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 I : Executive Summary

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 (This volume)**
Volume II:	**Main Report**
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

SUMMARY

1. Sewerage Master Plan up to 2022 for Greater Tirana

1.1 Objectives of Sewerage Development

Based on the findings in the study, 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 treatment; and
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.

1.2 Basic Considerations

(1) Basic Approach for planning

The following basic approach was adopted for preparation of sewerage planning:

- 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.

(2) Acceptance of industrial wastewater to the public sewerage system

It is decided that the wastewater from industrial areas and large factories is not accepted into the sewerage system considering Albanian environmental law on industrial effluents, very poor data availability and difficulties to treat sewage by a biological process.

(3) Sewage Collection System

The existing sewer system in Municipalities of Tirana and Kamza is planned to use at maximum. For new area where there is no public sewer system, a separate sewer system is planned.

(4) Sewage Treatment Process

To meet the effluent quality standard of BOD_5: 25 mg/L and SS: 35mg/L stipulated in the EU Directive, Trickling Filter Process is selected as the most appropriate sewage treatment process among four sewage treatment processes (Aerated Lagoon, Trickling Filter, Oxidation Ditch and Activated Sludge).

(5) Selection of Sludge Treatment Process

Gravitational thickening and non heated digestion are selected. The maximum use of sludge drying beds is planned considering the land space available. Mechanical dewatering equipment is also planned for the case of wet weather conditions for sludge drying beds.

1.3 Planning Fundamentals

(1) Design Flows:

Table 1.1 shows the population and design flows in 2022.

Table 1.1 Design Flows in 2022

Basin area	Administrative Population	Service Population	Daily flow(m^3/d)		Peak flow(m^3/d) (Max. hourly flow)
			Average	Maximum	
Tirana	724,400	700,000	175,000	217,000	308,000
Kamza	150,000	150,000	37,500	46,500	66,000
Kashar	50,670	50,000	12,500	15,500	22,000
Paskuqan	89,800	84,000	21,000	26,040	36,960
Berxulle	16,500	16,000	4,000	4,960	7,040
Total	1,031,370	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 design maximum hourly flow or peak flow is used to design the sewers and pumping stations.

(2) Design sewage quality

The design quality for influent sewage, in terms of BOD_5 and SS concentrations, is 200 mg/L, respectively based on the following basis.

- Pollutant loads in terms of BOD_5 and SS are 50 g/capita/day; and
- The unit design average daily flow is 250 L/capita/day.

The treated sewage concentrations have been set based on the EU Directives: 25 mg/L in BOD_5; and 35mg/L in SS.

1.4 Proposed Sewerage System Development up to the 2022 (Master Plan)

(1) Alternative Studies

Through the studies on various alternatives, 1) Case A: Single STP System vs. Case B: Multi STP System, with sub alternatives Case B-1 to B-4, 2) Trunk Sewer options Case B-3a to B-3d,and 3) Priority Project options, the sewerage system up to 2022 (M/P) is formulated. Table 1.2 shows the summary of the proposed sewerage development plan in the M/P. *Figure 1.1* shows a general plan of the proposed sewerage facilities.

(2) Implementation Schedule

The implementation program will be divided into three consecutive construction stages, starting at the earliest in 2009 and ending 2021.

(3) Phased Sewerage Development Plan

The proposed sewerage plan and the staged sewerage facilities development plan are presented in *Table 1.2* and *Table 1.3,* respectively.

Table 1.2 Proposed Sewerage Development Plan in M/P (2022)

Item	**Kashar STP Sewerage Area**	**Berxulle STP Sewereage Area**	**M/P Sewerage Area**
1. Service Area	6,090 ha	3,030 ha	9,120 ha
2. Service Population	830,320 person	169,680 person	1,000,000 person
3. Design Sewage Flow 3.1 Unit Sewage Generation Rate	Average Daily: 250 lpcd (liter/capita/day)	Maximum Daily: 310 lpcd	Maximum Hourly: 440 lpcd
3.2 Average Daily Flow	207,600 m^3/day	42,400 m^3/day	250,000 m^3/day
3.3 Maximum Daily Flow	257,400 m^3/day	52,600 m^3/day	310,000 m^3/day
3.4 Maximum Hourly Flow	365,400 m^3/day	74,700 m^3/day	441,000 m^3/day
4. Main and Branch Sewer			
4.1 Specification	Diameter: 200 to 600 mm Concrete or Plastic Pipe	Diameter: 200 to 800 mm Concrete or Plastic Pipe	
4.2 System	Existing sewer improvement work, Separate sewer, Gravity flow	Existing sewer improvement works, Separate sewer, gravity flow	
4.3 Laying Work	Length: 109 km Open Cut Method	Length: 74 km Open Cut Method	Length: 183 km
5. Trunk Sewer			
5.1 Specification	Diameter: 450 to 1650 mm Concrete pipe	Diameter: 450 to 1350 mm Concrete pipe	
5.2 Flow System	Gravity or pressured flow	Gravity or pressured flow	
5.3 Laying Work	Length: 14.8 km Jacking Method or Open Cut Method	Length: 5.9 km Jacking Method or Open Cut Method	Length: 20.7 km
6. Pumping Station Capacity	Kashar PS 213,500 m^3/day	Kamza PS 50,700 m^3/day	(Maximum Daily Flow)
7. Sewage Treatment Plant	Kashar STP	Berxulle STP	
7.1 Capacity (as the Maximum Daily Flow)	257,400 m^3/day	52,600 m^3/day	310,000 m^3/day
7.2 Sewage Quality			
Design Influent Quality	BOD_5/SS: 200/200 mg/L	BOD_5/SS: 24/30 mg/L	
Design Effulent Quality	BOD_5/SS: 200/200 mg/L	BOD_5/SS: 24/30 mg/L	
7.3 Sewage Treatment Process	Screeing + Grit Removal + Primary Sedimentation + Trickling Filter + Final Sedimentation + Chlorination	Screeing + Grit Removal + Primary Sedimentation + Trickling Filter + Final Sedimentation + Chlorination	
7.4 Sludge Treatment Facilities	Thickener + Anaerobic Digester + De-watering (Belt Filter Press and Sludge Drying Bed)	Thickener + Anaerobic Digester + Sludge Drying Bed (supported by De-watering (Belt Filter Press))	
7.5 Treated Sewage	Near-by river, upstream of	Tirana river, end of the	

Discharge Point	tributary of Lana River	planning area	
7.6 Sludge Disposal	Landfill, recommended the maximum re-use of sludge for agricutural farming or cement material	Landfill, recommended the maximum re-use of sludge for agricutural farming or cement material	

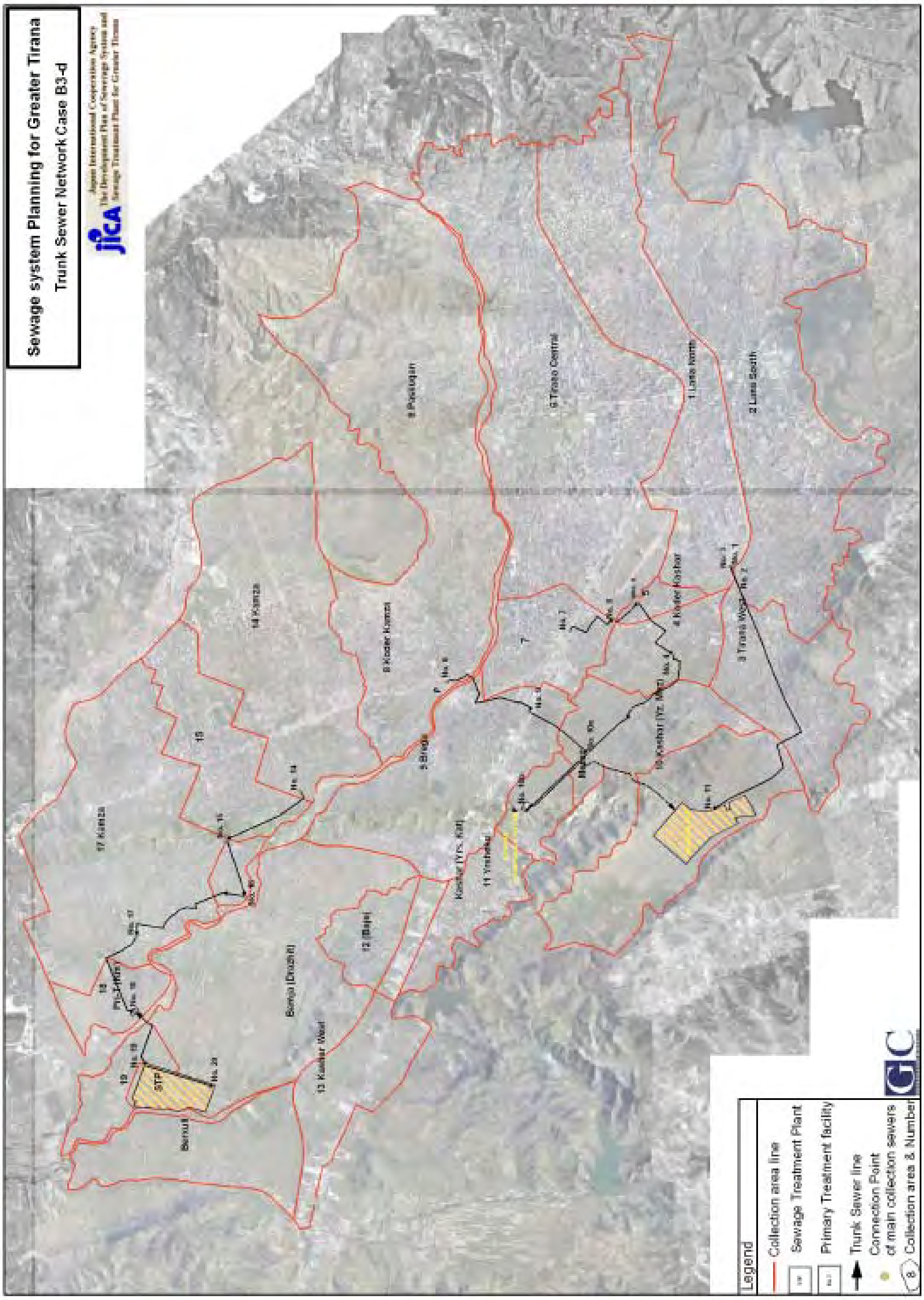

Figure 1.1 General Plan of Sewerage System (M/P)

Table 1.3 Staged Sewerage Facilities Development Plan (Sewerage M/P)

Item	Construction Stage		
	First stage (Target 2013)	Second stage	Third stage (Target 2022)
1. Service Area	2,343 ha	6,090* ha	3,030 ha
2. Service Population	342,500 person	830,320* person	169,680 person
3. Sewage Flow 3.1 Design Average Daily Flow 3.2 Design Maximum Daily Flow	 77,100 m^3/day 95,900 m^3/day	 207,600* m^3/day 257,400* m^3/day	 42,400 m^3/day 52,600 m^3/day
4. Construction of Main and Branch Sewer (Diameter, Length)	200 to 600 mm, 29.4 km	200 to 600 mm,79.6 km	200 to 800 mm,74 km
5. Improvement Measures for the Existing Sewer	Installation of manhole with weirs and other measures related the Lana interceptors	Installation of manhole with weirs and other measures related to the Tirana Interceptors	―――――
6.Construction of Trunk Sewer (Diameter, Length)	900 to 1,500 mm, 4.4 km	450 to 1650mm, 10.4km	450 to1,350mm, 5.9km
7. Pumping Station Capacity (Maximum Hourly Flow)	No PS required.	Kashar Pumping Station, 213,500 m^3/day	Kamza Pumping Station, 50,700 m^3/day
8. Sewage Treatment Plant	Kashar STP	Kashar STP	Berxulle STP
8.1 Capacity (Maximum Daily Flow)	95,900 m^3/day	257,400 m^3/day (Extension: 161,500 m^3/day)	52,600 m^3/day
8.2 Sewage Treatment Facilities	Secondary sewage treatment facilities, Trickling Filter Process	Extension of the Secondary treatment facilities.	Secondary treatment facilities, Trickling Filter Process
8.3 Sludge Treatment Facilities	Sludge treatment facilities, Anaerobic Digestion, Sludge Drying Beds and Belt Filter Press.	Extension of the sludge treatment facilities	Sludge treatment facilities Anaerobic Digestion, Sludge Drying Beds and Belt Filter Press.

Note: * shows the figures for the ultimate design figures. It means that the planning figures are at the target year of 2022. The sewerage facilities are designed at the planning figures.

(4) Project Cost

Prices were estimated based on the exchange rates as at 1st of November, 2005:

- 1 US Dollar = 107.23 Albanian Lek = 115.74 Japanese Yen; and
- 1 Euro = 129.463 Albanian Lek

Table 1.4 shows the project cost required implementing the M/P.

Table 1.4 Total Project Cost for M/P

Unit: Million Lek

Component	1st Stage(2009-2013)			2nd Stage(2014-2017)			3rd Stage(2018-2021)			Projects Total		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
Direct Construction Cost												
Trunk Sewer	1,375	298	1,673	807	1,380	2,187	26	454	480	2,208	2,132	4,340
Main Sewers	0	376	376	0	1,644	1,644	0	1,400	1,400	0	3,420	3,420
Kashar PS	0	0	0	328	221	549	0	0	0	328	221	549
Kashar STP	2,292	1,526	3,818	2,950	1,968	4,918	0	0	0	5,242	3,494	8,736
Kamza PS	0	0	0	0	0	0	208	137	345	208	137	345
Burxull STP	0	0	0	0	0	0	1,419	948	2,367	1,419	948	2,367
Total of Direct Construction Cost	3,667	2,200	5,867	4,085	5,213	9,298	1,653	2,939	4,592	9,405	10,352	19,757
Indirect Construction Cost												
Land Acquisition and Compensation	-	3,068	3,068	-	1,550	1,550	-	0	0	-	4,618	4,618
Administrative Expenses	-	293	293	-	465	465	-	230	230	-	988	988
Engineering Services	367	220	587	409	521	930	165	294	459	941	1,035	1,976
Physical Contingency	367	220	587	409	521	930	165	294	459	941	1,035	1,976
Capacity Bilding Cost	96	51	147	108	36	144	27	9	36	231	96	327
Total of Indirect Cost	830	3,852	4,682	926	3,093	4,019	357	827	1,184	2,113	7,772	9,885
Total Project Cost	4,497	6,052	10,549	5,011	8,306	13,317	2,010	3,766	5,776	11,518	18,124	29,642

(5) Operational and Maintenance Cost

The O&M costs include the expenditure needed for the following items: a) Personnel, b) Power, c) Chemicals for disinfection, dewatering and water quality measurement, d) Sludge Disposal, e) Routine Equipment Repairs, f) O&M of Sewers including inspection, cleaning and repairs.

The O/M cost are estimated about 104 million Leks in 2014 after the first commission of sewage treatment service, 270 million Leks in 2018 after the second stage project and 367 million Leks in 2022 after the third stage project.

(6) Replacement Cost

A replacement cost for mechanical and electrical is estimated at Leks 2,482 million for the 1st stage project, Leks 3,552 million for the 2nd stage project and Leks 1,763 million for the 3rd stage project. The replacement cost will be derived at the time of every 15 years after the completion of the works of each construction stage.

1.5 River Water Quality Improvement

The future BOD_5 concentrations, which are under low river flow conditions showing high concentration, are projected under available but very limited data and assumptions set forth. Reference points for the predicted water quality impacts are summarized in *Table 1.5*.

Table 1.5 Reference Points for Water Quality Projection

River	Location	Description
Lana River	F1	Crossroad of "Rruga Konferenca e Pezes" and "Bulevardi Bajram Curri"
	R5	Before the confluence of Lana & Tirana Rivers, on the Lana River side.
Tirana River	R4	Before the confluence of Lana & Tirana Rivers on the Tirana River side.
	R6	After the discharge point from the proposed STP in Berxulle

Table 1.6 summarizes the predicted water quality (0% no reduction of unspecified pollution load) at each reference point under the estimated low flow conditions.

Table 1.6 Effect on Water Quality Improvement Assuming Reduction of Unspecified Pollution Loads by 0 %, 50 % and 66 %

		BOD (mg/L)			
		2005	2014	2018	2022
F1	W/O Project	95	101	103	105
	0%	95	13	13	13
	50%	95	7	7	7
	66%	95	6	6	6
R5	W/O Project	125	128	129	130
	0%	125	70	29	28
	50%	125	59	21	21
	66%	125	55	19	18
R4	W/O Project	31	39	42	45
	0%	31	39	14	7
	50%	31	37	12	4
	66%	31	36	11	3
R6	W/O Project	53	60	62	65
	0%	53	43	22	16
	50%	53	38	18	12
	66%	53	36	16	10

Note: W/O Project: without project, With Project: the figures in percentage show the expected unspecified pollution load reduction.

The simulation results show the followings:

- Water quality improvement is expected at F1 after the first stage project.
- Other reference points, the water quality improvement is expected after the second stage project.
- At the reference point F1 and R4, further water quality improvement may be expected if any measures are taken to reduce the unspecified pollution load may be caused by sludge dumping, industrial wastewater and other pollution sources.

To achieve further improvement at each point, mitigation measures to address unspecified pollution loads (such as garbage dumping or direct discharge of industrial wastewater) should be developed and enforced in combination with the sewerage project. Trials to estimate water quality were undertaken based on 50% and 66% reduction of unspecified pollution loads. The results (shown in *Table 1.6)* indicate that significant water quality improvements can be expected at F1, R4 and R6. But additional water sources would be required to expect the further water quality improvement at R5.

1.6 Economic and Financial Evaluations

(1) Cost

Table 1.7 shows the annual disbursement schedule, including the capital investment, the O&M cost and the replacement cost. This cost information is used for financial and economic analysis and evaluation.

Table 1.7 Annual Disbursement Schedule

(Million Leks)

Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Financial Cost (incl. Price Escalation)	3,986	1,513	2,099	2,865	2,975	4,842	4,236	5,417	4,151	2,179	2,553	2,148	2,286	41,251
Financial Cost (excl. Price Escalation)	3,415	1,273	1,704	2,335	2,360	3,407	2,957	3,819	2,844	1,316	1,535	1,321	1,356	29,642
Economic Cost Converted (excl. Price	402	903	1,215	1,973	1,999	1,245	2,044	3,008	2,288	830	1,052	1,041	1,061	19,059

Economic Benefit

The expected economic benefits of the project are estimated the basic unit of benefits shown in *Table 1.8* and number of beneficiaries.

Table S1.8 Summary of Basic Unit of Economic Benefit

(As of 2005)

Benefit Items	Expected Willingness of People to Pay for the Whole Tageted Area by Means of Population-Weighted Average[1)] (Leks/HH per Year)	Saving Amount of Medical Expenditure[2)] (Leks/HH per Year)		Saving Amount of Income Decreasing[3)] (Leks/HH per Year)	
		Outpatient	Inpatient	Outpatient	Inpatient
Amount of Unit Benefit	4,193	244	660	4,885	15,368
Remarks & Sources	1. Estimated based on the result of the Public Awareness Survey made by JICA Study Team, January 2006. 2. Basic data and information for the nation and Tirana District are based on the information of the "Albania Poverty Assessment" Report No.26213-AL, November 5, 2003, the World Bank. The figures are the weighted average for the entire targeted areas. Details are shown in Annex. 3. Basic data and information for the nation and Tirana District are based on the information of the "Albania Poverty Assessment" Report No.26213-AL, November 5, 2003, the World Bank. The figures are the weighted average for the entire targeted areas. Details are shown in Annex in the Report.				

The result of economic analysis is summarized in *Table 1.9*:

Table 1.9 Result of Economic Evaluation of M/P

NPV	EIRR	B/C
-282 Million Leks	9.59 %	0.96

The EIRR of 9.59% is slightly lower than the applied discount rate of 10 %, but are higher than the minimum recommended rate of 5 % by the World Bank. Therefore, it can be concluded that the M/P is economically viable and socially responsible.

(2) Financial Evaluation

The financial benefit, namely the expected revenue due to collection of charges for sewerage services and connection fees is estimated.

It is recommended that the tariff level for the sewerage services should be 1 % of the average household income. A tariff revision schedule is recommended to ensure that the proposed tariff level can be reached by the target year of 2022. For commercial organizations (such as offices, shops, hotels, restaurants and factories) a tariff of Leks 7,339/annum per organization are applied.

Connection fee will apply to households once the charge equivalent to the average monthly income per customer. For commercials, it will apply at the rate of Leks 200,000 per customer.

Based on the above tariff settings and assumptions, the financial benefits are estimated. The financial evaluation was made using cash flows based on defined benefits and costs. The results are summarized in *Table 1.10*.

Table 1.10 Result of Financial Evaluation for M/P

NPV	FIRR	B/C
-664 Million Leks	9.06 %	0.95

The FIRR for M/P is 9.06 %. This is slightly lower than the applied discount rate of 10 %. Therefore, M/P seems financially viable.

1.7 Project Implementation Organization & Institutional Options

The current situation regarding decentralization of water and sewerage services is as follows:

(1) In accordance with the laws of Albania, local governments are the owners of the assets of the water supply and sewerage system facilities and are responsible for the provision of services. However, UKT has not been decentralized and remains under central government control supplying almost all of the Greater Tirana area.

(2) Central government has recently given its support to aggregation of local authorities rather than fragmentation into smaller uneconomic authorities.

(3) The municipalities and communes in the Greater Tirana area have not yet agreed to form a Joint

Authority for water supply & sewerage services, although there is a proposal for six municipalities to form a Joint Authority for Northern Greater Tirana which may form its own service provider (operator) and not use UKT. This proposal excludes the municipality of Tirana which has not yet indicated the direction it will take.

The main institutional reforms suggested by the Study are set out below:

(4) This report proposes a Joint Authority for Greater Tirana of all communes and municipalities in the Greater Tirana area, including Tirana, using a reformed and renamed UKT (GTW&SA) as the service provider (operator).

(5) Also proposed is a change to the law on Supervisory Councils which direct the operations of water & sewerage service providers (operators) to allow for majority membership for local governments with representation from central government.

(6) It is recommended that the Commercial Department of UKT extends its financial planning from the next years' budget, to short, medium and long term business plans.

(7) It is further recommended that the Technical Department of UKT gives equal status to the sewerage sector to that of the water sector before conversion to GTW&SA.

(8) These institutional reforms should be accompanied by resolution of the problem of illegal water use from the transmission mains particularly for irrigation.

2. Feasibility Study on the Priority Project

2.1 Priority Project

(1) Sewerage System Development Plan under the Priority Project

Table 2.1 shows outline of sewerage system development plan.

Table 2.1 Outline of Proposed Sewerage System Development Plan

	Item	Priority Project
1.	**Basic Information**	
1.1	Service Area	2,343 ha
1.2	Service Population	342,500
1.3	Unit Sewage Generation Rate	Average Daily 225 lpcd Maximum Daily: 280 lpcd
1.4	Sewage Flows	Average Daily: 77,100 m^3/day Maximum Daily: 95,900 m^3/day
2.	**Outline of Sewerage System**	
2.1	Sewers	
2.1.1	Trunk Sewer	Dia.: 900~1,500 mm, Length: 4.2km Material: Concrete, Jacking method
2.1.2	Main Sewer	Dia.: 200~600 mm, Length: 1.4 km Material: Plastic, Open-cut method
2.1.3	Branch Sewer	Dia. 200 mm, Length: 28 km Material: Planstic, Opent-cut method
2.2	Sewage Treatment Plant	Kashar STP
	Capacity	95,900 m^3/d

Item	Priority Project
Sewage Treatment Process	Screening + Grit Removal + Primary Sedimentation + Trickling Filter + Final Sedimentation + Chlorination
Sludge Treatment Process	Thickener + Anaerobic Digester + De-watering (Belt Filter Press and Sludge Drying Bed)
Sludge Generation for disposal Wet (Dry) basis	22.6 ton/day (8.2 ton/day)

Source: JICA Study Team

(2) Cost Estimates

The project cost is based on the price offset as of 21 June, 2006. The exchange rates on that day were:

- 1 US dollar = 96.28 Albanian Lek = 115.13 Japanese Yen; and
- 1 Euro = 122.96 Albanian Lek.

The total project cost is shown in *Table 2.2.*

Table 2.2 Total Project Cost for Priority Project

(Unit: Million Leks)

Component	FC	LC	Total
Direct Construction Cost			
Trunk Sewer	2,038	0	2,038
Main and Branch Sewers	0	288	288
Sewage Treatment Plant	2,000	2,054	4,054
Total of Direct Construction Cost	4,038	2,342	6,380
Indirect Construction Cost			
Land Acquisition and Compensation	-	1,146	1,146
Administrative Expenses	-	319	319
Engineering Services	404	234	638
Physical Contingency	404	234	638
Capacity Building	96	51	147
Total of Indirect Cost	904	1,984	2,888
Total Project Cost	4,942	4,326	9,268

Table 2.3 shows the estimated O&M costs.

Table 2.3 Overall Operation and Maintenance Costs for Priority Project

(Unit: Million Leks)

Items	Cost
Power Consumption	20.1
Chemicals	13.4
Personnel	39.1
Routine Equipment Repair	10.0
Sludge Disposal	6.6
O&M and Repair for Sewers	18.8
Total	108.0

Mechanical and electrical equipment will be replaced after 15 years operation. The replacement cost is estimated about 2,206 million Leks: FC 2,000 million Lek and LC 206 million Leks.

2.2 Financial and Economic Analysis

(1) Financial Analysis

Table 2.4 shows the proposed tariff revision schedule. For commercial and office users other than household, the amount of 15,261 Leks/firm per year is proposed. It was assumed that connection fees would be 15,000 Leks for domestic households and Leks 150,000 for commercial and office users. Number of customers to provide the sewerage service is estimated based on assumptions on connection rate and collection rate. The estimated revenues are used for financial evaluation.

Table 2.4 Proposed Tariff Revision Schedule for Household

Year	Average Annual Growth Rates of Income per House-hold	Annual Revised Schedule of Tariff Level Based on the Affordability of People to Pay					
		Tirana			Kashar		
		Estimated Annual Average Income Level (Leks/HH)	Teriff per Year (Leks)	Share Rate to Annual Income per HH	Estimated Annual Average Income Level (Leks/HH)	Teriff per Year (Leks)	Share Rate to Annual Income per HH
2014	3.63%	680,868	4,267	0.63%	551,960	2,922	0.53%
2015	3.50%	704,731	4,267	0.61%	571,305	2,922	0.51%
2016	3.38%	728,583	4,267	0.59%	590,641	2,922	0.49%
2017	3.27%	752,422	4,267	0.57%	609,967	2,922	0.48%
2018	3.17%	776,250	6,314	0.81%	629,283	4,812	0.76%
2019	3.07%	800,066	6,314	0.79%	648,590	4,812	0.74%
2020	2.98%	823,870	6,314	0.77%	667,887	4,812	0.72%
2021	2.89%	847,663	6,314	0.74%	687,175	4,812	0.70%
2022	2.81%	871,443	8,714	1.00%	706,453	7,065	1.00%

Table 2.5 shows the result of financial analysis. The FIRR of 7.21 % is higher than the applied discount rate of 5 %. The resulting B/C ratio is 1.16. The NPV is positive Leks 1,429 million. Therefore, the Project is financially sound from the perspective of meeting basic human needs that are based on the living environment.

Table 2.5 Result of Financial Evaluation in Case of 5 % of Discount Rate

NPV	FIRR	B/C
1,429 Million Leks	7.21%	1.16

(2) Economic Analysis

Table 2.6 shows the result of economic analysis. The resulting EIRR of 15.72 % is greater than the applied discount rate of 10%. Therefore the project is economically viable.

Table 2.6 Result of Economic Evaluation of the Project

NPV	EIRR	B/C
2,101 Million Leks	15.72%	1.56

2.3 Project Evaluation

(1) Technical Evaluation

Table 2.7 summarizes the technical evaluation of the proposed Priority Project.

Table 2.7 Technical Evaluation of the Proposed Priority Project

Criteria	Proposed Priority Project
(1) **Beneficiaries**	The direct beneficiaries are the polutaion within the Lana River Basin being serviced (342,500 people). Indirect beneficiaries are those who visit and work in the center of the municipality. These people will benefit from the improved water quality in Lana River. The service cover ratio for the planned population in 2013 is about 47%.
(2) **BOD/SS Load Reduction**	A BOD_5/SS load reducion of about 13.6/13.1 ton/day is expected. The total BOD_5/SS load generated in the Kashar STP area is about 32/32 ton/day. The STP is expected to be able to reduce the pollution loads by 40%. Maximizing the use of the existing sewer system would help to reduce pollution loads but would save on construction costs for the branch and main sewers.
(3) **River Water Quality Improvement**	In the Lana River, at the reference point 'F1' where the densely populated area ends or the existing interceptors (Lana North and Lana South) discharge the sewage to the river, the water quality would be improved drastically by the implementation of the Priority Project. The water projection using available data and information predicted that the BOD_5 concentrations at 'F1' would be 13 mg/L with the project and 101 mg/L without project. The BOD_5 concentration with project could be further improved by an appropriate management of unregulated garbage dumping and industrial wastewater. While in the Tirana River, the water quality improvements would be expected after the second stage project because the Priority Project focused only to the Lana River basin.
(4) **Treated Sewage Quality and Flow**	BOD_5/SS conc.: 24/30 mg/L, Average Daily Flow: 77,100 m^3/day Effluent Load of BOD_5/SS: 1.9/2.3 ton/day
(5) **Operation and Maintenance (O&M) Requirements**	Since the sewage would be conveyed in the proposed Trunk Sewer No.3 under gravity flow, no pumping station would be required. Training of the operators of the sewage and sludge treatement systems would be required.
(6) **Service Area Coverage**	The service area covered by the priority project is 2,343 ha, and the planned service area covered by Kashar STP is 6,090 ha. This means the coverage ratio compared to the Kashar STP coverage area is 38%.
(7) **Sewers**	The sewer develoment ratio for the Priority Project against the planned sewers are:

	Development Ratio	branch sewer 46%, main sewer 3%, and trunk sewer 28%. The low rate for main sewers means that the existing main sewers are used at maximu, and the new branch sewer will be constructed in the following stages.
(8)	**Project Promotion and Public Awareness**	The project is expected to have only a small number of beneficiaries but would help to improve the living environment in the Lana area and the water quality in the section of the Lana River in the urban center. This project is expected to significantly contribute to peoples' understanding of the sewerage system and its positive effects because people can visit the STP and see the treated sewage.

(2) Financial and Economic Evaluation

The results of financial and economic analysis show that the Project has enough financial and economic viability.

(3) Environmental and Social Considerations

The environmental assessment indicated:

- Overall, the proposed project is expected to have positive environmental impacts in terms of water quality and public health. This will be achieved through the improved sewerage system service standards.
- Construction of sewers and STPs may cause short term localized impacts for the nearby residents. However, these hazards can be limited through careful consideration of which construction methods to use and through proper operation and management of the sewerage system.
- Collection of sewage that is currently directly discharged into the Lana River and its tributaries will significantly improve the water quality in the Lana River and its tributaries.
- The beneficial effects of the project outweigh the adverse effects.

Mitigation measures, corrective action plans for risk, and monitoring should be properly undertaken to ensure that serious adverse impacts on the socio-economic situation and on the environment do not occur.

3. Conclusions and Recommendations

3.1 Conclusion

The Study has prepared a sewerage M/P to improve the water environment and the living environment of the Greater Tirana area with the consecutive three stage implementation program and identified the Priority Project.

The F/S for the proposed Priority Project verified the technical, economic, financial and environmental feasibility and sustainability. The F/S indicates that the proposed Priority Project should be implemented immediately to improve the water quality of Lana River and public health. The project is expected to significantly improve the communities' understanding of sewage treatment.

3.2 Recommendations

Followings are major recommendation to step forward to realize the projects:

- To obtain the land area for construction of the proposed STPs, PSs and sites for construction of vertical shaft for trunk sewer construction by jacking method;
- To accelerate the decentralization process through mutual understandings of parties concerned;
- To establish the execution body and realize and manage the project under the decentralization process;
- Three major legal issues that should be resolved for implementation of the Priority Works:
  - Law on Membership of Supervisory Councils;
  - Late Payment of Bills, Disconnection & Enforcement; and
  - Compulsory Connection to Sewers;
- Other measures to improve the river water environment:
  - Tight regulation of household solid waste, construction debris and construction spoil dumping;
  - Regulation of housing development especially in the upstream areas of rivers;
  - Establishment of a water quality and flow rate monitoring system for the rivers;
  - Strengthening of the regulatory system for industrial wastewater management;
  - Provision and promotion of an environmental education and awareness campaign aimed at preventing garbage dumping into the Lana and Tirana Rivers; and
  - Preparation and immediate implementation of a comprehensive solid waste management plan for the Greater Tirana area.

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

Final Report

Volume I: Executive Summary

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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

EXECUTIVE SUMMARY

Part I Master Plan

1.1 Background and Objectives

1.1.1 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 GoA has also 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.

1.1.2 Study Objectives

The objectives of the Study are 1) to prepare a Master Plan (M/P) for improving the sewerage system for Greater Tirana through to the target year 2022 and 2) to conduct a Feasibility Study (F/S) for Priority Project(s) identified in the M/P; and 3) to transfer technology to the Albanian counterpart personnel.

1.1.3 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 that are serviced by a piped water supply. These areas are identified in the urban development plan called "Strategic Plan for Greater Tirana (2002)".

1.2 Present Conditions

1.2.1 Financial Situations

(1) Central Government

Table S1.2.1 shows the financial status of the nation.

Table S1.2.1 Financial Status of the Nation

(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

The total Revenue grew from Leks 33,476 million in 1993 to Leks 135,484 million in 2001. This represents a 19.10 % annual average growth rate. 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 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.

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 S1.2.1*. 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.

(2) Local Governments

Table S1.2.2 shows a summary of financial status of municipalities, communes and 11 mini-municipalities under the Tirana Municipality.

Table S1.2.2 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
Revenue: Grant from the Other Government	421	514	240	307	0	0	241	309	80	104	105	114	108	126	172	192	35	41	44
Revenue: 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
Revenue: 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
Revenue: 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.

The 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. 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 *Table S1.2.2*. They are receiving grants from the local government and/or the central government more than 60 % of their revenue.

On the other hand, 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.

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. About 75 % of its revenue was provided by the central government as a grant.

(3) Water Supply and Sewerage Corporations

1) UKT (Water Supply and Sewerage Enterprise of Tirana)

The UKT is financially stable. *Table S1.2.3* shows UKT's annual profit and loss statement. In 2005, its revenue is Leks 1,115 million and expenditure is Leks 1,084 million. "Other Revenues (Other than financial)" describes the subsidy and/or contribution received from the state Government. In 2005, Leks 28 million (2.5 % of revenue) was provided to UKT by the central government as a grant (or contribution). In 2004, the central government provided a large subsidy that was funded by a loan from the Italian Government.

Table S1.2.3 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.

Table S1.2.4 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 Leks 1,288 million up to 2005. 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.

Table S1.2.4　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.

2) UKK (Water Supply and Sewerage Enterprise of Kamza)

The financial report was not completed because UKK only had records for two years since its establishment.

Table S1.2.5 shows the Profit and Loss Statement in 2004. 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.

Table S1.2.5　Profit and Loss Statement, UKK 2004

(Leks)

Expenditure	2004
Salaries and Wages from Grants	5,501,000
Salaries and Wages from Own Incomes	3,895,583
Social Security from Grants	1,846,000
Social Security from Own Incomes	1,234,000
Operational Expenditures	3,581,672
From Grants	2,492,500
Bank Commissions	25,748
Power Supply	432,000
Water Liquidations	1,213,467
Other Services	300
Chacellery	61,540
Invoices Notepad and Record of Due Paid Notepac	240,540
Maintenance of Water Supply System	399,000
Procurement of Chlorine	90,000
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

Revenue	2004	Remarks
Operational Income	8,847,780	Collection Rates:
From Kamza Area	3,850,410	67.30%
From Valias Area	574,360	51.70%
From Zall-Mner Area	551,930	80.90%
From Bathore 1 and 2 Areas	979,200	42.10%
From Bathore 3 and 4 Areas	1,155,440	57.60%
From Bathore 4/1 Area	435,840	(Extra)
Water Record of Due Paid Notep	118,600	Average Collection
Water Junctions	1,182,000	Rate:
Grants	7,210,475	59.92%
Total	16,058,255	

(Note)
Share rate of Grants to the total income: 44.90%

Source: UKK

1.2.2 Family Economy

The growth rate of wages and salaries in the past are as follows adjusted by the consumer price index

(CPI) reported in the same Statistics. *Table S1.2.6* shows the real wage growth.

Table S1.2.6 Real Wage Growth in Albania

(%)

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

Source: INSTAT

On the other hand, the average income per household (HH) in the study area is shown in *Table S1.2.7.*

Table S1.2.7 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.

1.2.3 Institutional Situations

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).

The major policies, strategies and plans which impact on the development of the water supply and sewerage sector for the Greater Tirana area may be summarized as follows:

- Decentralization in general and in particular for the water supply & sewerage sector;
- Albania Water Supply and Wastewater Sector Strategy; and
- Strategic Plan for Greater Tirana.

The current situation regarding decentralization of water and sewerage services is as follows:

(1) In accordance with the laws of Albania, local governments are the owners of the assets of the water supply and sewerage system facilities and are responsible for the provision of services. However, UKT has not been decentralized and remains under central government control supplying almost all of the Greater Tirana area.

(2) Central government has recently given its support to aggregation of local authorities rather than fragmentation into smaller uneconomic authorities.

(3) The municipalities and communes in the Greater Tirana area have not yet agreed to form a Joint Authority for water supply & sewerage services, although there is a proposal for six municipalities to form a Joint Authority for Northern Greater Tirana which may form its own service provider (operator) and not use UKT. This proposal excludes the municipality of Tirana which has not yet indicated the direction it will take.

1.2.4 Water Environment

(1) Rivers

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.

The 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 the Tirana Municipality. It joins the mid-part of the Tirana River. The Tirana River runs through the northern part of the 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 3.5km 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.

(2) Water Quality

1) Existing Water Quality Data

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 Ministry of Environment, Forests and Water Management (MoEFWM). The measurement points for water quality by IEP (and IPH) are also shown in *Figure S1.2.1*.

Water quality monitoring data for the Lana and Tirana rivers were provided by the IPH (2000 to 2003) and the IEP (2004 to 2005).

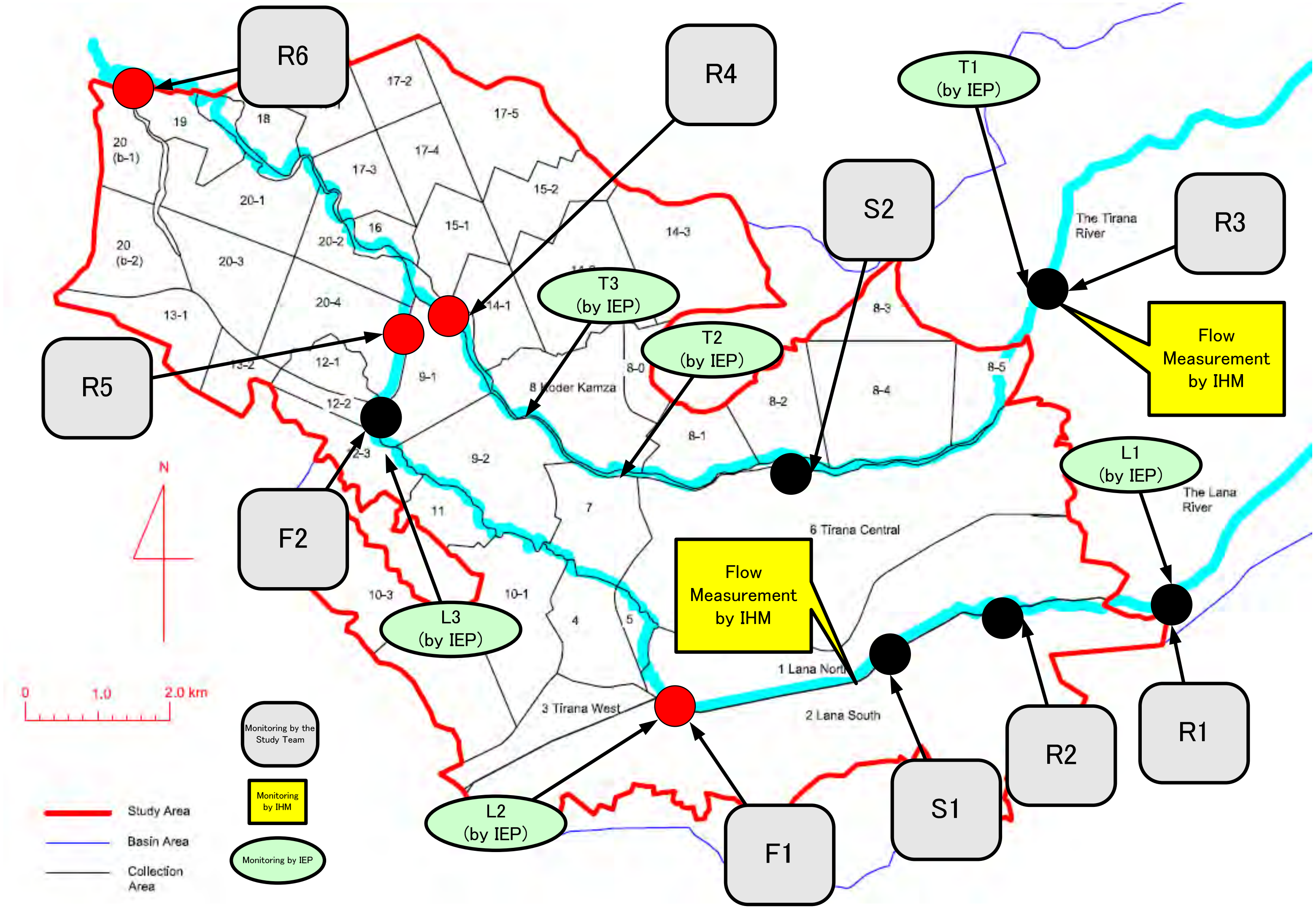

Figure S1.2.1 Regular Sampling Locations used by the IEP and IHM, Flow Measurement Locations used by the IHM and Sampling Locations used by the JICA Study Team

Table S1.2.8 and Table *S1.2.9* summarize the concentration ranges of major water quality parameters of BOD_5, NH4+-N, T-P, and Fecal Coliform from the existing data.

Table S1.2.8 Summary of Existing Water Quality Data of the Lana River

Water Quality Parameters	Upper Stream at L1	Middle Stream at L2	Lower Stream at L3
BOD_5 (mg/L)	2.0～35 (IPH)* 0.9～9.0 (IEP)	15～125 (IPH) 32～95 (IEP)	19～132 (IPH) 21～125 (IEP)
NH_4^+-N (mg/L)	0.0～3.5 (IPH) 0.1～1.1 (IEP)	1.9～37 (IPH) 8.0～16 (IEP)	2.7～36 (IPH) 10～17 (IEP)
T-P (mg/L)	0.01～2.8 (IPH) 0.02～0.2 (IEP)	0.3～3.3 (IPH) 0.9～4.3 (IEP)	0.8～3.5 (IPH) 1.2～5.1 (IEP)
Fecal Coliform (1,000 MPN/100ml)	1～234 (IPH) 210～9,300 (IEP)	100～5,430 (IPH) 1,100～240,000 (IEP)	500～2,520 (IPH) 1,100～240,000 (IEP)

Note: IPH: 14 Samples taken and analyzed between 2000 and 2003, and *: Very high value of 116 mg/L is recorded, but the other parameters of COD, NH_4^+-N, T-P show low values, therefore the high BOD value is excluded from the above table.

IEP: 7 samples taken and analyzed between 2004 and 2005

Table S1.2.9 Summary of Existing Water Quality Data of the Tirana River

Water Quality Parameters	Upper Stream at T1	Middle Stream at T2	Lower Stream at T3
BOD_5 (mg/L)	2.8～13 (IPH)* 0.2～2.2 (IEP)	8.1～97 (IPH) 2.3～31 (IEP)	7.2～112 (IPH) 3.9～28 (IEP)
NH_4^+-N (mg/L)	0.0～0.5 (IPH) 0.1～1.0 (IEP)	0.3～4.1 (IPH) 1.2～9.0 (IEP)	0.4～4.8 (IPH) 1.5～11 (IEP)
T-P (mg/L)	0.2～1.5 (IPH) 0.02～0.1 (IEP)	0.2～3.7 (IPH) 0.2～1.3 (IEP)	0.3～3.8 (IPH) 0.2～2.0 (IEP)
Fecal Coliform (1,000 MPN/100ml)	0.6～10 (IPH) 0.5～11 (IEP)	7～1,380 (IPH) 1,100～240,000 (IEP)	360～3,790 (IPH) 460～110,000 (IEP)

Note: IPH*: 14 Samples taken and analyzed between 2000 and 2003, and
IEP**: 7 samples taken and analyzed between 2004 and 2005

The existing data indicates that the water characteristics of each river are summarized.

(i) Lana River

- 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.

(ii) Tirana River

- 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.

2) Survey 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 of 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
- impacts to the nearby industrial areas.

The selected sampling locations are shown in *Figure S1.2.1*. The water quality survey results are summarized in *Table S1.2.10*. This table showed that the BOD_5 concentration in the Lana River ranged from approximately 10 mg/L in upstream to 60 mg/L at urban center. The BOD_5 concentration in the Tirana River ranged from approximately 10 mg/L in upstream to 50 mg/L at the Tirana urban center. At the confluence of the two rivers, the BOD_5 concentration reached approximately 60 mg/L.

The BOD_5 data reveals 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, which indicate sewage and fecal pollution, therefore the water of the Lana and Tirana River is polluted by the direct discharge of sewage which generated by human life and activities.

A comparison of the BOD_5 concentrations measured either side of an industrial business, revealed some influence of industrial wastewater pollution 45 mg/L before industrial area (F1) and 62 mg/L after (F2). Some of the exiting BOD_5 data at the location L2 and L3 collected by IEP also show such influence.

Table S1.2.10 Results of Water Quality Survey by 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

Table S1.2.11 presents the water quality data of samples taken at the outflows form the existing interceptor sewers. Compared with the sewage characteristics in the reference, the followings are revealed:

- each sample at S2 (sewage discharging to the Tirana River) shows that the water quality parameters have the same magnitude of weak raw sewage; and
- each sample at S1 (sewage discharging to the Lana River) shows that 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 at S1 and S2 show that higher MPN values in Total Coliform than reference value, in particular the samples at S1 show ten times higher than those at S2.

It can be explained that the reasons of samples showing weak BOD_5 strength as a sewage may be influenced by a rain water (run-off water) because the samples are taken at the beginning of the rainy season. The first samples were taken at the dry weather condition and the second samples were taken at the wet weather conditions. But the results do not show any big difference.

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 BOD5 concentrations indicate that the water quality is almost the same as for raw sewage in the middle and lower part of the Lana and Tirana River.

Table S1.2.11 Water Quality as Raw Sewage

Parameter	Lana River (2 Samples)	Tirana River (2 Samples)	Referece*	
			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 availabel	Not available

Source: JICA Study Team *:Wastewater Engineering, Treatment and Reuse, Third Edition, Metcalf & Eddy

3) Current BOD_5 Concentrations Used for Future Water Quality Projection

It was identified that a wide range of BOD_5 concentrations every year at different sampling locations as shown in *Figure S1.2.2* and *Figure S1.2.3*. 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.

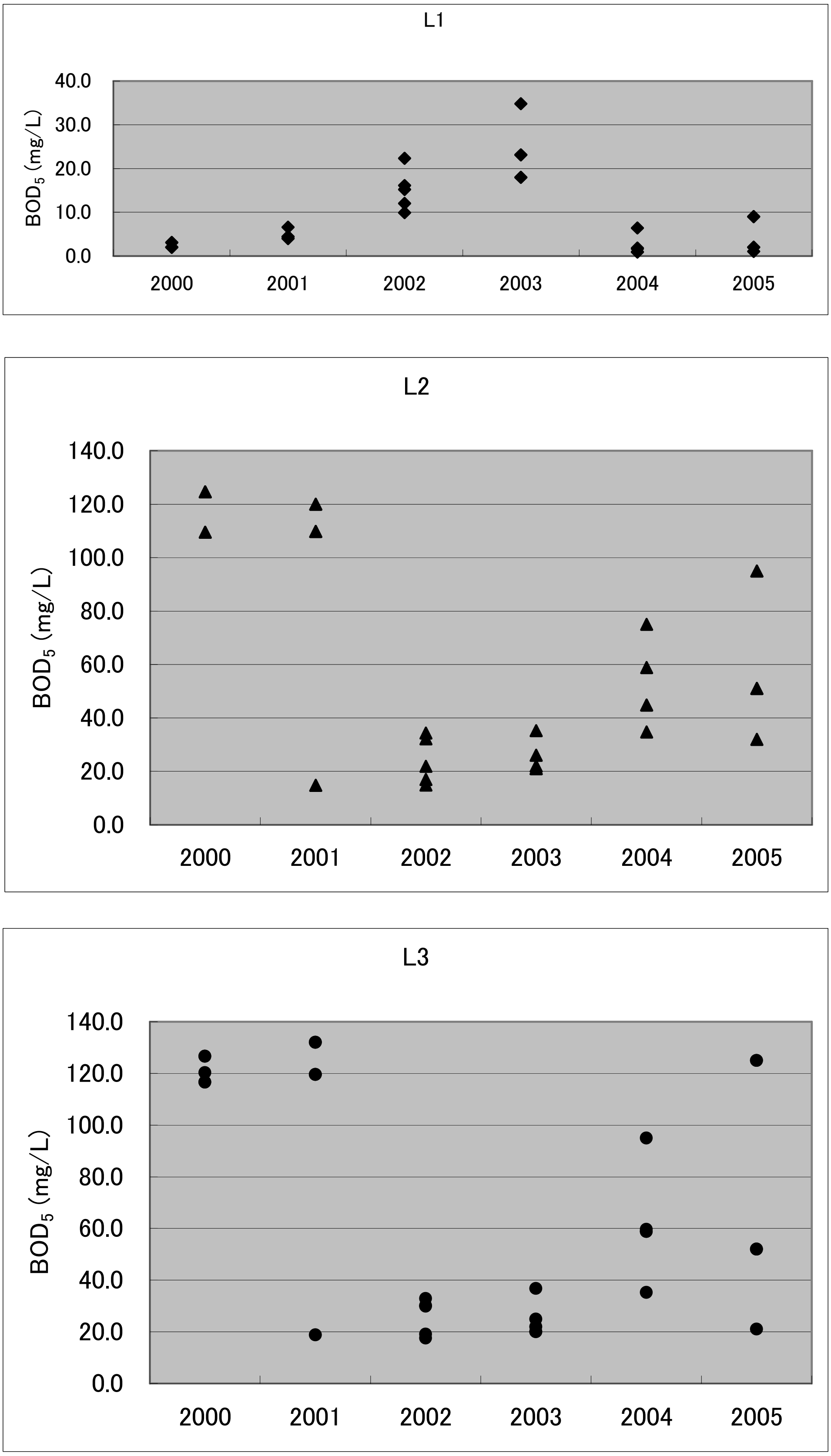

Figure S1.2.2 Existing BOD_5 Data in the Lana River

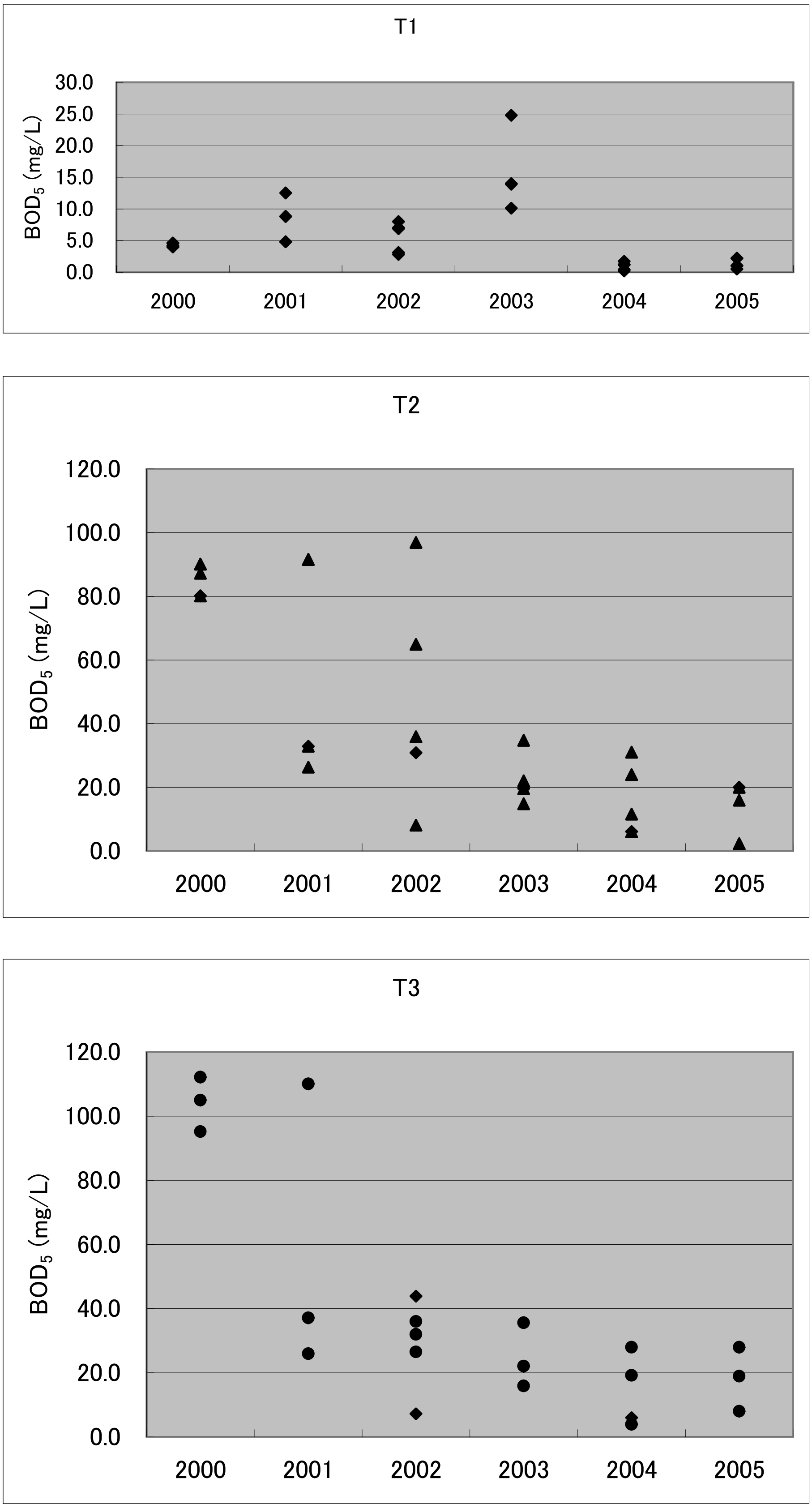

Figure S1.2.3 Existing BOD_5 Data in the Tirana River

The BOD_5 and NH_4^+-N concentrations are plotted for each reference point along Lana River and Tirana River, respectively. 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.

Table S1.2.12. presents the selected BOD_5 concentration at each point in the Study area which will be used as the present water quality.

Table S1.2.12 Selected Present BOD_5 Concentrations

Sampleing Point	River	BOD_5 Concentration	Remarks
L1	Lana River, Upper Reach	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.
L2	Lana River, Middle Reach	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.
L3	Lana River, Low Reach	125.0 mg/L	The higest cocentration data is selected because of the same reasons above. Data used: May in 2005.
T1	Tirana River, Upper Reach	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.
T2 and T3	Tirana River, Middle Reach	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.
R6	Tirana River, Low Reach	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

1.3 Existing Sewerage System

In the Study area, there are no sewage treatment plant and no sewage pumping stations. Only sewers have been developed in Tirana municipality and in the limited area in Kamza municipality.

1.3.1 Existing Sewer System

In Tirana Municipality, the existing sewer/drainage system covers almost all the municipal area. The existing sewer system is used to collect both sewage and rainwater. The exiting interceptors are outlined in *Table S1.3.1*. These interceptor have excess capacities in dry weather conditions, however are inadequate to carry both sewage and rainwater flows during wet weather conditions.

Table S1.3.1 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

Figure S1.3.1 shows the Lana North and Lana South interceptors.

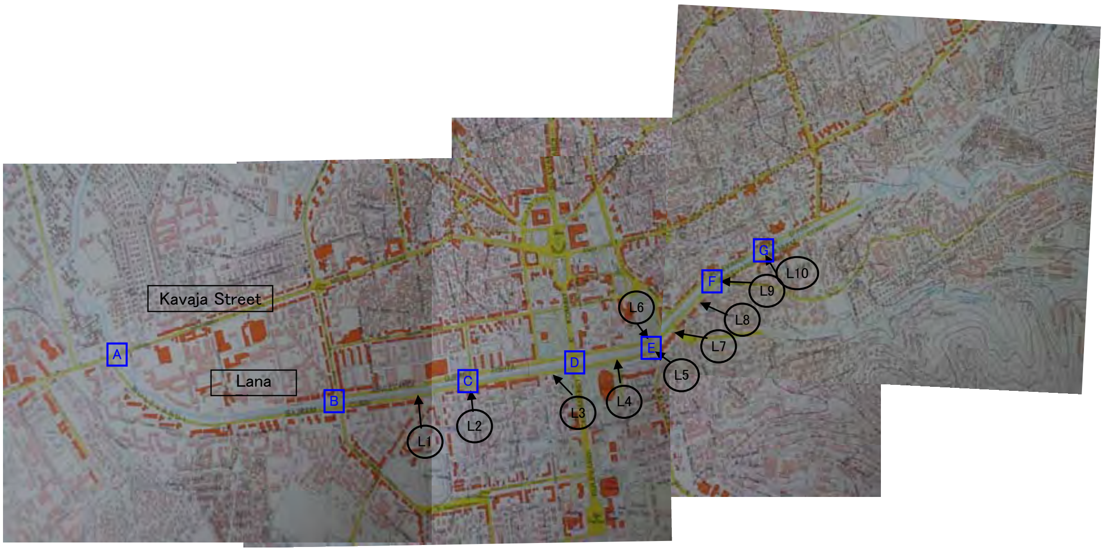

Figure S1.3.1 Lana North and Lana South Interceptors

The basic figures of Lana North and Lana South Interceptors are presented in *Table S1.3.2*. The Lana North Interceptor has slope between 3 and 16‰, the Lana South Interceptor has slope between 4 and 11‰.

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 function.

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. The plans show 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.

Table S1.3.2 Basic Figures of Lana North and Lana South Interceptors

Point Name	Sewer invert elevetion		Diameter	Length	Slope	Flow capacity	Notes
	UP	Dwn	mm	(m)		(m3/s)	
North-FE	109.89	104.17	800	359	0.016	3.6	
North-ED	104.17	102.70	800	500	0.003	1.56	
North-DC	102.70	98.76	800	544	0.007	2.38	
North-CB	98.76	93.79	1000	689	0.007	2.77	
North-BA	93.79	89.84	1000	1254	0.003	1.81	down half :2000mm
South-GF	116.14	109.53	800	615	0.011	2.99	
South-FE	109.53	105.56	800	359	0.011	2.99	
South-ED	105.56	*102.59*	800	500	0.006	2.21	
South-DC	102.59	98.90	800	544	0.007	2.38	
South-CB	98.90	93.73	1000	689	0.008	2.96	
South-BA	93.73	88.62	1000	1254	0.004	2.09	

Source: JICA Study Team

Under these conditions the interceptors are not used fully, the collected sewage is discharged into the Lana River and Tirana River at various 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 S1.3.2*. Five discharge points were found along the Tirana River in the Tirana municipality, as shown in *Figure S1.3.3*. Only three discharge points are officially registered on the facility map.

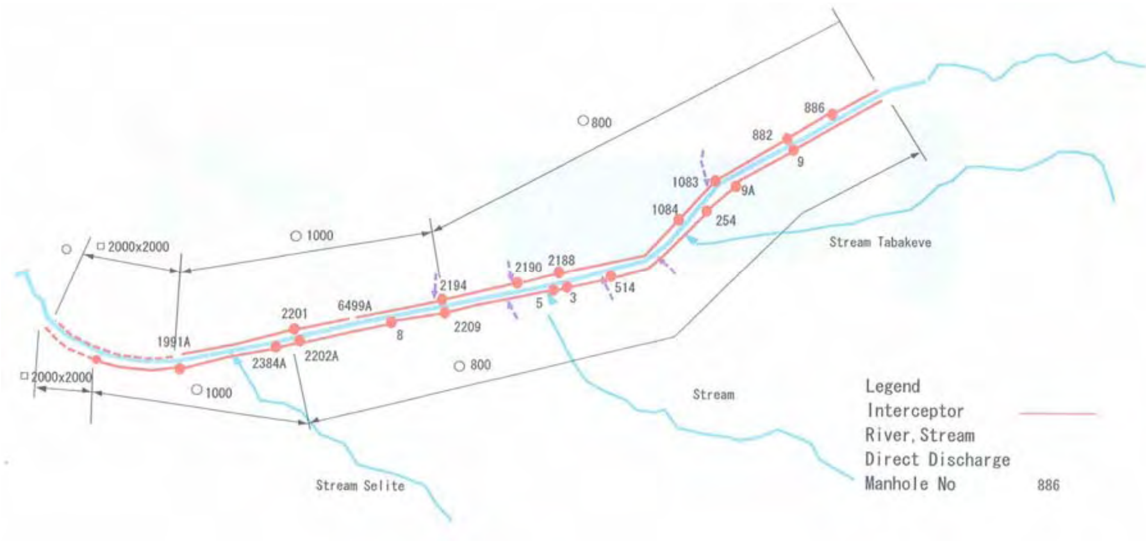

Figure S1.3.2 Discharging Points in the Lana River

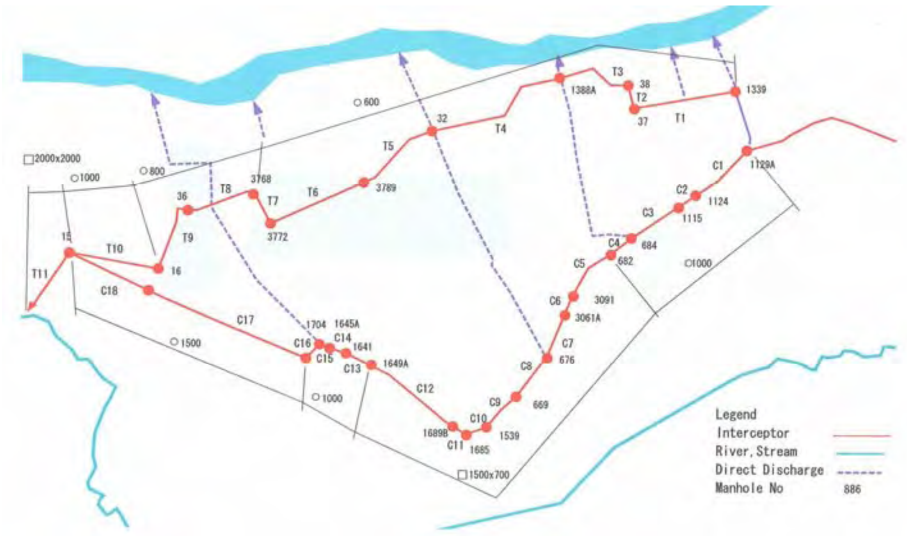

Figure S1.3.3 Discharging Points in the Tirana River

In Kamza Municipality, the existing sewer network is limited to cover the urban center area. The present sewerage/drainage development plan is to use the existing drainage channel used for agriculture. *Figure S1.3.4* shows the three discharge points along the Tirana River within Kamza municipality.

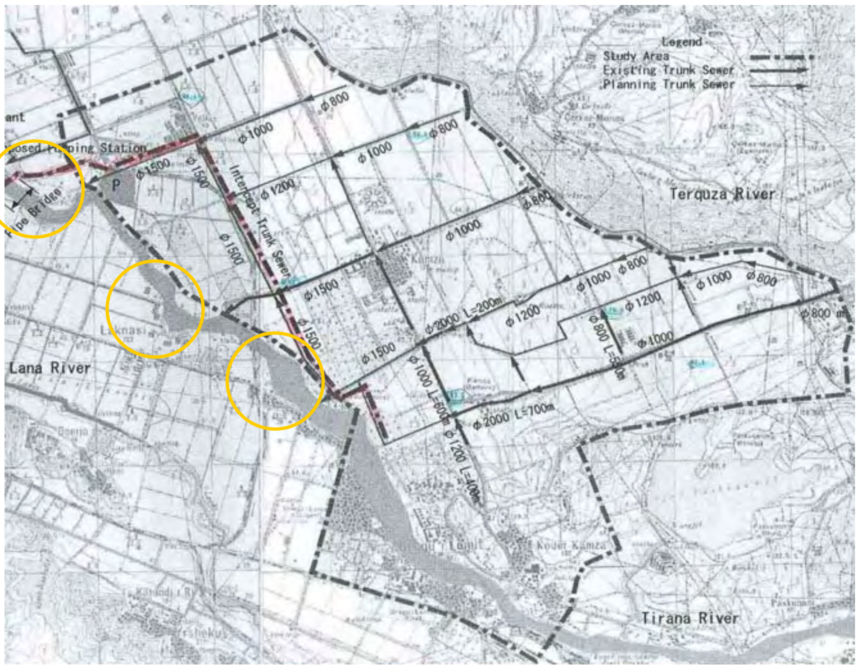

Figure S1.3.4 Discharging Points in the Tirana River from Kamza Municipality

In communes of Paskuqan and Berxulle, there are no existing public sewers and no development plans of sewers and drainage sewerage.

1.3.2 Other findings

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.

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 S1.3.5*. During wet weather conditions, the water level rises to the top of the culvert, but recedes quickly, where both the Lana North and the Lana South interceptors are discharging the sewage. In wet weather conditions, the water level at this point is increased up to the upper limit of concrete surface. Incidentally, the water depth at mid stream was observed reading about 20cm below even in a strong rainy day. *Figure S1.3.6* shows the high water level observed after a period of 10 consecutive days with significant rainfall (February to March 2006).

Figure S1.3.5 Mud Accumulated under Bridge at the Lana River

Figure S1.3.6 High Water Level at the Lana River after Significant Rainfall (Photograph taken on March 2nd 2006)

1.4. Basic Approach for Sewerage Planning

1.4.1 Objectives of Sewerage Development

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 in the study, 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; and

(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.

1.4.2 Acceptance of Industrial Wastewater to the Public Sewerage System

The quality and quantity of industrial wastewater are important issues to be considered when planning sewerage systems. For preparation of the sewerage plan it is decided that the wastewater from industrial areas and large factories is not accepted into the sewerage system, considering the following conditions in the study area:

- Since there is few 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.

The sewerage system will accept the "sewage" as water discharged from residential zones (mainly domestic), commercial zones (excluding toxic and chemical base wastewater), business zones (including wastewater from the existing small and house-industries but excluding toxic and chemical base wastewater) and offices in industrial zones.

This is the reason why the study uses the term "**sewerage system**" not "wastewater system". Industrial wastewater is not to be accepted from the industrial areas and large factories because of following 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.

1.4.3 Sewage Collection System

The existing sewer system in the municipalities of Tirana and Kamza should be used at their maximum use. For areas where there are no public sewers, a separate sewerage system will be developed. 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.

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 (1Q) 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 S1.4.1 shows the improved existing sewage collection and conveyance system. *Figure S1.4.2* shows the proposed sewage collection and conveyance system entering the STP.

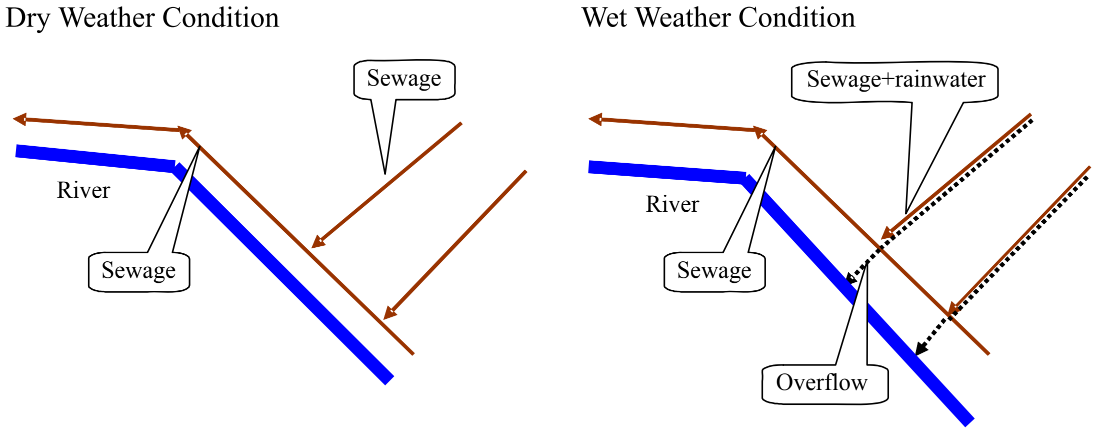

Figure S1.4.1 Improved Sewage Collection and Conveyance System

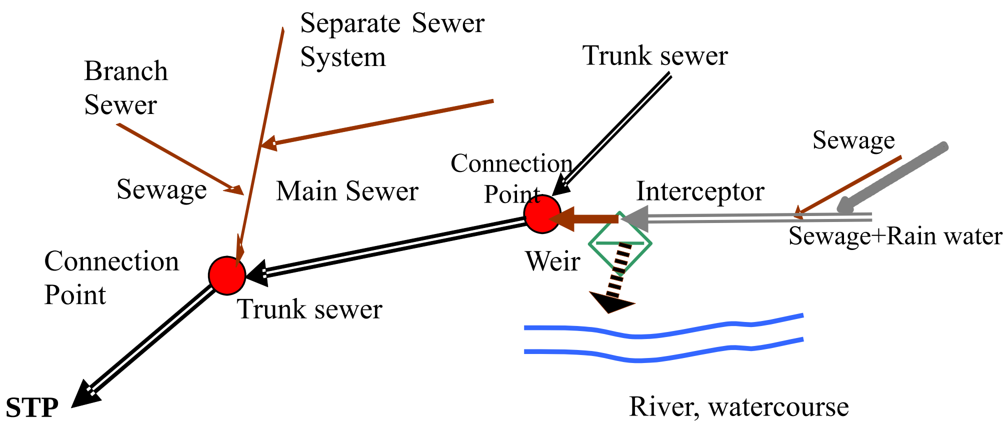

Figure S1.4.2 Proposed Sewage Collection and Conveyance System, under Wet Weather Conditions

1.4.4 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: i) Aerated Lagoon(AL); ii) Trickling Filter (TF); iii) Oxidation Ditch (OD), and iv) Activated Sludge Process (AS).

(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 5) Possibility of implementing primary treatment at independent sites.

(3) Assumptions to compare sewage treatment processes

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/SS are 200/200 mg/L, Effluent BOD/SS are 25/35 mg/L

2) How the treatment processes were compared

- 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.

(4) Comparison of the Sewage Treatment Process

Table S1.4.1 summarizes the results of the comparison of each sewage treatment process by the selection criteria.

Table S1.4.1 Comparison of Sewage Treatment Processes

	Aerated Lagoon (AL)	Trickling Filter (TF)	Oxidation Ditch (OD)	Activated Sludge (AS)
1) Easiness of O&M	◎ (50%)	○ (100%)	△ (125%)	× (250%)
2) O&M Cost 2.1) Electrical Cost 2.2) Personal Cost 2.3)Total	△ (470%) (60%) (390%)	◎ (100%) (100%) (100%)	△ (420%) (110%) (360%)	△ (460%) (150%) (400%)
3) Construction Cost	○ (106%)	○ (100%)	○ (108%)	△ (160%)

4) Applicability to the land available	(226%)	(100%)	(118%)	(30%)
5) Sludge Generation	◎ —	○ 45.735 ton/day 25 units of beltpress (100%)	○ 37.135 ton/day 24 units of beltpress (96%)	△ 52.805 ton/day 29 units of beltpress (132%)
6) Relationship with primary treatments facilities at independent sites	○	◎	○	◎
Overall Evaluation	2	1	3	4

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

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.

1.4.5 Sludge Treatment Process

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 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.

1.5. Sewerage System Development Plan up to 2022

1.5.1 Planning Fundamentals

(1) Planning area

The planning area 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 S1.5.1*): 1) Tirana municipality, 2) Kamza municipality, 3) Kashar commune, 4) Paskuqan commune, 5) Berxulle commune.

(2) Planning Population

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 these 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 S1.5.1* summarizes the registered population as of 2001 and 2005, and shows the population projections of 2022 using different methods. The table also shows the population size that was used to plan the sewerage system works. It was finally determined in consultation with relevant municipalities and communes.