is also a maintenance division for the village water supplies operating on the same basis as those in the city.

4) Village Water Supply Unit

The operation and maintenance of the village water supplies is divided into four brigades to cover the following areas:

- Vaqarr – Baldushk;
- Prez – Ndroq;
- Prez;
- Petrel – Zall, Basttar, Fushe Petrel; and
- Krrabe – Kllojke – Berxhide – Kerrabe – verri.

(4) Electromechanical Sector

This sector has 24 employees under the sector head and 45 drivers. It is divided into the following units all headed by a qualified engineer (university graduate), the units have seven technicians each with appropriate technical qualifications. In addition many of the staff have between 20-40 years experience with this enterprise.

1) Mechanical Unit

The unit carries out maintenance as and when required on all mechanical plant although there is no planned maintenance schedule as such.

2) Electrical Unit

Again there is no planned maintenance schedule as the work is mainly due to the permanent problem created by power fluctuations causing problems with control panels and submersible pumps.

3) Transport and Garage Unit, & Parking Unit

This unit controls the fleet of cars, vans, trucks, and all manner of plant and equipment. A recent change to the system was the introduction of a centralized plant and vehicle unit to create more efficient use of these resources. This is a secure area to which everything is returned at the end of the working day, except for emergency resources kept at the headquarters building comprising transport, excavator etc. Advance bookings are required for most of the plant and equipment, cars and vans being allocated to various sectors. It usually takes about two hours to obtain an item of equipment. It is proposed that specialist equipment be kept at the appropriate location but this has not yet been put into force (e.g. the sewer cleaning vehicle should be kept at the sewerage office).

6.7.5 Sewerage Sector

The sewerage sector is located in its own building remote from the UKT headquarters in Tirana. The building was used previously by the sewerage section of the Tirana Municipality Roads & Sewerage Enterprise. These offices house the head of the sector plus the 4 zonal engineers (these zones being the same as the geographic zones used by the Water Sector which run roughly North/South and East/West along the major highways which meet in the city centre). The zones are divided geographically rather than by network systems. Each zone is headed by an engineer with a workforce of twenty. There is also an emergency telephone operator on duty to receive calls on sewerage problems. The total number of employees is 88.

The sewerage plans are now kept in the UKT headquarters building where they are updated with additions to the network. The main and primary networks are being entered up on the GIS mapping system. The sewerage office is equipped with two old computers not suitable for use with network updating. The organization chart for the sewerage section is shown in figure 6.7.5.

The sewerage system is mixed with the drainage and the total length is about 530 km, 23.5 km of which are main carriers, 85 km are primary carriers and the remainder is the sewer network. This is a gravity system which discharges without treatment into the Lana and Tirana rivers. The system comprises four areas being the North and South Lana areas and the Tirana and Central areas.

Maintenance and repairs are carried out on a zonal basis under the direction on the zonal engineer. Each zone can handle about 5 emergency repairs per day depending upon the seriousness of the problem. The engineers walk or use public transport to supervise the works.

Vehicles and transport consists of one car for use by the head of sector and one small three wheel general purpose open back truck to cover all 4 zones. All other plant & equipment required including the specialist truck for dewatering and high pressure hosing (supplied under the Italian Cooperation program) are now kept at the central parking area.

The faults reported by the public on the emergency line are dealt with as a priority, and there is a maintenance plan of sorts for known trouble spots in the system where more major maintenance work is required. Details of the problems and work required are given to the UKT head office and /or the Municipality of Tirana where drainage is involved since this is a mixed system, and the works required are sometimes contracted out to the private sector.

The Head of the Sewerage Sector, and the zonal engineers, are all qualified engineers having attended 5 year courses at the civil engineering department of Tirana University. The maintenance workforce is trained on the job. The operators of the specialist sewerage truck were trained on its operation. Under the Italian Cooperation program, short 3 day training programs on modern methods of sewer repairs and maintenance have been held about twice a year.

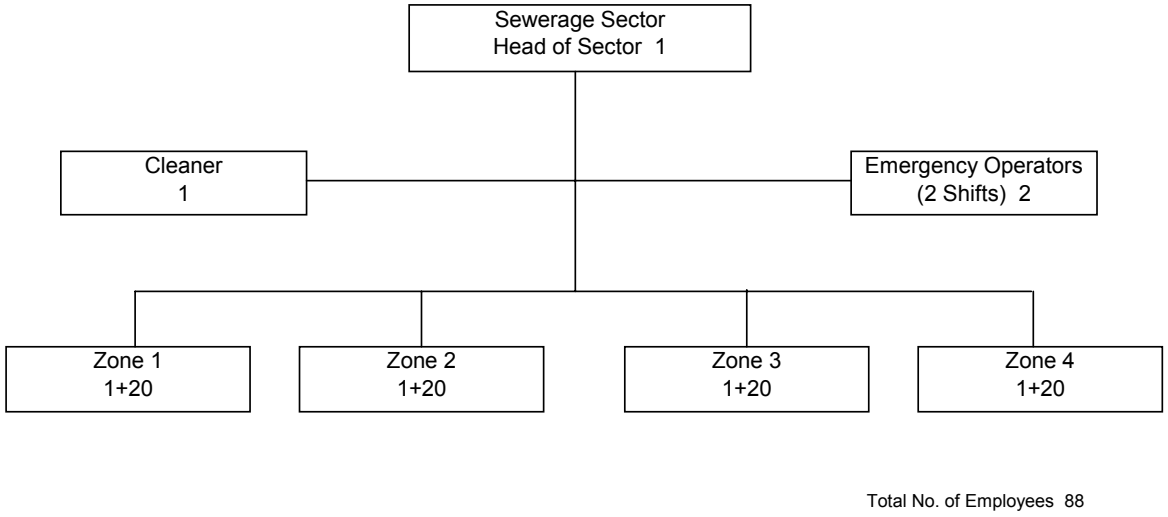


Figure 6.7.5 Organization Chart for Sewerage Sector of UKT

6.8 Water Supply and Sewerage Enterprise of Kamza (UKK)

The water supply system was originally under the control of UKT. This system was inadequate for the large migration into the municipality and under a World Bank financed project a new water supply system was constructed together with some sewers in the Bathore area. There is a plan to discharge an expanded wastewater system into the Tirana river On completion of the project the assets were handed over to the Municipality. UKK are responsible for the operation and maintenance of the systems including the billing and collection. It would appear that there is no Supervisory Council and the Enterprise is under the direct control of the municipal council.

The Water supply & Sewerage Enterprise has a Director with an engineering degree from Tirana University, and a Deputy Director both of whom are responsible for the operation and maintenance of the systems with a total workforce of about sixty. Vehicles and equipment are hired for maintenance work as and when required. There is a Finance Section, a Technical Section, a Sewerage Section and a Water

Section. The Water Section has three zones; Bathore, Kamza and Valias. The water source is a mixture of wells constructed under the World Bank project and a bulk water supply from the UKT Bovilla reservoir which feeds the old UKT distribution system in Bathore.

Due to past experience of poor service from UKT resulting in the implementation of an emergency water and sewerage project (which Kamza now operates) the mayor would resist any attempts to have UKT return as the service provider.

6.9 Other organizations in the Water and Wastewater Sector

6.9.1 Association of Water Supply and Sewerage Enterprises of Albania

The Association of Water Supply and Sewerage Enterprises of Albania (AWSSA) is a professional (not-for-profit) association of water supply and sewerage professionals working collectively to improve the delivery of water supply and sewerage services in Albania, and to voice the opinions and concerns of the water supply and sewerage utilities. Its objectives are:

- To improve the capacity of the personnel who deliver water supply and sewerage services in Albania, so that they can perform their duties in a professional, reliable and cost effective manner; and
- To represent the interests of water supply and sewerage utilities in Albania regarding laws, decrees, and regulations that may be proposed for action by parliament or by government.

Membership is open to any individual, organization, institution or company with an interest in contributing to the progress of the water supply and sewerage sector in Albania. The association's membership currently has 25 paid up utilities.

The Association plays a pivotal role in the overall decentralization process in the water sector. With funding from GTZ it has held a number of conferences which attracted various stakeholders including central government, local government, utilities and the donor community. These conferences have provided a forum for dissemination of information on the decentralization process in the water and sewerage sector and much discussion on the direction, achievements and problems in the process. The Spring 2006 Water Policy Conference resulting in the signing of a Consensus Document on Decentralization and Regionalization of water supply and wastewater services is an example of the important role played by AWSSA. The importance of the Association in capacity building is also given in section 6.3.4 of this report.

6.9.2 Assistance from Donors

There are a number of donors active in the water and sanitation sector in particular German/Albanian Cooperation has been singled out by GoA for its contributions. Under German/Albanian Cooperation, GTZ has provided support to Commercialization of Water Supply and Sewerage Enterprises since 2003. The project provides advice and assistance mainly to the Association of Water Supply and Sewerage Enterprises of Albania (AWSSA) as well as to local governments in their efforts to improve water

services. The GTZ project aims to:

- Strengthening personnel in the water sector on commercialization & decentralization; and
- Support for the development of the legal & institutional framework for commercialization.

The objectives are to:

- Strengthen the AWSSA in service delivery to its members;
- Strengthen the capacity of Municipalities in Water Supply & Sewerage responsibilities; and
- Increase awareness in AWSSA and stakeholders in the EU requirements in the water sector.

A draft document has been produce on "Guidelines for Supervisory Councils of Water Supply and Sewerage Utilities in Albania." which will greatly assist with the decentralization process. Target groups cover municipalities, water & sewerage enterprises and their supervisory councils, ministries, water utilities regulator, AWSSA and others.

German Cooperation has also been active in private sector participation (PSP) and Institutional Strengthening and Capacity Building as previously described in Chapters 6.3.2 and 6.3.4 respectively.

World Bank has also been very active providing funding for, among others, the National Environmental Action Plan (NEAP), the Water Supply and Wastewater Sector Strategy, and the "Benchmarking" program. World Bank have also been active in private sector participation (PSP) and Institutional Strengthening and Capacity Building as previously described in Chapters 6.3.2 and 6.3.4 respectively.

This does not detract from the assistance from other donors, governments, companies and international institutions listed below which were active in the sector as at March 2004:

- Government of Luxembourg;
- Dutch Government;
- Spanish Company FCC – Aqualia;
- Italian Government Cooperation (Technical & Financial Assistance to (UKT);
- World Bank (Integrated Management of Water & Ecosystems);
- European Investment Bank (EIB) (Municipal Water Infrastructure);
- Japanese Government (Sewerage System Study for the Greater Tirana area);
- Uruguay Government; and
- Phare Program.

The following Table 6.9.1 shows that projects of general value of Euro 153 million are in progress of which Euros 87 million were disbursed by March 2004.

Table 6.9.1 Funding of Projects under Implementation (Euros × 1000)

Donor	Committed (A)	Disbursed (D)	% D/A
Germany (KfW)	60,183	36,262	60%
World Bank (IDA)	34,274	23,808	70%
EU / Phare	27,932	12,177	44%
Italy	13,997	7,623	54%
IDB	11,086	2,517	23%
Austria	5,402	4,323	80%
Total	152,874	86,710	57%

Source: Albania Water Sector Conference 24 Mar. 2004

CHAPTER 7

CURRENT FINANCIAL STATUS

CHAPTER 7 CURRENT FINANCIAL STATUS

7.1 General

State and Local government financial information reveals significant issues relating to the sewerage development plan and to the local government. The financial status of the central government, the local governments, UKT, and UKK are discussed in this section. Current tariff system for water and sewerage services are collected and summarized, including current charge collection system and customer distribution of UKT and UKK.

7.2 Central Government

The Government of Albania generates the majority of its revenue from (1) Counterparts funds, (2) Tax Revenue, (3) Social Institute Contributions and (4) Non-tax (no Counterparts funds have been received since the year 2000). The total Revenue grew from Leks 33,476 million in 1993 to Leks 135,484 million. This represents a 19.10 % annual average growth rate. The main sources of revenue in Albania are taxes (V.A.T; Profit Tax; Excise Tax; Small business Tax; Personal Income Tax; National Taxes; Solidarity Tax; and Custom Duties). Property Tax and Local Taxes are also collected from the local Government. Tax revenue has grown from Leks 19,594 million in 1993 to Leks 91,788 million in 2001, which represents an average annual growth rate of 21.29 %.

The total Tax revenue consists of 45% from Value Added Tax (VAT), 11% from Profit Tax, 10% from Excise Tax, and 14% from custom Duties. These four sources represent 80% of the total tax revenue. These taxes are generated by corporations. Personal Income Tax represents only 7 % of the total tax revenue. The detail information is presented in Appendix 12.7.1.

Expenditure increased from Leks 50,678 million in 1993 to Leks 186,049 million in 2001. This represents an average annual growth rate of 17.65 %. Expenditure has exceeded Revenue since 1993, as shown in *Table 7.2.1*. Note that the growth rate is lower than that of revenue.

As of 2001, the registered deficit consisted of Leks 28 billion from domestic sources and Leks 22 billion from foreign sources.

Table 7.2.1 Albania's Financial Status

(millions leks)

Description	Year								
	1993	1994	1995	1996	1997	1998	1999	2000	2001
Revenue	33,476	44,475	53,716	51,572	56,645	93,519	107,506	120,637	135,484
Expenditure	50,678	60,984	77,134	87,596	100,730	141,628	165,692	170,621	186,049
Cash Balance	-17,202	-16,590	-23,418	-36,024	-44,085	-48,110	-58,186	-49,984	-50,566
Financing (Cash)	17,202	16,590	23,418	36,024	44,085	48,110	58,186	49,984	50,566
Domestic	11,624	15,817	14,854	28,293	37,726	27,596	27,928	29,958	28,266
– Privatization receipts		2,358	309	616	910	133	906	8,932	12,686
– Other	11,624	13,459	14,567	17,678	36,815	27,464	27,022	21,028	15,580
Foreign	5,578	692	8,542	7,731	6,360	20,513	30,257	20,024	22,300
Development (gross)			7,893	7,607	7,474	13,626	17,158	17,525	19,442
Budget Support and others			692	599	-27	8,169	13,951	3,499	3,677
Repayments			-43	-476	-1,088	-1,282	-851	-999	-818
Main Indicators:									
Domestically Financed Deficit	11,624	15,817	14,876	28,293	37,726	27,596	27,928	29,959	28,266
Dom. Reven. Minus Dom. Exp.	-11,624	-16,509	-15,525	-28,416	-36,611	-34,483	-41,028	-32,459	-31,124
Overall Balance	-17,202	-16,509	-23,418	-36,024	-44,085	-48,110	-58,186	-49,984	-50,566

Source: INSTAT

7.3 Local Government

In the following the current financial status of each local government is described, the detail information is presented in Appendix 12.7.4 through Appendix 12.7.34.

7.3.1 Tirana Municipality

Tirana municipality is financially sound. Its own revenue is Leks 5,989 million and expenditure is Leks 6,296 million, approximately 5% of the revenue is provided by the Central Government as a grant and/or contribution.

7.3.2 Kamza Municipality

Kamza municipality is in financial difficulty. In 2004, its own revenue is Leks 141 million and expenditure is Leks 450 million, 69% of the revenue came from the Central Government as a grant.

7.3.3 Kashar, Berxulle and Paskuqan Communes

Revenue in Kashar commune has increased by a factor of 9 between 2001 and 2004 (increasing from Leks 9 million in 2001 to Leks 80 million in 2004). However, Kashar commune is facing financial difficulties because the Governmental grants have reduced from 90 % of the total revenue in 2001 to 60 % in 2004.

The financial status of Paskuqan Commune is quite serious. Since 2002, the Government grants have reduced from 85% of the total revenue in 2002 to 83%, but the commune authority can not stand on its own feet even decentralization has been started.

The financial status of Berxulle commune is also serious. Its revenue is Leks 14 million and expenditure

is Leks 58 million in 2004. 75 % of its revenue was provided by the Central Government as a grant.

Table 7.3.1 shows a summary of financial status Municipalities, Communes and 11 Mini-Municipalities under the Tirana Municipality.

Table 7.3.1 Summary of Financial Status of Municipalities Communes and Mini-Municipalities

A. Greater Tirana Region (million Leks)

Local Government		Tirana Municipality				Kamza Municipality				Kashar Commune				Paskuqan Commune				Berxull Commune		
		2001	2002	2003	2004	2001	2002	2003	2004	2001	2002	2003	2004	2002	2003	2004	2005	2002	2003	2004
Total Expenditure		1,390	1,839	9,473	6,296	221	266	337	450	89	117	155	194	126	143	189	231	30	47	58
Revenue	Own Revenue	969	1,325	9,233	5,989	221	266	96	141	9	14	49	80	18	18	16	39	-5	6	14
	Grant from the Other Government	421	514	240	307	0	0	241	309	80	104	105	114	108	126	172	192	35	41	44
	With rate of:	30.28%	27.94%	2.53%	4.88%	0.00%	0.00%	71.47%	68.64%	89.92%	88.26%	68.09%	58.76%	85.53%	87.73%	91.36%	83.04%	115.46%	86.62%	75.34%

B. Tirana Mini Municipalities (million Leks)

Local Government		No.1		No.2		No.3		No.4		No.5	No.6		No.7	No.8		No.9		No.10		No.11	
		2003	2004	2003	2004	2003	2004	2003	2004	2004	2003	2004	2004	2003	2004	2003	2004	2003	2004	2003	2004
Total Expenditure		67	81	72	102	66	81	97	116	98	82	99	85	57	72	62	83	46	57	94	119
Revenue	Own Revenue	61	81	67	102	63	81	88	114	95	78	99	25	21	21	21	22	41	17	21	26
	Grant from the Other Governm	6	0	5	0	3	0	9	3	3	5	0	60	36	51	41	61	5	40	74	93
	With rate of:	8.80%	0.00%	6.44%	0.00%	4.60%	0.00%	9.04%	2.36%	2.80%	5.51%	0.00%	70.21%	63.61%	70.99%	66.53%	73.10%	11.29%	69.85%	77.96%	77.95%

(Note) The other government means the other higher governmental autholities as the ministries and/or the central Government.

Among the 11 Tirana Mini-Municipalities, No.7, 8, 9 and 11 are in the serious status according to their Profit and Loss Statements as indicated in the above table. They are receiving grants from the Local Government and/or the Central Government more than 60 % of their revenue.

7.4 Water Supply and Sewerage Corporations

7.4.1 UKT

The UKT is financially stable. *Table 7.4.1* shows UKT's annual profit and loss statement. In 2005, its revenue is Leks 1,115 million and expenditure is Leks 1,084 million. In 2005, Leks 28 million (2.5 % of revenue) was provided to UKT by the Central Government as a grant (or contribution).

Table 7.4.1 Profit and Loss Statement, UKT, 1999 - 2005

(Million Leks)

Expenditures	1999	2000	2001	2002	2003	2004	2005
I. Reduction of Own Production Stock	0	0	0	0	0	0	0
II. Exploitation Expenses and Other Flowing	308	514	565	626	814	1,117	1,084
III. Financial Expenses	31	19	29	26	32	30	22
Total (I + II + III)	339	533	594	652	846	1,147	1,106
Result from Common Activities	61	63	28	76	27	14	9
IV. Extra-Ordinary Expenses (Extra-Ordinary Results)	0	0	0	0	0	0	9
V. Profit before Taxes	61	63	28	76	27	14	18
VI. Taxes over Profit and Similar							
a) Tax over Profit (Profit from Common Activities)	18	19	15	19	15	7	5
b) Other Subtractions	0	0	0	0	0	0	0
VII. Net Profit (or of the Balance) (V - VI)	43	44	13	57	12	7	13

Revenues	1999	2000	2001	2002	2003	2004	2005
I. Revenues Included in the Business	368	540	565	650	774	916	1,057
II. Other Revenes (Other than financal)	31	49	47	67	86	233	28
Sub Total (I + II)	400	589	612	717	860	1,149	1,085
III. Financal Revenues	1	7	10	12	13	12	30
Total (I + II + III)	400	596	622	728	873	1,161	1,115
Result from the Common Activities	0	0	0	0	0	0	0
Losses	0	0	0	0	0	0	0
IV. Extra-Ordinary Revenues	0	0	0	0	0	0	9
Losses	0	0	0	0	0	0	0
V. Balance's Result	0	0	0	0	0	0	0
Losses	0	0	0	0	0	0	0

Source: UKT.

"Other Revenues (Other than financial)" describes the subsidy and/or contribution received from the state Government. In 2004, the Government provided a large subsidy that was funded by a loan from the Italian Government.

Table 7.4.2 shows a statement of UKT's Assets and Liabilities. During 2005, the total assets were Leks 10,238 million. This included an accumulated bad debt of approximately Leks 1.3 billion (to 2005) as shown in *Table 7.4.2.* These debt figures (from 1999) are listed in the item called "Clients for Selling and Services" under the sub-item called "Accounts Receivable (Long Term Credits)" of "C. Circulating Actives". UKT has not identified the cause of these bad debts. It is important to note that the bad debt exceeded the 2005 revenue. Appendix 12.F.1 and 2 in Volume III of the Supporting Report provides details about both the Statement of Profit and Loss and the UKT Balance Sheet.

Table 7.4.2 Balance Sheet Summary, UKT 1999 - 2005

(Million Leks)

Assets	1999	2000	2001	2002	2003	2004	2005
A. Signed Unrequestable Capital	0	0	0	0	0	0	0
B. Fixed Assets	2,164	3,930	5,538	5,463	5,782	5,645	8,478
I. Intangible Fixed Assets	1	0	0	0	4	4	3
II. Tangible Fixed Assets	2,162	3,930	5,538	5,463	5,778	5,641	8,474
III. Financial Fixed Assets	0	0	0	0	0	0	0
C. Circulating Actives	557	806	1,031	978	1,310	1,431	1,613
I. Situation of the Inventory in Process	27	38	40	80	90	125	117
II. Accounts Receivable (Long Term Credits)	455	659	833	703	965	1,170	1,339
a. Clients for Selling and Services	455	658	829	700	955	1,141	1,288
III. Bonus with Provisional Alocation	0	0	0	0	0	0	0
IV. Liquids and Other Cash Values	75	109	158	194	256	136	156
V. Advanced Paid or Registrated Expenses	0	0	0	0	0	0	0
D. Other Accounts	0	0	0	0	0	222	147
Total of Actives	2,721	4,737	6,568	6,441	7,092	7,298	10,238

Liabilities	1999	2000	2001	2002	2003	2004	2005
A. Own Capitals	607	2,362	2,365	2,462	2,887	2,941	5,737
I. Foundation Capital, Reserves, Profits/ Losses	336	2,249	2,220	2,265	2,606	2,608	5,321
II. Other Own Funds (Valid for State Enterprises)	212	6	43	53	5	5	5
III. Subsidiary for Investments	59	107	102	143	276	328	411
IV. Provisions for Risks and Expenses	0	0	0	0	0	0	0
B. Accounts Payable	2,114	2,373	4,204	3,977	4,203	3,879	4,113
I. Long Term Liabilities	1,897	2,067	3,729	3,788	3,892	3,734	3,960
II. Current Liabilities	217	306	476	189	311	143	148
III. Taken or Registered in Advance Revenues	0	0	0	0	0	1	5
C. Other Accounts	0	1	1	1	1	478	388
a. Pasive Conversion Differenmces	0	0	0	0	0	477	386
b. Counter-party of Emboided Stable Active (AQT) Excluded from the Capital	0	1	1	1	1	1	1
Total of Liabilities	2,721	4,735	6,569	6,439	7,091	7,297	10,236

Source: UKT.

7.4.2 UKK

The financial status of UKK is unstable. Its revenue is Leks 9 million and expenditure is Leks 16

million. During 2004, Leks 7 million (45 % of revenue) was provided by the Central Government in the form of a grant, as shown in the following table.

Table 7.4.3 Profit and Loss Statement, UKK 2004

(Leks)

Expenditure	2004	Revenue	2004	Remarks
Salaries and Wages from Grants	5,501,000	Operational Income	8,847,780	Collection Rates:
Salaries and Wages from Own Incomes	3,895,583	From Kamza Area	3,850,410	67.30%
Social Security from Grants	1,846,000	From Valias Area	574,360	51.70%
Social Security from Own Incomes	1,234,000	From Zall-Mner Area	551,930	80.90%
Operational Expenditures	3,581,672	From Bathore 1 and 2 Areas	979,200	42.10%
From Grants	2,492,500	From Bathore 3 and 4 Areas	1,155,440	57.60%
Bank Commissions	25,748	From Bathore 4/1 Area	435,840	(Extra)
Power Supply	432,000	Water Record of Due Paid Notep	118,600	Average Collection
Water Liquidations	1,213,467	Water Junctions	1,182,000	Rate:
Other Services	300	Grants	7,210,475	59.92%
Chacellery	61,540			
Invoices Notepad and Record of Due Paid Notepac	240,540			
Maintenance of Water Supply System	399,000	(Note)		
Procurement of Chlorine	90,000	Share rate of Grants to the total income:	44.90%	
Procurement of Small Working Tools	29,905			
From Own Income	1,089,172			
Bank Commissions	12,172			
Power Supply	180,000			
Water Liquidations	432,000			
Telephone Cards	50,000			
Procurement of Chlorine	120,000			
Repairing Cost	295,000			
Total Expenditure	16,058,255	Total	16,058,255	

Source: UKK

The financial report is not complete because UKK only has records for two years since its establishment.

7.5 User Charges for Sewerage Services (Tariffs)

7.5.1 Current Tariff Systems

(1) UKT

The UKT water and sewage tariff system consists of a specific (volumetric) system and a flat rate system. Both these systems are linked to the volume of water consumed. *Table 7.5.1* shows the specific system.

The water supply charge for enterprises is 4.5 times higher than for domestic customers. The charge for offices is 3.5 times that of domestic customers. The charge for sewerage services for enterprises is twice that of domestic customers, and the charge for offices is only 1.2 times that of domestic customers. It is therefore apparent that the tariff for sewerage services is significantly lower than that for water supply.

A 20 % value added tax is levied in addition to the charges for water supply and sewerage services.

The flat rate system for charging assumes a set (4.5 m^3) water volume consumed per person per month. To calculate the volume of water consumed the number of family members and the charges are combined, using the unit price as indicated in *Table 7.5.1*.

Table 7.5.1 Current UKT Specific (Volumetric) Tariff System

Charging Category	Water Supply Service	Sewerage Service
Domestic Customers (Households:HHs)	20 Lek/M^3	5 Lek/M^3
Offices (Governmental and private offices, and so on)	70 Lek/M^3	6 Lek/M^3
Enterprises (Manufacturing, factories, hotels, Restaurants, including bars cafes, shops, etc.)	90 Lek/M^3	10 Lek/M^3

Remarks: 1. The water volume discharged as sewage from HHs is calculated by the rate of 80 % of the charge for water supply and unit charge for sewerage is 5 Leks/M^3 according to the regulation of UKT.
2. The value added tax of 20 % is added to billing amount for both the charges for water supply and sewerage services.

(2) UKK

The existing tariff system for water supply and sewerage services in UKK is simple. *Table 7.5.2* shows the tariff system for UKK. It uses the flat rate system without any categories for customers. The charge for water supply is 80 Leks per person per month. Therefore, if the household consists of four people, the water charge is 320 Leks/HH per month (= 80 Leks × 4 people), and if the household consists of five people, the water charge is 400 Leks/HH per month (= 80 Leks × 5 people).

The sewerage services charge was set at 50 Leks/HH per year irrespective of the size of the family. It is recommended that individuals pay the sewerage levy when they connect to the water supply system, even if they do not connect to the sewer network. This would mean the sewerage services bill would be for 4 Leks/HH month. This amount is very small when compared with UKT's tariffs.

The sewerage services charge is increased to 2000 Leks/HH per year from 2006, regardless of the household size. People are required to pay the sewerage services when they pay the water supply, even if they are not connected to the sewer networks.

Table 7.5.2 Existing Tariff System for Water Supply and Sewage Service of UKK

Charging Category	Water Supply		Sewerage Service	
Whole the Customers (No classified by category)	80	Leks per person per month	2,000	Leks per HH per year

Remarks: 1. People in Kamza Municipality pay water charge once a year. At that pay time, the charge for sewage services is automatically included even the people do not connect with the sewage networks.
2. The above charge for sewerage services is applied from June, 2006. The former rate was only 50 Leks per household per year. The charge for water supply is not changed.

7.5.2 Current Status of Charge (Tariff) Collection

(1) UKT

Table 7.5.3 shows the number of customers who received bills and who paid and the amount of charge collected. The table indicates that an expected amount to be paid per customer is 6,267 Leks/customer for water supply service and 1,015 Leks/customer for sewerage service. It also shows that the charge collection rate is 79.75 % for water supply service and 80.85 % for sewerage service.

The data in *Table 7.5.3* do not allow for the analysis of distribution by type of customer. The customer distribution by type is set as in the following manner:

Table 7.5.3 Number of Charge Raised and Collected by UKT

Year	Charge Issued					Average Issued Amount per Customer (Lek/customer)	
	Water Supply		Sewerage		Total Issued Amount (Million Lek)	Water Supply	Sewerage
	Number of Customer	Issued Amount (Million Lek)	Number of Customers	Issued Amount (Million Lek)			
2000	96,448	540	83,486	86	626	5,600	1,024
2001	99,847	565	85,224	91	656	5,658	1,071
2002	107,286	662	92,283	92	754	6,171	996
2003	111,113	779	96,610	98	877	7,010	1,017
2004	117,605	811	104,709	101	912	6,898	967
Source: UKT.					Average:	6,267	1,015

Year	Charge Collected						Recovery Rate (Charge Collection Rate)	
	Water Supply			Sewerage				
	Number of Customers	Collected Amount (Million Lek)	Collected Charge per Customer (Lek/Customer)	Number of Customers	Collected Amount (Million Lek)	Collected Charge per Customer (Lek/Customer)	Water Supply	Sewerage
2000	73,601	413	5,613	63,451	68	1,074	76.28%	76.00%
2001	81,383	457	5,614	73,520	78	1,060	81.51%	86.25%
2002	88,297	548	6,203	76,597	77	1,000	82.30%	83.00%
2003	87,224	621	7,117	76,324	82	1,071	78.50%	79.00%
2004	94,264	666	7,070	83,771	87	1,037	80.15%	80.00%
Source: UKT.		Average:	6,323		Average:	1,048	79.75%	80.85%

The number of registered enterprises and households in Tirana were shown in *Table 2.2.3* and *Table 2.2.6* in Chapter 2. Because the number of the government offices is not available, it is assumed that the government offices are included in the number of registered enterprises. The registered enterprises are legal enterprises that must make payment for both water supply and sewerage services. Therefore, it can be assumed that the number of registered enterprises deducted from the total number of customers equates to the number of household customers. *Table 7.5.4* shows the estimated number of customers by two types of customers for water supply and sewerage services.

Table 7.5.4 Estimated Number of Customers by Type in Tirana Municipality

Year	Water Supply			Sewerage		
	HHs (1)	Enterprises and Offices (2)	Total	HHs (1)	Enterprises and Offices (2)	Total
2000	83,209	13,279	96,488	70,207	13,279	83,486
2001	84,605	15,242	99,847	70,002	15,242	85,244
2002	89,790	17,496	107,286	74,787	17,496	92,283
2003	90,961	20,152	111,113	76,458	20,152	96,610
2004	96,991	20,614	117,605	84,095	20,614	104,709

Note: (1) Number of customers of HHs are resulted from the total number of customers minus the number of customers of enterprises and offices.
(2) Number of customers is excerpted from the statistics, STAT

On the basis of the population of Tirana Municipality and the average family size as 3.76 persons/HH as shown in Table 2.2.3 of Chapter 2, number of HHs in 2001, 2002, 2003 and 2004 can be estimated as 127,097, 131,475, 137,675 and 146,733 respectively.

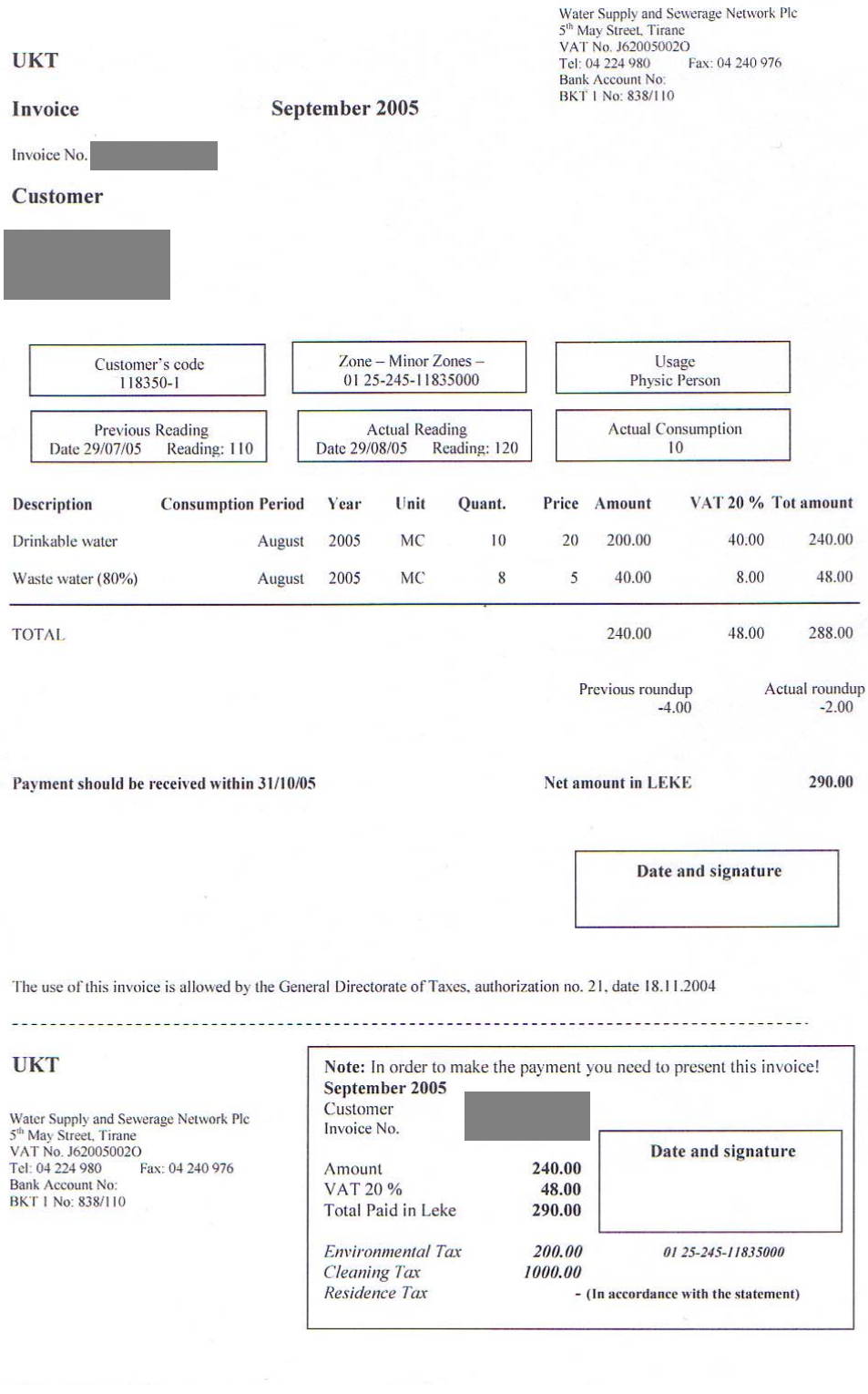
The connection and collection rates of HH's customers for water supply and sewerage services can be estimated as shown in *Table 7.5.5.*

Table 7.5.5 Connection and Collection Rates for Water Supply and Sewerage Services of UKT HH's Customers

Year	Total Number of HHs	Connection Rates				Collection Rates			
		Water Supply		Sewerage Services		Water Supply		Sewerage Services	
		Number of HH Custmers for issuing bill	Actual Connection Rate of HHs	Number of HH Custmers for issuing bill	Actual Connection Rate of HHs	Number of HH Custmers paid charge	Actual Collection Rate of HHs	Number of HH Custmers paid charge	Actual Collection Rate of HHs
	(1)	(2)	(3)=(2)/(1)	(4)	(5)=(4)/(1)	(6)	(7)=(6)/(2)	(8)	(9)=(8)/(4)
2001	127,097	84,605	66.57%	70,002	55.08%	66,141	78.18%	58,278	83.25%
2002	131,475	89,790	68.29%	74,787	56.88%	70,801	78.85%	59,101	79.03%
2003	137,675	90,961	66.07%	76,458	55.53%	67,072	73.74%	56,172	73.47%
2004	146,733	96,991	66.10%	84,095	57.31%	73,650	75.93%	63,157	75.10%
Average			66.76%		56.20%		76.67%		77.71%

Note: Column (1), Refer to Table 2.2.3
Column (2) and (4), Refer to Table 7.5.4
Column (6) and (8), Number of customers shown in Table 7.5.3 minus number of customer of offices and commercial enterprises shown in Table 7.5.4

Figure 7.5.1 is an example of a water supply and sewerage service bill in UKT, for people living in Tirana Municipality. UKT send this bill to households (customers) connected to the water supply system and sewer networks. Customers settle their bills at UKT office or their nearest branch offices. The note in the bill also presents an invoice of environmental tax and cleaning tax, the amount of these taxes are shown in annual figures. The cleaning tax is applied only for Tirana Municipality. The sewerage service charge level is about 0.21% of the average annual income of the households in 2005 for Tirana Municipality. The charge level of sewerage service, environmental tax and cleaning tax becomes about 0.4% of the average annual income of the households in Tirana Municipality.



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VAT No. J62005002O
Tel: 04 224 980 Fax: 04 240 976
Bank Account No:
BKT 1 No: 838/110

UKT

Invoice **September 2005**

Invoice No. [redacted]

Customer

[redacted]

Customer's code	Zone – Minor Zones –	Usage
118350-1	01 25-245-11835000	Physic Person

Previous Reading	Actual Reading	Actual Consumption
Date 29/07/05 Reading: 110	Date 29/08/05 Reading: 120	10

Description	Consumption Period	Year	Unit	Quant.	Price	Amount	VAT 20 %	Tot amount
Drinkable water	August	2005	MC	10	20	200.00	40.00	240.00
Waste water (80%)	August	2005	MC	8	5	40.00	8.00	48.00
TOTAL						240.00	48.00	288.00

Previous roundup -4.00 Actual roundup -2.00

Payment should be received within 31/10/05 **Net amount in LEKE** **290.00**

Date and signature

The use of this invoice is allowed by the General Directorate of Taxes, authorization no. 21, date 18.11.2004

UKT

Water Supply and Sewerage Network Plc
5th May Street, Tirane
VAT No. J62005002O
Tel: 04 224 980 Fax: 04 240 976
Bank Account No:
BKT 1 No: 838/110

Note: In order to make the payment you need to present this invoice!
September 2005
Customer
Invoice No. [redacted]

Amount	**240.00**
VAT 20 %	**48.00**
Total Paid in Leke	**290.00**
Environmental Tax	***200.00***
Cleaning Tax	***1000.00***
Residence Tax	

Date and signature

01 25-245-11835000

- (In accordance with the statement)

Figure 7.5.1 An Example UKT Bill for Water Supply and Sewerage Services

(2) UKK

UKK officials have indicated that there are no enterprises in Kamza Municipality. Most of the people living in Kamza Municipality work in Tirana Municipality. There are some shops and restaurants but they can be regarded as household industries (categorized as 'micro scale enterprises').

UKK's tariff collection system is not clear, however it seems to be similar to UKT's system. UKK applies a fixed tariff system. People within Kamza Municipality pay water tariffs once a year. The amount charged is Leks 80/person per month for water supply service. The tariff for sewerage service is automatically included in the bill even though the individual have not yet connected to the sewer network.

According to information from UKK, the number of customers who paid their bills in 2004 (not the total number of bills issued) was 27,650 for both the water supply and sewerage services. The number of customers includes both the ordinary HHs and the commercial, enterprises and business sector, because their business scale are very small and as small as the ordinary HHs in Kamza Municipality according to an information of UKK officials.

CHAPTER 8

BASIC APPROACH FOR SEWERAGE PLANNING

CHAPTER 8 BASIC APPROACH FOR SEWERAGE PLANNING

8.1 General

A basic planning approach for the sewerage system M/P for the Greater Tirana area was set up based on consideration of the existing situation. This chapter also provides details on the following issues that were considered when planning the sewerage system: acceptance of industrial wastewater to the sewerage system, sewer system and sewage treatment process.

8.2 Basic Planning Approach

The general objectives for sewerage system development are:

- To improve the communities' living and sanitary conditions by collecting and conveying sewage/wastewater;
- To contribute towards water quality improvements in the receiving water body by treating the collected sewage/wastewater at a Sewage Treatment Plant (STP); and
- To provide flooding protection and reduce flood damage by collecting sewage and rainwater in pipes and by discharging at a designated point into the river.

Based on the findings mentioned in the previous chapters, the sewerage plan for the Greater Tirana area will aim to:

(1) contribute towards water quality improvement in the Lana and Tirana Rivers, by introducing sewage/wastewater treatment.
(2) provide a better living and sanitary environment for more people by expanding the sewerage system which will collect and convey the sewage in an appropriate manner.

Significant capital investment is generally required to develop sewerage systems. Also, funds are required for ongoing proper O&M and management. Successful ongoing operation of the sewerage system is required to encourage additional sewerage development projects in the country.

The following basic approach was adopted based on the above considerations:

- Maximize the use of the existing sewer system (including the sewers and interceptors);
- Begin treating sewage as soon as possible so that improved water quality in the Lana and Tirana Rivers can be realized;
- Undertake the sewerage system development as a staged approach;
- Recommend sewage and sludge treatment technology that is easy to operate and maintain, has low energy consumption, and has low construction and O&M costs; and
- Acquire sufficient land at appropriate locations to provide for the recommended sewage and sludge treatment technologies.

8.3 Acceptance of Industrial Wastewater into the Public Sewerage System

The quality and quantity of industrial wastewater are important issues to be considered when planning

sewage systems. This is because the bacteria used in the biological sewage treatment processes are killed by toxic substances and chemicals in the industrial wastewater, if they are allowed to enter the STP. Therefore, the quantity and quality of industrial wastewater needs to be checked before it is accepted into the public sewerage system to ensure the treatment process will not be damaged.

Since there is a STP in Albania, there is a lack of experience in O&M of STPs.

In the Greater Tirana area most of the factories are either of a small or medium scale, and they are located in urban areas where residential, commercial and business zones are mixed.

The Albanian government does not have an official list of industrial factories that provides information regarding classification, water consumption, or discharge quantity and quality. Currently, wastewater from industrial areas and large factories is not accepted into the sewerage system.

This study has defined "sewage" as water discharged from residential zones (mainly domestic), commercial zones (excluding toxic and chemical base wastewater), business zones (excluding toxic and chemical base wastewater) and offices in industrial zones.

This study uses the term "sewerage system" not "wastewater system" so that it is clear that industrial wastewater is not to be accepted. Industrial wastewater is not to be accepted. The followings are major reasons.

- Albanian environmental law requires industries which produce wastewater to have their own treatment facilities that treat the effluent to approved standards prior to discharge into nearby watercourses.
- The flow rate and quality of industrial wastewater is not easily determined for the present conditions of operation. This means the required capacity for the STP cannot be accurately estimated.
- If industrial wastewater is accepted into the sewerage system it will be difficult to treat the sewage to an acceptable effluent quality because local engineers and operators lack the required experience. If some detrimental substances enter the system, the biological process would be damaged, which would reduce the treatment efficiency. If toxic or chemical wastewater enters the sewage treatment facilities, the bacteria would be damaged or killed. This would mean the treatment facilities would need to cease operating for a few weeks so that the bacteria can regenerate. In serious cases, the facilities may require a significant overhaul before they can work effectively.
- Since industrial wastewater has different characteristics for each industry type, different processes may be required to appropriately treat the wastewater. Mixing different industrial wastewater types can make it difficult to treat the wastewater.

8.4 Sewage Collection System

Findings in Chapter 5 indicate that the existing sewer system in the municipalities of Tirana and Kamza should be used at their maximum use. However, the new development area has no existing public sewer system. Therefore, a separate sewerage system will be developed for this area. Development of the

sewage treatment system will be given priority over the drainage system because the rainwater can be discharged using the existing drainage conduits or irrigation channels.

The following paragraphs explain the proposed improvements to the sewerage system.

Under dry weather conditions, the existing sewers will collect and convey sewage in systems that have existing interceptors. Where the existing sewers are not connected to the interceptors, additional sewers will be laid, providing for gravity flow, where possible. The interceptor will be connected to the trunk sewer at a connection point, from where the collected sewage will be conveyed through the new trunk sewers to a STP.

Under wet weather conditions, a mixture of sewage and rainwater is collected in the existing sewers. This flow will be intercepted by a weir structure that will be constructed in a manhole near the interceptor. The remaining overflow will be diverted into the nearby river. An amount of intercepted sewage equivalent to the dry weather flow will be conveyed via the interceptor to a connection point (where the interceptor connects to the proposed trunk sewer) and through to a STP.

Figure 8.4.1 shows the improved existing sewage collection and conveyance system. *Figure 8.4.2* shows the proposed sewage collection and conveyance system entering the STP.

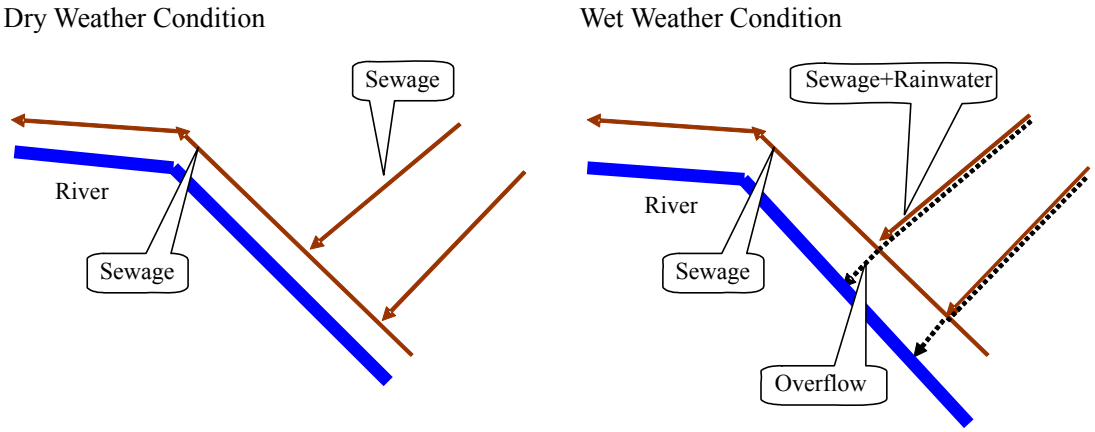

Figure 8.4.1 Improved Existing Sewage Collection and Conveyance System

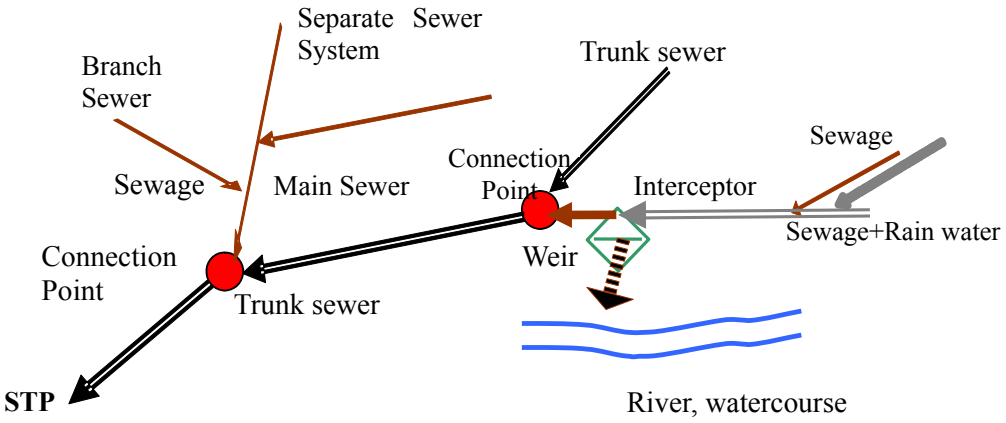

Figure 8.4.2 Proposed Sewage Collection and Conveyance System

8.5 Selection of Sewage Treatment Process

(1) Candidate Sewage Treatment Processes

The EU Directive requires the quality of effluent to comply with the following standard: BOD_5 of no more than 25 mg/L and SS of no more than 35mg/L. The following four sewage treatment processes were compared so that the most appropriate one could be selected:

- Aerated Lagoon(AL);
- Activated Sludge Process (AS);
- Trickling Filter (TF); and
- Oxidation Ditch (OD).

The AL was recommended in both the "JICA Report 1998" and the "Strategic plan of World Bank 2002". The AS was proposed in the "Italian Cooperation Report".

(2) Selection Criteria

The following factors were considered and compared when selecting the most appropriate sewage treatment process:

1) Ease of O&M;
2) O&M Costs;
3) Potential to use local products during implementation;
4) Availability of required site area for each of the processes;
5) Amount of sludge generated; and
6) Possibility of implementing primary treatment at independent sites.

1) Ease of O&M

Since there are no existing STPs in Greater Tirana it is expected that it will be difficult to find

experienced engineers/technicians who will be able to operate and maintain the STP. Therefore, when selecting the sewage treatment process, systems that are simple to operate and maintain are preferred.

2) O&M Costs

Since the electrical power supply conditions in Albania are poor, mechanically and electrically intensive treatment systems should be avoided. That is, systems that require less power are preferred. Also, to reduce O&M costs, systems that have low chemical requirements are preferred.

3) Potential to use local products during implementation

To minimize construction costs, local products and locally available goods and services should be used, where possible. Specifically, it is recommended that the amount of imported goods (e.g. mechanical and electrical equipment) be minimized to reduce costs and to facilitate maintenance.

4) Availability of required site area for each of the processes

The options were assessed to determine whether secondary treatment facilities would fit within the available area, based on the preliminary design of the treatment facilities.

The design focuses on fitting the sewage treatment facilities within the site area rather than the sludge treatment facilities. This is because it is more important that the influent is treated to a permissible level. If the site is large enough, then a sludge drying bed system can be applied as part of the "thickening and dewatering" process to lower the construction and O&M costs.

5) Amount of Sludge Generated

Systems that produce less sludge are preferable because this minimizes costly sludge treatment and disposal. *Table 8.5.1* shows the expected sludge production of each sewage treatment process.

6) Possibility of implementing primary treatment at independent sites

It is proposed that primary treatment facilities be constructed as close as possible to the place where the sewage is generated. This will allow sewage treatment to occur as soon as possible. Therefore, each sewage treatment process option was assessed to determine whether the primary treatment facilities could be separated from the STP sites. The STP design excludes primary treatment facilities at the STP site so that the site can be used to maximize the secondary sewage treatment and sludge treatment.

(3) Assumptions made when comparing the sewage treatment processes

This section presents the fundamental design parameters used to compare AL (aerated lagoon system), TF (trickling filter process), OD (oxidation ditch process) and AS (activated sludge process), as a means for selecting the most appropriate process.

1) Design conditions

Flow: Q_A (average daily flow) = 240,000 m^3/day used (for AL)
Q_M (maximum daily flow) = 300,000 m^3/day used (for TF, OD and AS)

Water quality: Influent BOD_5/SS are 200/200 mg/L
Effluent BOD_5/SS are 25/35 mg/L

Table 8.5.1 compares the design parameters for the major facilities for each process (excluding the components that are common to all i.e. inlet pumps and disinfection facilities).

2) How to compare the sewage treatment process

- Processes with fewer pieces of equipment and fewer operation tasks were judged to be easier to operate and maintain.
- Processes that use less power and require fewer operating staff were judged to be less costly in terms of O&M. This is because power and personnel costs are a significant proportion of O&M costs.
- Processes that produce less solids and therefore need fewer dewatering machines were judged to be most economical.
- Regarding providing primary treatment facilities: Processes that can be associated with primary treatment were judged positively, because primary treatment facilities can be constructed during the first stage of implementation. Options where the primary treatment facilities can be constructed at a site that is independent of the secondary treatment facilities, were judged to be preferable.
- Regarding land availability: Options where the proposed facilities could be fully located within the available site area were judged positively.

Table 8.5.1 Comparison Study for Each Sewage Treatment Process (1/4)

Comparison Item	Aerated Lagoons Method (AL)	Trickling Filter Method (TF)	Oxidation Ditch Method (OD)	Activated Sludge Methods (AS)	Remarks
(1)Basic conditions	・Daily average flow = 240,000 m^3/day ・Daily Max flow = 300,000 m^3/day ・Peak flow = 450,000 m^3/day ・Design water quality Item / Influent / Effluent / Removal Rate(%) BOD(mg/l) / 200 / 25 / 87.5 SS(mg/l) / 200 / 35 / 82.5	・Daily average flow = 240,000 m^3/day ・Daily Max flow = 300,000 m^3/day ・Peak flow = 450,000 m^3/day ・Design water quality (mg/l) Item / Influent / Effluent (PS) / Effluent (FS) / Removal Rate(%) BOD / 200 / 140 / 25 / 87.5 SS / 200 / 120 / 35 / 82.5 Rrimary BODremoval rate 30 % Rrimary SS removal rate 40 %	・Daily average flow = 240,000 m^3/day ・Daily Max flow = 300,000 m^3/day ・Peak flow = 450,000 m^3/day ・Design water quality Item / Influent / Effluent / Removal Rate(%) BOD(mg/l) / 200 / 25 / 87.5 SS(mg/l) / 200 / 35 / 82.5	・Daily average flow = 240,000 m^3/day ・Daily Max flow = 300,000 m^3/day ・Peak flow = 450,000 m^3/day ・Design water quality Item / Influent / Effluent / Removal Rate(%) BOD(mg/l) / 200 / 25 / 87.5 SS(mg/l) / 200 / 35 / 82.5 Rrimary BODremoval rate 30 % Rrimary SS removal rate 40 %	・Effluent water quality shall clear the average of target water quality BOD = 25 mg/l SS = 35 mg/l
(2)Flow chart 1)Sewage	Influent ↓ Screen/Grit Chamber + Pumping Station ↓ Complete Mixed Aerated Lagoon ↓ Partially Mixed Aerated Lagoon ↓ Disinfection Tank ↓ Effluent	Influent ↓ Screen/Grit Chamber + Pumping Station ↓ Primary Sedimentation ↓ Trickling Filter ↓ Final Sedimentation ↓ Disinfection Tank ↓ Effluent	Influent ↓ Screen/Grit Chamber + Pumping Station ↓ Oxidation Ditch ↓ Final Sedimentation Tank ↓ Disinfection Tank ↓ Effluent	Influent ↓ Screen/Grit Chamber + Pumping Station ↓ Primary Sedimentation Tank ↓ Aeration Tank ↓ Final Sedimentation Tank ↓ Disinfection Tank ↓ Effluent	
2)Sludge	The water in the AL is removed and sludge left in the AL becomes dried naturally. Therefore, the equipment like a machine dewatering is unnecessary.	Sludge Thickening Tank ↓ Sludge Dewatering	Sludge Thickening Tank ↓ Sludge Dewatering	Sludge Thickening Tank ↓ Sludge Dewatering	
(3)Outline of major facilities	① Grit Chamber Type : Parallel flow rectangular Surface load : 1,800 m^3/m^2/day Required area : 250 m^2 Unit number : 4 unit(s) Width : 4.0 m/unit Length : 15.6 m	① Grit Chamber Type : Parallel flow rectangular Surface load : 1,800 m^3/m^2/day Required area : 250 m^2 Unit number : 4 unit(s) Width : 4.0 m/unit Length : 15.6 m	① Grit Chamber Type : Parallel flow rectangular Surface load : 1,800 m^3/m^2/day Required area : 250 m^2 Unit number : 4 unit(s) Width : 4.0 m/unit Length : 15.6 m	① Grit Chamber Type : Parallel flow rectangular Surface load : 1,800 m^3/m^2/day Required area : 250 m^2 Unit number : 4 unit(s) Width : 4.0 m/unit Length : 15.6 m	

Table 8.5.1 Comparison Study for Each Sewage Treatment Process (2/4)

Comparison Item	Aerated Lagoons Method (AL)	Trickling Filter Method (TF)	Oxidation Ditch Method (OD)	Activated Sludge Methods (AS)	Remarks
	② Complete Mixed Aerated Lagoon Type : Rectangle Tank Retention time : 1.75 day Unit number : 16 unit(s) Required volum : 420,000 m^3 Depth : 3.0 m Width : 75.0 m Length : 116.7 m	② Primary Sedimentation Tank Type : Circular tank with sludge collector Sueface load : 50.0 $m^3/m^2/day$ Unit number : 24 basin(s) Required area : 250.0 m^2/unit Depth : 3.0 m Diameter : 17.8 m/basin	② Oxidation Ditch Type : Circulation Channel Retention time : 24.0 hr(s) Required volum : 300,000 m^3 Depth : 2.5 m Unit number : 80 basin(s) Width : 4.5 m Length : 333.3 m	② Primary Sedimentation Tank Type : Circular tank with sludge collector Sueface load : 50.0 $m^3/m^2/day$ Unit number : 24 basin(s) Required area : 250.0 m^2/unit Depth : 3.0 m Diameter : 17.8 m/basin	
	③ Partilly Mixed Aerated Lagoon Type : Rectangle Tank Retention time : 2.0 day Unit number : 48 unit(s) Required volum : 480,000 m^3 Depth : 4.0 m Width : 75.0 m Length : 33.3 m	③ Trickling Filter Type : Circular Tank BOD load : 0.3 kgBOD/m^3/day Inlet BOD : 42,000 kgBOD/day Unit number : 72 unit(s) Required volum : 140,000 m^3 Depth : 1.5 m Diameter : 40.6 m	③ Sedimentation Basin Type : Circular tank with sludge collector Sueface load : 10.0 $m^3/m^2/day$ Unit number : 40 basin(s) Required area : 750.0 m^2/unit Depth : 3.5 m Diameter : 30.9 m/basin	③ Aeration Tank Type : Rectangle Tank BOD-SS load : 0.35 kgBOD/kgSS/day Unit number : 48 basin(s) Required volum : 80,000.0 m^2/unit Depth : 5.0 m Width : 5.0 m/basin Length : 66.7 m	
	④ Disinfection Tank Type : Chlorination Type Retention time : 15.0 min Required volum : 2,500 m^3 Width : 4.0 m Depth : 3.0 m Length : 208.3 m	④ Final Sedimentation Basin Type : Circular tank with sludge collector Sueface load : 20.0 $m^3/m^2/day$ Unit number : 24 basin(s) Required area : 625.0 m2/unit Depth : 4.0 m Diameter : 28.2 m/basin	④ Disinfection Tank Type : Chlorination Type Retention time : 15.0 min Required volum : 3125.0 m^3 Width : 4.0 m Depth : 3.0 m Length : 260.4 m	④ Final Sedimentation Tank Type : Circular tank with sludge collector Sueface load : 20.0 $m^3/m^2/day$ Unit number : 24 basin(s) Required area : 500.0 m^2/unit Depth : 4.0 m Diameter : 25.2 m/basin	
		⑤ Disinfection Tank Type : Chlorination Type Retention time : 15.0 min Required volum : 3,125 m^3 Width : 4.0 m Depth : 3.0 m Length : 260.4 m		⑤ Disinfection Tank Type : Chlorination Type Retention time : 15.0 min Required volum : 3125.0 m^3 Width : 4.0 m Depth : 3.0 m Length : 260.4 m	• Sludge Thickening Tank Dry solid load 60 kgDS/m^2/day Type Circular tank with sludge collector • Sludge Dewatering Width 3.0 m Operation day 6.0 day/week Operation time 6.0 hr/day
	⑤ Sludge Thickening Tank -	⑥ Sludge Thickening Tank Unit number : 4 basin(s) Sludge content : 45,730 kgDS/day Required area : 190.5 m^2/basin Depth : 4.0 m Diameter : 15.6 m	⑤ Sludge Thickening Tank Unit number : 4 basin(s) Sludge content : 37,130 kgDS/day Required area : 155 m^2/basin Depth : 4.0 m Diameter : 14.0 m	⑥ Sludge Thickening Tank Unit number : 4 basin(s) Sludge content : 52,800 kgDS/day Required area : 220 m^2/basin Depth : 4.0 m Diameter : 16.7 m	
	⑥ Sludge Dewatering -	⑦ Sludge Dewatering Type : Beltpress filter type Sludge content : 45,730 kgDS/day Required capacity : 120.0 kg/m/hr Unit number : 25 unit(s)	⑥ Sludge Dewatering Type : Beltpress filter type Sludge content : 37,130 kgDS/day Required capacity : 100.0 kg/m/hr Unit number : 24 unit(s)	⑦ Sludge Dewatering Type : Centrifugal type Sludge content : 52,800 kgDS/day Required capacity : 120.0 kg/m/hr Unit number : 29 unit(s)	

Table 8.5.1 Comparison Study for Each Sewage Treatment Process (3/4)

Comparison Item	Aerated Lagoons Method (AL)	Trickling Filter Method (TF)	Oxidation Ditch Method (OD)	Activated Sludge Methods (AS)	Remarks
(4)Required site Surface area	① Grit Chamber 250 m^2 ② Complete Mixed Lagoon 140,000 m^2 ③ Partially Mixed Lagoon 120,000 m^2 ④ Disinfection Tank 833 m^2 m^2 m^2 (Total) 261,083 m^2	① Grit Chamber : 250 m^2 ② Primary Sedimentation Tar : 6,000 m^2 ③ Trickling Filter Tank : 93,333 m^2 ④ Final Sedimentation Basin : 15,000 m^2 ⑤ Disinfection Tank : 1,042 m^2 ⑥ Thickening Tank : 50 m^2 Sludge Dewatering 100 m^2 (Total) : 115,675 m^2	① Grit Chamber : 250 m^2 ② Oxidation Ditch : 120,000 m^2 ③ Sedimentation Basi : 30,000 m^2 ④ Disinfection Tank : 1,042 m^2 ⑤ Thickening Tank : 47 m^2 ⑥ Sludge Dewatering : 100 m^2 (Total) : 151,439 m^2	① Grit Chamber 250 m^2 ② Primary Sedimentation Tank 6,000 m^2 ③ Aeration Tank 16,000 m^2 ④ Final Sedimentation Basin 12,000 m^2 ⑤ Disinfection Tank 1,042 m^2 ⑥ Thickening Tank 880 m^2 ⑦ Sludge Dewatering 100 m^2 (Total) : 36,272 m^2	
Required site area	Surface area × 4.5 : 1,174,875 m^2 Approximately : 1,175,000 m^2 226 %	Surface area × 4.5 : 520,536 m^2 Approximately : 520,000 m^2 100 %	Surface area × 4.5 : 681,474 m^2 Approximately : 613,000 m^2 118 %	Surface area × 4.5 : 163,223 m^2 Approximately : 163,000 m^2 31 %	
(5)Required load	① Pumping Station Sewage lift pump 250.0 kw × 3 units = 750.0 kw ② Complete Mixed Lagoon Aerator 64 units (4units/basin) 30.0 kw × 64 units = 1,920.0 kw ③ Partially Mixed lagoon Aerator 96 units (2units/basin) 5.0 kw × 96 units = 480.0 kw (Sub-Total) 3,150.0 kw (2,560.0+480.0)+750.0×12/24 = 2,775.0 kw Miscellaneous Equipment 2775.0 kw × 5 % = 138.8 kw (Total) 2,914 kw ↓ 2,914 kw 470 %	① Pumping Station Sewage lift pump 340.0 kw × 3 units = 1,020.0 kw ② Trickling Filter Spry 0.0 kw × 72 units = 0.0 kw ③ Excess Sludge Pump 3.7 kw × 4 units = 14.8 kw ④ Sludge Collector (thickening tank) 0.75 kw × 4 units = 3.0 kw ⑤ Thickened Sludge Pump 1.5 kw × 4 units = 6.0 kw ⑥ Sludge Dewatering 5.5 kw × 25 units = 137.5 kw (Sub-Total) 1,181.3 kw (1,037.8) (1,020.0+14.8)×12/24 = 511.5 kw +(6.0+137.5)*6/12+3.0 = 40.4 kw Miscellaneous Equipment 511.5 kw × 10 % = 102.3 kw (Total) 613.8 kw ↓ 620 kw 100 %	① Pumping Station Sewage lift pump 250.0 kw × 3 units = 750.0 kw ② Oxidation Ditch Aerator 80 basins (units/basin) 11.0 kw × 160 units = 1,760.0 ③ Return Sludge Pump kw 3.7 kw × 16 units = 59.2 kw ④ Excess Sludge Pump 3.7 kw × 4 units = 14.8 kw ⑤ Sludge Collector (thickening tank) 0.75 kw × 4 units = 3.0 kw ⑥ Thickened Sludge Pump 1.5 kw × 4 units = 6.0 kw ⑦ Sludge Dewatering 5.5 kw × 24 unit = 132.0 kw (Sub-Total) 2,725 kw (2,584.0) (750.0+14.8)×12/24+3520+59. = 2,201.6 kw +(132.0+6.0)×6/24+3 = 37.5 kw Miscellaneous Equipment 2,201.6 kw × 20 % = 440.3 kw (Total) 2,642 kw ↓ 2,642 kw 426 %	① Pumping Station Sewage lift pump 250.0 kw × 3 units = 750.0 kw ② Blower 220.0 kw × 8 units = 1,760.0 kw ③ Return Sludge Pump 5.5 kw × 12 units = 66.0 kw ④ Excess Sludge Pump 3.7 kw × 4 units = 14.8 kw ⑤ Sludge Collector (thickening tank) 0.75 kw × 4 units = 3.0 kw ⑥ Thickened Sludge Pump 1.5 kw × 4 units = 6.0 kw ⑦ Sludge Dewatering 5.5 kw × 29 unit = 156.9 kw (Sub-Total) 930.7 kw (2,590.8) (750.0+14.8)×12/24+1520+44. = 2,208.4 kw +(156.9+6)*6/24+3.0 = 43.7 kw Miscellaneous Equipment 2,208.4 kw × 30 % = 662.5 kw (Total) 2,870.9 kw ↓ 2,871 kw 463 %	・ Major equipment only ・ Loads values are assumed based on the experience ・ Pump specification 1,000mm ×105m^3/min ×10m×250kw×4(1) AL,OD,AS (×14m×340kw×4(1)) ( )TR wastewater treatment Sludge treatment only wastewater treatment only wastewater treatment

Table 8.5.1 Comparison Study for Each Sewage Treatment Process (4/4)

Comparison Item	Aerated Lagoons Method (AL)	Trickling Filter Method (TF)	Oxidation Ditch Method (OD)	Activated Sludge Methods (AS)	Remarks
③ Electric charge ・ Consumed electricity ・ Electric charge	2,910 × 24 × 365 = 25,491,600 kwh/year 25,491,600 × 8.4 = 214,129,440 lek/year	620 × 24 × 365 = 5,431,200 kwh/year 5,431,200 × 8.4 = 45,622,080 lek/year	2,642 × 24 × 365 = 23,143,920 kwh/year 23,143,920 × 8.4 = 194,408,928 lek/year	2,871 × 24 × 365 = 25,149,960 kwh/year 25,149,960 × 8.4 = 211,259,664 lek/year	・ Unit price of electric 8.4 lek/kwh
④ Labor cost	Chief 1 Engineering 1 Operator 4 (1)*3shift+1standby Worker 6 p= 2 w= 4 s= 0 Total 12	Chief 1 Engineering 2 Operator 8 (2)*3shift+1standby Worker 10 p= 2 w= 5 s= 3 21	Chief 1 Engineering 2 Operator 8 (2)*3shift+1standby Worker 12 p= 2 w= 7 s= 3 23	Chief 1 Engineering 2 Operator 12 (3)*3shift+1standby Worker 16 p= 2 w= 10 s= 4 31	
⑤ Total O&M Cost(E+L)	12 × 500,000 lek/year/per = 6,000,000 lek/year 57 % ③ Electric charge + ④ Labor cost = 220,129,440 lek/year 392 %	21 × 500,000 lek/year = 10,500,000 lek/year 100 % = 56,122,080 lek/year 100 %	23 × 500,000 lek/year = 11,500,000 lek/year 110 % = 205,908,928 lek/year 367 %	31 × 500,000 lek/year = 15,500,000 lek/year 148 % = 226,759,664 lek/year 404 %	
⑥ Consturuction Cost	0.66 106 %	0.62 100 %	0.67 108 %	1.00 161 %	JICA2001Croatia Report
⑦Easiness in O&M ・ Equicpment to check	・ Lagoon (aerator)	・ Primary sedimentation tank (sludge scraper) ・ Trickling filter (rotary distributer) ・ Scoundary sedimentation (sludge scraper)	・ Oxidation ditch (aerator) ・ Scoundary sedimentation (sludge scraper) ・ (return sludge pump) (excess sludge pump)	・ Primary sedimentation tank (sludge scraper) ・ Aeration tank (diffuser) ・ Scoundary sedimentation (sludge scraper) (excess sludge pump) (return sludge pump) ・ Blower (blower)	
Number of units to operate (A)	1 unit	3 units	4 units	6 units	
・ Operation	・ To start and reset aerators	・ To control primary effluent to spray	・ To start and resst aerators ・ To control return sludge ratio	・ To control return sludge ratio ・ To control number of blower to operate ・ To control air to blow ・ To control excess sludge withdraw	
Number of units to operate (B)	1 unit	1 unit	1 units	4 units	
Total number o of units to operate (A) +(B)	2 unit 50 %	4 unit 100 %	5 units 125 %	10 units 250 %	

(4) Comparison of the Sewage Treatment Processes

Table 8.5.2 summarizes the results of the comparison of each sewage treatment process. The comparison is presented for each selection criteria.

Table 8.5.2 Comparison of Sewage Treatment Processes

	Aerated Lagoon (AL)	Trickling Filter (TF)	Oxidation Ditch (OD)	Activated Sludge (AS)
1) Ease of O&M	◎ (50%)	○ (100%)	△ (125%)	× (250%)
2) O&M Cost 2.1) Electrical Cost 2.2) Personnel Cost 2.3) Total	△ (470%) (60%) (390%)	◎ (100%) (100%) (100%)	△ (420%) (110%) (360%)	△ (460%) (150%) (400%)
3) Construction Cost	○ (106%)	○ (100%)	○ (108%)	△ (160%)
4) Land availability	(226%)	(100%)	(118%)	(30%)
5) Sludge Generation	◎ —	○ 45.735t/d 25 units of beltpress (100%)	○ 37.135t/d 24 units of beltpress (96%)	△ 52.805t/d 29 units of beltpress (132%)
6) Relationship with primary treatments facilities at independent sites	○	◎	○	◎
Evaluation	2	1	3	4

Note: ◎ very good, ○ good, △ acceptable, × not applicable

AL: Initially, primary treatment could be carried out using some of the lagoons as primary sedimentation tanks. Later in the project the lagoons would be equipped with aerators and would function as aerated lagoons. This process would need a considerable amount of power to operate the aerators (to supply air). However, the O&M would be simple. The power costs for this option would be similar to those for the OD and AS. The construction costs for this option would be similar to those for TF and OD. This option has the largest site area requirements.

TF: This process does not require much electrical power. The main power demand is to operate the sludge scrapers. This option has the lowest O&M costs. The O&M tasks would be relatively simple. The construction costs are similar to those for AL and OD. Sedimentation tanks constructed as part of the first stage could be used later as the primary sedimentation tanks, without any modifications.

OD: This option has smaller construction costs and simpler O&M requirements than AS. The construction and O&M costs are similar to those for AL, however the O&M activities are expected to be a bit more complicated than for AL. This option includes biological reactions and secondary

sedimentation. The secondary sedimentation tanks could be used as primary sedimentation tanks during the first stage of the project. If oxidation ditches are added in the future the primary sedimentation tanks could be converted to secondary sedimentation tanks (which constitute the oxidation ditch process).

AS: This option requires skilled and experienced operators and it has high energy demands. This option also has high construction and O&M costs. This option has the smallest site area requirements, which means it could be constructed in urbanized areas. The main advantage of this option is that it would produce the most constant and reliable effluent quality despite the complicated operation and maintenance tasks.

Since Albania has poor power supply conditions, it is preferable to implement the option that consumes the least amount of power. Therefore, if there is sufficient land available the TF is recommended because it has the easiest and least cost O&M.

The next most preferred option would be AL because it also has easy O&M, and the O&M costs are similar to those for TF. The next most preferred option would be OD because it is relatively easy to maintain, and the construction costs are less than for AS. In summary, the most appropriate option is TF, followed by AL, then OD and AS.

(5) Selection of the Most Appropriate Sewage Treatment Process

The above comparative study indicates that the Trickling Filter Process is the most appropriate sewage treatment process for Greater Tirana. Therefore, the following sections provide a detailed discussion of the trickling filter process.

8.6 Selection of Sludge Treatment Process

(1) General

Sewage treatment produces a large quantity of sludge each day. Therefore, sludge treatment needs to be carefully considered when designing the STP. Sludge treatment consists of the following three types of unit processes: thickening, digestion and dewatering. The most cost effective sludge treatment process is obtained by optimizing the combination of these unit processes.

- 'Thickening' condenses the sludge produced from the treatment plant so that the size of the subsequent processes can be minimized. Thickening can either be achieved using: (i) gravity, or (ii) mechanical methods.
- 'Digestion' has the following main functions: (i) reduction of bacteria in the sludge, (ii) reduction of the total solid mass by producing carbon dioxide and methane gases, and (iii) improvement of dewaterability. The digestion tank must be maintained at a high temperature (about 35°C) to provide for satisfactory sludge digestion. Therefore tank heating is required.
- 'Dewatering' reduces the sludge volume for final disposal. There are two types of dewatering processes: (i) air drying, and (ii) mechanical methods.
- The most cost effective sludge treatment process is obtained by optimizing the combination of these

unit processes.

(2) How to select the most appropriate sludge treatment process

The sludge treatment process was selected taking the following local situations into account:

- Since there are no existing sewage treatment plants in Albania, sludge treatment processes that are easy to operate and maintain were preferred.
- The Albanian power supply is not sufficient or stable. Therefore, sludge treatment processes that consume less power were preferable. Therefore, the preferred process should minimize mechanical components, since this would reduce the construction and O&M costs.
- The facilities for the sludge treatment process must fit within the available site area.

Thickening and digestion must occur before dewatering so that the sludge volume is reduced and the sludge is stabilized. Therefore, gravitational thickening and non-heated digestion are the recommended processes for thickening and digestion, respectively. The digester should have a large volume so that it can function as a sludge reservoir if the dewatering system fails.

A sludge mixing system will be installed in the digester to facilitate sludge digestion. The digestion period would be 20 days. It might be possible in the future to use digestion gas. Sludge drying beds could only be used if there was enough available space within the STP site.

(3) Considerations for selecting the sewage treatment and sludge treatment processes

The sewage treatment process was selected to meet the effluent standards. The sludge treatment process was also selected to minimize the sludge volume so that sludge disposal will be easier e.g. dewatered sludge disposal. The sewage treatment process is more important than the sludge treatment process from a compliance perspective, therefore selection of the sewage treatment process has been prioritized. This means the area requirements for the sewage treatment facilities should be met first, and the sludge treatment facilities should be designed to fit within the remaining area.

If there is sufficient available area for the sludge treatment facilities the following facilities should be provided:

Gravitational thickening + non heated digestion + natural drying

If sufficient area is not available, mechanical dewatering would be substituted for natural drying.

CHAPTER 9

SEWERAGE PLANNING FUNDAMENTALS

CHAPTER 9 SEWERAGE PLANNING FUNDAMENTALS

9.1 Target Year for Planning

The target year for the sewerage system development plan is 2022. The target year set in the "Strategic Plan" was 2017. The reasons why the target year has been extended are as follows:

- The "Strategic Plan" defines the target year to be 2017, however the sub-projects such as water supply and sewerage were prepared assuming a target year of 2022; and
- Due to the large scale of the proposals it would be difficult to construct all the identified facilities within 11 years which are the timeframe required to meet the target year of 2017.

9.2 Sewerage Planning Area

The area included in the sewerage plan was defined with consideration of the location of existing houses and buildings, topography, extent of the river basin, boundary of municipalities/communes, piped water supply area and the Strategic Plan. The area covered by the sewerage plan includes all or part of the following two municipalities and three communes (*Figure 9.2.1*): 1) Tirana Municipality, 2) Kamza Municipality, 3) Kashar Commune, 4) Paskuqan Commune, and 5) Berxulle Commune.

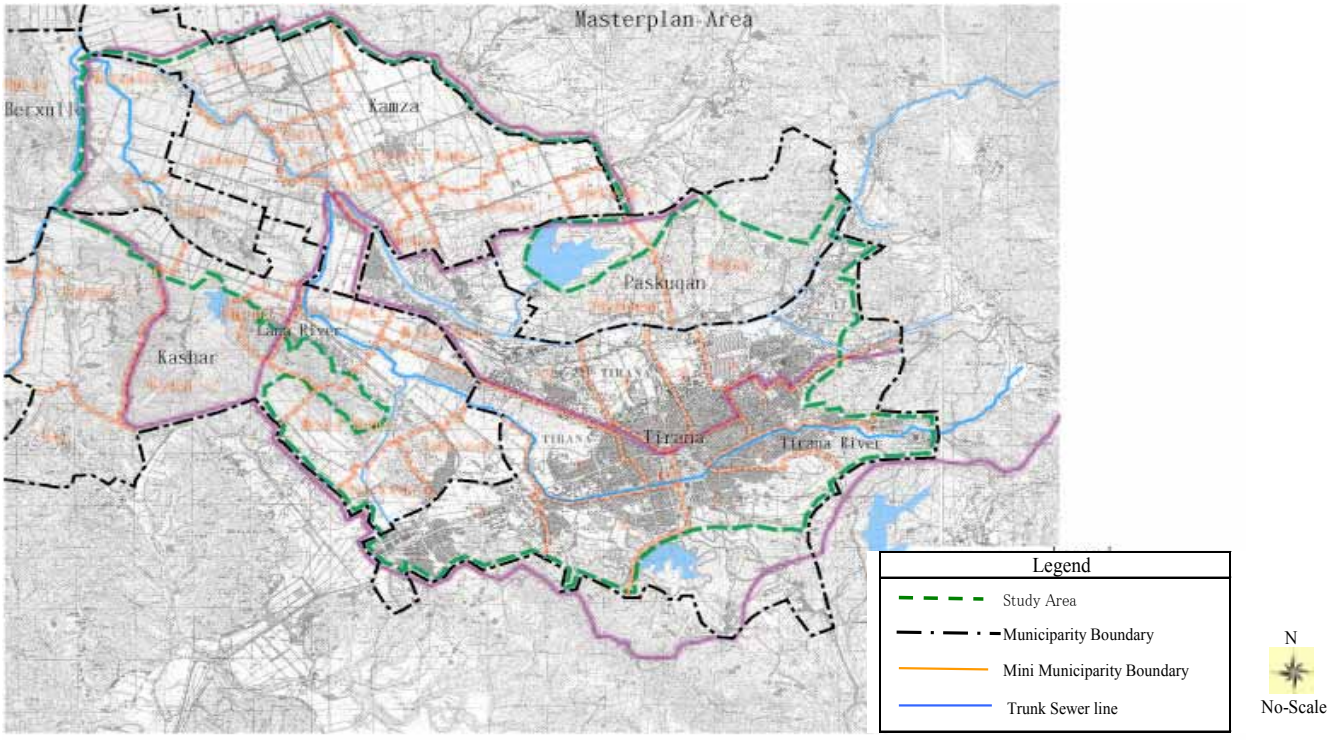

Figure 9.2.1 Area Covered by the Sewerage Plan

9.3 Population

9.3.1 Existing Population Projections

(1) National Population Projections by INSTAT

A statistical analysis of Albania's population data was sourced from INSTAT. The data was available in chronological order. Albania's population characteristics are shown in *Table 9.3.1*. The INSAT data for 2001 (dated 1 January) shows the population to be 10% greater than reported by the census data that is dated April 2001. The annual population growth rate is shown to be decreasing by 0.5 to 1.1 % from year to year.

Table 9.3.1 Population Changes in Albania (Unit; 1000 person)

Year	Urban	Rural	Total	Increase Ratio
1993	1,314.3	1,853.2	3,167.5	
1994	1,345.0	1,857.0	3,202.0	1.011
1995	1,381.0	1,867.8	3,248.8	1.015
1996	1,445.0	1,838.0	3,283.0	1.011
1997	1,526.0	1,798.3	3,324.3	1.013
1998	1,543.0	1,811.3	3,354.3	1.009
1999	1,555.2	1,818.2	3,373.4	1.006
2000	1,598.6	1,802.6	3,401.2	1.008
2001	1,439.7	1,978.4	3,418.1	1.005
2001(Census)	1,292.8	1,776.5	3,069.3	

INSTAT has made predictions about the future population until 2021. The analysis has adopted two scenarios: high and low projections are shown in *Table 9.3.2*. These projections take account of predicted birthrates and immigration rates. The annual growth rates are assumed to be 1.2% to 0.7% for the high scenario and between 0.7% to -0.2% for the low scenario.

Table 9.3.2 Albanian Population Projections (Unit; person)

Year	High Scenario		Low Scenario	
	Popuration	increase ratio	Popuration	increase ratio
2001	3,063,318		3,063,318	
2002	3,099,647	1.012	3,084,148	1.007
2003	3,134,966	1.011	3,102,781	1.006
2004	3,169,607	1.011	3,119,544	1.005
2005	3,204,140	1.011	3,134,982	1.005
2006	3,238,650	1.011	3,149,147	1.005
2007	3,273,686	1.011	3,162,030	1.004
2008	3,308,712	1.011	3,173,825	1.004
2009	3,343,657	1.011	3,184,697	1.003
2010	3,378,688	1.010	3,194,538	1.003
2011	3,413,683	1.010	3,203,224	1.003
2012	3,449,026	1.010	3,210,604	1.002
2013	3,483,981	1.010	3,216,785	1.002
2014	3,518,339	1.010	3,221,611	1.002
2015	3,551,898	1.010	3,224,936	1.001
2016	3,584,463	1.009	3,226,908	1.001
2017	3,616,118	1.009	3,227,398	1.000
2018	3,646,358	1.008	3,226,543	1.000
2019	3,674,994	1.008	3,224,231	0.999
2020	3,701,893	1.007	3,220,660	0.999
2021	3,726,945	1.007	3,215,753	0.998

(2) Strategic plan prepared by the World Bank

The Strategic Plan projected the population through to 2017, using recorded data from 2001 as the base year. The Strategic Plan divided the study area into 66 neighborhoods and the population was classified into municipalities as shown in *Table 9.3.3*.

Table 9.3.3 Population Projection in Study Area (Unit; person)

Municipality/ Commune	Area (ha)	Population (person) in 2001 (a)	Projected Population (person) in 2017 (b)	Increase Ratio (b)/(a)	Population Density (person/ha) 2001	Population Density (person/ha) 2017
Tirana	3,804	332,631	495,577	1.49	87.4	130.3
Kamza	1,371	44,552	147,494	3.31	32.5	107.6
Kashar	1,327	21,029	94,095	4.47	15.8	70.9
Paskuqan	611	21,592	95,774	4.44	35.3	156.7
Berxulle	481	12,041	31,630	2.63	25.0	65.8
Total	7,594	431,845	864,570	2.00	56.9	113.8

Source: Strategic Plan 2001

The projections indicate that the population in the study area will double between 2001 and 2022. There will be a 150% increase in the Tirana municipality, and the populations in the neighboring municipalities

and communes will increase by between 260% in the Berxulle commune and 450% in the Kashar commune. The area is agricultural except for the Tirana municipality but is expected to be developed for residential purposes in the future. According to the water supply plan of Strategic Plan, the population in the target year of 2022 was estimated to be 949,792.

(3) Other Population Projections for each Municipality and Commune

The following sections summarize the population information for each municipality and commune.

1) Tirana Municipality

A previous JICA Study (1998) estimated the 2010 population within the Tirana municipality and neighboring areas where urban development is expected. *Table 9.3.4* shows the year 2010 population in the urban areas of the municipality is expected to be approximately 732,000. The population in the Territory was estimated to be approximately 540,000 by 2010. This is 1.17 times larger than the base (1998) population. The populations in the neighboring areas are expected to have higher growth rates, increasing by up to 4.14 times.

Table 9.3.4 Projected Population in the Tirana Municipality (Unit; person)

Item	Popuation in Base year (1998)	Population Projection 2010	Increase Ratio
Winthin Municipality	459,956	540,173	1.17
Neighboring areas	46,445	192,232	4.14
Total	506,401	732,405	1.45

Source: JICA Study 1998

2) Kamza Municipality

The Kamza municipality has a water supply plan and a sewerage plan. The populations projected in these plans are shown in *Table 9.3.5*.

Table 9.3.5 Projected Population in the Kamza Municipality (Unit; person)

Item	Projected Popualtion	Base Population	Remarks
Sewerage Plan	250,000		Prepared by Kastribt Shehu
Water Supply Plan [2)]	59,713 (Y2015)	21,643 (Y2001)	Trend of annual growth rate
Water Supply Plan [2)]	98,973 (Y2015)	21,643 (Y2001)	Poluation Density on Land use

Source: 1) Main Conclusions of Project- IDEA, Primary Line of Sewerage and Discharge of Wastewaters to Tirana River,
2) "Kamza Municipality Emergency Water Supply Project, Final Design Report.

The projected population figures in the water supply plan are quite different from the figures in the sewerage plan. The sewerage plan estimates the population will be 250,000 by 2010. This is approximately 11.5 times greater than the base (2001) population of 21,643. The water supply plan makes two different population projections: a 60,000 population projection is based on an annual increase rate of 7% and a 99,0000 population assumes population densities range from 60 to 250 person/ha.

3) Kashar Commune

An urban development plan ("The Study for Tirana Western Zone") was completed for the Kashar

commune, funded by the Commune and Tirana District. There are no comprehensive population projections for this commune. Therefore, the future population in the urbanized area was estimated to be the same as a similar, representative commune, meaning the population is projected to reach approximately 60,000 in 2015.

9.3.2 Planning Population

As mentioned in section 2.2.1, municipalities and communes in Albania have a government department responsible for civic registration. The role of this department is to keep a register of all the residents living in their territory. The population data based on the civic registrations has been used to estimate the population size used to plan this project. The population projections have been made through to the target year of 2022. *Table 9.3.6* summarizes the registered population as of 2001 and 2005, and shows the population projections using different methods. The table also shows the population size that was used to plan the sewerage system works. The population used to plan the sewerage system is presented in the following table. It was determined in consultation with relevant municipalities and communes.

Table 9.3.6 Present Registered Population and Planning Population

Area	Population in 2001[1)]	Present population in 2005[1)]	Projected Populations in 2022			**Planning population in 2022**		Remarks
			Trend Analysis	Population Density	Develop -ment Plan	Within Territory	**Within Planning Area**	
Tirana	478,424	581,414	1,025,000	724,400		724,400	**700,000**	Density method
Kamza	49,068	75,858	180,000	130,000		150,000	**150,000**	Average figure
Kashar	16,810	18,228	25,670		25,000	50,670	**50,000**	Trend+ Development[2)]
Paskuqan	27,566	34,329	89,800			89,800	**84,000**	Trend figure
Berxulle	6,693	8,439	16,500			16,500	**16,000**	Trend figure
Total	578,561	718,268				1,031,370	**1,000,000**	

Source: 1) Data from "Bulletin Statistikor 2004", INSTAT.
2) Population at residential area of 52ha = 15,000, and around area =10,000.

Analyzing the trends based on the last five years of population data indicates that the 2022 population would be 1,025,000. This is much higher than those in the existing population projections. The Strategic Plan estimated the 2017 population assuming population densities based on urban development and land-use patterns. This study used the 2001 population density data from the Strategic Plan as shown in *Figure 9.3.1* to estimate the 2022 population in the Tirana municipality. The assumed population densities are shown in *Figure 9.3.2*. These were based on expected future land-use. The projected population is approximately 724,400 within the territory of the Tirana municipality and about 700,000 within the sewerage planning area.

The population in the Kamza municipality was estimated using trend analysis, assuming both a linear and

a logarithmic equation. The population density used in the calculations was estimated with consideration of expected future land-uses. Using trend analysis the population was estimated to be approximately 180,000. This was based on the most recent five years of data. Using population density the population was estimated to be approximately 130,000. The estimated population used in this study was assumed to be 150,000, which is the average of the two projections.

The population in the built up areas of the Kashar commune was estimated using a trend analysis based on the most recent five years of data. The population in the future urban areas was estimated by assuming population densities. The analysis estimated the total population within the territory to be 50,670. The population in the built-up areas was estimated to be 25,670 (using trend analysis) and the population in the future planned residential areas was estimated to be 25,000. The existing population is 15,000 and has an average population density of 200 person/ha. Therefore, the population is expected to increase by 10,000 in the new residential areas. The population used to plan the sewerage system was estimated to be approximately 50,000.

The population in the Paskuqan commune has the highest growth rate over the last five years of all the communes in the study area. The population within the territory and within the sewerage planning area is projected to be approximately 89,800 and 84,000, respectively. These projections were based on a trend analysis using the most recent five years of data.

The population in the Berxulle commune was also projected using a trend analysis based on the most recent five years of data. The population within the territory and within the sewerage planning area is estimated to be 16,500 and 16,000 respectively. These population estimates are less than those predicted in the Strategic Plan (which was 31,000). The smaller population estimate has been used in this study because the commune is in an agricultural area and there are no plans to develop the area.

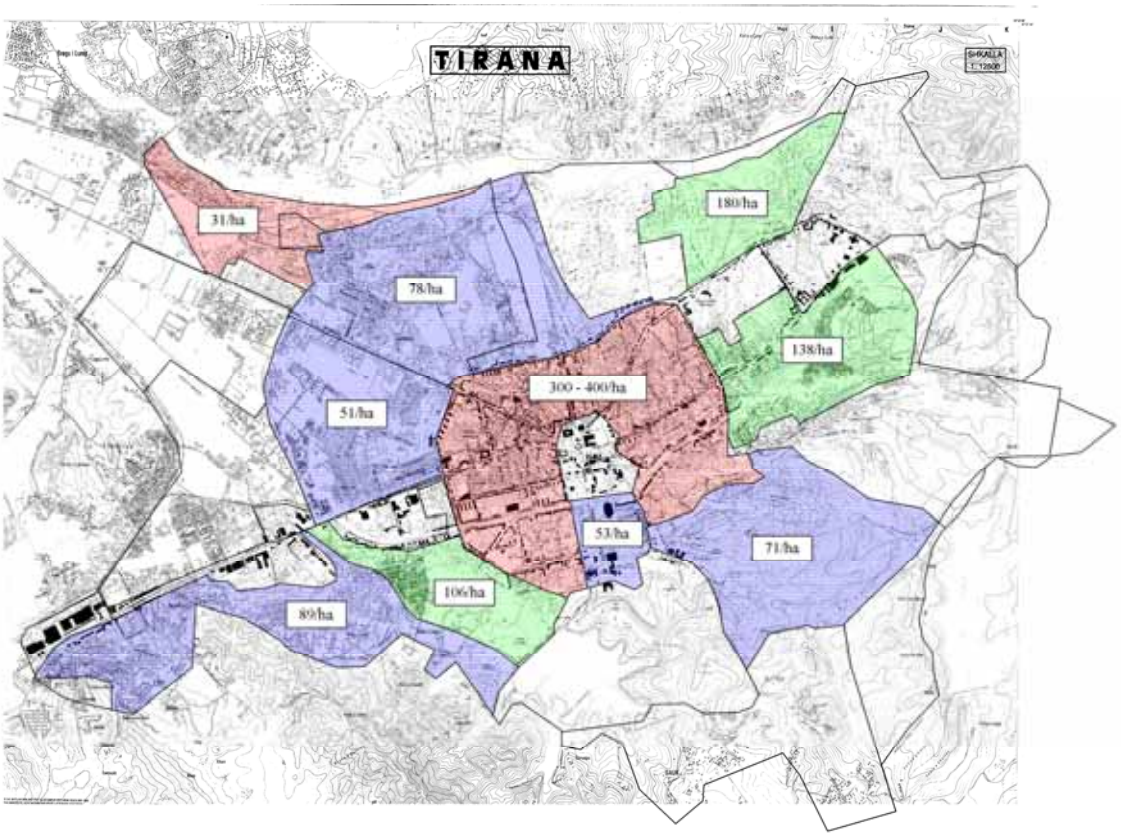

Figure 9.3.1 Base Population Density in Tirana (WB report 2001)

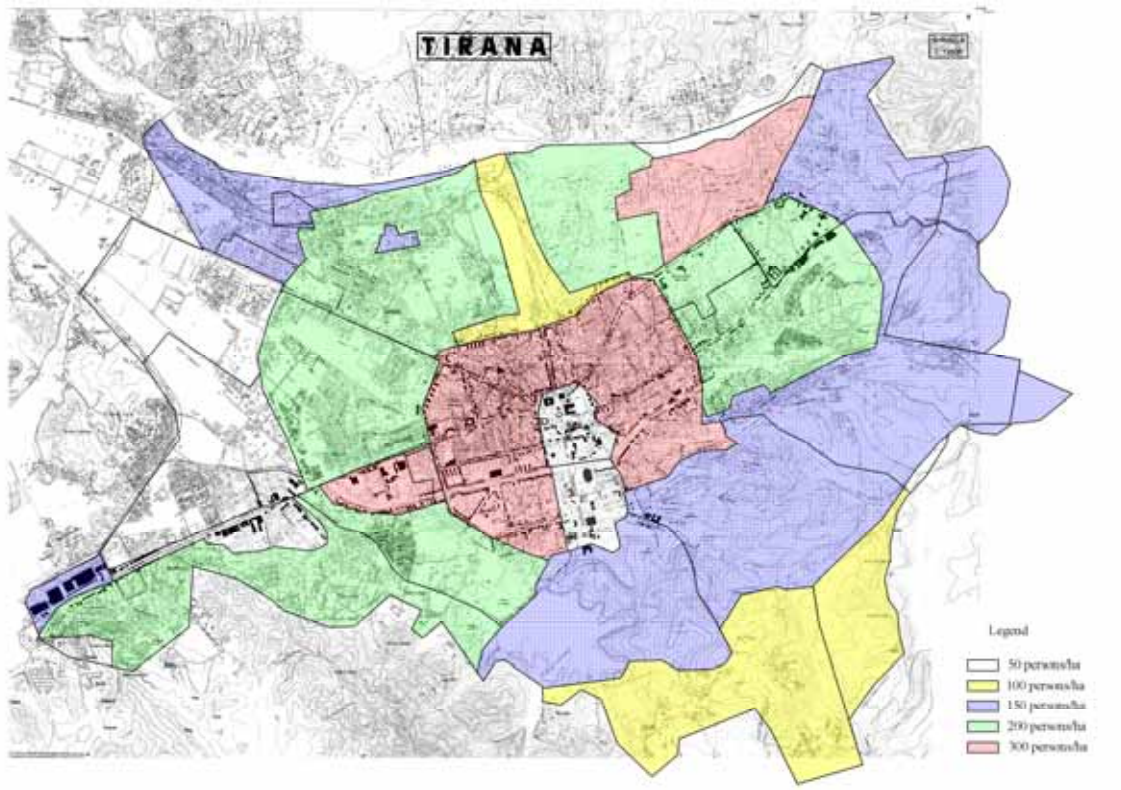

Figure 9.3.2 Estimated Population Density in 2022

9.4 Sewage Generation

This section presents the expected unit sewage generation. This was estimated based on the planned water consumption. A brief review of the existing piped water supply plan is also provided.

9.4.1 Unit Sewage Generation Rate

(1) Unit Water Consumption/Demand in the Existing Piped Water Supply Plans

The Strategic Plan (2001) assumed the following water demand when preparing the water supply plan for Greater Tirana:

- residential, commercial, and institutional sectors had a combined demand of 150 L/capita/day;
- the industrial sector had a demand of 50 m^3/ha/day; and
- unaccounted-for-water (lost water) was assumed to be 25% of the water produced.

When the lost water estimate of 25% is factored into the combined residential, commercial and institutional demand, the resulting demand is 200 L/capita/day. If the industrial component were also factored into the per capita demand, the total demand would be 220 L/capita/day.

The "Technical and Financial Assistance to the Greater Tirana TWS&SE, Master Plan (2002)" estimated unaccounted-for-water using the following three water demand scenarios:

- low - 150 L/capita/day (this is the actual billed volume of water) for the Tirana area, and 133 L/capita/day for village areas;
- medium - 180 L/capita/day for the Tirana area, and 180 L/capita/day for village areas; and
- high - 200 L/capital/day for the Tirana area, and 200 L/capita/day for village areas.

The unaccounted-for-water was estimated to be 57%, 47% and 41% for the respective scenarios. Based on these assumptions, the present water demand is set at 230 L/capita/day for all users. This assumes the most probable unaccounted-for-water rate of 47%. Based on the actual production capacity and number of consumers, the water supply per capita (including usage and losses) is approximately 430L/capita/day. The Master Plan (2002) – Section 4, "Evaluation of System Capacity", found that with rehabilitation of the water supply works for the existing water sources, a water demand of 200 L/capita/day can be met up until 2017, and that a water demand of 260 L/capita/day for Greater Tirana can be satisfied if the unaccounted-for-water (water loss) can be reduced to 20% (from the current estimated lose rate of 47%).

In the Kamza Commune, the unit water consumption per capita was taken from the "Kamza Municipality Emergency Water Supply Project and Master Plan for the Future, March 2001". The consumption rates are shown in *Table 9.4.1*. The unit water consumption during 2015 (the target year) is set to be approximately 200L/capita/day.

Table 9.4.1 Unit Water Consumption (L/capita/day) for the Kamza Municipality

Consumer Category / Year	2000	2005	2010	2015
Domestic	110	120	130	140
Commercial and Institutional	22	24	26	28
Industrial	22	24	26	28
Total	154	168	182	196

Source: "Kamza Municipality Emergency Water Supply Project and Master Plan for the Future, March 2001.

The existing water supply plan sets the future water consumption/demand in the range of 150 to 260 L/capita/day. The 150 L/capita/day figure excludes the industrial water and the 260 L/capita/day figure includes all users.

In addition, some existing reports on planned piped water supply for other urban cities/regions in Albania were collected and briefly reviewed. The planned water consumption/demand (excluding losses) was set between 190 and 230 L/capita/day. This demand is the sum of the following:

- domestic consumption: 130 to 170 L/capita/day;
- commercial and institutional consumption: 35 to 55 L/capita/day; and
- industrial consumption for small business: 22 to 25 L/capita/day.

(2) Unit Sewage Generation Rate

The Strategic Plan (2001) assumed that the future unit sewage generation rate for domestic, commercial, institutional, and commercial water usage will be about 143 L/capita/day (95% of the unit water usage of 150 L/capita/day at the target year of 2022).

Based on the review on the existing water supply plans mentioned above, the current unit water consumption/demand for domestic, commercial, institutional and business users ranges between 150 to 180 L/capita/day in Greater Tirana. The future water consumption/demand will reach 200 to 230 L/capita/day during the target year.

Considering the existing water supply plans, it is assumed that almost all water used will be collected by sewerage facilities and treated at the sewage treatment plant, therefore, the unit sewage generation for domestic, commercial, institutional and business is 150 L/capita/day presently (2005) and will be 200 L/capita/day during the target year of 2022 as shown in *Table 9.4.2*. For planning purposes, the unit sewage generation of 200 lpcd in 2022 could be divided into 150 lpcd for domestic sewage and 50 lpcd for sewage from commercial, institutional and business activities, taken into account of the domestic water demand is 150 lpcd.

Table 9.4.2 Unit Sewage Generation (Unit: L/capita/day)

2005 (Present)	2014	2018	2022
150	176	188	200

It should be noted that the sewage generation excludes industrial wastewater generated from large factories and factories located in industrial estates.

9.4.2 Pollutant Loads

The unit per capita pollutant loads for BOD_5 and SS are shown in *Table 9.4.3*. The unit pollution load of the sewage is assumed to be 40 g/(capita day) at present and 50 g/(capita day) at the target year.

Table 9.4.3 Unit Pollutant Loads

Item	2005 (Present)	2014	2018	2022
Pollution Loads per Capita (g/(capita day))	40	45	48	50

The planning figures of the unit BOD_5 load (g/(capita day)) are set based on the following discussions:

Table 9.4.4 shows examples of unit BOD_5 load (g/(capita day)). The first row is Albanian figure of 60 (g/(capita day)) set in the Albanian Law (No.9115), and the second and third rows are recommended figures for developing countries and the last two rows are UK's and USA's for reference. In case of USA and developing countries, breakdowns of unit BOD_5 load are shown in *Table 9.4.5*.

Table 9.4.4 Unit BOD_5 Load and estimated BOD_5 Strength

	Unit BOD_5 Load (g/(capita day))	Reference
Albania	60	Law No.9115, Article 3
Developing Countries in tropical climate	40	D. Mara
WHO	45	
UK	50 ～ 59	
USA	45 ～ 78	

Source: Guideline for preparation of sewerage master plan in developing countries, 1997 (in Japanese)

Table 9.4.5 An Example of Breakdown of Unit BOD_5 Loads in Sewage

Souce	USA		Tropical Countries	
Bath & Shower	9	55 (24)	5	18
Dishwashing	6		8	
Kitchen Solids Disposal	31		-	
Washing Clothes	9		5	
Toilet - feces	11	23	11	22
Toilet - urine	10		10	
Toilet - paper	2		1	
Total	78	78 (47)	40	40

Note: Figures in ( ) show the case that the kitchen solid disposal is excluded, because the use of kitchen disposer is not a common practice in other countries.

Source: Guideline for preparation of sewerage master plan in developing countries, 1997 (in Japanese)

In case of USA, the unit BOD_5 load is 47 (g/(capita day)) when the kitchen waste disposal is excluded because the use of kitchen disposer is not common practice in other countries. This table indicates that an appropriate unit BOD_5 load for domestic sewage would be between 40 to 50 (g/(capita day)).

The unit BOD_5 load may vary depending on ways of living and levels of standard of living. The figure of 60 (g/(capita day)) for domestic sewage set at Albanian Law seems too high as for the domestic sewage. Current and future ways of living and levels of standard of living in the study area is taken into account, the present and future unit BOD_5 loads for sewage generated from domestic, commercial, institutional and business activities are set between 40 to 50 (g/(capita day)).

9.5 Design Sewage Flows

9.5.1 General

Design sewage flows were set based on the unit sewage generation. These are the basis for designing the sewerage facilities.

9.5.2 Inflow and Infiltration of water

Available hydro-geologic information indicates that the groundwater table is not very high. This means inflow and infiltration of groundwater to the sewerage system may not occur except in the low lying area between the Tirana municipality and the Kashar commune, where the Lana River is located. However, the unaccounted-for-water rates are high. It is expected that part of the unaccounted-for-water that is lost through the water distribution network is eventually collected in the existing sewer and drainage conduits. The unit inflow and infiltration of this water is assumed to be approximately 50 L/capita/day.

9.5.3 Unit Design Flows

Sewage entering the sewerage facilities comes from residential areas, commercial areas, and offices in designated industrial sites. Industrial wastewater is excluded. Three types of unit design flow have been set for the target year of 2022. These design flows are based on the unit sewage generation of 200 L/capita/day, 50 L/capita/day of inflow/infiltration water, and flow variation factors.

These three unit design flows are listed below:

Unit Average Daily Flow = 200 + 50 = 250 L/capita/day;
Unit Maximum Daily Flow = 200 × 1.3 +50= 310 L/capita/day; and
Unit Maximum Hourly Flow = 200 × 1.3 × 1.5 +50= 440 L/capita/day.

9.5.4 Design Flows

Table 9.5.1 summarizes the design flows, and presents the population size and unit design flows that were used to calculate the design flows.

Table 9.5.1 Design Flows in 2022

Municipality/ Commune	Population	Design Daily flow (m^3/d)		Peak flow(m^3/d) (Max. hourly flow)
		Average	Maximum	
Tirana	700,000	175,000	217,000	308,000
Kamza	150,000	37,500	46,500	66,000
Kashar	50,000	12,500	15,500	22,000
Paskuqan	84,000	21,000	26,040	36,960
Beruxlle	16,000	4,000	4,960	7,040
Total	1,000,000	250,000	310,000	440,000

The design average daily flow is used to estimate pollutant loads, treatment effects, and O&M cost. The design maximum daily flow rate is used to design the treatment facilities. The treatment capacity of the STP is expressed as the design maximum daily flow rate. The design maximum hourly flow or peak flow is used to design the sewers and pumping stations.

9.6 Design Sewage Qualities

9.6.1 Quality of Influent Sewerage

The design quality for influent sewage (classified in terms of BOD_5 and SS concentrations) is listed below:

- Pollutant loads in terms of BOD_5 and SS are 50 g/capita/day;
- The unit design average daily flow is 250 L/capita/day;
- Therefore, the influent concentrations are 200 (=50×1,000/250) mg/L.

The above setting is applied after the following discussions:

As shown in *Table 4.4.7*, the water quality survey results show that the BOD_5 concentrations of samples taken at the outfall from the existing sewers were 87 and 96 mg/L at the sampling point of "S1" where the sewage is being discharged to the Lana River and 70 and 76 mg/L at the sampling point of "S2" where the sewage is being discharged to the Tirana River. Compared to the design BOD_5 concentration of 200 mg/L, our survey results indicate only half or one-third of the design figure.

However, the former JICA Study results showed that overall average of BOD_5 concentration was 200 mg/L, showing the same magnitude of the design quality. The 1998 JICA Study conducted an extensive water quality survey on the sewage discharged from a new apartment building, an old apartment building and an individual housing. Composite samples are taken and analyzed. Table 9.6.1 summarizes the survey results and shows an overall average of BOD_5 concentration of about 200 mg/L.

The above two water quality surveys showed different level of BOD_5 concentration of sewage. But for the influent BOD_5 concentration for planning and design of the new sewerage facilities, the 1998 JICA

study results are judged to be more reliable than those of this time survey results. Therefore, as the BOD_5 concentrations of 200 mg/L is applied for planning and design of the sewerage facilities.

Table 9.6.1 BOD_5 Concentrations of Sewage reported by the former 1998 JICA Study

Sewage Sampling	Dry Season	Rainy Season
New Apartment Building	133/232 mg/L (Ave. 183 mg/L)	88/142 mg/L (Ave. 115 mg/L)
Old Apartment Building	182 mg/L	240 mg/L
Individual Housing	267 mg/L	214 mg/L
Average	211 mg/L	190 mg/L

9.6.2 Required Level of Sewage Treatment

The following treated sewage concentrations have been set based on the EU Directives:

- 25 mg/L in BOD_5; and
- 35mg/L as the target treated sewage.

9.6.3 Treated Sewage Quality

The BOD_5 and SS concentrations in the primary and secondary effluent are shown in *Table 9.6.1*. These concentrations were set with consideration of the treatment efficiency in the primary and secondary treatment facilities. These design figures meet the effluent quality standards stipulated in EU Directives.

Table 9.6.2 Design Sewage Quality in STP

Parameter	Treatment efficiency (%)			Quality (mg/L)		
	Primary Treatment	Secondary Treatment	Overall	Raw Sewage	Primary Effluent	Secondary Effluent
BOD_5	30	83	88	200	140	24
SS	40	75	85	200	120	30

9.7 Planning Bases of sub-service area, "Collection Area"

The sewerage planning areas are divided into sub-service areas. Each sub-service area will be covered by a separate trunk sewer. The location of the trunk sewers will be based on topography, rivers, watercourses, railways, existing facilities, and administrative boundaries of the municipality or commune. The resulting sub-service areas called "Collection Areas" are shown *Figure 9.7.1*. The design figures, population and sewage flows for each service area are summarized in *Table 9.7.1*.

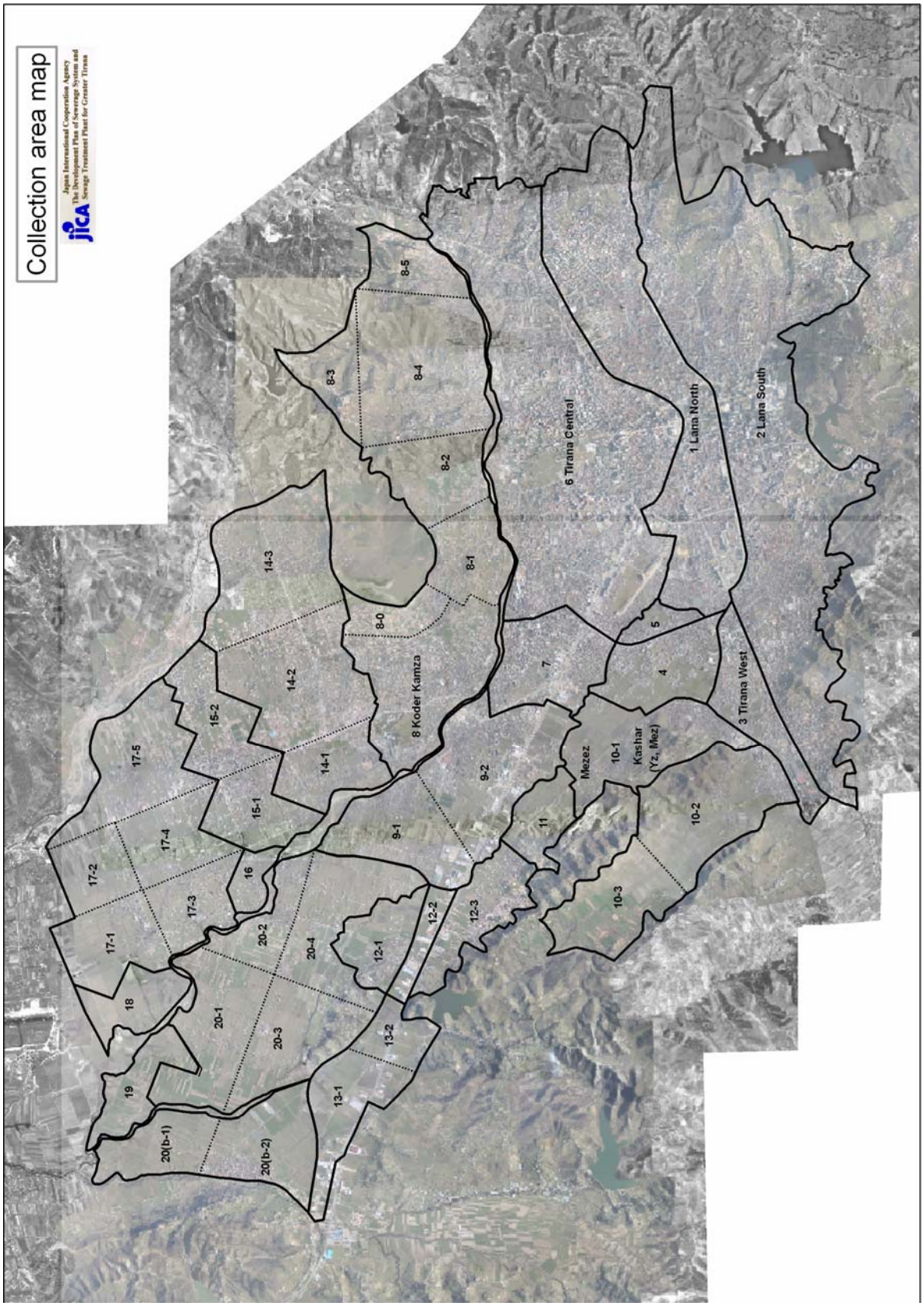

Figure 9.7.1 Collection Area

Table 9.7.1 Planning Bases of Sub-Service Area, "Collection Area"

Municipality	Connection Point	area (ha)	2005 Population	2022 Population	Daily average (m3/d)	Daily maximum (m3/d)	Hourly muximum (m3/d)
Tirana	No.1	306.0	72,660	82,262	20,566	25,501	36,195
	No.2	1770.4	211,218	257,654	64,413	79,873	113,368
	No.3	51.9	0	5,192	1,298	1,610	2,284
Kashar	No.4	143.5	1,672	2,293	573	711	1,009
Tirana	No.5	33.3	11,694	11,694	2,924	3,625	5,145
	No.6	1420.7	233,705	302,558	75,640	93,793	133,126
	No.7	169.0	9,386	11,306	2,827	3,505	4,975
Paskuqan	8-0	60.6	2,963	6,043	1,511	1,873	2,659
	8-1	123.5	7,549	12,315	3,079	3,818	5,419
	8-2	146.7	8,967	14,628	3,657	4,535	6,436
	8-3	91.8	5,258	9,154	2,288	2,838	4,028
	8-4	309.0	16,370	30,812	7,703	9,552	13,557
	8-5	110.8	4,515	11,048	2,762	3,425	4,861
	Sub-total	842.4	45,623	84,000	21,000	26,041	36,960
	8KoderKamza	259.6	14,418	17,368	4,342	5,384	7,642
	No.8	1,102.0	60,041	101,368	25,342	31,425	44,602
Kashar	9-1	134.0	3,326	4,188	1,047	1,298	1,843
	9-2	276.4	13,075	27,862	6,965	8,637	12,259
	No.9	410.4	16,401	32,050	8,012	9,935	14,102
	10-1	241.7	2,816	3,862	966	1,197	1,699
	10-2	214.6	5,001	8,429	2,107	2,613	3,709
	10-3	158.3	3,689	7,530	1,882	2,334	3,313
	No.10	614.6	11,506	19,821	4,955	6,144	8,721
	No.11	78.4	913	1,253	313	388	551
	12-1	68.7	1,741	3,250	812	1,007	1,430
	12-2	44.5	518	711	178	220	313
	12-3	128.1	1,493	2,047	512	635	901
	No.12	241.3	3,753	6,008	1,502	1,862	2,644
	13-1	131.4	1,531	2,100	525	651	924
	13-2	78.3	912	1,251	313	388	551
	No.13	209.7	2,443	3,351	838	1,039	1,475
Kamza	14-1	106.7	3,679	7,275	1,819	2,255	3,201
	14-2	263.9	9,099	17,993	4,498	5,578	7,917
	14-3	282.1	9,727	19,234	4,809	5,963	8,463
	No.14	652.7	22,506	44,502	11,126	13,796	19,581
	15-1	119.6	4,124	8,155	2,039	2,528	3,588
	15-2	143.1	4,934	9,757	2,439	3,025	4,293
	No.15	262.7	9,058	17,911	4,478	5,553	7,881
	No.16	39.3	1,355	2,680	670	831	1,179
	17-1	132.9	4,582	9,061	2,265	2,810	3,987
	17-2	94.4	3,255	6,436	1,609	1,995	2,830
	17-3	96.1	3,314	6,552	1,638	2,030	2,883
	17-4	121.6	4,193	8,291	2,073	2,570	3,648
	17-5	205.9	7,100	14,039	3,510	4,352	6,177
	No.17	650.9	22,444	44,379	11,095	13,757	19,525
Pri-T(Km)	No.18	82.9	2,858	5,652	1,413	1,752	2,487
STP	No.19	86.5	2,983	5,898	1,474	1,828	2,595
(Kamza)	20a-1	151.7	4,514	8,857	2,214	2,746	3,897
	20a-2	99.0	3,414	6,750	1,687	2,092	2,970
	20a-3	178.6	6,158	12,177	3,044	3,775	5,358
	20a-4	227.6	2,132	4,043	1,010	1,253	1,780
Berxull	20b-1	133.4	2,499	4,739	1,185	1,470	2,085
	20b-2	157.7	2,955	5,602	1,401	1,737	2,465
	No.20	948.0	21,672	42,167	10,541	13,073	18,555
Total		9,274.2	718,268	1,000,000	250,000	310,000	440,000