

## Solid Waste Management in Polog Region, North Macedonia, Phase I

### Improvement of the Solid Waste Management Services in the Polog Region, North Macedonia

#### – Amended Final Regional Waste Management Plan of Polog Region –



06 October 2020



## Solid Waste Management in Polog Region, North Macedonia, Phase I

Amended Final Regional Waste Management Plan of Polog Region

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## ABBREVIATIONS

AD	Anaerobic Digestion
CBA	Cost Benefit Analysis
CDPR	Centre for Development of Polog Planning Region
CDW	Construction and Demolition Waste
CHF	Swiss franc
CSR	Corporate Social Responsibility
EC	European Commission
EE	Electrical and Electronic
EEC	European Economic Community
EIA	Environmental Impact Assessment
EPR	Extended Producer Responsibility
ERP	Enterprise Resource Planning
EU	European Union
EUR	Euro
FS	Feasibility Study
IMWMB	Inter-municipal Waste Management Board
ISWM	Integrated Solid Waste Management
IU	INFRASTRUKTUR & UMWELT
IWM	Integrated Waste Management
LGU	Local Government Unit
LoE	Law on Environment
LoWM	Law on Waste Management
MAKStat	Republic of Macedonia State Statistical Office
MBT	Mechanical Biological Treatment



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MKD	Macedonian Dinar
MoAFWM	Ministry of Agriculture Forestry and Water Management
MoE	Ministry of Economy
MoEPP	Ministry of Environment and Physical Planning
MoF	Ministry of Finance
MoH	Ministry of Health
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
MTC	Ministry of Transport and Communication
NGO	Non-Governmental Organization
NTES	Nomenclature of Territorial Units for Statistic
NWMP	National Waste Management Plan
NWMS	National Waste Management Strategy
PCB	Polychlorinated Biphenyl
PCE	Public Communal Enterprise
PCT	Polychlorinated Terphenyl
PE	Polyethylene
PET	Polyethylene Terephthalate
PP	Polypropylene
PPE	Personal Protective Equipment
PPP	Private-Public-Partnerships
PR	Public Relations
RCDP	Regional Centre for Development of the Polog Region
RDC	Regional Development Centre
RDF	Refuse Derived Fuel
RWMB	Regional Waste Management Board
RWMP	Regional Waste Management Plan
SAA	Stabilization and Association Agreement
SEA	Strategic Environmental Assessment
SECO	State Secretariat for Economic Affairs
SWM	Solid Waste Management
WEEE	Waste Electrical and Electronic Equipment
WM	Waste Management
ZELS	Association of the Units of Local Self Government





## 0 Executive Summary

### Background

This Regional Waste Management Plan of the Polog Region (RWMP) is the policy document of the nine Municipalities of the Polog Region outlining how the Municipalities intend to improve the management of solid waste generated in the region. This policy document has been developed with the support of an Integrated Waste Management (IWM) Project funded by the Swiss State Secretariat for Economic Affairs (SECO) with a grant contribution of CHF 1.9 million. This project is implemented by the nine municipalities of the Polog Planning Region, represented by the Centre for Development of the Polog Planning Region.

The planning horizon of this RWMP for the Polog Planning Region is 10 years, subdivided into three implementation phases, in line with the requirement set in the Rulebook O.G No. 63 from 2013.

- Phase 1 (2019 – 2020): Implementation of quick-win measures / priority measures
- Phase 2 (2021 – 2026): Implementation of Regional Waste Management System / short-term measures
- Phase 3 (2027 – 2029): Planning and construction of new regional SWM facilities / medium-term measures

This RWMP provides policy framework for management of solid waste generated within the planning territory and in particular presents the preferred technologies and methods. Based on the agreed RWMP in further steps a feasibility study for the identified priority short term investment measures, as well as respective design and tender documents will be prepared.

The associated Strategic Environmental Assessment (SEA) proceeded simultaneously with the drafting process of RWMP.

### Project Area

The Polog Planning Region is formed by nine municipalities (Bogovinje, Brvenitsa, Gostivar, Jegunovtse, Teartse, Tetovo, Vrapchishte, Mavrovo and Rostusha, Zhelino) as administrative units of lower level which in total include 184 settlements.

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### Population and Waste Amounts

Knowledge about waste amounts and its composition is a fundamental requirement for waste management planning.

As there is no consistent data from municipalities or landfills regarding the amount of collected waste available, quantities of municipal waste generated and collected have been estimated based on

- available data and statistics, i.e. using the specific waste generation given in the NWMP 2009 – 2015, and the population data according to the CENSUS 2002 and MAKStat,
- information provided by the municipalities in the course of the assessment phase.

The calculated waste amounts are shown in the following table.

Municipal Waste Generation and Collection in Polog Region (2018)					
Municipality	Population	Waste Generation		Waste Collection	
		[t/a]	[t/d]	[t/a]	[t/d]
Brvenitsa	16,651	5,529	15	4,423	12
Bogovinje	31,100	10,327	28	8,262	23
Gostivar	83,921	33,771	93	30,394	83
Jegunovtse	10,387	3,449	9	2,759	8
Mavrovo & Rostusha	8,912	2,959	8	2,367	6
Teartse	22,973	7,628	21	3,051	8
Tetovo	92,360	37,167	102	33,451	92
Vrapchishte	27,700	9,198	25	7,358	20
Zhelino	28,382	9,424	26	3,770	10
<b>POLOG Region</b>	<b>322,385</b>	<b>119,453</b>	<b>327</b>	<b>95,835</b>	<b>263</b>

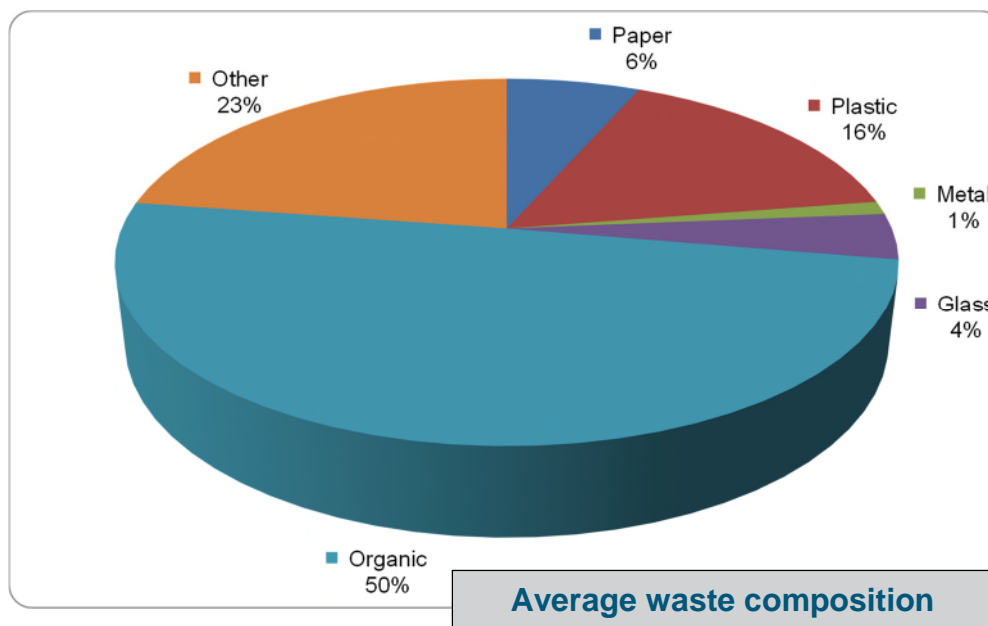
The average waste collection rate is estimated at 80% of the generated waste, based on information provided by the municipalities.

The average waste composition identified during the status assessment is shown in the figure below. Dry recyclable fractions (paper, plastic, metal and glass) make up for 27% of the total waste, whereas the amount of organic waste (e.g. food waste and green waste) comprises by far the biggest fraction (50%).

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### Key Challenges and Bottlenecks of Current Waste Management System

Overall, waste management services in Polog Region are not complying with the national regulations and international standards. Generally, services are rudimentary, only comprising of inefficient collection and poorly controlled disposal, without additional elements of advanced waste management as defined in the EU directives for waste.

Performance of waste collection services is hampered by

- Outdated and partly inappropriate collection vehicles
- Poor conditions of collection points and containers
- Overstaffing and insufficient qualification of public utilities
- Deficits in planning and monitoring at all levels
- Low fee collection rates
- Insufficient performance (and cost) monitoring

The focus for service provision is given to the cleaning of urban centres, with unserved areas especially in more remote settlements and very limited engagement of municipalities in separate collection, treatment and recycling.

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The biggest challenge in the current waste management, according to the statements from all municipalities and service providers, is the disposal of the collected waste.

Current shortcomings and challenges include:

- High level of pollution from the Rusino landfill resulting in blockages by the local population.
- Need of transport of collected waste out of the regional borders (because of blockages), resulting in high transport and disposal costs.
- Indiscriminate dumping of waste and uncontrolled dumpsites in all municipalities.
- Non-availability of approved (and controlled) locations for disposal of construction waste, causing uncontrolled dumping.

Municipalities, mostly refer to lack of funding as the main reason for the deficits in service provision. Nevertheless, SWM planning as well as performance and cost monitoring of services are poorly developed, and current unit costs for waste collection of public utilities are comparatively high.

Financing of improved waste management will be a key challenge. Based on affordability considerations there are only very limited possibilities to increase the waste management tariffs on short term. Assuming that implementation of EU and Macedonian standards and targets for waste management will at least double the current cost, a staged approach will be required. The Regional Waste Management Plan identifies, which priorities and targets can realistically be achieved in which time frame.

### Objectives and Targets for the Improvement of the Waste Management System

In compliance with the European Waste Directive (2008/98/EC) the main objective of any waste policy is the minimisation of the negative effects caused by generation and management of waste on human health and the environment. Thus, the overall objective of the RWMP is to contribute to **a clean and healthy environment for the population of the Polog Region.**

The basis for the development of options for technology and methods in waste management are the objectives and targets set on national or EU level in order to improve environmental, safety and health performance of the current waste management system. As the National Waste Management Plan 2009-2015 is outdated and the new plan (2018-2024) is not yet adopted, the RWMP is developed on the basis of the targets defined in the respective EU directives. Based on the assessment of the current situation in the Polog Region, realistic timelines for achievement of these EU targets have been identified.

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Targets and Timelines for the RWMP				
	EU Directives		RWMP Targets	
	Target	Date	Target	Date
<b>Waste Collection</b>				
Collection of Mixed Municipal Waste	assumed full coverage		90%	2024
Collection of Mixed Municipal Waste	assumed full coverage		100%	2029
<b>Separate Collection, Reuse and Recycling</b>				
Separation of bio-waste to be recycled at source or a separate bio-waste collection		31 Dec 2023	25% of households have access to separate collection of bio-waste	2026
Preparing for re-use and recycling of MSW	50%	2020	50% of households have access to separate collection of recyclables	2024
	55%	2025		
	60%	2030		
	65%	2035		
<b>Landfilling of waste and treatment of organic waste</b>				
Disposal on regional controlled landfill			90% of collected residual waste	2021
Disposal on regional landfill according to EU Directive			100% of collected residual waste	2024
Reduction of landfilled biodegradable components of MSW (compared to reference year)	by 25%	after 5 years	by 25%	2026
	by 50%	after 8 years	by 50%	2031
	by 65%	after 15 years	by 65%	2034
Reduction of the landfilled waste amount	to 10% or less of total generated MSW	2035	to 60% or less of total generated MSW	2031
<b>Fee collection and public awareness</b>				
Increase in fee collection efficiency			70% of households pay for SWM	2024
Increase in public awareness			40% of population participates in separation of dry recyclables	2026

### Preferred Technologies and Methods

Considering the current challenges and shortcomings of the SWM system in Polog region, as well as the limited affordability of the population to pay cost covering tariffs, the highest priority will be given to improvement of waste collection and safe disposal, followed by improvement of recycling and composting and finally the realisation of complex treatment

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facilities. Thus, the focal areas for short term interventions (during Phase I and Phase II) are:

- Improvement of waste collection and separation
- Improvement of waste disposal

Reduction of landfilled biodegradable components is, in the EU legal framework, stretched over several phases and a period of 15 years and thus will be a focus of the medium/ long term activities. As a result of the prioritization and option assessment, focal areas of interventions during Phase I and Phase II will be:

1. Development of Rusino landfill as a regional sanitary landfill according EU landfill directive, which includes
  - Quick-win measures for immediate improvement to be implemented during Phase I
  - Setting up the required operational structure for operation of Rusino landfill (and other regional facilities, as far as required);
  - Setting up financing schemes to secure sustainable operation and maintenance of the implemented investment measures and closure and aftercare of the Rusino landfill
  - Investment measures to develop Rusino landfill as sanitary landfill during Phase II
  - Site selection and preparations for the implementation of a new sanitary landfill/ regional waste management centre as a replacement for Rusino
2. Development of an optimised system for waste collection
  - Procurement of waste collection containers (quick-win measures, Phase I)
  - Provision of additional equipment (Phase II)
  - Improvement of efficiency of service delivery (Phase II)
3. Initiating engagement of municipalities in recycling and waste treatment (Phase I and II)
  - Identification and testing of most promising approaches for waste recovery and treatment (starting in Phase I)
  - Identification and testing of possible alliances with private sector and informal sector (starting in Phase I)

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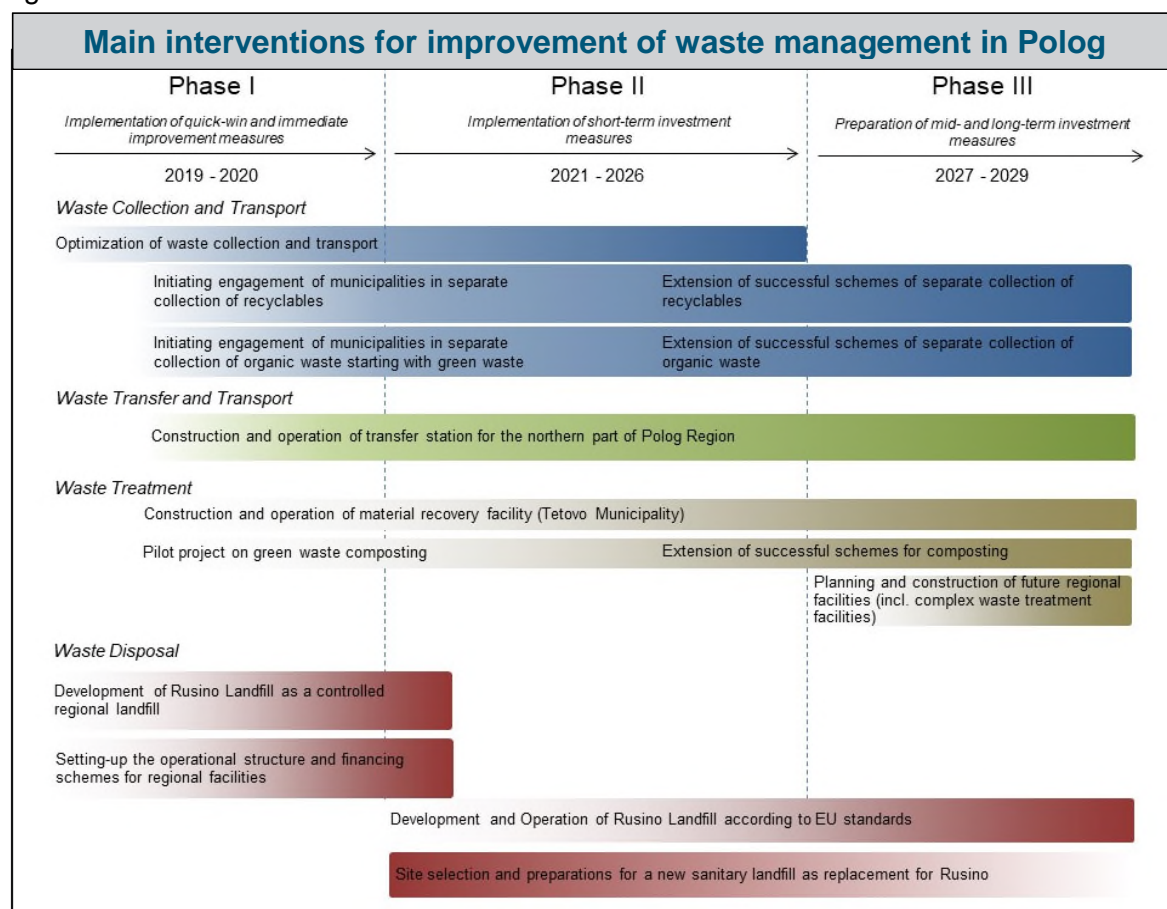
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- Realization of an MRF and a (pilot) composting plant (Phase II)
4. Development of an optimised system for waste transfer and transport (Phase I and II), which includes:
- Establishment of a transfer station for the municipalities in the northern part of Polog region

Phase III (2027 onward) will focus on the realisation of a regional waste treatment facility. In general, there are two possible technology options: either mechanical biological treatment (MBT), or incineration (with waste to energy). Frame conditions important for decision making might change within the next years, i.e. market situation for refuse derived fuel, technology costs, acceptance of technologies by population and decision makers etc. Therefore, the decision regarding the preferred technology should be taken at the beginning of Phase III of plan implementation based on the development of the various frame conditions.

Main interventions during the three Phases of the RWMP are summarized in the following figure.





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### Institutional Aspects

Currently, all waste management services are provided by the individual municipalities, respectively private companies on behalf of the municipalities. Nevertheless, certain elements of an integrated waste management system require large scale solutions for cost effective operations. Therefore, cooperation among municipalities, respectively a so-called “regionalisation” is required.

Whereas in the municipalities the institutional capacities for planning and implementation of waste management services need to be strengthened, the organisational structure for regional services need to be built up from scratch. As for the introduction of waste management measures, this RWMP anticipates a staged approach for the *Regionalisation* of waste management services:

- Phase I: A regional public waste management utility shall be established for operation of Rusino landfill by the beginning of 2020, serving all municipalities of the Polog Region.
- Phase II: The regional public utility shall be capacitated for operation of the sanitary landfill, to be realized during Phase II.
- Phase III: Additional tasks may be transferred to the regional public utility, once the company has been successfully established and has proven the efficiency and effectiveness of operations.

In all three phases, the private sector can be involved in the different activities of the public utility.

### Costs and Cost Recovery

Financing of improved waste management services will be a major challenge for implementing the RWMP. Even in case support from central government and/or donors can be secured for investment funding, the municipalities (respectively the population and businesses) have to ensure coverage of operational costs. The initial investment costs are summarized in the following table.



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Summary of initial investments (without taxes and consultancy)		
SWM Component	Overall Initial Investment Requirements (Estimation)	
Street Sweeping	480,000 EUR	29,520,000 MKD
Waste Collection	3,660,000 EUR	225,090,000 MKD
Transfer and Transport	3,500,000 EUR	215,250,000 MKD
Material Recovery		
Improvement of Rusino landfill	6,475,000 EUR	398,212,500 MKD
Rehabilitation of other dumpsites	5,200,000 EUR	319,800,000 MKD
Sophisticated waste treatment	Investment cost and funding to be clarified during Phase III	
<b>Grand Total (Phase I and Phase II)</b>	<b>19,315,000 EUR</b>	<b>1,187,872,500 MKD</b>

Without sophisticated waste treatment (which is scheduled for a later stage), the total initial investment is summing up to almost 20 million EUR (1,188 million MKD). Most likely, it will not be possible to secure funding for the full amount, required. Therefore, prioritization as well as the identification of less costly alternative solutions might be required. More detailed cost calculations as well as possibilities to reduce the costs of different components will be elaborated in the scope of a feasibility study.

Specific costs (costs per tonne of collected waste) for the three planning phases have been roughly estimated using reference values. The cost estimation is based on the planned technologies and methods as well as the forecasted amount of collected waste.

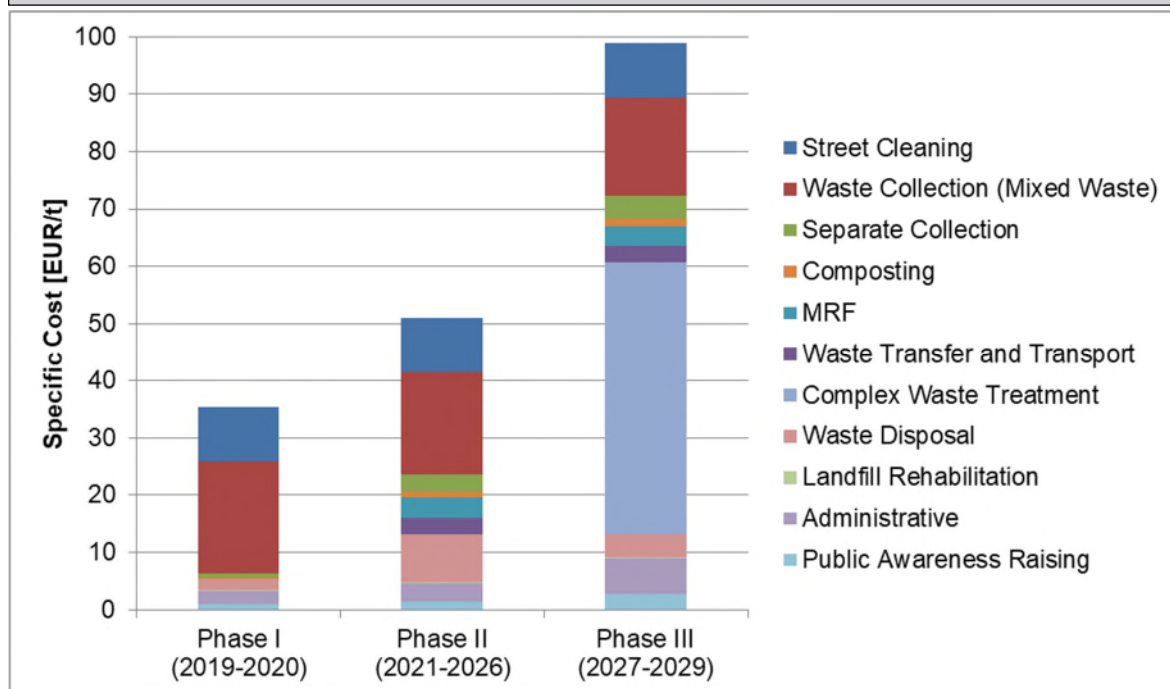
The total costs for municipal waste management in Polog Region are expected to increase from 3.5 million EUR (219 million MKD) per year in Phase I, to 6.2 million EUR (381 million MKD) per year in Phase II and 12.9 million EUR (791 million MKD) per year in Phase III. In order to compare the annual specific costs of the three phases, these costs are divided by the estimated collected amount of waste for the corresponding year. The estimated specific costs per tonne of collected waste are shown in the diagram below.

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### Estimated specific costs (EUR/t) for the three implementation phases



It is evident, that the specific costs in Phase II (51 EUR/t – 3,137 MKD/t) are expected to be substantially higher than in Phase I (35 EUR/t – 2,177 MKD/t). Main reason for the cost increase is the change of disposal from controlled landfill in Phase I to sanitary landfill in Phase II. Much higher costs are estimated for Phase III (99 EUR/t – 6,082 MKD/t) due to the operation of a sophisticated waste treatment facility.

For assessment of the impact of this cost development on the tariffs for households, it is assumed that financing of the future ISWM system will be fully covered through fees. In addition, it is assumed that 60% of the costs will be covered by fees from households and 40% by fees from business entities (and institutions). Based on these assumptions, the following cost covering fees for the three implementation phases have been calculated for fee collection rates of 90%, 70% and 40%.

Estimation of cost covering fees for households						
Fee collection rate	Phase I		Phase II		Phase III	
	EUR/hh/month	MKD/hh/month	EUR/hh/month	MKD/hh/month	EUR/hh/month	MKD/hh/month
90%	2.67	164	4.57	281	9.35	575
70%	3.43	211	5.87	361	12.03	740
40%	6.02	370	10.26	631	21.06	1,295

The current affordable SWM fee is estimated to be 445 MKD/household/month in average. In this regard, the calculated cost covering fees for the Phase I are within the



## **Solid Waste Management in Polog Region, North Macedonia, Phase I**

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affordability limit for all scenarios of fee collection rate. The ISWM system in Phase II is estimated to be affordable only in case of fee collection rate of 70% and 90%. Conversely, the ISWM system in Phase III, based on the current household income, would not be affordable. Therefore, during Phase III for identification of the preferred treatment option the affordability needs to be reassessed based on the actual income situation at that date.

The fees in the table above are average fees calculated considering only the total number of households in the region. In order to determine the fees for each municipality and settlement structure; urban, semi-urban, and rural areas, the costs and actual tariffs have to be calculated considering the local conditions and specific waste generation rates in each municipality.

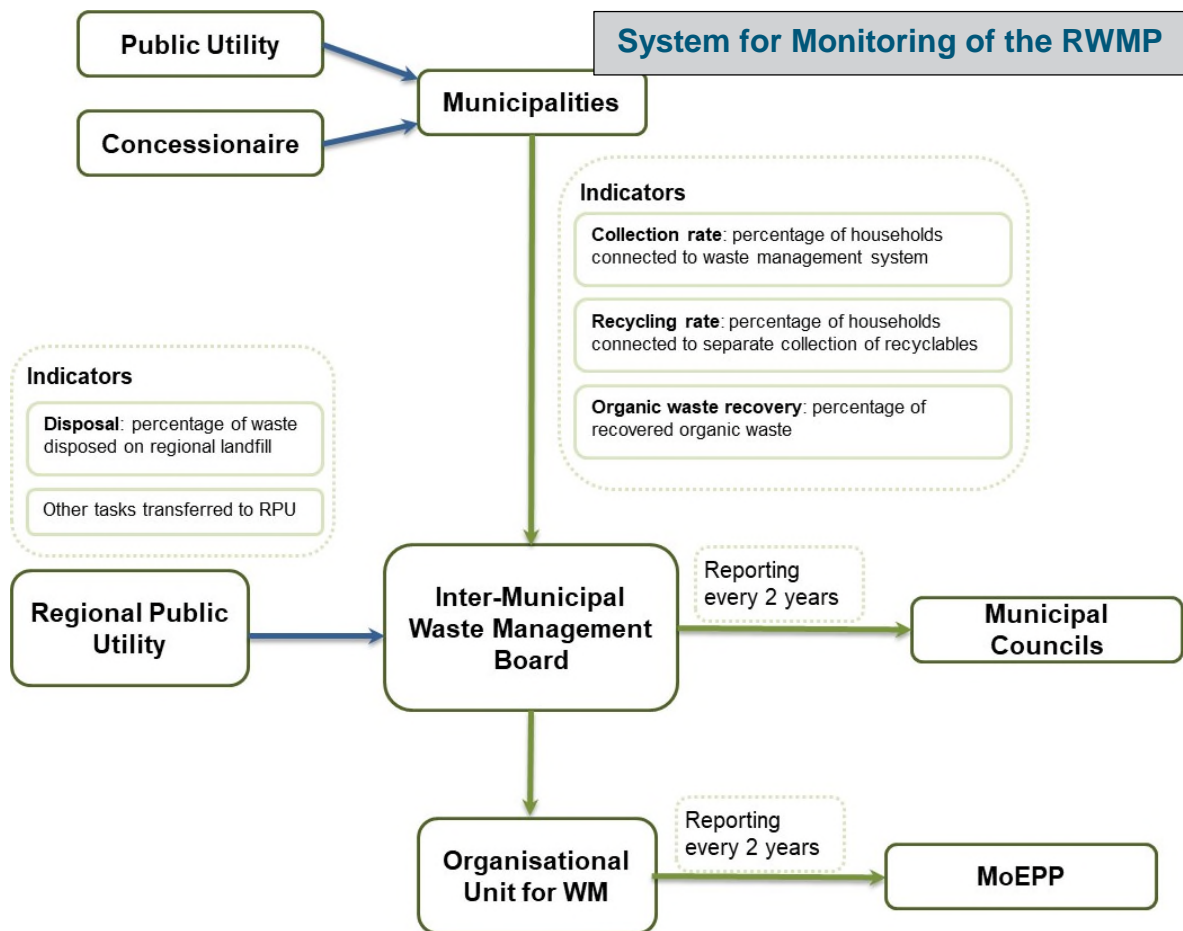
### **Monitoring and Revision of the RWMP**

In accordance with the Law on Waste Management, this RWMP has been prepared for a period of ten years. Thereafter a new plan will be prepared. In the meantime, the regional waste management board may put forward proposals for amendments of the RWMP every two years.

The implementation of the RWMP shall be monitored based on the targets of the plan, which are based on the EU directives for waste. Thereby, the progress and the achieved results can be measured, performance-based decisions can be made and the success of the plan can be defined and evaluated. In the following figure the system for monitoring and reporting as well as the indicators are presented.

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**Action Plan**

Activities, responsibilities and timelines, are summarized in the following action plan. Key responsibilities are addressed for all activities.



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Action Plan RWMP Polog 2019 - 2029																		
Nr.	Measures	Main Responsibility	Phase I				Phase II				Phase III							
			2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029					
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<b>1 Waste Collection (including separate collection)</b>																		
1.1	Improvement of waste collection services, incl. extension of service area in rural areas	M																
a)	Development of performance monitoring system	M																
b)	Procurement of equipment for waste collection and street sweeping	M/P																
b1)	Procurement of waste collection containers through quick-win measures	M																
1.2	Separate collection of recyclables and organic waste	EPR/M																
a)	Pilot projects for separate collection	EPR/M																
a1)	Pilot projects for separate collection in cooperation with informal sector through quick-win measures	EPR/M																
a2)	Pilot projects for separate collection and composting of green waste	M																
b)	Extension of pilot projects for separate collection	EPR/M																
<b>2 Waste Transportation and Transfer</b>																		
2.1	Clarification of the joint use of Tetovo transfer station	R/M																
2.2	Construction of Tetovo transfer station and or new transfer station, if required	Tetovo																
2.3	Construction of alternative transfer station, if required	to be clarified																
<b>3 Waste Treatment</b>																		
3.1	Implementation of pilot projects on green waste composting and home composting	M																
3.2	Extension of pilot projects for composting	M																
3.3	Implementation of material recovery facilities	Tetovo																
3.4	Implementation of a complex waste treatment facility	R/M																
a)	Planning of complex waste treatment	R/M																
b)	Construction of complex waste treatment facility	R/M																
<b>4 Waste Disposal</b>																		
4.1	Implementation of immediate improvement measure to convert Rusino dumpsite into a controlled regional landfill	R																
4.2	Setting-up the operational structure and financing schemes for regional facilities	R																
4.3	Development of Rusino Landfill as a sanitary landfill according to EU directives	R																
4.4	Site selection and preparations for a new sanitary landfill as replacement for Rusino Landfill	R/M																
a)	Site selection for replacement of Rusino	R/M																
b)	Preparations for the realisation of new sanitary landfill (incl. design, tender documents, mobilisation of funding etc.)	R/M																
4.5	Rehabilitation of dumpsites	M																
a)	Mapping, risk assessment and categorization	M																
b)	Preparation of rehabilitation concepts and cost estimations	M																
c)	Identification of funding, detailed design, procurement, implementation of rehabilitation works	M																

**Solid Waste Management in Polog Region, North Macedonia, Phase I**  
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Action Plan RWMP Polog 2019 – 2029 (continued)																		
Nr.	Measures	Main Responsibility	Phase I				Phase II				Phase III							
			2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029					
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<b>5 Institutional Development</b>																		
5.1	Establishment of a regional public waste management utility	R/M																
5.2	Capacitating the regional public utility for operation of regional landfill	R/M																
5.3	Transfer of additional tasks to the regional utility	R/M																
Transfer of additional tasks to be decided once regional public utility is successfully established																		
<b>6 Public Awareness, Public Participation and Waste Avoidance</b>																		
6.1	Implementation of Public Awareness Campaign as part of the Quick-Win Measures	R/M																
6.2	Participation of local stakeholders in the regional waste management planning through SEA	R/M																
6.3	Assigning responsibilities for public awareness and communication in the regional utility	R																
6.4	Development of brand and corporate identity of regional utility	R																
6.5	Creation of website and social media platform for regional utility	R																
6.6	Prepare and implement annual public awareness and communication action plan	R																
<b>7 Management of Construction Waste</b>																		
7.1	Determination of location for and establishment of inert waste landfills	M																
7.2	Establish operation for inert waste landfills	M																
7.3	Inform the constructors of the existence and location of the inert waste landfills	M																
7.4	Monitor the enforcement of existing regulations in regard to the separate collection, transportation and disposal of CDW	M																
<b>8 Management of Other Waste Streams</b>																		
8.1	Preparation of waste management programs by waste producers	W																
8.2	Annual reporting of waste data	W																
8.3	Cooperation between EPR-collective schemes with municipalities	W/M																
<b>9 Monitoring, Reporting and Revision</b>																		
9.1	Monitoring of the performance of the implementation of RWMP	R/M																
9.2	Reporting on plan implementation in every 2nd year of the commencement	R																
9.3	Revision of RWMP for the next implementation period	R																

## **Solid Waste Management in Polog Region, North Macedonia, Phase I** **Amended** Final Regional Waste Management Plan of Polog Region

### **1 Background**

This Regional Waste Management Plan of the Polog Region (RWMP) is the policy document of the nine Municipalities of the Polog Region outlining how the Municipalities intend to improve the management of solid waste generated in the region. It is a strategic document to implement national policies and legislation on solid waste management in the regional solid waste management of Polog Region and it has been prepared in line with North Macedonian legislation and national policy documents.

This Regional Waste Management Plan has been developed with the support of an Integrated Waste Management (IWM) Project funded by the Swiss State Secretariat for Economic Affairs (SECO) with a grant contribution of CHF 1.9 million. This project is implemented by the nine municipalities of the Polog Planning Region, represented by the Centre for Development of the Polog Planning Region, and supported by INFRASTRUKTUR & UMWELT, in association with SEHLHOFF and BAR E.C.E.

Based on the agreed RWMP in further steps a feasibility study for the identified priority short term investment measures, as well as respective design and tender documents will be prepared.

#### **1.1 Scope of the Plan**

This Regional Waste Management Plan covers the territory of Polog Planning Region, North Macedonia. The region is formed by nine municipalities which all support the development of the RWMP.

The planning horizon of this RWMP for the Polog Planning Region is 10 years from 2019-2029, subdivided into three implementation stages, in line with the requirement set in the Rulebook O.G No. 63 from 2013:

- Phase 1 (2019 - 2020): Implementation of quick-win measures / priority measures
- Phase 2 (2021 - 2026): Implementation of Regional Waste Management System / short-term measures
- Phase 3 (2027 - 2029): Planning and construction of new regional SWM facilities / medium-term measures

This RWMP provides policy framework for management of solid waste generated within the planning territory and in particular presents the preferred technologies and methods for the management of the municipal solid waste which comprises household waste and waste from other sources which is similar in nature and composition to household waste.

## Solid Waste Management in Polog Region, North Macedonia, Phase I Amended Final Regional Waste Management Plan of Polog Region

The presented options for future regional solid waste management shall improve the current waste management service performances on a regional level.

In addition to the typical components of municipal solid waste (biodegradable waste, dry recyclables, etc.), the plan also provides policy framework for the management of other waste streams which are not entirely part of MSW. They comprise construction and demolition waste, commercial and industrial waste, sewage sludge, hazardous waste (clinical and healthcare waste, waste oil, PCB/PCT, etc.), and special waste streams managed under EPR (packaging waste, WEEE and waste batteries and accumulators).

### 1.2 Policy and Regulatory Framework

#### 1.2.1 EU Waste Legislation and Waste Management Objectives

EU waste legislation can be divided into the following categories: framework legislation, legislation on waste management operation, legislation on specific waste streams and reporting and questionnaire legislation. The following figure gives an overview of EU legislation.

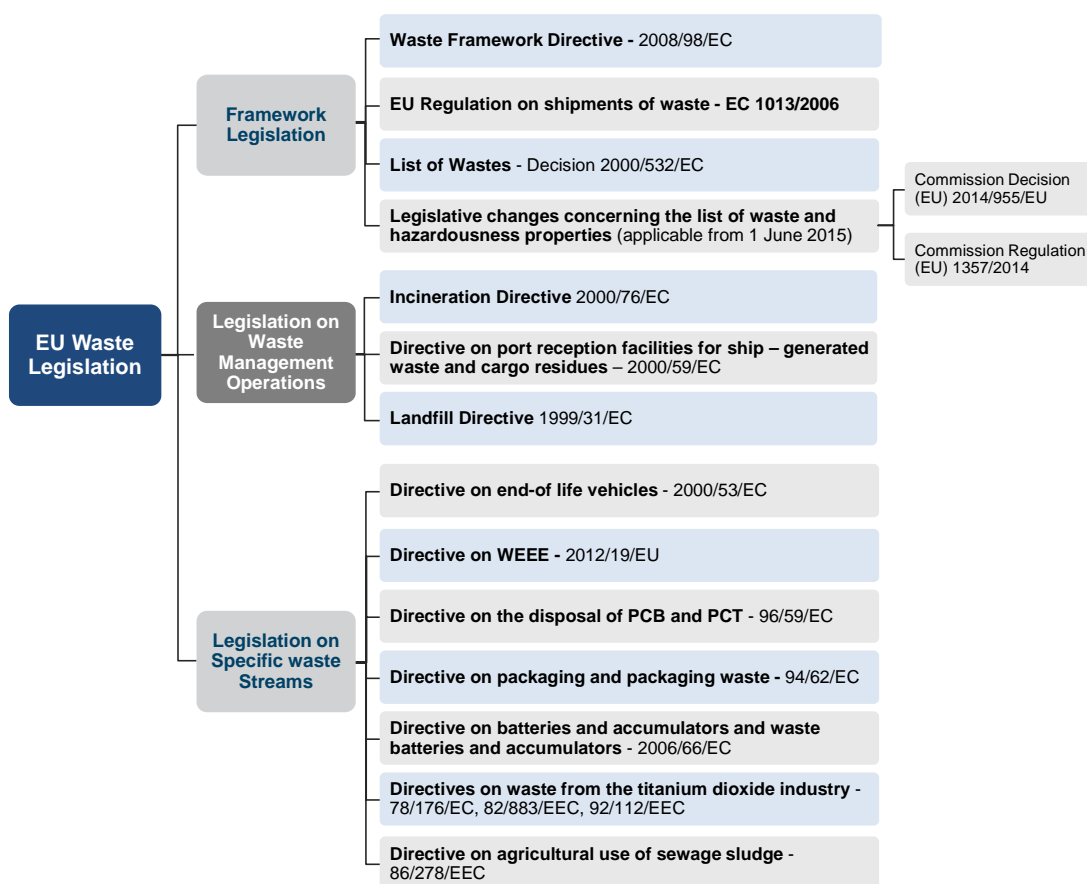


Figure 1 Overview of the main EU Waste Legislation



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The most overarching legislation is the Waste Framework Directive 2008/98/EC. The directive establishes a general framework for handling waste in EU and sets definitions and targets for EU waste management. The following are the key points of the directive:

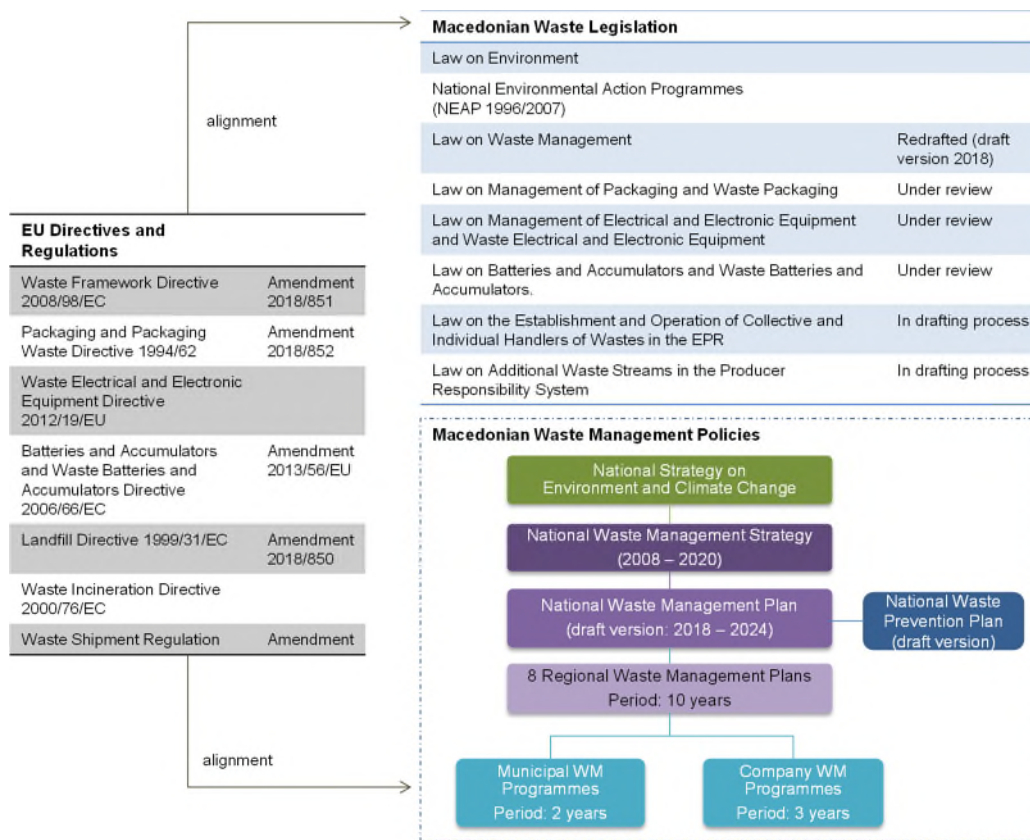
- Waste hierarchy: prevention, re-use, recycling, recovery, disposal
- Polluter pays principle
- Extended producer responsibility (EPR)
- Establishment of national waste management plans and prevention programs by competent national authorities
- Targets for member states with regards to separate collection, preparing for re-use and recycling and landfilling of waste.

### **1.2.2 National Waste Management Legislation and National Waste Policy**

In 2001 North Macedonia has initiated the process of approximation of the national legislation with the EU by signing the Stabilization and Association Agreement (SAA) and European Partnership. The country was declared a candidate country in December 2005. The EU annual report 2018 for North Macedonia describes that the aligning process of Macedonian policies and legislations with EU acquis in waste sector has made some progress. However, “significant efforts are needed as regards implementation and enforcement”. Furthermore, the report goes on saying that the country should “intensify the efforts for implementation of adopted regional waste management plans and establishing of integrated regional waste management system”.

The Macedonian legislation concerning environment in general and waste management in particular includes different documents such as laws, lists and rulebooks. The following graph displays the EU directives and regulations and Macedonian policy and regulatory framework for waste management.

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**Figure 2 Waste management related laws and regulations<sup>1</sup>**

The Law on Environment (LoE) establishes fundamental principles and regulates the rights and responsibilities in order to protect the environment at all levels. The Law on Waste Management (LoWM, 2004) regulates all concerns regarding non-hazardous and hazardous waste and special waste streams. It has first been amended in 2012 and is now being redrafted (draft version 2018) in compliance with the main principles of the European Waste Framework Directive.

Furthermore, the LoWM (as amended 2012) introduces the

- National Waste Management Strategy (NWMS), which defines long-term needs and legislative measures for enforcement (2008 – 2020; being redrafted 2020 – 2032)
- National Waste Management Plan (NWMP), which assesses the current SWM conditions and defines actions for improvement (2009 – 2015, being redrafted 2018 – 2024)

<sup>1</sup> Information source: Draft NWMP 2018 – 2024 (2018) and Draft Law on Waste Management (2018)

## Solid Waste Management in Polog Region, North Macedonia, Phase I

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- Regional Waste Management Plan (RWMP), which shall be in line with the NWMS and regulates funding and fees regarding SWM.

The Law on Management of Packaging and Packaging of Waste establishes environmental requirements for packaging during its production, market release and use-phase and the treatment of packaging waste which applies to all packaging produced and released in the Republic of North Macedonia. It includes rules for collection, reuse, recycling, treatment and disposal of packaging waste.

The Law on Management of Batteries, Accumulators and Waste Batteries and Accumulators regulates the requirements for environmental protection which should be met in the production and placement on the market of batteries and accumulators as well as the treatment of the waste batteries and accumulators.

The Law on Management of WEEE regulates requirements for environmental protection which should be met in the production and release of electrical and electronic equipment as well as the method of collection, treatment, processing and disposal of WEEE.

The regional approach to the municipal solid waste management is introduced by an amendment to the LoWM in 2012. The amendment inter alia mandates Municipalities form an Inter-Municipal Waste Management Board and to prepare and adopt a regional waste management plan.

### 1.3 Waste Management Objectives Set in National Plans

The newly drafted versions of the Law on Waste Management and the National Waste Management Plan 2018 – 2024 are in process of adoption and thus cannot yet be used as basis for the Regional Waste Management Plan. However, the Waste Management Plan 2009 – 2015 in several aspects is outdated and does not provide clear guidance.

**Table 1 Targets for municipal waste management in NWMP 2009 – 2015 and draft NWMP 2018 - 2024**

	NWMP 2009-2015 (2008)		Other Policy Instruments (2009/2011)			NWMP 2018-2024 (Draft 2018 not yet adopted)	
	Target	Year	Reference	Target	Year	Target	Year
<b>Waste collection and separation</b>							
Collection of mixed municipal waste	90%	2014				90% of households	2020
						100% of households	2024

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	NWMP 2009-2015 (2008)		Other Policy Instruments (2009/2011)			NWMP 2018-2024 (Draft 2018 not yet adopted)	
	Target	Year	Reference	Target	Year	Target	Year
Separate collection for metal, plastic, glass, paper & cardboard						50% of households	2020
Separate collection and treatment of municipal bio-waste						3 new treatment facilities for bio-waste	2024
Public engagement (campaigns to support roll out of collection services)						3 campaigns	2024
<b>Landfilling of waste</b>							
Landfill of MSW on temporary facilities (after conditioning) / at designated municipal sites	100%	2014				100%	2020
Landfill of MSW on facility compliant with EU standards	50%	2014				80%	2024
Reduction of landfilled biodegradable components of MSW	to 75%	2014	(1)	by 25%*	2017	by 25%*	2026
				by 50%*	2020	by 50%*	2031
				by 65%*	2027	by 65%*	2034
Reduction of landfill GHG emissions (landfills only)	reduction for app. 25% of CO <sub>2</sub> eq.	2014					
Diversion of industrial hazardous waste streams from non-hazardous landfills	100%	2010					
<b>Special waste streams</b>							
Packaging waste, recovery/processing	50%	2018	(2)	60%**	2020	60%	2020
Packaging waste, recycling:	25%	2018		55%**	2020	55%	2020

\* Percentage by weight of biodegradable waste amount in 1995

\*\* Percentage by weight of packaging waste to be processed / recycled

(1) Rulebook on the quantity of the bio degradable waste that is allowed to be land filled (Official Gazette of The Republic of Macedonia no. 108/09, 142/09)

(2) Law on Management of Packaging and Packaging Waste, Art. 35 ((Official Gazette of The Republic of Macedonia no.161/09, 17/11, 47/11)

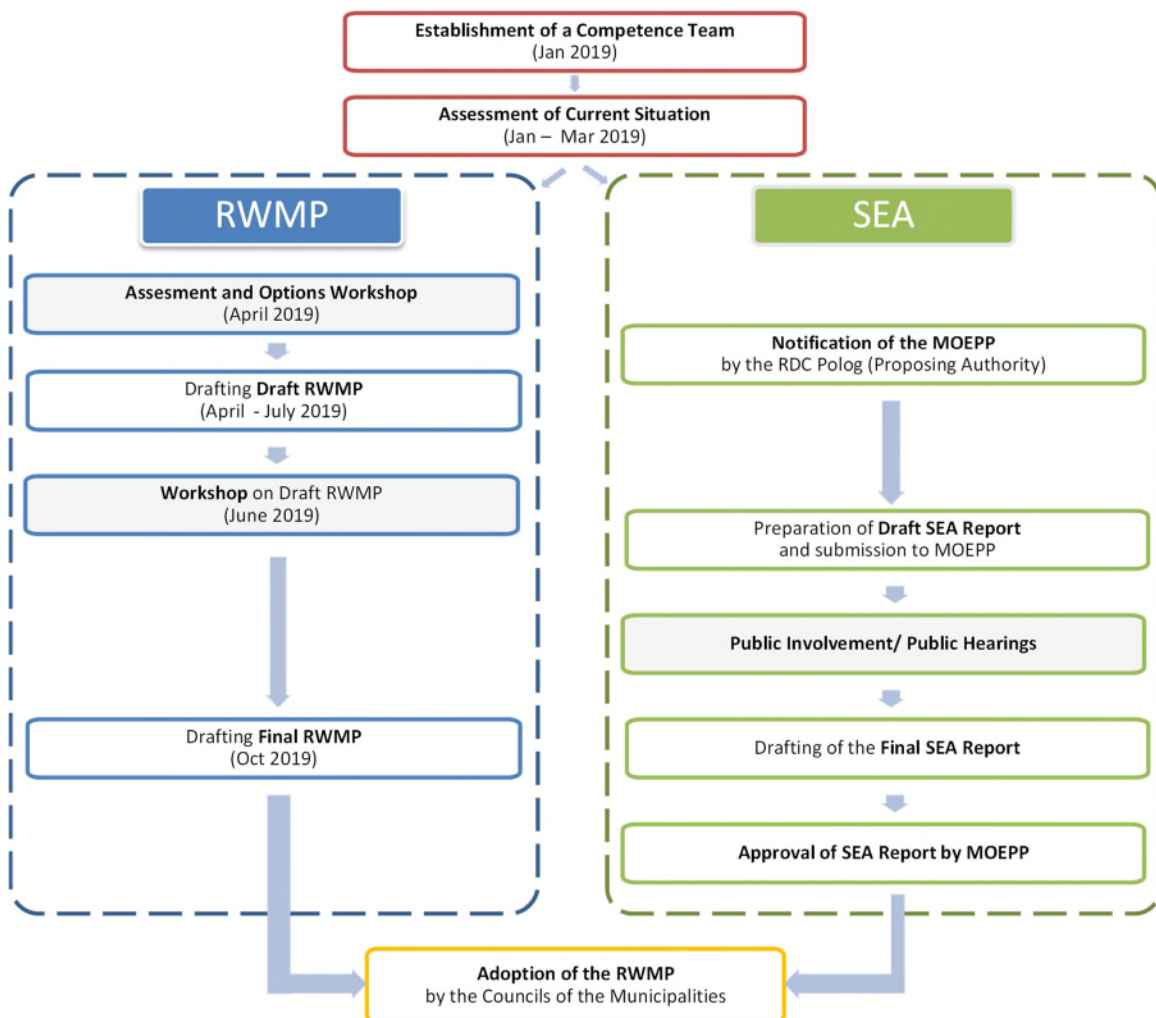
Summarizing, the National Waste Management Plan 2009– 2015 is outdated and the new plan (2018 – 2024) is not yet adopted. Therefore, the RWMP is developed on the basis of the targets defined in the respective EU directives (see chapter 1.2.1). Based on the assessment of the current situation in the Polog Region, realistic timelines for

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achievement of these EU targets have been discussed and a respective phased approach has been agreed upon (see chapter 3.2).

**1.4 Stakeholder Consultations for Preparation of the RWMP**

The RWMP-drafting process started beginning of 2019 with the establishment of a Competence Team and assessment of the current situation. The Competence Team consists of specialists from each municipality (environmental specialists, financial specialists) and representatives of the Centre for Development of Polog Planning Region. Representatives of the Ministry of Environment of Physical Planning (MoEPP) were also involved and supported the drafting of the RWMP. The following figure displays the key steps of the preparation of the RWMP as well as the associated Strategic Environmental Assessment (SEA).



**Figure 3 Key steps in the preparation of RWMP and SEA incl. consultation process**

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Based on the assessment of the current situation, a concept for the future regional solid waste management was developed. Technical and organizational options for the future regional SWM system were presented and preferred options were discussed in two workshops in April and June 2019 with the working group and representatives of the ministry. The draft RWMP was finished beginning July 2019. Interest groups and relevant stakeholders were consulted concerning the draft plan. Comments are incorporated into the final RWMP. The final RWMP is to be adopted by each of the Municipal Councils of the Municipalities in Polog Region and subject to approval by MoEPP.

The associated SEA proceeded simultaneously with the drafting process of RWMP. It started with the notification of the MoEPP by the Centre as the proposing authority. Results of the consultation are incorporated into the final SEA report and considered also for finalization of the RWMP.

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## 2 Status-Quo Analysis

### 2.1 General Framework

The Polog Planning Region is formed by nine municipalities (Bogovinje, Brvenitsa, Gostivar, Jegunovtse, Teartse, Tetovo, Vrapchishte, Mavrovo and Rostusha, Zhelino) as administrative units of lower level which in total include 184 settlements. The following map provides an overview of the region including the joining municipalities and their administrative centers.

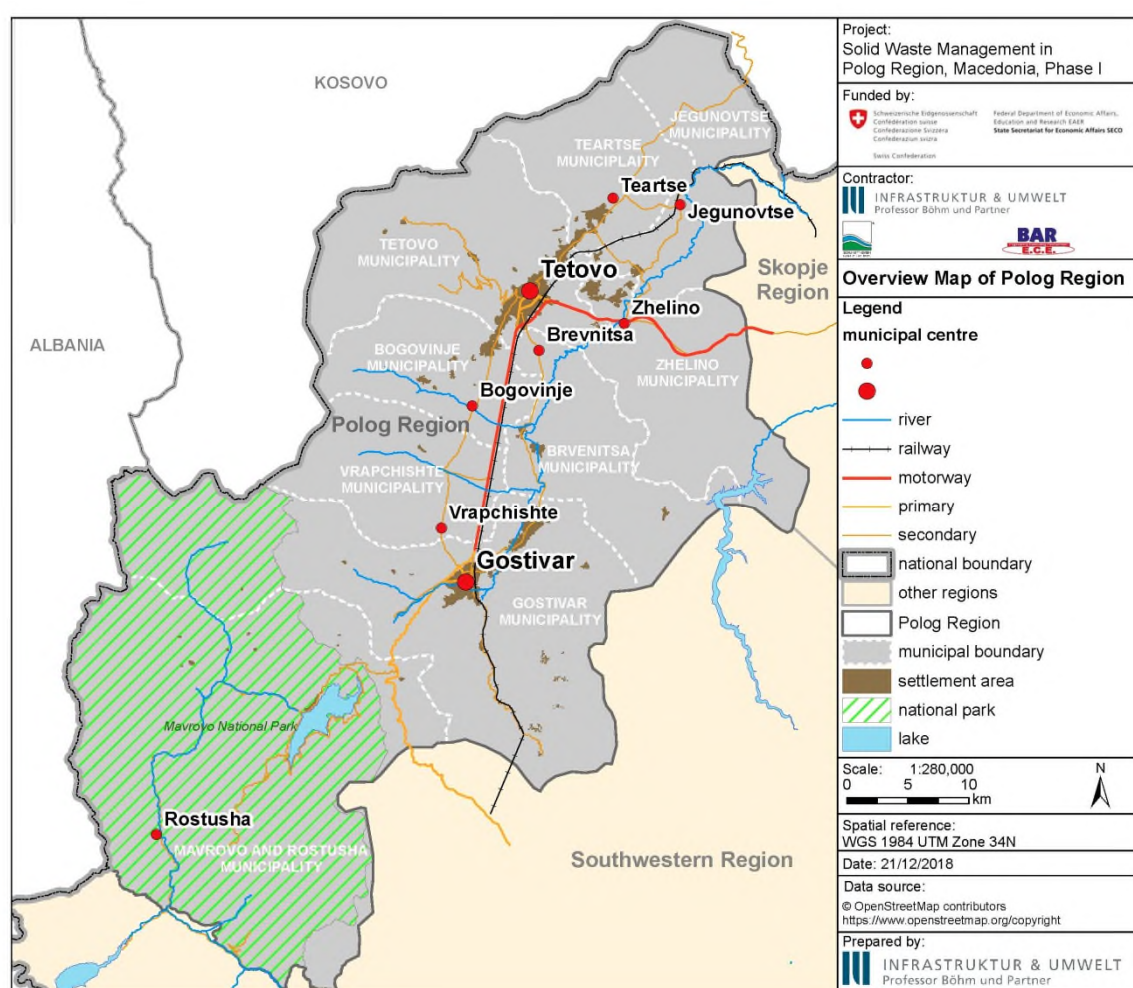


Figure 4 Overview map of Polog Planning Region with neighboring regions

#### 2.1.1 Geographical Location

The Polog Planning Region has a total area of 2,379 km<sup>2</sup> and is located in the northwestern part of the country and borders Albania and Kosovo. It extends over a length

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of 55 km and a width of 8 – 10 km. Internally, it borders the Southwestern and Skopje Statistical Regions. The largest towns in Polog Region are Gostivar and Tetovo.

### **2.1.2 Topography**

Polog Planning Region includes the Polog Valley, the Mavrovo Plateau, the mountain massif Bistra and the river Radika Valley. The Polog Planning Region is surrounded by the mountains Šar, Suva Gora and Zheden. In Polog Planning Region, the mountains Korab, Šar and Bistra have an elevation of above 2,000 m.

### **2.1.3 Climate**

The average annual temperature is 11°C. Over the year it reaches from -20°C up to +38°C. The lowest temperatures are in January and February, the highest in July and August. Hot summers and cold winters reflect the characteristics of a continental climate with an average rainfall of about 800 mm per year. In the winter period snowfalls reach depths up to 50 cm in mountain areas.

### **2.1.4 Geology**

Reaching from Šar Mountains in the north to Pelister Mountains in the south, the West-Macedonian zone is composed of Paleozoic metamorphic complex. This is characterised by volcanic and sedimentary formations at the bottom and carbonaceous formations on top.<sup>2</sup> In the western part of North Macedonia, karst landforms occur, whereas in high mountains remnants of glacial landforms and fossils are found. Mountains Bistra and Šar are composed of limestone, with sharp peaks and deep valleys.

### **2.1.5 Hydrogeological Features**

Polog Planning Region can be assigned to the Western Macedonian Hydrogeological province. Due to the karst formations, springs with high encroachments are present. Furthermore, the Polog and Skopje valley's groundwater are connected. The mountains zones in the western part of Polog Planning Region are practically impermeable, while the Vadar Basin area has middle to high transmissivity.<sup>3</sup>

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<sup>2</sup> Milevski, Ivica (2015): General Geomorphological Characteristics of the Republic of North Macedonia in Geological Review (48), p. 5 – 25

<sup>3</sup> Jovanovski, Milorad (2009): Hydrogeological Survey on Groundwater in North Macedonia





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### **2.1.6 Hydrology**

Most significant rivers in Polog Planning Region are Vadar with Vadar Basin comprising the whole area, Pena, Mazdracha, Bistrica, Rostushka and Radika. The river Vardar springs near to Gostivar and flows along the whole length of Polog Planning Region, smaller rivers discharge into Vardar River.

### **2.1.7 Land Use**

Of a total area of 2,379 km<sup>2</sup>, 1,697 km<sup>2</sup> are agricultural area. 25 % of this area is cultivated land while the remaining land is used as pastures. The cultivated land consists mainly of arable land and gardens (73 %) and meadows (25 %).

### **2.1.8 Protected Areas**

A large area in the south-east of Polog Planning Region is Mavrovo National Park (see [Figure 4](#) ~~Figure 4~~). In Polog Planning Region, the sites of natural significance Peshtera Ubavica (Cave Beaty) in Gostivar Municipality and Rechitsa in Tetovo are located.

### **2.1.9 Transportation Infrastructure**

Polog's traffic system connecting the municipalities with each other and external regions includes road and rail traffic. Most important roads are the highway between Skopje, Tetovo and Gostivar and the regional road sections between the centres of the municipalities. The local road network is partly in poor condition; there are sections with high damages, and in winter periods some local roads in the mountain areas have to be closed to traffic. The main railroad leads from Kichevo in the south over Gostivar and Tetovo to Skopje with railway stations in the urban areas of Gostivar, Tetovo and Jegunovtse. Industrial facilities are connected to the railway network by their own lines. A local airport does not exist in Polog Planning Region, the nearest is in Skopje with a relatively good and fast access.

### **2.1.10 Installations and Facilities for Wastewater Treatment**

In North Macedonia, 59.9 % of dwellings are connected to the public sewage system. However, the condition of the sewer network is weak and often does not lead to modern treatment systems.<sup>4</sup> Moreover, with nine wastewater treatment plants in 2011, only 13 % of the North Macedonian population are served. In 2010, no wastewater treatment plants

<sup>4</sup> MAKStat (2017): Environmental Statistics, 2017, p. 67

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were located in Polog Planning Region.<sup>5</sup> However, the European Union conducted Master Plans for the wastewater in the agglomeration area of Bitola, Strumica and Tetovo within the project “Preparation of studies (FS, EIA, CBA), design documentation and tender dossiers for wastewater collection and treatment investment projects in the municipalities of Strumica, Bitola and Tetovo”. A wastewater treatment plant in Tetovo shall serve 95,152 p.e. in the municipalities Tetovo, Brvenitsa, Bogovinje and Zhelino with a connection rate of nearly 100 % of the population in the agglomeration area until 2039.<sup>6</sup>

### **2.1.11 Hospitals and Centers for Public Health**

The main centres for medical care are located in the biggest cities of Polog Planning Region in Gostivar and Tetovo. A general hospital and a health centre are located in both cities. Together with other health institutions, there are 639 beds in inpatient health institutions in Polog Planning Region in 2016.<sup>7</sup> Furthermore, in Tetovo an institute for health protection is situated. Further, private health institutions such as dentist ambulatories and pharmacies are situated in Polog Planning Region.<sup>8</sup>

For the disposal of medical waste, medical facilities can conclude a contract with Drisla Skopje LLC, which operate an incinerator plant at Drisla landfill.

### **2.1.12 Industrial Sector**

The industrial sector assembles of the sectors by activity according to the National Classification of Activities (NKD Rev. 2) B – Mining and quarrying, C – Manufacturing industry, D - Electricity, gas, steam and air conditioning supply (excluding 35.3 Steam and air conditioning supply). The following figure illustrates the active business entities in the industrial sector in Polog Planning Region as at 31.12.2016.

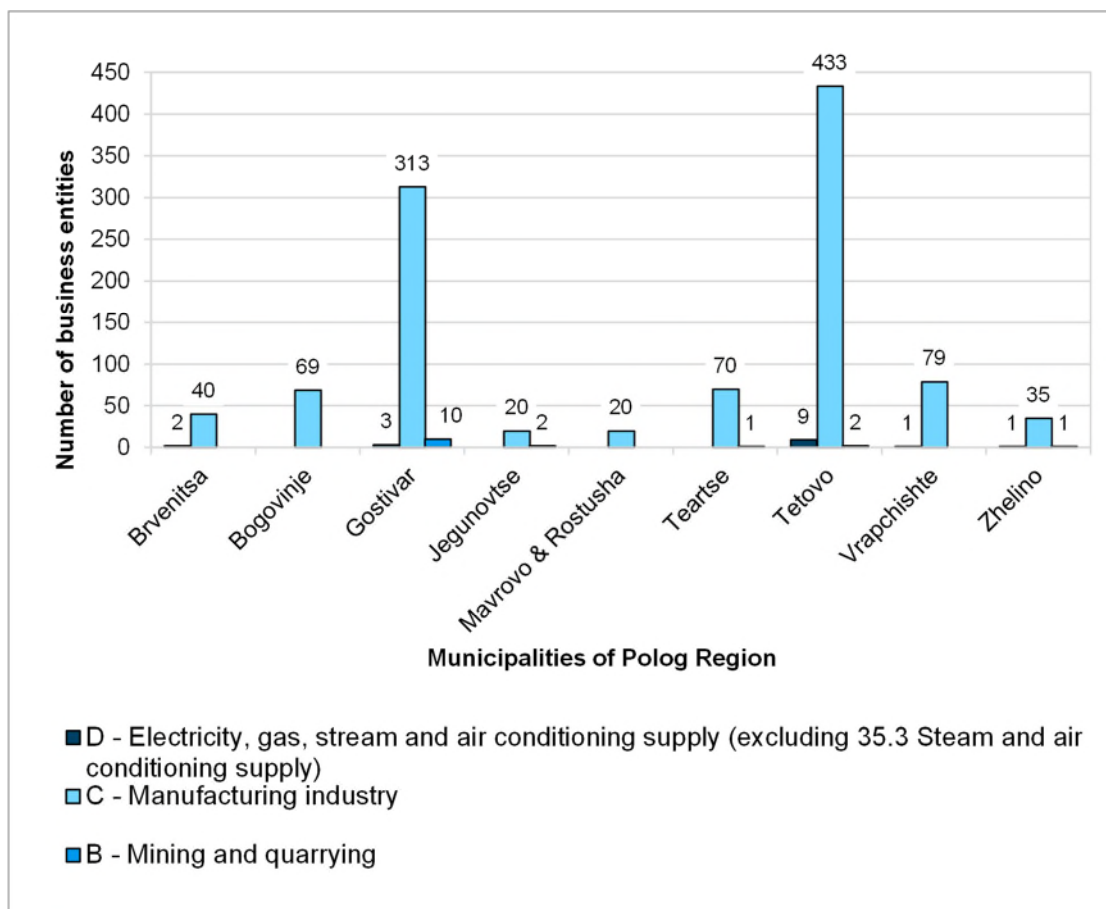
<sup>5</sup> Government of the Republic of North Macedonia, Ministry of Environment and Physical Planning, Republic of North Macedonia (2010): Water Strategy for the Republic of North Macedonia, p. 210

<sup>6</sup> European Union (2017): Preparation of studies (FS, EIA, CBA), design documentation and tender dossiers for wastewater collection and treatment investment projects in the municipalities of Strumica, Bitola and Tetovo, p. 9-10

<sup>7</sup> Institute for public health of the Republic of North Macedonia (2017): Health Map of Republic of North Macedonia 2016, p. 38, 39

<sup>8</sup> Secretariat of the Basel Convention (2008): Strategy on biomedical (healthcare) waste management

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**Figure 5 Active business entities by sectors of activity according to the National Classification of Activities - NKD Rev.2, 31.12.2016 in Polog Planning Region<sup>9</sup>**

The municipalities with the two biggest cities (Gostivar and Tetovo) also have the highest number of active business entities in the industrial sector. Most business entities in mining and quarrying operate in Gostivar municipality (10 entities); nine business entities of sector D are located in Tetovo municipality. Overall, most business entities operate in the manufacturing industry sector.

The industrial sector in Polog Planning Region, here composed of mining, manufacturing, electricity, gas, steam and air conditioning supply, water supply, sewerage, waste management and remediation activities, has a share of 12 % in the region, measured on the gross value added, by sector of activity in 2015.<sup>10</sup>

<sup>9</sup> MAKStat (2018): Statistical Yearbook of the Republic of North Macedonia, 2018, p. 570 – 575

<sup>10</sup> MAKStat (2018): Regions of the Republic of North Macedonia, p. 47

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Major companies of the region include Jugohrom Ferroalloys (previously a state-owned company Silmak from 1952), Zikoprom, Renova, Ve-Ze Shari, Edinstvo Chelopek and Ecolog International.

## 2.2 Demography, Population and Socio-Economic Situation

### 2.2.1 Demography and Population

In Polog Planning Region, Tetovo and Gostivar are the most populated cities. The following table lists the municipalities of the region as well as the population number according to the CENSUS 2002, the number of the midyear population 2017 estimated by the Republic of Macedonia State Statistical Office (MAKStat) and the population number for 2019 estimated by the Consultant who supported the development of the RWMP using the average increase rate between 2002 and 2017 as development rate.

**Table 2 Population number of the municipalities of Polog Planning Region**

Municipality	CENSUS 2002	Estimated Number 2017 (MAKStat)	Estimated Number 2019 (IU)
Brvenitsa	15,855	16,600	16,702
Bogovinje	28,997	30,964	31,236
Gostivar	81,042	83,738	84,104
Jegunovtse	10,790	10,412	10,363
Mavrovo & Rostusha	8,618	8,893	8,930
Teartse	22,454	22,940	23,006
Tetovo	86,580	91,988	92,734
Vrapchishte	25,399	27,550	27,850
Zhelino	24,390	28,114	28,652
<b>POLOG Region</b>	<b>304,125</b>	<b>321,199</b>	<b>323,577</b>

Polog Planning Region's estimated increase of population equals 0.36 % per year. The fastest growing municipalities are Vrapchishte and Zhelino. In Jegunovtse Municipality, the population number is slightly decreasing.

Polog is the only region in North Macedonia in which Macedonians are not the majority of the population. According to the latest census (2002), 73% of the inhabitants are of Albanian ethnicity, followed by Macedonian ethnicity with 18%. According to the latest census' results, almost in all municipalities, the majority of the population consists of Albanians. Only in municipalities of Jegunovtse and Mavrovo und Rostusha, more than 50 % of the population is Macedonian. In addition, Roma are more present in the most populated municipalities of Tetovo and Gostivar than in other municipalities.

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### **2.2.2 Socio-Economic Situation**

The most common household model in Polog Planning Region is a family of four members. The household income for Polog Planning Region has been calculated by the Consultant based on the ratio between the average net wage per employee in Polog Planning Region and in North Macedonia and amounts to 355,704 MKD or 371,822 MKD in urban areas and 335,357 MKD in rural areas. The calculated average income in the Polog Planning Region is lower than the national average due to the lower average net wage per employee.

According to the Republic of North Macedonia State Statistical Office (MAKStat), the unemployment rate in 2017 was 29.0 %. The unemployment rate is higher than the average rate of North Macedonia, which was 22.4 % in 2017. In Polog Planning Region, women in rural areas are most affected by unemployment (33.3 %) and men in urban areas least (27.0 %).

### **2.3 Waste Characterization**

An analysis of the municipal waste provides the basis for both the development of waste management concepts and the planning of recycling, treatment and disposal facilities.

During the analysis of the current situation of solid waste management, a waste quantity and composition analysis has been carried out in between 29 January and 04 February 2019, in order to verify and supplement already available figures regarding the daily generation of municipal solid waste and its composition in the Polog Planning Region.

#### **2.3.1 Waste Composition**

In order to consider differences in waste composition with respect to the municipality and settlement structure, waste samples from different municipalities and settlement structures were analyzed. Three municipalities of different representative sizes that are disposing at Rusino landfill have been selected. Furthermore, for each area sampling points have been selected. The respective areas are described in the following table.



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**Table 3 Description of exemplary collection areas for waste composition analysis**

Exemplary collection areas	Gostivar	Bogovinje	Jegunovtse
<b>Municipality size in comparison</b>	Big municipality	Medium sized municipality	Small municipality
<b>Settlement areas represented</b>	<ul style="list-style-type: none"> <li>Mixed uses in municipal centres (residential and commercial)</li> <li>High-density residential areas (block, apartment houses)</li> <li>Low density residential areas (detached and semi-detached houses, town-houses)</li> </ul>	<ul style="list-style-type: none"> <li>Mixed uses in municipal centres (residential and commercial)</li> <li>Low density residential areas (detached and semi-detached houses, town-houses)</li> <li>Detached houses with kitchen gardens</li> </ul>	<ul style="list-style-type: none"> <li>Detached houses with kitchen gardens</li> <li>Farmhouses</li> </ul>
<b>Exemplary for municipalities</b>	<ul style="list-style-type: none"> <li>Tetovo</li> <li>Gostivar</li> </ul>	<ul style="list-style-type: none"> <li>Bogovinje</li> <li>Teartse</li> <li>Vrapchishte</li> <li>Zhelino</li> </ul>	<ul style="list-style-type: none"> <li>Brvenitsa</li> <li>Jegunovtse</li> <li>Mavrovo &amp; Rostusha</li> </ul>
<b>Represented population share</b>	55%	34%	11%

The different settlement structures show the effect on waste composition due to population density and structure as well as different consumption pattern and ways of life. The municipal centres show the differences due to the business structure of the area.

It has to be pointed out, that due to seasonal effects the organic fraction was assumed to be low in comparison. Despite kitchen waste no other organic waste, i.e. no garden waste, has been found in the waste samples. As a matter of fact, the organic fraction will increase during summer. It is assumed, that the organic fraction during summer time will on average be 10 % higher than in winter time.

In the following figure, the average composition of household and household like waste in Polog region is given as a pie chart.

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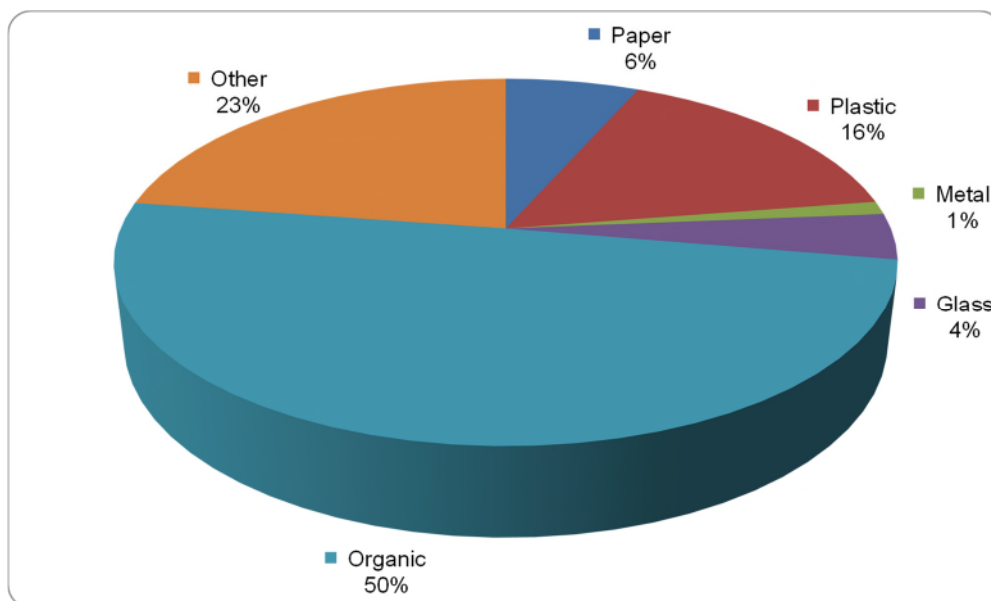


Figure 6 Average composition of household and household like waste [weight-%]

### 2.3.2 Waste Amounts

As there is no consistent data from Municipalities or the landfill available, quantities of municipal waste generated and collected have been estimated based on

- available data and statistics, i.e. using the specific waste generation given in the NWMP 2009 - 2015 and
- information provided by the municipalities in the course of the assessment phase.

For the specific waste generation data provided in the NWMP an iteration method has been applied, resulting in a specific waste generation for 2018 with

- 0.95 kg/cap/d for Tetovo and Gostivar municipalities and
- 0.78 kg/cap/d for the other municipalities in the Polog Planning Region.

The specific waste generation includes the entire municipal waste, namely household waste and commercial waste.

Multiplied with the population number, the generated waste amount is calculated for each municipality. In addition, a factor of 14/12 is applied to factor in the increased waste generation during the summer months (July – August) caused by the return of many Macedonians living abroad. The following table summarises the waste generation in the Polog Planning Region for the year 2018.

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**Table 4 Estimated waste generation in the Polog Planning Region (2018)**

Municipality	Population	t/a	t/m	t/d
Brvenitsa	16,651	5,529	461	15
Bogovinje	31,100	10,327	861	28
Gostivar	83,921	33,771	2,814	93
Jegunovtse	10,387	3,449	287	9
Mavrovo & Rostusha	8,912	2,959	247	8
Teartse	22,973	7,628	636	21
Tetovo	92,360	37,167	3,097	102
Vrapchishte	27,700	9,198	766	25
Zhelino	28,382	9,424	785	26
<b>POLOG Region</b>	<b>322,385</b>	<b>119,453</b>	<b>9,954</b>	<b>327</b>

For the estimation of the collection rates, information regarding the collection services provided by the municipalities has been used. Where necessary, the figures were adapted and generalised for the further forecast. The resulting collection rates and collected waste amounts for 2018 are shown in the following table.

**Table 5 Collection rates und collected waste amounts in Polog Planning Region (2018)**

Municipality	Collection rate	Collected waste amounts		
	[%]	[t/a]	[t/m]	[t/d]
Brvenitsa	80	4,423	369	12
Bogovinje	80	8,262	688	23
Gostivar	90	30,394	2,533	83
Jegunovtse	80	2,759	230	8
Mavrovo & Rostusha	80	2,367	197	6
Teartse	40	3,051	254	8
Tetovo	90	33,451	2,788	92
Vrapchishte	80	7,358	613	20
Zhelino	40	3,770	314	10
<b>POLOG Region</b>	<b>82</b>	<b>95,835</b>	<b>7,986</b>	<b>263</b>

It should be noted that the presented collection rate is slightly higher than the collection rate for the Polog Planning Region according to the Regional Yearbook 2018, and also the total amount of waste collected is about 2,500 t/a higher than stated in the Regional Yearbook.<sup>11</sup>

<sup>11</sup> See Republic of North Macedonia, State Statistical Office: Regions of the Republic of North Macedonia. 2018; Skopje; page 68.



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Based on the calculated amounts for waste generation and the average waste composition, the amounts of the different waste fractions are shown in the following table.

**Table 6 Average generated waste amounts per fraction [2018]**

Waste Fraction	Average percentage	Generated amount		
	[weight-%]	[t/a]	[t/m]	[t/d]
Paper and cardboard	6	7,167	597	20
Plastics	16	19,113	1,593	52
Metal	1	1,195	100	3
Glass	4	4,778	398	13
Organic	50	59,727	4,977	164
Other	23	27,474	2,290	75
<b>Total</b>	<b>100</b>	<b>119,453</b>	<b>9,954</b>	<b>327</b>

## 2.4 Institutions and Relevant Parties for Municipal Waste Management

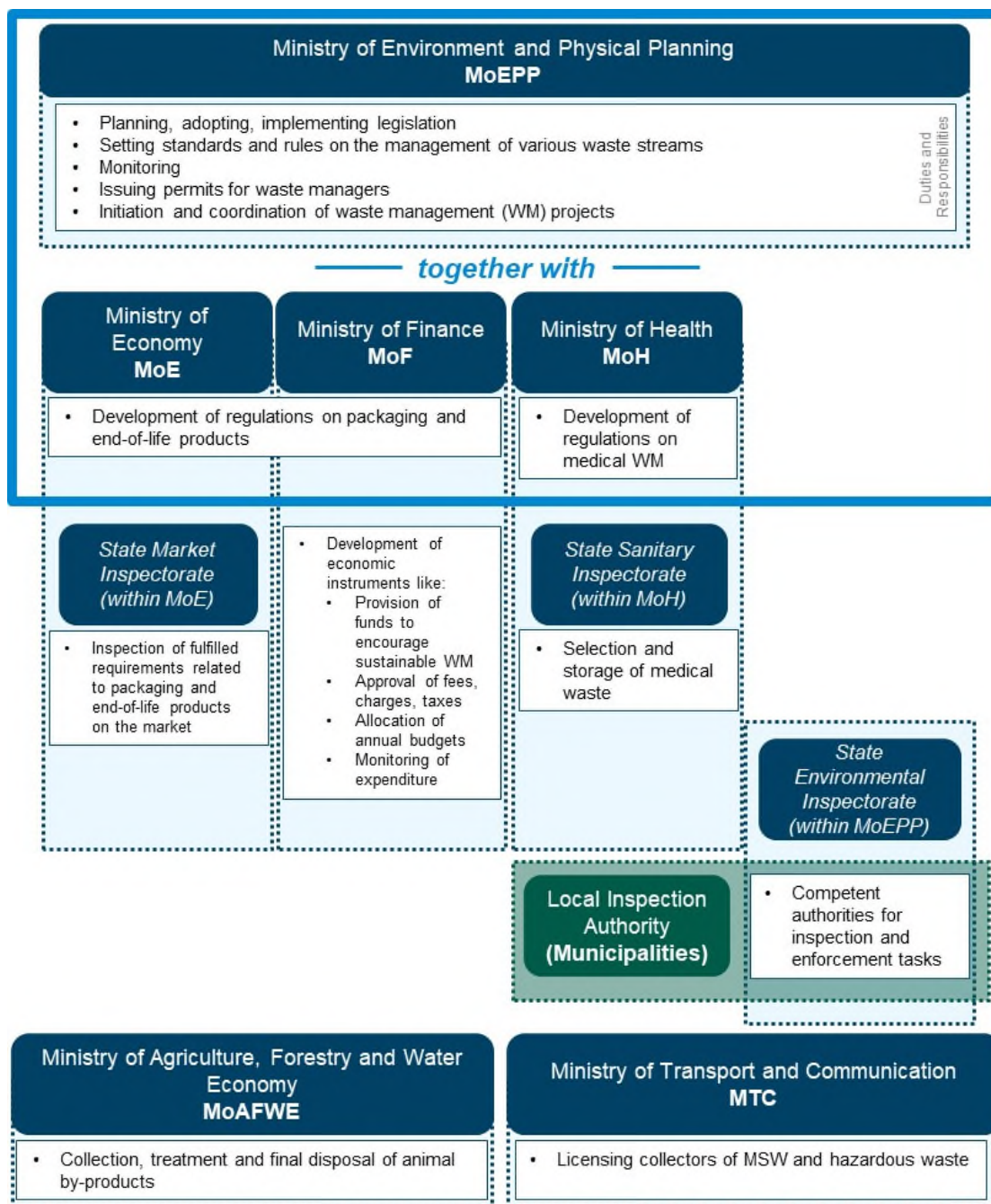
The relevant parties comprise national government institutions, the planning region and the local administrations. Furthermore, the private sector (as well as the informal sector) is involved.

### 2.4.1 National Government Institutions

On the national level, the key authority responsible for solid waste management affairs of North Macedonia is the Ministry of Environment and Physical Planning (MoEPP). The ministry is responsible for the preparation of national strategies and actions plans. MoEPP also coordinates international relations with the EU, international conventions and the international or bilateral donor community. Within MoEPP, a department on waste management was established in 2010.

The distribution of the duties and responsibilities regarding waste management of the institutions on a national level are illustrated in the figure below.

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**Figure 7 Distribution of duties and responsibilities of national institutions regarding waste management**

### 2.4.2 Regional Government Institutions

The Government of the Republic of North Macedonia adopted in December 2007 the Nomenclature of Territorial Units for Statistic (NTES) and the amendments in 2014 which provide a breakdown of territorial units at regional and local level. Regional development centres have been established in the North Macedonian planning regions which are also

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involved in the set-up of the regional waste management (in Polog Planning Region: Centre for Development of the Polog Planning Region).

The concept of regional integrated waste management systems has been introduced already in the NWMS 2008-2020 while the NWMP 2009-2015 follows by recommending the establishment of regional structures to coordinate SWM activities.

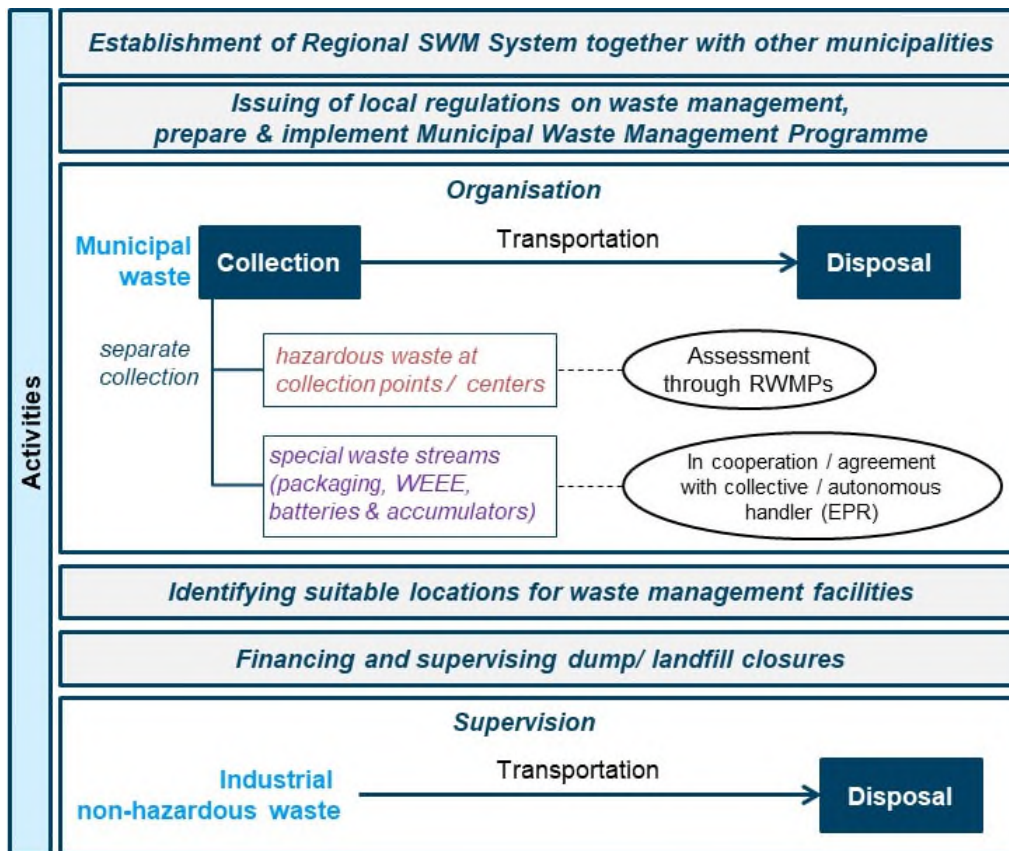
The Mayors (or a person authorized by the Mayor) of municipalities are members of the Inter-Municipal Waste Management Boards (IMWMB), which were established to support the regional integrated waste management.

### **2.4.3 Local Government Units (LGUs)**

As result of the decentralisation process in North Macedonia, the municipalities are responsible for many activities regarding waste management. Waste service is mainly provided by Public Communal Enterprises (PCEs) or by Private-Public-Partnerships (PPP).

In cooperation with the State Environmental Inspectorate, the municipalities are responsible for carrying out inspection and other enforcement tasks. Further activities under the responsibility of the municipalities are illustrated in the figure below.

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**Figure 8** Activities, municipalities are responsible to perform regarding waste management

The council of municipalities shall prepare a waste management programme for the implementation of the NWMS, NWMP and regional plan. Content of the programme also includes measures and activities for separation of hazardous components from waste.

**2.4.4 Private Sector Involvement**

The private sector is involved as provider for waste management activities, such as collection and recycling. These include MSW and special waste streams which are affected by extended producer responsibility (batteries, WEEE).

For the collection of communal waste and recyclables some North Macedonia municipalities, including municipalities in the Polog Region, agreed concessions or established Public-Private Partnerships (PPP) with private companies. Furthermore, there are various companies in North Macedonia engaged in recycling of various waste streams.

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## 2.5 Waste Collection and Transport

Waste collection service is either provided by public utilities or the private sector. The collection coverage varies in Polog Planning Region: some villages and settlements in some of the municipalities are not covered. Furthermore, yearly fluctuations due to difficult access in winter occur.

**Table 7 Waste collection services in municipalities of Polog Planning Region (according to questionnaire, October 2018)**

Municipality	Service provided by		Collection coverage
	Public Utility	Private Sector	
Bervenica		Concession	75% of population; 2624 out of 3447 households; no collection bins or service in 4 villages: Blace, Stenche, Gurgurnica and Volkovija
Bogovinje	Public Utility established by the municipality		All residential areas are served, but in winter limited due to difficult access
Gostivar	Public Utility established by the municipality	Concessions at Rusino landfill, no details reported	All residential areas are served (30% door to door collection, 70% containers)
Jegunovtse		Concession	All residential areas are served except 2 remote villages; 3 villages do not have bins: Staro Selo, Rogachevo and Ratae
Mavrovo & Rostrusha	Public Utility established by the municipality		In 16 settlement using special vehicle and in other villages with tractors (areas not reachable with a truck)
Teartse		Concession	Around 40% coverage; in all areas except in mountain villages: 2,200 households out of 5095, small enterprises and public institutions
Tetovo	Public Utility established by the municipality		Collection in Tetovo city and 10 out of 19 settlements
Vrapchishte		Concession	All residential areas are served
Zhelino		Concession	All residential areas are served

Waste collection in Polog Planning Region is mostly practiced using collection points where waste from households, business entities and institutions are collected all together in the same public bins or open collection points. House to house collection takes place in some areas, such as in parts of the urban centres (i.e. parts of Tetovo and Gostivar) using 120 l bins, bags or cartons. The public bins are made of metal or plastic mostly with a volume of 1,100 l, equipped with wheels and placed along the main roads in the cities.

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The collection points are not distributed evenly nor sufficiently which leads to indiscriminate waste dumping or piling of wastes around the collection points.

Communal waste containers are typically emptied on a daily basis while house to house collection may be at a reduced frequency, e.g. once per week.

Waste collection is carried out with mostly outdated and partly inappropriate collection vehicles. Several municipalities have shortage of the number of waste collection vehicles and in the coming years additional vehicles and substantial replacement of existing vehicles will be required.

Besides waste collection, services in urban areas include also street cleaning; street sweeping is mostly conducted manually. Nevertheless, littering in the urban centers is a general problem, with also little effectiveness of the street cleaning activities.

### **2.6 Recycling and Waste Treatment**

Separate waste collection and separation of recyclables from mixed waste takes place in the region only as small initiatives.

Some concessionaires sort out recyclables at their own premises. At Rusino landfill, a simple sorting facility for plastic, paper, iron, textiles and WEEE is currently abandoned, but a group of waste pickers is sorting out recyclables.

Mainly groups of Roma and other disadvantaged groups or individuals separate recyclables from public bins. However, only few families or individuals of the Roma community and other disadvantaged groups earn their living from separating recyclables from public bins or dumpsites.

In Tetovo, a family of up to 20 persons collects primarily PET bottles and other plastic items from public bins and two wire mesh cages in town. The cages have been manufactured locally by “their” middleman who also runs a small metal workshop. They store and transport the material in big-bags.

In Gostivar, a group of 10 to 15 persons collect recyclables at the Rusino Waste Disposal Site from the incoming waste. They store the waste in big-bags and sell them immediately to a middleman located at the landfill.

Beside these larger groups, only few individual collectors are reported to be active in other parts of the Polog Planning Region.



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Collective handlers, like PAKOMAK and ECOLECT, are planning to install containers for separate collection of glass and/ or WEEE. Furthermore, companies, independent from the EPR-scheme collect cardboard from shops. Middlemen buy recyclables from different sources (e.g. waste pickers), sort and resell the waste. In the region, no processing companies for recyclables are based. In Gostivar Municipality in 2019 separate collection is planned to be started on small scale for collection of glass bottles with depot containers.

Similar to the figures on waste generation, there are also no secured data on the amount of recyclables retrieved <sup>12</sup>from the waste stream. Bearing in mind that the entire Polog Planning Region may generate approx. 327 t/d of waste in total, and assuming that plastic, paper/cardboard, glass and some beverage cans represents less than 30% of the waste, there are approximately 90 t available to be recycled per day. Based on the visual impression, it is estimated that not more than 8-10 t/d of plastic, paper/cardboard and beverage cans/metal or 2-3% of the entire waste stream is retrieved per day by the various actors.

No waste composting activities have been reported by the municipalities. Although composting is traditionally practiced by farmers and households with bigger gardens, there is no information on composting organized by any of the municipalities.

### **2.7 Waste Disposal**

After being collected from the collection points, waste is transported to and disposed at various landfills and dumpsites. The table below provides an overview of the disposal locations currently used by the municipalities. Information in this table has been provided by the municipalities.

<sup>12</sup> The term retrieved is used for taking recyclable materials from the waste stream for further processing or sale in order to distinguish this activity from recovery which is defined in the EU waste directive as "any operation the principle result of which is waste serving a useful purpose by replacing other material which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function".

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**Table 8 Landfills, currently used by the municipalities (according to information from questionnaire, October 2018)**

Municipality	Location used for disposal of collected waste	Expenditures for disposal
<b>Bervenices</b>	Drisla	not reported
<b>Bogovines</b>	Rusino	106,000 MKD/month
<b>Gostivar</b>	Rusino	1,100 MKD/tonne
<b>Jegunovce</b>	This is under the obligations of the concessionaire	not reported
<b>Mavrovo &amp; Rostrusha</b>	Debar Municipality Landfill	31,520 MKD/month
<b>Teartse</b>	Rusino and Drisla	not reported
<b>Tetovo</b>	Drisla	1,550 MKD/tonne
<b>Vrapciste</b>	Rusino	not reported
<b>Zhelino</b>	Drisla (partly)	Concessionaire bears the disposal payment. Municipality pays the concessionaire per invoice 680 MKD/tonne

In all municipalities there are dumpsites where various types of waste are deposited (municipal waste, construction and demolition waste, agricultural waste). Partly these dumpsites are abandoned for some time (with no or minor rehabilitation activities) and partly there is ongoing disposal at these locations.

Currently, there is no systematic mapping and risk assessment of dumpsites in the region available.

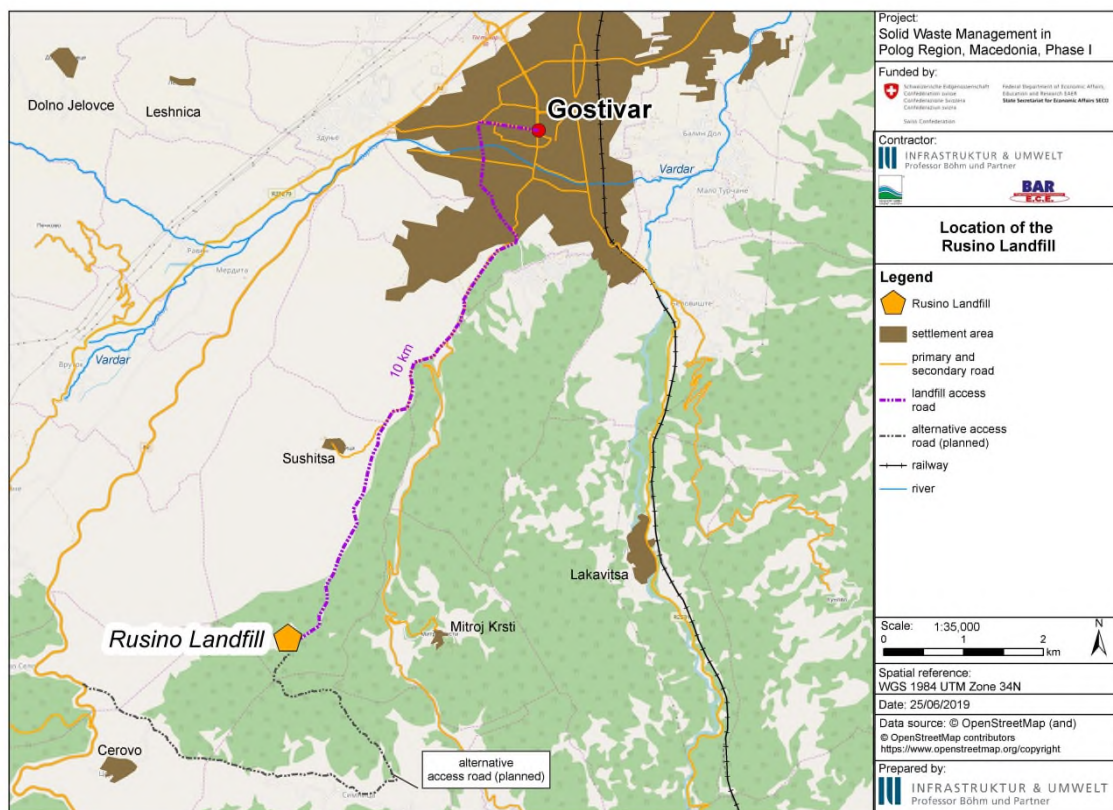
### 2.7.1 Rusino Dumpsite

The Rusino dumpsite was established in 1998. In 2005 the municipalities of Gostivar and Tetovo agreed to develop the dumpsite as an inter-municipal (regional) landfill for Polog Region, which should accept municipal solid waste from the biggest municipalities Tetovo and Gostivar.

The Rusino dumpsite is located in a distance of about 8 km south of Gostivar (10 km driving distance from Gostivar centre) and at an altitude of about 800 m above sea level on the slopes of mountain Bukovik.



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**Figure 9 Location of Rusino landfill**

In previous years, mainly due to poor management of the landfill and traffic of waste vehicles driving through the centre of Gostivar, there have been ongoing protests from local residents resulting in temporary blockage of the access road and limited use of the landfill. Currently, Rusino landfill is used for waste disposal mainly from Gostivar Municipality, whereas, Tetovo Municipality is not allowed to dispose its waste at this location.

### 2.8 Public Awareness, Public Participation and Waste Avoidance

Generally, the awareness level of the population and their own responsibility for a clean environment seems to be low, as scattered waste and indiscriminate dumping is visible throughout the region. The population is even less used to handling of waste (i.e. separation into different fractions) and their understanding for the need of (advanced) waste management (e.g. central disposal on regional sanitary landfill, closure and rehabilitation of existing dumpsites, waste separation, recycling measures) may also be low.

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There are various activities in the municipalities of the region, such as clean up campaigns, recycling and environmental initiatives. However, public awareness raising on waste and environment is not sufficiently anchored in the administration of the municipalities (as well as the Centre) and there is no comprehensive approach for dealing with this issue.

Ensuring the engagement and support of the public is a prerequisite to reach the objectives and results envisaged with the new ISWM system. Creating public awareness of the disadvantages and harms of the existing system as well as the advantages and benefits offered by the new ISWM system will positively affect public participation and willingness to contribute towards its implementation, either through behaviour changes or financially.

### 2.9 Financing of SWM Services

The Law and Waste Management refers to the polluter pays principle for financing of waste management services, which in practical terms means that costs for municipal waste management should be recovered from fees, to be paid from the recipients of these services. With regard to certain waste streams and the extended producer responsibility, including packaging waste, additional financing is foreseen in the respective legislation.

In general, waste management services in Polog Planning Region are financed from fees with very little subsidies from other sources. In the table below, the current tariffs for waste management services in the municipalities are presented.

**Table 9 Waste management tariffs in municipalities (according to information from questionnaire, October 2018)**

Municipality	Monthly Tariff for Households		Fee collection rate (% of household s actually paying the tariff)	Monthly Tariff for Businesses
	MKD	EUR		
<b>Bervenices</b>	195 MKD	3.18 EUR	not reported	not reported
<b>Bogovines</b>	200 MKD	3.26 EUR	38%	Varies per amount of waste from 300-3000 MKD per month
<b>Gostivar</b>	Fee per amount of waste, in average: 380 MKD/household	6.19 EUR	53%	per amount of waste, 1m3 = 650 MKD



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Municipality	Monthly Tariff for Households		Fee collection rate (% of households actually paying the tariff)	Monthly Tariff for Businesses
	MKD	EUR		
<b>Jegunovce</b>	186 MKD	3.02 EUR	not reported	314.28 MKD for a 120 liters container for legal entities
<b>Mavrovo &amp; Rostrusha</b>	0.36 MKD/m <sup>2</sup> yard surface and 1.20 MKD / m <sup>2</sup> residential area. For the Dolnerekanski region: lump sum, because buildings are not legalized	2.74 EUR for 200 m <sup>2</sup> yard surface and 200 m <sup>2</sup> residential area	80%	1.50 MKD per m <sup>2</sup> yard surface and 4.56 MKD / m <sup>2</sup> residential area
<b>Teartse</b>	195 MKD	3.18 EUR	55%	Bin 120l: 330 MKD / month Bin 240l: 490 MKD / month Container 1100l: 2500 MKD / month
<b>Tetovo</b>				
Urban	64.8 MKD per household member (= 259.2 MKD for a household of 4 persons)	4.22 EUR	68%	Charged per m <sup>2</sup> and by waste quantities; amounts not reported.
Rural	305 MKD	4.98 EUR		
<b>Vrapciste</b>	195 MKD	3.18 EUR	70%	400 MKD
<b>Zhelino</b>	175 MKD	2.85 EUR	not reported	6,000 MKD/month (lump sum)

The tariff for households is very similar in all municipalities (between 186 and 200 MKD per household and month) except for Gostivar and Tetovo municipalities, where the current tariff is 380 MKD for Gostivar and 280 MKD (based on average household size) for Tetovo.

Especially, where concessionaires are providing the services, municipalities don't include waste management services in their budgets. Instead, the concessionaires directly charge fees to the households and businesses. Even, in some cases the concessionaire may pay a certain percentage of the collected revenues to the municipalities as concession fee.

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### 2.9.1 Affordability Assessment

Based on the average household income, affordability considerations are made. As benchmark for the affordability 1.5 % of average household income is used. The values are shown in the table below.

**Table 10 Affordability consideration in Polog Planning Region**

	Average household income	Affordability for SWM Services		Current household tariffs
	MKD/a x 1,000	MKD/a	MKD/month	MKD/month
Urban Areas	371.82	5,577	465	ca. 250 - ca. 400
Rural Areas	335.36	5,030	419	186 - 200
<b>Average Polog Planning Region</b>	<b>355.70</b>	<b>5,336</b>	<b>445</b>	

Affordability can be calculated based on agreed statistical data and for the current situation has been identified as 465 MKD per household and month in urban areas and 419 MKD in rural areas.

Thus, based on affordability considerations and current incomes there is not much leeway for an increase of fees.

Willingness to pay will be mainly affected by the quality of services provided to the citizens. With improved services the population might also be willing to accept higher fees. However, even if there is willingness of the population and political decision makers to support an increase of fees, considering the current household income the potential for tariff increase is very limited. Therefore, with regard to the implementation of advanced waste management aspects affordability and financial sustainability will be a limiting factor.

### 2.10 Assessment of Isolated Settlements

The EU Landfill Directive defines in Article 2(r) isolated settlements as follows:

“isolated settlement” means a settlement:

- with no more than 2 000 inhabitants per settlement and no more than five inhabitants per square kilometre, or with more than 2 000 but less than 5 000 inhabitants per settlement and no more than five inhabitants per square kilometre and whose production of waste does not exceed 3 000 tonnes per year, and

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- where the distance to the nearest urban agglomeration with at least 250 inhabitants per square kilometre is not less than 100 km and with no access by road.;

North Macedonia plans to harmonize its legislation by including the definition of isolated settlements in future waste legislation which is under preparation.

According to this definition, one of the compulsory characteristics of an isolated settlement is that it is located further than 100 km from the nearest urban agglomeration with at least 250 inhabitants / km<sup>2</sup>. The analysis started to verify the fulfilment of this criteria.

Taking into consideration that Tetovo City and Gostivar City are the densest urban areas in the region with more than 2,000 inhabitants/km<sup>2</sup><sup>13</sup>, these cities are taken as reference points to which the distances from the outermost settlements in the region are measured. The following table summarizes the outermost settlements and their distances to Tetovo / Gostivar.

**Table 11 Distances between outermost settlements and urban areas in Polog Region**

Settlement	Municipality	Distance to Tetovo	Distance to Gostivar
Jazhintse	Jegunovtse	30 km	57 km
Lukovitse	Zhelino	34 km	58 km
Gurgurnitsa	Brvenitsa	37 km	30 km
Brodels	Gostivar	75 km	53 km
Kjafa	Gostivar	61 km	82 km
Tanushe	Mavrovo i Rostusha	67 km	46 km
Lazaropole	Mavrovo i Rostusha	95 km	74 km

According to the analysis, all the outermost settlements are located within 100 km distance from Tetovo and Gostivar City which leads to the conclusion that all the settlements in the region are also located within this distance. Therefore, the analysis resulted in the non-existence of isolated settlements in the region.

### 2.11 Summary of Key Challenges and Bottlenecks

Overall, waste management services in Polog Region are not complying with the national regulations or international standards. Generally, services are rudimentary, only comprising of inefficient collection and poorly controlled disposal, without additional elements of advanced waste management as defined in the EU directives for waste.

<sup>13</sup> Estimated based on the population number given in CENSUS 2002 and an area of between 14-16 km<sup>2</sup> (estimated using aerial image of Google Earth)

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Performance of waste collection services is hampered by

- Outdated and partly inappropriate collection vehicles
- Poor conditions of collection points and containers
- Overstaffing and insufficient qualification of public utilities
- Deficits in planning and monitoring at all levels
- Low fee collection rates
- Lack of public awareness
- Insufficient performance (and cost) monitoring

The major focus is given to the cleaning of urban centres with very limited engagement of municipalities in separate collection and recycling. The biggest challenge in the current waste management, according to the statements from all municipalities and service providers is the disposal of the collected waste; current shortcomings and challenges include

- High level of pollution by the Rusino landfill resulting in blockages by the local population.
- Need of transport of collected waste out of the regional borders (because of blockages), resulting in high transport and disposal costs.
- Indiscriminate dumping of waste with uncontrolled dumpsite in all municipalities.
- Non-availability of approved locations for disposal of construction waste, causing uncontrolled dumping.

Municipalities, mostly refer to lack of funding as the main reason for the deficits in service provision. Nevertheless, SWM planning as well as performance and cost monitoring of services are poorly developed, and current unit costs for waste collection of public utilities are comparatively high.

Financing of improved waste management will be a key challenge. Based on affordability considerations there are only very limited possibilities to increase the waste management tariffs on short term. Assuming that implementation of EU and Macedonian standards and targets for waste management will at least double the current cost, a staged approach will be required. The Regional Waste Management Plan identifies, which priorities and targets can realistically be achieved in which time frame.

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### 3 Planning of Solid Waste Management

The RWMP shall be the foundation for the planning of solid waste management in Polog Planning Region. It provides framework for the improvement of the current waste management system considering the relevant targets indicated in the respective legislation and plans.

#### 3.1 Assumptions for Planning

The planning horizon of the RWMP is from 2019-2029 divided into three phases in line with the requirement set in the Rulebook O.G No. 63 from 2013 as described in chapter 1.1. Forecast for the population and waste amounts is essential for SWM planning and has been prepared for the implementation period of the RWMP. The results are presented in this chapter.

#### Phase I (2019 – 2020)

Implementation of quick-win and immediate improvement measures (**priority measures**)

#### Phase II (2021 – 2026)

Implementation of short-term investment measures (**short-term measures**)

#### Phase III (2027 – 2029)

Preparation of mid- and long-term investment measures (**medium-term measures**)

Figure 10 Phases of the RWMP

#### 3.1.1 Population Forecast

The following table shows the forecasted population development in the Polog Planning Region for the period 2019 – 2029, subdivided into three phases in accordance with the implementation stages of the RWMP.

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**Table 12 Forecasted population development by municipalities (2019 – 2029)**

Municipalities	Stage 1		Stage 2		Stage 3	
	2019	2020	2021	2026	2027	2029
Brvenitsa	16,702	16,753	16,805	17,064	17,116	17,221
Bogovinje	31,236	31,373	31,511	32,208	32,349	32,633
Gostivar	84,104	84,288	84,472	85,398	85,585	85,959
Jegunovtse	10,363	10,338	10,313	10,192	10,167	10,119
Mavrovo & Rostusha	8,930	8,949	8,968	9,062	9,081	9,119
Teartse	23,006	23,038	23,071	23,237	23,270	23,336
Tetovo	92,734	93,109	93,486	95,394	95,780	96,557
Vrapchishte	27,850	28,002	28,154	28,927	29,084	29,401
Zhelino	28,652	28,924	29,200	30,616	30,907	31,499
<b>POLOG Region</b>	<b>323,577</b>	<b>324,775</b>	<b>325,980</b>	<b>332,097</b>	<b>333,340</b>	<b>335,845</b>

The table above shows that more than half of the population of the Polog Planning Region lives in Tetovo and Gostivar municipalities.

### 3.1.2 Waste Forecast

Based on the population forecast, generated and collected waste amounts and their development over the next years have also been estimated. The assumed specific waste quantities per capita and day (see chapter 2.3.2) are expected to increase annually by

- 0.91 % in urban municipalities and
- 0.75 % in rural municipalities

The following table summarizes the waste generation forecast for the municipalities in the Polog Planning Region over the planning horizon (2019 – 2029), subdivided into the three implementation stages.





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**Table 13 Waste generation forecast (2019 – 2029)**

Municipalities	Stage 1				Stage 2				Stage 3			
	2019		2020		2021		2026		2027		2029	
	t/a	t/d	t/a	t/d	t/a	t/d	t/a	t/d	t/a	t/d	t/a	t/d
Brvenitsa	5,596	15	5,665	16	5,734	16	6,092	17	6,166	17	6,318	17
Bogovinje	10,467	29	10,608	29	10,752	29	11,499	32	11,654	32	11,971	33
Gostivar	34,099	93	34,430	94	34,764	95	36,483	100	36,837	101	37,555	103
Jegunovtse	3,472	10	3,496	10	3,519	10	3,639	10	3,663	10	3,712	10
Mavrovo & Rostusha	2,992	8	3,026	8	3,060	8	3,235	9	3,272	9	3,345	9
Teartse	7,709	21	7,790	21	7,872	22	8,296	23	8,383	23	8,561	23
Tetovo	37,598	103	38,033	104	38,473	105	40,753	112	41,225	113	42,185	116
Vrapchishte	9,332	26	9,468	26	9,606	26	10,327	28	10,478	29	10,786	30
Zhelino	9,601	26	9,780	27	9,963	27	10,930	30	11,135	31	11,555	32
<b>POLOG Region</b>	<b>120,865</b>	<b>331</b>	<b>122,295</b>	<b>335</b>	<b>123,742</b>	<b>339</b>	<b>131,253</b>	<b>360</b>	<b>132,812</b>	<b>364</b>	<b>135,988</b>	<b>373</b>

For the waste collection it is assumed, that the collected waste amount differs from the generated amounts because not all settlement areas/ villages are served, especially in remote rural areas. However, the collection rate is expected to increase each year along with the improvement of the collection services and increase of awareness of the inhabitants as shown in the table below.

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**Table 14 Collection rate (2019 – 2029)**

Municipalities	Stage 1		Stage 2		Stage 3	
	2019	2020	2021	2026	2027	2029
Brvenitsa	80%	83%	86%	100%	100%	100%
Bogovinje	80%	83%	86%	100%	100%	100%
Gostivar	90%	91%	92%	97%	98%	100%
Jegunovtse	80%	83%	86%	100%	100%	100%
Mavrovo & Rostusha	80%	83%	86%	100%	100%	100%
Teartse	40%	43%	46%	61%	64%	70%
Tetovo	90%	91%	92%	97%	98%	100%
Vrapchishte	80%	83%	86%	100%	100%	100%
Zhelino	40%	43%	46%	61%	64%	70%
<b>POLOG Region</b>	<b>80%</b>	<b>82%</b>	<b>84%</b>	<b>93%</b>	<b>94%</b>	<b>96%</b>

The following table summarizes the waste collection forecast in the Polog Planning Region over the planning horizon (2019 – 2029).

**Table 15 Waste collection forecast (2019 – 2029)**

Municipalities	Stage 1				Stage 2				Stage 3			
	2019		2020		2021		2026		2027		2029	
	t/a	t/d	t/a	t/d	t/a	t/d	t/a	t/d	t/a	t/d	t/a	t/d
Brvenitsa	4,477	12	4,702	13	4,931	14	6,092	17	6,166	17	6,318	17
Bogovinje	8,373	23	8,805	24	9,246	25	11,499	32	11,654	32	11,971	33
Gostivar	30,689	84	31,331	86	31,982	88	35,388	97	36,100	99	37,555	103
Jegunovtse	2,778	8	2,901	8	3,026	8	3,639	10	3,663	10	3,712	10
Mavrovo & Rostusha	2,394	7	2,512	7	2,631	7	3,235	9	3,272	9	3,345	9
Teartse	3,083	8	3,350	9	3,621	10	5,060	14	5,365	15	5,993	16
Tetovo	33,838	93	34,610	95	35,395	97	39,530	108	40,400	111	42,185	116
Vrapchishte	7,466	20	7,859	22	8,261	23	10,327	28	10,478	29	10,786	30
Zhelino	3,840	11	4,205	12	4,583	13	6,668	18	7,126	20	8,089	22
<b>POLOG Region</b>	<b>96,938</b>	<b>266</b>	<b>100,274</b>	<b>275</b>	<b>103,679</b>	<b>284</b>	<b>121,438</b>	<b>333</b>	<b>124,224</b>	<b>340</b>	<b>129,953</b>	<b>356</b>

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The table above shows, that almost two third of the waste collected in the Polog Planning Region origins from the large municipalities, namely Tetovo Municipality and Gostivar Municipality in which 32% respectively 29% of the waste is collected.

Based on the waste composition presented in chapter 2.3.1, waste amounts according to the waste fractions have been computed for the next 10 years based on the assumption that the waste characteristic will not change significantly in its composition. The following figure illustrates the forecasted collected waste amount per fraction.

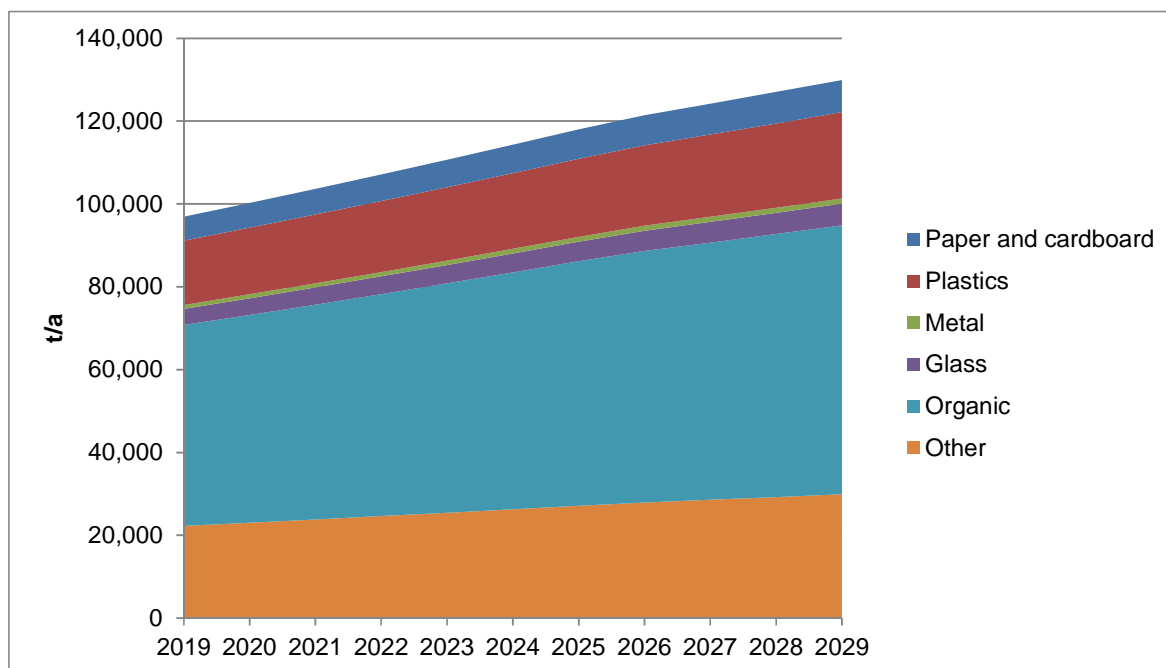


Figure 11 Forecast collected waste amount per fraction (2019 – 2029)

### 3.2 Determination of Objectives, Targets and Timelines

In compliance with the European Waste Directive (2008/98/EC) the main objective of any waste policy is the minimisation of the negative effects caused by generation and management of waste on human health and the environment. Thus, the overall objective of the RWMP is to contribute to **a clean and healthy environment for the population of the Polog Region.**

The basis for the development of options for technology and methods in waste management are the objectives and targets set on national or EU level in order to improve environmental, safety and health performance of the current waste management system. As mentioned before, the National Waste Management Plan 2009 – 2015 is outdated and the new plan (2018 – 2024) is still in process of adoption. Therefore, the RWMP is



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developed on the basis of the targets defined in the respective EU directives. Based on the assessment of the current situation in the Polog Region, realistic timelines for achievement of these EU targets have been identified.

Considering the current challenges and shortcomings of the SWM system in Polog region, as well as the limited affordability of the population to pay cost covering tariffs, the highest priority will be given to improvement of waste collection and safe disposal, followed by improvement of recycling and composting and finally the realisation of complex treatment facilities.

Thus, the focal areas for short term interventions (during Phase I and Phase II or RWMP implementation) are:

- Improvement of waste collection and separation
- Improvement of waste disposal

The EU targets for reduction of landfilled biodegradable components are stretched over several phases and a period of 15 years and thus will be a focus of the medium/ long term activities also in the Polog Region.

**Table 16 Targets and Timelines for the RWMP**

	EU Directives		RWMP Targets	
	Target	Date	Target	Date
<b>Waste Collection</b>				
Collection of Mixed Municipal Waste	assumed full coverage		90%	2024
Collection of Mixed Municipal Waste	assumed full coverage		100%	2029
<b>Separate Collection, Reuse and Recycling</b>				
Separation of bio-waste to be recycled at source or a separate bio-waste collection		31 Dec 2023	25% of households have access to separate collection of bio-waste	2026
Preparing for re-use and recycling of MSW	50%	2020	50% of households have access to separate collection of recyclables	2024
	55%	2025		
	60%	2030		
	65%	2035		

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	EU Directives		RWMP Targets	
	Target	Date	Target	Date
<b>Landfilling of waste and treatment of organic waste</b>				
Disposal on regional controlled landfill			90% of collected residual waste	2021
Disposal on regional landfill according to EU Directive			100% of collected residual waste	2024
Reduction of landfilled biodegradable components of MSW (compared to reference year)	by 25%	after 5 years	by 25%	2026
	by 50%	after 8 years	by 50%	2031
	by 65%	after 15 years	by 65%	2034
Reduction of the landfilled waste amount	to 10% or less of total generated MSW	2035	to 60% or less of total generated MSW	2031
<b>Fee collection and public awareness</b>				
Increase in fee collection efficiency			70% of households pay for SWM	2024
Increase in public awareness			40% of population participates in separation of dry recyclables	2026

Besides the targets presented above, the consideration of the waste hierarchy is a key aim towards a sustainable integrated waste management system in Polog Planning Region. The most favorable considered option is prevention of waste. If this option is not available or technically or economically executable, the following hierarchy levels shall be investigated. These are in order: Preparation for reuse, recycling, other recovery and as last and least favored option disposal.

### 3.3 Planned Technologies and Methods for the Future Regional SWM

Ensuring a clean and healthy environment, by securing basic sanitation and improving the collection and the disposal of municipal solid waste in Polog Planning Region is the main aim of this Regional Waste Management Plan. The technical and organisational options to achieve this goal can be subdivided into waste prevention and reduction, waste collection, waste transportation and transfer, waste treatment and recycling, waste disposal and rehabilitation and closure of dumpsites. Accompanying soft action such as public awareness campaigns are included in the concerning sub-chapters.

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### 3.3.1 Waste Prevention and Reduction

Waste prevention lies at the top of the waste hierarchy as it is key to sustainable waste management by preserving energy and natural resources as well as minimising costs and environmental impacts of waste management. As presented in the following figure, waste prevention can be realised at different stages. On the one side, waste prevention can be achieved by reducing the quantity of material used in the creation of products and increasing the efficiency with which products, once created, are used. According to the legal frame work, the Extended Producer Responsibility schemes (see chapter 1.2.1) also fulfil an important role.

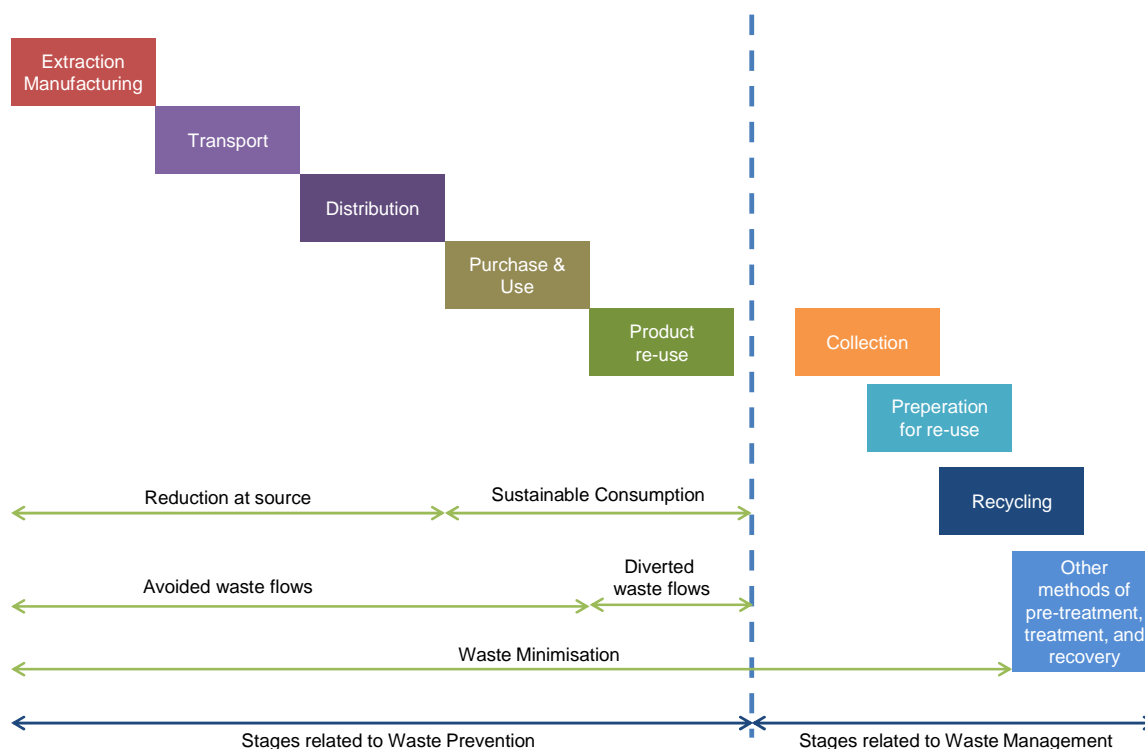


Figure 12 Illustration of definition of waste prevention<sup>14</sup>

At the local level, the public and private consumer will contribute to the waste prevention by changing their consumer habits as well as by the re-use of products.

The waste prevention plan for the Polog Region foresees following actions:

- **Provision of training programmes for competent authorities:** Before starting any waste prevention activity, it will be ensured that the respective staffs of the public and

<sup>14</sup> Preparing a Waste Prevention Programme, Guidance Document, EC DG Environment, 2012



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private service providers have sufficient and appropriate training as responsible persons for the preparation and implementation of waste prevention programmes and as multipliers. The municipalities of the Polog Region will take advantage of possibilities given through the implementation of donor funded projects. They will make the staff available for training programmes and ensure that the know-how gained is transferred to next generations.

- **Implementation of awareness campaigns:** with intensive awareness campaigns, public attention shall be drawn to behavioural change of the consumers. The campaigns shall focus on specific waste streams and offer practical, easy to follow guidance on waste preventing actions. As the environmental awareness of the population in the region is relatively low, the campaigns shall give information on the hazards of the poor (existing) waste management as well as the benefits of modern waste management systems.
- **Provision of information on waste prevention techniques:** the municipalities of the region together with the future regional waste management entity will make available targeted information in waste prevention techniques to specific users, such as businesses, industries, households and institutions. Methods for the provision of waste prevention information will include inter alia online information portals (websites of the LGUs and waste management companies as well as specific websites with calculation or planning tools) and/or information centres (telephone helpline, one-on-one consultation, on-site consultation, etc.)
- **Promotion of reuse and repair:** the municipalities will promote the reuse and repair of household articles by establishing reuse and repair centres in their territory. This includes the establishment of give-away shops and organisation of repair cafes.
- **Implementation of green public procurement policies:** the municipalities and governmental units will consider including waste prevention criteria in their calls for tender and contracts, as far as possible within the national public procurement rules. In this regard where appropriate, the longevity and reparability of purchased products will be emphasised and the purchase of used goods will be considered as an option.

As the small municipalities might not have sufficient funds to cover the expenses for a waste prevention programme, a competence centre for waste prevention shall be established, e.g. under the umbrella of future regional waste management entity.

The volume and quantity of the Construction and Demolition Waste (CDW) is approximately equal or higher than the amount of municipal solid waste. As the amount of CDW per generation point is much higher than the amount of municipal waste generated at one location, the prevention measures can be applied more easily and more effectively. With the integration of waste prevention in the early beginning of planning of construction and deconstruction CDW quantities can be reduced considerably. In this respect, the



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municipalities will encourage using long-lasting designs and construction materials which can be replaced and/or recycled after their useful lifetime. Also, during the construction works, the re-use of construction aids such as concrete forms or covering materials, would help to avoid CDW generation. The re-use of materials protects the resources as well as improve the economic efficiency of construction works. During demolition of buildings, the materials shall be collected separately so that the recyclable materials are segregated from non-recyclable materials and the landfill demand is minimised.

### **3.3.2 Waste Collection and Transport**

#### **3.3.2.1 Collection of Mixed Municipal Solid Waste**

Improvement of collection services will be a focal area in the first implementation phase/ short-term. Currently, the average collection rate in Polog Planning Region is at 82 %. Not all municipalities provide comprehensive services and some villages and settlements are not served due to their low accessibility or other reasons. Until 2020 a collection rate of 90 % and until 2024 100 % shall be achieved. Although the general waste collection rate in the region is relatively high, in rural, particularly mountainous areas, the waste collection services are hindered by the poor road conditions which do not enable collection trucks to reach villages in remote areas. Therefore, along with the improvement of transport infrastructure conditions, municipalities shall extend the collection services to the accessible villages.

The requirements on a modern waste management system which includes separation of waste into various fractions (i.e. different recyclable fractions, organic waste etc.) will be higher than the requirements of the current system where only mixed waste is collected. Therefore, it is essential to design the collection services in a sustainable manner with high efficiency and effectivity, not only in the areas to be newly connected, but in all existing areas as well.

### **Improving Planning and Monitoring Waste Collection**

With the installation of a weighbridge at the Rusino landfill municipalities will receive reliable information on waste amounts collected and delivered to the landfill by each truck. This information is a core element of the planning and monitoring system to be installed in each municipality.

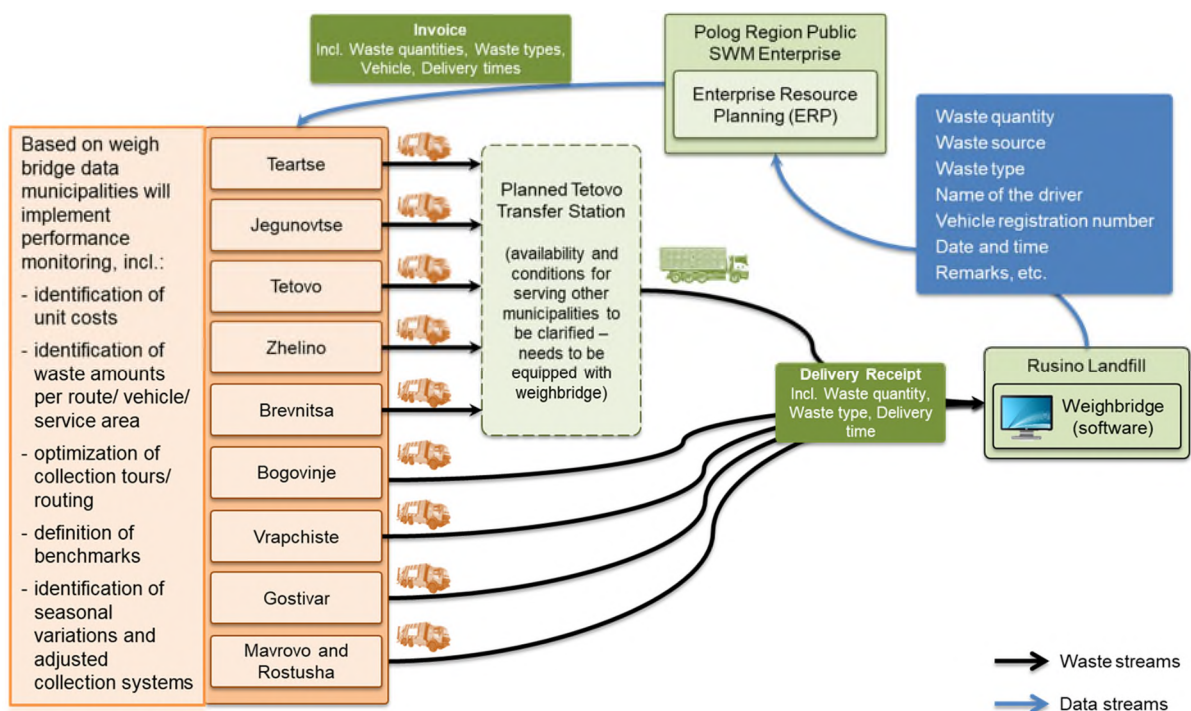
Using the information from the weighbridge, those municipalities providing services with their own public utilities shall:

- review the routing of trucks (based on filling rates and collection times) and revise the waste collection and street cleaning plans,



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- Identify unit costs for waste collection and determine benchmarks for financial and operational efficiency,
- Set the rules for supervision, monitoring, and reporting,
- Calculate required resources (staff, vehicles, containers, etc.) and costs on the base of actual work load,
- Establish financial and performance monitoring systems,
- Establish equipment maintenance systems and ensure high availability of the equipment,
- Carry out awareness campaigns in order to motivate the residents to actively participate in waste collection system (utilisation of containers, consideration of collection times, avoiding littering, etc.),
- Appoint a public relations manager in order to maintain permanent contact with citizens and businesses.



**Figure 13 Weighbridge as centre piece for development of data management and performance monitoring system**

In those municipalities, where the service provision is delegated to concessionaires, service standards and areas should be clearly defined and continuously monitored. Considering the ongoing projects for the implementation of a regional waste management

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infrastructure, the contracts with the private sector shall be designed with certain flexibility in order to adjust them once the future regional facilities are in place.

### Equipment for Waste Collection

An important element for the improvement of collection services is the procurement of appropriate equipment. As identified in the Status-quo Analysis, most of the equipment currently used for waste collection is far beyond the economic lifetime and in many cases not appropriate for the purpose. Further investments are needed for implementation of separate collection and for upgrading of collection points.

The following table presents an estimation of the initial investment costs for procurement of appropriate equipment for street cleaning and waste collection. This estimation assumes that 70% of the overall required equipment needs to be replaced or added.

**Table 17 Estimation of initial investment for procurement of 70% of the required equipment for street cleaning and waste collection**

Municipality	Investment Cost for Equipment for Street Cleaning and Waste Collection		
	Equipment for Street Cleaning	Equipment for Waste Collection (mixed waste collection and separate collection of recyclables)	Total for Street Cleaning and Waste Collection
Brvenitsa	22,500 EUR	164,300 EUR	<b>186,800 EUR</b>
Bogovinje	42,200 EUR	309,700 EUR	<b>351,900 EUR</b>
Gostivar	148,100 EUR	1,259,700 EUR	<b>1,407,800 EUR</b>
Jegunovtse	13,800 EUR	101,000 EUR	<b>114,800 EUR</b>
Mavrovo & Rostusha	12,000 EUR	87,700 EUR	<b>99,700 EUR</b>
Teartse	16,200 EUR	118,400 EUR	<b>134,600 EUR</b>
Tetovo	163,900 EUR	1,194,800 EUR	<b>1,358,700 EUR</b>
Vrapchishte	37,700 EUR	275,000 EUR	<b>312,700 EUR</b>
Zhelino	20,500 EUR	149,400 EUR	<b>169,900 EUR</b>
<b>Total EUR</b>	<b>476,900 EUR</b>	<b>3,660,000 EUR</b>	<b>4,136,900 EUR</b>
<b>Total MKD</b>	<b>29,329,350 MKD</b>	<b>225,090,000 MKD</b>	<b>254,419,350 MKD</b>

As a result of this calculation total initial investment for equipment for street cleaning and waste collection in Polog region amounts to approximately EUR 4.1 million (MKD 254 million), assuming the purchase of new equipment.

During the preparation of the Feasibility Study for Short Term Investments, it needs to be clarified, to which extend these investment costs can be covered from available funding.



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### **3.3.2.2 Separate Collection of Dry Recyclable Waste incl. Packaging Waste**

The target for separate collection of recyclables is set with:

- Coverage of 50% of households by separate collection for recyclables

Furthermore until 2020 for packaging waste which is part of dry recyclable waste the following targets are defined:

- Recycling of 55% of packaging waste<sup>15</sup>.

In order to achieve these targets, the municipalities shall begin to collect the dry recyclables separately. However, before implementing full scale separate collection systems, the municipalities shall start with initial pilot projects and test different models for the separate collection.

The following methods should be considered for separate collection of dry recyclables:

- Separate collection scheme in cooperation with companies licensed for collective scheme of recyclables (licensed collective handlers; see chapter 3.7.5)  
Actors under the EPR scheme are interested to establish permanent and compulsory structures to recover as much as possible of the material. However, this needs a tied relation with the consumers (shops, markets, households, municipalities) and an appropriate infrastructure for collection (collection points, containers, refund systems, etc.). Municipalities can cooperate with the licensed collective handlers and use their funds to build collection centers and implement schemes for separate collection at source by establishing connections to the shops and markets or by providing the collection infrastructure.
- Concept for separate collection at source developed together with the concessionaires  
Five municipalities in the region provide the municipal SWM services through concessionaires which are reported to already implement recovery activities by sorting out the recyclables out of the collected mixed waste mostly at their own premises. Municipalities can discuss and find solutions together with the concessionaires how to collect the recyclables already at source which will improve both the quantity and the quality of the collected recyclables and therefore also give benefits for both parties.
- Separate collection of recyclables in cooperation with informal sector and/ or NGOs  
Municipalities in which the informal sector is already present in the collection of dry

<sup>15</sup> Law on Management of Packaging and Packaging Waste, Art. 35 ((Official Gazette of The Republic of Macedonia no.161/09, 17/11, 47/11)



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recyclables shall approach the informal sector and discuss on possibilities of cooperation for collection of recyclables. For example, municipalities can install mesh wire containers in the city to collect PET bottles and cans and the informal sector can take the collected materials. Municipalities shall also explore the possibility to cooperate with NGOs active in environmental activities for the separate collection measures as well as in organizing awareness raising campaigns to introduce and motivate the inhabitants to participate actively in the separate collection schemes. Furthermore, NGOs can also be an important cooperation partner in regard to support the integration of informal waste sector into the municipal separate collection scheme.

- **Buy-back-centers**  
In separate collection schemes through buy-back-centers, waste producers deliver the recyclables to the center and receive a certain amount of rewards based on the quantity of the delivered recyclables. This method is attractive since the direct benefit for the waste producers can motivate them to separate the waste at source. However, this system is prone to operate uneconomically due to the dependency of market value of recyclables and a reduction of revenues from the selling of the recyclables may reduce funds for the award program. Therefore, this system requires a careful planning especially in terms of financing possibilities. Continual subsidies through municipal budget or funds from donors/ private companies (CSR fund) are often substantial elements of such programs.
- **Material Recovery Facilities (MRF) / Sorting Plants**  
Sorting out recyclables at MRFs through screening and sorting techniques is another option to recover recyclables. In order to operate economic efficiently, this option would be feasible only for large municipalities with a high amount of recyclable waste or if it is used by more municipalities. Tetovo municipality is currently planning to build a transfer station including sorting of recyclables. As mentioned before, sorting out recyclables out of mixed waste is also practiced currently by the concessionaires.

Considering the current situation in the region where separate collection and recycling mostly only take place as small initiatives and a recycling culture is not yet established, the EU targets on separate collection are rather to be achieved after a longer time period. Therefore, the municipalities shall:

- Start in the Phase I with **initial pilot projects** to collect the dry recyclables separately and test different models for the separate collection. An implementation concept including a financial analysis shall be prepared in advance. Starting point for such concept shall be that the financial benefits from the separate collection and subsequent sale of the dry recyclables shall support the integrated, regional waste management system as a whole. The concept will consider the existing recycling structures as well as socio-economic aspects. The concept shall be

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realistic and consider the feasibility in terms of awareness level of the inhabitants but also in particular in terms of existing markets for the separately collected recyclables.

- **Evaluate** the separation scheme of pilot projects, and revise it if necessary
- **Extend** a successful implementation scheme stepwise to a larger area to reach a 50% coverage of households in separate collection scheme until 2023
- Involve educational entities such as schools for implementation of the pilot activities for separate collection as well as awareness raising measures

In accordance with the North Macedonian regulations, measures for waste collection and separate collection shall be contained in the municipal waste management programs prepared for a period of two years<sup>16</sup>.

### **3.3.2.3 Separate Collection of Biodegradable Waste**

Biodegradable waste includes any organic matter in waste which can be found in municipal solid waste as green (garden) waste, food waste, paper waste, and other biodegradable components.

The separate collection of organic waste as well as the marketing of the products is one of the most challenging activities of municipal waste management. In order to have a high-quality product from the processing of organic waste (compost), the separation at source is crucial to have a preferably clean organic fraction without impurity of other materials. Therefore, participation of citizens in separate collection at source is of major importance for the success of the scheme.

Taking these challenges into consideration, the target for the separate collection of biodegradable waste (25% of households have access to separate collection of bio-waste until 2026) gives sufficient time for a stepwise introduction of schemes for separate collection and treatment of organic waste.

The separate collection will start with materials which can be collected and treated comparatively easy, such as green waste and market waste.

In order to gather first experience with separate collection and composting activities, municipalities will start with small initiatives in the short-term such as pilot projects for green waste composting.

<sup>16</sup> In future these municipal programmes may be replaced by organising waste management at local level through local legal acts thereby abolishing the obligation to submit plans to MoEPP for approval.

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Furthermore, home composting for own/ private use should be encouraged especially in rural areas and the population should be instructed not to dispose green waste in public waste containers.

As first steps, especially the collection of communal and commercial green waste of major producers (gardener, green care) will be initiated. Furthermore, at markets separate bins for organic waste from vegetables shall be installed. Later on, the separate collection of organic waste can be extended to other organic materials and producers, taking previous experience into consideration.

### 3.3.2.4 Waste Transportation and Transfer

For cost efficient transport of collected waste to the location of treatment or final disposal, especially in case of long distances, a waste transfer station might be considered. A distance for collection trucks of more than 30 km indicates advantages of a transfer station versus direct transport. For smaller vehicles, this criterion is set even lower.

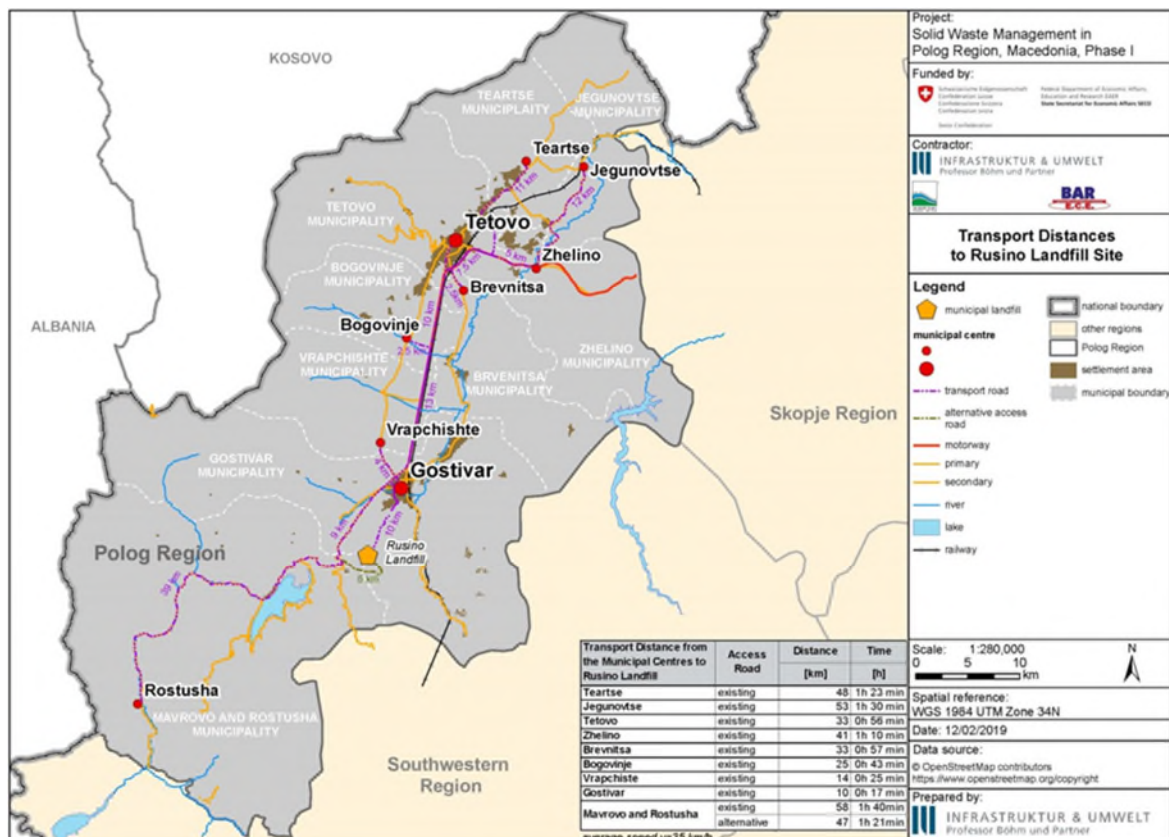


Figure 14 Transport distances to Rusino landfill site

Figure 14 illustrates the transport distances from the municipal centres to Rusino Landfill. As shown in this figure, several of the municipalities in the northern part of Polog

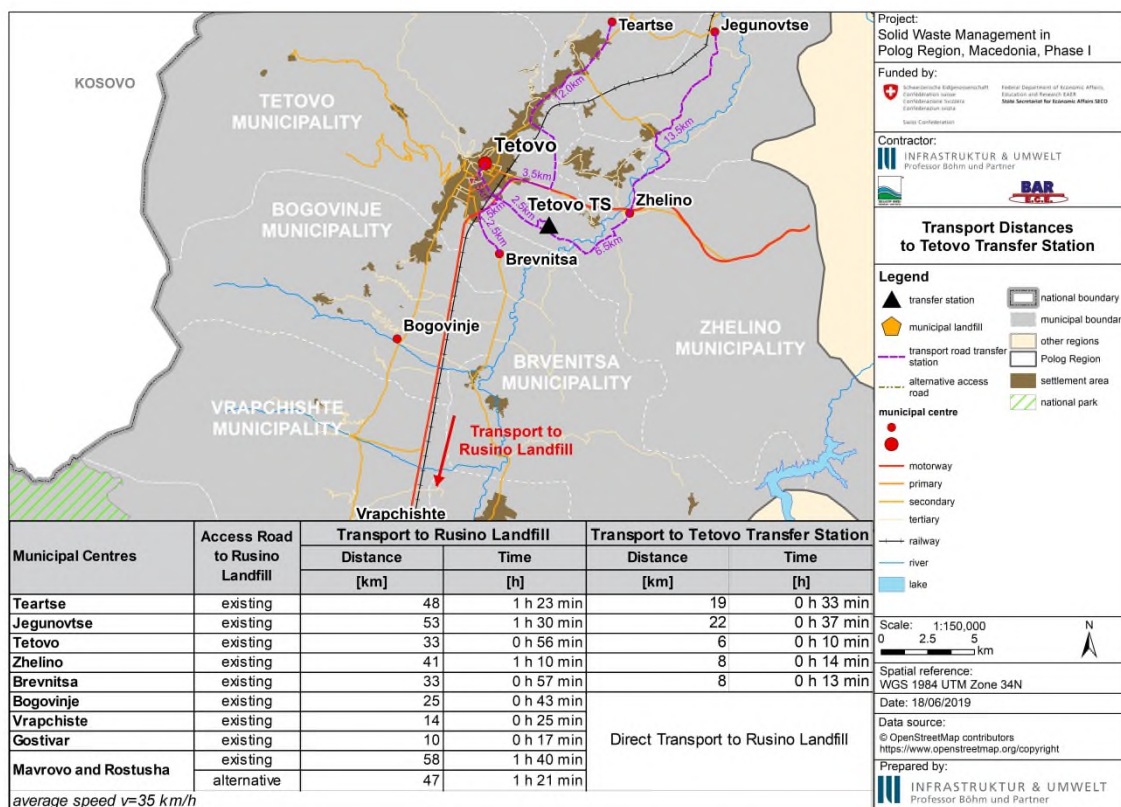
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region exceed a transportation distance of 30 km. Nevertheless, the individual operation of a transfer stations by small municipalities is not feasible, because of the inefficient use of large volume trucks for only little waste amounts. For economic utilization of the specialist transport equipment, the amount to be transferred should be at least 30 tons per day. This amount is only collected by Gostivar and Tetovo municipalities, whereas all other municipalities have lower waste amounts per day (see chapter 2.3.2).

In order to realize waste transfer also for smaller municipalities, there are different options:

- Waste transfer and long-distance transport is organised by the regional public utility, thus using the same equipment for different municipalities;
- Smaller municipalities reach consensus with bigger municipalities for common use of a transfer station;
- Transfer and long-distance transport is organised by a private contractor/ concessionaire, in case of servicing several municipalities.

Currently, Tetovo Municipality is planning the construction of a transfer station including a material recovery facility. The location of this transfer station is shown in the figure below.



**Figure 15** Planned Tetovo transfer stations as an option for serving the municipalities in the northern parts of Polog Region



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The location is well suited to also serve other municipalities in the northern parts of Polog region. Vice versa, building another transfer station in addition to the Tetovo transfer station would be less cost efficient. The municipalities in the north part of the Polog Region shall therefore agree on the common use of the planned transfer station.

In the southern parts of the region, only Mavrovo & Rostusha Municipality has to transport for more than 30 km – considering the new access road to the landfill the distance would be 47 km one way, and 58 km using the current landfill access road. Nevertheless, because of the small waste amounts (less than 10 tons per day), use of an individual transfer station operated by the municipality is not feasible<sup>17</sup>. Therefore, for Mavrovo & Rostusha Municipality direct transport to the Rusino landfill is foreseen.

### **3.3.2.5 Conceptual Approach for Waste Transfer and Long-Distance Transport**

Assuming the realization of Tetovo Municipality Sorting and Transfer Station, during Phase I (2019/2020) possibilities for common use of this transfer station need to be explored and contractual arrangements to need be agreed upon.

In case that no consensus can be reached on the common use of this transfer stations, the municipalities of Teartse, Jegunovtse and Zhelino may consider realization of another jointly used transfer station. This, however, would again raise the question regarding an operational structure for this facility. Since all three municipalities currently have concession contracts with private service providers, a private company might also build and operate the transfer station.

### **3.3.3 Waste Treatment**

#### **3.3.3.1 Targets for Waste Treatment**

The purpose of waste treatment is to reduce the environmental impact from waste and reduce the loss of valuable and useful materials. Treatment includes:

- a) separation (and processing) of recyclables either from mixed or separately collected waste
- b) treatment of organic components

According to the target defined in chapter 3.2 biodegradable components of MSW going to landfill shall be reduced by 25% until 2026, by 50% until 2031 and by 65% until 2034.

<sup>17</sup> In case responsibility for transfer and transport is delegated to the regional utility, a small transfer station could be established in Mavrovo & Rostusha Municipality



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### **3.3.3.2 Waste Treatment Options**

For the treatment of municipal waste, following options are available:

- **Material Recovery Facility (MRF)**

For the treatment of municipal solid waste, a material recovery facility (MRF) can be implemented. Two types of MRFs can be distinguished namely, dirty MRF for mixed waste and clean MRF for separately collected dry recyclable fraction (mixture of paper, cardboard, plastic, glass and metal waste).

In dirty MRFs mixed municipal solid waste is segregated by means of manual picking and/or mechanical separation technics such as sieving or magnetic separation. The waste stream is separated into recyclables and non-recyclable residual waste for disposal or further processing. Clean MRFs only process recyclables which have been separated at source. These recyclables can contain glass, plastics, paper and cardboard and metals. Similar to the dirty MRFs they are separated using different machinery according to the required output. The separated material is then processed for further recycling in another treatment plant.

A wide range of technologies is used in MRFs, from low tech facilities on the one side up to fully mechanized processes on the other hand. With increasing level of technology, the costs for initial investment will increase, while the number of workers for manual sorting will be reduced. Thus, the decision about the preferred technologies needs to consider the actual frame conditions, such as waste amounts and waste types, recyclables to be separated, labour costs etc. Even in case MRF designs are classified as low tech, experienced management, monitoring and quality control are necessary to assure good performance. Efficient operation and successful marketing of separated recyclables have a major impact on the overall cost balance of the facility.

- **Composting (Material Recovery)**

Composting is an aerobic stabilisation process of organic substances. There are numerous different composting technologies, from simple heap composting to open windrow composting passively aerated, windrow composting with compost turning by front end loader or specialised windrow turner, composting with forced aeration to fully automated in-house plants.

The recommendable plant sizes (capacity ranges) and the respective costs for aerobic stabilization depend on the type of technology being used. Simple windrow composting without active aeration is the least cost solution already suitable for very small composting plants; costs for fully automated in-house systems are usually several times higher.

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Therefore, these systems are only recommendable from a certain plant size (> 10,000 tons per year). The latter however, have clear advantages with regard to space requirements and emission control. In contrast, open windrow composting is not recommendable for the treatment of organic waste such as kitchen waste and food waste. In order to avoid or minimize emissions of odour and leachate as well as the infestation of flies, birds and rodents, covered or in-house solutions are to be preferred.

A basic prerequisite for production of quality compost (which can be marketed) is the separate collection of bio-waste. The additional expenditures required for this can be partly compensated by the achievable revenues from the sales of compost.

- **Anaerobic Digestion (Material and Energy Recovery)**

Anaerobic digestion (AD) is a stabilization process of organic substances. With respect to energy and material recovery, the main targets of AD of separately collected organic waste are the generation of biogas (and the subsequent production of electricity and heat) and the production of an arable soil conditioner. Further targets are the stabilization of the organic content of the waste in order to reduce both the amount of biodegradable municipal waste going to landfills as well as the respective resulting emissions. A basic prerequisite for achieving all these targets is the separate collection of bio-waste. The additional expenditures required for this can be partly compensated by the achievable revenues from the sales of power and compost.

- **Mechanical Biological Treatment (MBT, Material and/ or Energy Recovery)**

As the name shows, in the MBT there is a mechanical and a biological treatment process. The mechanical treatment phase might have various aims, such as the removal of inert materials or impurities and thus preparation of subsequent biological treatment, segregation of recyclable materials, and/ or preparation of refuse derived fuel (RDF). In the biological treatment phase the biomass or “compostable” fraction is processed through an anaerobic digestion, composting or bio-drying system with the purpose of mass reduction, production of compost-like material, biogas and/ or RDF, and/ or stabilisation of residues. The next figure visualises the process steps and outputs of MBT plants.

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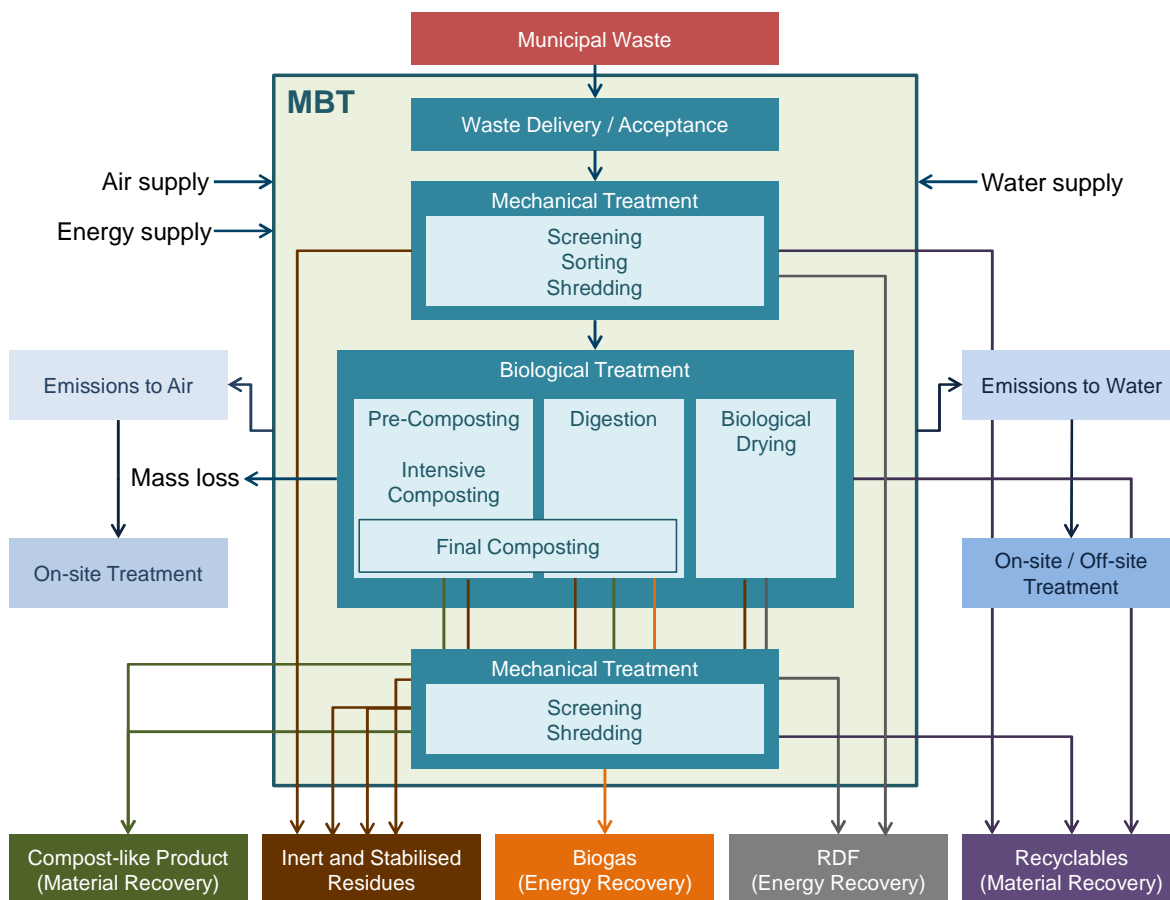


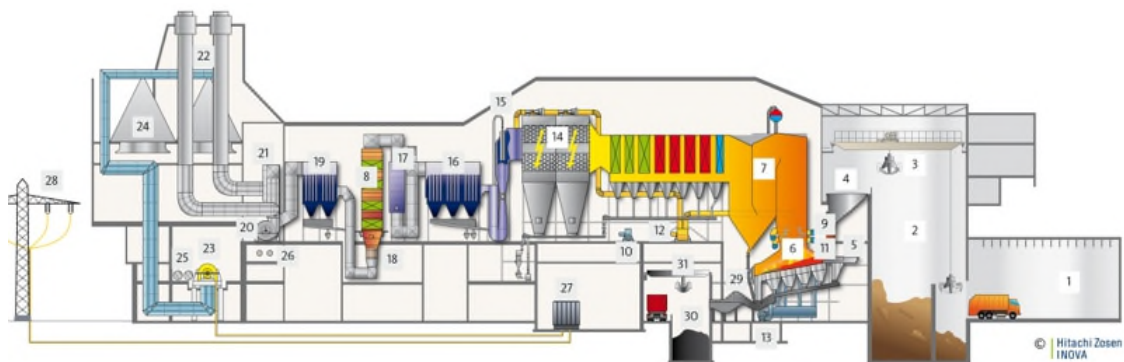
Figure 16 Process steps and outputs of MBT plants

- **Waste Incineration (with Energy Recovery)**

Incineration of waste means thermal treatment of waste in order to reduce its volume and hazard, at the same time to capture or destroy harmful substances which are or may be released during incineration and to recover energy, mineral and/ or chemical content from waste. As a result of these processes, an incineration plant consists of a complex set of interacting technical components.

There are various technologies to combust waste: Moving grate, rotary kiln, fluidised bed etc. The most common and well-proven technology is the mass burning with a moving grate where the waste is combusted at a temperature of 1,000 °C or more on a grate with combustion air injected from below the grate. In Europe approximately 90 % of installations treating municipal solid waste (MSW) use grates.

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Waste receiving and storage	Grate combustion and boiler	Flue gas treatment	Energy utilization	Residue handling
1 Tipping hall	4 Feed hopper	14 Electrostatic precipitator	23 Extraction-condensation turbine	29 Bottom ash extractor
2 Waste bunker	5 Ram feeder	15 Sodium bicarbonate injection	24 Air cooled condenser	30 Bottom ash bunker
3 Waste crane	6 Hitachi Zosen Inova grate	16 Fabric filter 1	25 District heating heat exchanger	31 Bottom ash crane
	7 Four-pass steam boiler	17 SCR DeNOx	26 Process steam extraction	
	8 External Economiser	18 Heat exchanger 1	27 Trafo	
	9 Secondary air injection	19 Fabric filter 2	28 Electricity Export	
	10 Secondary air fan	20 Induced draft fan		
	11 Recirculated flue gas injection	21 Heat exchanger 2		
	12 Recirculated flue gas fan	22 Stack		
	13 Primary air fan			

Figure 17 Components of a waste incineration plant<sup>18</sup>

### 3.3.3.3 Comparison of Identified Technology Options

Table 18 provides a direct qualitative comparison of the technology options for mixed waste treatment. The rating scales with respect of their respective characteristics are as follows:

- Institutional requirements: comprehensive - minor
- Technical criteria: ambitious (high-tech) – simple (low-tech)
- Social-economic importance: very relevant – less relevant
- Environmental impacts: very relevant – less relevant
- Financial characteristics: high unit costs – low unit costs

<sup>18</sup> System diagram: Hitachi Zosen INOVA, <http://www.hz-inova.com>

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**Table 18 Comparison of identified technology options for waste treatment**

Waste Treatment Option	Institutional Requirements	Technical Criteria	Socio-Economic Importance	Environmental Impacts	Financial Characteristics
<b>Material Recovery Facility (MRF)</b>					
Dirty MRF	+	0	+	+	+
Clean MRF	0	+	0	++	0
<b>Mechanical Biological Treatment (MBT)</b>					
MBT with anaerobic digestion	-	-	+	++	0
MBT with biological drying (RDF production)	0	0	0	++	0
MBT with composting	+	+	-	0	+
<b>Composting (Material Recovery)</b>					
Windrow composting plant	+	+	0	+	0
Fully automate in-house plant	0	0	+	++	-
<b>Anaerobic Digestion (Energy Recovery)</b>					
Anaerobic digestion	-	-	+	++	-
<b>Waste Incineration (Energy Recovery)</b>					
Moving grate incineration	-	--	0	+	--

With respect to the importance of the financial feasibility, a separate summary of key specifications of the above presented treatment options is compiled in the following table. The summary considers for each technology option the following details:

- Prerequisites,
- Throughput: minimum amount for economic operations,
- Waste types, to be treated,
- Specific initial investment costs: related to the annual throughput,
- Initial investment for the reference design capacity
- Specific net costs: converted for a reference system with a collected waste amount of 100,000 t/a<sup>19</sup>,
- Economy of scale: effects of increased throughput, and
- Remarks (explanations).

<sup>19</sup> This waste amount is to facilitate comparability and only serves to compare in principle the costs of the different waste treatment options. Moreover, this waste amount is of the same order as the amount expected to be collected during a largest part of the RWMP planning period.

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**Table 19 Summary of economic key specifications of waste treatment options**

Waste Treatment Option	Prerequisites	Throughput (minimum amount for economic operations) * Flexible: Technology can be adapted to input quantity	Waste Types	Specific Initial Investment Costs (related to the annual throughput)	Initial Investment	Specific Net Costs ** including revenues		Economy of Scale (effects of increased throughput)		Remarks
						Related to the annual throughput	Converted for a reference system with 100,000 t/a	Low	High	
Dirty MRF	Market for recyclables	Flexible*	Mixed municipal waste	75 EUR/t (50,000 t/a)	3,750,000 EUR	8 EUR/t**	4 EUR/t**			Quality of recyclables is low compared to clean MRF
Clean MRF	Market for recyclables	Flexible*	Recyclables from separate collection	120 EUR/t (15,000 t/a)	1,800,000 EUR	5 EUR/t**	0.75 EUR/t**			Additional costs for separate collection of recyclables to be considered
Windrow composting plant	Separate collection of organic waste, market for compost	Flexible*	Separately collected organic waste	120 EUR/t (10,000 t/a)	1,200,000 EUR	15 EUR/t**	2 EUR/t**			Additional costs for separate collection of organic waste to be considered
Fully automated in-house composting	Separate collection of organic waste, market for compost	> 10,000 t/a	Separately collected organic waste	220 EUR/t (25,000 t/a)	5,500,000 EUR	40 EUR/t**	10 EUR/t**			Additional costs for separate collection of organic waste to be considered
Anaerobic digestion	Separate collection of organic waste, market for compost	Flexible*	Separately collected organic waste	275 EUR/t (25,000 t/a)	6,875,000 EUR	50 EUR/t**	13 EUR/t**			Additional costs for separate collection of organic waste to be considered
MBT with anaerobic digestion	Market for products (Biogas)	> 10,000 t/a	Mixed municipal waste	230 EUR/t (100,000 t/a)	23,000,000 EUR	60 EUR/t**	60 EUR/t**			High requirement for the anaerobic treatment of mixed municipal waste
MBT with biological drying (RDF)	Market for products (Refuse Derived Fuel)	> 25,000 t/a	Mixed municipal waste	200 t/a (100,000 t/a)	20,000,000 EUR	50 EUR/t**	50 EUR/t**			Only feasible if there is sufficient demand for refuse derived fuel
MBT with composting	Markets for products (compost)	>10,000 t/a	Mixed municipal waste	150 EUR/t (100,000 t/a)	15,000,000 EUR	35 EUR/t**	35 EUR/t**			High area demand
Moving Grate Incinerator	A well-implemented waste management and environmental monitoring system, off taker for the products (power/heat)	> 50,000 t/a	Mixed municipal waste	600 EUR/t (100,000 t/a)	60,000,000 EUR	80 EUR/t**	80 EUR/t**			Incineration plant with a simple flue gas treatment and combined heat and power (CHP) utilisation. Costs are based on: Reference Document on BREF for Waste Incineration, EC, 2006.

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### **3.3.3.4 Conceptual Approach for Waste Treatment**

Considering the financial situation of the municipalities in the Polog Region and the limited affordability to pay for waste management services, waste treatment shall be implemented in a stepwise approach, in line with the targets of the EU directives.

During the first stage, the focus will be on

- Implementation / improvement of material recovery facilities.
- Implementing pilot projects on green waste composting and home composting

Currently, Tetovo Municipality is preparing for implementation of an MRF as component of the newly planned Tetovo transfer station. According to available information, this facility is planned for the separation of recyclables from mixed waste. It is assumed that with this facility approximately 10%<sup>20</sup> of the incoming waste amounts will be separated and the remaining 90% will be landfilled.

### **3.3.4 Waste Disposal**

#### **3.3.4.1 Targets and Phases for Improvement of Waste Disposal**

According to the targets defined in chapter 3.2 until 2024 100% of the residual waste collected in Polog region should be disposed in compliance with the EU landfill directive.

The municipalities of the Polog Region have agreed to develop the Rusino landfill (see further details in chapter 2.7.1), located in Gostivar Municipality as a regional landfill, to be used by all 9 municipalities. Thus until 2024 the Rusino landfill shall be converted into a regional landfill in compliance with EU standards.

The choice for Rusino, without considering alternatives, is justified particularly because of its availability and prior designation as a regional landfill. Experience has learned that selection of an alternative site could take several years which would mean that Rusino would continue to be used as non-standard landfill with serious environmental impacts as result. Moreover, the choice for Rusino also results in the transformation of a non-standard landfill into a sanitary landfill thereby minimizing environmental risk currently associated with the site. Opting for an alternative location would see a continuation of environmental impacts until the Rusino site would be closed and rehabilitated at high

<sup>20</sup> Even though the percentage of recyclable waste in the overall waste stream is estimated to be 20%, not all recyclable waste can be separated from the mixed waste stream for actual recycling. This is in part due to inefficiency of a MRF and in part due to contamination of recyclable waste as result of mixing the recyclable fraction the rest of the waste generated.



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costs. However, considering the limited capacity (estimated 10 years), the identification of a new regional landfilling location shall be initiated without delay. Such new location shall be large enough to function as a regional waste management centre with not only disposal capacity but also the possibility to establish waste treatment, organic waste treatment and/or waste recovery facilities in line with the step-wise approach this plan anticipates for the implementation of waste treatment.

In previous Over the years, mainly due to poor management of the Rusino landfill, there have been and are ongoing protests from local residents resulting in temporary-repeated blockage of the access road and limited use of the landfill. Nevertheless But, it is expected that with the improvement of Rusino landfill the conflicts with local residents can be solved and availability of the landfill for all municipalities of the region can be secured. Nevertheless, starting the selection process for a new site as replacement for Rusino, is also in this respect needed.

The improvement of Rusino landfill will take place in two consecutive phases:

- Phase I: Implementation of immediate improvement measure to convert Rusino dumpsite into a controlled landfill. This includes
- Implementation of priority construction measures for immediate improvement
  - Setting up the required operational structure for operation of Rusino landfill (and other regional facilities, as far as required);
  - Setting up financing schemes to secure sustainable operation and maintenance of the implemented investment measures

In addition, the design for upgrading Rusino to a sanitary landfill (in Phase II) is prepared during Phase I. This landfill design includes designs for the closure measures to be implemented at Rusino as soon as a replacement location will be taken into operation.

- Phase II: Development of Rusino landfill as a regional sanitary landfill in compliance with the EU landfill directive (which includes the preparation of closure and aftercare measures)

The site selection for a new landfill / a new regional waste management centre to replace Rusino shall be initiated Pearly in Pphase II.



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#### 3.3.4.2 Implementation of Immediate Improvement Measures (Phase I)

In the table below the construction and procurement measures at Rusino landfill to be implemented during Phase I to be implemented until 2020 are listed.

**Table 20 Construction and procurement measures at Rusino landfill to be implemented during Phase I (until end of 2020)**

No	Item	SECO financed Quick-win Measures	Regional Center
1	Rehabilitation of parts of the access road (from junction leading to Sushica village to the landfill)		✓
2	Leachate management including: <ul style="list-style-type: none"> <li>- Embankment, north-western side</li> <li>- Embankment, south-eastern side with leachate storage pond</li> <li>- Ditch construction at the south-western border</li> <li>- Equipment and installations for recirculation of leachate</li> </ul>	✓	
3	Preliminary staff office, sanitation, water, electricity (with generator), lighting	✓	
4	Electronic weighbridge and waste data software	✓	

Further investments to be implemented during Phase II will be planned during Phase I. Furthermore, an environmental impact assessment will be prepared.

The positive impact of these construction and procurement measures will depend on the improved operation of the landfill. They will require the setting up of the regional entity, budgeting and staffing as detailed in chapter 3.4.1.

**Table 21 Operational improvements to be implemented by the Regional Company for Waste Management**

No	Service / activity
1	A disposal plan for interim operation should be prepared, identifying where and in which sequence certain areas of the landfill will be filled (as well as which areas must be kept free from filling, such as the leachate storage pond)
2	All incoming waste to be recording at the weighbridge
3	Suitable material for intermediate coverage to be provided on a permanent basis



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No	Service / activity
4	The waste should be bulldozed over the disposal face on a regular basis and the compacted horizontal surface should be covered on a daily basis with 10-15 cm of porous soil material. This will reduce nuisance conditions associated with odour, litter, pests etc. It may be necessary to import this material as an ongoing revenue cost.
5	A site road should be developed on a continuous basis to the centre of the active disposal area from the site access road. This road should be formed using crushed stone (ideally 10 cm "crusher run") so as to provide a suitable surface for disposal vehicles reversing towards the tipping face and to reduce punctures.
6	Site staff should be provided with suitable Personal Protective Equipment (PPE) including hi-visibility vest, waterproof clothing, steel-soled boots (to prevent puncture wounds) and suitable gloves.
7	Pest control operations to be provided during appropriate seasons. Service may be provided by private contractor.

#### 3.3.4.3 Development of Rusino Landfill as a Sanitary Landfill According to EU Standards During Phase II

The regional sanitary landfill will be a landfill for non-hazardous waste and constructed and operated according to EU standards. The key elements of the sanitary landfill will be

- a suitable base and a surface layer,
- a fence and a gate,
- a weighbridge and a weighbridge office (already installed during Phase I),
- a leachate treatment collection and treatment system (with initial measures during Phase I),
- a landfill gas collection system,
- a surface water management system,
- appropriate mobile equipment with sufficient capacities,
- buildings for administration, staff accommodation, and equipment maintenance.

The estimated initial investment costs for development of Rusino landfill as a regional sanitary landfill are shown in the following table.

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**Table 22 Rough estimation of initial investment costs for development of Rusino  
dumpsite into a regional sanitary landfill according to EU standards**

Item	Initial Investment		Additional Optional Investment	
	[EUR]	[MKD]	[EUR]	[MKD]
Earthworks and moving of waste	700,000	43,050,000		
Base sealing (50,000m <sup>2</sup> )	2,250,000	138,375,000		
Landfill gas collection	200,000	12,300,000		
Landfill gas treatment		-	500,000	30,750,000
Leachate collection / treatment	1,750,000	107,625,000		
Groundwater wells	50,000	3,075,000		
Infrastructure (office, garage, fence etc.)	300,000	18,450,000		
Electricity and water supply	150,000	9,225,000		
Landfill operation equipment	500,000	30,750,000		
Access road		-	500,000	30,750,000
Contingencies (approx. 10%)	575,000	35,362,500	100,000	6,150,000
<b>Total Phase II</b>	<b>6,475,000</b>	<b>398,212,500</b>	<b>1,100,000</b>	<b>67,650,000</b>
Consultancy	647,500	39,821,250	110,000	6765000
<b>Total Phase II including Consultancy</b>	<b>7,122,500</b>	<b>438,033,750</b>	<b>1,210,000</b>	<b>74,415,000</b>

The operation of the landfill will be organised according to the operational standards of the EU landfill directive allowing the reduction of environmental impacts and increasing operational performance. The landfill will be operated according to an operation plan which includes instructions for:

- waste acceptance and registration
- organisation of waste disposal
- leachate collection and treatment
- landfill gas collection and treatment
- equipment and infrastructure maintenance
- environmental monitoring
- performance monitoring
- financial management



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- occupational health and safety
- emergency cases and fire protection
- human resources management
- closing and aftercare.

The functional structure for operating the landfill is presented in chapter 3.4.2.

Following the approval of the RWMP a Feasibility Study for detailing of the Phase II measures as well as an Environmental Impact Assessment will be prepared. The detailed design, technical specifications and tender documents for upgrading Rusino to a sanitary landfill in compliance with EU requirements will be made as well. In these studies and designs special attention will be given to environmental protection measures including closure and aftercare of the Rusino disposal site.

### **3.3.4.4 Identification of a New Landfill Location and Preparations for its Realisation**

As mentioned, the capacity of Rusino landfill is limited and its acceptance among the local population is limited as well. In order to ensure the timely availability of additional disposal capacity for the Polog Region, a study for the selection of a disposal site to replace Rusino will be initiated at the beginning of Phase II. The study will include the following steps:

- Definition of exclusion criteria. Base on the legal requirements for the siting of landfills and the limitations that, for instance, regulations on protective areas and residential areas put on landfill siting, exclusion criteria will be formulated on the basis of which all areas where a landfill cannot be located will be identified.
- Definition of preferences. Some locations are more suitable for landfill realisation than others. Aspects as existing infrastructure (roads, water and electricity supply), land ownership and geo- and hydrogeological situation have to be considered. The definition of preferences will identify the preferred characteristics for the replacement site.
- Identification of potential locations. Based on exclusion criteria and preferred characteristics, potential locations will be identified.
- Selection of the future replacement location. Comparison of potential locations through an EIA process will lead to the selection of the further replacement for the Rusino landfill. Participation of stakeholders, including the general public, in the selection process is herewith guaranteed.
- Design of the replacement landfill, elaboration of tender documents.

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After the study preparations for the realisation of the new landfill will be made including mobilisation of the necessary funds to be followed by tendering, contracting and the execution of the works.

### **3.3.4.43.3.4.5 Rehabilitation of Non-standard Landfills and Dumpsites**

Besides Rusino landfill in all municipalities there are non-standard landfills and dumpsites where various types of waste are deposited. Currently there is no systematic mapping and risk assessment of the existing sites.

In order to roughly quantify the required budget for rehabilitation, cost estimation is based on statistical data.

The European Union, Council Directive 99/31/EC on Landfill of Waste sets standards for landfills including their closure and rehabilitation. As such, the Directive is not applicable to old dumpsites established before the Directive, but in the EU the closure and rehabilitation requirements are commonly applied also for old landfills.

Key element of landfill closure and rehabilitation measures is, according to the EU Landfill Directive, a properly designed surface sealing. In order to prevent leachate generation and gas emissions, it should consist of gas drainage layer, impermeable mineral layer, drainage layer, and top soil cover.

Due to size and expected environmental impact existing dumpsites can be allocated to different categories. Besides environmental impacts caused by landfill gas, leachate, odour and vermin, the extraordinary environmental risks, like the distance to the next settlement, the distance to a water body (lake, river or drainage channel), and the distance to water wells, should also be taken into consideration.

The method for rehabilitation of the dumpsites is selected on the base of disposed waste amount, density, composition, and condition of the disposed waste (already decomposed or burned), surface and height of the dumpsite, topography of the dumpsite, and potential risks to the environment and human health. Consequently, the total as well as specific unit costs might differ considerably from dumpsite to dumpsite.

Based on experience, the average specific unit cost for all types of dumpsites is assumed to be 5.2 EUR per tonne of disposed waste. The amount of municipal waste generated in the Polog Region during the last 20 years is estimated with approximately 2 million tons. Assuming an amount of 1 million tons of waste deposited at non-rehabilitated dumpsites other than the Rusino dumpsite, rehabilitation requirements are estimated to be in the order of 5.2 million EUR (320 million MKD).

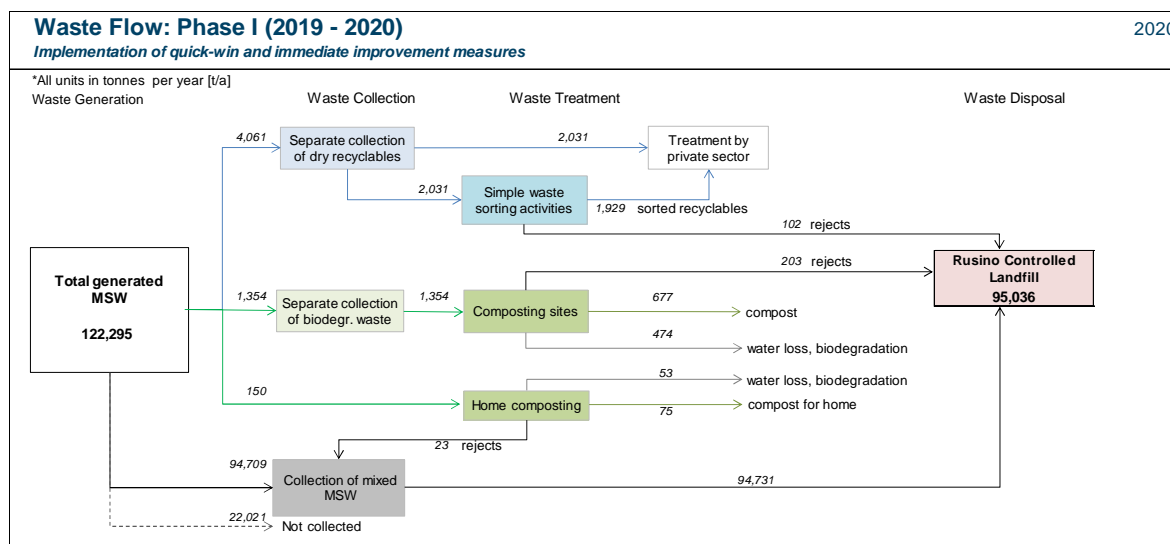
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For a more reliable cost calculation and implementation the following working steps are required:

1. Mapping, risk assessment and categorization of dumpsites
2. Preparation of rehabilitation concepts and cost estimations, including investigation of environmental impacts (i.e. groundwater pollution, gas emissions, etc) as far as required
3. Identification of funding, detailed design, procurement, implementation of rehabilitation works, monitoring

### 3.3.5 Effect of Introduction of Improvement Measures and New Technologies and Methods

As result of the improvement measures and plan implementation, the management of the waste generated in Polog Region will see a shift from most waste collected as mixed municipal solid waste and directly being transferred to the disposal site, towards increasing amounts being collected separately and being treated in composting plants, MRFs and sophisticated treatment facilities such as a MBT. The amount of waste requiring disposal also reduces over time. This process is illustrated in the following figures presenting waste flows for the three phases of RWMP implementation.



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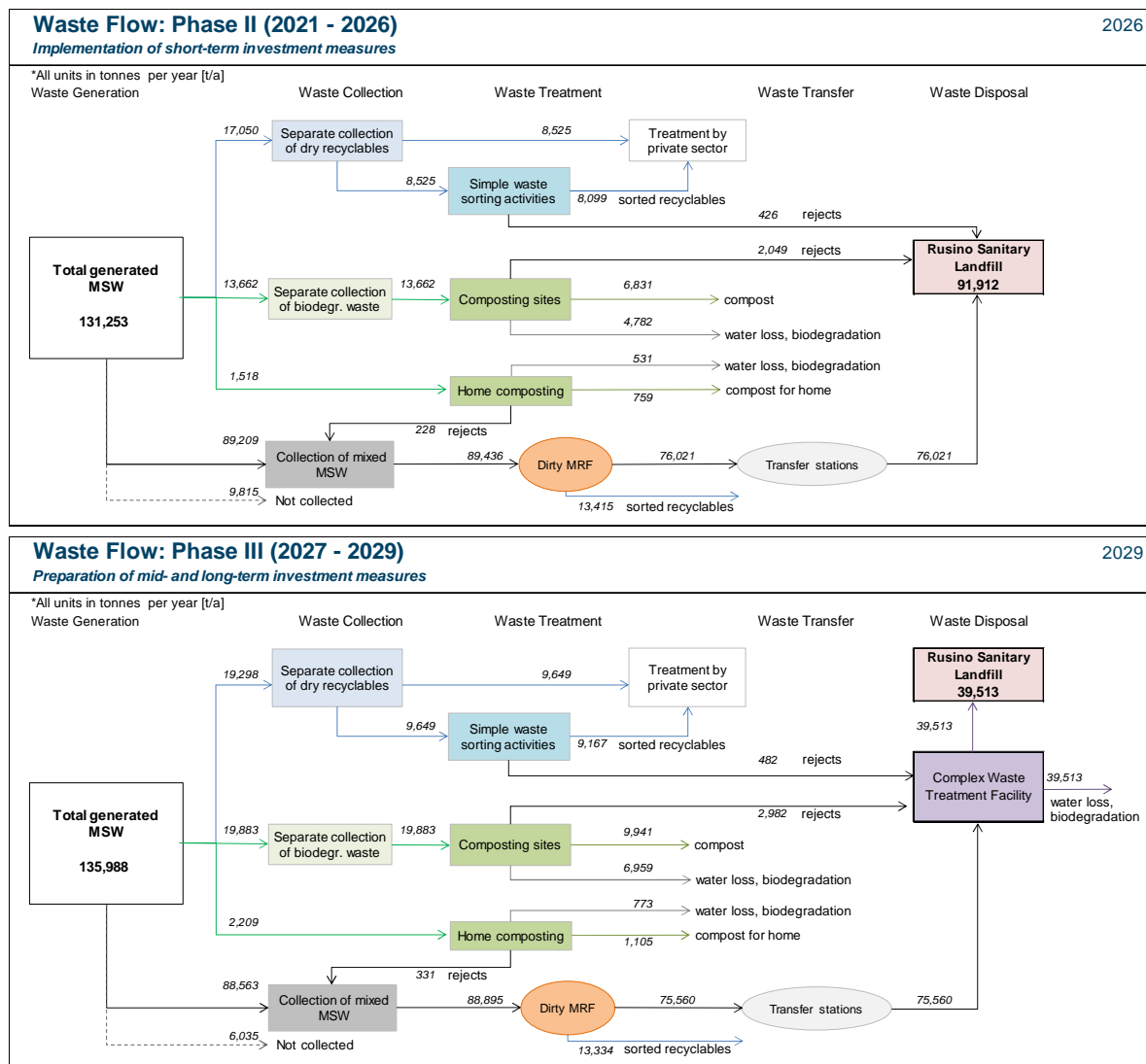


Figure 18 Waste flow during the three phases of the RWMP (2020, 2026, 2029)

### 3.3.6 Summary of Preferred Technologies and Methods

As a result of the prioritization and option assessment, focal areas of interventions during Phase I and Phase II will be:

1. Development of Rusino landfill as a regional sanitary landfill according EU landfill directive, which includes
  - Quick-win measures for immediate improvement to be implemented during Phase I
  - Setting up the required operational structure for operation of Rusino landfill (and other regional facilities, as far as required)

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- Setting up financing schemes to secure sustainable operations and maintenance of the implemented investment measures and closure and aftercare of the Rusino landfill
  - Investment measures to develop Rusino landfill as sanitary landfill during Phase II
  - Site selection and preparations for the implementation of a new sanitary landfill/ regional waste management centre as a replacement for Rusino
2. Development of an optimised system for waste collection:
- Procurement of waste collection containers (quick-win measures, Phase I)
  - Provision of additional equipment (Phase II)
  - Improvement of efficiency of service delivery (Phase II)
3. Initiating engagement of municipalities in recycling (Phase I and II)
- Identification and testing of most promising approaches for waste recovery and treatment (starting in Phase I)
  - Identification and testing of possible alliances with private sector and informal sector (starting in Phase I)
  - Realization of an MRF and a (pilot) composting plant (Phase II)
4. Development of an optimised system for waste transfer and transport (Phase I and II), which includes:
- Establishment of a transfer station for the municipalities in the northern part of Polog region

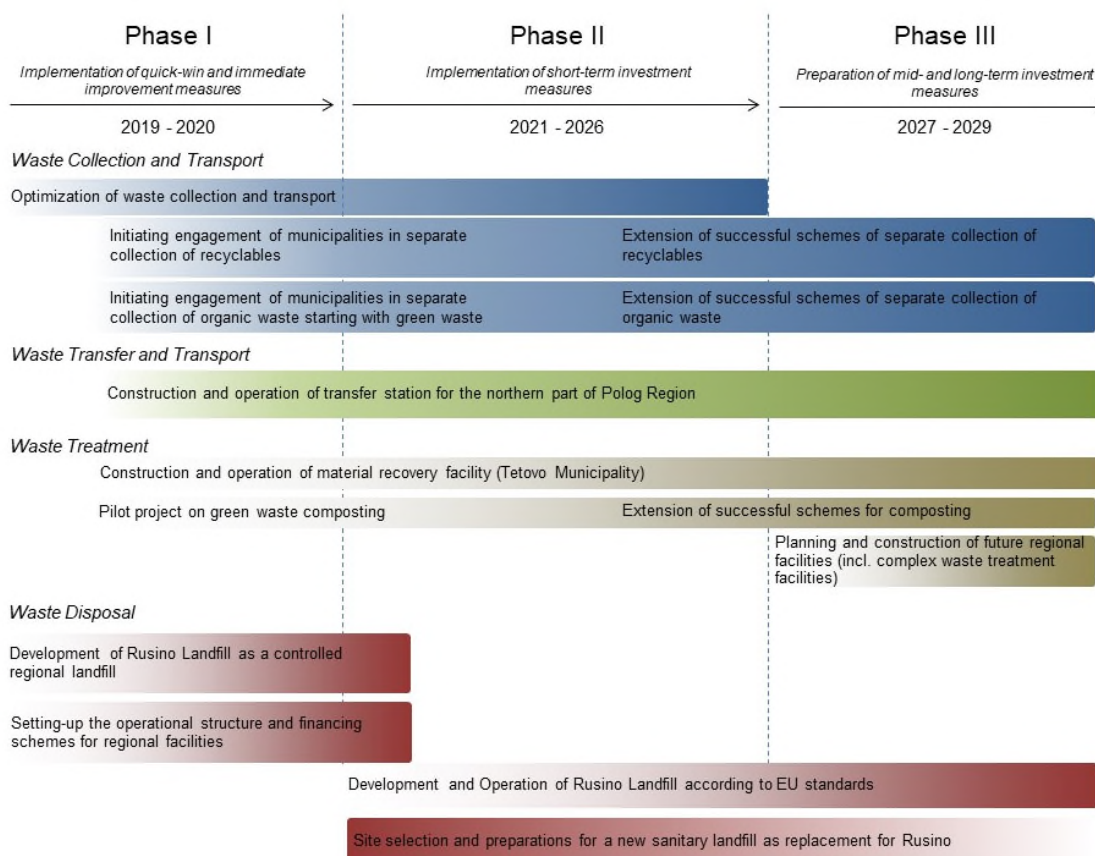
Phase III (2027 onward) will focus on the realisation of a regional waste treatment facility. In general, there are two possible technology options: either mechanical biological treatment (MBT), or incineration (with waste to energy). Frame conditions important for decision making might change within the next years, i.e. market situation for refuse derived fuel, technology costs, acceptance of technologies by population and decision makers etc. Therefore, the decision regarding the preferred technology should be taken at the beginning of Phase III based on the development of the various frame conditions.



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Furthermore, based on the results/ experiences of the previous phases, waste recovery activities (separate collection schemes, recycling, composting) will be further strengthened.

Main interventions during the three Phases are summarized in the following figure.



**Figure 19 Main interventions for improvement of waste management in Polog region during the three phases**

The cost implications of the various measures and phases are presented in chapter 3.5.

### 3.4 Institutional Aspects

Currently, all waste management services are provided by the individual municipalities respectively private companies on behalf of the municipalities.

Nevertheless, certain elements of an integrated waste management system require large scale solutions for cost effective operations. Because 7 out of 9 municipalities in Polog Region are too small for efficient operation of large scale facilities, cooperation among

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municipalities respectively a so-called “regionalisation” is required. Furthermore, establishment of regional waste management utilities is a requirement of the North Macedonian waste management regulations.

Whereas in the municipalities the institutional capacities for planning and implementation of waste management services need to be strengthened, the organisational structure for regional services need to be built up from scratch.

At the municipality level a special focus will be given to the development and implementation of instruments for planning and performance monitoring (see chapter 3.3.2.1).

*Regionalisation* of waste management services shall be implemented in a staged approach.

Phase I: A regional public waste management utility shall be established for operation of Rusino landfill, serving all municipalities of the Polog Region.

Phase II: The regional public utility shall be capacitated for operation of the sanitary landfill, to be realized during Phase II.

Phase III: Additional tasks may be transferred to the regional utility, once the company has been successfully established and has proven the efficiency and effectiveness of operations. In any case, the private sector can be involved in the different activities.

### **3.4.1 Development of Regional Public Waste Management Utility During Phase I (until end of 2019)**

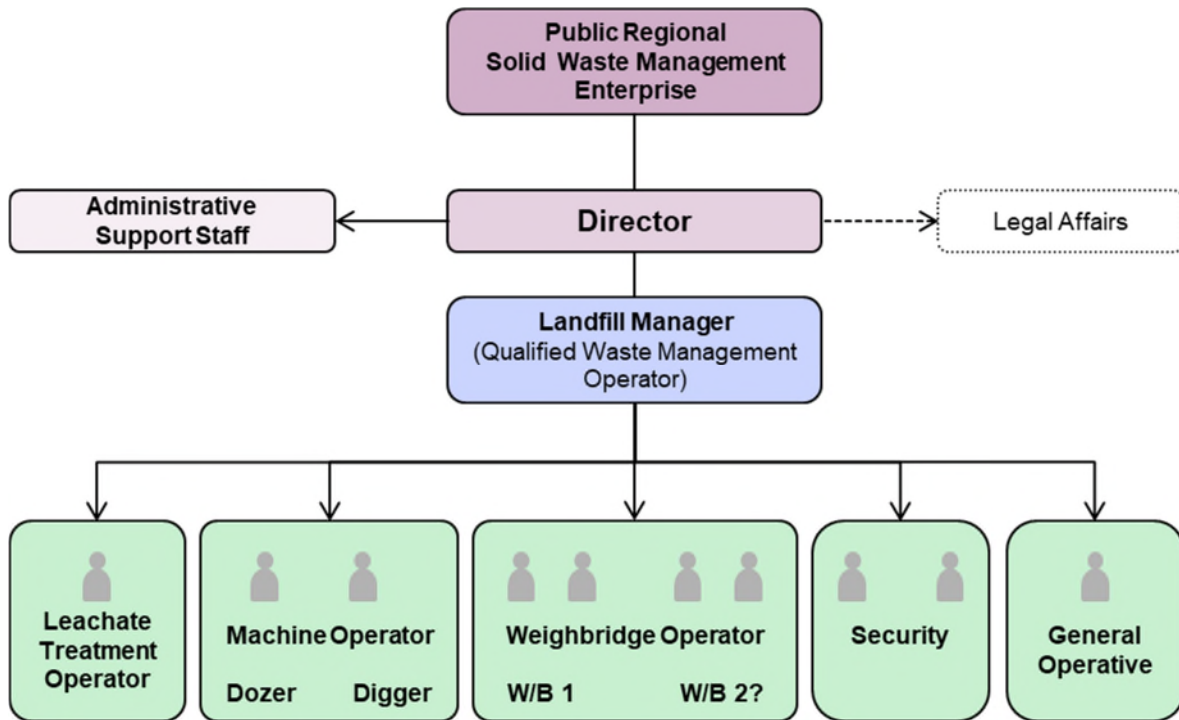
Rusino landfill, serving all municipalities of the Polog Region, shall be operated by the newly established regional public utility. Procedures for establishment of the regional public utility are ongoing. So far:

- a memorandum of cooperation for establishing a regional system for management of solid waste is signed by the 9 municipalities,
- the Inter-municipal Waste Management Board (IMWMB) is established, formed by the Mayors of 9 municipalities,
- RDC Polog acts as an Operational Office of the Board

Procedures for establishing the regional public waste management utility shall be finalized until end of 2019.

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For operation of Rusino landfill during Phase I, based on the functions, the following staffing is foreseen for the regional public waste management utility.



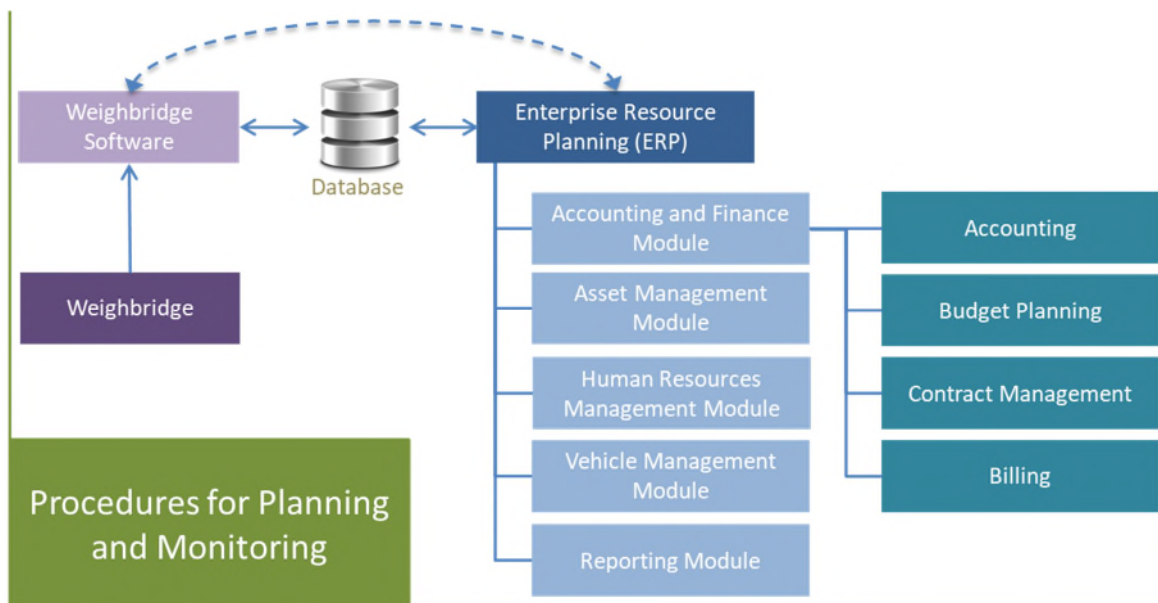
**Figure 20 Staffing for Regional Public Waste Management Utility during Phase I**

Job descriptions will be prepared for each position as a basis for the selection of staff.

The annual budget for operation is calculated with approximately 200,000 EUR (12.3 million MKD) for the first year of operation (2020).

From the startup of the regional utility an enterprise resource planning (ERP) system shall be established. The weighbridge software and the financial management software are core elements in this context. Therefore, the communication between the two software systems shall function smoothly through implementing this ERP system which supports the process of communicating relevant information about the physical and financial performance of the regional utility to various users, and it shall serve three purposes: planning, controlling and reporting. ERP will provide separate analytical accounts for the income from contracted services for waste transfer, haulage, and final disposal at the sanitary landfill, as well as separate analytical accounts for each of the business activities or administrative functions to which the expenses relate. The general setup of the EPR system is shown in the figure below.

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**Figure 21 Key elements of the monitoring and enterprise resource planning system**

**3.4.2 Capacitating the Regional Public Waste Management Utility for Management of Rusino Sanitary Landfill During Phase II (2021 - 2016)**

The organisational structure and staffing of the regional utility for operation of the Rusino Regional Sanitary Landfill will be elaborated in the Scope of the Feasibility Study, which will be prepared after approval of the RWMP.

According to the agreed functions of the regional company the staffing structure for operation of the sanitary landfill (and potential other facilities) will be developed and job descriptions will be prepared for all staff. The diagram below shows the possible functional structure, based on a preliminary functional analysis.

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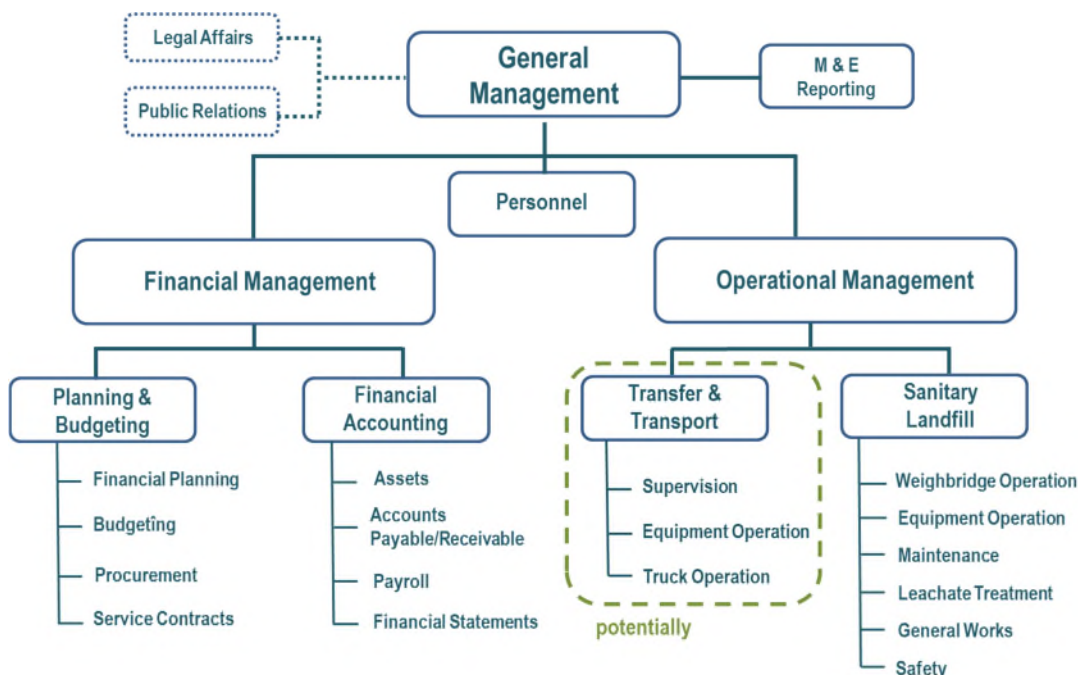


Figure 22 Functional structure of the regional public waste management utility during Phase II

### 3.5 Economy and Financing

Financing of improved waste management services will be a major challenge for implementing the RWMP. Even in case support from central government and/ or donors can be secured for investment funding, the municipalities have to ensure coverage of operational costs. In the following chapter the cost implications for implementation of the RWMP are presented, in terms of initial investment, operation and total costs. In order to allow comparison between the different phases, total costs are provided as unit cost, which refers to costs per tonne of collected waste.

#### 3.5.1 Funding Requirements

In the previous chapters estimated investment costs for the various components are presented. These initial investment costs are summarized in the following table.

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**Table 23 Summary of initial investments (without taxes and consultancy)**

SWM Component	Overall Initial Investment Requirements (Estimation)	
	EUR	MKD
Street Sweeping	480,000 EUR	29,520,000 MKD
Waste Collection	3,660,000 EUR	225,090,000 MKD
Transfer and Transport	3,500,000 EUR	215,250,000 MKD
Material Recovery		
Improvement of Rusino landfill	6,475,000 EUR	398,212,500 MKD
Rehabilitation of other dumpsites	5,200,000 EUR	319,800,000 MKD
Complex waste treatment	Investment cost and funding to be clarified during Phase III	
<b>Grand Total (Phase I and Phase II)</b>	<b>19,315,000 EUR</b>	<b>1,187,872,500 MKD</b>

Without complex waste treatment (which is scheduled for a later stage) the total initial investment is summing up to almost 20 million EUR (1,188 million MKD). Most likely, it will not be possible to secure funding for the full amount, required. Therefore, prioritization as well as the identification of less costly alternative solutions might be required.

More detailed cost calculations as well as possibilities to reduce the costs of different components will be elaborated in the scope of feasibility study.

### 3.5.2 Costs and Cost Recovery of SWM services

Costs for the three planning phases have been roughly estimated using reference values. The costs are calculated as system costs (including all elements of the SWM services) for the entire region, not differentiating between different municipalities and services provided by the regional utility. A detailed cost calculation will be conducted during the feasibility study for this RWMP.

The cost estimation is based on the planned technologies and methods as well as the forecasted amount of collected waste as presented in chapter 3.1.2. The waste amount of the last year of each phase is taken as reference (Phase I: 2020; Phase II: 2026; Phase III: 2029). Investment costs are included for all SWM components except for waste

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disposal. Administration costs are estimated to be 7% and costs for public information and awareness raising are estimated with 3% of the total costs for SWM services. The following table presents the estimated costs of the three phases<sup>21</sup>.

**Table 24 Estimated annual costs [EUR/a]**

	Phase I	Phase II	Phase III
	Basic SWM Services, incl. Pilot Projects for Recycling and Composting	Regional SWM System (Sanitary Landfill)	Sanitary Landfill with complex waste treatment facility
Street Cleaning	965,000	1,163,000	1,244,000
Waste Collection (Mixed Waste)	1,952,000	2,171,000	2,219,000
Separate Collection	76,000	358,000	524,000
Waste Transfer and Transport	0	354,000	362,000
Material Recovery Facility (MRF)	0	438,000	448,000
Composting	21,000	116,000	173,000
Complex Waste Treatment	0	0	6,184,000
Waste Disposal (operational costs only)	196,000	1,017,000	515,000
Landfill Rehabilitation <sup>22</sup>	19,000	18,000	17,000
Administrative	226,000	394,000	818,000
Public Awareness Raising	97,000	169,000	351,000
<b>Total Annual Cost (EUR/a)</b>	<b>3,553,000</b>	<b>6,198,000</b>	<b>12,855,000</b>
<b>Total Annual Cost (MKD/a)</b>	<b>218,509,500</b>	<b>381,177,000</b>	<b>790,582,500</b>

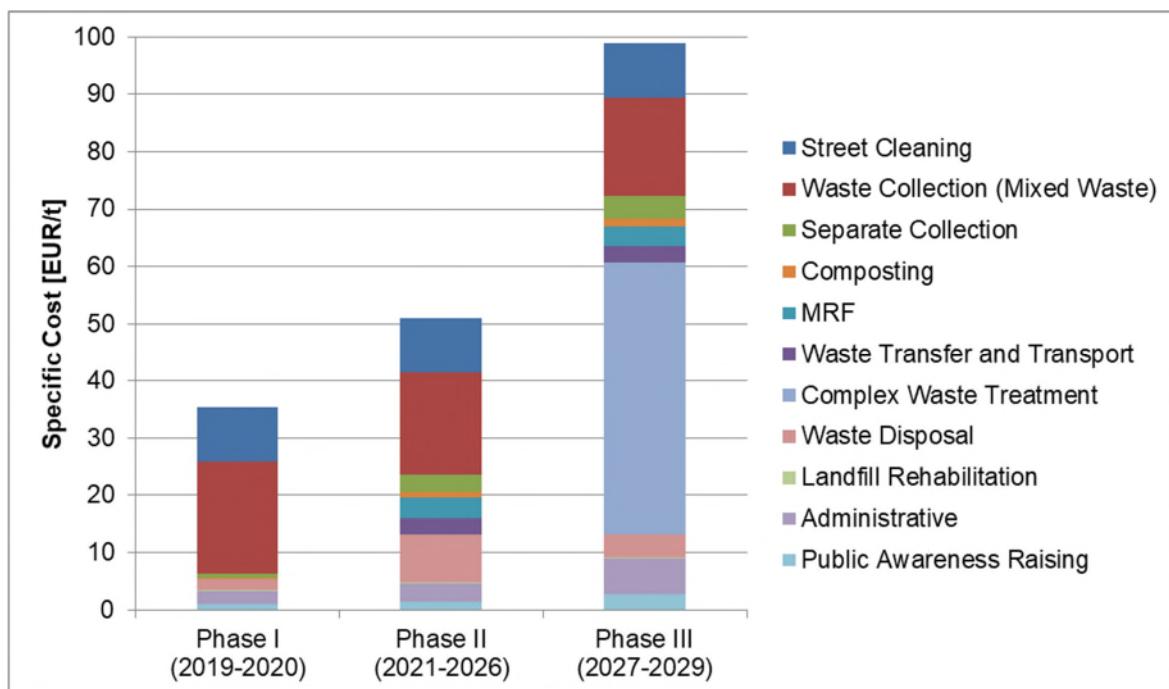
The service costs are expected to increase from 3.5 million EUR (219 million MKD) per year in Phase I, to 6.2 million EUR (381 million MKD) per year in Phase II and 12.9 million EUR (791 million MKD) per year in Phase III. In order to compare the annual specific costs of the three phases, these costs are divided by the estimated collected amount of waste for the corresponding year. The estimated specific costs are shown in the diagram below.

<sup>21</sup> The estimated costs already include deduction through the revenues generated from selling of recyclables.

<sup>22</sup> Annual costs for landfill rehabilitation assuming that rehabilitation or non-standard landfills other than Rusino landfill will be conducted gradually throughout the RWMP implementation period.

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**Figure 23 Specific costs for the three implementation phases**

It is evident, that the specific costs in Phase II (51 EUR/t – 3,137 MKD/t) are expected to be higher than in Phase I (35 EUR/t – 2,177 MKD/t). Main reason for the cost increase is the change of disposal from controlled landfill in Phase I to sanitary landfill in Phase II. Much higher costs are estimated for Phase III (99 EUR/t – 6,082 MKD/t) due to the operation of a complex waste treatment facility. In the following table these costs are presented again in detail.



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**Table 25 Specific costs for the three implementation phases [EUR/t]**

	Phase I (2019-2020)	Phase II (2021-2026)	Phase III (2027-2029)
	Basic SWM Services, incl. Pilot Projects for Recycling and Composting	Regional SWM System (Sanitary Landfill)	Sanitary Landfill with complex waste treatment facility
Street Cleaning	9.6	9.6	9.6
Waste Collection (Mixed Waste)	19.5	17.9	17.1
Separate Collection	0.8	2.9	4.0
Waste Transfer and Transport		2.9	2.8
MRF		3.6	3.4
Composting	0.2	1.0	1.3
Complex Waste Treatment			47.6
Waste Disposal	2.0	8.4	4.0
Landfill Rehabilitation	0.2	0.2	0.1
Administrative	2.3	3.2	6.3
Public Awareness Raising	1.0	1.4	2.7
<b>Total Specific Cost (EUR/t)</b>	<b>35</b>	<b>51</b>	<b>98</b>
<b>Total Specific Cost (MKD/t)</b>	<b>2,177</b>	<b>3,137</b>	<b>6,082</b>

For assessment of the impact of this cost development on the tariffs for households, it is assumed that financing of the future ISWM system will be fully covered through fees. In addition, it is assumed that 60% of the costs will be covered by fees from households and 40% by fees from business entities (and institutions). Based on these assumptions, the following cost covering fees for the three implementation phases have been calculated for fee collection rates of 90%, 70% and 40%.

**Table 26 Calculation of cost covering fees for households for the three phases**

Fee collection rate	Phase I		Phase II		Phase III	
	EUR/hh/ month	MKD/hh/ month	EUR/hh/ month	MKD/hh/ month	EUR/hh/ month	MKD/hh/ month
90%	2.67	164	4.57	281	9.35	575
70%	3.43	211	5.87	361	12.03	740
40%	6.02	370	10.26	631	21.06	1,295

As calculated in chapter 2.9.1 the limit of affordable SWM fee is estimated to be 445 MKD/household/month in average. In this regard, the calculated cost covering fees for the Phase I are within the affordability limit for all scenarios of fee collection rate. The ISWM system in Phase II is estimated to be affordable only in case of fee collection rate of 70% and 90%. Conversely, the ISWM system in Phase III, based on the current household income, would not be affordable. Therefore, during Phase III for identification of

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the preferred treatment option the affordability needs to be reassessed based on the actual income situation at that date.

The fees in the table above are average fees calculated considering only the total number of households in the region. In order to determine the fees for each municipality and settlement structure; urban, semi-urban, and rural areas, the costs and fees have to be calculated considering the local conditions and specific waste generation rates in each municipality.

### **3.6 Public Awareness Raising Measures**

Raising public awareness on waste management is an obligatory content of the municipal waste management services. It will be the duty of both the inter-municipal organisation for waste management (the Centre as well as the envisaged Regional Waste Management Company of Polog Planning Region) and the local level (the municipalities) to carry out PR and public awareness as well as waste avoidance activities, campaigns and programmes. The distribution will be in accordance with the agreed responsibilities in waste management:

- The regional company will be responsible for PR measures with regard to regional solid waste management issues, such as the new regional sanitary landfill and related aspects.
- The municipalities will be responsible for PR measures with regard to local solid waste management issues, namely waste collection and street sweeping as well as fee collection and general PR and public awareness measures that aim at a change of people's attitude and habits with regard to SWM.

#### **3.6.1 Public Relation and Information**

**Public relation and information** are an important aspect of an ISWM to enable the public to have access to relevant information and the understanding of the current issues and processes related to the future ISWM system in order make informed choices and actions. Public relation and information measures include:

- Development of individual brands and corporate identities  
Creation of public images, logos, typographies and colour palettes
- Creation of websites  
For a successful web presence it has to be secured that the websites are clearly designed and continuously updated, thus presenting all relevant information, which is also published with other media. Furthermore, it has to be known to the public that the web presences exist. For this purpose, respective links to the websites

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shall be shown in all other published information materials, such as advertisements and articles in local media.

- Publication of advertisements and articles in local media
- Creation of accounts and regular publication of activities at social media platforms  
Since social media nowadays play an important role in delivering information as well as a platform for interaction with the public especially for, but not limited to, the young generation, the company should also create and manage accounts in social media platforms. Symbols representing the social media accounts of the company should be visible in other information materials.

The future regional waste management company, responsible for operation of the regional sanitary landfill shall be visible and accessible for the public. For this purpose, it is important to assign the responsibility to build and maintain relevant infrastructure and measures for public relation and information to a specific unit in the organizational structure. Therefore, the regional utility shall:

- Assign responsibilities for public relations, awareness and information and provide training for the respective staff
- Develop company brands and corporate identities
- Create communication portals with the public (hotline, website, social media, etc.)
- Publish about the company activities regularly

Furthermore, at the local level, the municipalities shall provide the inhabitants access to submit complaints related to the SWM services. For this purpose, municipalities shall:

- Determine a corresponding unit for public relation and information to manage public relation activities with regard to waste management services
- Establish communication portal with the public (website, social media, hotline for complaints), e.g. attached to the existing portals of the municipalities
- Define this responsibility in concessionaire contracts in case of service provision by concessionaires

### **3.6.2 Public Awareness and Education Measures**

Ensuring the engagement and support of the public is a prerequisite to reach the objectives and results envisaged with the new ISWM system. In order to achieve this, **public awareness raising and education measures** are fundamental for promoting behaviour change and engaging the public. Creating public awareness of the disadvantages and harms of the existing system as well as the advantages and benefits offered by the new ISWM system will positively affect public participation and willingness

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to contribute towards its implementation, either through behaviour changes or financially. If people become aware of the negative impacts of waste, they will also become more willing to contribute toward waste avoidance.

There are several ways of raising public awareness on waste issues and providing information on how to deal with waste, including tailored and focussed information, awareness campaigns and delivery of educational courses. Development and implementation of the following measures should be considered:

- Creation and implementation of information campaigns for specific SWM related issues (e.g. waste avoidance, clean keeping of public streets and spaces) and for acceptance of public complaints
- Publishing of information booklets, flyers and posters (e.g. via bulk mailings or electronic newsletters)
- Organisation of events (e.g. opening ceremonies for new facilities, clean-up campaigns, open house presentations or public participation meetings) – either for the general public but also for specific multipliers, such as NGOs, community leaders or teachers
- Conduct lectures on waste issues for pupils and students
- Conduct door-stepping campaigns to inform the public on the legal framework and the local activities
- Public speeches of mayors and council members on municipal waste management issues

In order to publicly place the topic SWM and especially the implementation of the new ISWM system, the publication of advertisements and articles in local media are another reasonable instrument. Frequent articles about SWM in general and especially explaining the implementation and advantages of the new ISWM can help to arouse public interest, understanding and support as well as satisfy public thirst for knowledge. The information content could focus on

- How to reduce waste
- What can be reused or recycled, how to separate waste
- How to use municipal waste services
- Information on waste disposal especially on ways for separate collection
- Information on waste collection dates and contact information for services and complaints
- Waste events and outreach timetable



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**Public participation** in the decision-making process on waste is crucial for facilitating introduction of the ISWM system. In order to avoid public opposition (e.g. against the implementation of a new sanitary landfill or the rise of waste management tariffs), it is recommended that the citizens and businesses, and other relevant stakeholders be included early in the decision-making process and that issues are presented, clarified and discussed openly and properly. Public and timely participation of all relevant stakeholders, need to be an integral part of process for implementation of ISWM system.

In addition to the participation of the public and all relevant stakeholders in planning and approval procedures for waste facilities and in adoption of new regulations with regard to municipal SWM (e. g. tariffs), it is also important to show the public that they are playing an active and important part in successful implementation of new envisaged ISWM system and that their activities and behaviour can significantly contribute to the improvement of the current situation. The following measures are recommended:

- conduct workshops with local environmental and other NGOs to encourage their active involvement in municipal SWM, e.g. with regard to waste minimisation, recycling or composting
- organise workshops in each settlement area of the region to encourage involvement in local SWM activities
- make provisions to allow people to report illegal waste dumping, unclean areas and un-emptied containers
- conduct regularly surveys (e.g. via questionnaire) on service quality, exploring the satisfaction of households and businesses with SWM activities

During the implementation period of the RWMP, the regional utility shall:

- Organize public events to inform public on the activities implemented by the regional utility, including visitation of schools to the regional landfill
- Publish advertisements on the advantage of ISWM and positive impact produced by the company
- Implement awareness raising campaigns

The municipalities shall:

- Create banners, posters or advertisements on good practice of handling with waste
- Cooperate with educational entities and environmental NGOs to educate the inhabitants on good habits of waste disposal and separate collection

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- Organize workshops to support the implementation of pilot projects on recycling and composting

### 3.6.3 Key Activities and Timelines for Public Awareness and Communication and Participation

In the following table the key activities and timelines regarding public awareness, communication and participation are summarized.

Measures	2019	2020	2021	2022	2023	2024	2025	2026
<b>Regional Centre/ Utility</b>								
Implementation of Public Awareness and Environmental Education program as part of the quick-win measures.								
Participation of local stakeholders in regional waste management planning through the procedures of the Strategic Environmental Assessment (SEA)								
Assigning responsibilities for PA and communication about waste management in the regional public utilities.								
Development of brand and corporate identify of regional waste management utility								
Creation of website and social media platforms for regional waste management utility								
Prepare and implement annual action plan for PA and Communication								
<b>Municipalities</b>								
Nominate and publish contact person for complaints and public information								
Assign responsibilities for public awareness and communication								
Creation and implementation of campaign for specific messages/ events			ongoing activity					
Establish communication for waste related issues through various media (social media, municipality website, local media)			ongoing activity					
Establish alliances with NGOs/ environmental groups for planning of SWM			ongoing activity					

**Figure 24 Key activities and timelines for public awareness, communication and participation**



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### 3.7 Management of Other Waste Streams

#### 3.7.1 Construction and Demolition Waste (CDW)

By using the same figures as in the Draft NWMP 2018-2024 (0.63-1.42 tonnes of CDW/cap/year) and the mid-year population figures estimated by MAKStat for 2017, **CDW amount in Polog Region** can be estimated to range between 202,355 - 456,103 tonnes/year or **301,927 tonnes per year in average**. The increasing number of construction activities during the last five years indicates that the amount of CDW, in spite of limited economic growth, has substantially increased. On the other hand, indiscriminate dumping of construction waste is a major concern in most of the municipalities in the Polog Region. CDW is dumped at various locations, including water bodies, causing negative impacts to the environment and local population. Furthermore, dumping of CDW in riverbeds increases the flooding risk, for example by blocking the runoff of water courses. Therefore, improvement of CDW management in the region in the future is necessary.

Whereas the collection and transportation of CDW is within the responsibility of the waste producers, each municipality should identify and maintain a location for the treatment and disposal of inert waste. As long-distance transportation of this waste stream is not economically viable, solutions for disposal should be developed on local level. For improving the situation and CDW disposal, municipalities shall:

- Determine the location for an inert waste landfill in accordance with the regulations. Municipalities may consider the possibility to have a joint inert waste landfill with neighbouring municipalities;
- Ensure the establishment and operation of the landfill for treatment and disposal of inert waste. A landfill for inert waste may be established by the municipalities by establishing a public enterprise for management of a landfill for inert waste or also by a legal person;
- Inform the constructors of the existence and location of the designated inert waste landfill site;
- Monitor the enforcement of existing regulations in regard to the separate collection and transportation of CDW within the responsibility of the waste producer to the designated site as well as treatment and disposal at the landfill;
- Monitor and document the collected quantity of inert waste.

Furthermore, the construction companies shall:

- Manage the collection and transportation of the generated waste to the designated site;

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- Provide the required data and information in surveys and questionnaires in order to support data collection and assessment of the CDW management situation as well as the future policy and infrastructure development;
- Pay for the use of the inert waste landfill.

### **3.7.2 Commercial and Industrial Waste**

Commercial and industrial waste similar in nature to household waste is typically collected through the municipal waste collection services. However, according to the North Macedonian regulations, legal entities or individuals who produce more than 150 tonnes of non-hazardous waste or 200 kg of hazardous waste per year shall:

- Prepare and implement their own waste management programmes for a period of three years;
- Agree on collection contract with an independent contractor within the private sector;
- Record the generated waste amount according to the type and report the recorded data to the relevant institution

### **3.7.3 Sewage Sludge**

For the moment there is no sludge generation in the project area. There is a plan to construct a waste water treatment plant in Tetovo which has not yet been realized. Future technology has to be acknowledged when waste water treatment plants are implemented.

There are several options to make use or dispose of sewage sludge:

- Land spreading on agricultural land; use for land reclamation
- Composting, mechanical biological treatment (MBT)
- Mono-incineration, co-processing, combined waste incineration
- Gasification through pyrolysis
- Wet oxidation
- Landfilling.

Each of the processes needs preparatory steps like concentration, dewatering and drying. Some of them take place at the sewage plant, at intermediate locations or at the place of final utilisation/ disposal. The next figure gives an overview of the various processes.



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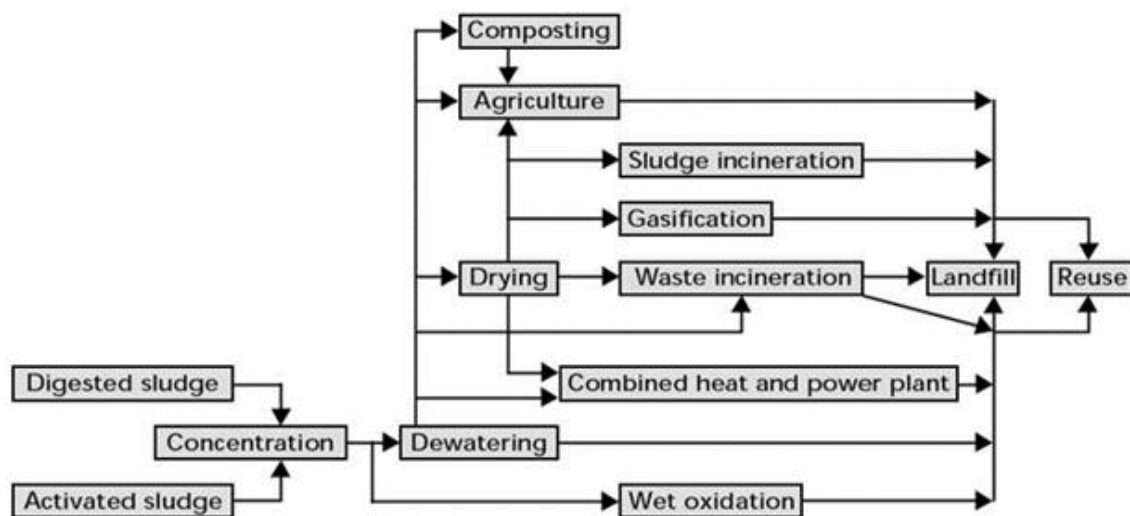


Figure 25 Processes for sewage sludge utilisation or disposal

### 3.7.4 Hospital and Hazardous Waste

Hazardous wastes pose a greater risk to the environment and human health than non-hazardous wastes and come from a wide range of sources. Properties of waste classified as hazardous are stated in Annex III of Directive 2008/98/EC and further specified in the EU List of Waste<sup>23</sup>. Hazardous waste shall be managed separately from other types of waste. Key hazardous waste streams generated in North Macedonia are:

- PCBs
- Waste oils
- Hazardous agricultural waste
- WEEE & Batteries (subject to EPR, see chapter 3.7.5)
- End-of-Life Vehicles (EPR scheme is in development)
- Household Hazardous Waste
- Clinical and healthcare waste
- Asbestos

Hazardous waste can also be sub-classified according to the origin, namely into hazardous waste of municipal origin, which is part of municipal waste management, and

<sup>23</sup> EU List of Waste established by the Decision 2000/532/EC, as last amended by Commission Decision 2014/955/EU



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industrial hazardous waste, of which the management is the own responsibility of the producing legal entities.

Producer of hospital and hazardous waste shall prepare their own waste management programs which contain measures for selection, transport and disposal of the produced waste as well as record and report the waste data to the Regional Waste Management Board as well as the competent national authority.

### **3.7.4.1 Industrial Hazardous Waste**

Legal entities or individuals who produce more than 200 kg of hazardous waste per year shall prepare and implement their own waste management programs for a period of three years. Hazardous waste generators may establish their own on-site landfills according to the environmental regulations. The established landfills are not allowed to receive waste from other waste generators.

Currently, data of hazardous waste generation are not recorded systematically. Existing data are rather based on estimates and surveys. Furthermore, the majority of industrial hazardous waste is disposed together with non-hazardous waste at municipal landfills. In order to ensure a sustainable industrial hazardous waste management in the region, the industrial hazardous waste producers shall include in their waste management programmes:

- Data on existing situation (waste data, organizational structure, current practices on hazardous waste management)
- Measures to improve data collection of hazardous waste. Data shall be collected systematically and separately from data of other types of waste and include information on types, quantities and sources of waste generation
- Measures for waste prevention by exploring opportunities to improve production techniques considering the best available techniques outlined in IED BREF notes
- Measures for management of generated hazardous waste (selection, treatment, processing, storage, removal, etc.)
- Reporting procedure
- Other data and measures required by Law on Waste Management and other relevant regulations



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### **3.7.4.2 Hazardous Waste of Municipal Origin**

Hazardous waste of municipal origin includes<sup>24</sup>:

- Asbestos panels
- Hazardous WEEE (incl. TVs, computer monitors, refrigeration equipment and fluorescent tubes)
- Motoring products (incl. waste oil and car batteries)
- Certain paints, household and garden chemicals.

Measures and activities to separate hazardous components from other waste in municipal waste collection shall be included in the municipal waste management programme. For the management of hazardous waste types which are part of EPR (WEEE, batteries and accumulators) municipalities should cooperate with the companies licensed for collective schemes. More on the management of hazardous waste of municipal origin is explained in chapter 3.7.5.

### **3.7.4.3 Healthcare Waste**

Healthcare wastes are generated in medical and health-care institutions as well in laboratories and research centres. Medical waste is separated at most of the healthcare institutions in the country. Healthcare waste is then incinerated in the incinerator for medical waste at the Drisla landfill site<sup>25</sup> or in a newly constructed incinerator operated by a private company<sup>26</sup>. Medical waste amount in the Polog Region can be estimated to be about 18,900 kg/year.

Health care facilities which generate more than 50 kg/year of hazardous waste are required to prepare Healthcare Waste Plans.

### **3.7.5 Special Waste Streams under Extended Producer Responsibility (EPR)**

Extended Producer Responsibility (EPR) in waste management is a strategy to link the responsibility especially for take-back, recycling and final disposal to the producers of the respective products. In this regard EPR systems generally provide additional funding for certain waste streams as well as organisational structures. Currently, the following legal

<sup>24</sup> Draft (2018) NWMP 2018-2024, p. 54

<sup>25</sup> REC Macedonia (2008): Pre-feasibility Assessment of Options for Establishment of an Integrated Solid Waste Management System in the Polog Region, Macedonia – Final Report

<sup>26</sup> Information by MoEPP.

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entities or collective schemes for the following waste streams have been established in the country<sup>27</sup>:

- Packaging (collective schemes): PAKOMAK, EURO EKOPAK, ECO PACKAGING, ALPAK EKO DOO
- WEEE (collective schemes): NULA OTPAD, EKON ELEKTRON, ELKOLEKT, EES
- Batteries and accumulators (licensed individual scheme) TAB MAK
- Batteries and accumulators (collective scheme OBA RECYCLING, NULA OTPAD, ELKOLEKT)

There are plans to extend the EPR scheme to include also End-of-Life Vehicles, tyres, textiles and oils & lubricants.

Municipal solid waste contains also waste streams managed under the EPR schemes. In the region, separate collection of these waste streams in cooperation with the companies licensed for collective schemes is still in the early phase, which is reported to take place only in two municipalities. In Mavrovo & Rostusha Municipality, two ECO warehouses are provided by ELKOLEKT for collection of WEEE, accumulators and batteries. The inhabitants bring their WEEE to these facilities by themselves. In addition, the municipal service also picks WEEE which is left next to the municipal waste containers and brings them to these facilities. In Gostivar Municipality, PAKOMAK also plans to separately collect glass on small scale with depot containers and also plastic, paper and cardboard. Two containers for collection of WEEE will be placed in the city centre.

Cooperation between municipalities and companies licensed for collective schemes should be strengthened in the future. Furthermore, in accordance to the waste hierarchy, prevention and reuse of waste shall have the priority over recycling, treatment and disposal. For this purpose, the municipalities shall:

- Implement measures to prevent and reduce waste generation, such as establishment of repair-hub and sharing community programs for the use of electrical and electronic appliances
- Come to an agreement with the companies licensed for collective schemes on the role and responsibility to establish the collection system of the packaging waste,
- Record data on the collected materials
- Inform the public about the new collection scheme and location of collection infrastructure for the relevant waste streams

<sup>27</sup> Draft (2018) NWMP 2018-2024

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- Organize awareness raising campaign to motivate the inhabitants to participate actively in the new collection scheme

The cooperation shall also be extended to the collection of other types of waste along with the extension of EPR scheme in Macedonia to include End-of-Life Vehicles, tyres, textiles and oils & lubricants.

### **3.8 Monitoring, Reporting and Revision of the Plan**

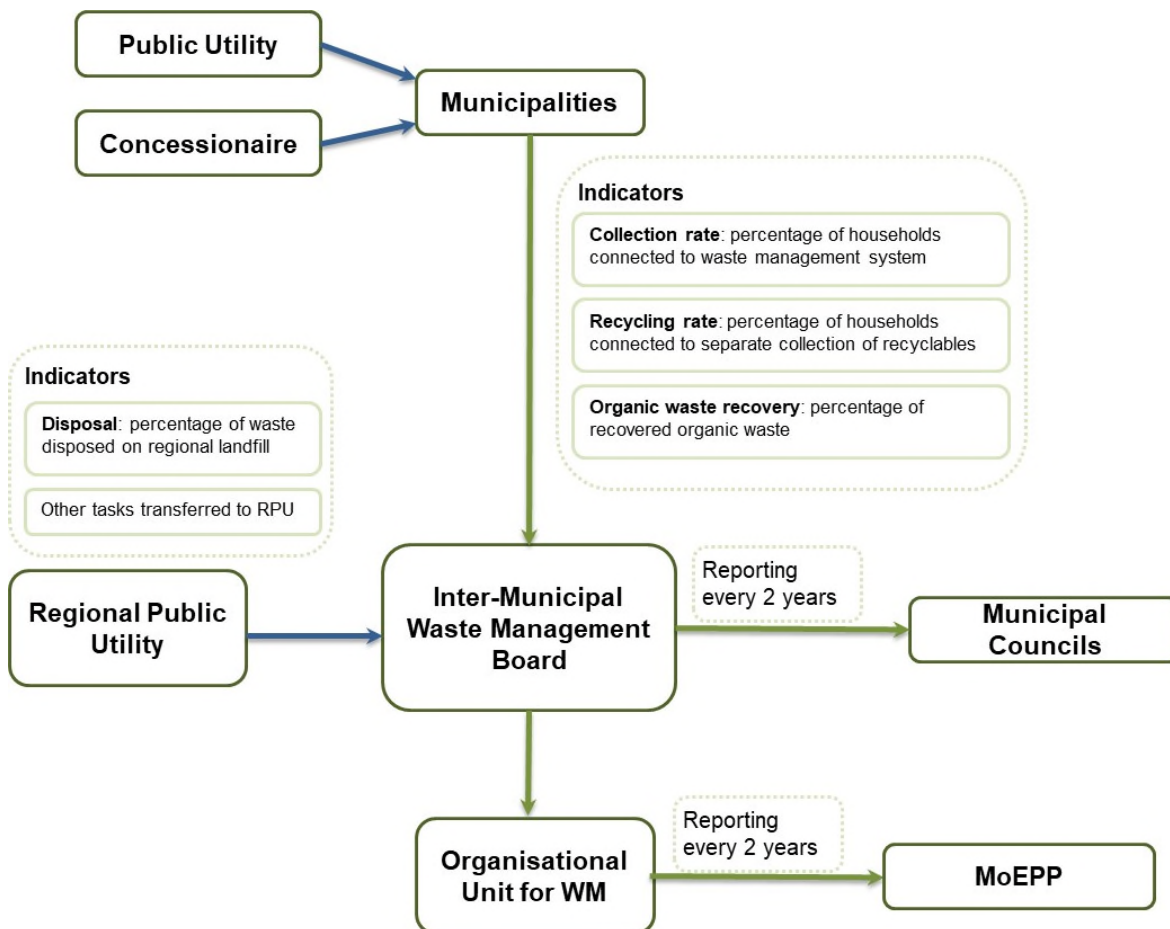
A new RWMP is foreseen to be prepared as a minimum every ten years. The regional waste management board may put forward proposals for amendments of the RWMP every two years.

Furthermore, the RWMP shall include indicators for monitoring the implementation of the plan. The regional waste management board shall, at every second year as of the commencement of the implementation of the regional plan, submit a report on the plan implementation to the municipal councils.

The performance of the RWMP shall be monitored based on the targets of the plan (see chapter 3.2) which are based on the EU directives for waste. Thereby, the progress and the achieved results can be measured, performance-based decisions can be made and the success of the plan can be defined and evaluated. The indicators cover compliance with relevant legislation, waste generation, and recycling and waste treatment targets.

In the figure below the system for monitoring and reporting is presented. This system includes various actors, according to the institutional setup for the provision of waste management services.

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**Figure 26 System for monitoring of the RWMP**

As shown in the figure above, the following indicators will be used for monitoring:

- Collection rate:** percentage of households connected to the waste management system
- Recycling rate:** percentage of households connected to systems for separate collection of recyclables
- Organic waste recovery:** percentage of recovered organic waste
- Disposal:** percentage of collected waste disposed on regional landfill

Other indicators to be used are directly linked to the targets listed in chapter 3.2 and include the percentage of the population paying for waste management services and the level of awareness expressed as the percentage of the population participating in source separation of waste.

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### 4 Action Plan

Activities, responsibilities and timelines, as elaborated in the previous chapters are summarized in the following action plan. Key responsibilities are addressed for all activities.

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**Table 27 Action plan, summarizing main activities, responsibilities and timelines for implementation of the RWMP**  
(M – Municipalities, R – Centre/ Regional Utility, EPR – Extended Producer Responsibility Scheme, W – Waste Producers)

Nr.	Measures	Main Responsibility	Phase I				Phase II								Phase III												
			2019		2020		2021		2022		2023		2024		2025		2026		2027		2028		2029				
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
<b>1 Waste Collection (including separate collection)</b>																											
1,1	Improvement of waste collection services, incl. extension of service area in rural areas	M																									
a)	Development of performance monitoring system	M																									
b)	Procurement of equipment for waste collection and street sweeping	M/P																									
b1)	Procurement of waste collection containers through quick-win measures	M																									
1,2	Separate collection of recyclables and organic waste	EPR/M																									
a)	Pilot projects for separate collection	EPR/M																									
a1)	Pilot projects for separate collection in cooperation with informal sector through quick-win measures	EPR/M																									
a2)	Pilot projects for separate collection and composting of green waste	M																									
b)	Extension of pilot projects for separate collection	EPR/M																									
<b>2 Waste Transportation and Transfer</b>																											
2,1	Clarification of the joint use of Tetovo transfer station	R/M																									
2,2	Construction of Tetovo transfer station and or new transfer station, if required	Tetovo																									
2,3	Construction of alternative transfer station, if required	to be clarified																									
<b>3 Waste Treatment</b>																											
3,1	Implementation of pilot projects on green waste composting and home composting	M																									
3,2	Extension of pilot projects for composting	M																									
3,3	Implementation of material recovery facilities	Tetovo																									
3,4	Implementation of a complex waste treatment facility	R/M																									
a)	Planning of complex waste treatment	R/M																									
b)	Construction of complex waste treatment facility	R/M																									
<b>4 Waste Disposal</b>																											
4,1	Implementation of immediate improvement measure to convert Rusino dumpsite into a controlled regional landfill	R																									
4,2	Setting-up the operational structure and financing schemes for regional facilities	R																									
4,3	Development of Rusino Landfill as a sanitary landfill according to EU directives	R																									
4,4	Site selection and preparations for a new sanitary landfill as replacement for Rusino Landfill	R/M																									
a)	Site selection for replacement of Rusino	R/M																									
b)	Preparations for the realisation of new sanitary landfill (incl. design, tender documents, mobilisation of funding etc.)	R/M																									
4,5	Rehabilitation of dumpsites	M																									
a)	Mapping, risk assessment and categorization	M																									
b)	Preparation of rehabilitation concepts and cost estimations	M																									
c)	Identification of funding, detailed design, procurement, implementation of rehabilitation works	M																									



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**Table 28 Action plan - continued**

Nr.	Measures	Main Responsibility	Phase I				Phase II								Phase III																															
			2019				2020				2021				2022				2023				2024				2025				2026				2027				2028				2029			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
<b>5 Institutional Development</b>																																														
5.1	Establishment of a regional public waste management utility	R/M																																												
5.2	Capacitating the regional public utility for operation of regional landfill	R/M																																												
5.3	Transfer of additional tasks to the regional utility	R/M																																												
<b>6 Public Awareness, Public Participation and Waste Avoidance</b>																																														
6.1	Implementation of Public Awareness Campaign as part of the Quick-Win Measures	R/M																																												
6.2	Participation of local stakeholders in the regional waste management planning through SEA	R/M																																												
6.3	Assigning responsibilities for public awareness and communication in the regional utility	R																																												
6.4	Development of brand and corporate identity of regional utility	R																																												
6.5	Creation of website and social media platform for regional utility	R																																												
6.6	Prepare and implement annual public awareness and communication action plan	R																																												
<b>7 Management of Construction Waste</b>																																														
7.1	Determination of location for and establishment of inert waste landfills	M																																												
7.2	Establish operation for inert waste landfills	M																																												
7.3	Inform the constructors of the existence and location of the inert waste landfills	M																																												
7.4	Monitor the enforcement of existing regulations in regard to the separate collection, transportation and disposal of CDW	M																																												
<b>8 Management of Other Waste Streams</b>																																														
8.1	Preparation of waste management programs by waste producers	W																																												
8.2	Annual reporting of waste data	W																																												
8.3	Cooperation between EPR-collective schemes with municipalities	W/M																																												
<b>9 Monitoring, Reporting and Revision</b>																																														
9.1	Monitoring of the performance of the implementation of RWMP	R/M																																												
9.2	Reporting on plan implementation in every 2nd year of the commencement	R																																												
9.3	Revision of RWMP for the next implementation period	R																																												