Republic of North Macedonia
Ministry of Environment and Physical Planning

Data Collection Survey on Water Environment Management of Lake Ohrid's Surrounding Area in the Republic of North Macedonia

Final Report

January 2022

JAPAN INTERNATIONAL COOPERATION AGENCY

TEC International Co., Ltd.
Nihon Suiko Sekkei Co., Ltd.

7R
JR
22-002

Republic of North Macedonia
Ministry of Environment and Physical Planning

Data Collection Survey on Water Environment Management of Lake Ohrid's Surrounding Area in the Republic of North Macedonia

Final Report

January 2022

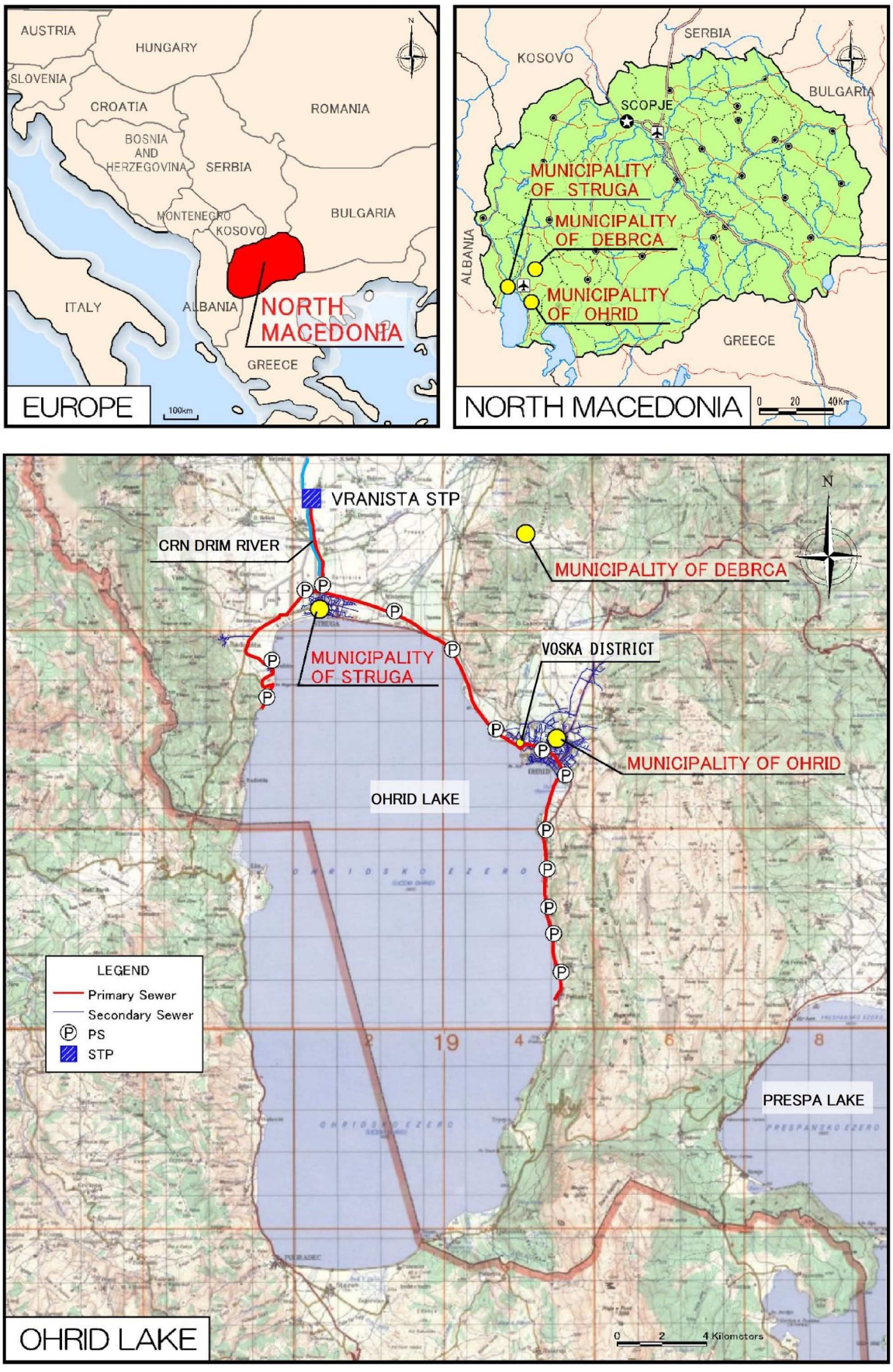
JAPAN INTERNATIONAL COOPERATION AGENCY

TEC International Co., Ltd.
Nihon Suiko Sekkei Co., Ltd.

Exchange Rate

1	MKD	2.105	JPY
1	EUR	130.000	JPY
1	EUR	61.758	MKD

As of October 2021


AUSTRIA
HUNGARY
SLOVENIA
CROATIA
ROMANIA
BOSNIA AND HERZEGOVINA
SERBIA
MONTENEGRO
KOSOVO
BULGARIA
ITALY
ALBANIA
NORTH MACEDONIA
GREECE
EUROPE
100km
SERBIA
KOSOVO
SCOPJE
BULGARIA
MUNICIPALITY OF STRUGA
MUNICIPALITY OF DEBRCA
MUNICIPALITY OF OHRID
ALBANIA
GREECE
NORTH MACEDONIA
0 20 40Km
VRANISTA STP
CRN DRIM RIVER
MUNICIPALITY OF DEBRCA
MUNICIPALITY OF STRUGA
VOSKA DISTRICT
MUNICIPALITY OF OHRID
OHRID LAKE
PRESPA LAKE
LEGEND
Primary Sewer
Secondary Sewer
PS
STP
OHRID LAKE
0 2 4 Kilometers
N

SURVEY AREA

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOS

ABBREVIATIONS AND ACRONYMS

BOD	Biochemical Oxygen Demand
CCTV	Closed Circuit Television
CHF	Swiss Franc
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
EBRD	European Bank for Reconstruction and Development
EU	European Union
EUR	Euro
FS	Feasibility Study
IPA	Instrument for Pre-Accession Assistance
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau
L/A	Loan Agreement
MKD	Macedonian Denar
MLSS	Mixed Liquor Suspended Solids
MoEPP	Ministry of Environment and Physical Planning
O&M	Operation and Maintenance
OD	Oxidation Ditch
P.E.	Population Equivalents
PE	Polyethylene
PE	Public Enterprises
PS	Pumping Station
PVC	Polyvinyl Chloride
RC	Reinforced Concrete
SCADA	Supervisory Control And Data Acquisition
SDG	Sustainable Development Goal
SECO	State Secretariat for Economic Affairs
SS	Suspended Solid
STP	Sewage Treatment Plant
TN	Total Nitrogen
TP	Total Phosphorus
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WB	Word Bank

1 Introduction

1.1 Background of the Survey

The Republic of North Macedonia (hereinafter referred to as "North Macedonia") has set the Operational Program of The Government of The Republic of North Macedonia (2020-2024)[1] as its mid-term national plan to achieve its next national goal of EU membership after joining NATO in February 2019. In order to achieve this goal, the Operational Program of The Government of The Republic of North Macedonia (2020-2024) was established as a medium-term national plan. The plan states that the government will adhere to the EU's environmental goals and the UN's SDGs. The sewerage development is given one of the top priorities of the government in its construction policy.

However, the European Commission's North Macedonia 2021 Report[2], which analyzes the current situation and issues related to the accession of candidate countries to the EU, states that North Macedonia has made little progress in implementing last year's recommendations on environmental protection and climate change measures and that water quality management has not been improved. In terms of water quality management, the report mentions the signing of a contract for the construction of a sewage treatment plant in Skopje and the construction of a primary sewer but says that the country needs to strengthen its administrative and inter-organizational coordination capacity in this area, reduce non-revenue water and fully recover costs.

As for the EU accession negotiations, North Macedonia was granted EU candidate status in 2005 and visa exemption for EU countries was introduced in December 2009. North Macedonia is considered as one of the first candidates for EU accession among the Western Balkan countries, but the decision to start EU accession negotiations has been postponed several times. In March 2020, the Council of the European Union approved the start of accession negotiations, but the negotiations have not been resumed at the time of this survey due to objections concerning the interpretation of the history, language and identity by the Republic of Bulgaria.

On the other hand, Lake Ohrid, which is the target area of this survey, together with Christian historical buildings and icons in the city of Ohrid, is registered as a natural and cultural heritage of the Ohrid region by UNESCO[3] and is also an important water body that was designated as a Ramsar wetland in February 2021. The conservation of the water environment of Lake Ohrid is an important issue for the Government of North Macedonia, not only from the perspective of establishing the conditions for EU accession, but also from the perspective of protecting the globally valuable Lake Ohrid.

With regard to Lake Ohrid, Japan has conducted the "Information Collection and Confirmation Survey on the Improvement of the Environment of Lake Ohrid in the Republic of Macedonia (2012) " and the

[1] https://vlada.mk/sites/default/files/dokumenti/programme_for_work_of_the_government_for_2020-2024.pdf
[2] North Macedonia 2021 Report https://ec.europa.eu/neighbourhood-enlargement/north-macedonia-report-2021_en
[3] In 2019, UNESCO's World Heritage Committee recommended that the Lake Ohrid be placed on the "Cultural Heritage in Danger" list if there is no improvement within two years due to inadequate conservation of the city's cultural heritage, but in July 2021, the World Heritage Committee gave it another two years.

"Project for the Improvement of Sewage Treatment Facilities in Lake Ohrid (2015) " as preparatory studies for cooperation and has explored the possibility of cooperation, but has yet to realize it. This survey aims to explore a cooperation scheme that can contribute to the conservation of the water environment in Ohrid, which is important from the perspectives of EU accession, UNESCO World Heritage Site and Ramsar Convention as mentioned above.

1.2 Purpose of the Survey

The purpose of this survey is to overview the current status and issues of the sewerage sector in the North Macedonia from the perspective of adaptation to EU environmental standards and to examine the approaches to cooperation in North Macedonia necessary to strengthen the operation and maintenance capacity of sewerage operations in order to contribute to the conservation of water quality of Lake Ohrid, by summarizing the current status and issues of the operation and maintenance management system of the public enterprises and related organizations responsible for sewerage operations in the area around Lake Ohrid.

1.3 Object of the Survey

For the purpose of the survey, which is to examine approaches for cooperation with North Macedonia to improve the water quality of Lake Ohrid and to strengthen the capacity of operation and maintenance of sewerage facilities, the survey covers organizations, institutions and facilities of the three cities, the municipalities of Ohrid, Struga and Debrca, which constitutes the North Macedonian side of the Lake Ohrid basin.

1.4 JICA Survey Team and Survey Schedule

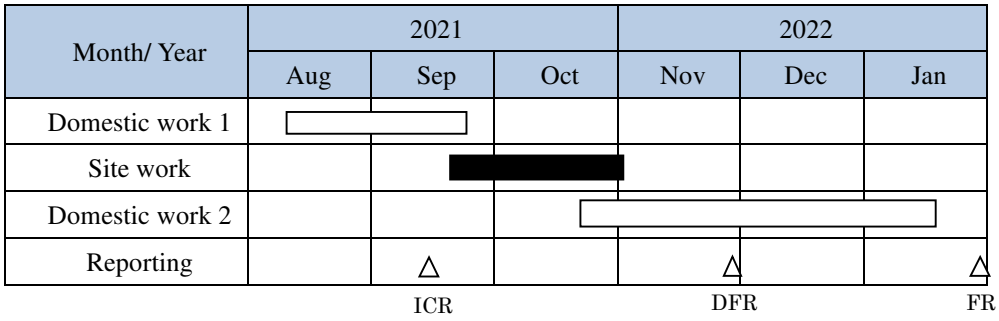
JICA Survey Team consists of a joint venture of TEC International Co., Ltd. and Nihon Suiko Sekkei Co., Ltd.

The Survey started in August 2021 and the site survey work in North Macedonia was conducted from late September to early November in kind cooperation with North Macedonian relevant organizations.

Members of the Survey Team are shown in Table 1.1 and the Survey schedule is shown in Figure 1.1.

Table 1.1 List of the Survey Team Member

Assignment	Name	Company
Team Leader/Water Environment Conservation	Takechi Akira	TEC International Co., Ltd.
Sewerage Business Operation	Ono Norio	TEC International Co., Ltd.
Sewerage Facility Planning 1	Ishizuka Okuto	Nihon Suiko Sekkei Co., Ltd.
Sewerage Facility Planning 2	Ogata Koichi	TEC International Co., Ltd.
Adviser （Domestic Support)）	Takahashi Haruki	TEC International Co., Ltd.
Information Collection (Technical/Management)	Nikolina Ruvcheska	Local Consultant
Information Collection (Technical)	Ivancho Georgiev	Local Consultant



ICR: Inception Report DFR: Draft Final Report FR: Final Report

Figure 1.1 Survey Schedule

2 Water Environment Management in North Macedonia

2.1 National Development Plan for the Water Environment Management

In 2010, Northern Macedonia adopted the National Strategy for Sustainable Development for the Republic of Macedonia[4] as its national development plan. The plan proposes strategic activities for the short term (2008-2010), medium term (2010-2015 and long term (2015-2030), with the primary goal of achieving EU accession.

The plan states that in the environmental area, i) the existence of the Ministry of Environment and Physical Planning (MoEPP) in North Macedonia as an enforcing body for the laws, international agreements, protocols and strategies related to water environment management and ii) the very rich biodiversity, the unique topography, the ancient lakes, the unspoiled alpine areas and the vast highlands and pastures, could lead to the sustainable development.

On the other hand, the following issues need to be overcome in order to realize this goal:

- ✓ Lack of specialized staff in the areas of environmental impact assessment, monitoring, overall pollution prevention and control and climate change
- ✓ Inter-sectoral cooperation and coordination
- ✓ Low level of implementation of enacted legislation
- ✓ Effective compliance with EU legislation requiring high levels of investment and significant administrative effort (e.g. in the areas of waste management and water treatment)
- ✓ Donor support and its effective use to make up scarce domestic funds for major environmental investments
- ✓ Lack of budgetary resources for environmental planning.

In addition, the following final goals are to be achieved by overcoming the above issues. (ANNEX-6 of the same plan):

- ✓ Establishment of a healthy ecosystem full of rich biodiversity and conserved natural resources for future generations.
- ✓ Economic development through new employment opportunities by protecting and improving the environment.
- ✓ Support the social prosperity of local governments through the recognition and utilization of the potential value of healthy ecosystems.

2.2 Legal Framework for Water Environment Management

According to the Water Strategy for the Republic of the Macedonia (2010), the legal framework directly or indirectly related to water environment management includes the following Laws on Environment (Official Gazette no. 53/05, 81/05, 24/07, 159/08, 48/10, 124/10, 51/11):

- ✓ Law on Waters (Official Gazette no. 87/08, 6 / 09, 161/09, 83/10, 51/11) • Law on Nature Protection (Official Gazette no. 67/04, 14/06, 84/07, 35/10, 47/11)

[4] https://www.moepp.gov.mk/wp-content/uploads/2014/12/NSSD-2-EN.pdf

- ✓ Law on Water Management (Official Gazette no. 85/03, 95/05, 103/08) • Law aquatic communities (Official Gazette no. 51/03, 95/05 113/07)
- ✓ Rulebook on the form and manner of keeping the register of aquatic communities (Official Gazette no. 15/04) • Decree on classification of waters (Official Gazette no. 18/99)
- ✓ Regulation on categorization of water streams, lakes, reservoirs and groundwater (Official Gazette no. 18/99, 71/99) • Rulebook on monitoring of sediment in reservoirs (Official Gazette no. 4 / 99)
- ✓ Rules for reporting on the state level and quantity of water accumulated in reservoirs, and the amount of water released by them (Official Gazette no. 8 / 99)
- ✓ Rulebook on the content and method of preparing management plans for river basins (Official Gazette no. 148/09)
- ✓ Regulation on methodology for assessment of river basins (Official Gazette no. 148/09)
- ✓ Rulebook on the content and method of preparing the program of measures (Official Gazette no. 148/09) Water strategy for the Republic of Macedonia / DRAFT VERSION 17/232
- ✓ Decision establishing the National Council for Water (Official Gazette no. 149/09) • Law on Inland waterways (Official Gazette no. 55/07, Official Gazette no. 26/09, 22/10, 23/11, 53/11)
- ✓ Law on Fisheries and Aquaculture (Official Gazette no. 7 / 08, 67/10, 47/11, 53/11)
- ✓ Law on Protection of Ohrid, Prespa and Dojran (Official Gazette of SFRY no. 45/77 mostly valid,8 / 80 partially valid, 51/88 mostly valid, 10/90 mostly valid, 62/93 mostly valid)
- ✓ Program for Protection of Ohrid, Prespa and Dojran (Official Gazette of SFRY no. 7 / 87)
- ✓ Resolution of Dojran Lake (Official Gazette no. 45/95) • Law on Ratification of Agreement between the Government of the Republic of Macedonia and the Council of Ministers of the Republic of Albania for the protection and sustainable development of the lake and its basin (Official Gazette no. 46/05)
- ✓ Act declaring the monument Dojran Lake Nature (Official Gazette no. 51/11)
- ✓ Regulations to implement measures to protect the strict natural reserve "Ezerani" Prespa Lake (Official Gazette no. 29/97)
- ✓ Act declaring the ornithological site "Ezerani" Prespa Lake, on a strict natural reserve (Official Gazette no. 37/96)
- ✓ Regulations to implement measures to protect the strict nature reserve in the gorge of Tikves Black River (Official Gazette no. 44/97)
- ✓ Law on Ratification of the Convention for the Protection of World Cultural Heritage (Official Gazette of SFRY no. 56/74)
- ✓ Decree on the Ratification of Convention on protection of wetlands of international importance for the protection of aquatic birds (Ramsar) (Official Gazette of SFRY no. 9 /77)
- ✓ Resolution on the impacts of climate change in the Republic of Macedonia (Official Gazette no. 31/10)
- ✓ Rules Amending the Rules for the maximum permissible amounts of radionuclides in food, water, air, land, products and raw materials of animal and plant origin and objects of general use. (Official Gazette no. 58/11)

Of these, Law on Environment, Law on Water and Law on Nature Protection are the major laws related to water environment.

2.2.1 Law on Environment

The Law on Environment is the basic law that covers all environmental quality, regional and related global issues, including air, water, etc. throughout North Macedonia. The Law is the basis for the following laws that regulate in detail specific issues related to environmental protection:

- ✓ Law on Waste Management (Official Gazette no. 68/04, 71/04);
- ✓ Law on Ambient Air Quality (Official Gazette no. 67/04) and
- ✓ Law on Waters (Official Gazette no. 87/08, 6 / 09, 161/09, 83/10,51/11)
- ✓ Law on Nature Protection (Official Gazette no. 67/04, 14/06, 84/07, 35/10, 47/11)
- ✓ Law on Setting the Prices for Water Services ((Official Gazette, No. 7/16)

The enactment of the new legislation in North Macedonia is in line with the program to approximate the national legislation to the EU legal system and is also in compliance with the European Partnership Action Plan. The focus will be on adopting specific laws in the areas of noise, chemical and genetically modified organisms.

2.2.2 Laws on Waters

The Law on Waters (Official Gazette no. 87/08, 6 /09, 161/09, 83/10, 51/11, 44/12, 23/13, 163/13, 180/14, 146/15 and 52/16) is the legal basis for the protection and management of water in North Macedonia. The law governs the use and development of water resources, protection of water from harmful effects, depleting abstraction and protection of water from pollution, sources of financing for water management activities and how they are financed, concessions, transboundary water resource and other issues.

The Law on Waters of 1998 (Official Gazette no. 4/98) was a necessary legal basis for addressing the growing problem of water pollution, but the law was not effective because it did not provide for integrated policies and procedures for water protection and river basin management. Subsequently, a new Law on Water (Official Gazette, 2008) was adopted in 2008 to comply with various EU Directives. In order to comply with various EU Directives, a new Law on Waters (Official Gazette, 2008) was adopted in 2008 (applicable from 2010), which provides a legal framework for future water resources management.

The Water Law covers springs, flowing water, convection water, groundwater, floods, river beds, channels, mineral wate and spring wate and stipulates that water is a gift of nature and is owned by the state.

2.2.3 Laws on Nature Protection

The Law on Nature Protection was enacted on the basis of the people's right to a healthy living environment and the people's obligation to protect and improve nature, as stipulated in the Constitution of North Macedonia. It states that nature protection shall be implemented through the protection of the diversity of life in and outside the protected areas, the protection of landscape and the protection of natural heritage.

2.2.4 Laws on Sewerage

The following laws, regulations and rules apply to sewerage systems:

- ✓ Law amending the law to supply drinking water and disposal of urban waste water (Official Gazette no. 28/06, 103/08, 17/11, 54/11)

- ✓ Methodology for determining the cost of drinking water and disposal of urban waste water (Official Gazette no. 107/05)
- ✓ Rulebook on conditions for collection, disposal and treatment, method and conditions for the design, construction and exploitation of systems and treatment plants for urban waste water, as well as technical standards, parameters, standards and emission standards for quality pre-treatment, disposal and purification of waste water, taking into account the load and the method for purification of urban waste waters discharged into sensitive areas of discharge of urban wastewater (Official Gazette no. 73/11)
- ✓ Manner and procedure for use of sludge, the maximum concentrations of heavy metals in soil where sludge is used, concentrations of heavy metals in sludge, the maximum annual quantities of heavy metals that can be incorporated into the soil (Official Gazette no. 73/11
- ✓ Rulebook on the manner and the maximum allowable concentration values and the parameters of the purified waste water for reuse them (Official Gazette no. 73/11)
- ✓ Rules on form and content of the application and permit reuse of purified wastewater, as well as the issuance of the permit (Official Gazette no. 60/11)
- ✓ Rules on form and content of the application and the license to use the sludge as well as the issuance of the permit for use of sludge (Official Gazette no. 60/11)
- ✓ Rulebook on conditions and manner of emission limit values for discharges of wastewater after their treatment, the method of their calculation, taking into account the special requirements for protection of safety zones (Official Gazette no. 81/11)

2.2.5 Laws on Setting the Prices of the Water Services

In addition to the above laws, Laws on the Setting Prices of the Water Services aims at the sound water services by;

- ✓ Ensuring that water services are affordable for the population, taking into account the income per household in the area in which the service is provided;
- ✓ Ensuring sustainable use of the water services infrastructure, with the ultimate goal of achieving full cost recovery;
- ✓ Improving the quality of the services in order to ensure that services are delivered in accordance with the best practices;
- ✓ Ensuring gradually the full application of the polluter pays principle, user pays principle and recovery of costs the costs of the resource according to the Law on Waters and;
- ✓ Improving the efficiency of the water services providing the best quality of water services at the minimum cost.

2.3 Roles and Responsibility of Relevant Organizations in the Field of Water Environment

Among the relevant national-level agencies in the field of water environment management, the Ministry of Environment and Physical Planning (MoEPP) and the Energy and Water Services Regulatory Commission (ERC), which are of direct relevance, are described below.

MoEPP is the competent ministry in the field of water environment protection and water supply and sewage services. ERC is an important agency that has become more relevant since the last survey in 2015 due to institutional framework change.

2.3.1 Ministry of Environment and Physical Planning: MoEPP

An overview of the ministry's organization is provided below, with some updates from the report, as many aspects have not changed significantly since the previous survey in 2015.

(1) Role and responsibilities:

MoEPP is responsible for setting up the overall legal frameworks for policies and legislations on environmental issues which was legally defined by the Law on Organization and Work of the Public Administration. MoEPP performs enhancement of legal harmonization process; preparation of national strategies and action plans; inspection and enforcement; and nationwide monitoring and establishment of information systems.

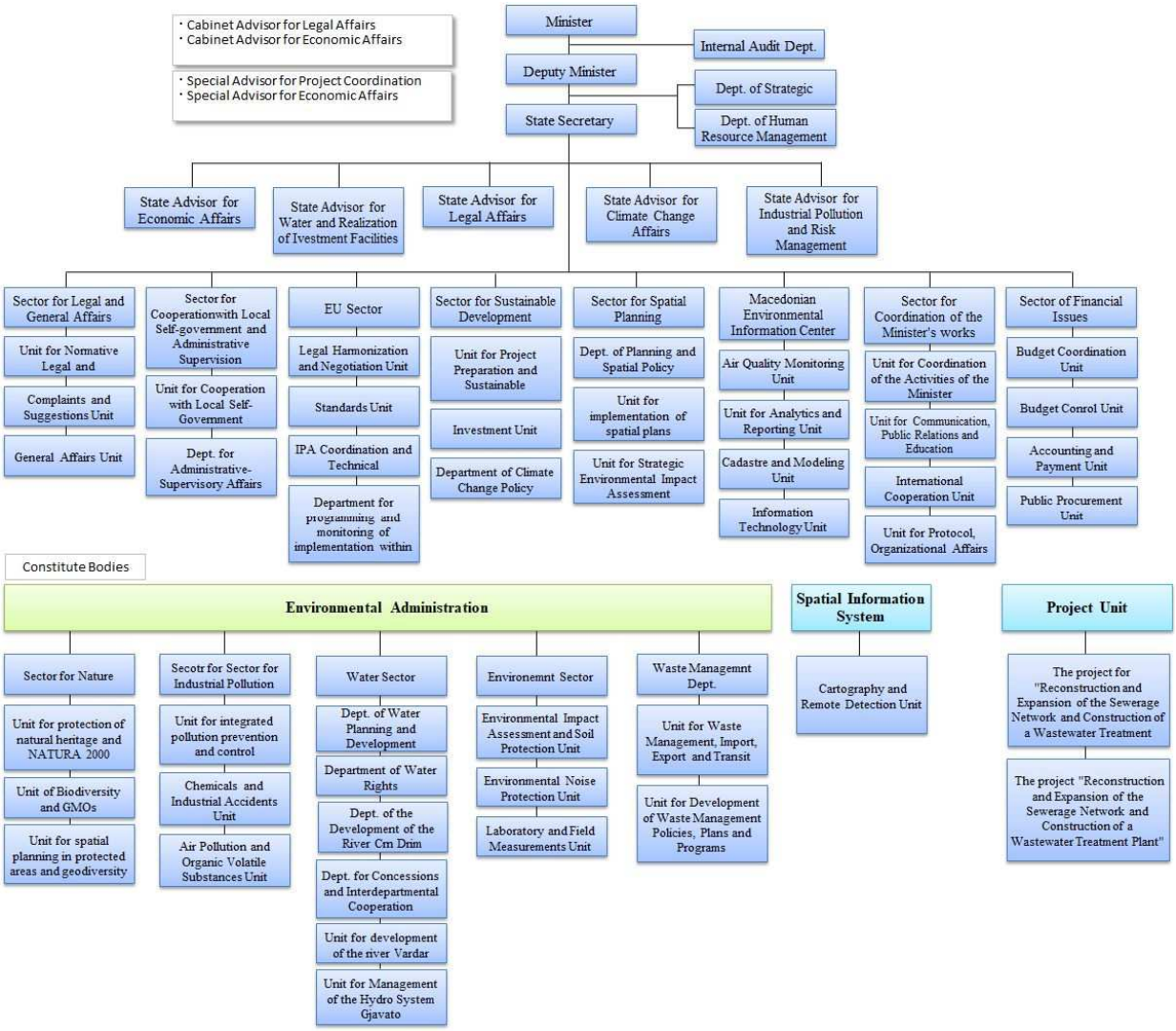
In addition, MoEPP has a role of international coordination in Water Sector at the national level in relation to EU and international conventions, and to international bilateral and multilateral donor agencies. From January 2011 onwards, MoEPP has been responsible for overall water management, including river basin management and the permit issuing system. The Country aspires EU integration and accession by producing and upgrading legislation and policies to meet EU standards, therefore MoEPP is a leading agency for this role.

The roles and responsibilities of MoEPP are described below:

- ✓ Monitoring the state of the environment
- ✓ Suggesting measures and activities for protection of water, soil, air and ozone layer protection against pollution
- ✓ Suggesting measures and activities for noise and radiation control, biodiversity, geo-diversity, national parks and protected areas
- ✓ Restoring environment in polluted areas
- ✓ Overall management of water
- ✓ Implementing measures for hazardous waste handling and chemical management
- ✓ Implementing spatial planning and processing, analysing and presenting digital spatial data
- ✓ Cooperating with scientific institutions for preparation of standards, norms, rules regulating the protection of the environment;
- ✓ Building a self-financing system with independent financial resources, environmental fees and other charges;

(2) Organization structure

MoEPP is organized by the main body and the constituent body. The organization chart of MoEPP is shown in Figure 2.1.



Source: MOEPP

Figure 2.1 Organizational Structure（MoEPP）

(3) Main body and its constitutional body

The roles and responsibilities of major Departments are shown in Table 2.1.

Water Sector is responsible for preparation and implementation of comprehensive policies and plans regarding water resource management and water and wastewater services. Main sections in Water Sector are shown in Table 2.2.

Table 2.1 Role and Responsibility of Sections

Composition	Department	Role and Responsibilities
Main Body	Sector for EU	• To coordinate all policies and legislative works in MoEPP for EU integration and EU approximation • To coordinate bilateral IPA and international cooperation projects • To coordinate projects related to the integration process to the EU
	Sector for Cooperation and with local Self-government and Administrative Supervision	• To make a plan for supervising the legality of the municipalities
	Sector for Sustainable Development and Investment	• To implement capital infrastructural investments/ projects • To prepare technical documentation • To handle climate change issues
	Sector for Physical Planning	• To develop spatial policies and plans • To implement the spatial plan
	Sector for Financial Issues	• Implementation of domestic public procurement • Development of public procurement plan
Constitute Body	Environment Administration	• The body of Environmental Administration is responsible for expert activities on environmental areas such as waste, water, air, soil, noise protection, defined by "Law on Environment 2005"

Source: MoEPP

Table 2.2 Composition of Water Sector

Department	Role and Responsibilities
Dept. of Water Planning and Development	• Preparation and implementation of water management plan and program • Preparation of National Water Strategy
Dept. for Concessions and Interdepartmental Cooperation	• Preparation of Water Law and Concession Law and laws related to Public Private Partnership
Dept. of Water Rights	• Development of regulation on water right, a permission for water use and drainage and the procedure
Dept. for Management of the Catchment area of the river Vardar	• Management and evaluation on Vardar River basin according to international conventions • Development of river basin management plans
Dept. for Management of the Catchment area of the river Crn Drim	• Management and evaluation on Crn Drim River basin according to international conventions • Development of river basin management plans
Dept. for Management of the Catchment area of the river Strumica	• Management and evaluation on Strumica River basin according to international conventions • Development of river basin management plans

Source: MoEPP

(4) Budget

Fiscal year in North Macedonia is started in January and ended in December. The annual budget size of MoEPP for FY2021 was MKD 922 million which is shared about 0.4% of the overall national budget planned and expenditure-based. This budget amount has almost doubled from the budget amount of FY2014. It is shared with approximately 0.4% of the national budget in FY2014. Looking at the past

three years, the overall budget has gradually increased, while major change is not seen in the share of MoEPP's budget against the national budget.

With regard to the ministry's annual budget in FY2021, the budget for environmental protection is MKD 601 million, which accounts for 65% of the total. Of this amount, MKD 210 million (shared 23% of the total) is planned to be allocated for activities aimed at sewers and sewage treatment plant and MKD 35 million (shared 4% of the total) for sewage collection systems in the Municipalities of Ohrid and Struga.

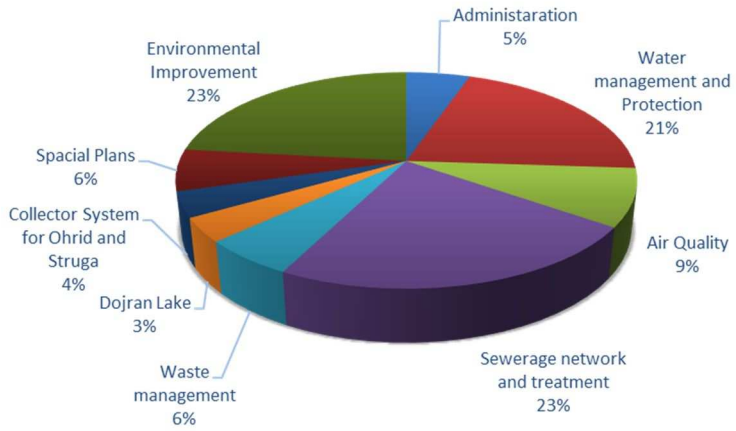
The budget size and composition of the MoEPP for the past three years is shown in Table 2.3 and the Figure 2.2.

Table 2.3 MoEPP Annual Budget (FY2019-2021)

(1,000 MKD)

Item	2019	2020	2021 (plan)	2021 (%)	Breakdown			
					Basic budget	Self-financing activities	Loan	Donation
Administaration		**43,088**	**48,950**	5%	**48,950**	0	0	0
Environmental Protection		**407,650**	**601,406**	65%	**547,406**	6,000	30,000	18,000
Investment in Environment	168,150	83,750		0%		0	0	0
Water management and Protection		0	191,260	21%	191,260	0	0	0
Air Quality		0	79,430	9%	73,430	6,000	0	0
Sewerage network and treatment		30,000	210,900	23%	180,900	0	30,000	0
Waste management		90,800	51,716	6%	33,716	0	0	18,000
Dojran Lake		48,100	33,100	4%	33,100	0	0	0
Collector System for Ohrid and Struga		150,000	35,000	4%	35,000	0	0	0
Arrangement of Torrents on the Riverbed of River Pena-Shipkovica, Tetvo	-	5,000		0%		0	0	0
Spacial Plans		**37,015**	**57,520**	6%	**57,520**	0	0	0
Monitoring and Air Pollution Protection	**49,830**	**74,850**		0%		0	0	0
Water Protection	**70,651**	**74,591**		0%		0	0	0
Environmental Improvement		**215,366**	**214,160**	23%	**205,480**	0	0	8,680
Total	**830,970**	**852,560**	**922,036**		**761,356**	**6,000**	**30,000**	**26,680**

Source: JICA Survey Team based on the information of MoEPP



Source: JICA Survey Team based on the information of MoEPP

Figure 2.2 MoEPP Annual Budget Structure (FY2021)

2.3.2 Energy and Water Services Regulatory Commission (ERC)

(1) Roles and responsibilities

The Energy and Water Services Regulatory Commission (ERC) is a body that regulates activities in the

energy and water sector and tariffs in the areas of electricity, gas, crude oil, oil and water. The activities of the ERC are controlled by the Parliament of the Government of North Macedonia.

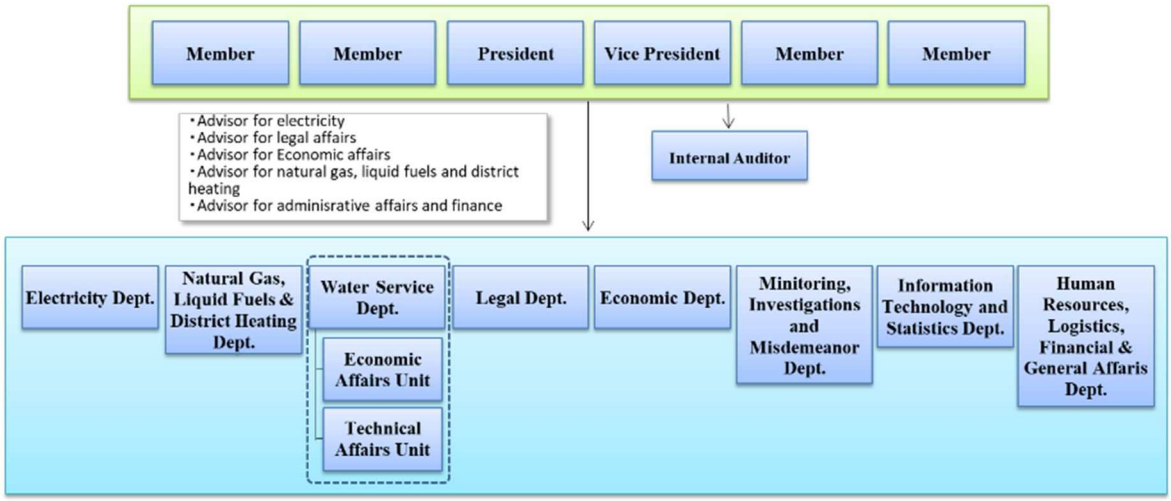
The authority is legally established in 2003 by the revised Law on Energy (Official Gazette No. 94/02), the Law on Energy (Official Gazette No. 96/18, Official Gazette No. 96 / 19) and the Law on Water Service Prices (Official Gazette, No. 7/16). The water and wastewater sector officially started setting tariffs by the ERC through the Law on Water Services Prices, 2019.

The role of the ERC in the water and wastewater sector is to regulate the tariffs for raw water, drinking water, urban wastewater and wastewater treatment in water service projects. The background to this is that water and wastewater tariffs have been set by the councils and heads of local governments. Although tariff revisions are proposed, they are frequently not approved in a timely manner. The existing tariffs were not sufficient to cover the cost of water services and the "polluter-pays principle" was not applied in some cases to sewage. In addition, public corporations operating water and wastewater services are inevitably prone to monopolization and the purpose of this project is to set tariffs that fairly reflect the cost of business services and to optimize the activities of public corporations.

(2) Organizational structure

The ERC consists of 6 commissioners and 37 staff members. The members of the ERC include the President and the Vice President of North Macedonia. The appointment term for the ERC Chair and Commissioners is for five years.

The overall organizational chart of the ERC is shown in Figure 2.3.



Source: JICA Survey Team based on the information of ERC

Figure 2.3 Organizational Structure (ERC)

(3) Departments

There are eight departments in the ERC, one of which is the Water Services Department, which is in charge of setting water and wastewater rates. Although the ERC organizational chart shows the existence of the Water Services Department and two sections, the Economic affair unit and the Technical affair unit, there is no actual staffing at present. According to the hearing, the reason for this is a rule that no

staff can be hired in election year and this has been the case for the last three years.

The staff member in charge of the energy sector is concurrently in charge of reviewing the actual pricing of water services. A working group consisted of eight members has been formed to evaluate the documents submitted by each public corporation from two aspects, technical and economic and to examine tariffs.

The organization chart of the ERC is shown in Table 2.4.

Table 2.4 Composition of Department (ERC)

No.	Department
1	Electricity Department 1.1 Electricity Market Unit 1.2 Grid Infrastructure, Renewable Sources and User Relations Unit
2	Natural Gas, Liquid Fuels and District Heating Department 2.1 Natural Gas and Liquid Fuels and User Relations Unit 2.2 District Heating Market and User Relations Unit.
3	Water Services Department 3.1 Economic Affairs in the Field of Water Services Unit 3.2 Technical Affairs in the Field of Water Services Unit
4	Legal Department 4.1 Normative-Legal Affairs and Licenses Unit; 4.2 Complaints and Consumer Protection Unit.
5	Economic Department 5.1 Economic Affairs in the Field of Electricity Unit 5.2 Economic Affairs in the Fields of Natural Gas, Liquid Fuels and District Heating
6	Monitoring, Investigations and Misdemeanor Department 6.1 Energy Markets Monitoring, Analyses and Publications Unit 6.2 Investigations and Misdemeanors Unit
7	Department for Information Technology and Statistics 7.1 IT Support Unit 7.2 Software Program Development Unit.
8	Human Resources, Logistics, Finance and General Affairs Department 8.1 Human Resources and General Affairs Management Unit; 8.2 Financial-Accounting Affairs Unit 8.3 Logistics and Public Relations Unit.

Source: ERC

(4) Targeted water and wastewater utilities

According to ERC's annual report (2020), 77 water and wastewater public enterprises throughout North Macedonia are covered. The ERC categorized public enterprises into four depending on type of services, which are shown as follows:

i) Raw water supply services: 7 public enterprises
ii) Drinking water supply services: 67 public enterprises
iii) Sewage and drainage services for urban areas: 54 public enterprises
iv) Sewage treatment services: 17 public enterprises

PE Kolektorski is classified as "sewage treatment services", PE Niskogradba is classified as "urban sewage and drainage services", PE Vodovod i Kanalizacija Struga is classified as "drinking water supply services" and "urban sewage and drainage services and PE Vodovod Ohrid is classified as "drinking

water supply services". PE Debrca is classified as "drinking water supply" and "urban sewage and drainage services".

(5) Consideration of tariff rate setting

Review cycle

The ERC has categorised PE into two main groups for tariff setting: i) 10,000 inhabitants and more, and ii) less than 10,000 inhabitants. The target cycle for tariff setting was defined for FY2018-2020 in the 1st group and for FY2019-2021 in the second group. The ERC firstly targeted the former group which has a relatively large inhabitants and considered the rates for the next three years in 2017. The ERC provided the results of proposed tariff rates to each PE of the 1st group. The rates have been applied since 2018. The actual application of the rates began in 2018. For smaller PE, the rate setting and review work is being staggered by one year.

Documents to be submitted

Each PE submits i) a business plan for 3 years, ii) a financial report and iii) a tariff proposal as the basis for setting and reviewing tariffs by the ERC. The tariff proposal should be submitted as an Excel model provided by ERC with the necessary information entered.

Evaluation and review

A working group is formed to evaluate the documents submitted by each corporation from two aspects: technical and economic. The member who examines the technical aspects scrutinizes technical information such as the quality of water and sewage services, facility conditions and non-revenue water status. The other is the member who examines the economic aspects, which includes monitoring and evaluating the financial situation and examining the tariffs. The information on standard of living of households in each region is also obtained based on surveys and data from the Bureau of Statistics, and the social aspects of the tariffs are also evaluated. The upper limit on the level of tariff rates for water and sewage services combined that households can afford is set at 3% of the average household income

In setting the tariffs, operating expenses, maintenance and management cost and depreciation of existing facility assets are subject to cost recovery.

Upon receipt of the documents from each corporation, the ERC has 60 days to respond with a decision on the tariff. Before making decision, a public hearing is held at the site, inviting residents, stakeholder and relevant agencies. After that, the ERC will notify the tariff price range with maximum and minimum charges. Each public corporation, in consultation with the Municipal Council, will decide on the rates within the price range instructed and obtain the approval of the Municipal Council.

The ERC is currently notifying a wide range of price ranges, but in the future, the ERC intends to notify a fixed price range that is less subject to political decision-making. In the hearing with the ERC, it explained that the ERC also informs each public corporation of feedback comments and points to be noted in the future when responding and public corporations find this very helpful.

Advantages of tariff rate regulation by ERC

Before the introduction of the ERC's rate regulation system, each public utility and local government had its own discretion and the rate setting tended to be influenced by political factors. Presently, based on a financial basis and certain standards common to the entire country, efficient rate levels and fairness to customers can be guaranteed to a certain extent, which is considered to be a major advantage.

2.4 Status of Achievement of SDGs related to Water Environment in North Macedonia

According to Sustainable Development Goals Voluntary National Review[5], the progress on the Clean Water and Sanitation (SDG 6) is as follows:

- ✓ National access to clean drinking water: 99%.
- ✓ Access to clean water for urban population: 100%.
- ✓ Access to clean water for rural population: 97%.
- ✓ Connection to sewerage system: 66% (of which 77% urban and 11% rural)

In order for further achievement, the following issues need to be addressed:

- ✓ Administrative capacities in the water sector are weak. Significant efforts are still needed to further align the legislation with the EU acquis in this sector.
- ✓ The water sector needs large investments. The 2012 National Water Strategy estimated investment needs for post-2011 at 15.2 billion denars (0.24 billion Euro), of which 12.9 billion denars (0.21 billion Euro) is required for wastewater treatment.
- ✓ The country is active in transboundary water cooperation, especially on shared transboundary lakes. However, the effectiveness of existing agreements needs to be strengthened.26
- ✓ Water quality remains a significant problem for many Roma households. Children in Roma settlements are at particular risk from untreated water and lack of waste management facilities.
- ✓ There are also concerns for untreated mining, municipal and industrial waste entering water systems, affecting the drinking water.

In order to overcome these problems, the following policies should be promoted as the next step:

- ✓ Establishing a system for flood assessment, protection and preparedness, handling and developing flood risk management plan.
- ✓ Increasing the level of investments in terms of GDP by building wastewater collection and treatment systems.
- ✓ Providing healthy drinking water to the population, through modern water supply systems on the basis of the "user pays" principle.
- ✓ Establishment of river basin management and improvement of the state of the environment, as well as preservation of human health by improving water quality.
- ✓ Complete transposition of legislation
- ✓ Establishment of a comprehensive water monitoring system.
- ✓ Completion of river basin management plans.

[5] Sustainable Development Goals Voluntary National Review, July 2020, State Statical Office, et al

2.5 Current Status of Sewerage in North Macedonia

The Development of National Water Study (2017), which investigated necessary sewerage system development to comply with EU Directive 91/271/EEC relating to sewage treatment, summarized the current status of sewerage facilities in North Macedonia and the future facilities needed as follows.

2.5.1 Current Status of Sewerage of North Macedonia

As of 2016, 77.2% of the urban population and 64% of the country's total population are connected to sewerage systems, as shown in Table 2.5 for each region (see Figure 2.4). In terms of the type of collection, as shown in Table 2.6, the separate system accounts for about 40%, but at least remaining 44% collect rainwater, which means that conversion to the separate system is considered necessary in the future.

Source: Development of National Water Study

Figure 2.4 Region of North Macedonia

Table 2.5 Connection to Wastewater Collection (2016)

Region	Population Connected	Population in Category 1 Agglomerations	Connectivity
Skopje	495,840	589,639	84,1%
East	114,573	130,854	87.6%
Pelagonia	165,145	178,023	92.8%
South East	84,528	111,411	75.9%
Polog	145,157	270,076	53.7%
South West	112,037	167,006	67.1%
Vardar	111,702	121,690	91.8%
North East	98,481	149,803	65.7%
Total	1,327,463	1,718,504	77.2%

Source: Development of National Water Study

Table 2.6 Wastewater Collection Network Type（2016）

System Type	Pipe length (m)	%
No data	417,925	16
Combined	198,793	8
Mostly mixed	335,349	13
Partially separate	542,458	21
Separate	1,055,624	41
Total	2,550,149	100

Source: Development of National Water Study

As of 2016, 19 sewage treatment plants shown in Table 2.7 were in operation, with a treated population of about 290,000. Assuming that the urban population which needs to be treated is 2.1 million, the treatment rate will be 13.6%. In addition, the treatment plants in Table 2.8 are expected to start operation in 2017/ and the treated population will be approximately 525,000, resulting in a treatment rate of 24.5%.

Table 2.7 Sewage Treatment Plants in Operation in 2016

STP Name	Name of Municipality	Design Capacity (Person equivalent[6]/day))	Treatment	Built
Nov Dojran	Dojran	12,000	Un known	1988
Miravtsi, Gevgelija	Gevgelija	3,000	Secondary	2000
Bogoroditsa, Gevgelija	Gevgelija	2,500	Secondary	2005
Lozovo	Lozovo	2,200	Primary	2006
Argulitsa, Karbintsi	Karbintsi		Tertiary	2016
Tarintsi, Karbintsi	Karbintsi	600	Tertiary	2005
Kukurechani	Bitola		Primary	2008
Krivogashtani	Krivogashtani	3,200	Secondary	2007
Berovo	Berovo	14,000	Secondary	2010
Kumanovo	Kumanovo	91,000	Secondary	2006
Chucher Sandevo	Chucher Sandevo	3,000	Secondary	2007
Ilinden	Ilinden	1,250	Secondary	2016
Marino, Ilinden	Ilinden	1,250	Secondary	2011
Kadino, Ilinden	Ilinden	1,250	Secondary	2015
Makedonski Brod	Makedonski Brod	5,000	Secondary	2000
Volkovo	Gjorche Petrov	19,500	Secondary	2016
Ezerani, Resen	Resen	12,000	Secondary	2004
Vranishta, Struga	Struga	120,000	Secondary	1988
Belchishta, Debartsa	Debartsa	500	Secondary	2006
Total		271,950		

Source: Development of National Water Study

Table 2.8 Sewage Treatment Plants - Under Construction

STP Name	Name of Municipality	Design Capacity (Person equivalen[t]/day)	Treatment	Built*
Gevgelija	Gevgelija	30,000	Secondary	2017/8
Kichevo	Kichevo	32.000	Secondary	2017/8
Prilep	Prilep	95.000	Secondary	2017/8
Radovish	Radovish	25.000	Secondary	2017/8
Strumica	Strumica	53.491	Secondary	2017/8
Total		235.491		

*: All treatment plants are in operation in November 2021.
Source: Development of National Water Study

[6] Person equivalent = Water volume containing BOD 60 mg

2.5.2 Projects Required to Comply with the EU Directives

According to the EU Directive (91/271/EEC), EU member states are required to comply with the following requirements with regard to sewerage:

- Collect sewage in urban areas with a population equivalent of 2,000 or more people.
- In the above mentioned urban areas, the following sewage treatment should be carried out.
  - ✓ Secondary treatment of collected sewage.
  - ✓ More advanced treatment for the sensitive areas and their watersheds in urban areas with a population equivalent of 10,000 or more.
  - ✓ In urban areas with a population of 2,000 or less, the discharge of sewage collected in freshwater bodies should be treated appropriately.
- All treatment plants should be operated properly under normal weather conditions.
- Discharge of industrial effluent into the sewage system should be permitted.
- Discharge of treated water from sewage treatment plants should be permitted.
- Discharge of wastewater from certain factories with a population equivalent of 4,000 or more should be permitted.
- Take measures to prevent pollution by rainwater drainage.
- Discharge of sludge from sewage treatment plants should be permitted.
- Encourage the reuse of sewage treatment sludge.
- Monitoring of sewage treatment plants and discharged water bodies.
- Monitoring of sewage sludge disposal and reuse.
- The above Development of National Water Study estimates that the construction of sewerage facilities required to comply with the EU Directive is as follows.

(1) Sewage collection

The facilities that need to be constructed in the future to comply with the regional EU Directive are shown in Table 2.9. In total, 1,332 km of collection pipes, 272 km of transit pipes, 23 PSs need to be constructed and 123,000 new households need to be connected.

(2) Sewage treatment

As shown in Table 2.10, the total number of sewage treatment plants to be constructed is 87. In terms of regions, the South East region requires the largest number of treatment plants (16), but the scale of the plants is small and the amount of sewage treated is only 7% of the total. The Skopje region has the largest number and scale of treatment plants, accounting for 36% of the total. In addition, regarding the treatment level, tertiary treatment accounts for 88% of the total treated water volume.

Table 2.9 Sewage Collection Facilities that Need to be Constructed to Comply with the EU Directive

Region	Sewers (m)	Transit（m）	PS (No.)	Connect (#)
East	55,247	28,300	3	4,573
Pelagonia	35,775	8,450	-	3,468
South West	166,123	44,710	9	15,099
South East	103,241	27,600	3	8,180
Polog	528,595	60,719	5	47,173
Vardar	50,784	26,900	1	3,444
North East	161,766	29,550	1	14,396
Skopje	230,600	45,400	1	27,140
Total	1,332,131	271,629	23	123,473

Source: Development of National Water Study

Table 2.10 Sewage Treatment Plants that Need to be Constructed to Comply with the EU Directive

Region	STP (No)	Treatment Capacity（PE）			Ratio
		Secondary	Tertiary	Total	
South East	9	18,911	189,399	208,310	9%
Skopje	14	92,993	751,847	844,840	36%
East	7	51,940	112,515	164,455	7%
Pelagonia	10	24,545	221,265	245,810	11%
South West	16	148,147	25,000	173,147	7%
Polog	14	60,631	283,678	344,309	15%
Vardar	11	56,225	101,912	158,137	7%
North East	6	56,326	127,980	184,306	8%
合計	87	509,718	1,813,596	2,323,314	100%

Source: Development of National Water Study

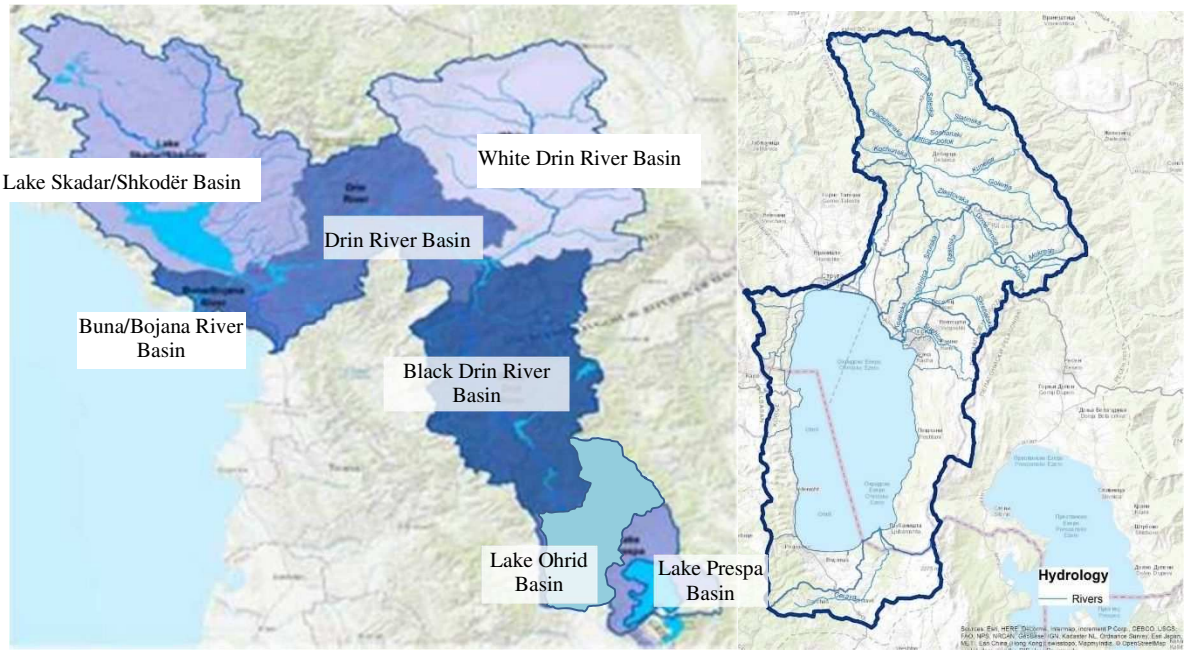
2.6 Water Environment of Lake Ohrid

2.6.1 Natural Conditions

(1) Topography and geology

Lake Ohrid is located on the border between southwestern North Macedonia and eastern Albania at an altitude of 693 meters above sea level and is said to be the oldest (2 to 5 million years old) and deepest lake in Europe (290 meters at its deepest point). The average depth is 155 m, the lake area is 358 km^2 and the basin area is 1,040 km^2 (lake surface area and basin area including the Albanian territory).

Hydraulically, most of the inflow water comes from Lake Prespa in the northeast through the karst aquifer and flows out at Struga as the Crn Drim River. The Ohrid Lake basin is part of the Drim River basin, which is located in the southwestern part of the Balkan Peninsula and extends into Albania, Kosovo, North Macedonia and Montenegro. The Drim River basin consists of seven basins, the Prespa Lake basin, the Ohrid Lake basin, the Crn Drim River basin, the White Drim river basin, the Drim River basin, the Skadar/Shkoder Lake basin and Buna/Bojana basin (see Figure 2.5).



Source: Lake Ohrid Watershed Management Plan,2020

Figure 2.5 Drim River Basin (left) and Lake Ohrid Basin (right)

(2) Climate and hydrology

Lake Ohrid is located in the Mediterranean climate zone. The average summer temperature is 21 degrees Celsius, the average winter temperature is 1.8 degrees Celsius and the average annual temperature is 11.5 degrees Celsius. Precipitation is low in summer and the average is 750 mm per year.

The hypothesis that water from Prespa Lake flows into Ohrid Lake through the karst aquifer had been proposed since the beginning of the 20th century and was proven by the radio-isotope observations in 1997 and 2001. In addition to these groundwater inflows, Lake Ohrid is fed by the Sateska[7], Koleska, Shushica and Grashnica rivers on the North Macedonian side, and the Cerave and Verdove rivers on the Albanian side. Many of these rivers are small and flow only during snowmelt and rainfall.

It is said that 3/4 of the Ohrid Lake inflow is discharged into the Crn Drim River and the remaining 1/4 is evaporated.

2.6.2 Socio-economic Conditions

(1) Administrative division

The watershed is divided into four municipalities, including the Albanian side: Municipality of Pogradec (Albania), Municipality of Ohrid, Municipality of Struga and Municipality of Debrca. The administrative district boundaries and the watershed is shown in Figure 2.6.

[7] The Sateska River used to flow into the Crn Drim River until 1964, when it was rerouted to flow into Lake Ohrid due to flood control measures on the Sateska side. However, since this rerouting caused a large amount of sediment to flow into Lake Ohrid, a rerouting project is currently underway with the support of UNDP to reroute the Sateska River back to the Crn Drim through the old river channel.

Source: Prepared by Survey Team based on Lake Ohrid Watershed Management Plan

Figure 2.6 Watershed Boundery and Admonistrative Boundery

(2) Population

The population by municipality within the Ohrid Lake basin is shown in Table 2.11, with the North Macedonian side of the basin accounting for 60% of the total population. The North Macedonian side of the basin has a high percentage of Municipality of Ohrid cities and Municipality of Debrca has only 3% of the population, making it a small potential source of load to Lake Ohrid[8]. While Struga has a large potential source of load in proportion to its population, only the central part of the city is within the watershed of Lake Ohrid.

[8] If the Sateska River rerouting is implemented, the potential as a pollution load source of Debrca will be even smaller.

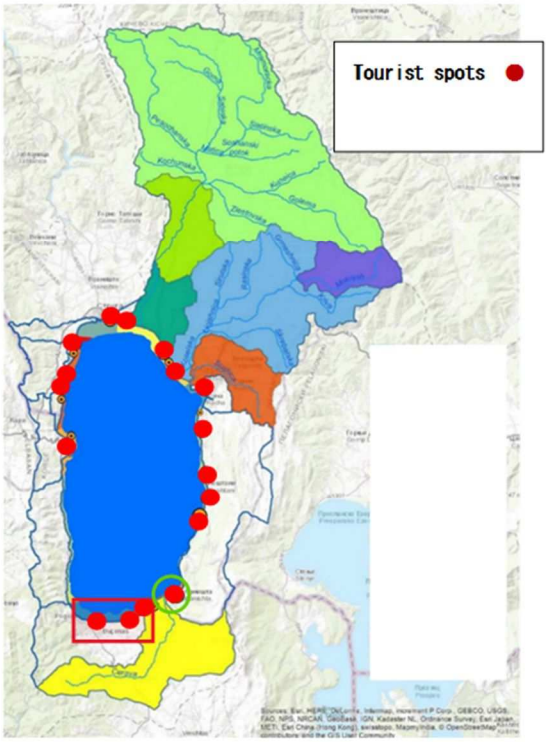
Table 2.11 Watershed Population of Lake Ohrid

Country	Name of Municipality	Within Ohrid Lake Basin			Population Density (person/ km^2)	Remarks
		Population	%	Area (km^2)		
North Macedonia	Ohrid	51,648	39.2%	381	136	Estimate of State Statical Office, 2015
	Struga	24,498	18.6%	54.8	447	Lake Ohrid Watershed Management Plan estimates. City of Struga 2015 population within the Lake Ohrid watershed.
	Debrca	3,942	3.0%	405	10	Estimate of State Statical Office, 2015
Albania	Pogradec	51,716	39.2%	206	251	Lake Ohrid Watershed Management Plan estimates. City of Pogradec 2011 population within the Lake Ohrid watershed.
Total		131,804	100%	1,047	128	

Source: As written in Remarks

(3) Tourist

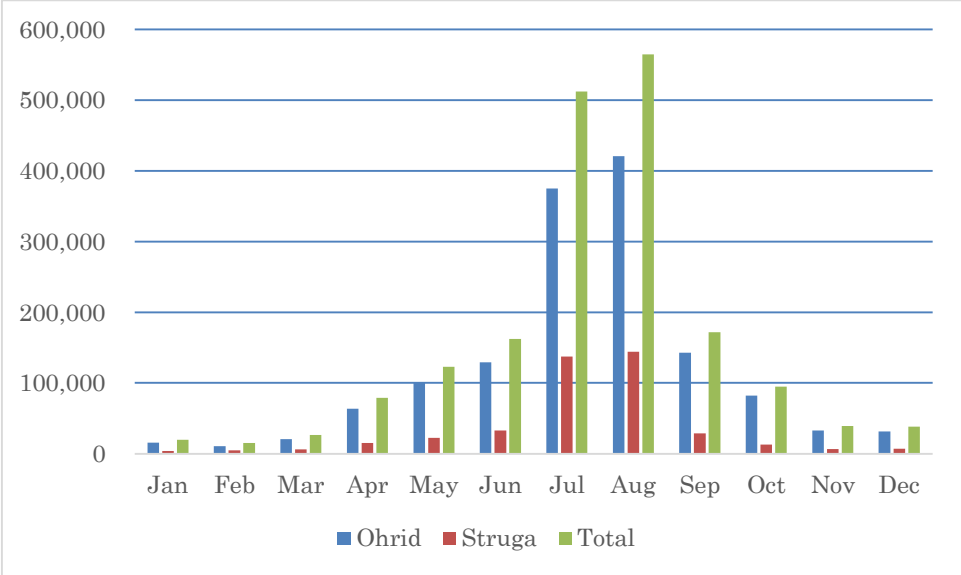
Lake Ohrid is one of the most popular tourist destinations in Europe, especially in Eastern Europe and the Balkans, because of its natural and cultural heritage. For this reason, there are many tourist facilities around Lake Ohrid, as shown in Figure 2.7.



Note: The red square indicates the Albanian side and the green circle indicates outside the sewerage service area.
Source: Lake Ohrid Watershed Management Plan

Figure 2.7 Tourist Spots of Lake Ohrid

Figure 2.8 shows the number of tourists per month for Ohrid, Struga and the total of two cities in 2019[9]. The number of tourists is much higher in Ohrid than in Struga because the major cultural heritages are located in Ohrid. Both cities have their peak in July and August, the summer vacation season. During this season, the number of tourists exceeds 500,000 per month, or more than 16,000 per day, which is equivalent to more than 20% of the total population of about 80,000 people in the Lake Ohrid basin on the North Macedonian side and is considered to have a significant impact on the amount of pollution generated in the basin. In addition, it is known that there are many residents in the Lake Ohrid basin who do not normally live there but only live there during the summer season. Since these residents are not included in the number of tourists in the tourism statistics, the actual pollution load from tourists may be even larger.



Source: Tourism Statistic of Municipalities of Ohrid and Struga

Figure 2.8 Monthly Number of Tourists in Municipalities of Ohrid and Struga (2019)

2.6.3 Water Quality of Lake Ohrid

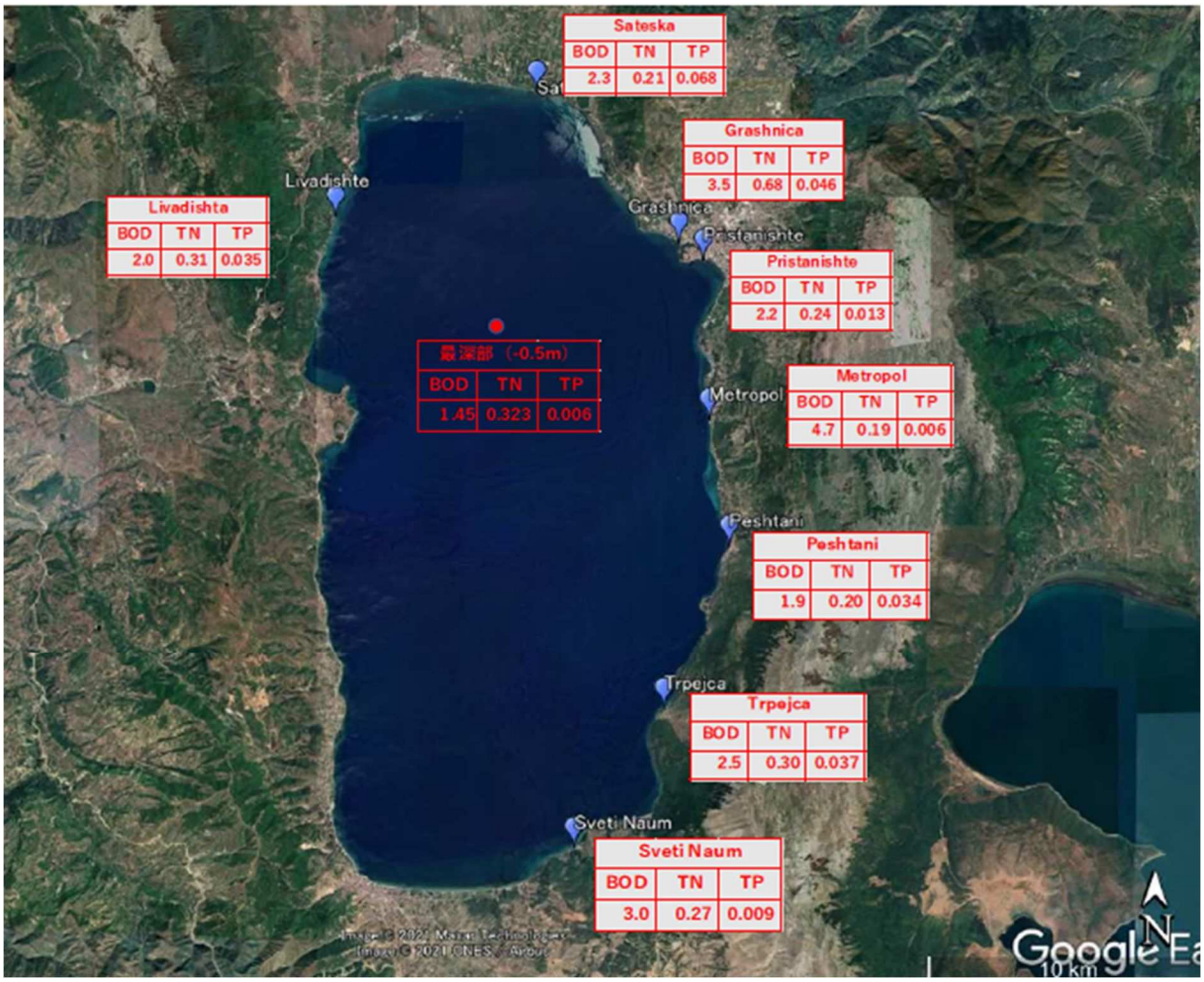
Periodic water quality surveys of Lake Ohrid are conducted by the Ohrid Public Health Institute, which observes the water quality of major beaches and inflowing rivers from a hygienic point of view, but does not measure lake-related items such as T-N and T-P. The Hydrobiology Institute has been conducting lake water quality observations of Ohrid Lake on a project basis from 2016 to 2018. Some of the results of the measurements are shown in Figure 2.9. The water quality in the deepest part of the lake (the sampling depth is 0.5 m) is the average of four measurements in 2016 and the water quality in the periphery of the lake is the average of five measurements in 2017.

In the comparison of T-P concentrations, the deepest part of the lake is at an oligotrophic level according to the OECD classification in Table 2.12, but at the periphery, T-P concentrations are above 0.01 mg/l at most sites, which can be considered a mesotrophic condition.

[9] Although 2020 data also is available, the 2019 data is used because it is strongly influenced by COVID-19

Table 2.12 Trophic Classification of Lakes（OECD, 1962）

Trophic Conditions	T-P (mg/l)	Chlorophyl a (ug/l)		Transparency (m)	
		Average	Max	Average	Minimum
Hyper Oligotrophic	Less than 0.004	Less than 1	Less than 2.5	More than 12	Less than 6
Oligotrophic	Less than 0.010	Less than 2.5	Less than 8.0	More than6	Less than 3
Mesotrophic	0.010～0.035	2.5～8	8～25	6～3	3～1.5
Eutrophic	0.035～0.100	8～25	25～75	3～1.5	1.5～0.7
Hyper eutrophic	More than 0.1	More than 25	More than 75	Less than 1.5	Less than 0.7



Source: Prepared by the Survey Team based on data provided by Hydrobiological Institute

Figure 2.9 Water Quality at the periphery and at the deepest part of Lake Ohrid

Since there is currently no regular limnological water quality survey[10] in Lake Ohrid, it can be said that without a doubt the lakeshore is becoming increasingly polluted, but how this affects the entire lake and how Lake Ohrid will change has not been discussed quantitatively. Continual and periodic limnological water quality monitoring is required for quantitative discussion of water pollution in Lake Ohrid.

[10] Limnological survey means a survey with three-dimensional sampling points in planar and depth directions to measure physicochemical indicators, pollution indicators, nutrient concentrations, chlorophyll concentrations, algae, and aquatic organisms. By continuing these surveys, it will be possible to discuss the limnological changes in the lake.

2.6.4 Water Environment Conservation Risks of Lake Ohrid

As mentioned in 2.6.3, it is clear that pollution from the surrounding areas is a threat to the water quality protection of Lake Ohrid. UNESCO Ohrid Lake Management Plan (2019)[11] lists a number of threats to water environment conservation as shown in Table 2.13.

Table 2.13 Threats to Lake Ohrid Water Conservation by UNESCO's Ohrid Lake Management Plan (2019)

Influence	Main risks	Knowledge of causes	Description of causes
Impacts of water quality in the watershed of Lake Ohrid	Intake of nutrients	well known	Sateska River and Lake Prespa
	Input of sediments	well known	Estuaries of the Lake (Sateska and Koselska River)
	Sewerage waters	well known	Unfinished collector's system is in poor condition; Obsolete run‐down station and inadequately dimensioned treatment plant on wastewaters in Vranista
	Pollution of heavy metals	insufficiently known	Discharge of waste water from industry and mines in a Cross boundary Context
Diffuse pollution, changes in hydrology and erosion from agriculture and unsustainable forestry	intensive farming	unknown	Bioaccumulated pesticides in fish
	Watering	well known	HMS Ljubanista ‐ Irrigation water in this system is supplied by pumping water from springs near St. Naum
	Impoundment	well known	Intakes of irrigation water from the river Sateska affecting fish stocks
	Cutting trees	unknown	Illegal logging in Velgoshti
	fires	unknown	Anthropogenically caused fires on Galicica; Burning of the reed belt
Pressure on protected areas from unsustainable tourism	Construction of houses, villas, hotels	well known	Construction of weekend houses in infrastructure in protected areas of the National Park Galicica and construction of hotels in the coastal band and maintenance of the "Bay of Bones"
	Landscaping beaches	intermediately known	Incompatible buildings in the coastal band that disturb the landscape
	Water sports	well known	Destruction of places of spawning fish; Oil spill outs
	Pollution	well known	Burdening the collector's system and TP station
Entering non‐indigenous species	Competition with native species	intermediately known	The rainbow trout is a threat to the Ohrid trout
	population changes	insufficiently known	Elodea canadensis in macrophyte communities
Change of habitats and losses	Coast transformation	well known	Fragmentation of Studenchishko Marsh; urbanization in coastal zone
	Fragmentation of coastal macrophyte vegetation	intermediately known	Macrophyte belt in Pestani and Trpejca
	Change and cap	well known	Usurpation of Svetinaumski springs (construction of catering facilities) as capture of water springs for irrigation
	Impoundment of springs	well known	Impoundment of the spring Bay Well
	Eutrophication	insufficiently known	Changing micro biofilm and algal communities especially the rocky shores

[11] Management Plan for Natural and Cultural Heritage of the Ohrid Region, 2019-2028, https://www.moepp.gov.mk/wp-content/uploads/2014/12/Management-Plan-Ohridski-Region_ENG.pdf

Influence	Main risks	Knowledge of causes	Description of causes
Unsustainable fishing	Excessive fishing	well known	Illegal fishing of the Ohrid trout
	Release of alien and invasive species of fish	insufficiently known	Detected non‐indigenous species that are a direct threat to indigenous species of fish
Global change	Rise in average temperatures	insufficiently known	Enhanced eutrophication followed by anoxia in many parts of the lake causing fish kill

As shown in the above table, there are a number of threats to the conservation of the water environment of Lake Ohrid, but the issues related to sewerage directly affect the lake water quality and are therefore important for the conservation of the water environment, especially water quality.

2.7 Assistance of Development Partners in Water Quality Protection

2.7.1 EU

The EU helps EU candidate countries to meet the conditions for accession through a funding scheme called the Instrument for Pre-accession Assistance (IPA). The IPA was launched in 2007 and partially modified in 2013 to operate as IPA II from 2014 to 2020 (as a result, the IPA from 2007 to 2013 is now called IPA I). The funds provided to North Macedonia under IPA I and IPA II were EUR 615 and 664 million, respectively. Currently, IPA III is under negotiation.

The sewerage related projects implemented in North Macedonia under IPA II (including those under bidding) are as follows:

- Kichevo: construction of sewage network (bidding process in progress)
- Bitola and Tetvo: construction of sewage network and sewage treatment plant (bidding process in progress)
- Skopje: Construction of collector (primary sewer) and renovation of sewage treatment plant
- Vinica and Kochan: Design of sewage pipeline network from Vinica to sewage treatment plant in Kochan

The EU Delegation has identified the following challenges for the water and wastewater sector in North Macedonia:

- The issue is management including facility maintenance and management rather than facility maintenance. Management should include the preparation of renewal plans for aging facilities, and appropriate maintenance and management should be carried out on an ongoing basis.
- The tariff system should also be based on the principle of full cost recovery, but the majority of entities have not been able to achieve this; in 2016, tariff regulation was introduced to enable the public corporation to set appropriate service tariffs.
- The size of the entity is too small to have the capacity to properly maintain and manage the facilities. On the other hand, the number of staff is perceived to be excessive, resulting in high costs. Therefore, the government has a strategy to consolidate smaller entities to create larger entities according to the basin level[12].

[12] However, MoEPP does not accept this view.

- Regardless of the water supply, sewerage or other sectors, there is a lot of political arrangement in the public corporation staff, especially in management posts. As a result, staff members are replaced depending on the results of elections.
- Including the above points, it is significant to make water and sewerage services sustainable in general.
- During 2014-2020, through various projects by IPA, the North Macedonian government has been aligning with and implementing EU laws and regulations; EU laws and regulations should be more respected and enforced.

The EU Delegation also explained the reason why the project to improve sewerage facilities around Lake Ohrid, which was supposed to be implemented with IPA funds at the time of the JICA survey in 2015, has not been implemented as follows:

- The FS for the improvement of Vranista STP and sewage pipes was conducted and completed in 2016. However, as a result of the FS, the project was never implemented and no progress has been made. There is no clear plan for future implementation of the project.

The conclusion of the FS pointed to the lack of sustainability of municipal and public enterprises funds and the weakness of the organization's management structure as challenges. The IPA is responsible for 85% of the funds and the North Macedonian side is responsible for 15%. In this sense, the capacity building that JICA is going to plan in the future is very important and meets the needs.

2.7.2 KfW

In recent years, KfW has mainly focused its assistance on (i) the energy sector and (ii) the agriculture and irrigation sector. (i) relates to climate change adaptation and mitigation measures and (ii) targets for local governments.

KfW established the Prespa-Ohrid Nature Trust Fund (PONT) in 2015, with a funding scale of about EUR 30 million, to provide funds to NGOs, local government and research institutions to support related activities.

The activities aim at the protection of the biosphere around Prespa and support is provided not only in North Macedonia, but also across borders, including Albania and Greece. Although the main focus of the fund is nature conservation and biodiversity protection, it also covers support for the sewerage sector, but there are currently no specific cooperation projects in the sewerage and drainage sector.

In 2003, KfW installed a sludge thickening tank at the Vranista treatment plant and a pump for the primary sewer PS.

2.7.3 SECO (State Secretariat for Economic Affairs)

Assistance related to water supply and sewerage is provided for areas in the watershed units. The project around Lake Ohrid was completed in 2010 (SECO installed a sludge dewatering machine for the Vranista treatment plant and pumps for the primary sewer PS in 2010). The following water supply,

sewerage and environment-related projects are currently underway:

- Gostivar water system improvement, to complete in 2023
- Kocani STP improvement, to complete in 2022
- Bregalnica basin nature conservation, to complete in 2022
- Flood control in the Polog area, to complete in 2027

SECO believes that the hard support in North Macedonia has been completed and changed its future support policy from hard support to soft support. Therefore, SECO will not provide hard support after the ongoing projects.

3 Current Status of the Sewerage Sector in the Target Area

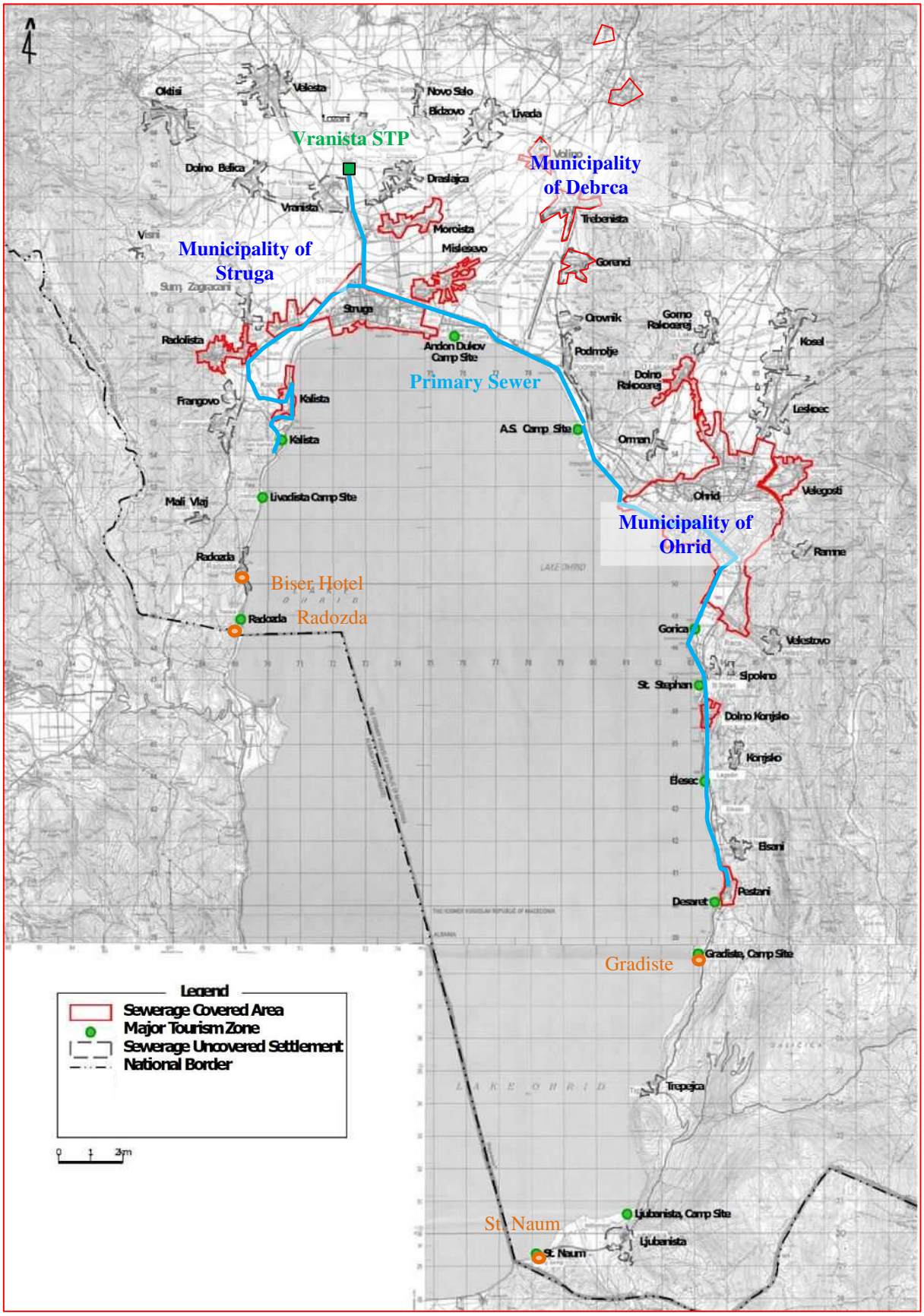
3.1 Overall Outline of Sewerage Facilities

The sewerage facilities around Lake Ohrid are as shown in Figure 3.1.

i) Vranista STP, which treats sewage
ii) Primary sewers that carry sewage from each district down to the sewage treatment plant
iii) A network of secondary sewers collecting sewage discharged in each district around Lake Ohrid.

These components and their contents have not changed significantly from 2015 when the JICA survey conducted.

In addition to the sewerage system with the Vranista STP, on-site treatment facilities have been installed in Gradiste, the St. Naum, Radozda and Biser Hotel districts. These on-site treatment facilities are for tourist facilities and do not receive sewage from individual residents. The management of these treatment facilities are conducted by people associated with tourist facilities.



Source: JICA Survey Team

Figure 3.1 Outline of Sewerage System around Ohrid Lake

3.2 Implementation Structure and Management Status

3.2.1 Role of the Public Enterprises in the Sewerage Business Management

Before the dismantling of the former PE PROAQUA in 2019, the management of sewerage business and the operation and maintenance of sewerage facilities were comprehensively carried out by this public enterprise. After the dismantling of PE PROAQUA, the Vranista STP and the primary sewer have become national assets and the facility management has been transferred to the PE Kolektorski, which was established by the government in December 2018.

In addition, maintenance of the secondary sewer network in each municipality has been transferred to PE Niskogradba in Municipality of Ohrid, PE Vodovod i Kanalizacija Struga in Municipality of Struga which has been reestablished by Municipality of Struga in 2019 and PE Debrca in Municipality of Debrca. The ownership and new construction work related to the secondary sewer network has been transferred to each municipality.

Roles of each organization are summarized in Table 3.1.

In this way, the former PE PROAQUA was dismantle and the management of the sewerage business was divided into the government and the municipalities. As a result, there is no organization to manage sewerage system comprehensively and also to develop an integrated sewerage plan.

Table 3.1 Role of Executing Organization related to Sewerage Business

Organization	Parent Organization	Vranista STP / Primary Sewer				Secondary Sewer (Owned by the municipality)			
		Planning	Design/ Construction	Tariff collection (Treatment Fee)	Owner	Planning	Design/ Construction	Operaton and Maintenance	Tariff collection (Collection Fee)
Before dismantling (PE) PROAQUA (2015-2019)									
(PE) PROAQUA	Ohrid City Struga City	✓	✓	Not collected from Debrca				Struga City only	Struga City only
Ohrid City	-				Co-ownership with Struga City	City MP	✓		
(PE) Niskogradba	Ohrid City						Construction work reqested by Ohrid city	✓	✓
Struga City	-				Co-ownership with Ohrid City	City MP	✓		
Debrca City	-					Local Environment Action Plan	✓		
(PE) Debrca	Debrca City							✓	✓
After dismantling (PE) PROAQUA (2019-)									
(PE) Kolektorski	Government	Non	✓	Not collected from Debrca	Government ownership				
Ohrid City	-	Non				Preparing to review the City MP	✓		
(PE) Niskogradba	Ohrid City	Non					Construction work reqested by Ohrid city	✓	✓
(PE) Vodovod Ohrid	Ohrid City	Non		Acting for (PE) Kolektorski (2019-2020)					
Struga City	-	Non				Under review of the City MP	✓		
(PE) Vodovod i kanarizacija Struga	Struga City	-					Cooperate with construction supervision	✓	✓
Debrca City	-	Non				Local Environment Action Plan	✓		
(PE) Debrca	Debrca City	Non						✓	✓
MP: Master Plan									

Source: JICA Survey Team

3.2.2 Municipality of Ohrid

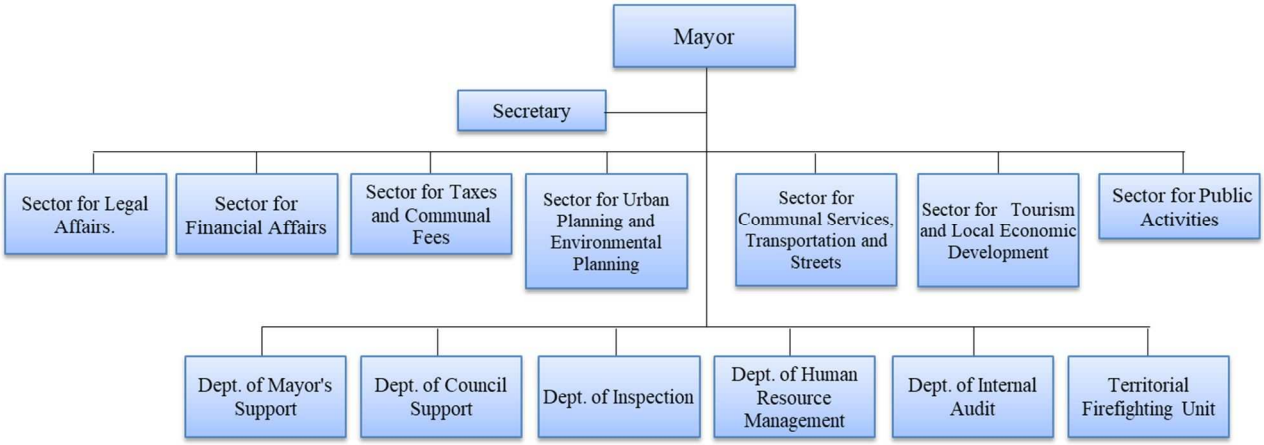
The Municipality of Ohrid is defined as a unit of local government (a community of local residents in a certain area defined by law). Its powers as a public institution are specified in the Law on Local Self-Government (Official Gazette of RM, No. 5/29 January 2002).

The implementing authority of local governments is stipulated in the Statute of the Municipality Ohrid (No. 07 - 2152/17, 2010) and other regulations.

(1) Organizational structure

Ohrid's departments consist of seven main sectors, with the Sector for Communal Services, Transportation and Roads having jurisdiction over sewerage projects. Of these, the Communal Services Sector, which has jurisdiction over sewerage services, has 11 employees, five of whom are civil engineers.

The organizational structure of the Municipality of Ohrid is shown in the Figure 3.2.



Source: JICA Survey Team based on the information of the Municipality of Ohrid

Figure 3.2 Organization Structure（Municipality of Ohrid）

The Municipality of Ohrid performs the following services related to water supply, sewerage and environmental protection projects:

- Drinking water supply
- Collection and treatment of sewage
- Collection and treatment of rainwater
- Environmental protection (prevention and control of pollution of water, air, soil and natural environment, prevention of noise and non-ionizing radiation).

The Communal Services Sector is responsible for the following activities related to the water sector.

- Planning and formulation of annual water supply plan
- Planning and formulation of annual sewer and drainage development plan

(2) Budget

The municipality's financial resources are divided into self-financing and other financial resources. The municipality's self-generated revenue is based on local taxes, user fees and charges as stipulated by law. The municipality may receive subsidies from the central government and other sources and is allowed to raise funds from domestic and foreign capital markets in accordance with the law.

The total budget size (planned) for FY2021 is MKD 1,298 million in both revenue and expenditure. Of this amount, the general budget, which is Ohrid's self-financed budget, is MKD 732 million, accounting for about 56% of the total budget in both revenue and expenditure. As for other revenues, the budget allocated by the central government is relatively large at about 39%.

With regards to the budget for sewerage projects, there are two types of requests from the municipality in case of large scale infrastructure development except for self-budget of Municipality of Ohrid: one is to the central government (Ministry of Environment and Urban Planning and Ministry of Transportation) and the other is to foreign donors directly. For example, the trunk road improvement project, completed in September 2021, was funded by the World Bank and the municipality with 50% each of EUR 500,000 as JV project. The project scope also included the provision of water supply and sewerage to be buried in the road.

The Table 3.2 shows the executive budget table (plan) for the Municipality of Ohrid.

Table 3.2 Budget (plan) for the Municipality of Ohrid (FY2021)

(MKD)

Item	2021	(%)
Revenue		
General Budget		
Income tax, profit tax and capital gains tax	16,150,000	1%
Property taxes	194,000,000	15%
Taxes on specific services	280,765,000	22%
Usage fees or licenses for doing business	1,850,000	0%
Fines, court and administrative fees	2,500,000	0%
Fees and fees	7,460,000	1%
Other government services	20,000	0%
Other non-tax revenue	6,100,000	0%
Sale of land and intangible investments	49,634,128	4%
Transfers from other levels of government	173,536,872	13%
Self-fund	42,143,504	3%
Grant	503,382,735	39%
Donations	21,222,264	2%
Total	**1,298,764,503**	
Expenditure		
General Budget		
Salary and Fee	130,382,576	10%
Reserves and undefined expenses	400,000	0%
Goods and servicesInterest payment	169,463,424	13%
Interest payment	250,000	0%
Subsidies and transfers	95,500,000	7%
Social benefitsCapital expenses	500,000	0%
Capital expenses	322,810,000	25%
Maintenance repair	12,710,000	1%
Self-fund	42,143,504	3%
Grant	503,382,735	39%
Donations	21,222,264	2%
Total	**1,298,764,503**	

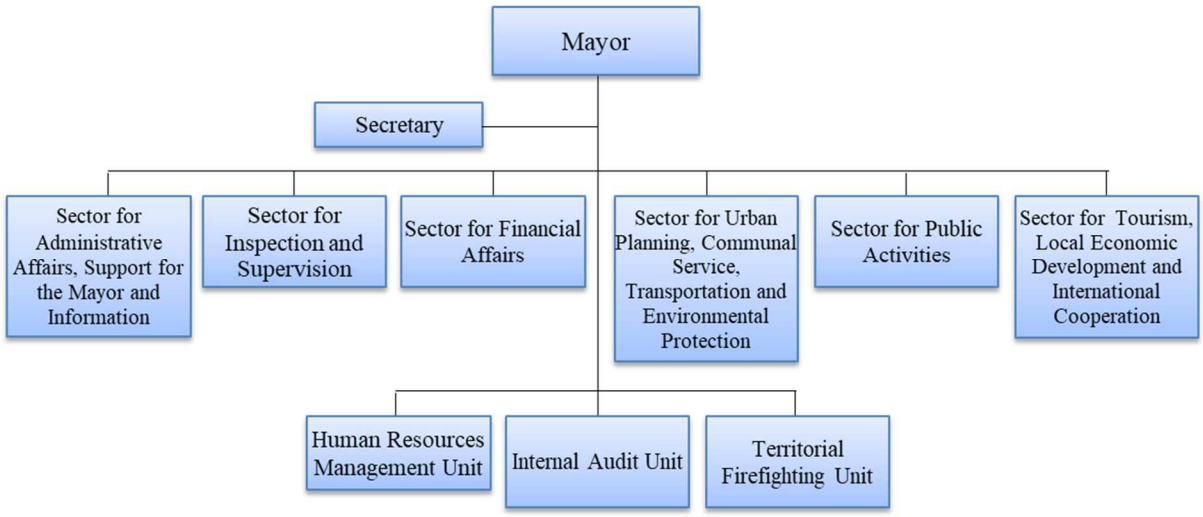
Source: The Municipality of Ohrid

3.2.3 Municipality of Struga

The Municipality of Struga is defined as a unit of local government (a community of local residents in a certain area defined by law). In addition, the implementing authority of the local government is stipulated in the Law on Local Self-Government (Official Gazette of RM, No. 5/29 January 2002).

(1) Organizational structure

The organizational structure of the Municipality of Struga consists of six sectors under the mayor. Of these, the Communal Service unit in Sector for the Urban Planning, Communal Services, Transportation and Environmental Protection Sector is the department responsible for sewerage services. The organizational structure of the Municipality of Struga is shown in Figure 3.3.



Source: JICA Survey Team based on the information of the Municipality of Struga

Figure 3.3 Organization Chart（the Municipality of Struga）

(2) Budget

The total budget size (planned) for FY2021 is MKD 978 million in both revenue and expenditure. Of this amount, the general budget, which is the budget of the Municipality of Struga, is MKD 379 million in both revenue and expenditure, accounting for about 39% of the total budget. The total budget size for FY2021 is slightly smaller than that of Ohrid, at about 70.5%. The budget allocated by the central government accounts for about 60% of the total budget, which is different from the budget structure of the Municipality of Ohrid.

Response to debt of former PE PROAQUA

At the time of the demolition of the former PE PROAQUA, the total debt amounted to EUR 3 to 4 million. Of this amount, the Municipality of Struga shouldered MKD 150 million and made payments to the state. However, in a subsequent court case, it was ruled that PE PROAQUA's debt should be borne by the state. Therefore MKD 75 million (50% of the MKD150 million that the municipality shouldered) has already been repaid by the stat and the remaining MKD 75 million will be returned by the state.

The budget table for the Municipality of Struga is shown in Table 3.3.

Table 3.3 Budget (plan) of the Municipality of Struga (FY2021)

(MKD)

Item	2021	(%)
Revenue		
General Budget		
Income tax, profit tax and capital gains tax	7,302,000	1%
Property taxes	67,200,000	7%
Taxes on specific services	171,740,000	18%
Usage fees or licenses for doing business	120,000	0%
Fines, court and administrative fees	2,010,000	0%
Other non-tax revenue	2,697,215	0%
Sale of land and intangible investments	56,980,000	6%
Transfers from other levels of government	71,220,898	7%
Self-fund	15,109,000	2%
Grant	576,382,000	59%
Donations	8,111,200	1%
Total	**978,872,313**	
Expenditure		
General Budget		
Salary and Fee	107,830,000	11%
Reserves and undefined expenses	1,000,000	0%
Goods and servicesInterest payment	132,770,113	14%
Subsidies and transfers	34,000,000	3%
Social benefitsCapital expenses	500,000	0%
Capital expenses	103,170,000	11%
General Budget	15,109,000	2%
Income tax, profit tax and capital gains tax	576,382,000	59%
Property taxes	8,111,200	1%
Total	**978,872,313**	

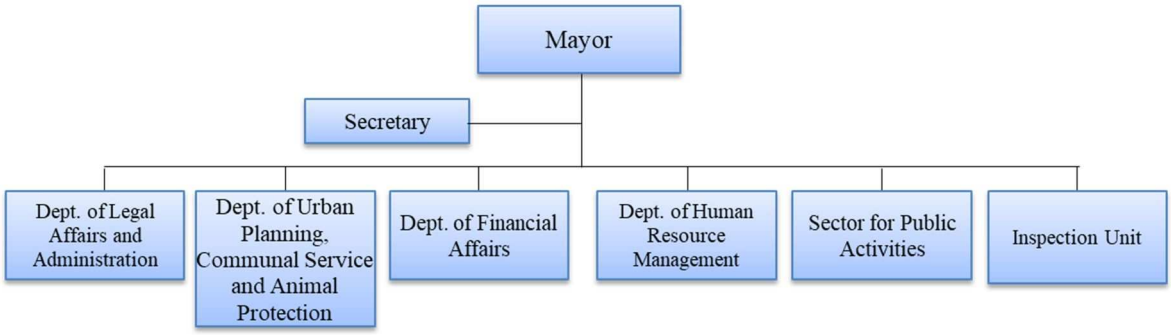
Source: Municipality of Struga

3.2.4 Municipality of Debrca

The Municipality of Debrca is defined as a unit of local government (a community of local residents in a certain area defined by law). In addition, same as the other municipality, the implementing authority of the local government is stipulated in the Law on Local Self-Government (Official Gazette of RM, No. 5/29 January 2002).

(1) Organizational structure

The organizational structure of the Municipality of Debrca consists of five sectors and one unit under the mayor. Of these, the Department of Urban Planning, Communal Service, Animal Protection is the department responsible for sewerage services. The number of all staff members is 23 persons, while that of each section is unknown. The organizational structure of the Municipality of Debrca is shown in Figure 3.4.



Source: JICA Survey Team based on the information of the Municipality of Struga

Figure 3.4 Organization Chart（the Municipality of Debrca）

(2) Budget

Table 3.4 shows the executive budget table (plan) for the Municipality of Debrca.

The total budget size (planned) for FY2021 is MKD 121 million in both revenue and expenditure. Of this amount, the general budget, which is the self-budget of the Municipality of Debrca, is MKD 74 million in both revenue and expenditure, accounting for about 62% of the total budget. Within the total budget (plan) in FY2021, the budget amount for sewerage and treatment facilities is accounted for MKD 19 million which is shared approximately 15% of the total.

Table 3.4 Budget (plan) for the Municipality of Debrca (FY2021)

(MKD)

Item	2021	(%)
Revenue		
General Budget		
Income tax, profit tax and capital gains tax	370,000	0%
Property taxes	7,860,000	6%
Taxes on specific services	8,300,000	7%
Usage fees or licenses for doing business	10,000	0%
Fines, court and administrative fees	330,000	0%
Fees and fees	232,000	0%
Other non-tax revenue	308,000	0%
Sale of land and intangible investments	6,704,000	6%
Transfers from other levels of government	50,414,950	42%
Self-fund	10,000	0%
Grant	35,124,000	29%
Donations	11,337,050	9%
Total	**121,000,000**	
Expenditure		
General Budget	74,528,950	62%
Self-fund	10,000	0%
Grant	35,124,000	29%
Donations	11,337,050	9%
Total	**121,000,000**	

Source: The Municipality of Debrca

3.2.5 PE Kolektorski

(1) Background

The former PE PROAQUA was established in 1998 as an inter-municipal public enterprise to manage the water services and the sewage and wastewater services for the municipalities of Struga and Ohrid. PE Kolektorski is one of the three new PEs created following the demolition of the former PE PROAQUA in 2018. The government decision (Official Gazette no. 222/2018, Government of Macedonia) established PE Kolektorski in December 2018, a state PE managed and owned by the central government. The assets, equity and liabilities of the former PE PROAQUA were finally liquidated in December 2019. The establishment of the PE was financed with MKD 5 million.

(2) Scope of work

The sewage collection service (operation and maintenance of the primary sewer, PSs associated with the primary sewer and the Vranista STP) has been transferred from the former PE PROAQUA.

According to the Articles of Incorporation, the company shall engage in activities that serve the public interest in the field of environmental conservation through sewage and wastewater facilities, including sewage collection, sewage treatment plant and drainage.

(3) Organization and departments

1) Administrative organization

PE Kolektorski is under the direct control of the government and the government's Supervisory Board and Management Board serve as the management organization. Both the Supervisory Board and the Management Board consist of five members each, who are appointed by the President (or Vice President) (Government of Macedonia Official Gazette No. 35/2019). The term of office is four years.

It is stipulated that the Supervisory Board is in charge of auditing material and financial matters. It reviews the financial reports (annual) and activity reports (quarterly and annual) submitted by the PE and presents its opinion to the Management Board. The Management Board approves these financial and activity reports.

2) Management bodies

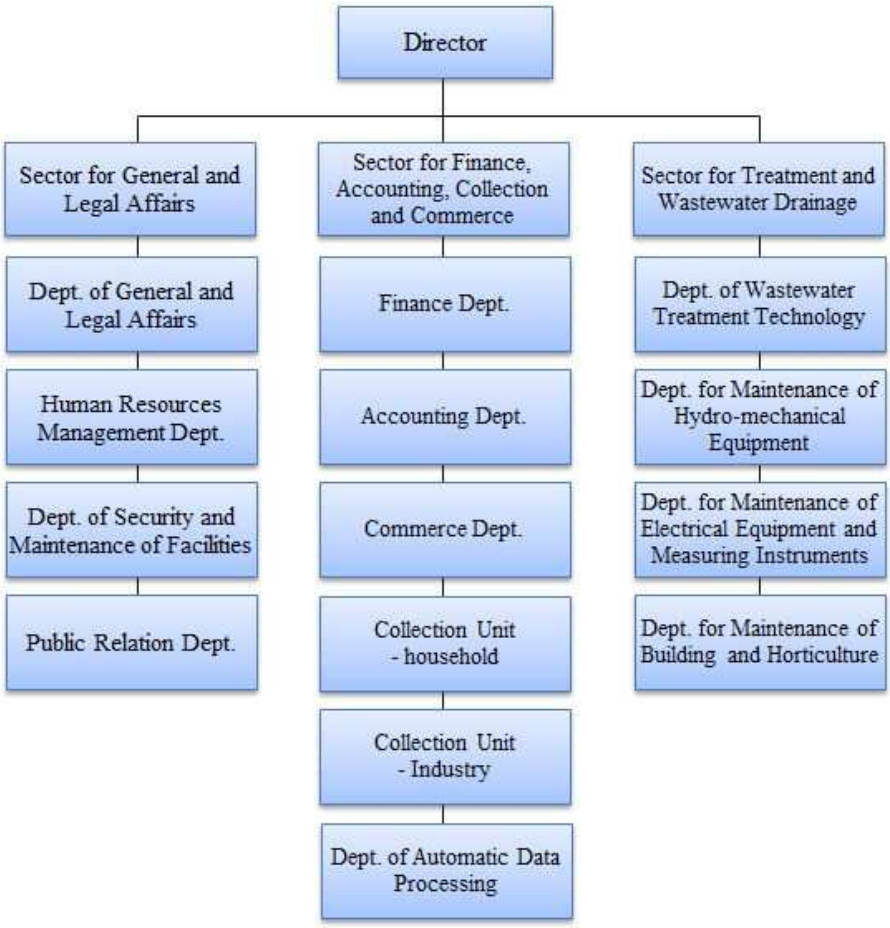
According to the Statute of the PE, the head office is located in Skopje, but according to the interviews, the head office does not have its own office and the office in Ohrid is where the PE's operations are conducted.

The board of directors is the highest decision-making body in the management of PE. The board of directors has four members, appointed by the Government of North Macedonia. The term of office is four years.

The PE is authorized to have one Director and one Vice-director, but the post of Vice-director is vacant. The Director and Vice-director of PE are appointed by the Management Board through an open recruitment process. The term of office is four years.

3) Departments and sections

The PE is divided into three main departments: General Affairs and Legal Affairs, Finance, Accounting and Sales and Sewage Treatment and Drainage. The organizational chart is shown in Figure 3.5.



Source: PE Kolektorski

Figure 3.5 Organizational Structure（PE Kolektorski）

4) Staffing

As of October 2021, the number of staff is 61; the number of staff indicated in the three-year management plan (2021-2023) prepared in 2020 is 64 (2016), a decrease of three since the establishment of the project in 2018.

At the time of the demolition of the former PE PROAQUA, the staff of the sewage collection unit was transferred to PE Kolektorski intact. New employees were hired for the management level, finance director and accounting director.

The ratio of administrative and technical staff, excluding the President of PE, is 64% and 34% respectively, with the majority being administrative staff. Some of the technical staff requested an increase in the number of on-site maintenance personnel. The current technical staffs are the minimum number which are not sufficiently cover the operation and maintenance of sewage facilities. The number of staff per 1,000 connections is 3.36. The number of staff by department is shown in the Table 3.5.

Table 3.5 Number of Staff Members (PE Kolektorski)（FY2020）

	Section	Staff number (Approved)	Staff number (Actual)
Director		1	1
Assistant Director		1	0
Secretary		1	0
Driver		1	1
Sector for Legal and General Affairs	Head	1	1
	1.1 Dept. of General and Legal Affairs	11	11
	1.2 Dept. of Human Resource Management	4	4
	1.3 Dept. of Security and Maintenance of Facilities	4	4
	1.4 Dept. of Public Relation	3	3
Sector for Finance, Accounting, Collection and Commerce	Head	1	0
	2.1 Dept. of Finance	3	2
	2.2 Dept. of Accounting	5	3
	2.3 Collection Unit-household	4	4
	2.4 Collection Unit -industry, administration	3	3
	2.5 Dept. of Automatic Processing Data	3	3
	2.6 Dept. of Commerce	2	2
Sector for treatment and Wastewater Drainage	Head	1	1
	3.1 Dept. of Wastewater Treatment Technology	5	3
	3.2 Dept. of Maintenance of Hydromechanical Equipment	6	5
	3.3 Dept. of Maintenance of Electrical Equipment and Measuring Instruments	8	5
	3.4 Dept. of Maintenance of building and horticulture	9	8
		77	64

Source: JICA Survey Team, PE Kolektorski, Business Plan (2021-2023)

(4) Financial status and billing and collection status

1) Income statement

Operating revenue for FY2020 is MKD 79 million, of which the main business (sewerage project revenue) accounts for MKD 64 million, shared 81% of the total. Compared to FY2018, sewerage revenue is decreased by about 10%, but overall operating revenue is went up slightly by about 2%. It was told that the main cause of revenue decrease is due to the influence of the COVID-19 pandemic.

Operating expenditure in FY2020 is MKD 51 million, which is 1.5 times higher than that in FY2018 and shows an increasing trend. The largest component of operating expenditure is employee salaries, at 53% of the total. This is followed by the cost of equipment and power with 24% and other service expenses with 14%. Depreciation of assets is also accounted for using the straight-line method.

The net profit/loss (before tax) for FY2020 is a positive MKD 9.5 million. Operating profit has remained positive for the last three years after the dismantling of the former PE PROAQUA, but the profit margin has been declining due to the gradual increase in operating expenditures.

The income statement for the most recent three years is shown in Table 3.6.

Table 3.6 Income Statement (PE Kolektorski)（FY2018-FY2020）

(MKD)

Item	2018	2019	2020	2020 (%)
Operating Revenue				
Sales revenue	72,695,577	71,910,263	64,384,857	81%
Other income	4,816,533	6,784,111	15,066,864	19%
0	**77,512,110**	**78,694,374**	**79,451,721**	100%
Operating Expenditure				
Materials, energy, spare parts and small inventory	11,773,735	12,318,643	12,270,616	24%
Maintenance and overhaul costs	2,133,841	2,763,228	816,544	2%
Insurance costs of construction facilities and equipment	20,651	0	27,107	0%
Salaries	15,835,830	20,372,758	27,431,412	53%
Other service costs	2,531,152	3,402,848	7,396,940	14%
Other extraordinary expenses	1,200,354	1,991,120	3,465,454	7%
Taxes, contributions and other dutis	0	87,485	214,130	0%
Total	**33,495,563**	**40,936,082**	**51,622,203**	100%
Depreciation				
Depreciation of own fixed asset	20,517,103	16,636,724	11,902,733	70%
Depreciation of other fixed assets	0	0	5,082,594	30%
Total	**20,517,103**	**16,636,724**	**16,985,327**	100%
Other				
Other costs not included above	807,792	1,755,085	719,236	55%
Financial expenses	112,776	200,591	581,136	45%
Financial income	0	0	0	0%
Total	**920,568**	**1,955,676**	**1,300,372**	100%
Net Profit/Loss	**22,578,876**	**19,165,892**	**9,543,819**	

Source: JICA Survey Team, PE Kolektorski, Business Plan (2021-2023) and Financial Report (2020)

2) Balance sheet

The total amount of debt taken over from the former PE PROAQUA was approximately EUR 7 million. The breakdown is i) Repayment of EUR 4.5 million for KfW project, ii) Repayment of EUR 2 million for Municipality of Struga and iii) Repayment of EUR 0.5 million for private companies. As for i), the central government has already rebuilt and repaid the debt, but PE Kolektorski needs to repay the central government. However, PE Kolektorski needs to repay the central government. As for ii), the central government has already repaid EUR 1.5 million for reconstruction and PE has to repay the reconstruction amount to the central government and the remaining EUR 0.5 million to the Municipality of Struga. iii) has already been repaid by PE.

Table 3.7 shows the balance sheet of PE Kolektorski for 2019 to 2020. The net balance was negative in FY2019, but is expected to improve to a positive MKD 17 million in FY2020. The impairment of net assets includes debt from the former PE PROAQUA and repayments to the Municipality of Struga. In addition, PE Kolektorski has no new long-term debt obligations.

Accounts receivable in current assets in FY2020 amounted to MKD 399 million, or 97% of the total. Of this, 99% is accounts receivable from customers. The breakdown shows that 63% is from customers in Ohrid and 37% is from customers in Struga.

Table 3.7 Balance Sheet (PE Kolektorski) (FY2019-2020)

(MKD)

Item	2019 (7-12)	2020
Asset		
Fixed Assets		
Fixed Assets	430,311,691	621,030,301
Property, building and equipment	918,462,484	1,125,796,192
Write-off	-488,150,793	-504,765,891
Non-material assets	60,000	1,308,167
Non-material assets	60,000	1,460,000
Write-off	0	-151,833
Long-term financial resources	0	0
Total	430,371,691	622,338,468
Current Asset		
Stocks	1,572,007	1,614,300
Receivable	383,163,557	399,401,870
Receivables form customer	376,835,930	395,470,761
Receivables from Ohrid	246,813,577	249,071,514
Receivables from Struga	129,944,604	146,321,498
Other receivables	77,749	77,749
Claims from the state for taxes	1,827,044	2,294,620
Other receivables	55,709	43,091
Cash and cash equvalents	4,444,874	1,593,398
AVR	14,608,360	14,598,860
Total	399,343,924	415,615,030
Asset Total	**829,715,615**	**1,037,953,498**
Capital and Liailities		
Capital and reserves	-130,082,414	17,814,973
State capital	256,202,066	256,452,066
Accumulated profit	0	0
Accumulated loss	-395,731,492	-247,312,331
Profit/Loss for business year	9,447,012	8,675,238
Non-cuurent liabilities	278,388,616	478,863,551
Long-term liabilities	0	0
Donations	278,388,616	478,863,551
Cuurent liabilities	681,409,411	541,274,974
Liabilities to suppliers	398,113,826	303,678,870
Total credit	278,410,376	235,644,004
Short-term loans	144,482,605	143,606,209
Short obligations for Struga municipality	133,927,771	92,037,795
Tax liabilities	2,212,247	1,418,205
Gross salary of employees	2,672,673	330,178
Other liabilities	289	203,717
Capital and Liabilities Total	**829,715,613**	**1,037,953,498**

Source: JICA Survey Team, PE Kolektorski, Business Plan (2021-2023) and Financial Report (2020)

(5) Status of billing and collection

1) Number of customer connections

The exact number of customer connections is not known, as PE Kolektorski is currently developing service contracts with customers. However, the number of monthly bills has been hovering between 17,000 and 19,000 and this number can be considered as the number of customer connections.

The number of people receiving sewage treatment services is estimated to be 70,733 (FY2019) and the

penetration rate to the target population is 61%.

2) Sewerage charges

Sewerage charges are based on a uniform metered rate system. There are three types of customers: general households, industrial/commercial and public institutions. The uniform rate system will continue until 2023, which is the year covered by the three-year plan, but in the next three years, a two-part tariff system will be applied, combining fixed and pay-as-you-go rates.

The PE Kolektorski is calculating the possibility of payment by household. Based on the current tariffs for households, it is estimated that the average expenditure to PE is about 0.37% of the average household income.

The Table 3.8 shows the sewerage tariffs.

Table 3.8 Sewerage Charge (2018-2021)(PE Kolektorski)

Customer type	Unit	2018	2019	2020	2021
Domestic	MKD/m^3	16.54	16.64	16.66	21.42
Industrial and Commercial	MKD/m^3	26.52	26.58	26.70	34.27
Public institution	MKD/m^3	26.52	26.58	26.70	34.27

Source: Kolektorski
[Note] VAT is not included in the above amount

3) Billing and collection

After the dismantling of the PE PROAQUA, billing and collection were carried out by PE Vodovod Ohrid and PE Vodovod i Kanalizacija Struga on their behalf until the establishment of PE Kolektorski. For billing, the company receives monthly meter readings from Vodovod Ohrid and Vodovod i Kanalizacija Struga and calculates the billing amount based on the consumption.

In FY2019, the amount billed was MKD 72 million and the amount collected was MKD 59 million. The breakdown of the fee collected was 60% for households and 40% for industry/commercial/other.

The collection efficiency rate is calculated from the amount collected against the amount billed and was 66% in 2018 and 83% in 2019. There is no significant difference in the collection rate by customer category. The collection rate was low at the beginning after the dismantling of the former PE PROAQUA, but showed an improving trend in FY2019. For non-payer, PE Kolektorski takes a measure on issuing notices two or three times. There are some cases to bring this into the court for dispute if customers do not react to pay.

The main source of requests and complaints from customers is related to incorrect billing amounts and the handling of unpaid accounts.

The most recent billing and collection amounts are shown in Table 3.9.

Table 3.9 Tariff Revenue Collection (PE Kolektorski)

Item	Unit	2018	2019
Amount billed（Total）	MKD	**71,695,577**	**71,910,263**
Amount billed（Domestic）	MKD	43,751,209	43,454,624
Amount billed（Industrial/Commercial/Other）	MKD	27,944,368	28,455,639
Amount collected（Total）	MKD	**47,319,081**	59,685,517
Amount billed（Domestic）	MKD	28,875,798	36,067,337
Amount billed（Industrial/Commercial/Other）	MKD	18,443,283	23,618,180
Collection efficiency ratio（Total）	%	66	83
Collection efficiency ratio（Domestic）	%	66	83
Collection efficiency ratio（Industrial/Commercial/Other）	%	66	83

Source: PE Kolektorski, Business Plan (2021-2023)

4) Customer payment methods

The payment methods for customers fees are cash payment at the office counter (Ohrid and Struga), payment at the bank counter and e-banking.

5) Awareness-raising activities and training

Awareness-raising activities

For the customers, the bill from PE Kolektorski is an additional one by the PE newly created when the former PE PROAQUA was disorganized. The name is thought to be not well known by the residential people because Kolektorski is a new PE and the collection works is just transferred in January 2021. Therefore, the Director of the Finance Department is emphasizing the importance of raising and spreading customer awareness through awareness-raising. Currently, in addition to the notice on the website, the staff explains the situation to the customers when they distribute the bills.

Training

The Human Resource Management Department does not organize training for each department and there is no specific training plan or training records. Each department sends its staff to training conducted by the central government or private companies commissioned by the department to educate its staff. Since the Coronavirus pandemic, online training has been the main source of training.

The central government sponsors training courses on finance, public procurement, human resource management systems, etc. and the relevant administrative staff participate in these courses. The cost is borne by each PE and is about MKD 3,000 (JPY 6,300) per participant. In principle, all employees of the relevant departments of PE are required to participate in training organized by the central government.

For example, training on human resource management systems is conducted 2-3 times a year. PE uses the same information system and the content of the training is mainly related to how to enter data into the information system. Training courses offered by private companies are voluntary and a list of training courses is sent to PE on a regular basis. These training courses are mainly for administrative staff.

The training for technical staffs are limited to the training by the contractors of sewage treatment plant

in 1987 and when dewatering machines were replaced. Training on pump operation and maintenance was also held; however, it was long ago and when it was conducted is unclear.. Until now, the training on operation and maintenance for collector system has not been carried out.

The list of training courses is shown in Table 3.10.

Table 3.10 Training Course List by Private Company

Course
1. Office and archive work
2. Process of implementing functional analysis in public sector institutions
3. Preparation of Acts for internal organization and systematization of public sector institutions
4. Work in the human resource management system
5. Preparation of annual plans for employment in public sector institutions
6. Implementation of procedures for (filling positions), employment and promotion in public sector institutions
7. Managing the performance of administrative staff
8. Implementation of the law on public sector employees and the law on administrative employees

Source: PE Kolektorski

(6) Observation and Main issues

When the former PE PROAQUA was dismantled, the employees of the sewage collection unit were basically transferred to the new unit and the number of employees has not changed significantly since that time. The number of staff members per 1,000 connection is 3.36 persons, which is relatively appropriate range in terms of employee size. It is general characteristic that the daily operation and maintenance of the sewerage facilities usually require a lot of staff. Therefore, the number of technical staff members is two times or more than the number of administrative staff. However, looking at the composition of the staff, more than 60% of the staff are administrative staff, which is not balanced as a sewerage PE.

3.2.6 PE Niskogradba

(1) Background

Niskogradba Sewerage Company is a maintenance company established and registered (No. 30320100001540, 6/2010) by the decision of the Ohrid municipal council (No. 07--999, 4//2010) in 2010, before the demolition of the former PE PROAQUA. The background of the establishment is that the former PE PROAQUA was in charge of the maintenance of secondary and tertiary sewers, but it became a problem because the sewers were not maintained sufficiently and the municipal council decided to establish a new PE.

(2) Scope of work

The main activities are i) construction, reconstruction and maintenance of sewers and ii) construction, reconstruction, maintenance and preservation of roads. As for sewers, this project covers secondary and

tertiary sewers in Ohrid.

(3) Organization and departments

1) Organization

The Management Board is the highest decision-making body in the management of PE. There is also a Supervisory Board that oversees financial and technical matters.

Both the Management Board (appointed by the Ohrid municipal council) and the Supervisory Board consist of five members.. The appointment term is four years.

2) Departments

The Director is supported by the Director's Support Office, which is responsible for three areas (administration and technology, finance and legal affairs and sales) and has independent advisors and a secretary. The departments responsible for practical operations are arranged in four main sectors. The three departments in the sewage sector are responsible for the construction and maintenance of sewage and drainage facilities such as sewers and PSs. The main tasks of each department are shown in Table 3.11.

Table 3.11 Role and Responsibilities of Each Section

Section	Activity
Director's support and advisor	• Selecting strategic priorities for PE and determining the implementation plan
Assistant to the Director for Operational and Technical Affairs	
Assistant to the Director for Financial and Legal Affairs	
Adviser to the Director of Commercial Affairs and Technical Preparation	
Independent Advisor to the Director / Advisor to the Director (for legal and economic affairs)	
Independent Officer - Secretary of the Director	
Department of Planning, Investment and Development	• Coordinate overall activities through planning and design • Preparation of activity plans and annual reports • Preparation of investment plan documents • Preparing and issuing requests and letters (including comments and suggestions to the Ohrid city plan) • Facilitating the effective use of financial resources
Sector for Legal Affairs	
i) Administration and Legal Affairs Dept.	• Legal support for all PE activities
ii)Human Resource Dept.	• Implementation of activities related to human resources management, including social security and employment of staff
Sector for Financial and Accounting	
i)Finance and Accounting Dept.	• Planning and implementation of the financial plan for each fiscal year and preparation of financial statements
ii) Public Procurement Dept.	• Formulation of procurement plans and implementation in accordance with official procurement procedures
Sewerage Sector	
i) Dept. of Technical Affairs	• Preparation of technical documents related to sewage and wastewater in general and facilities • Participation in public hearings in the Municipality of Ohrid (e.g., comments on the draft municipal plan) • Preparation of technical documentation for necessary investments related to facility construction and other activities
ii) Dept. of Sewerage Network Maintenance , Construction and Reconstruction of Sewerage Network	• Construction of secondary and tertiary sewer network in and around the Municipality of Ohrid • Connection of new sewers for clients, inspection and verification of existing facilities and maintenance
iii) Sewerage and Stormwater Maintenance Dept.	• Periodic inspection and maintenance (cleaning, removal of foreign materials) of the road sewer network and PSs
Sector for Sewerage	
i)Sewerage Facilities, Installation, Street and Roads Dept.	• Sector for Sewerage • Installation, renewal and maintenance of traffic signals and poles on roads
ii)Construction Maintenance Dept.	• Repair and paving of roadside roads • Installation of manholes on repaired roads
Sector for Sewerage Facilities, Installation, Street and Roads	
i)Maintenance of Mechanization and vehicles Dept.	• Repair and paving of roadside roads
ii) Fleet Exploitation Unit	• Installation of manholes on repaired roads

Source: PE Niskogradba Business Plan（2021-2023）

3) Staffing

As of October 2021, the number of authorized staff is 133, while the actual number of staff assigned is 113; the number of staff indicated in the three-year management plan (2021-2023) prepared in 2020 was 111 (FY2020).

The proportion of administrative and technical staff, excluding the President of PE, is almost 50% each, with a large number of administrative staff. Of the administrative staff, the number of staff in the Finance and Accounting Department alone accounts for 34 (28% of the total), which is unbalanced as a PE. As mentioned before, it would be said that approximate balance between the number of technical staff members and the number of administrative staff members is 2:1 or more. There is the undeniable impression that there is an element of staffing due to political influence in this regard.

The number of staff per 1,000 connections is 4.2 persons. The number of staff members by department (2020) is shown in Table 3.12.

Table 3.12 Number of Staff Members

Section	Staff number (actual)	Plan for increase*
Director	1	
Director's support and advisor		
Assistant to the Director for Operational and Technical Affairs	1	None
Assistant to the Director for Financial and Legal Affairs	1	None
Adviser to the Director of Commercial Affairs and Technical Preparation	1	None
Independent Advisor to the Director / Advisor to the Director (for legal and economic affairs)	0	Necessary
Independent Officer - Secretary of the Director	1	None
Department of Planning, Investment and Development	4	None
Sector for Legal Affairs		
i). Administration and Legal Affairs dept.	9	Necessary
ii) Human Resource dept.	2	
Sector for Finance and Accounting		
i) Finance and Accounting dept.	31	Necessary
ii) Public Procurement dept.	4	
Sector for Sewerage		
i) Dept. of Technical Affairs	0	Necessary
ii) Dept. of Sewerage Network Maintenance , Construction and Reconstruction of Sewerage Network	16	
iii) Sewerage and Stormwater Maintenance Dept.	14	
Sector for Sewerage Facilities, Installation, Street and Roads		
i) Sewerage Facilities, Installation, Street and Roads dept.	9	Necessary
ii) Construction Maintenance dept.	2	
Sector for Vehicle and Machine		
i) Maintenance of Mechanization and vehicles dept.	6	Necessary
ii) Fleet Exploitation Unit	9	
	111	

Source: PE Niskogradba Business Plan（2021-2023）
[Note] *: The schedule is indicated in Business Plan

(4) Financial status and billing and collection status

1) Financial status

Income Statement

In FY2020, operating revenue was MKD 66 million, of which the main business (sewerage project revenue) accounted for MKD 63 million, or 94%. Compared to FY2018, sewerage revenue has increased by 8% and overall operating revenue has increased by about 12%.

Operating expenditure in FY2020 is MKD 56 million, increased by 13% compared to FY2018. The largest expense item in operating expenditure is employee salaries, which is quite large at 69% of the total. This is followed by equipment and power expenses (16%). Of the operating expenditure items, the largest increase is in employee salaries, which has increased by 17% since FY2018. Depreciation expense on assets is also recorded using the straight-line method.

The net profit/loss (before tax) in FY2018 was a loss of MKD 0.3 million, while in FY2020 it was a profit of MKD 6.3 million. In the last two years, operating revenues have been commensurate with operating expenditures and cost recovery including depreciation has been achieved.

The income statement for the last three years is shown in Table 3.13.

Table 3.13 Income Statement (PE Niskogradba)（FY2018-2020）

(MKD)

	2018	2019	2020	2020 (%)
Operating Revenue				
Sales revenue	58,334,850	66,311,141	62,924,012	*94%*
Other income revenue	1,451,473	1,953,479	4,008,251	*6%*
Total	**59,786,323**	**68,264,620**	**66,932,263**	100%
Operating Expenditure				
Material, energy, spare parts and inventory costs	8,372,722	10,356,993	9,119,071	*16%*
Transportation, telecommunication, vehicle maintenan	1,732,462	1,667,754	1,651,770	*3%*
Insurance costs for construction facilities and equipme	106,743	102,756	106,456	*0%*
Other service costs	3,034,717	2,392,695	3,312,266	*6%*
Other and extraordinary expense	2,841,439	3,361,961	3,275,899	*6%*
Staff salary and allowance	33,562,376	36,015,906	39,229,080	*69%*
Other operating expenses	668,071	643,118	218,267	*0%*
Total	**50,318,530**	**54,541,183**	**56,912,809**	100%
Depreciation etc.				
Depreciation costs	949,267	988,191	1,067,475	*25%*
Value adjustment of current assets	9,199,154	4,779,668	3,191,674	*75%*
Total	**10,148,421**	**5,767,859**	**4,259,149**	100%
Others				
Financial expenses	253,022	239,839	38,006	*6%*
Financial income	586,142	684,631	635,616	*106%*
Total	**333,120**	**444,792**	**597,610**	100%
Net Profit/Loss (before tax)	**-347,508**	**8,400,370**	**6,357,915**	

Source: PE Niskogradba Business Plan（2021-2023）、Financial Report（2020）

Balance Sheet

Table 3.14 shows the balance sheet for FY 2018 to 2020. Accounts receivable under current assets in FY2020 is MKD 54 million, increased by 22% over FY2018. The data for FY2019 shows that 68% of the accounts receivable is due to unpaid sewerage bills. This includes 44% from residential customers

and 24% from industrial/commercial customers. Thirty-one percent of the accounts receivable are for sewer, lateral and other construction work.

Table 3.14 Balance Sheet (PE Niskogradba)（FY2018-2020）

(MKD)

	2018	2019	2020
Assets			
Fixed Assets			
Intangible assets		5,700	248,900
Tangible assets		9,271,936	8,536,746
Investment in real estate		0	0
Long-term financial resources		0	0
Fixed Assets Total	**9,689,696**	**9,277,636**	**8,785,646**
Current Assets			
Cash and cash equivalent	5,732,788	3,951,970	5,959,234
Receivables	44,794,411	51,819,172	54,861,849
Inventories	3,853,841	4,941,309	5,081,372
Other Assets			
Other asset	1,399	554	832
Current Assets Total	**54,382,439**	**60,713,005**	**65,903,287**
Capital and Liabilities			
Capital and reserves	20,307,097	27,296,658	32,730,109
Liabilities	38,491,874	37,728,538	37,300,888
Short-term liabilities	*38,491,874*	*37,728,538*	*37,300,888*
Long-term liabilities	*0*	*0*	*0*
Deffered payment	5,273,163	4,965,445	4,657,936
Capital and Liabilities Total	**64,072,134**	**69,990,641**	**74,688,933**

Source: PE Niskogradba Business Plan（2021-2023）、Financial Report（2020）

2) Billing and collection

Number of customer connections

PE Niskogradba has 26,256 customer connections (2019), of which 24,877 (95%) are residential and 1,379 (5%) are industrial and commercial. Of the total number of customer connections, customers in the Ohrid region account for the majority, 93% of the total.

According to the Management Plan of PE Niskogradba, the population of the target area in 2019 is estimated to be 50,447 of which the penetration population receiving sewage services is 47,203 with a penetration rate of 94%. The number of customer connections is shown in Table 3.15.

Table 3.15 Customer Connection (PE Niskogradba)（FY2019）

Region	Number of sewerage Connection		Total
	Domestic	Industrial and Commercial	
Ohrid	22,959	1,334	24,293
Velgoshti	437	1	438
Dolno Konjsko	218	7	225
Dolno Lakocerej	12	0	12
Елешец	0	1	1
Lagadin	223	11	234
Leskoec	263	14	277
Settlement East	37	1	38
Pestani	543	8	551
Other	185	2	187
Total	24,877	1,379	26,256

Source: PE Niskogradba Business Plan（2021-2023）

Sewerage charges

Sewerage charges are divided into two categories: Household and Industrial/Commercial. Customers other than households, such as public institutions and general businesses, are classified in the Industrial and Commercial category. The tariff system is a two-part tariff system that combines metered and fixed charges. The unit price of the metered rate is applied on a uniform metered basis, by which the price remains constant even if the water consumption increases.

The Table 3.16 shows the sewerage tariffs.

Table 3.16 Sewerage Charge（2018-2021）(PE Niskogradba)

	Customer Type	Unit	2018	2019	2020	2021
Metered charge	Domestic	MKD/m^3	8.21	9.05	9.51	9.51
	Industrial/ Commercial	MKD/m^3	14.21	15.66	16.46	16.46
Fixed charge	Domestic	MKD	57.14	57.14	57.14	57.12
	Industrial/ Commercial	MKD	95.24	95.24	95.24	95.21

Source: PE Niskogradba
[Note] VAT is not included in the above amount

Billing and collection

Water meters are read by PE Vodovod Ohrid and billing is done based on the water consumption data received from PE. The bills for the previous month are printed at the beginning of each month and distributed to customers between the 5th and 15th of the month. PE Niskogradba pay monthly fixed fee of MKD 120,000 as the data fee for customer consumption.

Table 3.17 shows the tariff revenue collection. In FY2019, the amount billed is MKD 30 million and the amount collected is MKD 19 million. The breakdown of the amount collected was 60% for households and 40% for industrial/commercial/other.

The collection rate is 65% (FY2019) and there is still room for improvement. There is no significant difference in the collection rate by customer category.

The number of fees charged/collected fluctuates with the season, with the highest in the summer during the tourist season and the lowest in the winter.

Table 3.17 Tariff Revenue Collection (PE Niskogradba)

Item	Unit	2018	2019
Amount billed（Total）			
Amount billed（Domestic）	MKD	27,338,814	30,036,529
Amount billed (Industrial/Commercial）	MKD	16,680,105	17,853,329
Amount collected（Total）	MKD	10,658,709	12.183.200
Amount billed（Domestic）			
Amount billed (Industrial/Commercial）	MKD	17,223,452	19,523,809
Collection efficiency ratio（Total）	MKD	10,508,466	11,604,664
Collection efficiency ratio (Domestic）	MKD	6,714,986	7,919,145
Collection efficiency ratio (Industrial/Commercial）			
Amount billed（Total）	%	63%	65%
Amount billed（Domestic）	%	63%	65%
Amount billed（Industrial/Commercial）	%	63%	65%

Source: PE Niskogradba Business Plan（2021-2023）

(5) Awareness-raising activities

Although PE has implemented some activities to promote the payment of fees to those who have not yet paid, the activities themselves are limited.

(6) Main issues

- About half of the staff are administrative staff, which is unbalanced as a PE
- Because administrative staff (especially upper management) are affected by political staffing, staff tend to be replaced depending on the results of elections

3.2.7 PE Vodovod Ohrid

(1) Background

PE Vodovod Ohrid is one of the three new PE created following the demolition of the former PE PROAQUA in 2018. In December 2019, the registration of the former PE PROAQUA was cancelled. At the same time, PE Vodovod Ohrid was formally established.

(2) Scope of work

The water supply and sewerage business of the Municipality of Ohrid was transferred from the former PE PROAQUA. The company supplies drinking water to the residents of the Municipality of Ohrid.

(3) Organization and departments

1) Management Organization

The Management Committee is the highest decision-making body in the management of PE. There is also an Audit Committee that oversees financial and technical matters. The Steering Committee consists of 7 members and the Audit Committee consists of 5 members, the former from the Ohrid municipal council and the latter from the Municipality of Ohrid.

2) Department

There are two sectors: "Water Supply Facilities, Production and Water Treatment" and "Finance and Accounting". The details are as shown in Table 3.18.

Table 3.18 Role and Responsibilities of Each Section

Section	Activity
Sector for Sewerage Facilities, Installation, Street and Road	
Accounting dept.	• Recording of financial information, recording of incoming and outgoing information • Preparing financial reports and budgets
Collection dept.	• Reading water meters, distributing invoices and collecting fees • Management of water supply equipment
Sector for Finance and Accounting	
Automatic Data Processing Unit	• Entering and updating customer management data • Issuance of invoices
Public Procurement dept.	• Preparation of public procurement plans, specifications and implementation of public procurement
Maintenance, Reconstruction of the Water Supply Network and Shovel and Plugs dept.	• Maintenance and construction of water pipeline systems • Maintenance and management of construction equipment and waterworks equipment
Water Meter Workshop dept.	• Calibration of water meters • Installation and renewal of water meters • Repair of water meters
Technical Affairs and Development dept.	• Digitization and optimization of water pipeline systems • Preparation of guidelines • Water quality monitoring • Leakage reduction

Source: PE Vodovod Ohrid

3) Staffing

As of December 2020, the number of staff is 261 (243 permanent staff and 18 contractual staff); In 2019, the number was 268, so it was decreased by seven from 2019.

The number of staff per 1,000 connections is 8.1. At the time of the dismantling of the former PE PROAQUA, the staff of the then Ohrid Water Supply Unit was transferred to PE Vodovod Ohrid intact.

(4) Financial status and billing and collection status

1) Financial situation

Income Statement

Table 3.19 shows he income statement of PE Vodovod Ohrid. The operating balance for the most recent year, 2020, showed a net loss of MKD 5,914 thousand. Revenue from the water supply business, which is the core business, accounted for MKD 112 million, or 78% of the total. PE has invested in a small hydropower project, which generated revenue of MKD 23 million, or 16% of the total.

Operating expenditures for FY2020 are estimated at MKD 138 million, with employee salaries accounting for the largest portion at 67%. This is followed by equipment and power expenses (21%).

According to PE, the loss for FY2020 will be covered by the profit of MKD 987,000 thousand in 2019 and the profit from the split from the former PE PROAQUA before 2019.

Table 3.19 Income Statement (PE Vodovod Ohrid)

(1,000 MKD)

	2019 (7-12)	2020	2020 (%)
Operating income			
Sales revenue	64,399	112,314	78%
Operating income	5,205	23,389	16%
Other income	6,189	8,087	6%
Total	**75,793**	**143,790**	100%
Operating Expenditure			
Materials, energy, spare parts and small inventory	17,536	29,500	21%
Maintenance and overhaul costs	1,133	1,581	1%
Insurance costs of construction facilities and equipment	42	69	0%
Salaries	40,463	92,618	67%
Other service costs	4,896	10,000	7%
Other extraordinary expenses	4,031	4,561	3%
Taxes, contributions and other dutis	121	289	0%
Total	**68,222**	**138,618**	100%
Depreciation			
Depreciation of own funds	2,139	3,221	43%
Amortization of grants	2,416	4,207	57%
Total	**4,555**	**7,428**	100%
Other Expenditure			
Other costs	4,052	7,275	199%
Financial expenses	74	14	0%
Financial income	2,636	3,631	99%
Total	1,490	3,658	100%
Net Profit/Loss	1,526	-5,914	

PE Vodovod Ohrid, Financial Report（2020）

Balance Sheet

The balance sheet is shown in Table 3.20.

Table 3.20 Balance Sheet (PE Vodovod Ohrid)

(1,000 MKD)

	2019	2020
Assets		
Fixed Assets		
Tangible assets	382,806	387,889
Property, building and equipment	591,481	603,092
Write-off	-208,675	-215,203
Intangible assets	1,115	808
Intangible assets	2,272	2,164
Write-off	-1,157	-1,356
Fixed Assets Total	**383,921**	**388,697**
Current Assets		
Stocks	22,716	25,894
Receivables	385,295	359,961
Receivable from customers	331,031	343,078
Claim from the state for taxes	1,068	1,505
Other receivables	836	246
Cash and cash equivalent	52,360	15,132
AVR	5,526	1,624
Current Assets Total	**413,537**	**387,479**
Capital and Liabilities		
Capital and reserves	338,420	320,739
State-public capital	241,367	241,367
Accumulated profit	96,066	85,286
Accumulated loss	987	-5,914
Current liabilities	327,858	315,804
Non-current liabilities	131,179	139,634
Long-term liabilities	1,577	1,577
Grant	129,602	138,057
Capital and Liabilities Total	**797,457**	**776,177**

Source: PE Vodovod Ohrid

2) Billing and collection

Water and sewage charges

Table 3.21 shows the water tariffs. Customers other than households, such as public institutions and general companies, are classified in the "industrial" category. PE Vodovod Ohrid adopted two parts of tariff structure which combined fixed tariff rate and metered tariff rate. The unit price of the tariff is based on a uniform metering system by that the price remains constant even if the water consumption increases.

Table 3.21 Water Tariff Rate(2018-2019)(PE Vodovod Ohrid)

Charges	Category	Unit	2018	2019
Metered Charge	Domestic	MKD/m^3	27.41	27.41
	Industrial/ Commercial	MKD/m^3	39.20	39.20
Fixed Charge	Domestic	MKD	70	100
	Industrial/ Commercial	MKD	100	120

Source: PE Vodovod Ohrid
[Note] VAT is not included in the above amount

Number of customer connections

The total number of customer connections of PE Vodovod Ohrid is 33,065 (2021), of which 31,915 (95%) are general households and 2,150 (5%) are industrial and commercial as shown in Table 3.22.

Table 3.22 Customer Connection (PE Vodovod Ohrid)（2019）

Region	Number of connection		Total
	Domestic	Industrial/Commercial	
Ohrid	30,915	2,150	33,065

Source: PE Vodovod Ohrid

Billing and Collection

Customer payment options include: i) cash payment at the counter, ii) cash payment at the post office/bank, iii) direct debit at the post office/bank and iv) internet payment. Remote payment is also available for owners of single-family houses and apartments who do not live there permanently, through methods iii) and iv) above.

(5) Major issues

- The non-revenue water ratio has not been calculated due to the failure of the measuring equipment (flow meters) in the spring and reservoirs. However, according to the results calculated based on the design capacity and operating hours of the pumps, the non-revenue water ratio is as high as about 70%.
- It is necessary to maintain and repair the malfunctioning flowmeters and update them as necessary.
- The cost of electricity accounts for a large part of the operating expenses because raw water is transported by transmission and distribution pipelines for more than 10 km. A major challenge is to reduce the cost of electricity by distributing water through natural flow and to solve the shortage of drinking water during the tourist season.
- There is a need for improved know-how and capacity for GIS programs, practical application of SCADA systems and knowledge and advice on maintenance and repair of broken equipment in general and vehicles in particular.

3.2.8 PE Vodovod i Kanalizacija Struga

(1) Background

PE Vodovod i Kanalizacija Struga is one of the three new PE created following the demolition of the former PE PROAQUA in 2018. The decision of the Steering Committee of the former PE PROAQUA (No. 02-1126 / 3, 10/2019) and the decision of the Municipality of Struga (No. 03 1205/1, 10/2019) decided to establish it as a municipal PE managed by the Municipality of Struga. In December 2019, the registration of the former PE PROAQUA was cancelled and at the same time, PE Vodovod i Kanalizacija Struga was established.

(2) Scope of work

From the former PE PROAQUA, the water supply, sewerage and drainage services of the Municipality of Struga, except for the operation and maintenance of the primary sewage trunk line, trunk line and

Vranista STP, have been transferred to PE. The main scope of work is as follows:

- Water intake from water sources, water treatment and drinking water supply
- Collection, treatment and discharge of sewage from secondary and tertiary sewers of customers in the Municipality of Struga
- Drainage of stormwater from urban areas

(3) Organization and departments

1) Management body

The Management Board is the highest decision-making body for the operation of PE. There is also a Supervisory Board that oversees financial and technical matters. The Management Board consists of eight members and the Supervisory Board consists of five members, who are appointed by the municipal council of the Municipality of Struga.

PE Vodovod i Kanalizacija Struga is a municipal-funded PE and the municipality has authority over personnel issues of the PE. Therefore, XX explained to us that the municipality can change the head of PE if it causes problems. The activities of PE Vodovod i Kanalizacija Struga are checked and evaluated by the Public Service Department in the Audit Division. The department consists of five members of the Supervisory Board.

2) Departments

PE's departments are divided into four main sectors, with the Water Supply Facilities, Production and Water Treatment Sector responsible for technical matters. The Sewerage Maintenance Department of the same sector is in charge of the maintenance and management of sewerage facilities.
The composition of the departments and the number of staff are shown in Table 3.23.

3) Staffing

According to Table 3.23, the number of employees is 136, which is a decrease of 6 from a year ago. The ratio of administrative and technical staff, excluding the President of PE, is 53% and 47%, respectively, with a large number of administrative staff. Considering the staff composition as a sewerage PE, the staff composition lacks balance. Approximate criteria could be that the number of technical staff members is two times or more than the number of administrative staff.

At the time of the dismantling of the former PE PROAQUA, the staff of the then Struga Water and Sewerage Unit were transferred to PE Vodovod i Kanalizacija Struga basically intact.

The number of staff per 1,000 connections is 14.3.

Table 3.23 Number of Staff Members by Section

Section		Staff number (Actual)
Director		1
Secretary		0
Driver		0
1. Sector for Financial and Commercial Operations		
	Head	
	1.1 Dept. of Accounting	10
	1.2 Dept. of Public Procurement	5
	1.3 Dept. of Automatic Data Processing	1
2. Sector for General and Legal Affairs		
	2.1 Dept. of General and Legal Affairs	6
	2.2 Dept. of Human Resources	4
	2.3 Dept. of Security and Facility Maintenance	13
3. Sector for Water Supply Facilities, Production and Water treatment		
	3.1 Dept. of Technical Affairs and Services	10
	3.2 Dept. of Maintenance and Reconstruction of Water Supply Network and Connection	19
	3.3 Dept. of Maintenance of Sewerage and Stormwater	5
	3.4 Dept. of Maintenance of Chlorination Stations	24
	3.5 Dept. of Machinery and Vehicles	6
4. Sector for Billing		
	4.1 Dept. of Billing (household connection)	25
	4.2 Dept. of Billing (non-household connection)	7

Source: PE Vodovod i Kanalizacija Struga

(4) Financial status and billing and collection

1) Financial Status

Income Statement

Operating revenue for FY2020 is MKD 82 million, of which water and sewage business revenue (the core business) accounts for MKD 70 million or 85%.

Operating expenditure for FY2020 is MKD 93 million. The largest component of operating expenditure is employee salaries, at 54% of the total. This is followed by equipment and power expenses (16%). Electricity alone accounts for 16% of the total operating expenditure, which is relatively large because raw water is pumped from intake points more than 10 km away.

When the ERC examines the setting of tariffs, it allocates costs according to the proportion of income from each project and examines appropriate tariffs.

2) Billing and collection of fees

Water and sewage charges

Table 3.24 shows the water and sewerage tariffs. Water and sewerage charges are divided into two categories: general household and non-general household. All non-household customers, such as

industrial, commercial, public institutions and general businesses, are classified in the "non-household" category. The tariff is based on a uniform metered rate, by which the price remains constant even if the amount of water consumed increases. In addition to over-the-counter payment and bank payment, online payment has been introduced as a payment method.

Table 3.24 Water and Sewerage Charge (PE Vodovod i Kanalizacija Struga)

Category	Unit	2019	2020
Water supply			
Domestic	MKD/m^3	29.61	27.50
Non-domestic	MKD/m^3	44.59	43.08
Sewerage			
Domestic	MKD/m^3	10.98	9.73
Non-domestic	MKD/m^3	20.01	18.26

Source: PE Vodovod i Kanalizacija Struga
[Note] VAT is not included in the above amount

Customer Connection

Number of customer connection for water service is 16,313 connections in 2020 as shown in Table 3.25. The composition is 14,908 connections for household and 1,405 connections for non-household. Number of customer connection for sewerage service is accounted for 9,522 connections. The composition is 8,384 connections for household and 1,138 connections for non-household.

Table 3.25 Number of Customer Connection for Water and Sewerage Service (FY2020)

	Customer type	Number of connection
Water supply	Household	8,384
	Non-household	1,138
	Total	9,522
Sewerage	Household	8,384
	Non-household	1,138
	Total	9,522

Source: PE Vodovod i Kanalizacija Struga

Billing and Collection

PE Vodovod i Kanalizacija Struga makes billing and collection combined water charge with sewerage charge. In FY2020, the total amount of fee billing and fee collection was MKD 92 million and MKD 71 million, respectively, with a fee collection rate of 78%. Of the total amount billed, general households accounted for about 70%. The fee collection rate was 78% for general households and 76% for non-general households, with no significant difference as shown in Table 3.26.

Table 3.26 Tariff Revenue Collection（FY2020）

Month	Domestic（MKD）		Collection efficiency	Non-domestic（MKD）		Collection efficiency	Total（MKD）		Collection efficiency
	Billed amount	Collected amount	%	Billed amount	Collected amount	%	Billed amount	Collected amount	%
1	5,290,409	4,068,767	77	2,216,786	1,266,319	57	7.507.195	5,335,086	71
2	5,234,591	3,482,034	67	2,298,773	2,229,849	97	7,533,364	5,711,883	76
3	5,183,279	3,367,375	65	1,969,100	1,349,664	69	7,152,379	4,717,039	66
4	5,224,749	3,244,945	62	1,742,064	994,906	57	6,966,813	4,239,851	61
5	5,328,614	3,970,973	75	1,573,639	1,392,886	89	6,902,253	5,363,859	78
6	5,626,342	4,070,347	72	1,868,285	1,458,504	78	7,494,627	5,528,851	74
7	5,754,983	4,340,836	75	2,970,377	1,350,276	45	8,725,360	5,691,112	65
8	6,158,938	5,550,393	90	2,854,038	1,275,949	45	9.012.976	6,826,342	76
9	5,942,242	4,928,588	83	3,187,780	1,518,836	48	9,130,022	6,447,424	71
10	5,543,960	4,903,946	88	2,347,723	1,926,000	82	7,891,683	6,829,946	87
11	5,493,649	4,675,764	85	2,033,144	3,134,909	154	7,526,793	7,810,673	104
12	5,382,568	4,899,450	91	1,692,904	2,361,460	139	7,075,472	7,260,910	103
Adjust	-506,588			-116,613			-623.201		
Total	65,657,736	51,503,418	78	26,638,000	20,259,558	76	92,295,736	71.762.976	78

Source: PE Vodovod i Kanalizacija Struga

The need to improve fee collection has been recognized in the action plan of PE. The following items, which are not currently being implemented, are issues that need to be addressed in the collection of fees for water and wastewater services

- Reminding customers through SMS and email
- Application of subsidies to the poor and promotion of payment
- Review of fee collection methods and consideration of new payment options
- Proper data management of unpaid bills
- Consideration of measures to suspend connections to non-paying customers
- Monitoring of illegal connections

(5) Public relations and awareness-raising activities

At present, there are few awareness-raising activities to promote payment of fees to non-payers. In addition, there are no specific awareness-raising activities to curb the dumping of wet wipes and other waste (see 3.4 Operation and Maintenance Status of Facilities).

The system allows customers to post their opinions and complaints on PE's website. The website also accepts complaints about inaccurate water billing volume, in addition to corruption accusations and customer complaints.

3.2.9 Outline of Performance Indicators (PIs) of Public Enterprises

(1) Performance indicators (PIs) of public enterprises

Table 3.27 shows the key operational indicators for water supply and sewerage services of each PE.

Table 3.27 Performance Indicators (PIs) of Public Enterprises on Sewerage Services (FY2020)

PIs	Unit	PE Kolektorski System	PE Niskogradba	PE Vodovod Ohrid	PE Vodovod i Kanalizacija
1. Coverage ratio*1		62%	94%	-	-
2. Number of Employees per 1,000 connection		3.2	4.3	8.1	14.3
Number of Employees	Person	61	113	268	136
Number of Connection	Connection	19,000	26,256	33,065	Water 16,313 Sewerage 9,522
3. Cost recovery – sewage collection	%	114%	108%	96%	82%
Operating income	MKD 1,000	79,452	66,932	143,790	82,088
Operating expenditure	MKD 1,000	69,908	61,770	149,704	99,594
4. Tariff					
Volumetric (Household)	MKD/m^3	16.64	9.05	27.41	9.73
Volumetric (Non-household)	MKD/m^3	26.58	15.66	39.20	18.26
Fix (Household)	MKD/m^3	-	57.14	100	-
Fix (Non-household)	MKD/m^3	-	95.24	120	-
5. Collection efficiency	%	83%	65%	93%	77%

(Reference information: Number of Employees per 1,000 connection*2)

Service Type	Water supply and sewerage both	Water supply only	Sewerage only
North Macedonia (average)	5.08	3.13	2.73
EU region (average)	4.39	4.78	-
EU region (upper 20%)	1.63	1.45	0.9
Worldwide (average)	35.50	12.63	7.43
Worldwide (upper 20%)	1.44	0.65	1.08

[Note]
*1: Coverage = (Number of population treated) / (Number of population in the administrative area)
*2: International Benchmarking Network (2016). Average value is different by target service type of water/ sewerage service.
Source: JICA Survey Team based on each PE information

(2) Number of staff in each PE

According to the database of North Macedonia registered in the International Benchmarking Network (FY2016), the number of staff per 1,000 connections of the average in EU and in North Macedonia are respectively 4.39 persons and 5.08 persons for water supply and sewerage services. The averages for only water supply service are 4.78 persons in EU and 3.13 persons in North Macedonia, and the average of only sewerage service are not available in EU and 2.73 persons in North Macedonia.

Using this as a rough guide for comparison, the number of employees is above average for all of the municipalities, but the difference is not so great for PE Kolektorski and PE Niskogradba. On the other hand, the number of employees in PE Vodovod Ohrid and PE Vodovod i Kanalizacija Struga Waterworks is more than twice the average, which means that the number of employees per connection is considered to be high and there is still room to reduce the number of employees to an efficient and appropriate size.

While, in case of sewerage service only, the number of employees per 1,000 connections in the upper 20% of EU region and worldwide is in the rage between 0.9-1.08. Therefore, PE Kolektorski and PE Niskogradba are required to target these levels to promote further management efficiency.

Also, in general, it is rare that two PEs specialized sewerage services exist in one municipality and that the service operation is subdivided as in the case of the municipalities of Ohrid and Struga. From the broad perspective beyond the PE unit, the necessity to reduce the staff numbers and to enhance management efficiency will become increasingly crucial issue.

(3) Level of water and sewerage charges in each PE

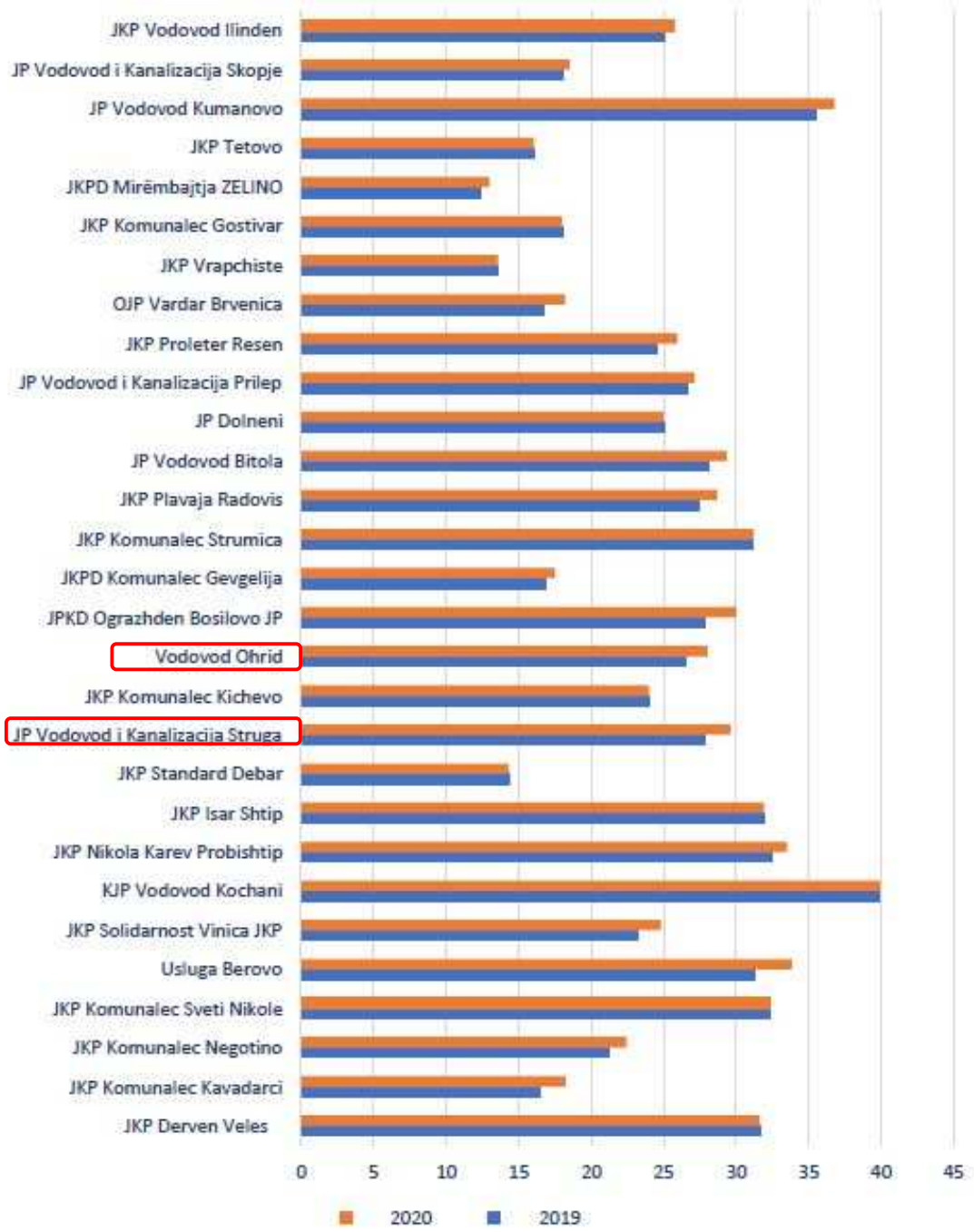
ERC's annual report (2020) compares sewerage rates in cities with more than 10,000 inhabitants nationwide.

Comparing water and sewerage rates (more than 10,000 inhabitants, for general households), the rates of PE Vodovod Ohrid correspond to the tenth and thirteenth highest rates out of 29 PEs nationwide, shown in Figure 3.6.

Sewerage charges are categorized into two areas: urban sewerage and sewerage treatment. PE Vodovod i Kanalizacija Struga and PE Niskogradba which handle secondary and tertiary sewerage pipes are classified as urban sewerage, while PE Kolektorski which handles primary sewerage pipes and treatment plants is classified as sewerage treatment.

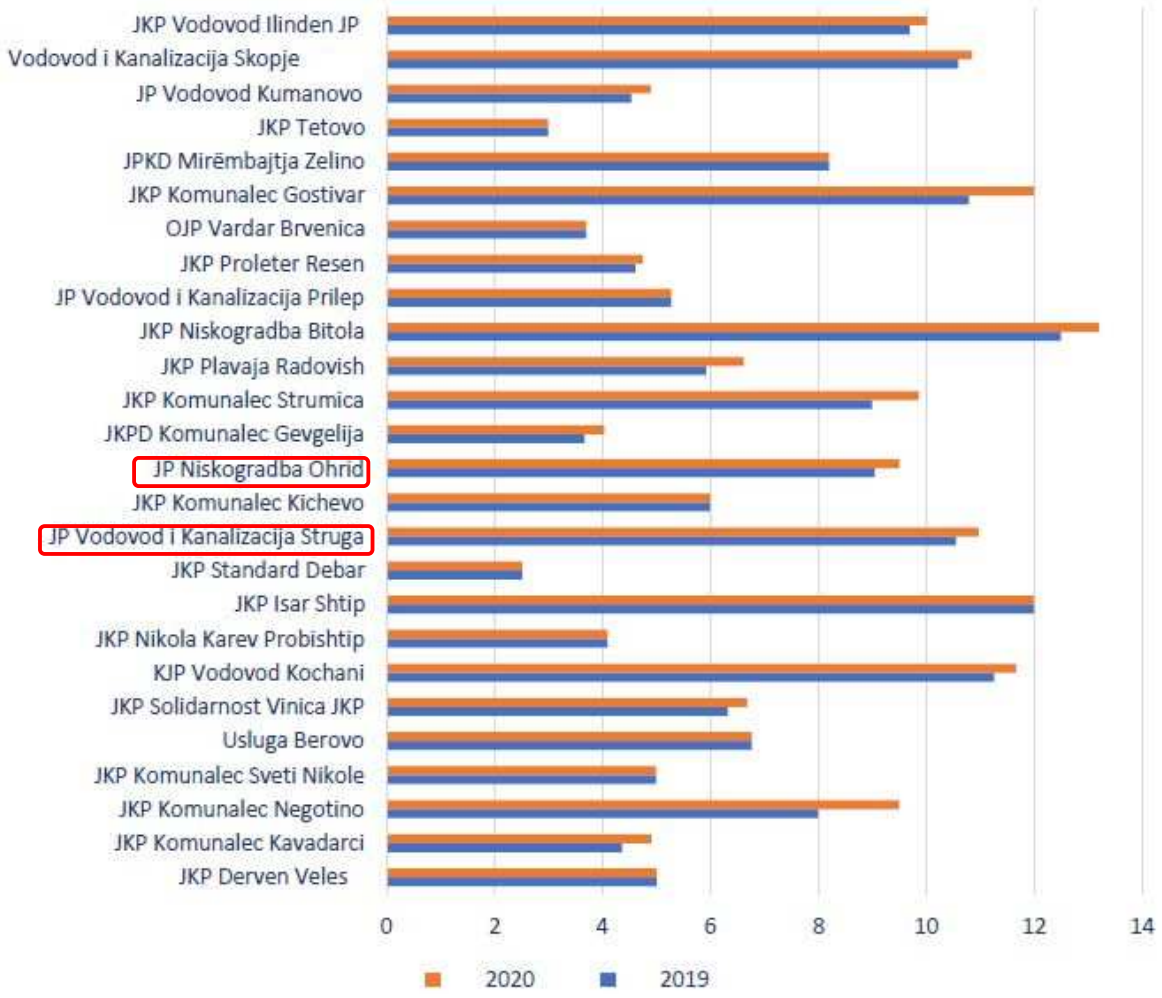
In terms of tariffs for municipal sewerage service (for households with more than 10,000 inhabitants), PE Vodovod i Kanalizacija Struga is the sixth and PE Niskogradba the ninth most expensive of the 26 municipalities nationwide, shown in Figure 3.7. By national standards, it can be said that water rates are considered to be at a medium level, while sewerage rates (urban sewerage) are set at a relatively high level.

Comparing the level of charges for sewerage treatment (for households with a population of 10,000 or more), PE Kolektorski charges (FY2020) is the highest among the 13 public enterprises nationwide shown in Figure 3.8.



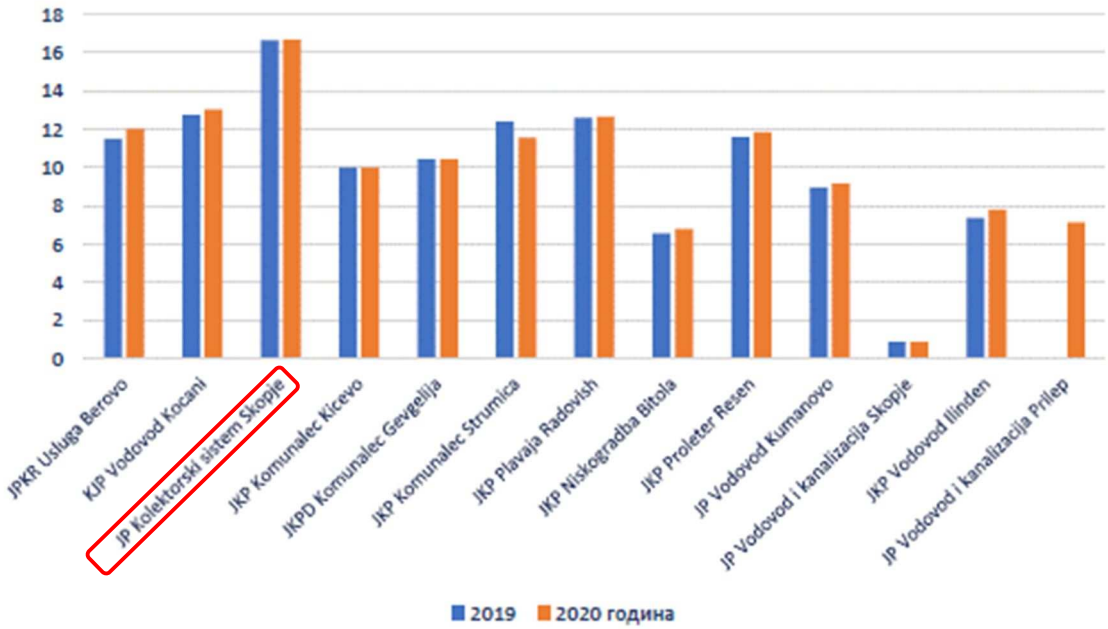
Source: ERC Annual Report（FY2020）

Figure 3.6 Water Supply Charge in Macedonia (Population More than 1 million people, Domestic: MKD/m^3) Comparison Figure



Source: ERC Annual Report（FY2020）

Figure 3.7 Sewerage Charge in Macedonia (Urban Wastewater)(Population More than 1 million people, Domestic: MKD/m^3) Comparison Figure



Source: ERC Annual Report（FY2020）

Figure 3.8 Sewerage Charge in Macedonia (Urban Wastewater)(Population More than 1 million people, Domestic: MKD/m^3) Comparison Figure

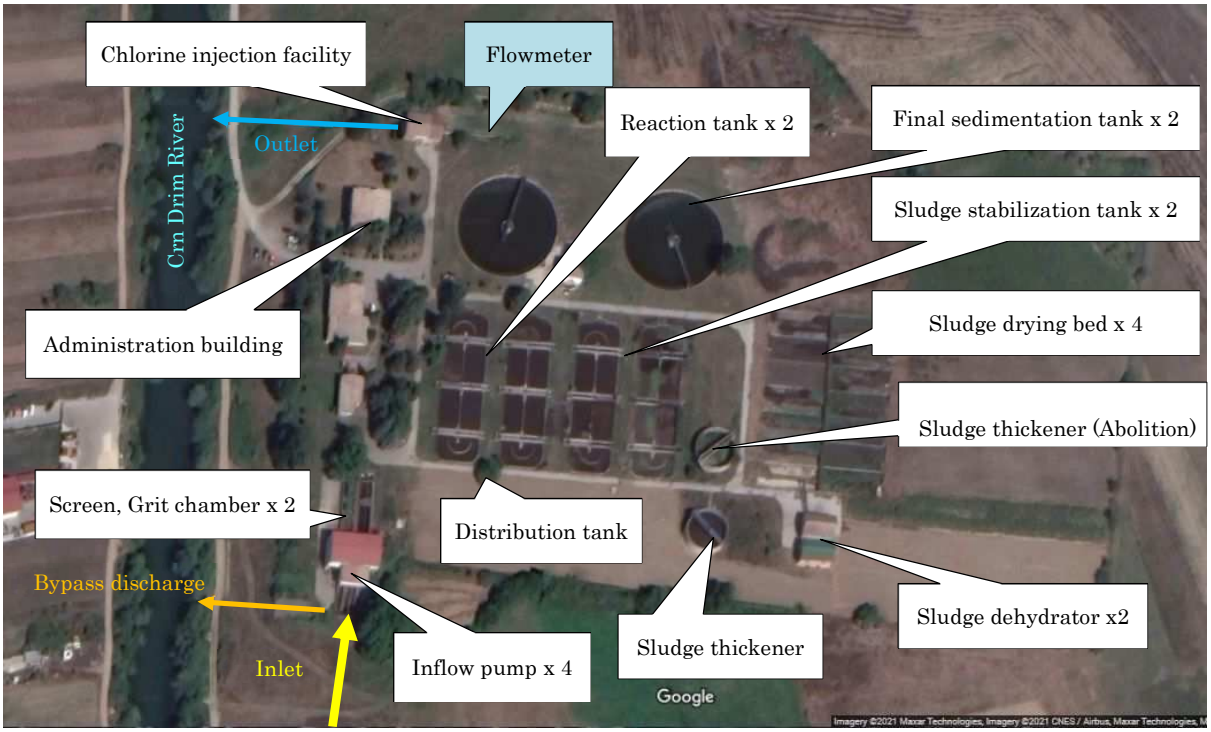
3.3 Sewerage Facilities

3.3.1 Vranista STP

The Vranista STP is an oxidized ditch sewage treatment plant that is responsible for the treatment of sewage generated around Lake Ohrid area. The overall layout is shown in Figure 3.9.

When the inflowing sewage exceeds the capacity of the Vranista STP, the part of the inflowing sewage is discharged directly into the Crn Drim River through a bypass discharge channel installed in front of the inflow pump facility.

- Location: North of downtown Municipality of Struga, right bank of the Crn Drim River
- Start of service: 1988 (construction started in 1985)
- Treatment capacity: 470L/sec (40,608m^3/day)
- Resident staff: 20 (daytime only, only guards at night)



Source：Google Earth

Figure 3.9 Layout of Vranista STP

As for the facilities in the treatment plant, two of four planned inflow pumps have broken down and have been removed, one of two planned sludge dewatering machines has failed, etc. as shown in Table3.28. It is in a serious situation of deterioration.

Table 3.28 List of Facilities at Vranista STP

Facility	Unit (Planed)	Operation (Available)	Remarks
Inflow pumps	4 units	2 units	2 Units have been Removed due to Failure
Screen and Grit Chamber	2 lines	1 line	Only 1 line is in Operation due to Screen Failure
Reaction Tank	2 tanks	2 tanks	
Sludge Stabilization Tank	2 tanks	2 tanks	
Sludge Thickener	2 tanks	1 tank	Newly installed by KfW in 2003, is in operation
Sludge Dehydrator	2 tanks	1 tank	Installed by Switzerland in 2010.
Sludge Drying beds	4 beds	4 beds	
Final Sedimentation Tank	2 tanks	2 tanks	
Chlorine injection facility	1 build	-	No chlorine injection equipment has been installed. Treated sewage water is discharged without chlorination
Administration building	1 build	1 build	Water Quality Lab Building is Tilting due to ground subsidence

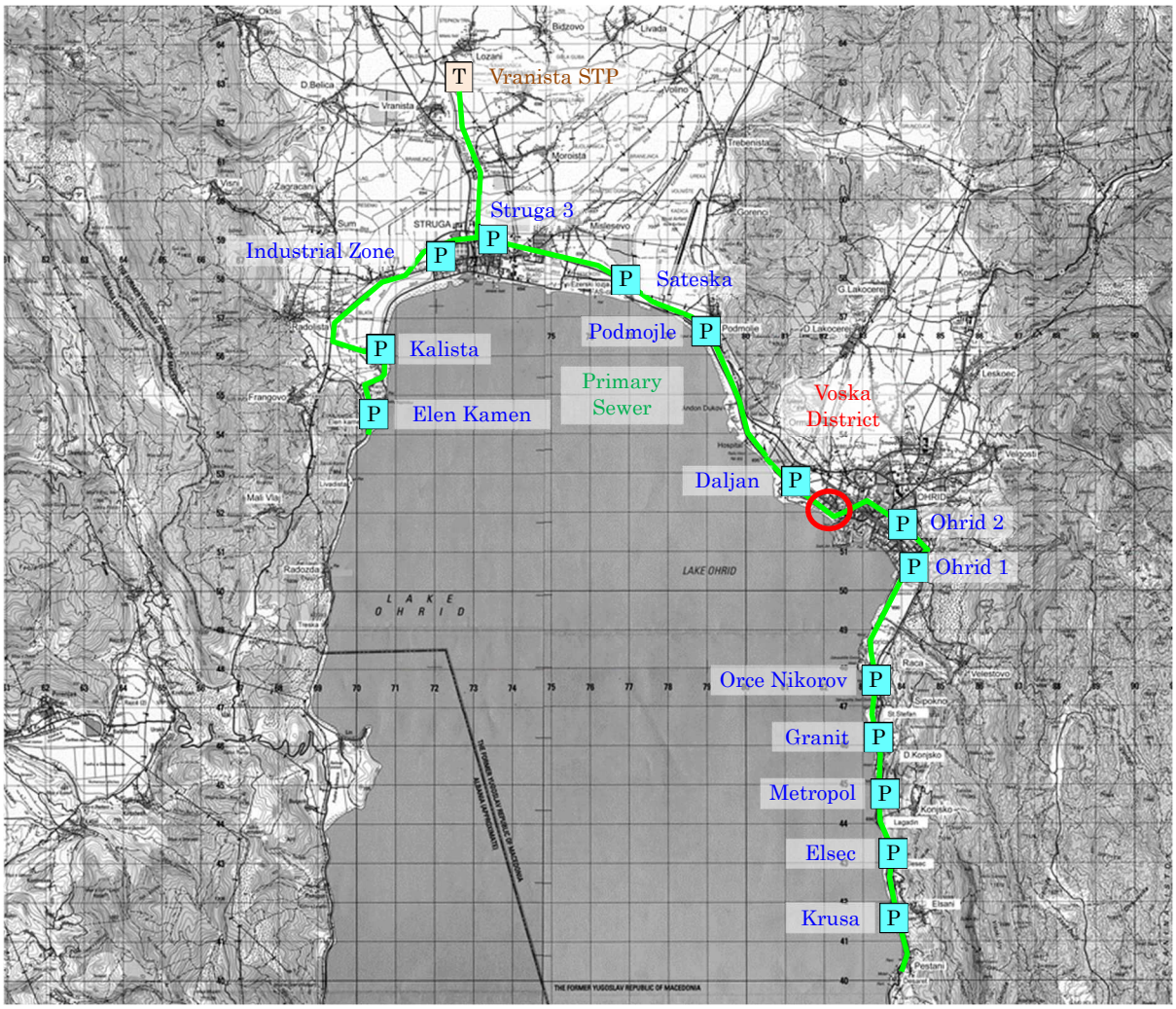
Source: JICA Survey Team

3.3.2 Primary Sewer

The primary sewer collects sewage generated from the area around Lake Ohrid and leads to the Vranista STP. It consists of about 41 km of sewer pipes and 14 PSs (Figure 3.10).

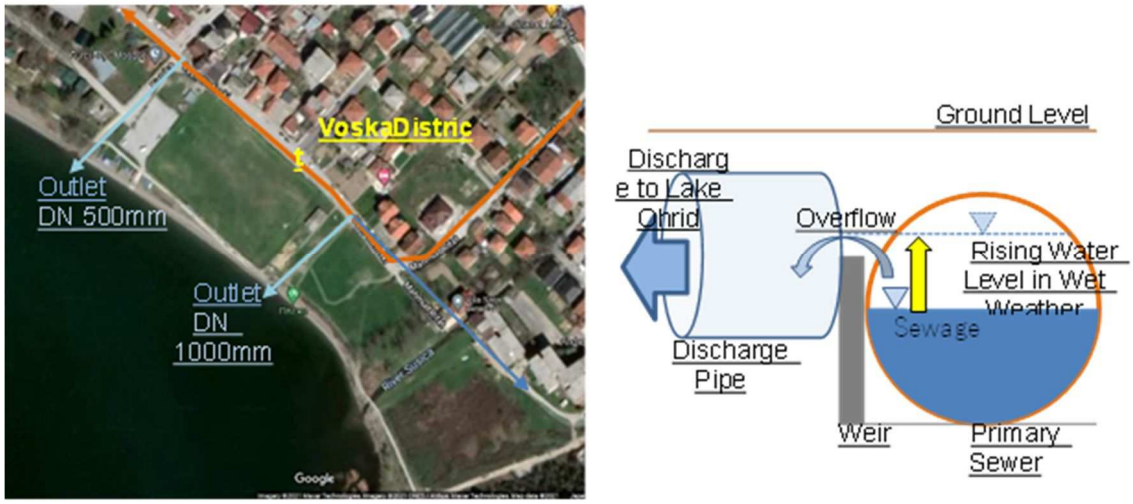
Primary sewers are located along the shore of Lake Ohrid. In the Voska District located in the northern part of downtown of Municipality of Ohrid, two illegal discharge pipes into Lake Ohrid have been installed (Figure 3.11). This district is prone to flooding and it is said that local businesses (hotels, stores, etc.) installed these pipes to alleviate the problem, but the backgrounds of their installation are unclear.

In wet weather conditions, the water level in the primary sewer rises due to the inflow of rainwater, some part of untreated sewage overflows into the discharge pipe and discharges to Lake Ohrid. This illegal discharge contributes to the deterioration of the water quality of Lake Ohrid (Photo 3.1).



Source: PE Kolektorski

Figure 3.10 Location of Primary Sewer



Source: JICA Survey Team

Figure 3.11 Location of Iligall Outlet and Untreated Sewage Discharge Mechanism

Discharge Point in Wet Weather (Municipality of Ohrid)

Discharge Point in Wet Weather (Enlargement of red square part)

Discharge Point 1 (Dry weather)

Discharge Point 1 (Wet weather)

Discharge Point 2 (Dry weather)

Discharge Point 2 (Wet weather)

Source: JICA Survey Team photos (October 2021)

Photo 3.1 Discharge Point in Wet Weather (Voska District)

14 PSs installed in the primary sewer are shown in Table 3.29. In 2010, 6 PSs were rehabilitated mainly by replacing the electric motors by Switzerland assistance. However, these PSs are still deteriorating rapidly, due to improper maintenance and 8 of the 14 PSs have some failed pumps. As a result, the

number of available pumps in each PS does not meet the planned number.

Therefore, PE Kolektorski is currently conducting a tender for the rehabilitation of 4 pumping facilities in Krusa, Elsec, Metropol and Kalista (as of November 2021).

4 PSs have also discharge-pipes to discharge untreated sewage into Lake Ohrid (one via the Daljan River). The current status of each PS is shown in Photos 3.2 to 3.5.

Table 3.29 List of PSs installed in the Primary Sewer

PS Name	Pump Type	Q'ty (Planned) [Unit]	Q'ty (Unavailable) [Unit]	Rehabilitation, etc.	Discharge to
Krusa	Submersible	2		Under bidding for rehabilitation	
Elsec	Submersible	2	1	Under bidding for rehabilitation	
Metropol	Submersible	2	1	Under bidding for rehabilitation	
Granit	Screw	3	1 (Not installed)		
Orce Nikolov	Screw	2	1		
Ohrid 1	Screw	3	1	2 Units by Swiss in 2010	
Ohrid 2	Screw	3	1	2 Units by Swiss in 2010	
Daljan	Screw	4		3 Units by Swiss in 2010	Daljan river
Podmojle	Screw	4	2	3 Units by Swiss in 2010	Lake Ohrid
Sateska	Screw	4	1	3 Units by Swiss in 2010	
Struga 3	Screw	6	2	5 Units by Swiss in 2010	Crn Drim River
Industrial Zone	Submersible	2			
Kalista	Submersible	2		Under bidding for rehabilitation	Lake Ohrid
Elen Kamen	Mono pump	2			Lake Ohrid

Source：JICA Survey Team



Outlook | Pump Well | Pump Outlet

Krusa PS



Outlook | Pump Well | Pump Outlet

Elsec PS



Outlook | Inside of PS | Pump Outlet

Metropol PS



Outlook | Pump Room | Pump Outlet

Granit PS

Source：JICA Survey Team photos (October 2021)

Photo 3.2 PSs located in the Primary Sewer Line (1/4)

Outlook

Inflow Pump (Screw)

Pump Room

Orce Nikolov PS

Outlook

Pump Room

Billboard of Rehabilitated Pump (by Switzerland Aid)

Ohrid 1 PS

Outlook

Inflow Pump (Cover)

Pump Room

Ohrid 2 PS

Outlook

Inflow Pump (Screw)

Direct Discharge Point

Daljan PS

Source：JICA Survey Team photos (October 2021)

Photo 3.3 PSs located in the Primary Sewer Line (2/4)



Outlook | Inflow Pump (Screw) | Direct Discharge Point

Podmojle PS



Outlook | Inflow Pump (Screw) | Pump Room

Sateska PS



Outlook | Inflow Pump (Struga Side) | Inflow Pump (Ohrid Side)



Pump Room | Direct Discharge Point | Discharge to Crn Drim River（2 Points）

Struga 3 PS

Source：JICA Survey Team photos (October 2021)

Photo 3.4 PSs located in the Primary Sewer Line (3/4)

Outlook | Pump Well | Inside of PS

Industrial Zone PS

Outlook | Pump Well | Discharge Port（to Lake Ohrid）

Kalista PS

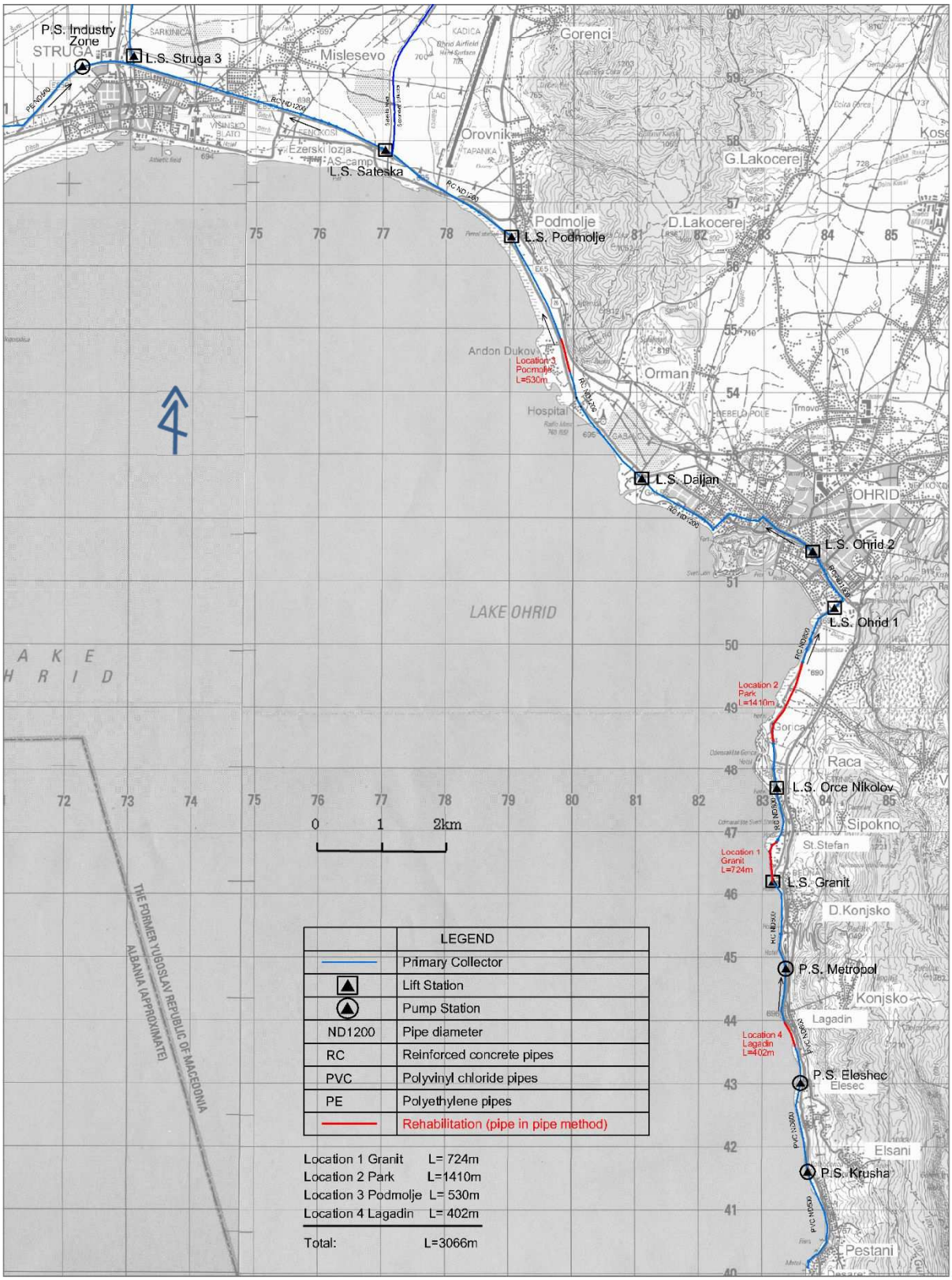
Outlook | Chamber Room | Inside of PS

Elen Kamen PS

Source: JICA Survey Team photos (October 2021)

Photo 3.5 PSs located in the Primary Sewer Line (4/4)

Primary sewers are deteriorating rapidly and the infiltration of unidentified water is considered to be a problem due to damage of sewers pipes and intrusion of tree roots etc. Based on the priority of rehabilitation according to the JICA survey in 2015, the government of North Macedonia has started the primary sewer rehabilitation project in 2020. In 2020, about 3.1 km section of the primary sewer was rehabilitated by a Croatian company using the pipe in pipe method. (Figure 3.12). In 2021, the project was postponed due to the government's budget allocation for Covid-19 disaster control. But this rehabilitation project would be continued in 2022.



Source: PE Kolektorski

Figure 3.12 Location of Primary Sewer Rehabilitation

3.3.3 Secondary Sewer

The information on the secondary sewers installed in the municipalities of Ohrid, Struga and Debrca is managed by CAD drawings. According to PE Niskogradba, the CAD drawings are currently being converted into GIS as a national project, along with information on other infrastructure facilities such as underground power lines and communication cables. But the progress is slow.

(1) Municipality of Ohrid

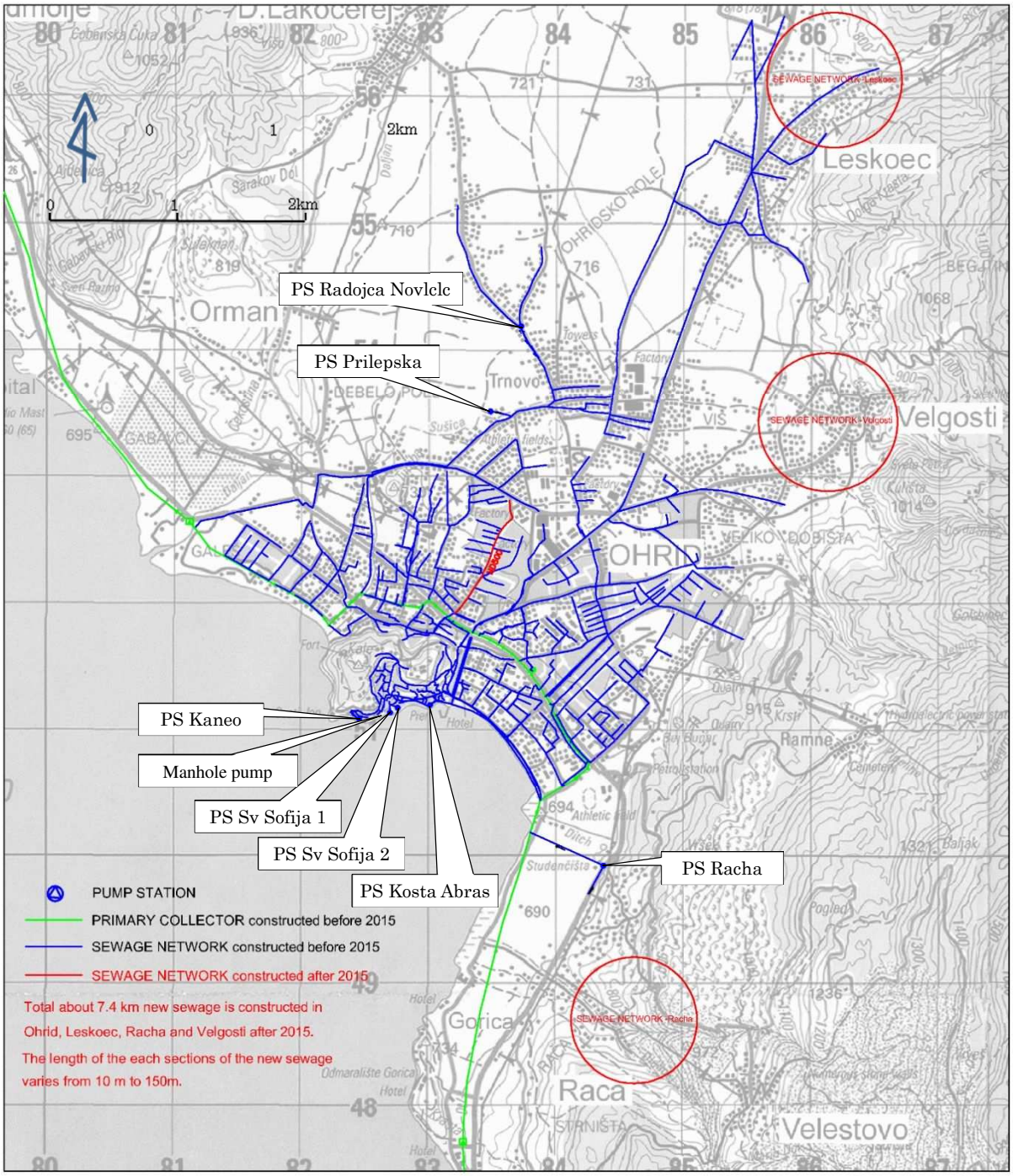
Most of the secondary sewers in the Municipality of Ohrid were constructed as combined sewers in the 1970s and 1980s. Some drainage sewers were constructed in some areas to convert existing combined system to separate sewer system, but most of them are still combined sewers. There are 7 PSs and a small manhole PS in the secondary sewer network system (Table 3.30). The small manhole PS having discharge pipe, discharges untreated sewage into Lake Ohrid in wet weather conditions. Since 2015, the sewerage service area has continued to expand gradually, in line with the expansion of urban areas.

A location map of secondary sewers (separated and combined) and PSs in the Municipality of Ohrid is shown in Figure 3.13 and secondary sewers (stormwater) are shown in Figure 3.14.

Table 3.30 PSs in the Municipality of Ohrid

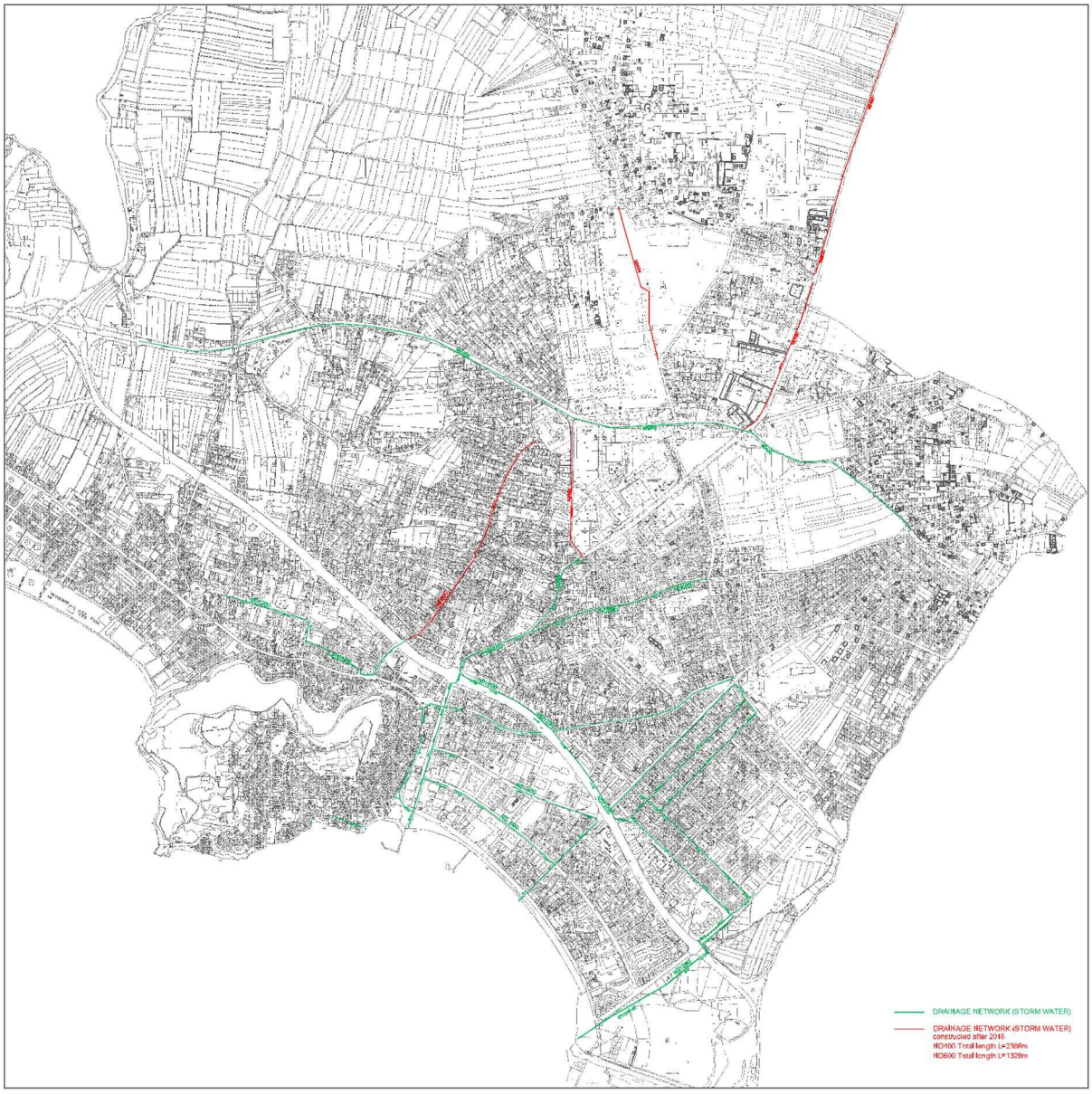
PS Name	Pump Type	Q'ty (Planned)	Q'ty (Unavailable)	Problems	Discharge
Radojca Novicic	Submersible	2 units	1 unit	• A fire broke out in the electrical system in 2020. • Only one unit has been repaired.	To Secondary Sewer No Discharge
Kaneo	Horizontal	2 units	1 unit	• When the lake level is high and strong winds are blowing, the pumps are submerged and fail due to the lake water hitting the shore.	To Secondary Sewer
Kosta Abrash	Submersible	2 units		• The pumping pipe from the PS passes under the building of ALECSANDRIJA Hotel next to the PS, so it is difficult to maintain.	To Secondary Sewer No Discharge
Racha	Submersible	2 units		• When the inflow sewer is full and the pump well level rises, sewage naturally overflows into the primary sewer. • Pump failures fluently occur (every week in recent years) due to the clogging materials, mainly wet wipes.	To Secondary Sewer No Discharge
Prilepska	Submersible	2 units			To Secondary Sewer
Sv Sofija 1	Submersible	2 units			To Secondary Sewer
Sv Sofija 2	Submersible	2 units			To Secondary Sewer
Manhole Pump	Submersible	2 units			To Secondary Sewer, but discharge to Lake Ohrid in wet weather condition

Source：JICA Survey Team



Source: PE Niskogradba

Figure 3.13 Location Map of Secondary Sewer (Separated and Combined) and of PSs in the Municipality of Ohrid



Source: PE Niskogradba

Figure 3.14 Location Map of Secondary Sewer (Storm Water) in the Municipality of Ohrid

(2) Municipality of Struga

Most of the secondary sewers in the Municipality of Struga were constructed as combined sewers in the 1970s and 1980s. Some drainage sewers were constructed in some areas to convert existing combined system to separate sewer system, but most of them are still combined sewers like the Municipality of Ohrid. There are 6 PSs in the secondary sewer network system (Table 3.31). At 3 of 6 PSs, some pumps have been left in disrepair or removed. At these PSs, sewage is designed to flow downstream if the water level in the upstream sewer rises. But the sewer upstream of the PS always keeps stagnant sewage in a full pipe. This may cause the accumulation of sludge and contaminants in the sewer, as well as the generation of malodors and hydrogen sulfide.

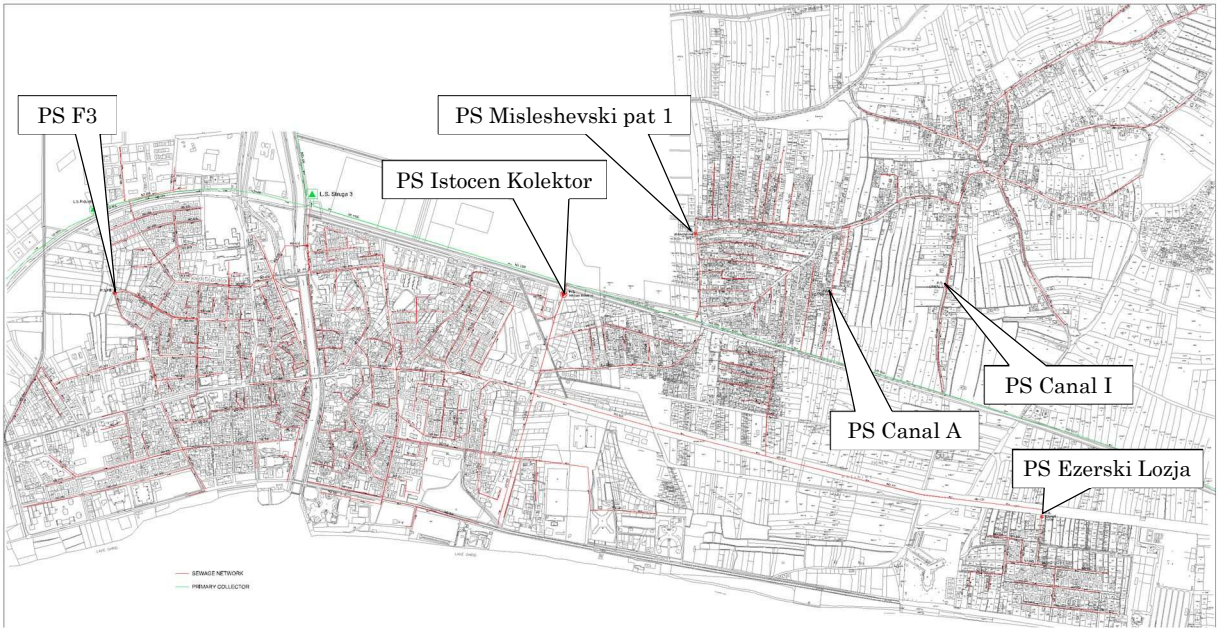
A location map of secondary sewers (separated and combined) and PSs in the Municipality of Struga

are shown in Figure 3.15, and secondary sewers (stormwater) are shown in Figure 3.16.

Table 3.31 PSs in the Municipality of Struga

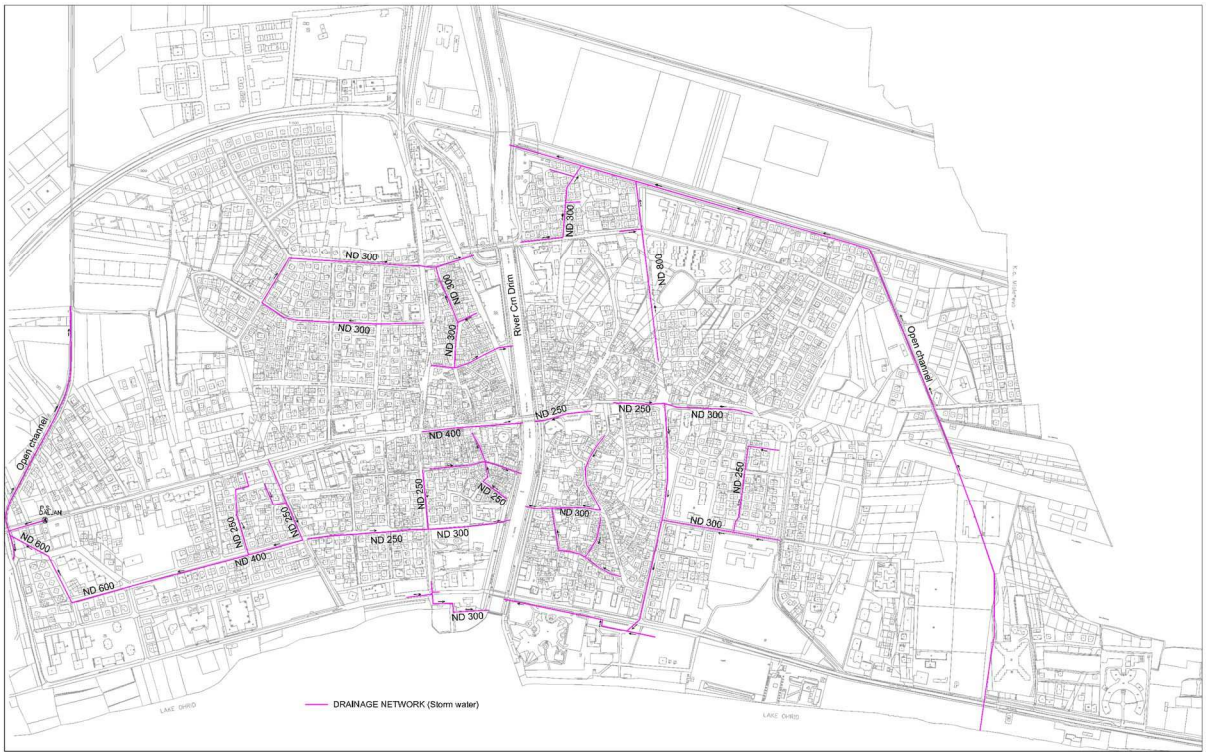
PS Name	Pump Type	Q'ty (Planned)	Q'ty (Unavailable)	Problems	Discharge
F3	Submersible	1 unit		• Temporary PS • The downstream sewer cannot be laid due to the land acquisition problem.	To Secondary Sewer
Istochen Kolektor	Submersible	2 unit		• Alternate operation • Due to the difficulty in acquiring land for the project, land for PS is insufficient	To Secondary Sewer
Misleshevski Pat 1	Submersible	1 unit	1 unit	• The pump is still out of order and the control panel has been removed.	To Secondary Sewer
Canal A	Submersible	1 unit	Removed	Ditto	To Secondary Sewer
Canal I	Submersible	1 unit	Removed	Ditto	To Secondary Sewer
EZERSKI LOZJA	Submersible	1 unit	-		To Secondary Sewer

Source：JICA Survey Team



Source: PE Vodovod i Kanalizacija Struga

Figure 3.15 Location Map of Secondary Sewer (Separated and Combined) and of PSs in the Municipality of Struga



Source: PE Vodovod i Kanalizacija Struga

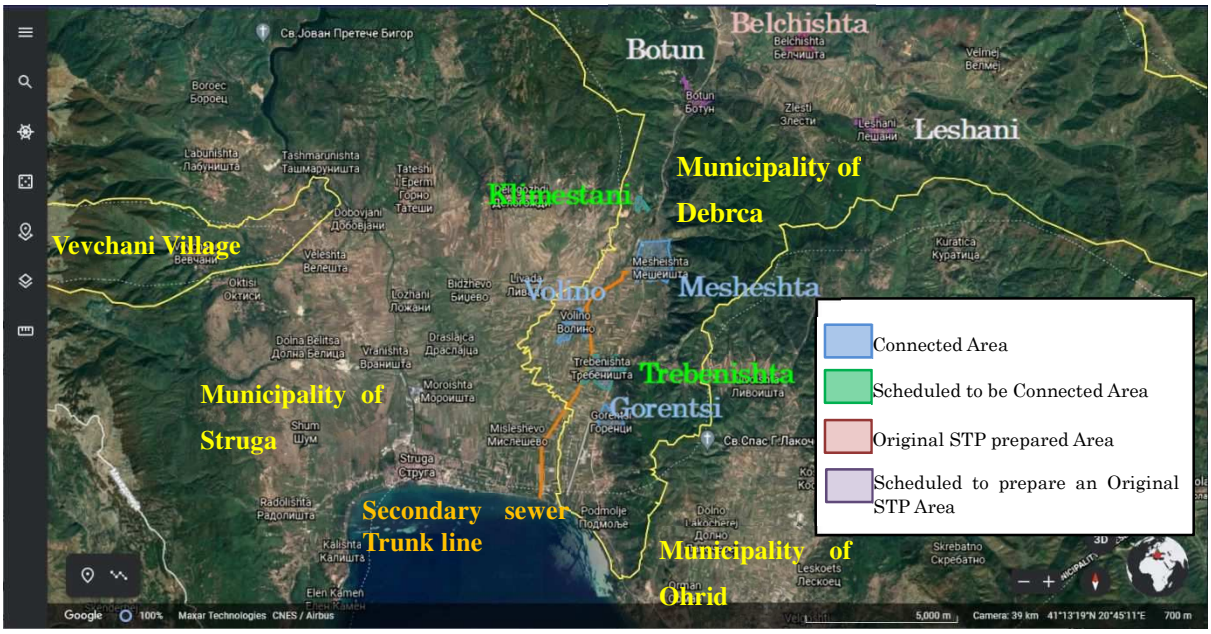
Figure 3.16 Location Map of Secondary Sewer (Storm Water) in the Municipality of Struga

(3) Municipality of Debrca

A secondary trunk sewer line was constructed by a World Bank project in 2014, which connects to the primary sewer near the Sateska PS. Overall, the secondary sewers for five districts in the lower basin of the Sateska River (Klimestani, Mesheshta, Volino, Trebenishta and Gorentsi) are planned to be constructed by the Municipality of Debrca's own budget and to be connected to the primary sewer. Three districts (Mesheshta, Volino and Gorentsi) have been connected as of November 2021. In the two unconnected districts (Klimestani and Trebenishta), septic tanks are currently used for individual treatment and the treated sewage is discharged into the Sateska River.

In the upstream areas of the Sateska River, decentralized treatment plants are planned to be constructed: Belchishta district has been constructed, Leshani district is scheduled to be constructed and Botun district was scheduled to be constructed in 2016 while it has been suspended due to the financial difficulties of the Municipality Debrca. The management for all sewage facilities in the Municipality of Debrca are carried out by PE Debrca.

The outline of sewerage system development in the Municipality of Debrca is shown in Figure 3.17.



Source：Google Earth & JICA Survey Team

Figure 3.17 Outline of Sewerage Development Plan for Municipality of Debrca

3.4 Operation and Maintenance Status of Facilities

3.4.1 Vranista STP and Primary Sewer

The operation and maintenance of Vranista STP and primary sewer are carried out by 20 staff of the PE Kolektorski, who are stationed at the Vranista STP. The remote operation and monitoring system have not been installed and all operation and control are carried out by checking the situation on-site.

(1) Vranista STP

The operation and maintenance status of the Vranista STP is shown in Table 3.32. There are many issues due to the lack of measurement equipment and personnel.

Table 3.32 Summary of Operation and Maintenance of Vranista STP

Item	Description	Issue
1) Staffs	There are only 20 staff members involved in operation management They are only assigned during the daytime.	The system cannot be managed 24 hours a day and there is a shortage of personnel.
2) Flow Control	The inflow volume is adjusted by operating available two inflow pumps. Usually, only one pump is operated, but when the inflow volume increases, such as during wet weather, two pumps are operated.	Flow meters are only installed in the waterways from the final settling tank to the chlorine mixing facility and detailed flow control is impossible.
3) Disposal of Screenings	Screenings trapped in the inflow screen are collected by the PE in the Municipality of Struga Corporation in charge of waste disposal and landfills.	
4) Disinfection	Although there is a chlorine injection facility, disinfection by chlorine injection is not implemented.	There are concerns about health hazards caused by pathogenic microorganisms contained in the treated effluent.
5) Water quality control	Water quality for inflowing sewage and discharged water is regularly tested at the water quality lab in the administration building. ・ Items to be tested two to three times a week: Water temperature, color, odor, COD, BOD5, pH, DO, electrical conductivity ・ Items to be tested once a week: SS ・ Items to be checked once a month: Cr, Mn, PO_4-P, Pb, Cd, Cl, Cu, NH_4, Ni, Al, Cl2, SO_4, NO_3-N, NO_2-N, Zn, CN	Although disinfection is not conducted, the inspection of E. coli or E. Coli group count, which is an indicator of pathogenic microorganisms, is not conducted.
6) Sludge Disposal	The sewage sludge is thickened, dewatered, sun-dried and then piled up in the field at the treatment plant site. When the PE PROAQUA was managing the site, the dried sludge was sold for agricultural use, but it has now been discontinued since the dried sludge for agricultural use is an illegal activity.	Since the final disposal site for the sludge has not been decided yet, the sludge is tentatively piled up in the treatment plant. It is necessary to consider the disposal method, such as securing a disposal site in the future etc.
7) Inspection frequency	The inspection frequency of the equipment is very low, ranging from once a month to several times a year. ・Inlet screen: Once a month ・Dewatering machine, electric engine: once or twice a year	Due to the extremely low frequency of inspection, preventive maintenance activities are not sufficiently carried out. This may lead to equipment failure and malfunction.

Note) Sewage sludge was sold to farmers when it was managed by the former PE PROAQUA. However, since the use of sewage sludge for farmland is prohibited by law, the sale of sewage sludge was discontinued after the dismantling of the former PE PROAQUA. As a result, the sewage sludge is piled up in the sewage treatment plant.
Source：JICA Survey Team

The changes in water quality of influent and effluent at Vranista STP from 2016 to 2020 are shown in Table 3.33 and Table 3.34.

In particular, influent BOD (see Figure 3.18 and Figure 3.19) is around 70 mg/L throughout the year,

although there are gradual fluctuations in BOD, which is higher during the summer tourist season from May to September and lower during the off-season from October to April. There is no significant change in this trend between 2016 and 2020.

The area around Lake Ohrid is a tourist spot and there are many commercial areas. This value of BOD 70 mg/L is quite low compared to the example of BOD values in commercial areas in Japan (Table 3.35).

This is probably because a large amount of unidentified water is flowing into the sewer and the sewage is diluted.

On the other hand, the water quality of treated sewage effluent was slightly lower in 2016, but since then, it has shown values of 8-12 mg/L throughout the year (Figure 3.19).

The water quality standards for treated sewage effluent in North Macedonia comply with EU directives: BOD_5 at 20°C: 25mg/L, COD: 125mg/L, T-P: 1mg/L, T-N: 10mg/L. The treated effluent water quality at the Vranista STP is below the standard for all indicators except for T-P, which was 1.06mg/L in November 2020, above the standard.

Table 3.33 Water Quality of Influent at Vranista STP

Item	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BOD5 at 20°C [mg/L]	2016		35.0	45.5	46.3	87.5	70.0	60.6	81.2	73.8	57.5	60.0	80.0
	2017	35.5	50.4	58.2	50.0	82.7	70.0	75.2	71.3	71.8	58.6	65.2	65.4
	2018	70.1	55.3	60.7	70.2	75.3	80.1	80.6	85.2	80.4	70.8	60.2	60.6
	2019	71.7	61.2	65.4	65.4	77.5	74.8	70.8	81.2	73.8	68.8	62.6	70.7
	2020	65.4	57.6	64.1	70.7	71.2	70.3	75.4	81.2	74.7	57.2	60.4	80.2
COD [mg/L]	2016		63.42	84.78	85.30	128.50	132.30	102.50	105.60	101.50	71.81	75.91	108.38
	2017	51.15	60.10	83.79	75.20	108.35	132.30	138.80	115.30	101.70	72.92	91.40	98.27
	2018	110.20	93.20	106.40	124.20	139.30	132.30	138.70	147.60	130.11	128.10	112.40	105.98
	2019	106.40	91.60	84.78	95.30	128.50	132.30	102.50	105.60	101.50	92.40	85.91	108.38
	2020	102.60	88.30	84.78	109.20	122.40	132.30	102.50	105.60	101.90	72.82	88.91	109.23
T-P(PO4-P) [mg/L]	2016		0.69		0.65		1.14	1.11	1.28			1.02	
	2017	0.59			0.64		1.04	1.12	0.98			0.85	
	2018	0.76			0.38		1.14	1.11	2.27			1.02	
	2019	1.39			1.13		0.89	1.11	1.96			0.80	
	2020	1.17			0.66		1.14	1.11	2.78			1.37	
NH4-N [mg/L]	2016												
	2017	0.05			0.05		0.02	0.01	0.02			0.02	
	2018	1.20			1.32		1.81	1.88	1.92			1.56	
	2019	1.69			1.33		1.37	1.63	1.88			0.57	
	2020	0.01			0.05		1.22	1.08	0.64			0.06	

Note） BOD_5 at 20°C: BOD value required for 5 days at 20°C.
T-P(PO_4-P): Phosphate form phosphorus. Phosphate ion expressed as the amount of phosphorus.
NH_4-N: Ammonium form nitrogen. Ammonium ion expressed as the amount of nitrogen.
Source: PE Kolektorski

Table 3.34 Water Quality of Treated Effluent at Vranista STP

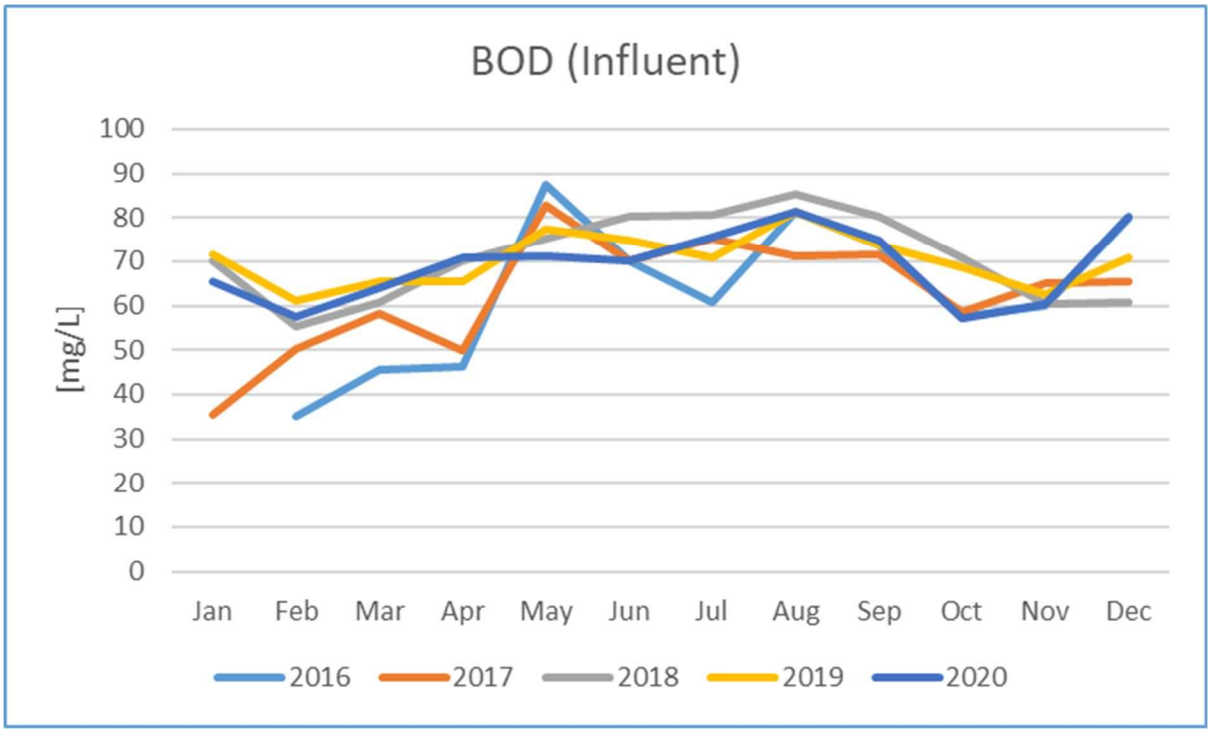
Item	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BOD5 at 20°C [mg/L]	2016		3.0	3.5	3.0	3.5	4.0	6.0	7.0	5.5	4.0	5.0	7.0
	2017	5.0	6.2	6.5	7.2	8.6	8.8	9.3	7.9	8.1	7.6	7.3	6.7
	2018	10.4	8.9	8.2	11.4	11.8	12.3	12.8	14.2	12.6	11.5	10.3	10.7
	2019	12.4	9.4	12.9	11.5	12.6	11.1	12.4	10.9	10.2	9.1	10.1	9.8
	2020	8.4	8.7	9.2	8.3	8.5	10.8	10.6	12.3	8.3	8.8	7.4	7.0
COD [mg/L]	2016		11.63	12.89	11.52	14.25	16.60	16.90	19.90	17.40	21.02	20.82	27.65
	2017	12.37	16.40	18.10	21.40	24.25	26.70	28.80	26.10	28.60	21.30	20.80	20.20
	2018	25.63	14.26	18.21	31.56	30.40	27.30	32.70	35.30	31.70	32.10	29.80	27.20
	2019	33.80	21.70	23.70	24.10	26.10	23.20	27.10	25.80	25.20	21.02	20.82	17.67
	2020	28.30	27.70	30.40	24.90	28.20	34.60	37.10	34.10	19.80	22.02	25.30	27.65
T-P(PO4-P) [mg/L]	2016		0.54		0.70		0.67	0.54	0.91			0.63	
	2017	0.56			0.70		0.91	0.92	0.93			0.88	
	2018	0.66			0.42		0.67	0.63	0.60			0.54	
	2019	0.74			0.56		0.55	1.00	0.61			0.65	
	2020	0.45			0.70		0.67	0.91	0.91			1.06	
NH4-N [mg/L]	2016												
	2017	0.05			0.05		0.02	0.01	0.01			0.02	
	2018	0.48			0.13		0.58	0.26	0.99			0.67	
	2019	1.98			1.20		1.21	0.26	0.78			0.17	
	2020	0.01			0.05		1.02	0.88	0.72			0.01	

Note) BOD_5 at 20°C: BOD value required for 5 days at 20°C.
T-P(PO_4-P): Phosphate form phosphorus. Phosphate ion expressed as the amount of phosphorus.
NH_4-N: Ammonium form nitrogen. Ammonium ion expressed as the amount of nitrogen.
Source: PE Kolektorski

Table 3.35 Examples of Sewage Quality (BOD) in Commercial Area in Japan

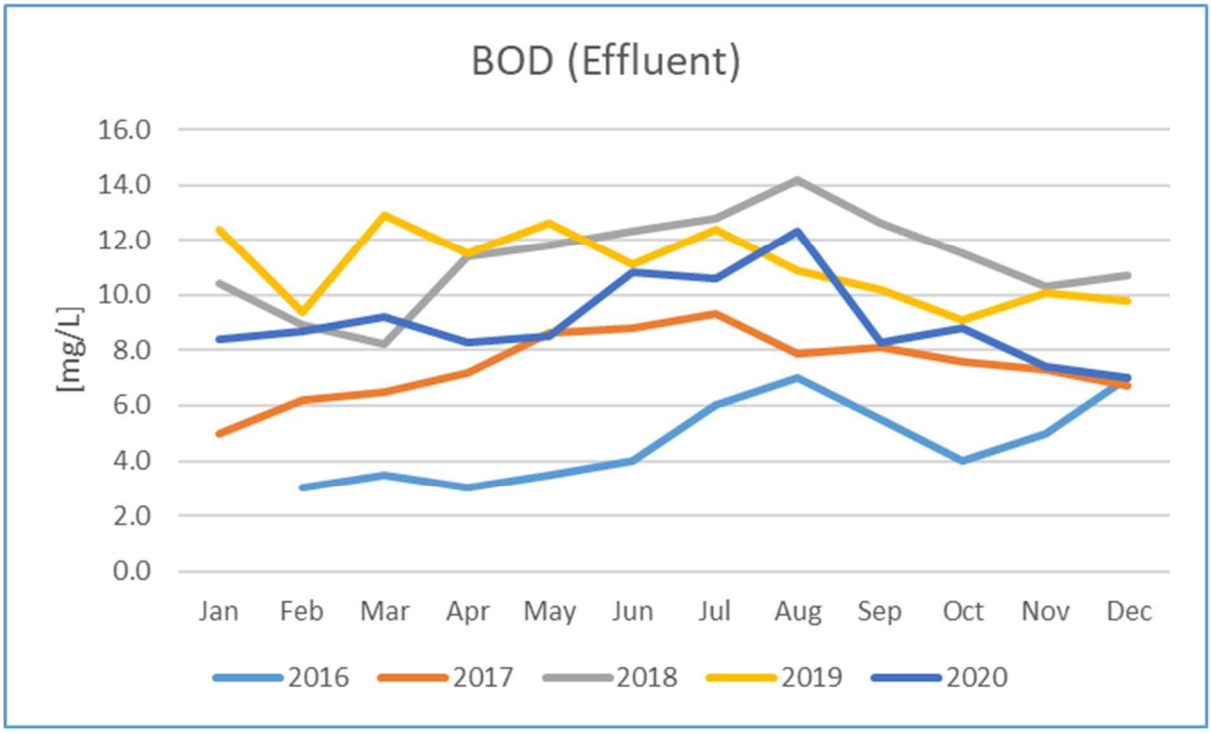
Survey Agency (Japan)	Year	BOD [mg/L]	COD [mg/L]	SS [mg/L]	T-N [mg/L]	T-P [mg/L]	Target City
Ministry of Construction	1980	171	75	64	21	10	Kiryu City
Ministry of Construction	1981	195	88	84	25	9.3	Kiryu City
Ministry of Construction	1981	136	102	197	29	10.7	Sendai City
Ministry of Construction	1981	201	114	205	30	11	Sendai City
Ministry of Construction	1981	124	68	79	32	2.6	Nishinomiya City
Ministry of Construction	1981	117	67	82	29	3.3	Nishinomiya City
Public Works Research Institute	1988	506	184	235	29	4.7	Kobe City
Public Works Research Institute	1988	425	151	186	33	3.8	Toyonaka City

Source: "Guideline and commentary for comprehensive sewerage planning by basin" January 2015
Ministry of Land, Infrastructure, Transport and Tourism in Japan (43p)



Source: PE Kolektorski

Figure 3.18 Change of Influent BOD at Vranista STP



Source: PE Kolektorski

Figure 3.19 Change of Treated Effluent BOD at Vranista STP

(2) Primary sewer

The pump facilities installed in the primary sewer are inspected once a day by 20 staff stationed at the Vranista STP. They are also responsible for the operation and maintenance of the sewage treatment plant

and primary sewer, as shown in Table 3.36. Their pump facilities' operation is adjusted according to the conditions of the inflowing sewage at that time, but cleaning is not carried out.

In addition, inspection and cleaning of the primary sewer are not usually carried out because of the lack of adequate equipment.

The PE Kolektorski did not take over the necessary equipment for the maintenance and management of the sewers from the former PE PROAQUA. Now it does not have the sewer survey equipment, such as TV cameras and the cleaning equipment (high-pressure washers and vacuum trucks). When it is necessary to unclog a sewer or clean a pump well, the PE Kolektorski rents a private high-pressure washing truck or vacuum truck.

Now the PE Kolektorski is currently conducting a tender for the procurement of vacuum trucks needed for cleaning pump wells and sewers. (As of November 2021)

Table 3.36 Summary of Operation and Maintenance of Primary Sewer

Item	Description	Issue
1) PS	• PSs are usually unmanned, but remote-control systems are not installed. • The operation is adjusted according to the inflow of sewage during the daily patrol and inspection. • In addition, cleaning of foreign substances and sludge accumulated in the pump wells is not carried out.	• In many PSs, water level gauges are not installed or are out of order, so pump operations are only adjusted during inspections. • It is not possible to quickly adjust the operation in response to changes in the volume of inflowing sewage. • This is one of the factors triggering problems such as the discharge of untreated sewage into Lake Ohrid. • PSs having submersible pumps are not equipped with screens for removal of foreign substances and pumps break down frequently due to inflow of objects, mainly wet wipes. • In addition, proper cleaning is not carried out because the PE Kolektorski does not have the cleaning equipment.
2) Sewer	• No inspection or cleaning is carried out under normal circumstances.	• Proper inspections and cleaning of sewers are not being carried out, because of lack of necessary equipment for inspection and cleaning. .

Source：JICA Survey Team

3.4.2 Secondary Sewers

The maintenance and management of secondary sewers are carried out by the Public Enterprises of each municipality. Table 3.37 shows the maintenance management system and equipment owned by public enterprises of each municipality.

Table 3.37 Operation and Maintenance System and owned Equipment

Public enterprise	Maintenance and management system	Equipment
PE Niskogradba	14 staffs	3 High-pressure washing trucks
PE Vodovod i Kanalizacija Struga	1 team (5 persons)	1 High-pressure washing truck
PE Debrca	12 persons (concurrently managing the water supply system)	

Source: JICA Survey Team

The maintenance status of the secondary sewer and PSs is shown in Photo 3.6 and Table 3.37. Basically, PSs are inspected once a day on a routine basis. As for the sewer, regular inspections are not carried out, but cleaning is only carried out when problems such as clogging occur. Particularly, pump failure and clogging of the sewer caused by dumping of wet wipes into the sewerage system is considered to be frequent problems.

Pump Clogged by Wet Wipe

Cleaning sediment in a manhole by human power

A piece of concrete dumped into a manhole

Sediment collected from inside sewer

Pulling out a clogged pump.

Removing wet wipes

Source: PE Niskogradba, JICA Survey Team（October 2021）

Photo 3.6 Maintenance and Cleaning of Secondary Sewers

Table 3.38 Maintenance and Management Status of Secondary Sewers in each City Enterprise

Item	Description	Issue
Municipality of Ohrid (PE Niskogradba)		
1) PS	Patrol inspections are conducted once a day.	Due to the lack of a vacuum truck, the inside of the pump wells cannot be properly cleaned. In addition, pump breakdowns have been occurring frequently, three to four times a week in many locations. This is mainly due to wet wipes dumped in the sewage.
2) Sewer	Periodic surveys and inspections are not conducted and cleaning is carried out only when sewers are blocked. PE Niskogradba receives 10 to 20 requests per day on average for cleaning of clogged sewers, It is only able to handle 20 requests per day while 30 requests are made at the most.	The clogging is mainly caused by wet wipes dumped in the sewage and blocks dumped in the manholes. In the cleaning work, PE Niskogradba has only a high-pressure washing trucks, but not a vacuum truck. It is only able to collect about 50% of the clogged material and about half of it flows downstream. This causes problems such as further clogging of secondary sewers downstream and failure of pump facilities.
Municipality of Struga (PE Vodovod i Kanalizacija Struga)		
1) PS	Patrol inspections are conducted once a day.	The inside of the pump wells is not properly cleaned, because of the lack of a vacuum truck. Pump failures occur mainly by clogging of wet wipes dumped into the sewage.
2) Sewer	Periodic surveys and inspections are not conducted. The PE responds only when there is a problem, such as a clogged pipe or sewage overflow.	No manhole cover is used at the inflow area of PSs or manhole covers have many opening holes . These allow rainwater to enter the sewer pipes easily despite the separated sewer areas. In addition, due to the lack of vacuum trucks, it is not possible to sufficiently remove the objects causing the blockage
Municipality of Debrca City (PE Debrca)		
1) Sewer	Periodic surveys and inspections are not conducted. PE Debrca conducts cleaning only when sewers are clogged.	

Source：JICA Survey Team

[Problems with wet wipes]

Wet wipes, which are a major cause of clogged pipes and pumps in the target area, are made of plastic fibers and are insoluble in water.

There are warnings on boxes of wet wipes not to dispose of them in toilets. However, wet wipes are used in the toilet as a substitute for toilet paper as a local custom and thus end up flowing into the sewerage system.

Source: JICA Survey Team

Photo 3.7 Warning Signs of Wet Wipes and Wet Wipes Clogged in Pump

3.5 Sewerage Development Plan

3.5.1 IPA Project

The IPA project is an assistance project for countries seeking to join the EU. A FS was conducted in 2015 regarding the upgrading of the sewerage system around Lake Ohrid.

According to an IPA project officer in the Municipality of Struga, the following six contents below were included in the project initially (Figure 3.20). However, three were excluded from the project because (3) the JICA survey was conducted in 2015 and expected to be implemented by JICA, (4) was a low priority for immediate implementation and (6) was technically difficult.

(1) Rehabilitation of the Vranista STP
(2) Diversion of combined sewer area to separated sewer area in Ohrid
(3) Rehabilitation of primary sewers
(4) Development of sewerage system in four villages located in the north of Municipality of Struga
(5) Development of sewerage system in the area on the west side of Lake Ohrid near the Albanian border
(6) Development of the sewerage system in the sewerage undeveloped area in the south of Municipality of Ohrid, east of Lake Ohrid.

Moreover, due to financial problems, (2) and (5) were excluded from the project scope and finally only the rehabilitation of the Vranista STP (1) was left in the short-term scope.

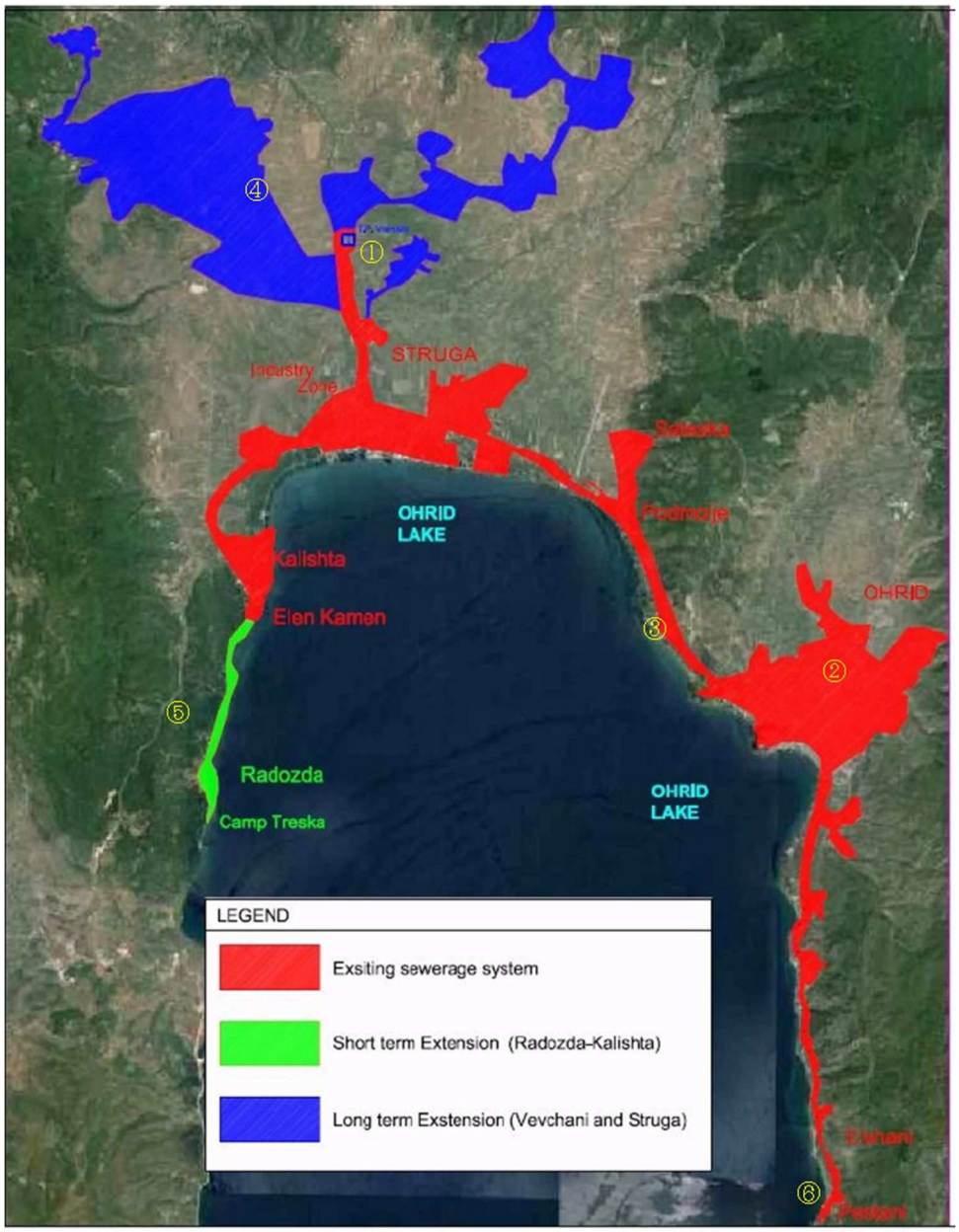
In 2015, the financial situation of the former PE PROAQUA, which managed the sewerage system around Lake Ohrid, was deteriorating. As a precondition for the implementation of this IPA project, the former PE PROAQUA was required to reduce its workforce in order to improve its financial situation.

This was probably due to the fact that while it was considered necessary to improve the rate recovery ratio and reduce fixed costs in order to improve the management of the former PROAQUA Corporation,

it was judged necessary to give higher priority to reducing labor costs among fixed costs.

Specifically, a total of 220 employees were to be reduced by 44 each year for the five-year period from 2015 to 2019. However, the project has been suspended because the Municipality of Ohrid, which is one of the founding two bodies (Ohrid and Struga) of the former PE PROAQUA, refused to accept this proposal.

After dismantling of the PE PROAQUA in 2019, the conditions for resuming the project have not been clearly stated and the future implementation of the rehabilitation of the Vranista STP remains uncertain.



Source: Preparation of necessary documentation for upgrading the WWTP in Vranishta, extension of the collector system for Ohrid Lake and separation of the foul and storm priority water network in the Cities of Ohrid and Struga, Final Report, December 2015, IPA/OPRD2007-20113.1/LOT6/10

Figure 3.20 Target Area of IPA Project

3.5.2 Sewerage Master Plan for Each Municipality

Municipalities are obligated to develop master plans for the public infrastructure facilities within their area. Although the municipalities of Ohrid, Struga and Debrca have not developed a master plan specifically for sewerage, they have positioned sewerage facilities as one of the public infrastructure facilities in their city master plans individually.

(1) Municipality of Ohrid

The latest urban master plan was formulated in 2012, but it only covers the central part of the municipality. It does not include the ELSHANI and TRPEJCA areas in the southern part of the municipality, which do not have sewerage systems. The initial design of the sewerage system for these two districts was considered in 2016 and technical problems were identified. A tender for the review of the plan and design is currently undergoing. The urban master plan is in the process of preparation for updating.

(2) Municipality of Struga

The current urban master plan is outdated and deviates from the current situation. Therefore, the municipality is currently commissioning a consultant to review the master plan.

(3) Municipality of Debrca

The municipality has positioned sewerage facilities in the Local Environment Action Plan. The Local Environment Action Plan for 2019-2025 has already been formulated.

3.5.3 Master Plan for Vranista STP and Primary Sewer

After dismantling of the PE PROAQUA, the Vranista STP and primary sewers have been nationalized and their management has been transferred to the PE Kolektorski, which is directly controlled by the state government. In addition, the secondary sewer network connected to the primary sewer became to be owned by each municipality where these sewer networks are located. Each city is responsible for new construction, etc., while maintenance is carried out by the public enterprises established by each municipality.

As a result, the responsibility of management for sewerage system around Lake Ohrid is finely divided. In addition, the PE Kolektorski has no developed comprehensive master plan for the sewerage system around Lake Ohrid. This may lead to poor coordination among the public enterprises and the municipalities, resulting in a lack of systematic sewerage project management.

In North Macedonia, the municipality is obligated to develop a master plan for the public facilities within their municipality. The PE Kolektorski believes that the Municipality of Struga, where the Vranista STP is located, should develop such a plan. However, this is unlikely as the Municipality of Struga and the PE Vodovod i Kanalizacija Struga are not involved in the management of the Vranista STP and primary sewer. Normally, it would be appropriate for the PE Kolektorski, which manages the sewage treatment plant and primary sewers, and the MoEPP, which has jurisdiction over nationwide sewerage services, to take the lead in developing a new comprehensive sewerage development master plan, but at this time

these organizations have no intention to do so.

Therefore, a comprehensive master plan for the sewerage system around Lake Ohrid has not been developed and the absence of a body to develop such a plan is an issue which needs to be discussed.

4 Challenges and Issues in the Sewerage Field

4.1 Challenges and Issues

4.1.1 Sewerage Business Management

By analyzing the information the survey team collected, it recognized that public enterprises have some challenges and issues on sewerage business management field. Those are summarized in Table 4.1.

Table 4.1 Issues in the Sewerage Business Management Field (1/2)
Sector: Organization structure, Finance / Tariff Collection

PE name	Organization structure	Finance / Tariff Collection
PE Kolektorski	• The staff composition ratio between administrative and technical staff is unbalanced. (Administrative staff 64%, technical staff 34%)[13] In the long term, it is necessary to systematically increase and replenish technical staff. There is a possibility that O&M of the facilities is insufficient due to a lack of technical staff. • The upper posts of the public enterprises are susceptible to political influence and tend to be replaced depending on the election results. Thus, it is assumed to be difficult to carry out business management that fits the sewerage service of PE and to prepare mid-and long-term policies and implement them.	• The tariff collection rate is improving from 66% (2018) to 83% (2019), but it is lower than the water supply business. • Since the public corporation was completely new due to the dismantling of the former PE PROAQUA, it is necessary to raise recognition among customers. • No sewerage service contract with customer (currently under preparation)
PE Niskogradba	• The staff composition ratio between administrative and technical staff is unbalanced. (administrative staff 50%, technical staff 50%). In the long term, it is necessary to systematically increase and replenish technical staff. There is a possibility that O&M of the facilities is insufficient due to a lack of technical staff. • The upper posts of the public enterprises are susceptible to political influence and tend to be replaced depending on the election results. Thus, it is assumed to be difficult to carry out business management that fits sewerage service of PE and to prepare mid-and long-term policies and implement them.	• Tariff collection rate is low (65%) and needs improvement • Weak measures for non-payer
PE Vodovod Ohrid	• The staff composition ratio between administrative and technical staff is unbalanced. In the long term, it is necessary to systematically increase and replenish technical staff. There is a possibility that O&M of the facilities is insufficient due to a lack of technical staff. •	
PE Vodovod i Kanalizacija Struga	• The staff composition ratio between administrative and technical staff is unbalanced. (administrative staff 53%, technical staff 47%). In the long term, it is necessary to systematically increase and replenish technical staff. There is a possibility that O&M of the facilities is insufficient due to a lack of technical staff. • The upper posts of the public enterprises are susceptible to political influence and tend to be replaced depending on the election results. Thus, it is assumed to be difficult to carry out business management that fits sewerage service of PE and to prepare mid-and long-term policies and implement them.	• Tariff collection rate is low (77%) and need improvement • Weak measures for non-payer

Source: JICA Survey Team

[13] Mainly two challenges are pointed about related to this: 1) There is a possibility that O&M of the facilities is not sufficiently done due to a lack of technical staff, 2) Abundant staffing costs which can be reduced might be occurred and might disturb the efficient management of PE.

Table 4.2 Issues in the Sewerage Business Management Field (2/2)
Sector: Public relations / Public awareness, others

PE name	Public relations / Public awareness	Other
PE Kolektorski	• Although some activities are being carried out to promote customer tariff payment, further improvements are needed.	• Although there are relatively some training opportunities for clerical staff, training opportunities for technical staff are infrequent and limited. • Training for technical staff is mainly provided by contractors at the time of facility introduction, therefore there are few training opportunities to cultivate appropriate skills required for maintenance.
PE Niskogradba	• Public awareness activities such as restraining the dumping of wet wipes into sewer (toilet) have not been implemented. • Little activity to promote customer tariff payment	
PE Vodovod Ohrid		• High non-revenue water rate in water supply business (estimated 70%)[14]
PE Vodovod i Kanalizacija Struga	• Public awareness activities such as restraining the dumping of wet wipes into sewer (toilet) have not been implemented. • Little activity to promote customer tariff payment	• High non-revenue water rate in water supply business (estimated 68%)[14] • In particular, there are few opportunities to improve skills related to maintenance of technical staff

Source: JICA Survey Team

The main challenges and issues of sewerage business management are summarized as follows:

(1) Organization structure

- In each public enterprise, the ratio of clerical staff is generally high and the percentage of technical staff is low. According to interviews to PE staff, this may be partly due to political staffing. Related this, mainly two challenges are pointed out: 1) There is a possibility that O&M of the facilities is insufficient due to a lack of technical staffs, 2) Abundant staffing costs which can be reduced might be occurred and might disturb the efficient management of PE[15]. In case of PE Kolektorski, the level of challenge in the former possibility is higher than the latter possibility.
- Insufficient staffing and shortage of maintenance equipment have occurred because the facility maintenance plan from a medium- to long-term perspective and the corresponding personnel and equipment procurement plan have not been formulated.

(2) Tariff billing and collection

- The tariff collection rate for sewerage business of each public enterprise, which is lower than that for the water supply business, needs to be improved. Especially for PE Niskogradba and PE Vodovod i Kanalizacija Struga, there is still a lot of room for improvement in tariff collection, such as associating the water and sewer network ledger system with resident information and collecting a fixed amount of sewerage tariff for well users. In addition, it is essentially required to work toward a 100% collection rate.

[14] Although the non-revenue water rate can be estimated from the data obtained from public enterprises, the breakdown of non-revenue water is unknown because there is no information that analyzes the overall water balance.
[15] The surrounding environment is different between PEs, so that sometimes only one case could be found.

(3) Public relations and public awareness

- Although some public enterprises have a track record of promoting customers tariff payment when distributing invoices, their activities are limited. It is necessary to effectively improve the collection of tariff by strengthening public relations / public awareness activities related to the promotion of customer tariff payment.
- Although some public relations (posters) for suppressing the dumping of wet wipes into sewer (toilet) have been carried out at tourist facilities, according to interviews to some staff, it is said that there is not much noticeable effect. In addition, no particular public awareness activities related to this issue has been carried out by the municipalities of Ohrid / Struga or the public enterprises. It is necessary to strengthen public relations / public awareness activities in order to reduce equipment failures, improve the function of sewer pipes and effectively strengthen maintenance.
- Public awareness activities related to environmental conservation in general are carried out on a very small scale (for elementary school students) at the Public Service Department of Municipality of Ohrid. From the perspective of preventing littering into lakes and throwing blocks into manholes of sewer, it is necessary to strengthen public awareness activities for the general public and tourists. In particular, public awareness on environmental conservation for the younger generation (elementary school students, etc.) who will be responsible for the future is effective, therefor it is desirable to expand the target and scope of this activity.

(4) Staff training

- Although there are relatively some training opportunities for clerical staff regarding common systems for each public corporation (finance, public procurement, human resources management), training opportunities for technical staff are limited. Training to practice the planned and preventive maintenance of sewerage facilities (sewer pipes (primary, secondary), PSs and sewage treatment plant) is necessary.

(5) Overall issues

Issues related to the entire sector that are not included in the public enterprises' issues mentioned above are described below:

- With the dismantling of the former PE PROAQUA, the water and sewage business units have been subdivided, making comprehensive sewerage business management difficult and the responsible body for taking the initiative is not clear[16]. The sewerage business in the target area spans Municipality of Ohrid and Municipality of Struga and the management entity differs depending on the class and location of the sewerage facility. Therefore, for example, a comprehensive sewerage plan (master plan) is originally necessary, but the problem is that there is no comprehensive sewerage business management that transcends administrative areas and an organization that is responsible for it.

[16] According to the Articles of Incorporation of the PE Kolektorski, in addition to the maintenance of the sewage system (primary sewage system, sewage treatment plant), it includes research on facility construction, repair and renewal, business organization, and related investment activities. However, according to the interview to the public enterprises and the activities of the existing departments, activities focusing only on the former are carried out.

- With the dismantling of the former PE PROAQUA, each public enterprise is responsible for tariff billing and collection. 3 public enterprises in Municipality of Ohrid and 2 public enterprises in Municipality of Struga carry out tariff billing and collection operation. However, from the viewpoint of efficiency, it is desirable to have one institution to perform the tariff billing and collection collectively and distribute it to each public enterprise afterwards.

4.1.2 Sewerage Facility, Management, Operation and Maintenance

(1) Vranista STP

[Facility]

- The facilities as a whole are significantly deteriorated and many of them are stopped due to breakdowns. If any more equipment breaks down, there is a concern that normal sewage treatment will be adversely affected. Therefore, urgent rehabilitation is considered necessary. Although a sewage treatment plant rehabilitation plan by IPA was considered in 2015, the project has been suspended and its resumption is uncertain.

[Operation and Maintenance]

- 20 staff members are stationed in sewage treatment plant during the daytime only. In order to improve the operation and maintenance of facilities, it is desirable to review staffing and work shifts.
- There is high possibility of failure of equipment since the frequency of equipment inspections is extremely low and appropriate preventive maintenance activities are not being carried out.
- Dry sludge is piled up in the sewage treatment plant site as the final disposal method of sewage sludge is undecided, which may cause the environmental issue.

(2) Primary sewer

[Facility]

- The pump facilities have deteriorated significantly and 8 of the 14 pump facilities do not meet the planned number of pumps. Urgent rehabilitation is required. The rehabilitation of PSs by government funds was scheduled to be carried out together with the primary sewer rehabilitation. But the pump rehabilitation implementation was transferred to the Kolektorski Sewerage Corporation due to lack of the government budget and its implementation is uncertain.
- Several PSs have discharge pipes and untreated sewage is discharged to Lake Ohrid in rainy weather.
- The sewer pipes of the upstream part of the primary sewer on the eastern shore of Lake Ohrid are laid too close to the shore of the lake. Therefore, the manhole is submerged and the lake water flows into the sewer when the lake water level rises.
- A discharge pipe from the primary sewer to Lake Ohrid is illegally installed in the Voska district and untreated sewage is discharged to Lake Ohrid in rainy weather.

[Maintenance]

- Since the PS does not have a remote monitoring or remote-control system installed and the operation adjustment is done with the patrol inspection once a day, appropriate operation

management of PS according to the fluctuation of the inflow sewage volume is not performed. It is also one of the causes of the discharge of untreated sewage from PS to Lake Ohrid.

- Regular inspections of sewer pipes have not been carried out and maintenance is a follow-up type.
- Although bidding is currently being held to procure vacuum trucks, there is a shortage of equipment for inspecting and cleaning sewer pipes such as TV cameras for sewer pipe inspections and high-pressure washer vehicles.

(3) Secondary sewer

[Facility]

- Since there are many combined sewer areas, the inflow of stormwater causes an increase in the amount of sewage, which increases the discharge of untreated sewage to Lake Ohrid.
- The installed submersible pump frequently fails due to the entanglement of wet wipes that are illegally dumped into the sewer (toilet).

[Maintenance]

- Pump failures frequently occur due to entanglement of wet wipes dumped in the sewer (toilet).
- Also in the sewer pipe, the wet wipes dumped in the sewer (toilet) is the main factor of causing the pipe to be clogged.
- Illegal dumping of concrete blocks and bricks into the manhole of sewer is a problem. The manhole covers are being replaced with lockable ones recently, but this problem still remains.
- Regular inspections of sewer pipes have not been carried out and maintenance is follow-up type.
- Public enterprises which maintain and manage sewer pipes own high-pressure washer vehicles but not vacuum trucks. Therefore, only about 50% of the clogged materials is recovered in sewer pipe cleaning work and the rest of them flows downstream. This causes problems such as further clogging of the downstream pipe.

4.1.3 Sewerage Master Plan

After the dismantling of the PE PROAQUA, the Vranista STP and primary sewer network in the sewerage system around Lake Ohrid were nationalized. These are managed by the PE Kolektorski which was established by the government. In addition, the secondary sewer network connected to the primary sewer became to be owned by each municipality where these sewer networks are located and each municipality is responsible for new construction, etc., while maintenance is carried out by the public enterprises established by each municipality. As a result, while the sewerage system around Lake Ohrid is one wide-area sewerage system, the responsibility for ownership, construction and maintenance is finely divided.

In addition, since there is no sewerage master plan for this wide-area sewerage system, each responsible organization individually prepares business plan and manage its sewerage business and the sewerage business is inconsistent.

Therefore, it is necessary to formulate a comprehensive sewerage master plan for this wide-area

sewerage system to align the sewerage business policy, but it is also an issue that there is no organization that should formulate a sewerage master plan.

4.2 Development Needs and Problem-solving Measures

This section summarizes the development needs for the issues mentioned in the previous sections and the possible cooperation scheme of Japanese ODA (Table 4.3).

In terms of business operation and management, the dismantling of the PE PROAQUA caused the sewerage business operation to be divided into multiple municipalities and public enterprises, resulting in the loss of unity in business operations. In addition, the low rate of tariff collection is putting pressure on management of public enterprises. It is important to deal with these issues.

In terms of facilities, rehabilitation of the Vranista STP and primary sewer, which are the basis of the sewerage system in the target area, should be prioritized.

In terms of operation and maintenance, it is considered to be a high priority that the introduction of equipment necessary for maintenance and the implementation of preventive maintenance activities, and in terms of planning, the formulation of a comprehensive sewerage master plan.

Table 4.3 Development Needs and Possible Support Methods for Issues

Category		Issues	Development needs	Possible Cooperation schemes of Japanese ODA
Business operation / management	Entire sector	• There is no comprehensive sewerage plan. • Comprehensive sewerage business management is difficult due to the fragmentation of the organization and lack of responsible organization.	Formulation of a comprehensive sewerage development plan Strengthening governance capabilities between public corporations	Technical Cooperation
	PE Kolektorski	• Imbalance of technical and clerical personnel. • Small number of staff in charge of maintenance	Formulation of medium- to long-term human resource plan	Technical Cooperation
		• Low tariff collection rate compared to water supply business.	Promote tariff payments by customers	Technical Cooperation
		• Relatively low customer awareness.	Strengthening public relations	Technical Cooperation
		• Sewerage service contract with costumer not concluded.	Promotion of customer contracts	Technical Cooperation
		• Relatively vulnerable promotion of payment to customers.	Strengthen promotion of tariff payment	Technical Cooperation
		• Limited training opportunities for technical staff (especially maintenance staff)	Increased training opportunities	Technical Cooperation
	PE Niskogradba	• Imbalance of technical and clerical personnel. • Small number of staff in charge of maintenance	Formulation of medium- to long-term human resource plan	Technical Cooperation
		• Low tariff collection rate.	Improvement of tariff collection rate	Technical Cooperation
		• Vulnerable countermeasures for nonpayers	Strengthening measures for	Technical Cooperation

Category		Issues	Development needs	Possible Cooperation schemes of Japanese ODA
			nonpayers	
		• Public awareness activities such as restraining the dumping of wet wipes into sewer have not been carried out.	Strengthening public relations / enlightenment activities to curb wet wipe dumping	Technical Cooperation
		• Limited training opportunities for technical staff (especially maintenance staff).	Increased training opportunities	Technical Cooperation
	PE Vodovod Ohrid	• Imbalance of technical and clerical personnel. • Small number of staff in charge of maintenance.	Formulation of medium- to long-term human resource plan	Technical Cooperation
		• High non-revenue water rate.	Reduction of non-revenue water rate	Technical Cooperation
		• Limited training opportunities for technical staff (especially maintenance staff).	Increased training opportunities	Technical Cooperation
	PE Vodovod i Kanalizacija Struga	• Imbalance of technical and clerical personnel. • Small number of staff in charge of maintenance	Formulation of medium- to long-term human resource plan	Technical Cooperation
		• High non-revenue water rate.	Reduction of non-revenue water rate	Technical Cooperation
		• Relatively low tariff collection rate.	Improvement of tariff collection rate	Technical Cooperation
		• Vulnerable countermeasures for nonpayers	Strengthening measures for nonpayers	Technical Cooperation
		• Limited training opportunities for technical staff (especially maintenance staff).	Increased training opportunities	Technical Cooperation
		• Public awareness activities such as restraining the dumping of wet wipes into sewer have not been carried out.	Strengthening public relations / enlightenment activities to curb wet wipe dumping	Technical Cooperation
	Municipality of Ohrid Municipality of Struga	• Public awareness activities such as restraining the dumping into sewer of wet wipes have not been carried out.	Strengthening public relations / enlightenment activities to curb wet wipe dumping	Technical Cooperation
		• Public awareness activities related to environmental conservation in general are small and limited.	Strengthening public awareness activities for the general public and tourists	Technical Cooperation
Facility	Vranista STP	• The facility is aging, but the IPA rehabilitation project is suspended.	Rehabilitation planning and implementation	Financial support / ODA loan [1]
	Primary sewer	• Aging pump facilities	Rehabilitation planning and implementation	Financial support / ODA loan
		• Discharge of unidentified sewage to Lake Ohrid (Infiltration of uncertain water[2], discharge pipe illegally installed in Voska district, discharge pipe installed in PS)	Reduction of unidentified water infiltration by rehabilitation of pipes	Financial support / ODA loan
			Installation of reservoir in Voska district for reducing discharge to Lake Ohrid	Financial support / ODA loan
			Reduction of untreated sewage discharge by	Financial support / ODA loan

Category		Issues	Development needs	Possible Cooperation schemes of Japanese ODA
			introducing a simple treatment facility	
		• Aging pipes and delays in their rehabilitation projects	Short-term intensive rehabilitation	Financial support / ODA loan
	Secondary sewer	• Increased amount of sewage in rainy weather due to the infiltration of stormwater into sewer in combined sewer system area	Improve combined sewer system to separated sewer system	Indirect support through technical cooperation (enlightenment of residents, preparation of guidelines, etc.) [3]
		• Submersible pump failure and clogging of sewer pipes due to wet wipes	Introducing a pump that is resistant to clogging	Financial support / ODA loan
			Suppressing the dumping of wet wipes into sewage, which is the main cause of clogging	Technical Cooperation
Operation and maintenance	Vranista STP	• Inappropriate staffing	Formulation of human resource plan	Technical Cooperation
		• Lack of preventive maintenance	Staff education and preparation of operation maintenance guidelines	Technical Cooperation
		• The final disposal method of sewage sludge is undecided.	Positioning of final disposal method of sludge by sewerage master plan	Technical Cooperation
	Primary sewer	• Delay in responding to pump operation according to the amount of inflow sewage and pump failure	Introduction of remote monitoring and remote control systems	Financial support / ODA loan
		• Lack of preventive maintenance	Staff education and preparation of operation maintenance guidelines	Technical Cooperation
		• Insufficient equipment (high pressure washer vehicle, vacuum truck, TV camera for survey inside sewer pipe) required for maintenance	Introduction of maintenance equipment	Financial support / ODA loan or Technical cooperation (equipment procurement) [4]
	Secondary sewer	• Submersible pump failure and clogging of sewer pipes due to wet wipes	Introducing a pump that is resistant to clogging	Financial support / ODA loan
			Suppressing the dumping of wet wipes into sewage by enlightening residents	Technical Cooperation
		• Illegal dumping of blocks, etc. into manholes	Prevention of illegal dumping of blocks, etc. by awareness raising	Technical Cooperation
			Introduction of manhole cover with key	Financial support / ODA loan
		• Lack of equipment (high pressure washer vehicle, vacuum truck, TV camera for survey inside sewer pipe) required for maintenance	Introduction of maintenance equipment	Financial support / ODA loan or Technical cooperation (equipment

Category		Issues	Development needs	Possible Cooperation schemes of Japanese ODA
				procurement) [5]
Planning	Master plan	• There is no comprehensive sewerage plan (master plan) and systematic sewerage business managements and operations are not carried out.	Formulation of a comprehensive sewerage master plan	Technical Cooperation

[Note]

1) It is necessary to avoid conflict with the rehabilitation business by the IPA project.
2) When unidentified water such as stormwater or groundwater flows into the sewer pipe, the amount of sewage increases and the discharge of sewage that exceeds the flow capacity of sewer pipe and pump capacity is likely to occur.
3) Improvement of the combined sewer system area to separated sewer system requires the construction of a new stormwater pipe and the separation to wastewater and stormwater of the drainage system in the residential land connected to the sewerage system. Therefore It is considered that this project needs a long time and is not proper to urgent support program.
4) The PE Kolektorski which manages the primary sewer, is currently bidding for vacuum truck procurement.
5) The PE Niskogradba and the PE Vodovod i Kanalizacija Struga, which manage secondary sewer network, have high-pressure washer vehicles, but the lack of vacuum trucks is a major obstacle to maintenance such as pipe cleaning.

5 Priority Agenda and Ideas of Potential Cooperation in Sewerage Sector

5.1 Priority Agenda and Countermeasures

It is obvious and visible that the rehabilitation of sewerage facilities, which are significantly deteriorated, is high priority to improve the water environment in Lake Ohrid. About 80,000 people live in the Lake Ohrid basin on the North Macedonian side alone and at the peak of the tourist season in July and August, about 16,000 tourists a day join and sewage for about 100,000 people is generated. Currently, most of the sewage generated is collected by the existing sewer system, sent to the Vranista STP and then discharged into the Crn Drim River after the treatment. So far, the relationship between the water quality of Lake Ohrid and the pollutant load has not been quantitatively analyzed, but it is known that the lake shore area is slightly eutrophic (medium-nutrient) condition and the lake as a whole remains oligotrophic. It is clear that this is largely due to the existing sewerage system. If the existing sewerage system malfunctions and a large amount of sewage flows directly into Lake Ohrid, the impact will be immeasurable.

As the result of survey, the survey team recognized that various countermeasures should be taken in a proper manner from short term, mid-term and long-term perspective. As summarized in Table 4.3 current issues and development needs from the perspectives of business operation/management, facilities, operation/maintenance and planning are recognized. In this regard, it is important that step-by-step countermeasures toward those diverse development needs will be taken to maximize the effect of the project.

(1) Priority 1: Countermeasure in Short Term

It is necessary to improve the facility maintenance capacity of the sewerage public enterprise, prior to the rehabilitation of the facility. It is unfortunate, but with the current maintenance ability, it cannot be expected that the facility will be properly maintained even if the rehabilitation of the facility is preceded. Then there is a concern that equipment failures will occur frequently in the next few years, as it is now. ,

However, in improving the facility maintenance capacity of the sewerage public enterprise, it is necessary to strengthen the financial base of the sewerage public enterprise. Particularly, improving the recovery rate of sewerage charges is a major issue in strengthening the financial base. The stable financial base would make the sewerage public enterprise allocate sufficient personnel and equipment for proper maintenance.

In addition, it can be said that raising the awareness of the residents through public awareness activities is also an important issue. It is reported that the dumping of wet wipes into the sewer and the throwing blocks into the manhole are a heavy burden on the maintenance of sewer pipes.

Therefore, in short term, it is necessary to consider seriously how to maintain the capacity of existing facilities, prior to the rehabilitation of the facility. As the result of survey, it is suggested to take actions in improving operation and maintenance capacity of the sewerage public enterprise, strengthening financial base and enlightening residents as early as possible.

Issues and risk factors to be considered

In order to improve the operation and maintenance capacity of sewerage business and facilities, it is necessary to strengthen the finance and operation and maintenance capacity of the sewerage public enterprises. However, in terms of finance, it is impossible to set the sewerage tariff independently. Regarding the operation and maintenance system, the number of members of each department of public enterprises is regulated by law and cannot be increased easily. Moreover, the equipment necessary for maintenance is insufficient, it should be noted that it is also necessary to procure these devices for strengthening the capacity of the sewerage enterprises.

(2) Priority 2: Countermeasure in Short to Mid-Term

There is no doubt that the rehabilitation of sewerage facility is high priority, but under the condition with the proper O&M to be taken by the sewerage public enterprise. As described above, many sewerage facilities such as the Vranista STP and primary sewer, were in place by 1988 when the sewage treatment plant was put into service, are in a state of remarkable deterioration. There is a concern that the sewerage system will not be able to play a sufficient role if it is damaged more or the facility is shut down due to more equipment failure. In addition, the infiltration of large amounts of unidentified water into the sewer squeezes facility capacity and causes problems with the discharge of untreated sewage.

Therefore, it is desirable to prioritize the rehabilitation of the Vranista STP, primary sewer and PSs, which are the basis of the sewerage system in the target area, and to take measures that can be implemented in a short period of time for reducing the infiltration of unidentified water and the discharge of untreated sewage at the same time.

1) Rehabilitation of Vranista STP:

North Macedonia expected to implement the rehabilitation of Vranista STP as IPA Project in the past, but it is unfortunately not commenced yet and the outlook for the project is still uncertain as of November 2021.

2) Primary Sewer:

Since 2020, the rehabilitation of the primary sewer has been underway by the North Macedonian government. It was not implemented in 2021 due to the budget allocated to corona measures, but it is expected to resume in 2022. Regarding the rehabilitation of the pump facilities installed in the primary sewer, a bidding is being conducted by the PE Kolektorski for some pump facilities. While respecting North Macedonian Government ownership and leadership, there might be potential for cooperation by donors in case of any urgent needs occurred. When examining cooperation for the rehabilitation of the primary sewer, further detailed study to fully understand the current status, future schedule and operation and management system of the rehabilitation would be needed to avoid the other rehabilitation project.

(3) Priority 3: Countermeasure in Mid to Long Term

In mid to long term, it is necessary to build a mechanism for smooth business coordination among sewerage public enterprises such as coordinating committees and councils. At present, the fragmentation of the organization that manages sewerage in the target area makes comprehensive sewerage business management difficult and there is no responsible organization to cover the whole sewerage system in

the basin.

In addition, since there is no sewerage master plan for the sewerage system, each responsible organization individually prepares and manages each business plan, making the situation inconsistent. Therefore, it is necessary to formulate a comprehensive sewerage master plan for effective and efficient sewerage system under the coordination mechanism mentioned above and to align with the sewerage business management policy and maintenance policy in each public enterprise and municipality.

Issues and risk factors to be considered

Due to the dismantling of the PE PROAQUA, the organization that comprehensively manages the sewerage business in the target area was lost, but it is probable that there was sufficient reason for the dismantling to be judged to be appropriate. Therefore, it must be considered inappropriate to aim for the establishment of a comprehensive management organization through organizational integration, etc. again. However, the PE Kolektorski which was established with the dismantling of the PE PROAQUA, is in a position to manage the sewage treatment plant and the primary sewer, which are the core facilities of the sewerage system in the target area. It is considered desirable to build a system that PE Kolektorski can take the initiative in coordinating the organizations involved in this sewerage business in the target area.

5.2 Possibility of Utilizing Japanese Technology, Knowledge and Know-how

To tackle with above mentioned priority agenda, there are technologies, knowledge and know-how of Japan that could be expected to be utilized as follows:

(1) Priority 1: Capacity Development for maintaining the capacity of existing facilities such as improving operation and maintenance capacity, strengthening financial base and enlightening residents

Japan's sewerage system has a history of more than 150 years, starting with the construction of a sewer culvert in a foreign settlement in Yokohama in 1869. A lot of knowledge and know-how for general maintenance are accumulated. In recent years, the Ministry of Land, Infrastructure, Transport and Tourism, Japan published the guidelines for establishing a management cycle starting from maintenance information, which consists of "Sewer Facility Edition" in 2020 and "Treatment Plant / Pumping Station Facility Edition" in 2021. These findings can be utilized.

From the viewpoint of conducting public awareness, it is considered effective to utilize the knowledge and know-how of Shiga Prefecture, which made successful achievement in improving the water quality of Lake Biwa, which is the largest lake in Japan. In Shiga Prefecture, the Shiga Prefectural Lake Biwa Museum signed a comprehensive cooperation agreement with the Ohrid Hydrobiological Research Institute in 2017 and it can be said that it has a deep connection with the Ohrid region. It is expected that Shiga Prefecture's know-how and knowledge related to water environment conservation will be utilized in the field of public awareness and environmental education.

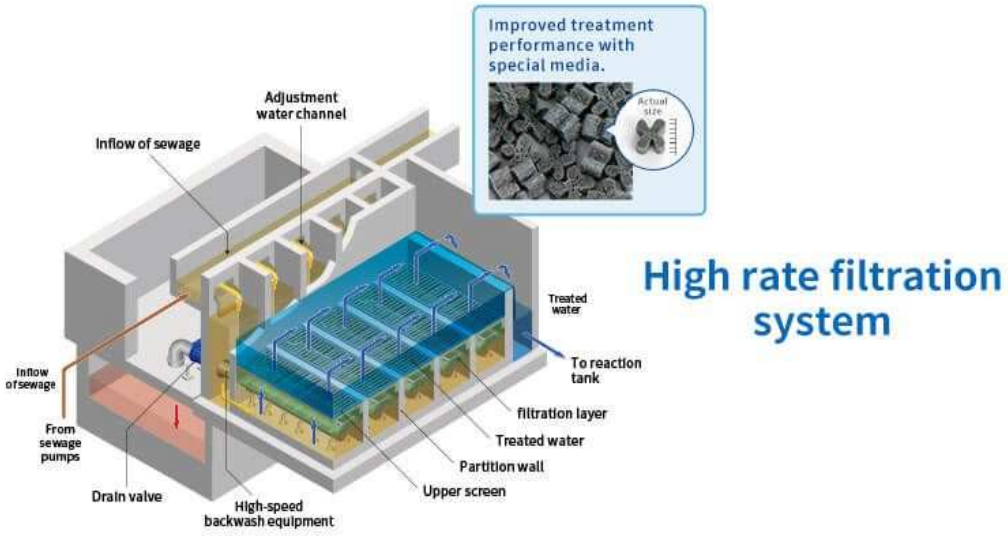
Regarding tariff collection, it can be expected that business efficiency will be improved by introducing

a water meter (smart meter) equipped with a communication function. By installing smart meters meter readers can obtain meter reading data more frequently without visiting the site. The introduction of smart meters can be expected to have various effect, such as improving the efficiency of meter reading operations, improving customer service and enabling efficient facility maintenance and capital investment.

(2) Priority 2: Rehabilitation, renewal and renovation of Sewerage facility

The sewerage system in the target area of this survey is significantly deteriorated as a whole and rehabilitation such as renovation and renewal is required. In particular, it is important to improve the situation where untreated sewage is discharged into Lake Ohrid due to the unidentified water flowing into the sewage in large quantities at present. But, in the short term, effective improvement measures to reduce unidentified water are effective, but it is difficult to eliminate untreated sewage discharge to Lake Ohrid. Therefore, in the medium term, it is considered effective to introduce a facility that simply treats untreated sewage and reduces outflow of the pollutant load to Lake Ohrid, such as the "High rate filtration system". Therefore, with a view to the medium- to long-term future, it is considered effective to introduce a facility that simply treats untreated sewage and reduces the outflow of pollutant loads to Lake Ohrid. An example of a facility with Japanese technology is the utilization of the "high-efficiency solid-liquid separation system".

- Features of high rate filtration system
  - BOD removal performance of 40% or more
  - SS removal performance 50-70%
  - 100% removal of impurities



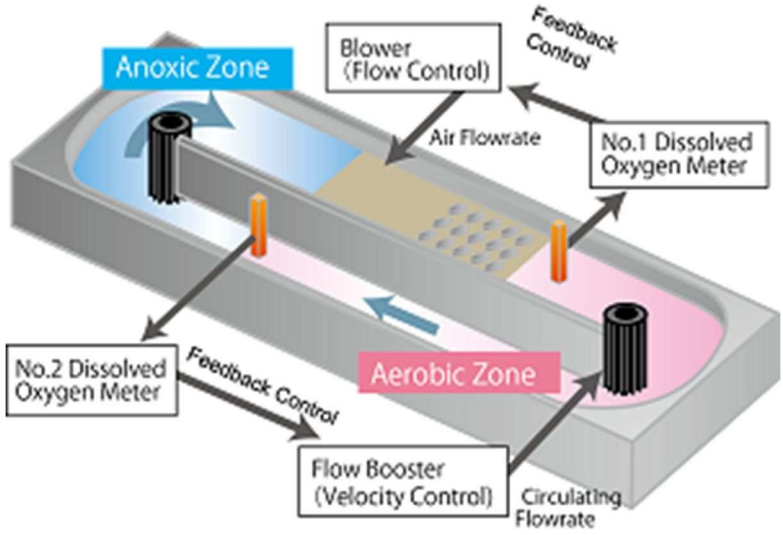
Source: METAWATER website

Figure 5.1 Schematic Diagram of High Rate Filtration System

In addition, if the amount of unidentified water into sewage decreases, the contamination concentration in sewage will increase and it is expected that the quality of treated water will deteriorate in the current

sewage treatment facilities. In particular, regarding nitrogen and phosphorus in treated sewage, there is concern that the standards set by the EU Directive cannot be met, so it is considered necessary to improve the sewage treatment method that can remove nitrogen and phosphorus. Since the Vranista STP uses the oxidation ditch method, the adoption of "Oxidation Ditch (OD) nitrogen removal system by dual Dissolved Oxygen (DO) control" will be considered as an improvement method.

- Features of Oxidation Ditch (OD) nitrogen removal system by dual Dissolved Oxygen (DO) control
  - It is possible to increase the treatment capacity
    Treatment capacity can be increased by automatically controlling the aeration air volume and circulation flow rate.
  - Power consumption can be reduced by 30% or more
    Energy saving is possible by setting an appropriate aeration air volume based on DO value with low stirring power.
  - Stable treatment is possible
    Stable formation of aerobic zone and anoxic zone enables advanced treatment of nitrogen and phosphorus.



Source: Maezawa Industries, Inc. website

Figure 5.2 Schematic Diagram of Oxidation Ditch (OD) Nitrogen Removal System by Dual Dissolved Oxygen (DO) Control

In addition to these, it is considered important to take measures against wet wipes dumped into the sewer. Not only wet wipes cause pump failure due to entanglement in the pump but also it, made of water-insoluble plastic fibers, could adversely affects the water environment of Lake Ohrid by being discharged with untreated sewage.

There are three main countermeasures for this wet tissue problem. Basically, i) is important, but it is expected that it will take time to raise the awareness of the residents. Therefore, it can be said that it is effective to carry out ii) and iii) in parallel. In particular, ii) is judged to be an effective countermeasure

method, considering that all pump facilities on the primary trunk line are not equipped with machineries such as screens for removing trash and impurities. Another possible solution to the wet wipe problem is to install a shower toilet. See 5.3 for more information on the popularization of shower toilets. .

i) Awareness-raising to stop flushing wet wipes into sewer (source measures)
ii) Install a screen in front of the pump to remove wet wipes
iii) Change to a pump that is resistant to clogging (adoption of a cutter pump)

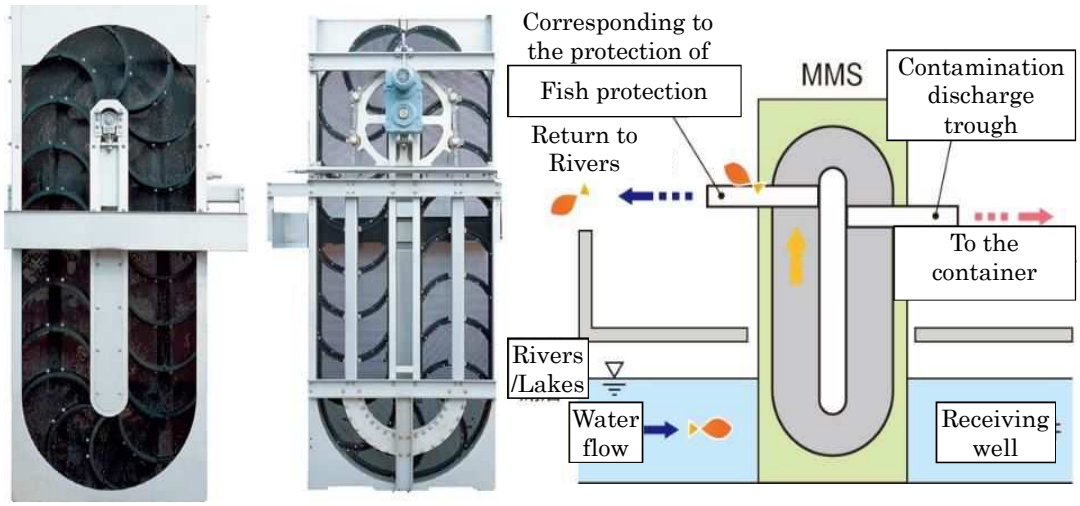
When introducing a screen, it is desirable to have the following features.

- Compact size that is not easily restricted by installation space
- No blockage will occur even if a large amount of impurities flow in.
- Simple structure and easy maintenance such as inspection and repair

Considering these conditions, an example of an effective countermeasure facility is a "multi-mesh screen".

■ Features of Multi Mesh Screen (MMS)

- It is difficult for impurities to flow out.
- It is difficult for blockage to occur
- Simple, lightweight, compact and energy saving
- Easy maintenance
- Supports fish protection (optional)



Source: Maezawa Industries, Inc. website

Figure 5.3 Schematic Diagram of Multi Mesh Screen

(3) Priority 3: Building a comprehensive sewerage business management system

It can be said that the management system of the sewerage system in the target area is similar to the basin sewerage system in Japan. For example, the PE Kolektorski which manages sewage treatment plants and primary sewage, is similar to a prefecture that manages sewage treatment plants and basin trunk sewer lines and the public enterprises of each municipality that manages secondary sewer, are similar to the municipalities that manages the connected sewer network.

Shiga Prefecture, which has a close connection with the target area, has been involved in the operation of the basin sewerage business for more than 40 years since the formulation of the "Lake Biwa Basin Sewerage Basic Plan" in 1971. Shiga Prefecture's knowledge of sewerage business management is considered to be effective in improving the sewerage business in the target area so that it can be operated comprehensively.

5.3 Ideas for the Cooperation Utilizing with Japanese Technologies and Know-how

Based on the contents up to the previous section of this chapter, this section organizes the ideas of cooperation utilizing with Japanese technologies and know-how toward each priority. Table 5.4 shows the roadmap for the final cooperation plan.

(1) Priority 1: Capacity Development for maintaining the capacity of existing facilities such as improving operation and maintenance capacity, strengthening financial base and enlightening residents

In order to achieve the goal of priority 1, it is considered appropriate to implement the following technical cooperation including "strengthening the facility maintenance capacity of the sewerage public enterprises", "strengthening the financial base of the sewerage public enterprises", "enlightenment of residents and environmental education" and "the providing equipment for sewer network maintenance".

Activity 1: Strengthening the facility maintenance capacity of the sewerage public enterprises
Activity 2: Strengthening the financial base of the sewerage public enterprises
Activity 3: Enlightenment of residents (prevention of dumping wet wipes into sewer)
Activity 4: Enlightenment of residents (promotion of payment of sewerage tariff)
Activity 5: Public awareness / environmental education (role of sewerage, environmental conservation of lake Ohrid)
Equipment provision:
Introduction of sewer network maintenance equipment (high pressure washer, vacuum truck, TV camera for sewer pipe inspection, etc.)

Table 5.1 shows the draft of the technical cooperation project that summarizes these. Regarding the strengthening of the financial base, as the data on which the sewerage charge is billed is provided by the water supply public enterprises, it can be said that the improvement of the non-revenue water rate of water supply leads to the improvement of the sewerage tariff collection. Therefore, Table 5.2 also shows a technical cooperation plan aimed at reducing the non-revenue water rate of the water supply public enterprises as an optional plan so that the implementation details can be adjusted according to the budget and the scale of input from the Japanese side.

Table 5.1 Technical Cooperation Project Proposal

Outcome	Activity	Counterpart
1. The facility maintenance capacity of the sewerage public enterprises is strengthened	1-1 Understand the current situation and existing plans through baseline surveys 1-2 Understand the ability level of staff through capacity assessment 1-3 Formulate a human resources development plan for staff in the maintenance department 1-4 Create a format for maintenance records and conduct training related to monitoring. 1-5 Develop manuals/guidelines for facility maintenance 1-6 Conduct training on the operation of procured vehicles (vacuum vehicles) 1-7 Aim to improve appropriate maintenance ability through OJT for maintenance department staff 1-8 Carry out regular monitoring of maintenance status 1-9 Review monitoring results and provide technical support to improve preventive maintenance capacity	➢ PE Kolektorski ➢ PE Niskogradba ➢ PE Vodovod i Kanalizacija Struga ➢ (PE Debrca)
2. The financial base of the sewerage public enterprise is strengthened	2-1 Sort the current situation and issues related to billing and collecting tariff operations 2-2 Consider measures for non-payers 2-3 Consider measures for low-income earners 2-4 Develop manuals / guidelines for measures against nonpayers and low-income earners 2-5 Prepare feasible measures as a tariff collection improvement plan 2-6 Implement a tariff collection improvement plan and monitor it regularly 2-7 Review monitoring results and reflect them in the next improvement plan	➢ PE Kolektorski ➢ PE Niskogradba ➢ PE Vodovod i Kanalizacija Struga
3. The capacity of public relations / public awareness for environmental protection and sewerage business service is strengthened	3-1 Sort the current situation regarding public relations / public awareness of local governments and sewerage public enterprises 3-2 Prepare a public relations / public awareness activity plan related to the importance of environmental conservation and sewerage business services 3-3 Prepare materials for public relations / public awareness activities 3-4 Conduct public relations / public awareness activities for general residents and elementary school students 3-5 Conduct public relations / public awareness activities for tourists	➢ PE Kolektorski ➢ PE Niskogradba ➢ PE Vodovod i Kanalizacija Struga ➢ PE Debrca ➢ Municipality of Ohrid ➢ Municipality of Struga ➢ Municipality of Debrca
Donated materials and equipment	➢ Vacuum truck ➢ TV camera for sewer in-pipe inspection ➢ Maintenance equipment	

Table 5.2 Technical Cooperation Project Proposal (Option for Water Supply Sector)

Outcome	Activity	Counterpart
Capacity on Non-Revenue Water (NRW) reduction and water intrusion reduction is strengthened	1-1 Understand the current status of NRW of water supply service 1-2 Consider NRW reduction measures and prepare NRW reduction plan 1-3 Implement feasible short-term measures among NRW reduction plan 1-4 Understand the current status of water intrusion from domestic customer and public stands 1-5 Consider installation f stop valve, identify the sites possible to be installed and prepare an installation plan 1-6 Install stop valves according to the plan	➢ PE Vodovod Ohrid ➢ PE Vodovod i Kanalizacija Struga

In addition to technical cooperation, the following may be a potential private-sector cooperation project from the viewpoint of reducing the use of wet wipes and improving the sewerage tariff collection rate.

1) Reducing the use of wet wipes

➢ Popularization of shower toilets:

Shower toilet might be a measure to reduce the amount of wet wipes used, which is the main cause of clogging of sewer pipes. Installation of shower toilets in hotels, public facilities, etc. where foreign tourists, who are the main dischargers, use could make this issue solved. If citizens who use public facilities experience shower toilets and have good impression of it, it can be expected that shower toilets will spread to general housing. In addition, the effect can be further improved by coordinating with the public awareness activities of the technical cooperation project above.

2) Improvement of sewerage tariff collection rate

➢ Introduction of electronic meters (smart meters):

By introducing electronic meters that can check the amount of used water remotely, the time and effort required to read the water meter will be reduced. The tariff collection rate will be improved by reducing the labor involved in the tariff collection.

(2) Priority 2: Rehabilitation, renewal and renovation of Sewerage facility

Rehabilitation of sewerage facilities is as listed below but can be broadly divided into two categories: Vranista STP and primary sewer and measures against unidentified water. Japanese technology introduced in 5.2 may be effective for Measure 1 and 2.

Activity 6: Strengthening the facility operation and maintenance capacity of the sewerage public enterprises (operation and maintenance of sewage treatment plant and pump facilities)

Activity 7: Enlightenment of residents (improvement from combined sewer system to separated sewer system)

Measure 1: Rehabilitation of Vranista STP (including upgrade)

Measure 2: Rehabilitation of primary sewer and pump facilities (including upgrade)

Measure 3: Rehabilitation of secondary sewer and pump facilities

Measure 4: Measures to reduce unidentified water (control of well drainage, etc.) and reduce untreated sewage discharge to Lake Ohrid (installation of initial stormwater retention reservoir in Voska district, etc.)

Measure 5: Improvement from combined sewer system to separated sewer system

1) Rehabilitation of Vranista STP [Activity 6 and 7, Measure 1]

It can be said that the priority of rehabilitation is high because the Vranista sewage treatment plant is significantly deteriorated and the urgency of countermeasures is high. However, in starting this, it is a major premise that advance inter-donor coordination including analyzing the background of the suspension of the treatment plant rehabilitation project by IPA.

Six years have passed since the FS conducted by IPA in 2015 and it is necessary to reexamine the contents of rehabilitation. Therefore, the contents of the project and the project cost will be reviewed by the FS. In addition, technical support such as staff training related to the operation management of the updated facility and residents' enlightenment activities for the improvement from combined sewer system to separated sewer system will be carried out together.

[Prerequisites]

- Pre-coordination between donors for Vranista STP rehabilitation
- Implementation of FS for rehabilitation of Vranista STP

2) Rehabilitation of Primary Sewer, Measures against Unidentified Water [Measures 2, 3, 4 and 5]

The measures will focus on rehabilitation of the primary sewer, reduction of unidentified water and control of untreated sewage discharge to Lake Ohrid. Since these measures have been considered by the JICA survey in 2015, it is desirable to basically follow the contents of these measures and implement the projects that are positioned as emergency measures. It should be noted that the rehabilitation project for the primary sewer carried out by the North Macedonian government and the rehabilitation for the primary sewer pump facility carried out by the PE Kolektorski should be fully coordinated.

Table 5.3 shows a list of countermeasures that can be implemented in the medium term and are desired to be implemented with priority, as a reference. Among these measures, rehabilitation of the primary sewer with the renewal of the sewer pipe leads to reduction of the amount of groundwater (unidentified water) that infiltrates into the sewer, the installation of a stormwater retention reservoir leads to the curb of untreated discharge to Lake Ohrid and the drainage control of wells contributes to the reduction of spring water (unidentified water) flowing into secondary sewer pipes.

[Prerequisites]

- Pre-coordination with the primary sewer rehabilitation project carried out by the North Macedonian government
- Pre-coordination with the primary sewer pump facility rehabilitation project carried out by PE Kolektorski

Table 5.3 Support Contents related to Rehabilitation of Primary Sewer, Measures against Unidentified Water into Sewer and Equipment for Sewer Maintenance

Primary sewer rehabilitation

Location		Material	Diameter [mm]	Length [m]	Construction method	Cost [EUR]	Implementation of North Macedonia government		Revised cost [EUR}
From	To						Length [m]	Construction method	
Desaret（東岸起点）	PS Krusa	PVC	ϕ500	1,717	CIPP method	725,000			725,000
PS Orce Nikolov	PS Ohrid 1	RC	ϕ800	3,000	Pipe making method without backfill	1,612,000	1,410	Pipe-in-pipe	854,000
PS Ohrid 1	PS Ohrid 2	RC	ϕ1,000	1,045	Pipe making method without backfill	713,000			713,000
PS Ohrid 2	PS Daljan	RC	ϕ1,200	3,337	Pipe making method without backfill	2,678,000			2,678,000
PS Dalijan	PS Podmolje	RC	ϕ1,200	5,006	Pipe making method without backfill	3,994,000	530	Pipe-in-pipe	3,571,000
Ancilary and Temporary works						2,027,000			1,748,000
Sum				14,105		11,749,000	1,940		**10,289,000**
								1EUR=130.00JPY	**1.34 bil JPY**

Installation of stormwater reservoir

Location	Capacity [m3]	Cost [EUR]	Implementation of North Macedonia side	Revised cost [EUR}
Voska地区	3,400	1,583,000		**1,583,000**
			1EUR=130.00JPY	**0.21 bil JPY**

Rehabilitation of pump station in primary sewer

Pump station name	Rehabilitation details	Cost [EUR]	Implementation of (PE) Kolektorski	Revised cost [EUR}
Ellen Kamen	Exchange submersible pump x2, Installation of mechanical and electrical equipment	68,000		68,000
Kalista	Exchange submersible pump x2	24,000	Bidding	
Elsec	Repair submersible pump x1	11,000	Bidding	
Ohrid 2	Repair screw pump x2, Installation of manual sluice gate x1	139,000		139,000
Daljan	Installation of submersible pump x1 and manual sluice gate x2	166,000		166,000
Podmojle	Installation of manual sluice gate x1 and bar screen x1	89,000		89,000
Vranista STP (inflow pump)	Repair screw pump x2, Installation of manual sluice gate x1	375,000	Excluded due to sewage treatment plant	
Sateska	Repair screw pump x1, Installation of manual sluice gate x1	114,000		114,000
Struga 3	Repair screw pump x1, Installation of automatic dust extractor x3 and sluice gate x4	957,000		957,000
All PS in primary sewer	Installation of SCADA system to 14 pump stations	1,717,000	Bidding at 4 PS	1,226,000
Sum		3,660,000		**2,759,000**
			1EUR=130.00JPY	**0.36 bil JPY**

Suppression of Well drainage

Countermeasure	Number of location	Cost [EUR]	Implementaion of North Macedonia side	Revised cost [EUR]
Installation of stop valve	10	5,000		**5,000**
			1EUR=130.00JPY	**0.65 mil JPY**
			Total Sum	**14,636,000**
				1.88 bil JPY

Note: Based on the emergency measures project cost proposed by the 2015 JICA survey, the project cost is calculated by reviewing the implementation quantity and exchange rate.
Source: JICA Survey Team

(3) Priority 3: Building a Comprehensive Sewerage Business Management System

It is an activity to achieve comprehensive sewerage business management with an eye on the long-term ideal of the sewerage system in the target area. The main contents are the establishment of a coordinating committee, etc. to coordinate among related organizations of the sewerage system in the target area and the formulation of a sewerage master plan.

Activity 8: Reform of awareness of government officials of target countries, senior officials of public enterprises, local government officials, etc. through country-specific training

Activity 9: Establishment of coordinating mechanism for related organizations, such as coordinating committee

Activity 10: Formulation of sewerage master plan

In particular, it is important for the PE Kolektorski, which manages the core facilities of the sewerage

system in the target area such as sewage treatment plants and primary sewer, to take the initiative and to change their mindset to lead related organizations.

Table 5.4 Roadmap for Cooperation Proposal

Year			Short term					Medium term					Long term									
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Roadmap			Priority 1: Maintaining the capacity of existing facilities																			
						Priority 2: Sewerage facility rehabilitation																
											Priority 3: Build a comprehensive sewerage business management system											
Priority 1	Maintaining the capacity of existing facilities																					
	Activity 1	Strengthening the facility maintenance capacity of the sewerage public enterprises (Introduction of preventive maintenance activities)	Technical Cooperation																			
	Activity 2	Strengthening the financial base of the sewerage public enterprises	Technical Cooperation			Continued implementation by the North Macedonian side																
	Activity 3	Enlightenment of residents (prevention of dumping wet wipes into sewer)	Technical Cooperation			Continued implementation by the North Macedonian side																
	Activity 4	Enlightenment of residents (promotion of payment of sewerage tariff)	Technical Cooperation			Continued implementation by the North Macedonian side																
	Activity 5	Public awareness / environmental education (role of sewerage, environmental conservation of lake Ohrid)	Technical Cooperation			Continued implementation by the North Macedonian side																
	Equipment Provision	Introduction of sewer network maintenance equipment (high pressure washer, vacuum truck, TV camera for sewer pipe inspection, etc.)	Technical Cooperation																			
Priority 2	Sewarage facility rehabilitation																					
	Activity 6	Strengthening the facility operation and maintenance capacity of the sewerage public enterprises (operation and maintenance of sewage treatment plant and pump facilities)									Technical Cooperation											
	Activity 7	Enlightenment of residents (improvement from combined sewer system to separated sewer system)									Technical Coopration		Continued implementation by the North Macedonian side									
	Measure 1	Rehabilitation of Vranista STP (including upgrade)				Plan review and design			Construction													
	Measure 2	Rehabilitation of primary sewer and pump facilities (including upgrade)	Imlementation by North Macedonian side			Construction																
	Measure 3	Rehabilitation of secondary sewer and pump facilities				Plan and design		Construction					Continued implementation by the North Macedonian side									
	Measure 4	Measures to reduce unidentified water (control of well drainage, etc.) and reduce untreated sewage discharge to Lake Ohrid (installation of initial stormwater retention reservoir in Voska area, etc.)				Plan and design		Construction														
	Measure 5	Improvement from combined sewer system to separated sewer system											Implementation by the North Macedonian side									
Priolity 3	Build a comprehensive sewerage business management system																					
	Activity 8	Reform of awareness of government officials of target countries, senior officials of public enterprises, local government officials, etc. through country-specific									Technical Cooperation											
	Activity 9	Establishment of coordinating mechanism of related organizations such as coordinating committee									Technical Cooperation		Management by the North Macedonian side									
	Activity 10	Formulation of sewerage master plan									Technical Cooperation										Review by North Macedonian side	