

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

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

– Final Feasibility Study Report –



19 June 2020



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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 North Macedonia State Statistical Office
MBT	Mechanical Biological Treatment
MKD	Macedonian Denar
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

Introduction

Chap
1

The Integrated Waste Management Project for Polog Region (the Project) provides technical assistance to develop the framework conditions for an Integrated Waste Management (IWM) system in the region.

In previous project steps of this Project a Regional Waste Management Plan for the Polog Region (RWMP) has been prepared, outlining how the Municipalities in the Polog Region intend to improve the management of solid waste generated in the region. The planning horizon of the RWMP is 10 years (2019 – 2029). It is intended that in subsequent projects the Polog Region is supported in implementing further short- and medium-term measures as defined in the RWMP and to prepare for a future advanced waste management system in the long-term.

In this Feasibility Study, the scope for such subsequent projects is presented and the feasibility is assessed. The planning horizon of the Feasibility Study goes beyond the planning horizon of the RWMP and covers the years 2023 – 2042.

General Project Description – Project Objectives, Relevance and Effects

Chap
2.1

The overall Project objective is to contribute to improved quality, effectiveness and sustainability of waste management services in the Polog Region and to reduce negative environmental and health impacts. It addresses immediate short remediation needs and lays the basis for future infrastructure investments.

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, in the RWMP the highest priority is given to improvement of waste collection and safe disposal, followed by improvement of recycling and composting and only in a later stage the realisation of advanced waste management options, such as for example complex waste treatment facilities.

The planning horizon of this Feasibility Study goes beyond the implementation phases of the RWMP, as it is defined for the time period 2023 – 2042.

General Project Description – Summary of Planning Criteria

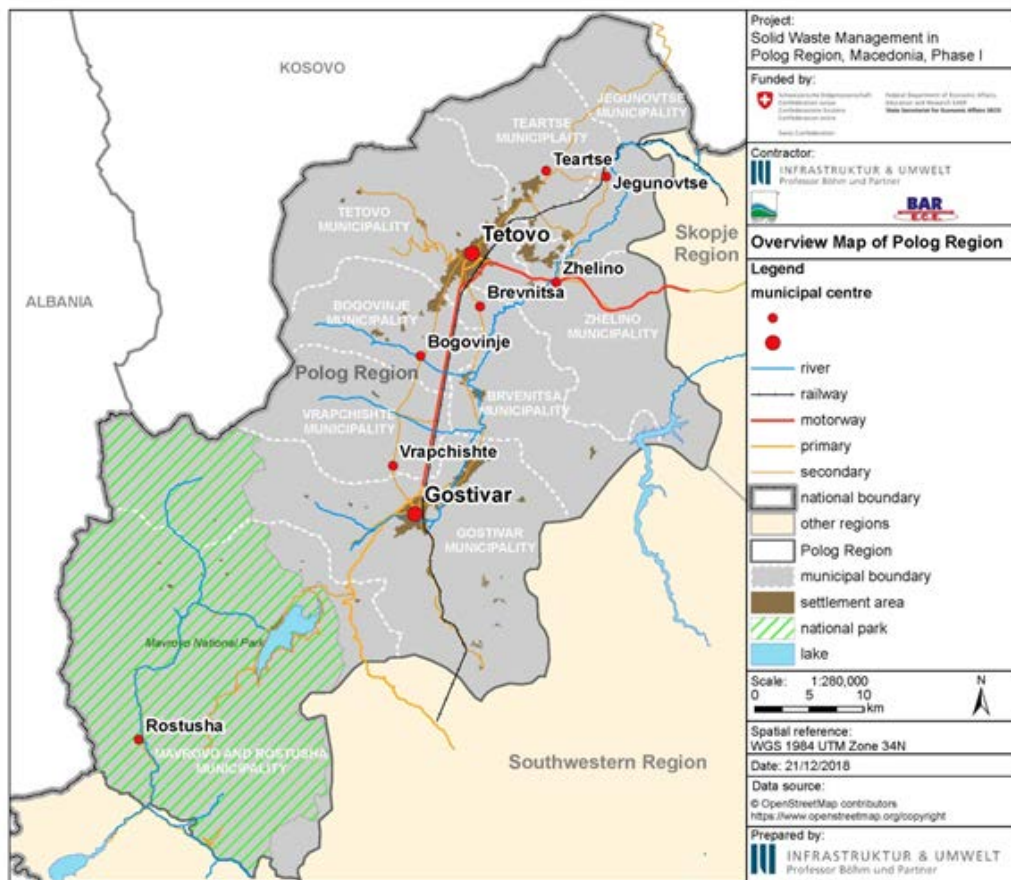
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2.2

The Polog Planning Region, as shown in the map below, is formed by nine

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municipalities (Bogovinje, Brvenitsa, Gostivar, Jegunovtse, Teartse, Tetovo, Vrapchishte, Mavrovo and Rostusha, and Zhelino) which in total include 184 settlements on a total area of 2,379 km². The population is forecasted to increase from 328,407 in 2023 to 352,788 in 2042. Slightly more than 50 % of the population lives in the predominantly urban municipalities Tetovo (29 %) and Gostivar (25 %).



The waste generation is forecasted to increase from 126,691 tons per year in 2023 to 156,794 tons per year in 2042; while the collected waste amount is forecasted to increase from 108,783 tons per year in 2023 to 156,794 tons per year in 2042. With about 50 % the organic fraction accounts for the largest share, followed by the recyclables fractions (paper, plastic, glass and metal), which together makes up for about 27 %.

General Project Description – Summary of Status Quo Assessment

Chap
2.3

Currently waste management services and practices leave much to desire. The waste management system is largely based on collection, transport and dumping



and in order to safeguard the environment and meet national requirements and international standards improvements and investments are required. Investments can in the current situation not be made due to too low waste collection tariffs and too low fee collection rates.

Option Analysis as well as Investment Measures and Conceptual Design Chap 3 & 4

In these chapters options for improvement of SWM services in Polog Region are assessed and the recommended project measures are presented in detail.

Waste Collection, incl. Separate Collection Chap 3.1 & 4.1

Improvement of Waste Collection Services

It is suggested to continue and extend the house-to-house collection using 120 l bins. However, waste collection in municipal centres with multi-storey buildings is proposed to be implemented using bring-system in 1.1 m³ containers due to the limited available space.

In order to have a cost-efficient waste collection, large compaction trucks with a capacity of 18 m³ are considered for waste collection from municipal centres and other settlements in which the roads are well established. In order to reach areas with narrow roads in the urban centres of Tetovo and Gostivar and the surrounding agglomeration, small compaction trucks (8 m³) are suggested.

Mixed MSW in villages in the mountainous areas with narrow, winding and/or unpaved roads will be collected in two steps: Primary and secondary collection. In the primary collection, waste containers will be emptied using small tipper trucks (6 m³) since they give more flexibility in operation. Then, the tipper trucks will bring and off-load the collected waste to a large compaction truck with a capacity of 18 m³ which after being fully loaded will transport the waste to a Transfer Station or Rusino Landfill.

To implement improved waste collection services, the initial investment costs, for all the nine municipalities combined, amount to about 7.0 million EUR (without contingencies and VAT). Depending on the availability of existing equipment in the Polog Region at time of procurement (owned by public or private operators), these costs might be lower.

Due to the expected increase of the amounts of separately collected recyclables, the total amount of mixed MSW will decrease over the planning horizon.



However, the number of households served is estimated to increase along with the population development. Therefore, about 0.8 million EUR shall be invested for new waste collection equipment over the planning horizon on top of the above mentioned initial investments of 7.0 million EUR.

The containers shall be replaced every 5 years, while the replacement period for the vehicles is assumed to be 10 years. The total replacement costs will be then 9.3 million EUR for the entire Polog Region over the entire planning period.

The operating costs consist of staff costs, maintenance and repair of equipment, costs of consumables of vehicles, costs of special tools and clothes/personal protective equipment (PPE). The operating costs for mixed MSW waste collection are estimated to rise from 2.1 million EUR in 2023 – 2.7 million EUR in 2043. About two third of the operating costs are for the payment of the salaries. These costs are the total system costs irrespectively of whether public or private operators provide the waste collection services.

Separate Collection

Ongoing initial activities in separate collection in the region, including activities undertaken by collective handlers under the EPR scheme, are recommended to be continued and extended:

- Regarding the collection of glass waste, it is recommended to procure steel depot containers instead of plastic containers if new containers are required. The steel containers are more appropriate for heavy duty use and more durable.
- The current separate collection of PET bottles shall be extended to cover other types of packaging waste (plastic & metal waste). For the large scale implementation of separate collection of packaging waste the use of standard containers of 1.1 m³ capacity is proposed. These containers are compatible with the lifting device of compaction trucks.
- In addition to the current collection of cardboard waste (from shops), it is suggested to also separately collect paper and cardboard waste from households using standard steel containers with 1.1 m³ volume.

Considering the long-distance transport to the off-takers in Skopje and the higher amount of separately collected waste to be collected and transported, compaction trucks are proposed for the collection of these recyclables. The depot containers for glass waste shall be emptied by hook-lift trucks with a special lifting device (hoist).



Initial investment is planned to cover the estimated system capacity in the first two implementation years. An additional investment of 100 EUR per recycling bin location is estimated for the extended use of the upgraded container spots. The initial investment costs for separate collection at the beginning of the implementation (without contingencies and VAT), is calculated to be about 2.4 million EUR.

The number of equipment is estimated to increase along with the increased amount of separately collected recyclables; therefore, additional investment of about 2 million EUR is estimated. Furthermore, trucks are to be renewed every ten years and collection containers every 5 years, which will cost about 3.6 million EUR in total until 2042.

Total investments for the separate collection activity in the region are estimated to be about 8 million EUR for the planning horizon.

The estimated operating costs for separate collection, not including replacement costs, will increase over the years along with the increasing amount of collected recyclables. In the first year an annual cost of around 0.7 million EUR is estimated which will increase to about 1.4 million EUR by the end of the planning horizon.

From sale of separately collected recyclables, certain revenues will be generated. Applying current, average prices the development of potential revenues has been calculated over the implementation period: In the first implementation year revenues of around 0.6 million EUR are estimated, which are estimated to increase to around 1.5 million EUR in 2042.

Waste Transportation and Transfer

Chap
3.2 &
4.2

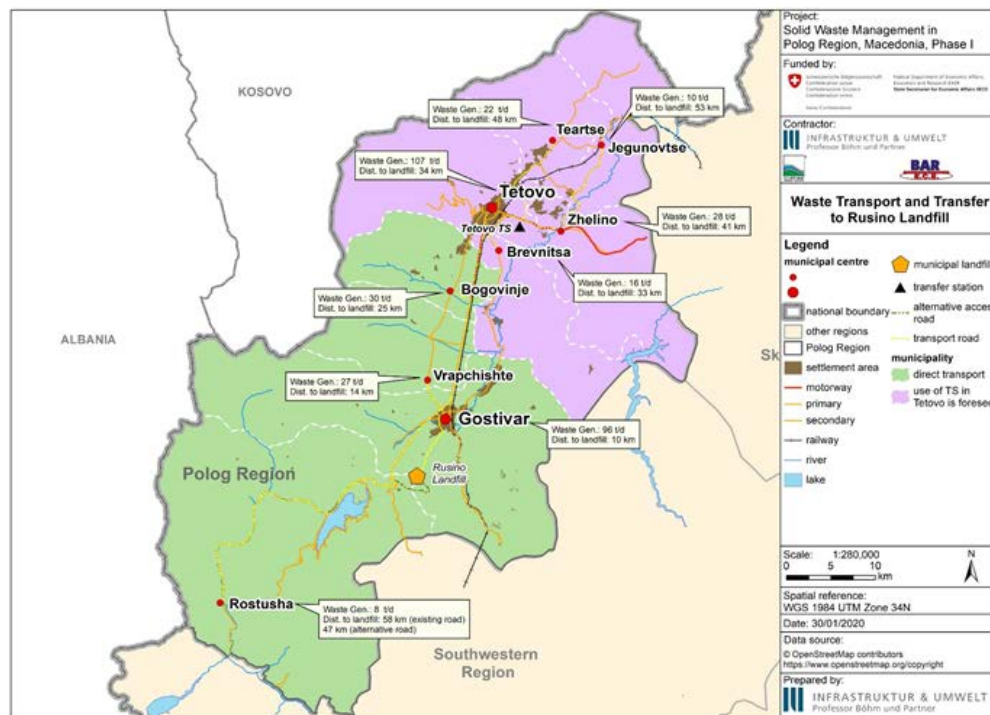
According to the results of an economic analysis of various modes of transport the transport of waste via a transfer station would be more economical for the northern municipalities of the Polog Region, namely Teartse, Jegunovtse, Tetovo, Zhelino and Brvenitsa. The transfer station should be located near the waste generation centre, i.e. the City of Tetovo.

All other municipalities (Bogovinje, Vrapchishte, Gostivar and Mavrovo & Rostusha Municipalities) shall directly transport the waste to the Rusino landfill.

The transport concept is presented in the following map.

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Hook-lift trucks carrying two roll-on/off containers are recommended for the transport of waste from Tetovo transfer station to the Rusino landfill, as they are low-maintenance equipment with low investment costs.

Given the fact that the additional transport and the disposal in a sanitary landfill will considerably increase the costs of SWM, the design of the transfer station should be as simple as possible to allow a cost efficient operation. Since the waste quantities to be transferred and transported in the region are relatively low, a transfer station where the waste is directly loaded into the transportation (roll-on/off) containers is the most suitable solution.

The investment costs of the transfer station in Tetovo are estimated to be about 0.3 million EUR. The mobile equipment to be procured will include 4 hook-lift trucks with trailers and 13 roll-on/off containers. The investment costs are estimated to be about 0.6 million EUR. Thus the total investment costs required to implement the long distance transport concept will be about 0.9 million EUR without contingencies and taxes.

The operating costs of the waste transfer and transport consist of fuel costs, maintenance costs of the equipment and infrastructure, salaries, and administrative costs. Furthermore, the highway toll between Tetovo and Gostivar



is considered as well.

Despite an increase in the separate collection of recyclable waste, the waste amounts to be transported to Rusino Landfill will increase from about 46 thousand t/a in 2023 to about 65 thousand t/a in 2042. The annual operating costs will be about 0.4 million EUR in 2023 and increase to about 0.5 million EUR in 2042.

Waste Treatment (Composting)

Chap
3.3 &
4.3

It is recommended to start the introduction of composting activities first on pilot-scale for separately collected garden and green waste. Windrow composting is the preferred technical option. Besides the low cost for investment and operation, also technical skills for operation can be built up within a short period. Later on, in a stepwise approach, more comprehensive technologies for waste treatment shall be implemented. The decision on such advanced schemes shall be based of the experience from the pilot projects and the development of the overall frame conditions.

It is proposed to start green waste composting in Tetovo and Gostivar Municipalities. The design capacity for each of the two plants shall be 4,200 tons per year. No special bins are foreseen; the green waste will be handed over from the waste generators directly to the collection vehicle. One multi-purpose dump truck is foreseen for each composting plant, which will be used for the collection of the green waste and other tasks.

The initial investment costs at the beginning of the implementation will be about 1.1 million EUR (about 0.5 million EUR for each plant; without contingencies and VAT). The total replacement costs will be about 0.5 million EUR. The annual operating costs will be about 0.1 million EUR.

The pilot compost plants will each produce about 2,100 tons of compost per year (4,200 in total). In order to cover the operating costs, the minimum selling price should be 25 EUR/t.

Waste Disposal

Chap
3.4 &
4.4

Options for waste disposal are not considered for the implementation of the RWMP. The only realistic option for the planning period of the RWMP is the Rusino disposal site in Gostivar Municipality. Alternatives for this site would take many years to develop and shall be considered as replacement for Rusino only. A

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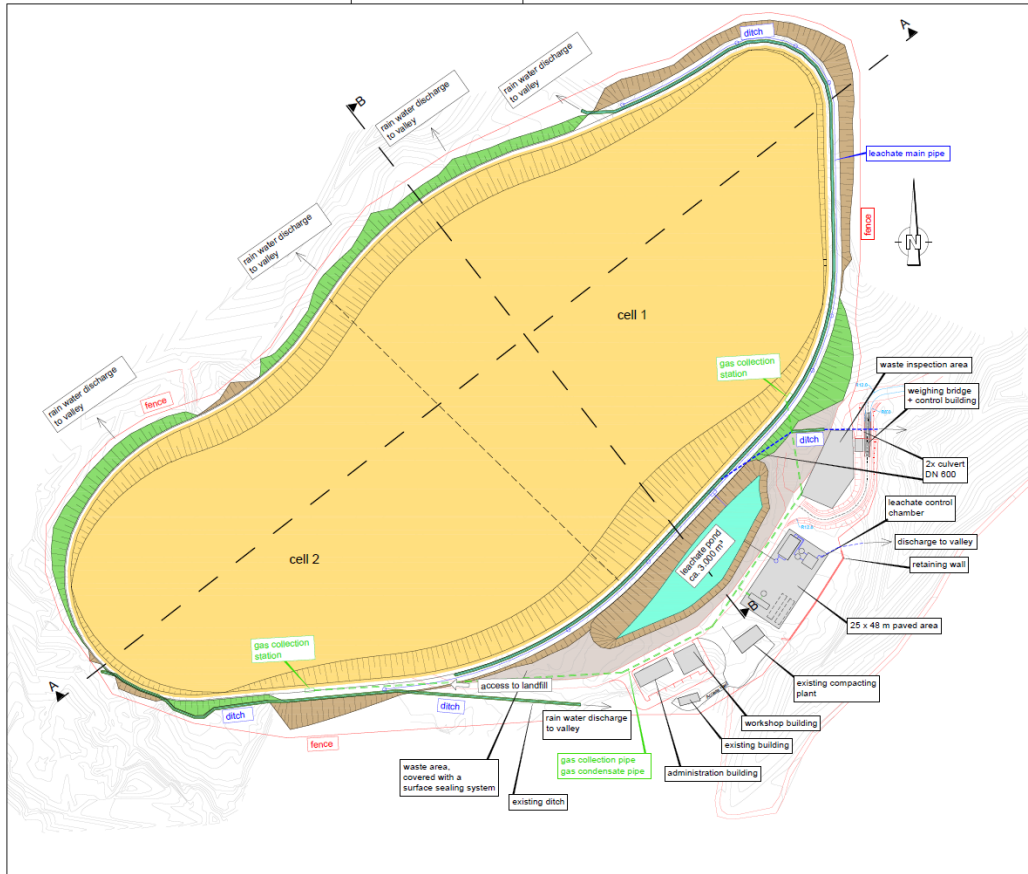
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replacement site has been estimated to be required after a period of approximately 10 years and shall be identified during a siting study to be implemented early in Phase II of RWMP implementation.

The landfill will be designed according to the specifications of the Macedonian Law on Solid Waste Management and the Rulebook on conditions that have to be fulfilled by the landfills (Official Gazette No. 78/09), as well as the EU Landfill Directive 1999/31/EC (including the Council Decision 2003/33/EC). As a result the key elements of the landfill will be

- a base and surface sealing system,
- a leachate collection and treatment system to avoid groundwater contamination and
- a landfill gas collection and treatment system to avoid greenhouse gas emissions (methane).

A conceptual design of the landfill has been prepared, as shown in the following overview map.





Especially to minimize the leachate amount, the landfill will be divided into two cells respectively construction stages. According to the landfill design a total waste volume of about 1,050,000 m³ is available at Rusino site. Thus the lifetime of the Rusino landfill will be in total 10 years.

The maximum height of the filled waste amounts to about 20 m. The maximum length inside the disposal area amounts to about 490 m (from south-west to north-east); the maximum width is about 220 m. The new sanitary landfill will be constructed on top of the existing waste body.

For infrastructure facilities only the area along the access road is available. The landfill area itself will be separated by a gate to avoid uncontrolled truck access to the site. Between the gate and the landfill the entrance area (control building etc.) and the infrastructure area (buildings, container area etc.) are realised. The infrastructure area also includes the leachate pond, the gas station and the leachate treatment units.

The initial investment costs for the construction of the infrastructural facilities, first construction phase of landfill and procurement of mobile equipment will be about 5.9 million EUR. In order to make an overall assessment over the planning horizon of the Feasibility Study, it is assumed that a new landfill will be constructed for the time period after 2032. The investment costs of this landfill are assumed to be about 6 million EUR. The annual operating costs will increase from about 0.6 million EUR (in 2023) to about 0.8 million EUR (in 2042).

The gas generated in the landfill will be collected and used for electricity production. This will allow the generation of revenues. The revenues will start with about 0.5 million EUR in 2028 and end with about 0.1 million EUR in 2050. In total the revenues are estimated to sum up to about 6.3 million EUR that can be used to cover (part of) the operating costs of the sanitary landfill.

Closure of Illegal Dumpsites

Within the Polog Region, 73 illegal dumpsites have been identified. It concerns sites that have not been (fully) closed and still attract waste on a regular or occasional basis. Sites that have been fully closed and have been covered with soil or are fully overgrown with vegetation are not included.

The most suitable closure and rehabilitation option will differ per dumpsite and will depend on the risks the site presents. All sites for which environmental and/or

Chap
3.5 &
4.5



safety risks have been identified, suitable interventions have been recommended, such as

- Removal and transportation of the waste to another (sanitary) landfill and rehabilitation of the location.
- In-situ closure and rehabilitation by covering the waste with a layer of soil which is then to be sown with grass.
- In-situ closure and rehabilitation by installing a capping system on top of the waste, after reducing the footprint and minimising infiltration

In addition, stabilisation of waste may be required in case where waste is disposed of on a slope and risk of waste slides exist.

The cost of rehabilitation of the dumpsites has been estimated to amount to about 3 million EUR excluding contingencies and excluding VAT. In case of disposal of waste, from sites to be rehabilitated by removal of waste, at Drisla landfill, the costs will increase to approximately 4.3 million EUR excluding contingencies and excluding VAT.

Institutional Set-up

Chap
5

The recommended institutional set-up concerns partial regionalisation whereby the Municipalities, through their local public utility enterprises or private operators, remain responsible for waste collection and delivery of waste to the nearest transfer station or to the regional disposal facility Rusino. An inter-municipal Joint Public Enterprise, or JPE, will manage and operate the joint facilities including the transfer stations and the regional landfill. In a later stage other regional waste management facilities may be added to the system and managed by the JPE.

Institutional Set-up at Regional Level

Based on the Law on Waste Management, a Regional Waste Management Centre or, once the new draft Law on Waste Management is adopted, an Operational Unit for Regional Waste Management within the Centre for Development of the Polog Planning Region, shall oversee regional waste management activities.

A Regional Waste Management Centre has not been established in the Polog Region (or in any other region of RN Macedonia). Instead a Project Management Unit for the Project Solid Waste Management in Polog Region has been established within the Centre for Development of the Polog Planning Region as



precursor to the above mentioned Operational Unit. The PMU is staffed with four employees, which is considered sufficient also for the future Operational Unit.

Institutional Set-up at Municipal Level

The municipalities will retain responsibility for waste collection and delivery to a transfer station or the regional landfill and in practice delegate this task to either their local PUE or a private operator. Within the Municipalities an employee, or in larger municipalities several employees, shall be assigned with the task of monitoring the performance of the PUE or private operator. These employees are most likely the environmental inspectors in the municipalities, although the financial departments will also have some monitoring tasks.

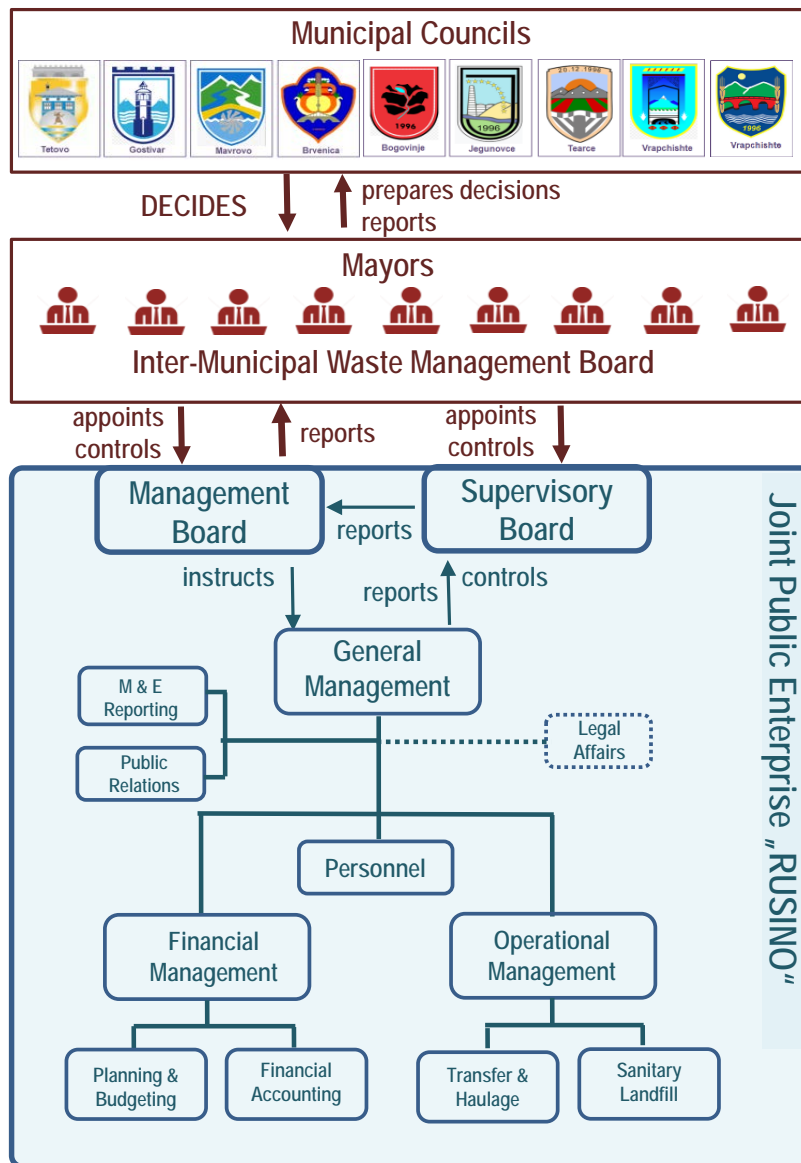
The PUE and private operator are or shall be structured to the need of the waste collection. Staff numbers will highly depend on the size of the PUE or private operator.

Organisational Structure of JPE “Rusino”

Once quick-win measures have been implemented at the Rusino disposal site, JPE “Rusino” will be responsible for managing the site. However, in absence of own landfill equipment other than a weighbridge, a private company will be engaged for waste handling, compaction and covering. After upgrade of the Rusino landfill to EU standards, the JPE “Rusino” will take over all operations at the landfill and will also manage transfer stations and transfer operations. The organisational set-up will reflect these tasks and include several departments and sub-department.

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At decision making level the Municipal Councils of the nine founding municipalities of Polog Region are the supreme authorities. The Mayors are acting as the hierarchical superiors and controlling the performance of the JPE.

At the executive level, the Management Board is the administrative body which defines the business policy and adopts programs for operation and development of the JPE.

The JPE Director executes the decisions of the Management Board at the company level, conducts those activities envisaged by the development programme, manages and coordinates the working activities, and delivers the



results in financial terms. Certain functions and responsibilities are delegated by the Director to lower levels in the hierarchy, and the departments and divisions may have different degrees of competencies.

The Supervisory Board controls the material-financial operations of the JPE through audits reviews of the annual reports and gives their opinion to the Management Board.

Costs

The costs for waste collection and transportation by local PUEs and private operators already include the costs for the institutional set-up at municipal level, which have been assessed to be 7% of the operational costs.

The costs of the PMU and, in future, the Organisational Unit for Regional Waste Management, are included in the overall costs for the Centre for Development of the Polog Region and covered by the nine municipalities.

Costs of operations of the regional landfill, the transfer station and the transfer vehicles have also been included in the respective operation and maintenance costs. Only the costs for the management and administration of the JPE “Rusino” are to be taken into account additionally. These “overhead” costs are about 0.1 million EUR per year.

Financial and Economic Analysis

Chap
6

Methodology and Main Financial Assumptions

The financial and economic analysis is based on the Guidelines to Cost-Benefit Analysis (CBA) of the EU.

The main objective of the financial analysis is to demonstrate the capability to generate sufficient revenues over the economic lifetime of the Project to be able to cover project-related costs in accordance with the “polluter pays” principle. The Discounted Cash Flow (DCF) methodology is used to calculate financial performance indicators and funding gap rate (grant rate).

Financial analysis of the Cost-Benefit Analysis (CBA) covers the economic lifetime of the Project between 2021 and 2042 of which:

- Investment Period is 2 years (2021-2022) and
- Operation period is 20 years (2023-2042).



Investment and O&M costs, determined separately for the following SWM service components, are considered:

1. Collection;
2. Recycling;
3. Composting;
4. Transport;
5. Disposal.

Technical Assistance (TA) component for capacity building is added as an investment cost item to the above SWM service costs. The costs for closure of existing wild dumpsites is assumed to be covered from other sources and not taken into account in this Feasibility Study.

Investment Costs

Undiscounted and discounted total investment¹, implementation consultancy and technical assistance (TA) costs including contingencies of 10% are estimated to be about 56.7 million EUR and about 41.7 million EUR. Out of the total discounted investment costs including contingencies, about

- 91% are for investment costs excluding TA (about 38.0 million EU),
- 6% are for implementation consultancy (about 2.3 million EUR) and
- 3% are for technical assistance (TA) (about 1.4 million EUR).

Out of the total discounted investment costs including contingencies and excluding TA, about

- 36% are for collection services (about 14.5 million EUR),
- 17% are for recycling services (about 6.7 million EUR),
- 4% are for composting services (about 1.5 million EUR),
- 4% are for transfer and transport services (about 1.8 million EUR) and
- 39% are for disposal services (about 15.9 million EUR).

Residual value as of 2042 including and excluding contingencies of 10% is

¹ Undiscounted investment is the total nominal value of investments to be made over the investment period; the discounted investment is the current value of those future investments.



estimated to be about 5.7 million EUR and about 5.2 million EUR, respectively.

Average Operation and Maintenance (O&M) Costs

Undiscounted and discounted average operation and maintenance (O&M) cost is about 5.3 million EUR/ year and about 3.2 million EUR/ year, respectively. Out of the total discounted average O&M cost about

- 52% is for collection,
- 22% is for recycling,
- 2% for composting,
- 9% is for transfer & transport and
- 15% is for disposal services.

Total Costs

The Net Present Value (NPV) of Project investment costs including implementation consultancy and TA fees, 10% contingencies and O&M costs over the lifecycle of the Project (2021 – 2042) are calculated by taking the residual value at year 2042 into account. As being the best proxy of long-term marginal cost, Dynamic Prime Costs (DPC) of the Project are calculated.

NPV is calculated to be about 105.7 million EUR over the planning period (2021-2042). Dynamic Prime Costs (DPC) are calculated to be about 63 EUR/ton of which about 63% is for O&M costs (about 39 EUR/ton) and about 37% is for investment costs (about 23 EUR/ton).

Financial Analysis

Based on SWM tariffs set at an affordability ratio of 1%, i.e. tariffs set at 1% of the average affordable household income, it has to be concluded that the Project is not financially feasible since both the Financial Net Present Value (FNPV/C) and the Financial Internal Rate of Return (FIRR/C) demonstrating the return on investment (without loan and grant financing for investments; only with project-related revenues) are negative. The resulting Funding Gap Rate and the associated Grant Rate have been calculated to be about 94% and 80%, respectively. However, even with national financing, covering the difference between the Funding Gap and the grant, the Project is not feasible since both the Financial Net Present Value (FNPV/K) and the Financial Internal Rate of Return (FIRR/K), demonstrating the return on local capital (with local grant financing for



investments and project-related revenues), are negative. Since the FNPV/K is negative (about -17.7 million EUR) and FRR/K (about -4%) is below the financial discount rate of 4%, grant financing is necessary for the implementation of the Project.

The financial analysis also shows that grant financing cannot avoid a negative, cumulative cash flow for all years of the Project period, accumulating to a short fall of more than 18 million Euros after ten years of operations. The Municipalities could, in principle and on temporary basis, provide working capital² during the initial 10 years of the Project, but in view of the magnitude of the deficit this cannot be regarded as a feasible solution.

Economic Analysis

In spite of the lacking financial feasibility, the Economic NPV (ENPV) of the Project is estimated to be about 19.9 million EUR at a social discount rate of 5%, whereas the Economic Rate of Return (ERR) is about 19% and Economic Benefit-Cost Ratio (B/C) is 1.2. This means that the Project is good for the welfare of the Polog Region and North Macedonia and should be implemented from an economic point of view.

Conclusion for Project Financing

In view of the economic desirability, additional financial analysis has been carried out. Assuming the same investment and O&M costs but higher SWM tariffs (maximum affordability rates of overall 1.31%) and revenues, based on a rapid increase of the tariff collection rate from the current 55% to 95% in 2030, a lower Grant Rate of about 52% has been calculated. But, also under these less conservative assumptions, the results do not change the fact that a negative cumulative cash flow is forecasted for the entire Project period. Only the magnitude of the maximum cumulative negative cash flow is reduced from about -18.3 million EUR to about -17.1 million EUR. Still an amount which cannot be expected to be covered by the Municipalities.

Further analysis showed that in order to reach positive cash flows, re-investments and O&M costs would have to be seriously reduced. In total reductions of an amount of some 17 million EUR should be realised. However, while turning the

² Capital to be provided by the member municipalities of the JPE in order to ensure sufficient liquidity and thus financial sustainability of the project.

project financially feasible, the technical feasibility would be seriously affected, simply because the system would run out of sufficient operational equipment.

For the financial and economic analysis presented in this report, a cost-benefit analysis, according to the requirement of the European Commission, has been conducted. There are alternative financial analysis approaches, for instance those used by IFI's such as World Bank or EBRD. These other approaches focus on the question whether a projects can be implemented against affordable tariffs, assuming a certain project funding package, rather than determining the need for grants assuming certain revenues. While within the framework of this feasibility study alternative financial analysis methods have not been applied, knowledge of these methods, combined with the results of the analyses and assessments that have been carried out, indicate that the Project can be implemented with positive cash flows, against affordable tariffs provided that

- grant financing of around 50% of initial investment costs can be secured with the remaining costs to be covered by preferential loans;
- tariffs are set close to the affordability limit (1.5% of average household income) from the start of project implementation; and
- a high tariff collection rate, of around 90%, is realised also right from the start.

Environmental and Social Impacts

Chap
7

The implementation of the proposed project measures will improve the rate of waste collection, separately collected re-useable waste fraction and the environmentally soundness of waste disposal. In view of the current situation in which a significant percentage of the waste generators does not receive any waste collection services, re-use and recycling of waste is limited and all waste disposals depends on non-compliant landfills and dumpsites, the overall impacts will be positive for both the environment and social aspects. However, some negative impacts may be caused including increased nuisance from traffic and reduced opportunities for the informal sector to generate income.

Overall, implementation of the proposed measures will have long term positive impacts on the environment and the population of the Polog Region. Mitigative measures can provide further environmental protection and compliance.

Risk Analysis

Chap
8

Lack of financing is assumed to be one of the most relevant risks for project



implementation.

The implementation of the proposed project measures will considerably increase the costs for waste management services. Successful project implementation is expected to depend on the readiness to increase waste tariffs, to allocate sufficient budget for regional and municipal SWM measures and to support the mode of financing in the long-term.

In addition, ensuring the engagement and support of the public is a prerequisite to reach the objectives and results envisaged with the proposed waste management system. Creating public awareness of the advantages and benefits offered by improved SWM will positively affect public participation and willingness to contribute towards its implementation, either through behaviour changes or financially.

Project Implementation

Chap
9

The measures presented in this document will be implemented with involvement of a number of entities, including the Inter-municipal Waste Management Board (IMWMB), the Centre for the Development of the Polog Planning Region (i.e. the Regional Development Centre, RDC) and, in future, the organisational unit for regional waste management therein, the Joint Public Enterprise for management of Rusino landfill and regional transfer station(s) (JPE "Rusino") and the nine Municipalities in the Polog Region. In addition, as is currently the case, the private sector may be involved for the provision of waste management services³. Other stakeholders are involved donor organisations and IFIs, the MoEPP and, most likely, the MoF as provider of national contributions to the required investments and guarantor for loans provided by one of more IFIs.

The measures, representing the initial investments, will be implemented through a number of contracts including:

- A works contract for the upgrade of Rusino landfill (approx. 5.1 million EUR).
- A supply contract for the supply of landfill equipment (approx. 0.9 million EUR)
- A works contracts for compost plant construction (approx. 0.6 million EUR)

³ Although the private sector may provide some of the required investments, in this document no distinction is made between public and private investments. Instead, the total system costs are considered and addressed.



- A supply contract for equipment for compost plants (0.5 million EUR)
- A works contract for the construction of a transfer station (approx. 0.3 million EUR)
- A supply contract for equipment for the transfer station (approx. 0.8 million EUR)
- Supply contracts for the supply of waste collection vehicles and the provision of waste bins and containers (combined value approx. 6.6 million EUR)
- A service contract for engaging a consultancy firm to provide technical assistance for project implementation, supervision of contract implementation and related services (approx. 3.2 million EUR).

In addition it is anticipated, although not part of the initial investments as defined in this document, that one or more work contracts for the closure of dumpsites (approx. 3 million EUR) will be concluded.



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1 Introduction

The nine municipalities of the Polog region are implementing an Integrated Waste Management (IWM) Project (hereinafter “the Project”) funded by the Swiss State Secretariat for Economic Affairs SECO with a grant contribution of CHF 1.9 million, and supported by INFRASTRUKTUR & UMWELT, in consortium with SEHLHOFF and BAR E.C.E.

The Project supports implementation of the new waste regulation in the Polog municipalities and improvement of the organization of the regional and local waste disposal systems. It is designed to provide for advanced waste management solutions, based on the concepts and standards outlined in the EU standards and in national waste management legislation and policy, in line with the EU accession roadmap.

The Project provides technical assistance to develop the framework conditions for an IWM system in the region. It is meant to pave the way for a subsequent project, which shall focus on the realisation of regional investment measures and the required institutional support.

In previous project steps a Regional Waste Management Plan for the Polog Region (RWMP) has been prepared, outlining how the Municipalities in the Polog Region intend to improve the management of solid waste generated in the region. The planning horizon of the RWMP is 10 years (2019 – 2029), subdivided into three implementation phases.

During the RWMP’s first implementation phase (2019 – 2020), the ongoing Project supports the implementation of priority measures (quick-win measures), especially to avoid further environmental degradation caused by unsuitable SWM practices in the region. It is intended that in subsequent projects the Polog Region is supported in implementing further short- and medium-term measures as defined in the RWMP and to prepare for a future advanced waste management system in the long-term.

In this Feasibility Study, the scope for such subsequent projects is presented and the feasibility is assessed. The planning horizon of the Feasibility Study goes beyond the planning horizon of the RWMP and covers the years 2023 – 2042.



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2 General Project Description and Background

2.1 Project Objectives, Relevance and Effects

2.1.1 General Project Objectives

The overall project objective is to contribute to improved quality, effectiveness and sustainability of waste management services in the Polog Region and to reduce negative environmental and health impacts. It addresses immediate short remediation needs and lays the basis for future regional infrastructure investments.

2.1.2 Objectives, Targets and Timelines as Defined in the Regional Waste Management Plan

In compliance with the EU Waste Framework 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 planning horizon of the RWMP for the Polog Planning Region is 10 years from 2019-2029, subdivided into three implementation stages:

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

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. The targets and timelines for the RWMP are displayed in the following Table 1.

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Table 1 Targets and timelines for the RWMP

Targets and Timelines for the RWMP				
	EU Directives		RWMP Targets	
	Target	Date	Target	Date
Waste Collection				
Collection of Mixed Municipal Waste	assumed full coverage		90%	2024
Collection of Mixed Municipal Waste	assumed full coverage		100%	2029
Separate Collection, Reuse and Recycling				
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		
Landfilling of waste and treatment of organic waste				
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
Fee collection and public awareness				
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

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 only in a later stage the realisation of advanced waste management options, such as for example complex waste treatment facilities.

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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 and longer 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 compliant with the EU landfill directive
2. Development of an optimised system for waste collection
3. Initiating engagement of municipalities in recycling and waste treatment
4. Development of an optimised system for waste transfer and transport

Phase III (2027 onward) will focus on the realisation of advanced waste management options, such as a regional waste treatment facility.

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

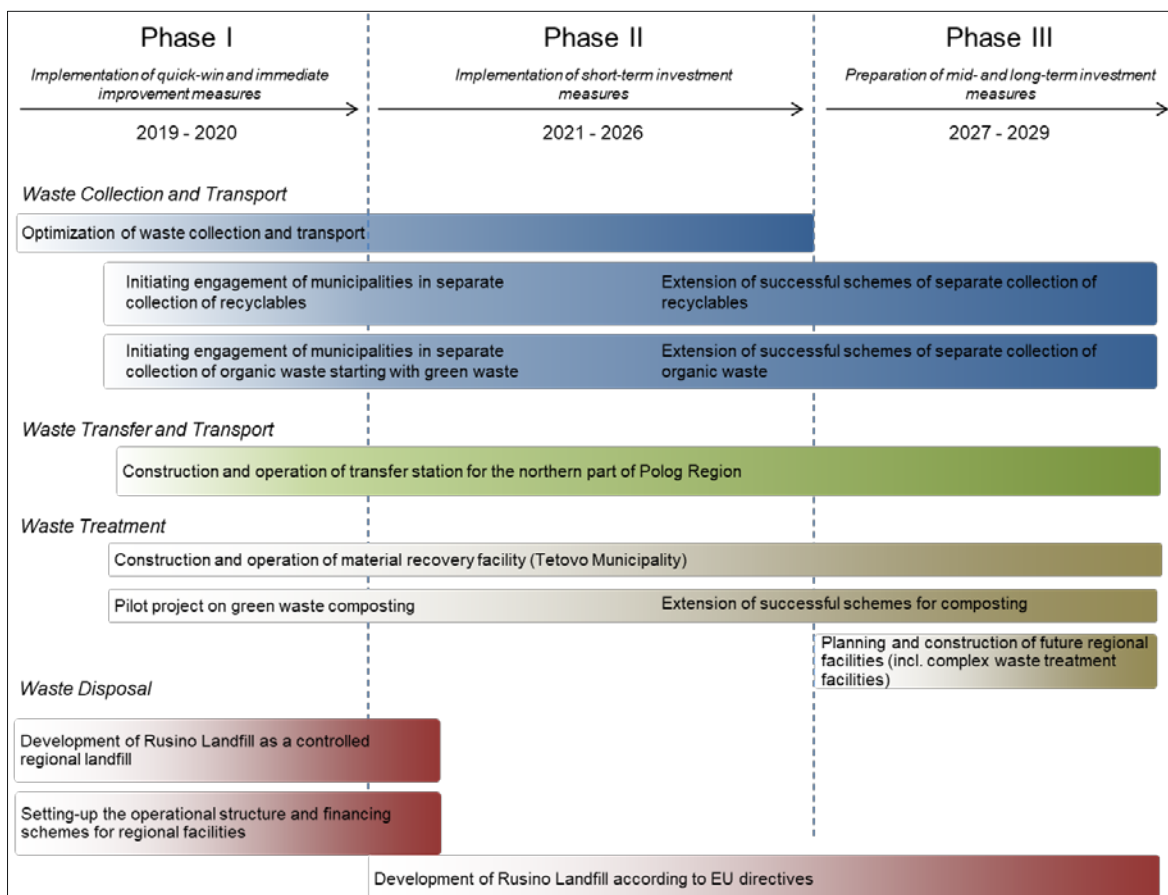


Figure 1 Main interventions for improvement of waste management in Polog Region as defined in the RWMP

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The planning horizon of this Feasibility Study goes beyond the implementation phases of the RWMP, as it is defined for the time period 2023 – 2042.

2.2 Summary of Planning Criteria

2.2.1 Project Area

The Polog Planning Region is formed by nine municipalities (Bogovinje, Brvenitsa, Gostivar, Jegunovtse, Teartse, Tetovo, Vrapchishte, Mavrovo and Rostusha, and Zhelino) as administrative units of lower level which in total include 184 settlements on a total area of 2,379 km². The following map provides an overview of the region, the nine municipalities and their administrative centres.

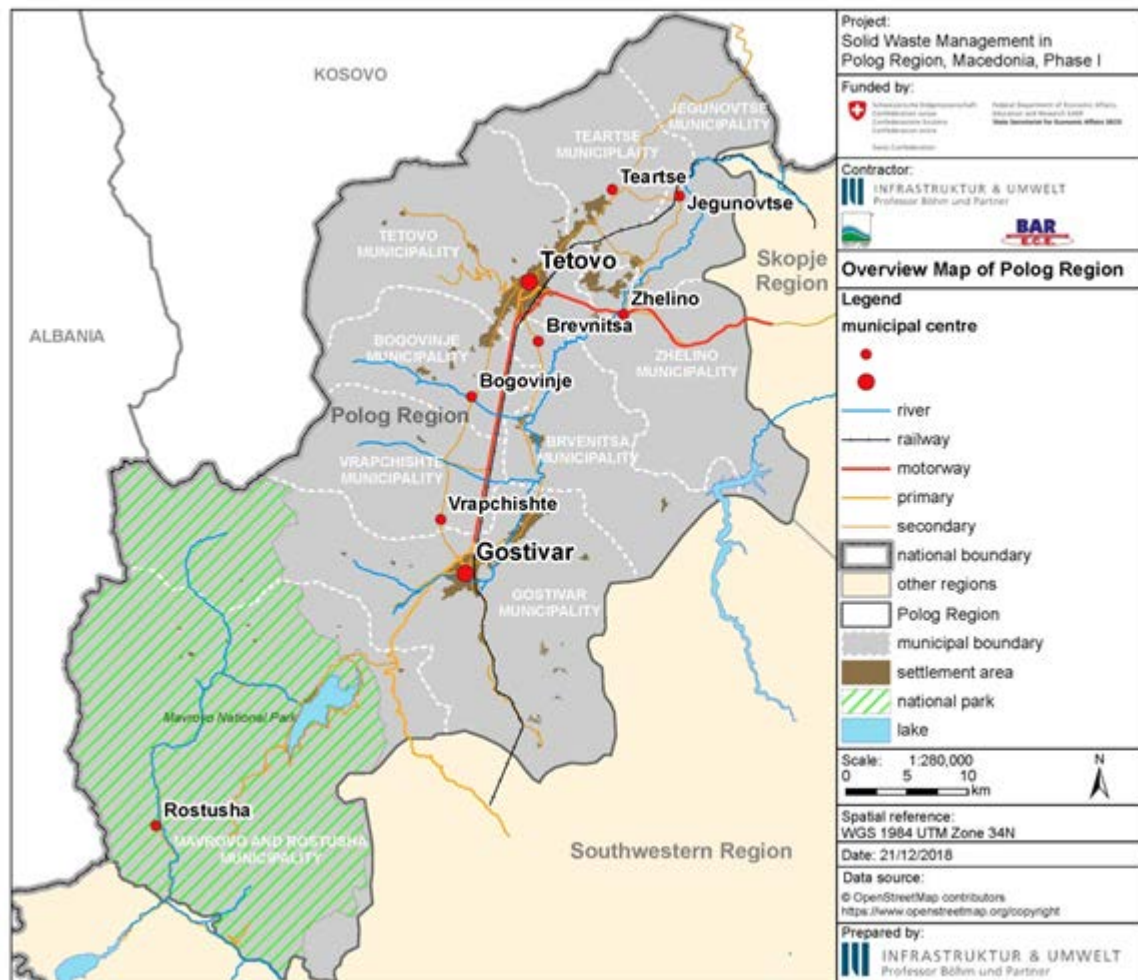


Figure 2 Overview map of Polog Planning Region with neighbouring regions



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2.2.2 Population and Population Forecast

In Polog Planning Region, Tetovo and Gostivar are the most populated cities. The following table shows the forecasted population development in the Polog Planning for the planning horizon of the Feasibility Study (2023 – 2042).

Table 2 Population forecast (2023 – 2042)

Municipality	Planning Horizon Feasibility Study			
	Year 1 - 10		Year 11 - 20	
	2023	2032	2033	2042
Brvenitsa	16,908	17,380	17,433	17,920
Bogovinje	31,788	33,064	33,209	34,543
Gostivar	84,841	86,524	86,713	88,432
Jegunovtse	10,265	10,047	10,023	9,811
Mavrovo & Rostusha	9,005	9,177	9,196	9,371
Teartse	23,137	23,437	23,470	23,773
Tetovo	94,245	97,734	98,129	101,762
Vrapchishte	28,461	29,883	30,046	31,547
Zhelino	29,758	32,407	32,715	35,627
POLOG Region	328,407	339,652	340,935	352,788

2.2.3 Waste Composition, Waste Quantities and Waste Forecast

Within the framework of the Project, a waste quantity and composition analysis has been carried out. Considering different settlement structures and seasonal effects, an average composition of household and household-like waste in the Polog Region was determined.

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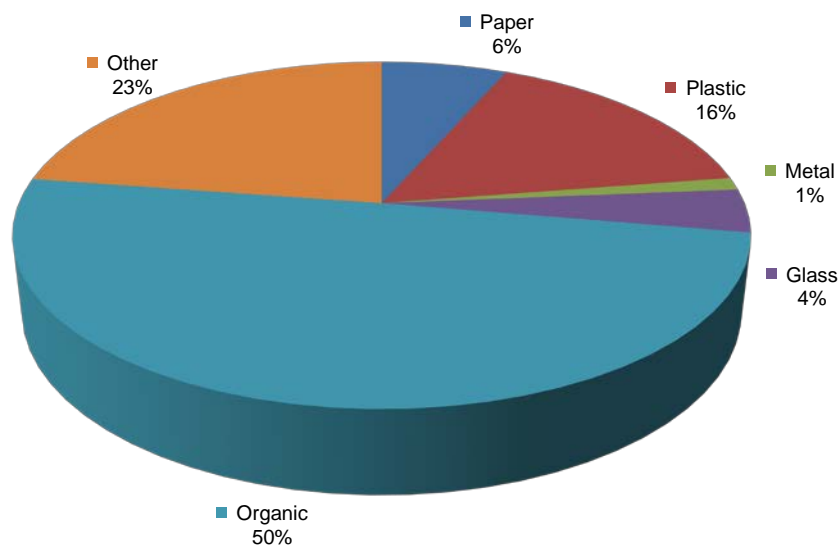


Figure 3 Average composition of household and household like waste in weight-%

As there are no consistent data from Municipalities or the landfill available, quantities of municipal waste generated and collected have been estimated. For the specific waste generation data provided in the NWMP an iteration method has been applied, resulting in a specific waste generation rate for 2018 of

- 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 rate includes the total municipal waste, namely household waste and commercial waste but not the higher waste generation rates during the holiday season when tourist and people working abroad visit the region. To take this waste into account a factor of 1.17 was applied on the above generation rates per capita.

The following table displays the waste amounts estimated to have been generated in the municipalities of the Polog Region in 2018.

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Table 3 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
POLOG Region	322,385	119,453	9,954	327

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

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

The following table shows the waste generation forecast for the Polog Planning for the planning horizon of the Feasibility Study (2023 – 2042).

Table 4 Waste generation forecast (2023 – 2042)

Municipality	Planning Horizon Feasibility Study							
	Year 1-10				Year 11-20			
	2023		2032		2033		2042	
	t/a	t/d	t/a	t/d	t/a	t/d	t/a	t/d
Brvenitsa	5,874	16.1	6,552	17.9	6,631	18.2	7,307	20.0
Bogovinje	11,044	30.3	12,464	34.1	12,632	34.6	14,066	38.5
Gostivar	35,441	97.1	38,658	105.9	39,033	106.9	42,167	115.5
Jegunovtse	3,566	9.8	3,787	10.4	3,813	10.4	4,022	11.0
Mavrovo & Rostusha	3,129	8.6	3,459	9.5	3,498	9.6	3,824	10.5
Teartse	8,039	22.0	8,835	24.2	8,928	24.5	9,709	26.6
Tetovo	39,369	107.9	43,667	119.6	44,172	121.0	48,434	132.7
Vrapchishte	9,888	27.1	11,265	30.9	11,429	31.3	12,832	35.2
Zhelino	10,339	28.3	12,216	33.5	12,444	34.1	14,433	39.5
POLOG Region	126,691	347.1	140,902	386.0	142,581	390.6	156,794	429.6

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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.

Based on the waste composition and the assumption that waste characteristic will not change significantly, waste amounts per waste fraction have been computed. The following figure illustrates the forecast of collected waste amounts per fraction.

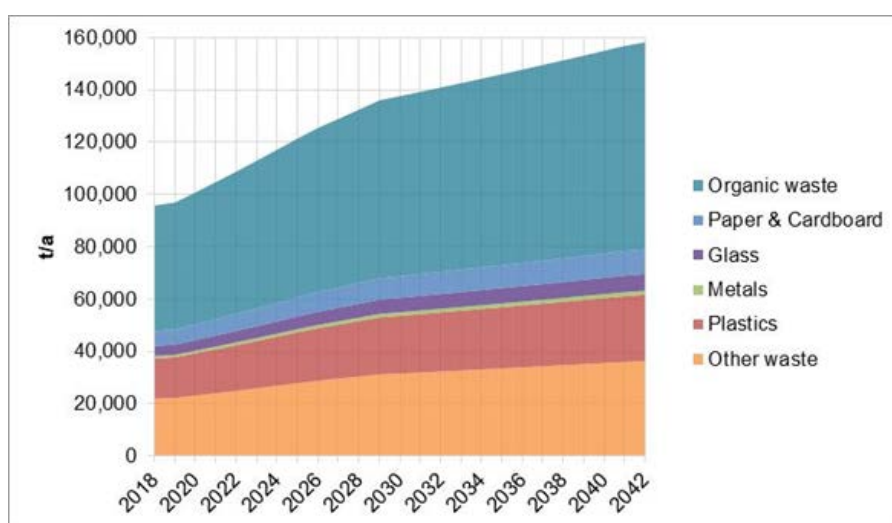


Figure 4 Forecasted collected waste amounts per fraction (2023 – 2042)

2.3 Summary of Status Quo Assessment

2.3.1 Policy and legal framework

2.3.1.1 EU Waste Legislation and Waste Management Objectives

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

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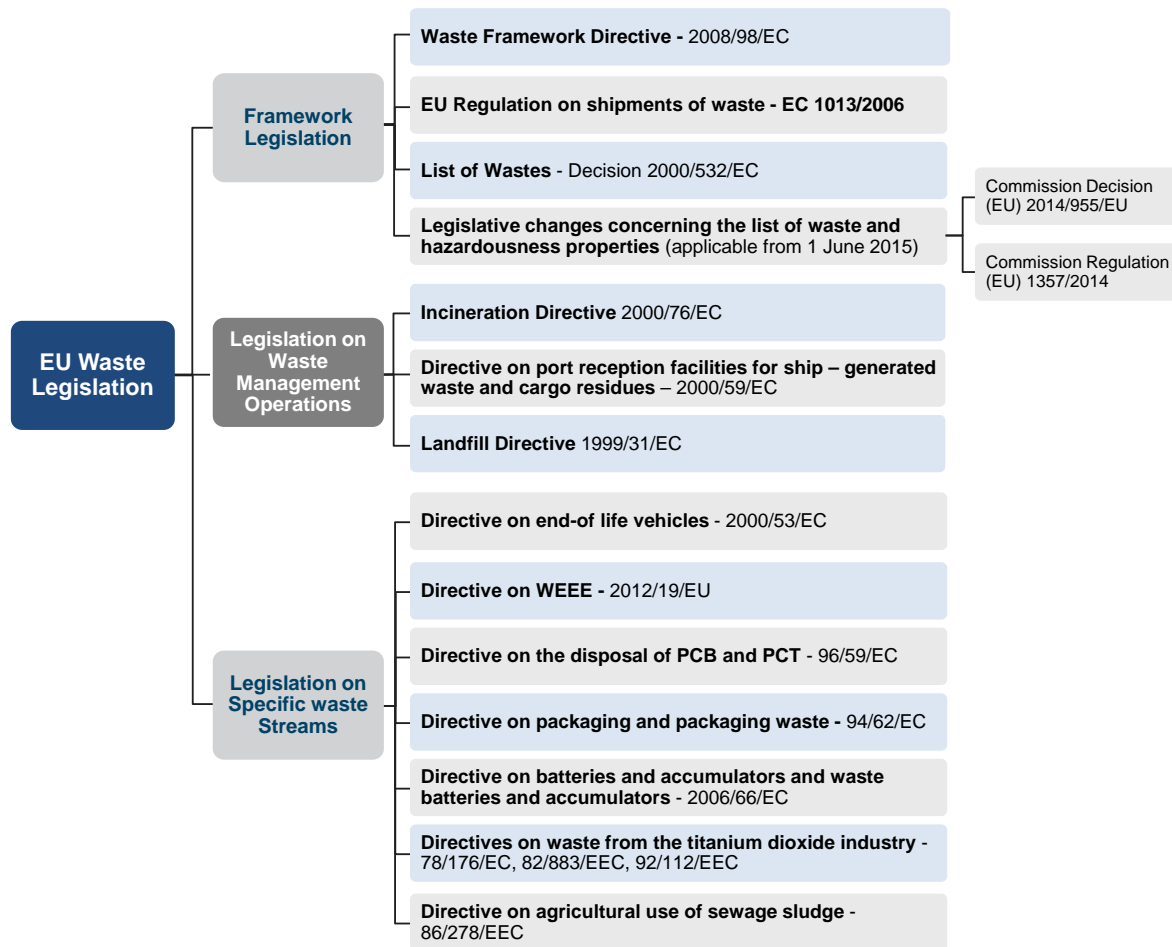


Figure 5 Overview of the main EU Waste Legislation

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 programmes by competent national authorities
- Targets for member states with regards to separate collection, preparing for re-use and recycling and landfilling of waste.

2.3.1.2 National Waste Management Legislation and National Waste Policy

In 2001 North Macedonia has initiated the process of approximation of EU law and aligning their national legislation with the EU by signing the Stabilization and Association

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Agreement (SAA). 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.

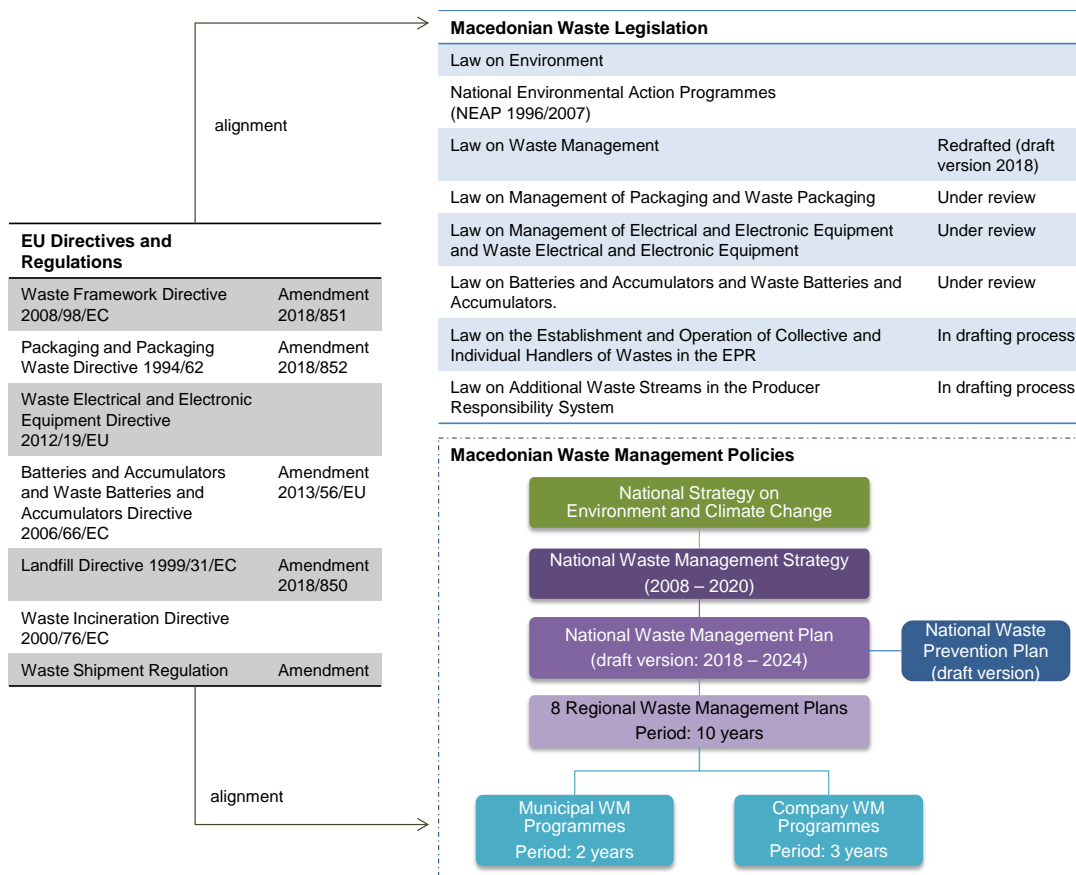


Figure 6 Waste management related laws and regulations⁴

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

⁴ Information source: Draft NWMP 2018 – 2024 (2018) and Draft Law on Waste Management (2018)



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Waste Management (LoWM, 2004) regulates non-hazardous and hazardous waste and special waste streams. It has first been amended in 2012 and is now being redrafted (draft version 2018) to be brought 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)
- 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 to form an Inter-Municipal Waste Management Board and to prepare and adopt a regional waste management plan.

2.3.1.3 Extended Producer Responsibility

The Extended Producer's Responsibility principle was introduced in the LWM in 2008. The Law provides that the producer or importer of products and packaging that generate waste, at the end of the life cycle of these products and packaging, shall be responsible for the management of this waste and that the producer and/or importer shall be liable to



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pay compensation for the treatment of this waste. The management of special waste streams, as well as the amount of compensation for waste treatment, is regulated by the Law on Packaging and Packaging Waste, the Law on Management of Electrical and Electronic Equipment and Waste from Electrical and Electronic Equipment and the Law on Management of Batteries and Accumulators and Waste from Batteries and Accumulators.

The draft National WM Plan 2018-2024 contains a modern and comprehensive approach to the issues related to the EPR. According to the draft Plan, the new, draft LWM, which is also in the process of adoption, will provide the general framework, while secondary legislation will provide the specific rules for each waste stream, responsibilities, scope, definitions and targets for collection and recycling, including increasing the scope of EPR to new waste streams, development a new Implementation Model, creation of a Producer Balancing Body (Clearing House), allocation of responsibilities to ensure effective implementation, finance, fair competition, transparency and control, a robust system of enforcement and raising public awareness.

The draft LWM provides that the special waste stream management systems shall be financed from the fee prescribed in accordance with the regulations on special waste streams and the regulations for the establishment and operation of the collective or independent handler as part of the extended responsibility regime.

2.3.2 Street Sweeping, Waste Collection, Transport and Transfer

Waste collection in Polog Region is mostly practiced using collection points where households, business entities and institutions all place their waste 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 bin, bags or cartons. The public bins are made of metal or plastic mostly with a volume of 1,100 litres, equipped with wheels and placed along the main roads in the cities. Most containers are worn-out and missing wheels. The collection points are not distributed evenly nor sufficiently which leads to indiscriminate waste dumping or piling of wastes around the collection points.

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

Waste management services are provided by public utilities companies (PUC) in part of the municipalities and by concessionaires (private companies) in other. With very few exceptions, available waste collection trucks have by far exceeded their economic life time and none of the municipalities own sufficient equipment.



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For municipalities using a small collection truck, which are mostly used, the use of a transfer station may be considered in case of a transport distance of more than 20 km. Tetovo Municipality is currently using a transfer station for the transportation of waste to Drisla landfill.

2.3.3 Recycling and Waste Treatment

Separate waste collection and separation of recyclables from mixed waste takes place in the region as small-scale, largely informal initiatives. Also PAKOMAK, which is one of the four companies in the country, responsible for organizing the recovery of packaging materials, is reporting very limited activities in Polog region. Similar to the data on waste generation, there is no reliable information on the amount of recyclables recovered. Based on visual impressions, it is estimated that not more than 8-10 t/d of plastic, paper/cardboard and beverage cans/metal or 3-4% of the entire waste stream is recovered per day by the various actors.

Waste composting activities were not reported by the municipalities. Although composting is traditionally practised by farmers and households with bigger gardens, there is no information on composting organized by the municipalities.

2.3.4 Waste Disposal

After being collected from the collection points, waste is transported to and disposed at non-compliant, semi-official landfills, including Rusino landfill, Drisla landfill in Skopje and Debar landfill in Southwest Region.

In addition, in all municipalities there are so-called “wild” dumpsites where various types of waste are deposited (municipal waste, construction and demolition waste, agricultural waste). In part these dumpsites are abandoned for some time (with no or minor rehabilitation activities) and part is still being used.

2.3.5 Non-municipal Solid Waste

Non-municipal solid waste summaries various waste streams, for example: For construction and demolition waste, estimations indicate that an average amount of 302,000 tonnes per year is generated in the Polog Region. 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. Further non-municipal solid waste streams include industrial waste, sewage sludge, hospital and hazardous waste, industrial hazardous waste, hazardous waste of municipal origin, healthcare waste, waste electrical and electronic equipment, waste batteries and accumulators, end-of-life cars, etc. Due to their composition, properties and



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hazardousness, these waste streams shall not be treated with municipal solid waste. They are, however, often disposed of together with municipal solid waste and endanger thereby the environment and human health.

Non-municipal solid waste streams require individual solutions with separate funding. The management of non-municipal solid waste will not be scope to this Feasibility Study but shall be organised and funded in consultation and cooperation between waste generators and competent authorities, as this is, similar to the environmentally sound management of municipal solid waste, a major task.

2.3.6 Public Awareness, Public Participation and Waste Avoidance

Generally, the level of awareness within the population of the importance of proper waste management and of their own responsibility for a clean environment seems to be low, as scattered waste and illegal, wild dump sites are present throughout the project area. The population is even less used to handling of waste 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.

So far, PR and public awareness as well as waste avoidance activities, campaigns and programs have not taking place in the Polog region in a coordinated way. Some municipalities occasionally conduct cleaning campaigns or seek to inform their population about the benefits of waste separation and recycling. Changing people's habits requires a long-term educational process. This process must be supported by incentives to reward desired behaviour and/ or fines to penalize non-compliance.

It is commonly accepted, that SWM follows the so-called waste management hierarchy, which means that waste avoidance, re-use and recycling have priority over the treatment and disposal of waste. However, disposal on dumpsites and poorly managed landfills is currently the main disposal route. Both, consumer and producers need to be addressed to promote waste avoidance; especially the consumers can be addressed on regional level.

2.3.7 Socio-economic and Financial Situation

In general, waste management services in Polog Planning Region are financed from fees and to a certain extent through cross-subsidies from other sources.

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 tariffs are 380 MKD for Gostivar and 280 MKD for Tetovo (as per assessment of the Consultant in October 2018).

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Especially, where concessionaires are providing the services, municipalities do not 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.

Based on the average household income, affordability considerations are made. As maximum benchmark for the affordability 1.5% of average household income is used. The values are shown in the table below, as presented in the Project's Assessment Report.

Table 5 Affordability consideration in Polog Planning Region

	Average household income	Affordability for SWM Services per household		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
Average Polog Planning Region	355.70	5,336	445	

Affordability can be calculated based on agreed statistical data and for the current situation it has been identified as

- 465 MKD per household and month in urban areas (Tetovo and Gostivar Municipalities) and
- 419 MKD in rural areas (all other Municipalities).

Thus, based on affordability considerations and current incomes there is some leeway for an increase of fees. However, it should be noted that the above table shows the maximum affordability benchmark of 1.5 % of average household income; in general, a benchmark of around 1 % of average household income is more appropriate.

Anyhow, it is reported that the willingness to pay the tariffs/ the fee collection rate is comparatively low: At the beginning of 2020 both urban Municipalities Tetovo and Gostivar mentioned an overall fee collection rate of about 40 %. In the rural municipalities, where concessionaires are providing collection services, the fee collection rate is considerably higher⁵, but the percentage of population served is lower. All in all, it is assumed, that the average fee collection rate in the Polog is about 40 % (percentage of

⁵ The higher fee collection rate in rural areas is mainly due to the fact that private operators collect fees directly from their customers, while customers who don't pay do not receive services.



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waste generators paying waste fees). This low fee collection rate seriously hampers the possibilities for investments in the waste management system.

Fee collection rate/ willingness to pay are mainly affected by the quality of services provided to the citizens. With improved services the population might also be willing to accept higher fees. Still, with regard to the implementation of advanced waste management, aspects of affordability and financial sustainability are to be considered as a limiting factor.

2.3.8 Waste Management System Performance

Data regarding collected waste amounts are not accurate; therefore, it is not possible to reliably calculate unit costs (costs per ton) for waste management services.

Considering the scale of service provisions, as the key activities are limited to collection, transport and dumping of waste, the tariffs in Gostivar and Tetovo are relatively high. The equipment is often in poor condition and purchased without strategy which leads to non-compatible technologies and an inefficient work-flow.

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

2.3.9 Key Challenges and Shortcomings

Overall, waste management services in Polog Region are not complying with the national regulations or international standards.

Outdated and partly inappropriate collection vehicles, the poor conditions of collection points and the low fee collection rate hamper the collection service in the region. Furthermore, there is a deficit in planning and monitoring at all levels and overstaffing and insufficient qualification in public utilities.

The biggest challenge in the current waste management system, 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 to transport collected waste over the regional borders to the Skopje region (because of blockages), resulting in high transport and disposal costs
- Indiscriminate dumping of waste with uncontrolled dumpsites in all municipalities



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- Non-availability of approved locations for disposal of construction waste, causing uncontrolled dumping.
- Lack of funding as main reason for the deficits in service provision

Financing of improved waste management will be a key challenge. Based on affordability considerations there are only 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.

Successful project implementation will require:

- Political will and cross-party consensus to adopt new legislation and institutional reforms for waste management,
- Cooperation between the municipalities,
- Readiness of municipalities to provide the agreed funding and the required support for agreed improvement measures,
- Readiness of municipalities to contribute to reliability and accuracy of waste management data,
- Municipalities support future increase of affordable tariffs for waste management services

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3 Option Analysis

3.1 Improvement of Waste Collection

3.1.1 Assessment of Options for Improvement of Waste Collection

Different options for the improvement of waste collection, including separate collection of source separated waste fractions, are presented and assessed in this chapter. The most appropriate and therefore proposed option will be elaborated in details, including conceptual designs and cost estimates, in section 4.1.

3.1.1.1 Improvement of Mixed Waste Collection Services

The Regional Waste Management Plan of Polog Region (RWMP) requires the improvement of collection services to be a focal area in the short-term implementation period. The collection rate shall increase from 82% at the current state to 90% by 2024 and 100% by 2029. For this purpose, the RWMP anticipates the procurement of new collection equipment to replace most of the equipment currently used for waste collection which is mostly far beyond the economic lifetime and in many cases no longer fit for purpose. Further investments will be made for upgrading waste collection points.

In general there are two options for the collection of waste: house-to-house collection (kerbside collection) and drop-off collection (bring system). Both methods are used in the region. The advantages and disadvantages of both systems are listed in the following table.

Table 6 Comparison of house-to-house and drop-off collection

House-to-house collection	Drop-off collection
Clear waste ownership	Indefinite waste ownership
Best possibility to apply polluter-pays principle (individual charging)	Tariffs cannot be linked to the amount of waste generated per waste generator
Clean collection spots and long-lasting bins	Due to missing ownership, drop-off locations might be dirty and a possibility of vandalism & theft
High space requirement per waste generator (especially in urban areas; locations for bins and containers have already to be considered during planning and construction of buildings)	Lower space requirement
All waste types can be collected	Less suitable for certain waste types, like organic waste from households/ food waste
High costs (particularly in rural areas with long distances between two collection spots)	Lower costs

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The common sizes of the containers are 120/240 litre and 1.1 m³. In bring system mostly large containers such as 1.1 m³ wheeled bins are used. While the smaller containers are made of plastic, large containers are often made of steel. However, the more economical plastic containers are less suitable for drop-off collection due to risk of fire and other kind of damage.

The large containers are normally used by several households and thus it might happen that nobody takes care of the condition of the container or the location. Furthermore, nobody wants to have waste containers located next to her/his house. In this respect, small containers for each household might be used in areas where sufficient space is available at each household.

The steel round lids as currently available in the project region are heavy and difficult to use. In most cases, the lids are not closed or removed (or stolen because of their scrap metal value). Another weak point of the steel containers used in the region is the swivel caster wheels, which often get broken by moving of full containers on uneven grounds (see Figure 7). Therefore, it is suggested to procure containers with heavy-duty casters with a sturdy connection between the top plate and the container, to use flat lids made of plastic, which can be replaced with low costs in case of damage, and to pave the drop-off points where the containers are located.



Figure 7 Steel containers 1.1 m³ used in the project region without lids and partly broken swivel caster wheels

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Figure 8 Round lid versus flat lid on steel containers with 1.1 m³ volume

To empty the large containers, compaction trucks with varying capacities shall be provided. There are three types of compaction vehicles; rear loader, side loader and front loader. While side loaders can empty bins up to 1.1 m³ capacity, the rear loaders with special attachments might empty larger containers as well. The front loader can empty containers with capacities from 2.5 m³ to 10 m³ and is thus suitable to collect commercial waste. The use of side loaders requires properly paved roads and sidewalks and a good cooperation of the waste generators so that they bring their bins to the correct positions for emptying before the arrival of the collection vehicle.



Figure 9 Compaction vehicles: left a large and right a small vehicle

While the large containers can be emptied by compaction trucks with a simple lifting device, for small containers a more advanced lifting device, normally referred to as a comb-lifter, is necessary. The initial investment costs will be higher, but due to less maintenance because less heavy bins are handled by the device, the total costs will be less over the years. Typically, modern waste collection vehicles can empty both type of containers.

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When using small containers, the collection speed per hour will be lower due to more frequent emptying operations. However, the collection frequency can be decreased because of a larger container volume available for each household.



Figure 10 Small waste containers and collection vehicle with suitable lifting device

Another option to collect waste is to combine the use of small tipping trucks and compaction trucks. Small trucks have a better manoeuvrability and can therefore be more suitable for waste collection in areas with narrow, winding roads. However, in case of long transport distance to a transfer station/ landfill, direct transport using small vehicles might not be economical due to the low loading capacity. This can be optimized by collecting the waste in two steps: Primary and secondary collection. In the primary collection waste is collected from the containers using small tipping trucks, which is followed by the secondary collection where the small trucks bring and unload the collected waste into a large compactor truck, as displayed in the following figure. The large compactor truck will then bring the waste to a transfer station or landfill.

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Figure 11 Secondary collection: A small waste truck off-loads the waste into a larger compaction truck

Table 7 compares the capacities of large and small compaction trucks as well as small tipping trucks considering two shifts operation at six days of the week.

Table 7 Minimum capacities of selected collection vehicles

Parameter	Unit	Large compaction vehicle	Small compaction vehicle	Tipping Truck
Capacity	m ³	18	8	6
Density	t/m ³	0.5	0.45	0.3
Average filling rate		90%	90%	90%
Capacity	t/trip	8.1	3.24	1.62
Number of trips per day	t/d	2	2	2
Working days	d/week	6	6	6
Working weeks	week/a	52	52	52
Availability	%	80%	80%	80%
Annual capacity	t/truck/a	4,044	1,617	809

Furthermore, two scenarios can be elaborated in implementing waste collection regarding the responsibility and organizational set-up:

- Each Municipality collects their own waste with their own vehicles (waste collection as local activity)

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- A regional entity collects waste in all nine municipalities (waste collection as regional activity).

The following table summarizes the characteristic of each scenario.

Table 8 Comparison of implementation of waste collection as local and regional activity

	Local Activity	Regional Activity
Organizational aspects	Clear assignment of responsibility. Each municipality is responsible to collect the waste and maintain the drop-off points which are located within the territory of the municipality itself.	Assignment of responsibility in waste collection and maintenance of cleanliness of the waste collection infrastructure is more complex since the regional entity is implementing the waste collection but municipalities have authority and are still responsible for the public service of their territory.
Utilization of resource	More vehicles are required.	Fewer vehicles are required.
Response to report and complaint from residents	Direct communication and immediate response to reports and complaints from the residents because the occurrence takes place within the municipal territory.	Late response to reports and complaints due to more complex organizational set-up between regional entity and municipal authority
Acceptability	The larger municipalities would like to continue with waste collection by their local public utility companies.	Regionalisation of waste collection is supported only by some of the smaller municipalities

Implementation of waste collection as a regional activity has the main advantage of a lower required number of vehicles due to better utilization compared to the implementation as local activity where each municipality has their own vehicles. For the Polog region, the required total number of trucks could be reduced by 16% if the waste is collected by a regional entity. Such a reduction foresees a proper organisation of the collection services which might be difficult to achieve for a newly established regional entity.

In the scenario of implementation of waste collection as a regional activity, the responsibility for the implementation will be at the regional SWM entity while on the other side performance of this activity has a direct impact on the local situation and to the daily lives of the population within a territory under the authority of the local government. A well-established organisational and operational structure is required to ensure a smooth implementation.

At this point in time there is insufficient support for handing over waste collection to a regional entity.

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3.1.1.2 Separate Collection of Dry Recyclables

The RWMP sets a target for separate collection of recyclables, namely 50% of households shall have access to separate collection of recyclables by 2024. In order to reach this several methods are proposed in the RWMP:

- Separate collection scheme in cooperation with companies licensed for collective schemes of recyclables management (licensed collective handlers)
- Concept for separate collection at source developed together with the concessionaires and public utility companies
- Separate collection of recyclables in cooperation with informal sector and/ or NGOs
- Buy-back-centres
- Material Recovery Facilities (MRF) / Sorting Plants

Currently, some activities in separate collection of recyclables have been started on small scale in Polog Region. The collective handlers in the Macedonian EPR system, including PAKOMAK and ELKOLEKT, organize the separate collection of glass waste in depot containers and paper and cardboard as well as plastic bottles in mesh boxes installed on the roadside as shown in the following figures.



Figure 12 Depot containers for glass waste installed on the roadside in Gostivar City

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Figure 13 Mesh wire boxes for separate collection of PET bottles and cardboard waste

According to the Consultant's observation in field, the current implementation indicates active participation of the population. They are already disposing the waste glass in the provided depot containers. However, the containers are made of a type of plastic material, which can be easily damaged in the utilization.

Considering these existing activities and experiences, an assessment of options for separate collection of various types of waste has been made. Technical options for separate collection of recyclables are in general similar to the options for collection of mixed MSW as described in the previous chapter. The following table summarises the suitability of various collection systems for different waste types.

Table 9 Suitability of collection systems for main waste types

Waste type	House-to-house Collection		Bring System		
	Plastic bags	Individual bins	1100 litre wheelie bins	Depot containers	Underground containers
Mixed household waste	✓	✓	✓	⚠	✓
Paper & cardboard	⚠	✓	✓	✓	✓
Glass	⚠	✓	✓	✓	✓
Packagings	✓	✓	✓	✓	✓
Organic (food) waste	✗	✓	✗	✗	✗
Textiles	✗	✗	⚠	✓	⚠
WEEE	✗	✗	⚠	✓	⚠

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The following figure presents the available options for separate collection. Systems like large four-wheel containers (up to 7 m³) and underground containers are not considered because of the high costs compared to low recyclable quantities.

Table 10 Separate collection system available

<p>Plastic bags with 70 to 120 litre volume (in combination with containers for heavy materials like glass and paper /cardboard)</p>		
<p>Depot containers with 1.5 m³ to 5 m³ capacity, with single or multiple chambers;</p>		
<p>Four-wheel containers with volumes up to 1100 litre, with different lid apertures for different kind of waste;</p>		

In the following table, the benefits and disadvantages of each system are compared considering the technical, environmental and social aspects.

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Table 11 Comparison of the alternatives for separate collection

Drop-off centres with depot containers	Kerbside collection with standard or specialised containers	Kerbside collection with plastic bags
System has been implemented on small scale and accepted well.	Experience in kerbside collection of paper and cardboard waste in front of shops using mesh wire boxes.	Plastic bags are suitable only for certain types of waste, e.g. packaging waste.
Only one driver is required for the collection and transport	At least two workers are required for the emptying of containers	At least two workers are required for the collection of bags
Higher investment costs because of specialised vehicle and depot containers	New containers must be purchased, existing vehicles might be used	Plastic bags must be purchased, existing vehicles might be used
An additional vehicle might be needed as reserve vehicle	Maintenance & repair times of vehicles can be overcome with existing vehicles	Maintenance & repair times of vehicles can be overcome with existing vehicles
Higher costs for preparation of container sites	Lower costs for preparation of container sites	No investment for container locations
If the pilot project will not be successful, the containers cannot be used for any other purposes and vehicles have to be modified	If the pilot project will not be successful, the standard containers can be used for the collection of residual waste	If the pilot project will not be successful, there will be no loss of investments
Attractive containers symbolising developed waste management and easily distinguishable	Same kind of standard containers (in spite of remarkable labelling) can cause a mistake by throwing of waste Recyclables stored in specialised containers such as mesh wire boxes are visible from outside and therefore can prevent mistakes by throwing other waste.	Problem of space in apartments
At low acceptance, the containers will be a target of vandalism	A lock might be necessary to prohibit unauthorised access to the recyclable materials	Plastic bags can be misused or damaged by street animals
Low participation, but better separation	Low participation, but better separation	Strong participation in separation of packaging waste, but high misthrow quote

Depot containers are a symbol for separate collection of recyclables all over Europe. However, their use is only economically feasible, if sufficient quantities of recyclables are available and the population is willing to participate. The major disadvantage of depot

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containers is the requirement for a specific vehicle with a loader crane⁶. In this respect, the roads leading to the containers shall be wide enough and always accessible. In order to overcome the maintenance and repair times, a further vehicle might be necessary as reserve vehicle.

A separate collection system with plastic bags requires low investment costs. However, the operation will cost more compared to drop-off system due to increased operational time and driving distance required to pick up the plastic bags from the roadside or from each house. Therefore, the total costs of this system can be higher than the drop-off system. Furthermore, the most important issue for a successful implementation is the acceptance and willingness by the population to participate.

The main drawback of the standard containers is the high impurity because of confusion between the residual waste containers and recyclable containers. This can be prevented by using different colours for the containers and/or to use mesh wires for the front and/or rear sides of the containers to make the recyclables visible from the outside.

With regard to institutional options for the implementation of measures for separate collection of recyclables, two main activities are to be considered: EPR organisations or municipalities. An assessment and comparison of these options is given in the following table.

Table 12 Comparison of institutional options for separate collection of recyclables

EPR Organisations	Municipalities
The operation area is either a whole region or country.	Only the municipal area is covered.
Due to a larger operation area, higher quantities of recyclables can be collected and economy of scale effects can be realised.	Particularly in small municipalities, the waste quantities might not be sufficient to implement separate collection activities.
Due to concentration in certain type of waste, the services can continuously be improved.	A limited special attention can be paid to the separate collection activities.
EPR organisations might have better possibilities for marketing of recyclables due to direct contacts to potential off-takers.	The marketing of the recyclables might be a challenge.
Better prices for recyclable materials can be achieved.	The prices, particularly for low quality materials, would be low.
In case of outsourcing certain services, EPR organisations would have better contract conditions.	Private companies might not be interested in separate collection services because of low quantities and payments.

⁶ For this reason, the collection of glass from depot containers, provided as part of the EPR scheme, is conducted by a private company engaged by PAKOMAK and not by the public or private waste collection companies operating in the general waste management system of the Polog Region.



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EPR Organisations	Municipalities
The transport of recyclable materials from distant regions to the recyclers can be organised at comparatively low cost.	The transport costs might be very high if the collected quantities are not sufficient.
Professional public relations and awareness raising activities can be provided.	The share of costs for PR activities might be high in the total costs for separate collection activities.
The knowledge and experience gained in one region can easily be transferred to other regions.	Individual efforts will be necessary to make use of experiences from other regions and municipalities.

The comparison above shows, that the organisation of separate collection activities at regional (or even national) level by EPR organisations has many benefits compared to local organisation by individual municipalities. Usually, there is a general assumption that the recycling activities are profitable activities and the municipalities are eager to implement these activities themselves. Apart from the fact, that the possibility of making profit depends on various factors, the public enterprises often fail in separate collection activities due to lack of knowledge, marketing possibilities, and public relations. Particularly in small municipalities, the lack of skilled staff could be a bottleneck for successful implementation of separate collection activities.

The available options for the separate collection of organic waste are the small bins (usually 240 litre), 1.1 m³ containers, and in case of green waste bulky collection from the streets and drop-off locations (mostly compost plants). As good quality compost requires an input with only a small amount of impurities, the separate collection of organic waste is the most challenging separate collection activity. Therefore, as described in chapter 3.3, a pilot project for composting is recommended in order to test the framework conditions for collection and treatment of organic waste. This pilot project foresees the collection and treatment of green waste. It assumes that the waste generators will deliver the waste to the compost plants and the municipalities will organise additional tours for separate collection of green waste at certain times of a year.

3.1.2 Recommendation for Improvement of Waste Collection (incl. Separate Collection)

3.1.2.1 Improvement of Waste Collection Services, incl. Extension of Service Area in Rural Areas

In general, house-to-house collection with small bins has more advantages regarding the clear waste ownership, the application of polluter-pays-principle and less wild dumping of waste. Furthermore, this collection system is currently implemented in parts of the municipalities. Therefore, it is suggested to continue and extend the house-to-house collection using 120 l bins. However, waste collection in municipal centres with multi-



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storey buildings is proposed to be implemented using bring-system in 1.1 m³ containers due to the limited available space.

In order to have a cost-efficient implementation, large compaction trucks with a capacity of 18 m³ are considered for waste collection from municipal centres and other settlements in which the roads are well established. In order to reach areas with narrow roads in the urban centres of Tetovo and Gostivar and the surrounding agglomeration, small compaction trucks (8 m³) are suggested. Mixed MSW in villages in the mountainous areas with narrow and/or unpaved roads will be collected in two steps: Primary and secondary collection. In the primary collection, waste containers will be emptied using small tipper trucks (6 m³) since they give more flexibility in operation. Then, the tipper trucks will bring and off-load the collected waste to a large compaction truck with a capacity of 18 m³, which after being fully loaded will transport the waste to a Transfer Station or Rusino Landfill.

More details on the conceptual design for collection of mixed municipal solid waste are provided in section 4.1.

3.1.2.2 Separate Collection of Dry Recyclables

In section 3.1.1.2, ongoing initial activities in separate collection in the region are presented which include separate collection of glass waste in depot containers, PET bottles in mesh wire boxes on roadsides and paper and cardboard waste in mesh wire boxes in front of shops. Since these activities are accepted quite well by the residents, it is recommended to continue the separate collection of these materials, in close cooperation and coordination with the collective handlers responsible for the implementation of the EPR schemes, and extend the collection activities to other areas. In order to achieve the recycling targets, other type of recyclables, like all packaging waste incl. metals, shall be collected as well. Furthermore, the recycling activities target not only commercial entities, like in case of paper and cardboard currently, but also the households.

Regarding the collection of glass waste, organised by PAKOMAK, it is recommended to procure steel depot containers instead of plastic containers if new containers are required⁷. The steel containers are more appropriate for heavy duty use and more durable.

The current separate collection of PET bottles shall be extended to cover other types of packaging waste (plastic & metal waste). Since the emptying of mesh wire boxes, as used

⁷ Procurement of new depot containers will, most likely, be the responsibility of the collective handlers, e.g. PAKOMAK. However, the investment costs are part of the overall system costs and will be regarded as such in this document.



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in the current separate collection of PET bottles, can only be done manually and therefore requires much time and effort, implementation of separate collection of packaging waste, which will be extended to a larger scale, is proposed to use standard containers of 1.1 m³ capacity. These containers are compatible with the lifting device of compaction trucks and therefore less time is required in the emptying process. In order to prevent contamination of other waste thrown into the containers, the front side shall be of mesh wires so that the inside of the containers is visible from the outside.

In addition to the current collection of cardboard waste from the shops, it is suggested to also collect paper and cardboard waste from households separately. Due to the higher amount of packaging and paper & cardboard waste, it is recommended to use containers which can be emptied using compaction trucks in order to have an efficient collection and transport. Therefore, standard steel containers with 1.1 m³ volume are considered. The containers can also be modified with mesh wire on the front and back sides in order to make the collected paper & cardboard visible from the outside.

Considering the long-distance transport to Skopje and the higher amount of packaging waste and paper & cardboard waste, compaction trucks are proposed for the collection of these recyclables. The depot containers for glass waste shall be emptied by hook-lift trucks with a special lifting device (hoist).

More details on the conceptual design for separate collection of dry recyclable waste are provided in chapter 4.1.1.2.

3.2 Waste Transportation and Transfer

3.2.1 Assessment of Options for Waste Transfer and Transport

Generally there are two options for the waste transport:

- Direct transport with collection vehicles
- Transport via transfer station with long distance transportation trucks

Since the load capacities of the waste collection vehicles are mostly lower than the capacities of transportation trucks, over certain distances it is more economical to use transfer stations and transportation vehicles. The transportation trucks require low maintenance compared to compaction trucks and the full operational capacity of the compaction trucks can be used for waste collection for which they are actually procured.

With the direct transport of the waste, each municipality would be responsible for the transport of their waste to the landfill. On the one side, this would avoid an additional interface between municipalities and transfer station operator, on the other side, due to

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higher requirement for vehicles and staff, the management effort of the municipalities might increase. Although the site requirements for transfer stations are less compared to the landfills, allocation of a suitable site might be a long lasting process, because of closeness to the settlement areas and complaints from the population. Since one transfer station might be used by more than one municipality, the ownership and operation of the transfer station including transport must be clarified in advance.

The typical transportation trucks for municipal waste are hook-lift trucks transporting one or two roll-on/roll-off containers with ca. 30 m³ capacity each and tractors with semi-trailers with ca. 60 m³ capacity. Roll-on/off containers and semi-trailers are available with larger capacities and with compaction units; however, the allowable gross vehicle weight is mostly the limiting factor to transport larger amounts of waste.



Figure 14 Hook-lift truck with two and one roll-on/off container

In order to make better use of vehicle payload, the compaction units for roll-on/off containers can be installed at the transfer stations as stationery compactors. Thus one compactor for each loading point (container place) or a shifting plant (for containers or compactors) shall be installed. The high investment and operating costs can only be justified by high waste amounts to be transported.

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Figure 15 Fully enclosed transfer station with a shifting plant

The compaction unit of the semi-trailers might be driven by the engine of the tractor or by a separate engine. The benefit of the latter is the possibility to operate the compaction unit without the tractor, e.g. when it transports another semi-trailer to the landfill. In contrast to this benefit, the capacity of the semi-trailer is reduced due to volume and weight of the separate engine. Furthermore, compacting semi-trailers require high maintenance and in case of failure of the compaction unit, the entire trailer is out of operation.

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Figure 16 Tractor and a semi-trailer with a self-driven compaction unit

In order to compare the economic performance of the various options, the specific costs per tonne have been calculated considering following assumptions:

Table 13 Assumptions of key variables for transportation cost calculation

Item	Value	Unit
Investment Costs		
8 m ³ compaction truck	85,000	EUR/vehicle
18 m ³ compaction truck	120,000	EUR/vehicle
30 m ³ hook-lift truck	90,000	EUR/truck
30 m ³ hook-lift truck with trailer	120,000	EUR/truck + trailer
60 m ³ semi-trailer truck with compaction unit	165,000	EUR/truck
Transfer station	350,000	EUR
Transfer station for semi-trailer	400,000	EUR
Operating Costs		
Fuel price	1.10	EUR/l
Working days	312	d/a
Effective working hours	7	h/shift
Salary Driver	5,520	EUR/a
Transfer station O&M costs	4%	of investment costs

As semi-trailer trucks have a larger minimum turning curve than hook-lift trucks, a transfer station with semi-trailers for long distance waste transport should be sited on a larger area. Therefore, higher investment costs for the transfer station are considered.

Following table gives the assumed capacities of the assessed trucks per trip.



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Table 14 Capacity of the assessed trucks per tour

Truck type	Capacity per trip (t)
8 m ³ compaction truck	3.6
18 m ³ compaction truck	8.5
30 m ³ hook-lift truck	9.0
30 m ³ hook-lift truck with trailer	18.0
60 m ³ semi-trailer truck	20.0

The hook-lift truck with trailer has a total volume capacity of 60 m³, without mechanical compaction. The semi-trailer truck should have a compaction unit. However, the waste to be delivered to the transfer station will already be compacted during the collection. Due to the gravity effect a certain compaction will take place in the roll-on/off containers as well. In comparison, the semi-trailer trucks will not be able to further compact the waste which has a high organic content and moisture. As above mentioned, the gross vehicle weight will also limit loading and compaction of much higher quantities of waste. According to Macedonian traffic regulations, the trucks with three axes may have a maximum, gross vehicle weight of 24 tonnes, while it is for trucks with five or more axes 40 tonnes. Consequently, the benefit of the semi-trailer in respect of payload compared to the hook-lift trucks with trailers will only be around 11% (two tonnes per trip).

In the following figure, the specific costs of waste transport by various options are compared. While the compaction trucks transport the waste directly to the landfill, the hook lift trucks and semi-trailer trucks transport the waste from the transfer station to the landfill. For the compaction trucks only the costs of the transport without collection are considered.

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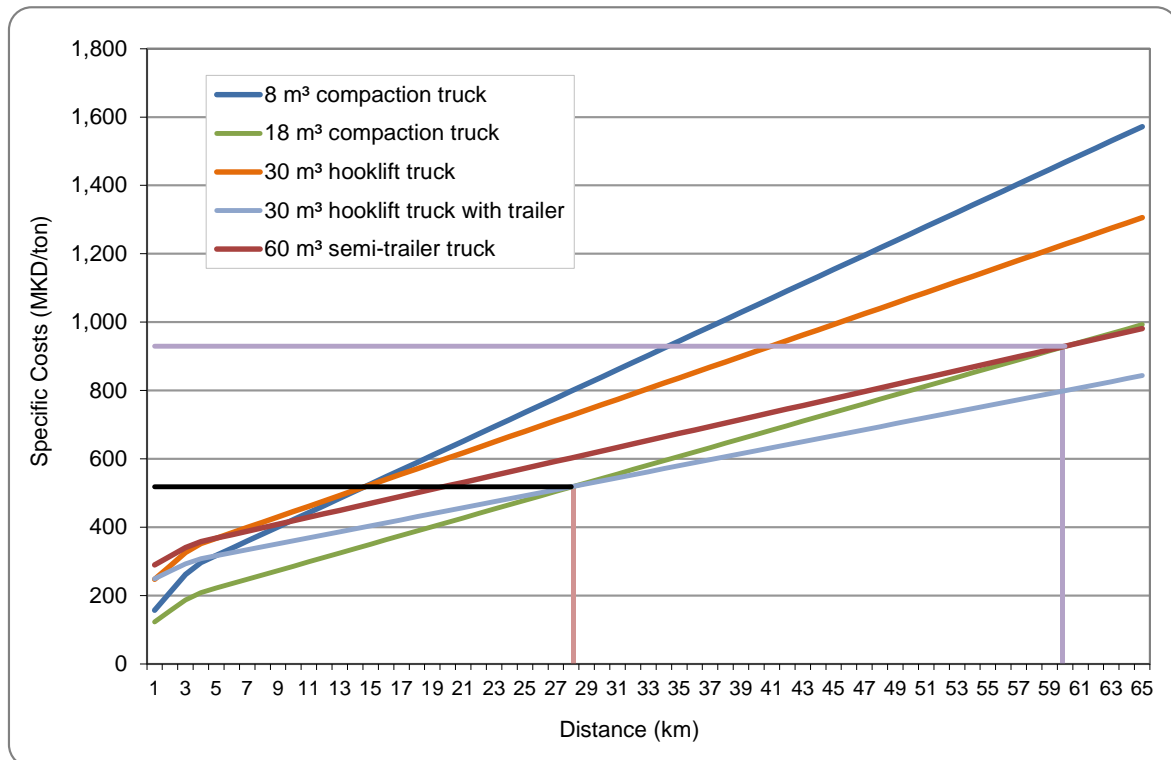


Figure 17 Comparison of specific costs for different trucks

The transport with 8 m³ compaction trucks and hook-lift trucks with only one 30 m³ container will be much more expensive than the other options. Compared to the direct transport with 18 m³ collection vehicles, the hook-lift trucks with trailers and semi-trailer trucks will be more economical for distances higher than 28 km and 60 km respectively.

For the transfer process, there are different alternatives; push-pit transfer (loading with a bulldozer or wheel loader), direct dump transfer (open top containers or trailers), or compactor transfer stations (as mentioned before).

A push-pit (or surge pit) transfer station has the advantage to store peak waste flow and thus to reduce the number of transport containers or trailers. However, with the operation of an additional machine (bulldozer or wheel loader) additional operating costs are generated. The temporary disposal of waste on an open area might generate environmental emissions; like odour, dust, and flies, and this might result with public resistance.

In direct dump transfer, waste is unloaded directly into the open top roll-on/off containers or semi-trailers. For this purpose, a transfer station with two levels; base level for the transport containers and trucks and a ramp level for the waste collection trucks, shall be constructed.

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At the compactor transfer stations, waste is usually unloaded into the hopper of the compaction unit and pushed into a container or trailer. In order to have continuous operation, at least two compaction units shall be available in case one unit requires maintenance or repair.

3.2.2 Recommendation for Waste Transfer and Transport

According to the results of the economic analysis of various modes of transport as presented in Figure 17, for the following municipalities the transport of waste via a transfer station would be more economical.

Table 15 Distances between the municipal centres and the Rusino landfill

Municipal Centre	Distance to Rusino Landfill [km]	TS required?
Teartse	48	Yes
Jegunovtse	53	Yes
Tetovo	33	Yes
Zhelino	41	Yes
Brvenitsa	33	Yes
Bogovinje	25	No
Vrapchishte	14	No
Gostivar	10	No
Mavrovo and Rostusha	30 - 60	No

The distances presented above are between the municipal centres and the Rusino landfill. If the settlements in the opposite direction of the landfill are considered as well, the necessity of a transfer station is even more obvious.

The distances between the Rusino landfill and Mavrovo and Rostusha are 30 km and 60 km respectively. If a new access road to the landfill would be realised from the south, the distances would be 10 km less. In the municipality of Mavrovo and Rostusha, about one third of the waste is currently collected in Mavrovo and the rest in Rostusha. Because of the low total waste quantities to be transported, a small transfer point instead of a full scale transfer station could be considered. On the other hand, considering a compaction truck with 18 m³ capacity, only one tour per day will be necessary. Therefore, as presented in the section 3.1.1.13.2.1, collection of waste in the villages with small tipper trucks and transfer into a large compaction truck is considered for this municipality. The compaction trucks shall then directly transport the waste to the Rusino landfill.

This transport concept is presented in the following map.

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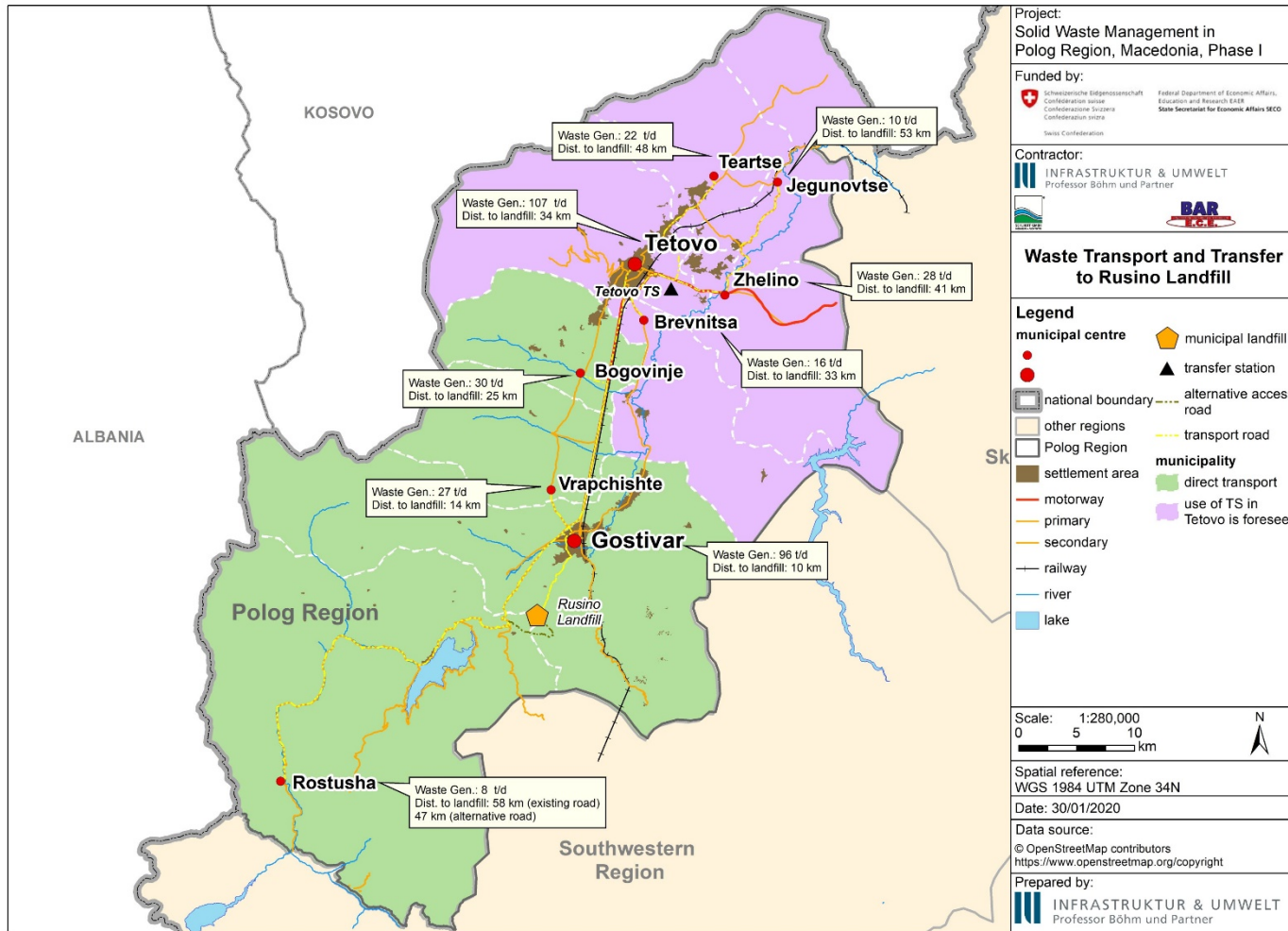


Figure 18 Waste transport concept



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As presented in Figure 17, the utilisation of semi-trailers with compaction units would be economical for distances above 60 km. Also considering the low waste quantities, a transfer station in Tetovo would not be economical compared to direct transport. However, hook-lift trucks with roll-on/off containers can be operated more economical than the compaction trucks and semi-trailers. The main weak point of the semi-trailers is their low availability due to high maintenance requirements. Always a spare truck and trailer should be available in order to ensure a continuous operation. In contrast, the hook-lift trucks as well as the roll-on/off containers are low-maintenance equipment with low investment costs. Therefore, hook-lift trucks carrying two roll-on/off containers are recommended for the transport of waste from Tetovo transfer station to the Rusino landfill.

Given the fact that the additional transport and the disposal in a sanitary landfill will considerably increase the costs of SWM, the design of the transfer station must be as simple as possible to allow a cost efficient operation. Since the waste quantities to be transferred and transported in the region are relatively low, a transfer station where the waste is directly loaded into the transportation (roll-on/off) containers is the most suitable solution.

3.3 Waste Treatment

3.3.1 Assessment of Options for Waste Treatment

In the RWMP various options for waste treatment have been presented and assessed regarding their viability for Polog Region. According to the RWMP treatment of organic waste shall start with implementing pilot projects on green waste composting and home composting. According to the targets presented in the RWMP, 25 % of the households shall have access to separate collection and treatment of bio-waste by 2026.

In the following, options and requirements for green waste composting, implemented through public services, will be described.

The general aims of the pilot composting projects are:

- to evaluate the feasibility, costs, adverse impacts and the like, prior to large-scale implementation of the separate collection and treatment of bio-waste (and thus to avoid wasting of time and money on an inadequately designed, full-scale composting project);
- to introduce the residents of Polog Region to separation and recovery of organic waste;
- to reduce the amount of organic waste going to landfill in a cost effective way;

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- to develop competences and experience in the production and marketing of (high quality) compost;
- to make necessary adjustments and improvements to the envisaged approach for collection and composting.

In the following chapters the technical options for green waste composting in Polog Region will be presented. The preferred solution will be described in detail in chapter 4.3.

3.3.1.1 Assessment of Technical Options for Composting of Green Waste

There are numerous different composting technologies; from simple heap composting to open windrow composting with forced aeration to fully automated indoor plants. Another process, which is getting increasing attention, especially with regard to electricity production and CO₂ avoidance, is the digestion of organic waste.

In the following sub-chapters three different options for organic waste treatment will be briefly presented and assessed with regard to the planned green waste composting in Polog Region:

- Open windrow composting
- In-vessel composting
- Anaerobic digestion

Open Windrow Composting

Open windrow composting is the traditional method for composting, which is used by farmers and gardeners.



Figure 19 Windrow composting of green waste

In general a windrow composting plant of the envisaged size consists of a delivery and screening area, a composting area, a curing area, and a storage area. For the turning and

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transport of the material within the plant a skid loader or specialized compost turner is required. The screening of the mature compost is carried out in a screening machine (either mobile or stationary). For the shredding of coarse parts (e.g. tree branches and trunks) a shredder is used. Small scale equipment like thermometer, pH-meter, CO₂-meter is required to control the composting process.



Figure 20 Pull-type windrow compost turner⁸ (l.), chipper⁹ (middle), drum screen¹⁰ (r.)

Simple windrow composting without active aeration is the least cost solution already suitable for very small composting plants; in contrast, open windrow composting is not recommendable for the treatment of kitchen waste and food waste because of issues with emissions, odour and leachate as well as the infestation of flies, birds and rodents.

The specific initial investment costs are usually in a range of 80 to 120 Euros per ton related to the design capacity¹¹. Operational costs are in a range of 10 to 20 Euros per ton (related to the input).

In-vessel Composting

In-vessel systems provide a controlled environment for the composting process, either in a closed building, in modular containers, in drums etc. Usually these systems come along with special devices for turning of the compost, automated aeration and watering, as well as the treatment of exhaust air. These facilities have clear advantages with regard to space requirements and emission control. Encapsulation and treatment of exhaust air allows composting of organic waste from kitchens, restaurants and food processing. There are various technical solutions available, with different stages of technical complexity and automatization.

⁸ Source: <http://www.compost-systems.com/en/green/maschinentchnik/agrarlinie>

⁹ Source: <https://www.lectura-specs.com/en/manufacturer/husmann/983082>

¹⁰ Source: <https://www.pyme.pe/hidromin>

¹¹ Assuming a design capacity of 5000 tons per year, initial investment would be between 400,000 to 600,000 EUR

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Figure 21 Examples for in-vessel composting

Initial investment costs are usually several times higher than for open windrow composting. Therefore, these systems are only recommendable from a certain plant size; for economic operations usually 10,000 t/a are considered as minimum input.

The specific initial investment costs are usually in a range of 180 to 220 Euros per ton related to the design capacity¹². Operational costs are normally about 40 Euro per ton (related to the input).

Besides comparably high initial investment and operation costs, there is a need for skilful operations, especially with regard to the maintenance of the technical equipment.

Anaerobic Digestion

In general, anaerobic digestion (AD) is a stabilization process of organic substances in a sealed environment (in order to prohibit oxygen intake). AD can be used as a stand-alone solution or combined with (successive) composting. With respect to energy and material recovery, the main targets of this technology option are the generation of biogas (production of electricity and heat) and the production of an arable soil conditioner.

To ensure a stable degradation process several prerequisites are essential in addition to the exclusion of oxygen, inter alia the operating temperature, mixing and feeding of the reactor. There are various different technologies for anaerobic digestion, i.e. wet and dry fermentation, continuous feeding or batch systems etc. For green waste, the preferable solution would be *dry fermentation* in a batch system (see following figure).

¹² Assuming a design capacity of 10,000 tons per year, initial investment would be between 1,800,000 to 2,200,000 EUR

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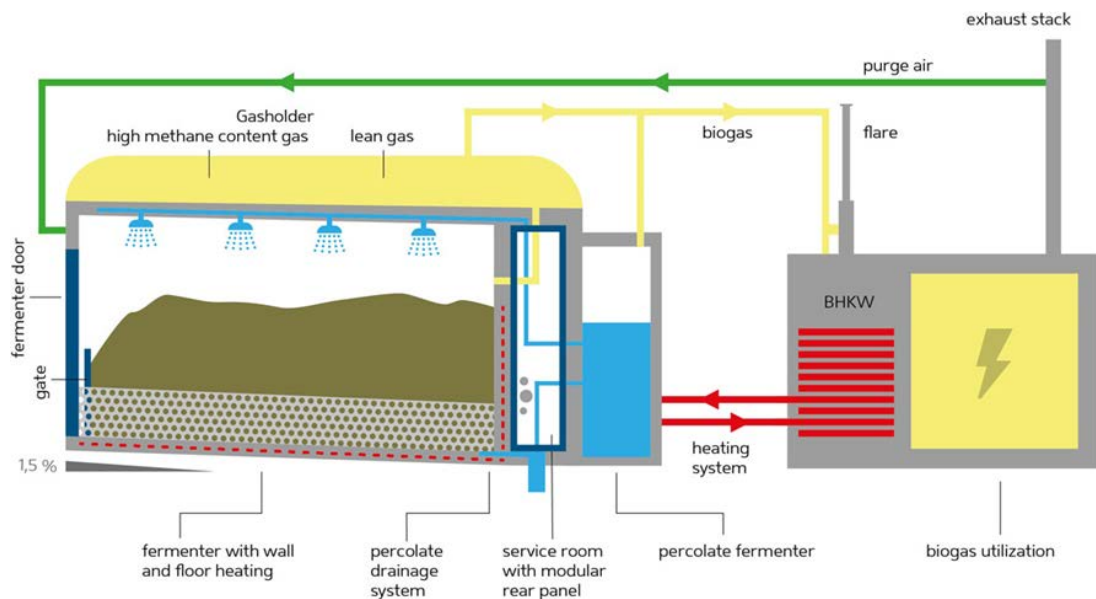


Figure 22 Example for dry digestion with “Bekon” process (www.bekon.eu)

The costs for AD mainly depend on the technology type and design parameters being used. Batch AD is less complex and hence less expensive compared to continuously operated digesters and the risk of failure is limited. The specific initial investment costs are usually in a range of 200 to 300 Euros per ton related to the design capacity¹³. Operational costs are normally about 50 Euro per ton (related to the input).

Although the marketing of biogas (electricity and heat) may generate revenue, the overall costs for AD are usually higher than for aerobic stabilization, unless there are specific subsidy schemes, e.g. for feed-in of electricity and/ or CO₂ savings.

Besides comparably high investment and operation costs, there is a need for a high degree of monitoring and control regarding the treatment conditions, operation settings and maintenance of the digestion process.

3.3.2 Recommendation for Green Waste Composting

In the table below, a summary of the economic aspects of the presented options for green waste composting in Polog is shown.

¹³ Assuming a design capacity of 5,000 tons per year, initial investment would be between 1,000,000 to 1,500,000 EUR

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Treatment Option	Prerequisites	Throughput (minimum amount for economic operations) * Flexible: Technology can be adapted to input	Specific Initial Investment Costs (related to the annual throughput)	Initial Investment	Specific Net Costs ** including revenues Related to the annual throughput	Remarks
Windrow composting plant	Separate collection of organic waste, market for compost	Flexible*	120 EUR/t (5,000 t/a)	600,000 EUR	15 EUR/t**	Additional costs for separate collection of organic waste to be considered
Automated in-house composting	Separate collection of organic waste, market for compost	> 10,000 t/a	220 EUR/t (10,000 t/a)	2,200,000 EUR	40 EUR/t**	
Anaerobic digestion	Separate collection of organic waste, market for compost and possibilities for feed in of heat and electricity	Flexible*	275 EUR/t (5,000 t/a)	1,375,000 EUR	50 EUR/t**	

Figure 23 Summary of the economic aspects of different options for treatment of green waste in Polog Region

Due to the recommended approach to start the introduction of composting activities first on pilot-scale for separately collected garden and green waste, at the beginning, priority will be given to technologies with comparably low investment and operation costs. As a result of the assessment presented above, windrow composting is the preferred technical option. Besides the low cost for investment and operation, also technical skills for operation can be built up within a short period. Later on, in a stepwise approach, more comprehensive technologies for waste treatment shall be implemented. The decision on such advanced schemes shall be based on the experience from the pilot projects and the development of the overall frame conditions.

3.4 Waste Disposal

Options for waste disposal are not considered for the implementation of the RWMP. The only realistic option for the planning period of the RWMP is the Rusino disposal site in Gostivar Municipality. Alternatives for this site would take many years to develop and shall be considered as replacement for Rusino only. A replacement site has been estimated to be required after a period of approximately 10 years and shall be identified during a siting study to be implemented early in Phase II of RWMP implementation.

3.5 Closure of Illegal Dumpsites

3.5.1 Assessment of Options for Closure of Dumpsites

Within the Polog Region, 73 dumpsites have been identified. It concerns sites that have not been (fully) closed and still attract waste on a regular or occasional basis. A detailed overview of the identified dumpsites is included in the Polog Dumpsite Mapping Report annexed as separate volume to this Feasibility Study (Annex 1). Sites that have been fully



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closed and have been covered with soil or are fully overgrown with vegetation are not included.

For closure and rehabilitation of the identified dumpsites the following options exist:

1. Removal of the waste from the location and transportation of the waste to another dumpsite or (sanitary) landfill, rehabilitation of the location by sowing the plot with grass or planting of shrubs.
2. In-situ closure and rehabilitation by covering the waste with a layer of soil which is then to be sown with grass. Prior to covering the waste, the waste has to be heaped up to reduce the footprint of the site and the waste body shall be shaped with 33% slopes (1 vertical : 3 horizontal) in order to minimise infiltration of precipitation and thus leachate generation.
3. In-situ closure and rehabilitation by installing a capping system on top of the waste, after reducing the footprint and minimising infiltration as explained above, consisting of a gas drainage layer, a low permeable mineral barrier, a drainage layer and a layer of top soil which is then to be sown with grass. Depending on the amounts of landfill gas that has to be expected, landfill gas can be vented to the air through a compost filter or a flare may have to be installed.
4. In addition to the measures described above, covering and capping, stabilisation of waste may be required in case where waste is disposed of on a slope and risk of waste slides exist. In such situation the removal of waste is preferred but due to large waste amounts the costs may be prohibitive in some case. Waste stabilisation with e.g. geo-synthetics (geo-grids; geo-nets) or other stabilisation methods may be more cost effective. As a rule of thumb, for sites with a volume of more than 10,000 m³, it has been assumed that removal of the waste will be too costly compared to stabilisation and covering or capping.

3.5.2 Recommendations for Closure of Dumpsites

The most suitable closure and rehabilitation option will differ per dumpsite and will depend on the risks the site presents. As presented in the annexed dumpsite mapping report, most dumpsites contain construction and demolition waste only or mainly. From an environment point of view these sites pose little risk and can be rehabilitated by covering the waste with a layer of soil and sowing of grass or planting of shrubs. This option is especially to be chosen for low risk sites with substantial amounts of waste which would be costly to remove.



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A number of sites, although presenting only small environmental risks, are located in or near river beds and flooding areas. The accumulations of waste can obstruct water flows in the river and thus result in flooding of adjacent lands or, after build-up of water, result in waste being washed away to downstream areas causing pollutions with debris and possibly damage to infrastructure, such as bridges, and buildings. Sites in or near river beds are therefore proposed to be rehabilitated by removal of waste.

Sites presenting substantial environmental risks shall be rehabilitated by removal of waste or, in case the cost of removing the waste are prohibitive, by in-situ rehabilitation by installing a capping system that will prevent spread of pollutions to soil, groundwater and air. If deemed necessary, because of the presence of substantial amounts of biodegradable waste, a gas collection system and gas flare shall be installed.

All sites for which environmental and/or safety risk have been identified are listed in Table 16 with indication of the recommended interventions. A more detailed description of the sites can be found in the mapping report.

Table 16 Dumpsites requiring rehabilitation

Dumpsite (n° in mapping report)	Estimated waste volume (m ³)	Environmental risks	Safety risks (e.g. risk for waste slides or erosion)	Recommended rehabilitation method
Bogovinjski Vakuf (1.3)	20,000	++		Capping
Zabela Pirok (1.6 and 1.7)	8,000	+	++	Removal
Bogovinje river (1.8 and 1.9)	>20,000	+	+	Capping
Bogovinje Village (1.10)	1,200		+	Removal
Radiovce – near Vardar river (2.7)	3,000	++	++	Removal
Kunovo dumpsite (3.3)	2,400	+	+	Removal
Vrutok – Recane (3.4 and 3.5)	6,000	+	+	Removal
La Terrace restaurant (3.6)	2,500	+	+	Removal
Zdunje – Lesnica road (3.7)	5,000	+	+	Removal
Rziste – Zeden (4.1)	4,000		+	Removal
Jegunovce near the limestone separation (4.2)	1,500	+	+	Removal
Kopance – Rudina (4.4)	20,000	+		Capping
Tudance – Siricino road (4.5)	10,000	++	++	Removal
Siricino (4.6)	10,000	+	++	Removal
Siricino – Zelino road (4.7)	3,000	+	++	Removal
Vratnica - Rakita river bridge (4.12)	24,000	+++	+++	Stabilisation and capping
Trebishte Kamen (5.3)	1,000	+	++	Removal



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Dumpsite (n° in mapping report)	Estimated waste volume (m ³)	Environmental risks	Safety risks (e.g. risk for waste slides or erosion)	Recommended rehabilitation method
Trebishte (5.4 and 5.5)	5,000	+	+	Removal
Shpirovo dare (5.6)	3,000	+	+	Removal
Velebrdo dump (5.7)	10,000	+	+	Removal
Rostushe road to Lajsovci (5.8)	5,000	+	+	Removal
Dobroste upper location (6.2)	3,000	+	++	Removal
Glogji dump (6.3)	60,000	+	++	Stabilisation and capping
Prsoyce – Orman (6.4)	150,000	+		Covering
Slatino dump (6.5)	40,000	+		Covering
Tetovo – Selce 1 (7.1)	10,000	+	+++	Removal
Tetovo – Selce 2 (7.2)	2,000	+	++	Removal
Selce village dump (7.3)	30,000	+	++	Stabilisation and capping
Shipkovicа village (7.5)	2,000	+	+	Removal
Logovina Gradec (8.3)	28,000	+		Covering
Palatica on the bank of Vardar river (9.1)	15,000	++	+	Stabilisation and capping
Siricino – Zelino road (9.2)	2,000	+	+	Removal
Zelino village (9.3)	1,000	+	+	Removal
Dobarce Chiflik (9.7)	7,500	++		Removal



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4 Investment Measures and Conceptual Design

4.1 Waste Collection

4.1.1 Technical Specifications for Improvement of Waste Collection

4.1.1.1 Improvement of Waste Collection Services

Based on the current waste collection practices and the proposed option in section 3.1.2, the following concept has been elaborated:

- In Tetovo Municipality 40% of the waste will be collected in 1.1 m³ metal containers placed in public spaces and 60% in 120 l plastic containers which will be placed within the premise of each detached house.
- In Gostivar Municipality, percentage of collection using 1.1 m³ will be reduced to 40% and use of 120 l plastic containers will be increased to 60% in areas with accessible roads and where sufficient place is available at each household, for example in the residential areas south of Vardar River.
- In the other, small municipalities, 10% of the waste will be collected in 1.1 m³ containers and 90% in 120 l containers.

Required number and type of containers has been calculated as follows:

- Number of 120 l containers is calculated based on the estimation of number of served households¹⁴.
- Required number of 1.1 m³ is calculated based on the forecasted amount of collected waste, container capacity and collection frequency (7 days/week in Tetovo and Gostivar Municipalities, and once a week in the other municipalities).

Based on the calculation of an average waste generation per household in each municipality, it is suggested to empty the small collection containers (120 l) twice a week in Tetovo and Gostivar Municipalities and once a week in other municipalities. For further calculation, it is assumed that in each collection the 120 l bins will be filled 55% in Tetovo and Gostivar due to the more frequent collection and 80% in other municipalities where bins are emptied once a week.

¹⁴ Number of served households is estimated based on the forecasted population figures, assumed development of collection coverage (collection rate) and average number of household members in each municipality according to CENSUS 2002.

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It is also assumed that the collection rate will increase along with the improvement of road conditions to villages in rural areas. Table 17 summarizes the forecasted collected waste amounts according to the type of collection container proposed to be used. The figures do not include amount of recyclables for all municipalities and organic waste for Tetovo and Gostivar Municipality, which will be collected separately. The estimated required numbers of containers are presented in Table 18.

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Table 17 Estimated waste amount for collection with different container types in each municipality

Year	Collected Waste Amount per Year [t/a]																			
	Brvenitsa		Bogovinje		Gostivar		Jegunovtse		Mavrovo & Rostusha		Teartse		Tetovo		Vrapchishte		Zhelino		Polog Region	
	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l
	10%	90%	10%	90%	40%	60%	10%	90%	10%	90%	10%	90%	40%	60%	10%	90%	10%	90%	30%	70%
2023	468	4,209	878	7,904	10,144	15,215	285	2,569	249	2,244	418	3,760	11,430	17,144	785	7,069	533	4,797	25,190	64,913
2024	475	4,273	893	8,034	10,027	15,040	288	2,594	253	2,276	452	4,068	11,324	16,987	799	7,193	581	5,232	25,092	65,696
2025	489	4,398	920	8,279	10,083	15,124	295	2,655	260	2,340	492	4,427	11,411	17,116	824	7,420	638	5,740	25,411	67,498
2026	509	4,577	959	8,629	10,284	15,426	305	2,749	270	2,433	538	4,842	11,660	17,490	860	7,742	703	6,329	26,088	70,216
2027	524	4,713	988	8,896	10,488	15,732	313	2,815	278	2,503	585	5,263	11,912	17,868	888	7,990	770	6,934	26,746	72,713
2028	528	4,755	999	8,988	10,694	16,040	314	2,825	280	2,523	632	5,689	12,168	18,251	898	8,081	840	7,557	27,352	74,710
2029	533	4,798	1,009	9,081	10,901	16,352	315	2,835	283	2,543	680	6,122	12,426	18,639	908	8,173	911	8,197	27,966	76,740
2030	538	4,841	1,019	9,174	11,111	16,667	316	2,845	285	2,564	729	6,561	12,688	19,032	918	8,266	984	8,855	28,589	78,805
2031	543	4,885	1,030	9,269	11,194	16,791	317	2,855	287	2,584	734	6,609	12,808	19,213	929	8,360	999	8,992	28,842	79,558
2032	548	4,929	1,040	9,364	11,278	16,917	318	2,865	289	2,605	740	6,657	12,929	19,394	939	8,455	1,015	9,131	29,097	80,317
2033	553	4,973	1,051	9,461	11,362	17,043	319	2,875	292	2,626	745	6,706	13,051	19,577	950	8,551	1,030	9,273	29,354	81,083
2034	558	5,018	1,062	9,558	11,446	17,169	321	2,885	294	2,647	751	6,755	13,174	19,761	961	8,647	1,046	9,416	29,612	81,856
2035	562	5,062	1,073	9,656	11,531	17,296	322	2,895	296	2,668	756	6,804	13,298	19,947	972	8,745	1,062	9,561	29,872	82,635
2036	568	5,108	1,084	9,755	11,616	17,424	323	2,905	299	2,689	762	6,854	13,423	20,134	983	8,844	1,079	9,709	30,135	83,422
2037	573	5,153	1,095	9,855	11,702	17,552	324	2,915	301	2,710	767	6,904	13,548	20,322	994	8,944	1,095	9,858	30,399	84,215
2038	578	5,199	1,106	9,956	11,788	17,681	325	2,925	304	2,732	773	6,954	13,674	20,512	1,005	9,045	1,112	10,010	30,664	85,014
2039	583	5,245	1,118	10,058	11,874	17,811	326	2,935	306	2,754	778	7,004	13,802	20,703	1,016	9,147	1,129	10,164	30,932	85,821
2040	588	5,292	1,129	10,161	11,961	17,941	327	2,945	308	2,775	784	7,055	13,930	20,895	1,028	9,251	1,147	10,320	31,202	86,635
2041	593	5,339	1,140	10,264	12,048	18,072	328	2,955	311	2,797	790	7,106	14,059	21,088	1,039	9,355	1,164	10,479	31,473	87,456
2042	598	5,386	1,152	10,369	12,136	18,204	329	2,965	313	2,819	795	7,157	14,189	21,283	1,051	9,460	1,182	10,640	31,746	88,284



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Table 18 Required number of containers for waste collection in each Municipality in Polog Region

Year	Number of Containers																			
	Brvenitsa		Bogovinje		Gostivar		Jegunovtse		Mavrovo & Rostusha		Teartse		Tetovo		Vrapchishte		Zhelino		Polog Region	
	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l	1.1 m ³	120 l
2023	51	2,936	96	6,338	160	10,498	31	2,011	27	1,636	46	2,316	180	12,181	86	4,628	58	2,766	736	45,310
2024	52	3,044	98	6,581	158	10,634	31	2,073	28	1,695	49	2,461	179	12,362	87	4,810	64	2,964	746	46,624
2025	53	3,153	101	6,825	159	10,771	32	2,136	28	1,754	54	2,607	180	12,544	90	4,994	70	3,164	767	47,948
2026	56	3,262	105	7,071	162	10,908	33	2,198	30	1,813	59	2,753	184	12,727	94	5,179	77	3,369	799	49,280
2027	57	3,339	108	7,247	166	11,045	34	2,238	30	1,854	64	2,900	188	12,912	97	5,314	84	3,577	828	50,426
2028	58	3,349	109	7,279	169	11,184	34	2,232	31	1,858	69	3,047	192	13,098	98	5,343	92	3,788	852	51,178
2029	58	3,360	110	7,311	172	11,322	34	2,227	31	1,862	74	3,194	196	13,285	99	5,372	100	4,004	875	51,937
2030	59	3,370	111	7,343	175	11,462	35	2,222	31	1,866	80	3,342	200	13,474	100	5,401	108	4,223	899	52,703
2031	59	3,380	113	7,375	177	11,487	35	2,217	31	1,870	80	3,490	202	13,528	101	5,430	109	4,446	908	53,223
2032	60	3,391	114	7,408	178	11,512	35	2,211	32	1,874	81	3,639	204	13,583	103	5,460	111	4,672	916	53,750
2033	60	3,401	115	7,440	179	11,537	35	2,206	32	1,878	81	3,788	206	13,638	104	5,489	113	4,903	925	54,280
2034	61	3,411	116	7,473	181	11,562	35	2,201	32	1,882	82	3,937	208	13,693	105	5,519	114	5,137	934	54,815
2035	61	3,422	117	7,505	182	11,587	35	2,196	32	1,885	83	4,087	210	13,748	106	5,549	116	5,376	943	55,355
2036	62	3,432	118	7,538	183	11,613	35	2,190	33	1,889	83	4,237	212	13,804	107	5,579	118	5,619	952	55,901
2037	63	3,443	120	7,571	185	11,638	35	2,185	33	1,893	84	4,388	214	13,860	109	5,610	120	5,866	961	56,454
2038	63	3,453	121	7,605	186	11,664	36	2,180	33	1,897	84	4,539	216	13,916	110	5,640	122	6,117	970	57,011
2039	64	3,464	122	7,638	187	11,689	36	2,175	33	1,901	85	4,691	218	13,972	111	5,671	123	6,372	980	57,573
2040	64	3,475	123	7,671	189	11,715	36	2,170	34	1,905	86	4,842	220	14,029	112	5,701	125	6,631	989	58,139
2041	65	3,485	125	7,705	190	11,740	36	2,164	34	1,909	86	4,849	222	14,086	114	5,732	127	6,695	998	58,365
2042	65	3,496	126	7,739	192	11,766	36	2,159	34	1,913	87	4,856	224	14,143	115	5,764	129	6,758	1,008	58,594

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For each municipality, the collection area is divided into two categories (example for Tetovo Municipality is given in Figure 24):

- **Area A:** Settlements in agglomeration and in plain with good accessible and wide roads: large (18 m³) and small (8 m³) compaction trucks
- **Area B:** Settlements which are scattered in mountainous areas: Primary collection using tipper trucks (6 m³) followed by secondary collection using large compaction trucks (18 m³)

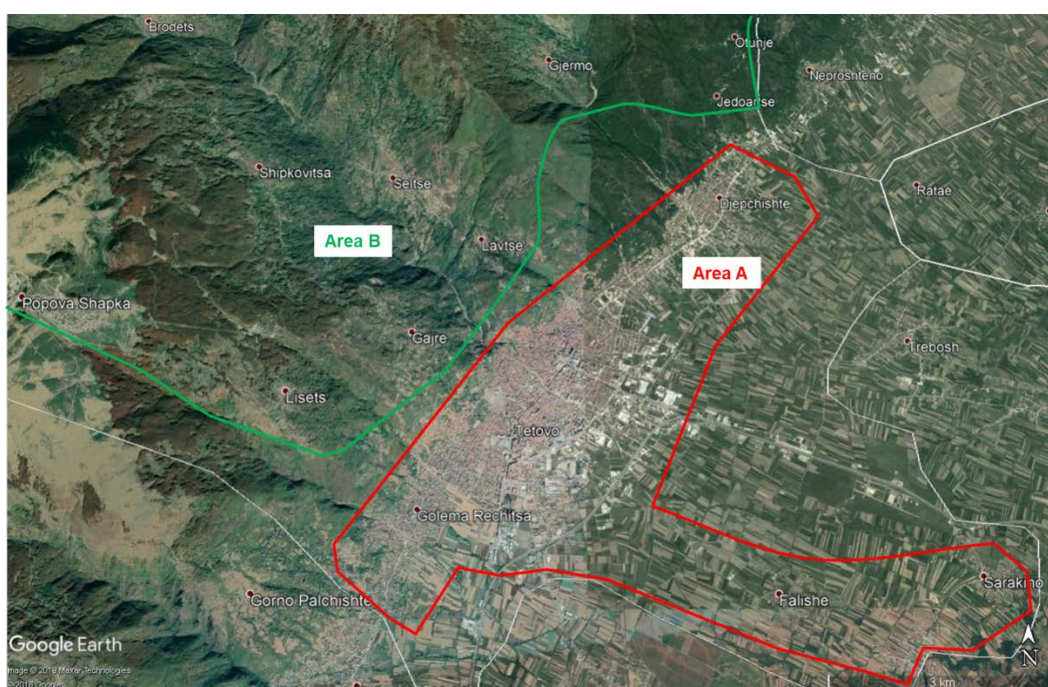


Figure 24 Example of a differentiation of collection areas (Source of base map: Google Earth)

The following table comprises the percentage of waste distribution according to the area, vehicle and container type. The estimation is based on the distribution of population in the villages according to the CENSUS 2002¹⁵ and assumption that in Tetovo and Gostivar Municipalities 70% of the waste in collection area A will be collected using large compaction trucks and 30% using small compaction trucks.

¹⁵ Census of Population, Households and Dwellings in the Republic of Macedonia, 2002 – Book X. Population data of several villages is not available and therefore is estimated based on number of dwellings, if data is availability, or estimated based on aerial photograph.

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Table 19 Estimated distribution of collected waste amount according to vehicle and container types

Municipality	Area Type	Population (2002)	Vehicle Type	Container Type	Percentage of Waste Amount
Brvenitsa	Area A	13,879	CT 18 m ³	1.1 m ³	10%
				120 l	78%
	Area B	1,976	TT 6 m ³	120 l	12%
Bogovinje	Area A	23,055	CT 18 m ³	1.1 m ³	10%
				120 l	70%
	Area B	5,942	TT 6 m ³	120 l	20%
Gostivar	Area A	74,153	CT 18 m ³	1.1 m ³	40%
				120 l	25%
		CT 8 m ³	120 l	28%	
	Area B	5,861	TT 6 m ³	120 l	7%
Jegunovtse	Area A	7,227	CT 18 m ³	1.1 m ³	10%
				120 l	57%
	Area B	3,563	TT 6 m ³	120 l	33%
Mavrovo & Rostusha	Area A	2,649	CT 18 m ³	1.1 m ³	10%
				120 l	17%
	Area B	7,093	TT 6 m ³	120 l	73%
Teartse	Area A	17,195	CT 18 m ³	1.1 m ³	10%
				120 l	65%
	Area B	5,659	TT 6 m ³	120 l	25%
Tetovo	Area A	73,828	CT 18 m ³	1.1 m ³	40%
				120 l	20%
		CT 8 m ³	120 l	26%	
	Area B	12,875	TT 6 m ³	120 l	15%
Vrapchishte	Area A	18,354	CT 18 m ³	1.1 m ³	10%
				120 l	79%
	Area B	2,253	TT 6 m ³	120 l	11%
Zhelino	Area A	12,655	CT 18 m ³	1.1 m ³	10%
				120 l	42%
	Area B	11,735	TT 6 m ³	120 l	48%

Furthermore, the following approach is applied:

- It is assumed that the municipalities in the northern part of the region (Tetovo, Teartse, Jegunovtse, Brvenitsa and Zhelino) will send the collected waste to the planned Transfer Station in Tetovo, while the other municipalities will transport the waste directly to Rusino Landfill, as proposed in chapter 3.



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- The required number of trips per year is calculated based on the collected waste amount and vehicle capacity in one trip.
- The required number of trucks is calculated as the required capacity given in number of operating hours for the specified truck type. In real operation, with a more detailing planning, the number of shifts shall be adjusted considering these annual operating hours.
- Number of trips/day/vehicle:
 - Primary collection in 120 l bins using dump trucks 6 m³: 3 trips/day
 - Collection in 1.1 m³ using CT 18 m³: 1 trip/day for waste collection in Mavrovo & Rostusha Municipality due to the long transport distance to Rusino Landfill; 2 trips / day in other municipalities
 - Collection in 120 l bins using CT 18 m³: 1 trip/day due to the high number of waste bins to be emptied in one trip and therefore the long collection time Collection in 120 l bins using CT 8 m³ in urban areas and their agglomeration of Tetovo and Gostivar Municipalities: 2 trips/day

The following tables summarize the estimated number of collection vehicles and personnel required during the implementation period, based on the considerations mentioned above. The calculation considers 85% availability of personnel. It is assumed that 20 staff (drivers and workers) will be supervised by one person.



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Table 20 Required number of collection vehicles and personnel

Year	Collection Trucks			Personnel		
	CT 18 m ³	CT 8 m ³	TT 6 m ³	Supervisors	Drivers	Workers
2023	26	6	17	9	60	120
2024	26	6	17	10	62	124
2025	26	6	18	10	62	124
2026	26	6	20	10	63	126
2027	27	6	20	10	66	132
2028	28	6	20	11	67	134
2029	30	6	20	11	69	138
2030	30	6	21	11	71	142
2031	30	6	21	11	72	144
2032	31	6	21	11	72	144
2033	31	6	21	11	73	146
2034	31	6	21	12	74	148
2035	31	6	21	12	74	148
2036	31	6	21	12	74	148
2037	31	6	21	12	74	148
2038	31	6	23	12	75	150
2039	31	6	23	12	76	152
2040	30	6	24	12	77	154
2041	32	6	24	12	77	154
2042	33	6	25	12	78	156

Over the years, the required number of trucks as well as staff will decrease in accordance with the decrease of the mixed waste quantities as a result of separate collection activities. The surplus equipment and staff capacities can be allocated to separate collection.

4.1.1.2 Separate Collection of Dry Recyclables

As already described in chapter 3, glass waste will be collected separately in depot containers while separate collection of packaging waste and paper & cardboard waste will be implemented using 1.1 m³ containers, possibly modified with mesh wire on the front and rear sides. In general, the volume of available depot containers varies from 1.5 – 5 m³. Due to the small amount of glass waste, it is recommended to place containers with 1.6 m³ capacity for collection of glass (see Figure 25) which will be emptied using hook-lift truck with a crane compatible with the containers (see Figure 26).



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Figure 25 Example of depot container for glass



Figure 26 Emptying of a depot container with hoist hook

In order to make sure that the recyclables are put into the designated/ correct containers, the containers for recyclable collection should be located at each container spot together with the container(s) for residual waste collection.

Considering the generated waste amounts and population densities, it is recommended to empty the depot containers for packaging waste three times a week in the larger municipalities (Tetovo & Gostivar) and twice a week in other smaller municipalities. Due to



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the smaller amount of glass and paper & cardboard waste and in order to have an efficient transport, containers for these recyclable fractions are proposed to be emptied once a week. However, during the first phase of implementation, the intensities of use and the filling rates need to be monitored. Based on these findings more detailed calculations can be made, which may lead to adjustments regarding the numbers of containers or container sizes at each collection point.

All container spots shall be mapped and investigated before the start of implementation, in order to get a detailed overview of their locations and conditions. Before starting the separate collection, the collection spots shall be rehabilitated; an overall positive appearance of the collection sites is important, in order to visualise a positive change in the waste management system and to gain public support. Rehabilitation works may include paving, fencing and greening. Information campaigns shall be conducted to inform the population in the project area about the separate collection and the importance of proper source separation.

The new hook-lift trucks for glass waste collections shall have the same lifting system as the existing depot containers. For a better manoeuvrability of the truck in urban areas, trucks with a 20 m³ roll-on/off container are recommended.

For the calculation, transport to the waste handlers in Skopje is assumed, except for recyclables collected in Mavrovo & Rostusha Municipality. Since a simple sorting and baling facility is already established in Mavrovo, recyclables collected in the municipality should be transported to this facility, accumulated, and then to be picked up by waste handlers / private recycling companies from, for example, Skopje.

Considering the long-distance transport to Skopje and the higher amount of packaging waste and paper & cardboard waste, compaction trucks with a capacity of 18 m³ are proposed for the collection of these recyclables with an assumed compaction ratio of 1:6 for packaging waste and 1:5 for paper & cardboard waste. Such a truck can empty about 98 containers of packaging waste and 81 containers of paper & cardboard waste during a collection round. The hook-lift truck for glass waste collection is assumed to empty about 13 depot containers during one trip.

The following table comprises the frequency and specification of proposed equipment for separate collection.



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Table 21 Collection frequency and equipment for separate collection

	Collection Freq. per Year	Container Vol. [m ³]	Vehicle Vol. [m ³]	Compaction Ratio	Truck Capacity (No. of Containers)
Glass	52	1.6	20	1 : 1	13
Packaging					
Tetovo & Gostivar	156	1.1	18	1 : 6	98
Other municipalities	104				
Paper & Cardboard	52	1.1	18	1 : 5	81

Based on the proposed concept and the estimated amount of collected recyclables, including rejects estimated to be 15%, the number of containers required for separate collection has been calculated for each municipality and for the whole Polog Region. In addition to the consideration regarding the calculated waste amount, amount of containers for glass waste for the initial phase also considers the population distribution. For this purpose, one glass container is calculated for every 2,000 inhabitants in settlements with a population of more than 2,000. Then the number will increase along with the increase of the collected amount of recyclables. Collection of glass waste in Jegunovtse Municipality will start first in 2025; because according to the calculation only 1-2 containers are required until 2024 and waste collection and transport for the small amount of glass waste would therefore not be economical.

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Table 22 Collected amount of recyclables over the implementation period

Year	Separate Collection of Recyclables [t/a]																													
	Brvenitsa			Bogovinje			Gostivar			Jegunovtse			Mavrovo & Rostusha			Teartse			Tetovo			Vrapchishte			Zhelino			Polog Region		
	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C
2023	83	353	125	156	664	234	526	2,234	788	51	216	76	44	188	67	74	316	111	583	2,477	874	140	594	209	95	403	142	1,751	7,444	2,627
2024	112	475	168	210	894	315	690	2,931	1,034	68	289	102	60	253	89	106	453	160	766	3,256	1,149	188	800	282	137	582	205	2,337	9,933	3,506
2025	130	552	195	245	1,039	367	782	3,323	1,173	78	333	118	69	294	104	131	556	196	870	3,698	1,305	219	932	329	170	721	254	2,694	11,448	4,041
2026	138	588	208	261	1,109	391	814	3,458	1,221	83	353	125	74	313	110	146	622	220	907	3,856	1,361	234	995	351	191	813	287	2,849	12,107	4,273
2027	146	619	219	275	1,169	413	846	3,598	1,270	87	370	131	77	329	116	163	692	244	946	4,019	1,418	247	1,050	371	214	911	322	3,001	12,756	4,502
2028	150	639	226	284	1,208	426	880	3,740	1,320	89	380	134	80	339	120	180	764	270	985	4,186	1,477	255	1,086	383	239	1,015	358	3,143	13,357	4,714
2029	155	659	233	293	1,247	440	915	3,887	1,372	92	389	137	82	349	123	198	841	297	1,026	4,358	1,538	264	1,122	396	265	1,126	397	3,289	13,979	4,934
2030	160	679	240	303	1,287	454	950	4,038	1,425	94	399	141	85	360	127	217	921	325	1,067	4,536	1,601	273	1,160	409	292	1,242	439	3,440	14,622	5,161
2031	165	700	247	313	1,328	469	977	4,151	1,465	96	409	144	87	370	131	223	947	334	1,099	4,672	1,649	282	1,198	423	303	1,289	455	3,545	15,065	5,317
2032	170	721	255	322	1,370	484	1,004	4,266	1,506	99	419	148	90	381	135	229	974	344	1,132	4,810	1,698	291	1,237	437	314	1,336	472	3,651	15,517	5,476
2033	175	743	262	333	1,413	499	1,031	4,383	1,547	101	429	152	92	392	138	236	1,002	354	1,165	4,951	1,748	301	1,277	451	326	1,385	489	3,759	15,977	5,639
2034	180	765	270	343	1,457	514	1,059	4,502	1,589	103	440	155	95	403	142	242	1,030	363	1,199	5,095	1,798	310	1,318	465	338	1,435	507	3,870	16,446	5,804
2035	185	787	278	353	1,502	530	1,088	4,623	1,632	106	450	159	98	415	146	249	1,058	374	1,233	5,241	1,850	320	1,360	480	350	1,487	525	3,982	16,924	5,973
2036	191	810	286	364	1,548	546	1,117	4,746	1,675	108	461	163	100	427	151	256	1,087	384	1,268	5,390	1,903	330	1,403	495	362	1,540	544	4,097	17,412	6,145
2037	196	834	294	375	1,594	563	1,146	4,870	1,719	111	472	166	103	438	155	263	1,117	394	1,304	5,542	1,956	340	1,447	511	375	1,595	563	4,214	17,908	6,321
2038	202	857	303	386	1,642	579	1,176	4,997	1,764	113	482	170	106	450	159	270	1,147	405	1,340	5,697	2,011	351	1,492	526	388	1,651	583	4,333	18,414	6,499
2039	207	882	311	398	1,690	597	1,206	5,125	1,809	116	493	174	109	463	163	277	1,177	415	1,377	5,854	2,066	362	1,537	543	402	1,708	603	4,454	18,930	6,681
2040	213	906	320	409	1,740	614	1,237	5,256	1,855	119	504	178	112	475	168	284	1,208	426	1,415	6,015	2,123	373	1,584	559	416	1,767	624	4,578	19,456	6,867
2041	219	931	329	421	1,791	632	1,268	5,389	1,902	121	516	182	115	488	172	292	1,240	438	1,454	6,178	2,180	384	1,632	576	430	1,828	645	4,704	19,992	7,056
2042	225	957	338	434	1,842	650	1,300	5,523	1,949	124	527	186	118	501	177	299	1,272	449	1,493	6,344	2,239	395	1,681	593	445	1,891	667	4,832	20,538	7,249



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Table 23 Number of containers for separate collection in each municipality

Year	Number of Recyclable Containers																													
	Brvenitsa			Bogovinje			Gostivar			Jegunovtse			Mavrovo & Rostusha			Teartse			Tetovo			Vrapchishte			Zhelino			Polog Region		
	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C	Gl.	Pack.	P&C
2023	6	69	25	14	129	46	47	290	154	0	42	15	6	37	13	11	62	22	48	321	170	9	116	41	10	79	28	151	1,145	514
2024	6	93	33	15	174	62	51	380	201	0	57	20	6	50	18	12	88	32	53	422	224	11	156	55	11	114	40	165	1,534	685
2025	7	108	38	16	202	72	53	431	228	3	65	23	6	58	21	13	108	39	56	479	254	11	181	64	12	140	50	177	1,772	789
2026	7	115	41	16	216	77	54	448	238	3	69	25	6	61	22	13	121	43	57	500	265	12	194	69	13	158	56	181	1,882	836
2027	7	121	43	17	228	81	55	466	247	3	72	26	7	64	23	14	135	48	58	521	276	12	204	72	13	177	63	186	1,988	879
2028	8	125	44	17	235	83	56	485	257	3	74	27	7	66	24	14	149	53	59	543	287	12	211	75	14	198	70	190	2,086	920
2029	8	128	46	17	243	86	57	504	267	3	76	27	7	68	24	15	164	58	60	565	299	13	219	77	15	219	78	195	2,186	962
2030	8	132	47	18	251	89	58	523	277	3	78	28	7	70	25	15	179	64	61	588	311	13	226	80	15	242	86	198	2,289	1,007
2031	8	136	48	18	259	92	59	538	285	3	80	29	7	72	26	15	184	65	62	606	321	13	233	83	16	251	89	201	2,359	1,038
2032	8	141	50	18	267	94	59	553	293	3	82	29	7	75	27	16	190	67	63	623	330	13	241	85	16	260	92	203	2,432	1,067
2033	8	145	51	18	275	97	60	568	301	3	84	30	7	77	27	16	195	69	64	642	340	14	249	88	16	270	95	206	2,505	1,098
2034	8	149	53	19	284	100	61	584	309	3	86	31	7	79	28	16	201	71	65	660	350	14	257	91	17	279	99	210	2,579	1,132
2035	8	153	54	19	292	103	62	599	317	3	88	31	7	81	29	16	206	73	65	679	360	14	265	94	17	289	102	211	2,652	1,163
2036	9	158	56	19	301	107	62	615	326	3	90	32	7	83	30	16	212	75	66	699	370	14	273	97	17	300	106	213	2,731	1,199
2037	9	162	58	20	310	110	63	631	334	3	92	33	7	86	31	17	217	77	67	718	380	15	282	100	18	310	110	219	2,808	1,233
2038	9	167	59	20	319	113	64	648	343	4	94	34	7	88	31	17	223	79	68	738	391	15	290	103	18	321	114	222	2,888	1,267
2039	9	172	61	20	329	116	65	664	352	4	96	34	7	90	32	17	229	81	69	759	402	15	299	106	18	332	118	224	2,970	1,302
2040	9	177	63	20	338	120	66	681	361	4	98	35	7	93	33	17	235	83	70	779	413	15	308	109	19	344	122	227	3,053	1,339
2041	9	181	64	21	348	123	66	698	370	4	101	36	8	95	34	17	241	85	71	801	424	16	318	112	19	356	126	231	3,139	1,374
2042	10	186	66	21	358	127	67	716	379	4	103	37	8	98	35	17	248	88	72	822	435	16	327	116	19	368	130	234	3,226	1,413

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Based on the required number of collection containers and the specification, the required number of collection rounds in a year has been calculated as summarized in the following table. In the calculation, it is assumed that one collection round will only cover one municipality. More detailed planning can be conducted within the framework of the preparation of a collection plan which can analyse the possibility to include two or more municipalities in a collection round in order to have a more efficient collection.

Table 24 Number of collection rounds per year

	Collection Rounds / Year			
	2023-2026	2027-2031	2032-2036	2037-2042
Glass				
Tetovo & Gostivar	208-260	260	260-312	260-312
Other municipalities	52-104	52-104	52-104	52-104
Packaging				
Tetovo & Gostivar	468-936	780-1.092	936-1.248	1.092-1.404
Other municipalities	104-312	104-312	104-416	104-416
Paper & Cardboard				
Tetovo & Gostivar	104-208	208-260	208-260	260-312
Other municipalities	52	52-104	52-104	52-104

It is assumed that the collection vehicles will be operated max. 6 days a week and the collection can be divided into two working shifts per day. Based on this assumption and also considering the time required for emptying the containers as well as the driving distance and time from each municipality to the waste handlers in Skopje or the recycling facility in Mavrovo and back, the maximum number of trips per day for separate collection has been determined as presented in the following table.

Table 25 Maximum number of trips per day for separate collection of dry-recyclables

	Glass	Packaging	Paper & Cardboard
Brvenitsa	2	1	2
Bogovinje	2	1	1
Gostivar	2	1	1
Jegunovtse	2	1	1
Mavrovo & Rostusha	1	1	1
Teartse	2	1	1
Tetovo	2	1	2
Vrapchishte	2	1	1
Zhelino	2	1	2



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Considering the low amount of recyclables, it is recommended to organise, where possible, the separate collection as a regional activity in order to achieve better economies of scale. This is especially important for the smaller municipalities where only very limited amounts of recyclables can be expected. Therefore, the required number of collection vehicles for the whole region has been calculated as the sum of the required truck capacity of all municipalities. Furthermore, the number of staff required for separate collection has also been calculated assuming 85% availability of personnel due to holidays, sick leave, etc. In the first years, 2 supervisors are considered to be sufficient for the whole region. Starting from 2025, 3 supervisors will be required for the whole region considering one supervisor to be responsible for the implementation in three municipalities. In addition, two workers for one vehicle are calculated for the collection of packaging waste and paper & cardboard waste.

Table 26 Required number of vehicles and personnel for separate collection in Polog Region

Year	Number of Vehicles			Personnel		
	Hoist Trucks (20 m ³)	Compaction Trucks [18 m ³)		Supervisors	Drivers	Workers
	Glass	Pack.	P&C			
2023	2	7	2	2	11	18
2024	2	8	2	2	12	20
2025	2	10	2	2	14	24
2026	2	10	2	3	14	24
2027	2	11	2	3	15	26
2028	2	11	3	3	16	26
2029	2	11	3	3	16	28
2030	2	11	3	3	16	28
2031	2	12	3	3	17	28
2032	2	12	3	3	17	30
2033	2	12	3	3	17	30
2034	2	12	3	3	17	30
2035	2	13	3	3	18	30
2036	2	14	3	3	19	32
2037	2	14	3	3	19	32
2038	2	14	3	3	19	32
2039	2	14	3	3	20	34
2040	2	14	3	3	20	34
2041	2	16	3	3	21	38
2042	2	16	3	3	21	38

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4.1.2 Costs for Improvement of Waste Collection (incl. Separate Collection)

This chapter elaborates the investment and operating costs required for the improvement of collection of mixed waste and separately collected recyclables. The cost is calculated for the whole region.

4.1.2.1 Investment Costs

For the calculation of the investment costs for waste collection, following assumptions have been used.

Table 27 Assumptions for the calculation of investment costs for waste collection

	Unit price	
	EUR	MKD
Containers mixed MSW (1.1 m ³)	310	19,000
Bins mixed MSW (120 l)	18	1,100
Depot containers for glass fraction	500	30,750
Containers for packaging, paper & cardboard fractions (coloured/ labelled for recyclables)	325	20,000
Large compaction truck	120,000	6,150,000
Small compaction truck	85,000	3,997,500
Tipper truck	55,000	2,152,500
Hoist truck	110,000	6,150,000
Improvement of container locations	500	30,750

The following table presents the required equipment and investment costs for collection of mixed MSW in Polog Region over the planning horizon. The initial investment costs have been estimated based on the assumption that all equipment will be procured new. The initial investment costs for mobile equipment amount to about 7 million EUR (without contingencies and VAT). Depending on the availability of existing equipment in the Polog Region at time of procurement, these costs might be lower. The initial investment costs include investment for spare containers (5%) and for the improvement of 870 container locations each for 500 EUR.

Due to the increase of the amounts of separately collected recyclables, the total amount of mixed MSW will decrease over the planning horizon. However, the number of households served is estimated to increase along with the population development and increase of waste collection rate. Therefore, 212,958,000 EUR shall be invested for new waste collection bins/ containers over the planning horizon.



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The containers shall be replaced every 5 years, while the replacement period for the vehicles is assumed to be 10 years. The total replacement costs will be then 9.3 million EUR for the entire Polog Region.



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Table 28 Required equipment and investment costs for collection of mixed MSW in Polog Region

Year	Waste Quantity [t/a]	Initial investments [EUR/a]						Renewals [EUR/a]					Total Investments [EUR/a]		
		CT		TT	Container		Drop-off points	CT		TT	Container		Initial	Renewal	Total
		18 m ³	8 m ³	6 m ³	1100 l	120 l		18 m ³	8 m ³	6 m ³	1100 l	120 l			
2022		3,720,000	510,000	1,155,000	269,700	953,064	435,000						7,042,764	0	7,042,764
2023	93,608												0	0	0
2024	92,414												0	0	0
2025	92,524												0	0	0
2026	93,776												0	0	0
2027	92,174												0	0	0
2028	92,415				28,830	62,820	46,500				269,700	953,064	138,150	1,222,764	1,360,914
2029	92,583												0	0	0
2030	92,676												0	0	0
2031	91,343												0	0	0
2032	89,965												0	0	0
2033	88,543	240,000	0	220,000	14,570	51,102	23,500	3,720,000	510,000	1,155,000	298,530	1,015,884	549,172	6,699,414	7,248,586
2034	87,074												0	0	0
2035	85,559												0	0	0
2036	83,995												0	0	0
2037	82,383												0	0	0
2038	80,721				15,190	40,446	24,500				313,100	1,066,986	80,136	1,380,086	1,460,222
2039	79,008												0	0	0
2040	77,242												0	0	0
2041	75,424												0	0	0
2042	73,552												0	0	0
Total	1,736,981	3,960,000	510,000	1,375,000	328,290	1,107,432	529,500	3,720,000	510,000	1,155,000	881,330	3,035,934	7,810,222	9,302,264	17,112,486



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Investment cost for separate collection in the region has also been calculated based on the estimated, required number of vehicles and the assumed unit costs. The calculated cost includes spare containers, namely 5% of the total required amount and a reserve hoist truck for separate collection of glass waste. Assuming an improvement of environmental awareness and behaviour in separate collection, number of equipment is estimated to increase along with the increased amount of separately collected amount of recyclables.

Initial investment is planned to cover the estimated system capacity in the first two implementation years. Since an overall positive appearance is important in order to visualise a positive change in the waste management system and to gain public support, upgrade of container locations is recommended. For this reason, an additional investment of 100 EUR per recycling bin location is estimated for the extended use of the upgraded container spots. Therefore, the initial investment costs for separate collection at the beginning of the implementation (without contingencies and VAT), is calculated to be about 2.44 million EUR.

While evaluating the implementation progress of the pilot activity, more vehicles and containers should be procured over the planning period. Additional investment of about 2 million EUR is estimated over the planning horizon. Furthermore, trucks are to be renewed every ten years and collection containers every 5 years which will cost about 3.62 million EUR in total until 2042.

Therefore, total investments for the separate collection activity in the region are estimated to be 8 million EUR for the planning horizon 2023-2042, as summarized in the following table.



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Table 29 Required equipment and investment costs for separate collection of recyclables in Polog Region

Year	Hoist Truck (20 m ³)	Compaction truck (18 m ³)	1.6 m ³ Depot Container	1.1 m ³ Container	Initial investments [EUR/a]			Replacements [EUR/a]		Total Investments [EUR/a]		
					Trucks	Container	Cont. Locations	Trucks	Container	Initial	Renewal	Total
2022					1,530,000	844,250	62,600			2,436,850	0	2,436,850
2023	3	9	159	1,742						0	0	0
2024	3	10	174	2,330						0	0	0
2025	3	12	186	2,690	240,000	232,325	17,575			489,900	0	489,900
2026	3	12	191	2,854						0	0	0
2027	3	13	196	3,011	240,000					240,000	0	240,000
2028	3	14	200	3,157		224,475	17,025		844,250	241,500	844,250	1,085,750
2029	3	14	205	3,306	0				0	0	0	0
2030	3	14	208	3,461					232,325	0	232,325	232,325
2031	3	15	212	3,567	120,000				0	120,000	0	120,000
2032	3	15	214	3,674					0	0	0	0
2033	3	15	217	3,784	0	193,250	14,650	1,530,000	224,475	207,900	1,754,475	1,962,375
2034	3	15	221	3,897				0	0	0	0	0
2035	3	16	222	4,006	240,000			240,000	0	240,000	240,000	480,000
2036	3	17	224	4,127				0	0	0	0	0
2037	3	17	230	4,244	0			240,000	0	0	240,000	240,000
2038	3	17	234	4,363		211,775	16,075	0	193,250	227,850	193,250	421,100
2039	3	17	236	4,486	0			0	0	0	0	0
2040	3	17	239	4,612				0	0	0	0	0
2041	3	19	243	4,739	240,000			120,000	0	240,000	120,000	360,000
2042	3	19	246	4,871				0	0	0	0	0
Total					2,610,000	1,706,075	127,925	2,130,000	1,494,300	4,444,000	3,624,300	8,068,300

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4.1.2.2 Operation Costs

The operating costs consist of staff costs, maintenance and repair of equipment, costs of consumables of vehicles, costs of special tools and clothes/personal protective equipment (PPE).

Following assumptions are used by calculating the operating costs of waste collection activities.

Table 30 Assumptions for operating costs calculation for waste collection

Gross wage supervisor	1000	€/month
Gross wage driver	750	€/month
Gross wage collection worker	500	€/month
Number of salaries	12	per annum
Fuel price	1.1	€/l
Working days	312	Days/a
<u>Maintenance and repair costs</u>		
Compaction vehicles	10%	of investment costs
Tipper trucks	6%	of investment costs
Containers	5%	of investment costs
Insurance costs vehicles	2%	of investment costs
<u>Average fuel consumption</u>		
Large compaction vehicle	45	l/100km
Small compaction vehicle	28	l/100km
Tipper truck	14	l/100km
Hoist trucks	40	l/100 km
Clothes and tools	200	€/worker/a

The estimated operating costs for the entire region are presented in the table below. About two third of the operating costs are for the payment of the salaries. Each of the cost positions for the maintenance and fuel will make about 27% of the total operating costs. The other costs include the insurances for vehicles and special clothes and hand tools for the workers.

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Table 31 Operating costs of waste collection in Polog Region [EUR/a] ¹⁶

Year	Mixed MSW Quantity [t/a]	Personnel costs [EUR]	Maintenance and Repair [EUR]	Consumption (e.g. fuel) [EUR]	Other [EUR]	Total [EUR]
2023	93,608	1,368,000	419,100	206,215	129,100	2,122,415
2024	92,414	1,422,000	419,100	197,805	130,500	2,169,405
2025	92,524	1,422,000	422,400	200,509	131,600	2,176,509
2026	93,776	1,443,000	429,000	205,926	134,400	2,212,326
2027	92,174	1,506,000	441,000	213,866	138,600	2,299,466
2028	92,415	1,539,000	453,000	220,933	141,800	2,354,733
2029	92,583	1,581,000	477,000	225,913	147,800	2,431,713
2030	92,676	1,623,000	480,300	230,956	150,100	2,484,356
2031	91,343	1,644,000	480,300	236,163	150,700	2,511,163
2032	89,965	1,644,000	492,300	238,343	153,100	2,527,743
2033	88,543	1,665,000	492,300	240,497	153,700	2,551,497
2034	87,074	1,698,000	492,300	242,683	154,500	2,587,483
2035	85,559	1,698,000	492,300	244,941	154,500	2,589,741
2036	83,995	1,698,000	492,300	247,121	154,500	2,591,921
2037	82,383	1,698,000	492,300	249,431	154,500	2,594,231
2038	80,721	1,719,000	498,900	251,655	157,300	2,626,855
2039	79,008	1,740,000	498,900	253,935	157,900	2,650,735
2040	77,242	1,761,000	490,200	256,225	157,200	2,664,625
2041	75,424	1,761,000	514,200	258,537	162,000	2,695,737
2042	73,552	1,782,000	529,500	260,795	166,100	2,738,395
Total	1,736,981	32,412,000	9,506,700	4,682,450	2,979,900	49,581,050

The estimated operating costs for separate collection for the entire region are presented in the table below. The costs will increase over the years along with the increasing amount of collected recyclables. In the first year an annual cost of around 665,000 EUR is estimated for the operation which will increase to 1.36 million EUR by the end of the planning horizon.

¹⁶ The calculation of costs does not consider any price change over time (e.g. inflation).

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Table 32 Operating costs of separate collection of recyclables in Polog Region [EUR/a]

Year	Quantity of Collected Recyclables incl. 15% Impurities [t/a]	Personnel costs [EUR]	Maintenance and Repair [EUR]	Consumption (e.g. fuel) [EUR]	Other [EUR]	Total [EUR]
2023	11,822	222,000	165,134	244,022	33,800	664,956
2024	15,776	252,000	186,584	283,388	37,000	758,972
2025	18,183	294,000	216,441	328,424	43,000	881,866
2026	19,228	306,000	219,093	338,654	43,000	906,746
2027	20,259	327,000	233,639	355,183	46,000	961,821
2028	21,214	327,000	247,998	368,431	48,400	991,829
2029	22,202	348,000	250,430	382,179	49,000	1,029,609
2030	23,223	348,000	252,910	386,764	49,000	1,036,674
2031	23,927	357,000	266,626	400,296	51,600	1,075,523
2032	24,644	369,000	268,334	404,313	52,000	1,093,647
2033	25,375	369,000	270,099	409,092	52,000	1,100,191
2034	26,120	369,000	271,954	416,935	52,000	1,109,889
2035	26,880	378,000	285,669	430,101	54,600	1,148,370
2036	27,654	399,000	299,588	458,676	57,600	1,214,863
2037	28,443	399,000	301,541	460,186	57,600	1,218,327
2038	29,247	399,000	303,469	461,600	57,600	1,221,668
2039	30,066	420,000	305,420	470,816	58,200	1,254,436
2040	30,901	420,000	307,445	481,841	58,200	1,267,486
2041	31,752	453,000	333,511	510,624	64,000	1,361,135
2042	32,619	453,000	335,634	512,159	64,000	1,364,793
Total	489,533	7,209,000	5,321,516	8,103,685	1,028,600	21,662,801

4.1.2.3 Revenues from Separately Collected Recyclables

At planned recycling rates, in order to reach the targets of the RWMP, the following amounts of recyclable fractions, without impurities, are estimated for the separate collection during the implementation period.



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Table 33 Collected amount of recyclables in Polog Region at planned recycling rate [t/a]

Year	Amount of Recyclables [t/a]				
	Paper & Cardboard	Plastics	Glass	Metals	Total
2023	2,284	6,092	1,523	381	10,280
2024	3,048	8,129	2,032	508	13,718
2025	3,514	9,370	2,342	586	15,811
2026	3,716	9,908	2,477	619	16,720
2027	3,915	10,440	2,610	652	17,617
2028	4,099	10,931	2,733	683	18,447
2029	4,290	11,440	2,860	715	19,306
2030	4,488	11,967	2,992	748	20,194
2031	4,624	12,329	3,082	771	20,806
2032	4,762	12,699	3,175	794	21,430
2033	4,903	13,076	3,269	817	22,065
2034	5,047	13,460	3,365	841	22,713
2035	5,194	13,851	3,463	866	23,374
2036	5,344	14,250	3,562	891	24,047
2037	5,496	14,656	3,664	916	24,733
2038	5,652	15,071	3,768	942	25,432
2039	5,810	15,493	3,873	968	26,144
2040	5,971	15,923	3,981	995	26,870
2041	6,136	16,362	4,090	1,023	27,610
2042	6,303	16,808	4,202	1,051	28,364
Total	94,596	252,255	63,064	15,766	425,681

Over the 20 years of implementation, about 426,000 tonnes of recyclables materials will be collected separately and forwarded to private waste handlers / recycling companies for recycling. From sale of recyclables, certain revenues will be generated. The market values of recyclables fluctuate depending on the supply and demand on the international market. For the estimation of revenues following specific prices, which are current, average prices, are used.

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Table 34 Values of recyclables in EUR/t

		Values of Recyclables [EUR/t]
Paper & cardboard		29
Plastics		57
Glass		5
Metals		350
Aluminium	35%	600
Ferrous Metals	60%	143
Aluminium scrapped foil	5%	1,088

Applying the above unit prices and quantities, the development of potential revenues has been calculated over the implementation period, as displayed in the following graph. In the first implementation year revenues of around 555,000 EUR are estimated. At planned extension of separate collection coverage and therefore the development of separate collection rate, the annual revenues are estimated to increase to around 1.5 million EUR in 2042.

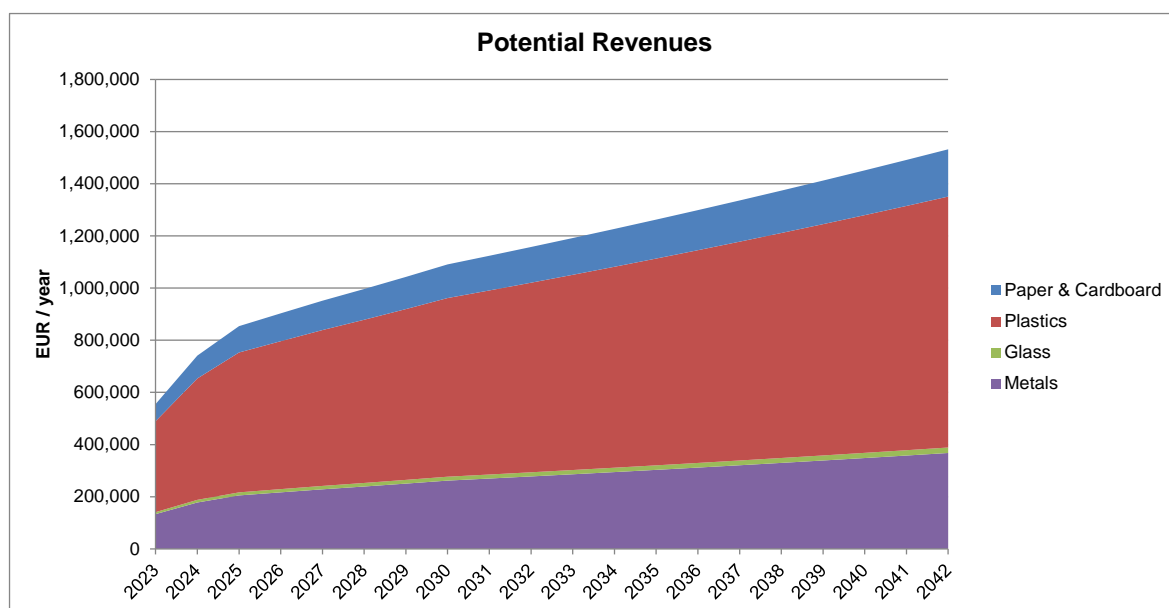


Figure 27 Development of potential revenues of separately collected recyclables in Polog Region

In summer 2019, the Municipality of Mavrovo & Rostusha has started separate collection. However, until end of October 2019 they only baled and stored the collected recyclables. These should either be transported by the municipality to Skopje or be picked up by the recycling companies from there over a distance of 90 km one way. As the collected waste amounts are small compared to the long distance to be transported, in the following, the

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economic benefits of separate collection in Mavrovo & Rostusha Municipality are analysed. The analysis considers:

- Revenues generated from selling of recyclables,
- Economic savings from the transport and disposal cost which would have been incurred if the amounts of recyclables collected were collected and disposed together with mixed MSW,
- Operating cost for the separate collection
- Transport cost to the recycling facilities in Skopje

Table 35 Analyses of economic benefits of separate collection in case of separate collection in Mavrovo & Rostusha Municipality

Year	Revenues	Economic Savings for Transport & Disposal of Mixed MSW	Op. Cost Separate Collection	Transport Cost to Skopje	Total Economic Benefits
	[EUR/a]	[EUR/a]	[EUR/a]	[EUR/a]	[EUR/a]
2023	14,057	10,030	-7,807	-10,733	5,546
2024	18,892	13,480	-10,492	-14,425	7,454
2025	21,918	15,639	-12,173	-16,736	8,648
2026	23,321	16,641	-12,953	-17,807	9,202
2027	24,536	17,507	-13,627	-18,735	9,681
2028	25,288	18,044	-14,045	-19,309	9,978
2029	26,055	18,591	-14,471	-19,894	10,280
2030	26,835	19,147	-14,904	-20,490	10,588
2031	27,629	19,714	-15,345	-21,097	10,902
2032	28,438	20,291	-15,794	-21,714	11,221
2033	29,261	20,879	-16,252	-22,343	11,546
2034	30,100	21,477	-16,717	-22,983	11,876
2035	30,953	22,086	-17,191	-23,635	12,213
2036	31,822	22,706	-17,674	-24,298	12,556
2037	32,706	23,337	-18,165	-24,973	12,905
2038	33,607	23,979	-18,665	-25,661	13,260
2039	34,523	24,633	-19,174	-26,360	13,622
2040	35,456	25,299	-19,692	-27,073	13,990
2041	36,405	25,976	-20,219	-27,797	14,364
2042	37,371	26,665	-20,756	-28,535	14,745
Total	569,172	406,120	-316,114	-434,599	224,579

As shown in the table above, the separate collection activity is only profitable if the savings due to less transport and disposal at the landfill are considered. Further detailed



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planning can optimize the economic efficiency of the implementation, for example by excluding recyclable materials in the separate collection with low market value such as glass.

4.2 Waste Transportation and Transfer

4.2.1 Technical Design

The transfer station (TS) should serve the Municipality of Tetovo and the northern municipalities of the Polog Region (Teartse, Jegunovtse, Zhelino and Brvenitsa). The expected, required capacity of the transfer station will be approx. 160 tonnes per day at the beginning of operation.

A ramp type transfer station with the utilisation of roll-on/off containers is recommended as such transfer stations have high availability and low operating costs. Due to comparatively high density of the waste, the benefits of a compaction prior to transport will be limited.

The amount of waste in one 30 m³ roll-on/off container is approx. 10 tonnes. The hook-lift trucks shall use a trailer to transport the waste to the Rusino landfill. Thus the amount of waste to be transported in one trip will be 20 tonnes. This means 8 trips per day will be required at the beginning of operations.

Assuming a distance of 40 km between the TS and the landfill, one round trip will take 2.3 hours. At least three transportation trucks shall be available at the TS. One additional truck shall be purchased as a spare truck. The transport shall be organised in such a way that the time between the arrivals of the trucks at the TS to exchange the containers shall be maximum 75 min. During these 75 minutes a peak delivery of 125 m³ waste is expected. Consequently at least 4 containers shall be available at the same time for emptying of collection trucks. Considering an emergency container, it is recommended to have 5 containers.

The number of containers must be sufficient to cover the peak waste deliveries. In addition to the containers placed at the transfer stations ready for loading, 2 spare containers, have to be purchased. Furthermore, since the full containers will be replaced by empty containers, for each truck with trailer at least additional two containers must be purchased. Thus a total of at least 13 containers with a nominal capacity of 30 m³ shall be purchased before the beginning of the operations.

In future, the capacity of the transfer station can be increased by adding additional transportation trucks and containers to the transport fleet.

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An example design for such a transfer station is given in following figure. Once the site is available and approved, the design shall be adjusted to the topography and framework conditions of the site.

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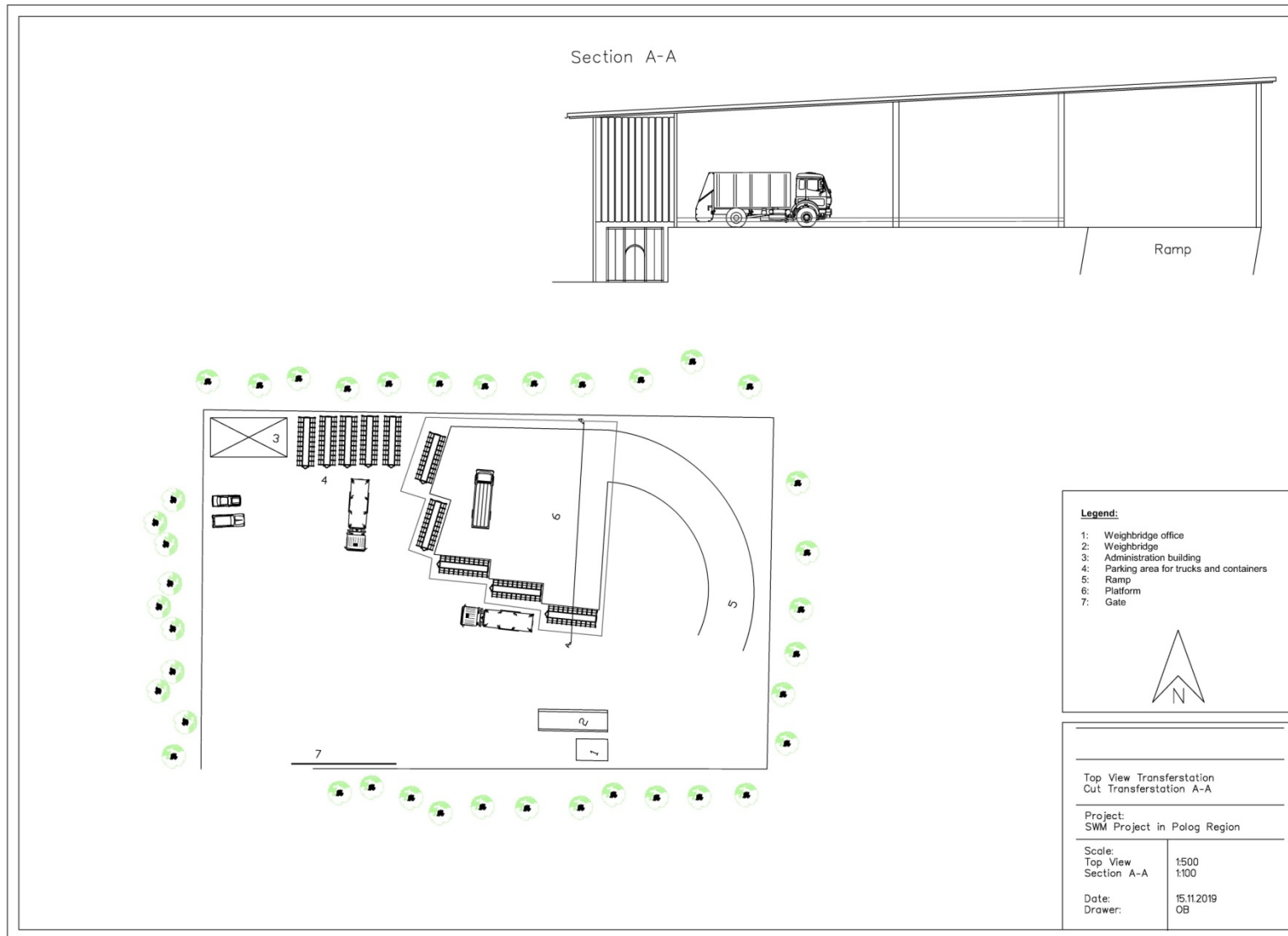


Figure 28 Example design of a transfer station

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The side view of such a transfer station is illustrated in the following figures again.

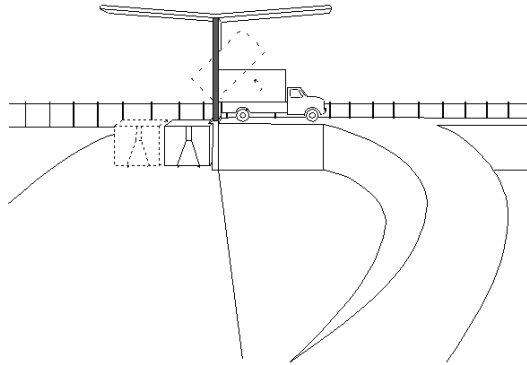


Figure 29 Principle design of a ramp type transfer station

A fully closed transfer station is not necessary if the benefits (dust and odour minimisation, better visibility) and costs (higher investment costs, additional operating costs for lighting and aeration) are weighed against each other. An alternative option would be partly closing of the unloading area in order to minimise dust, rainwater infiltration, and spillage of waste (see next photos). The design might include a fixed hopper, which would be more robust and allow quick operation.



Figure 30 Partly closed unloading area with hopper

Since the waste will be delivered from different municipalities, a weighbridge will be necessary to record the waste quantities in order to prepare invoices. In addition to the weighbridge control building, a building for the staff with sanitary facilities shall be constructed on the site.



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The existing road¹⁷ from Gostivar to the Rusino landfill goes through the city with high traffic during the day time. Therefore, in order to avoid this high traffic, the waste transport can be conducted during the evening and night times. The draft design above foresees some space for the spare containers, which might also be full containers. Thus if the waste is delivered during day time, only with exchanging of full containers with the empty ones, the transport of the containers can be delayed for couple of hours. However, this will not be sufficient for receiving all waste during day time and delivering to the landfill during night time. Therefore, the delivery times to the transfer station shall be clarified with the waste collection companies and municipalities.

For the operation of the transfer stations and use of the transport vehicles, one supervisor, two weighbridge officers, two workers, three to four security staff and five drivers are considered. The workers and security staff shall assume the replacement function for each other.

4.2.2 Site Identification

When identifying a potential location for a transfer station, the following criteria (in accordance with “the Rulebook on the Minimum Technical and Environmental Requirements to be met by the Transfer Stations”) should be taken into consideration:

- **Location and surrounding:** The site should be in an area without any risk of flooding (not within 1:100 flood plain). The area should not be a protected flora or fauna habitat and also not of any historical, archaeological or cultural significance. Natural and public parks and reserves as well as water protection areas are also excluded. Agriculturally valuable land shall be avoided.
- **Distance to settlements:** The minimum distance to the residential areas, hospitals, food manufacturing industry, or schools should be 300 m. In certain cases, the distance might be less than this; however, in this case the transfer station should totally be enclosed in order to minimise the emissions. This would result with higher investment and operating costs.
- **Accessibility:** The location should be close to main collection routes in order to increase the waste collection efficiency. Furthermore the transfer station should also have an easy access to the highway and/or to the primary and secondary roads. The roads shall be suitable for heavy transportation trucks (>44 tonnes

¹⁷ Possibly an alternative access road from the south, connecting the M65 to the landfill site, will be constructed enabling waste collection vehicles to avoid travel through Gostivar.



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gross vehicle weight). Traffic through residential areas should be avoided, because of the risk of increasing air emissions, noise emissions and traffic block.

- **Visibility:** The transfer station should preferably be orientated so that transfer operations and vehicle traffic are not visible to the surrounding environment. Otherwise, visual impact mitigation measures, like trees, berms, landscaping might be applied.
- **Size:** The required area for the transfer station will be minimum 4,000 m²; however, this might change depending on the shape and topography of the site. In order to be on the safe side and to have a buffer zone around the site, a site with a minimum size of 5,000 m² shall be searched.
- **Ownership:** Public-owned land plots shall be preferred.

Generally, the transfer station should be located near the waste generation centre, i.e. the City of Tetovo. Considering the connection of the northern municipalities and the access to the highway, the search area can be limited within the area along the highway region east of the Tetovo City as presented in the following figure:

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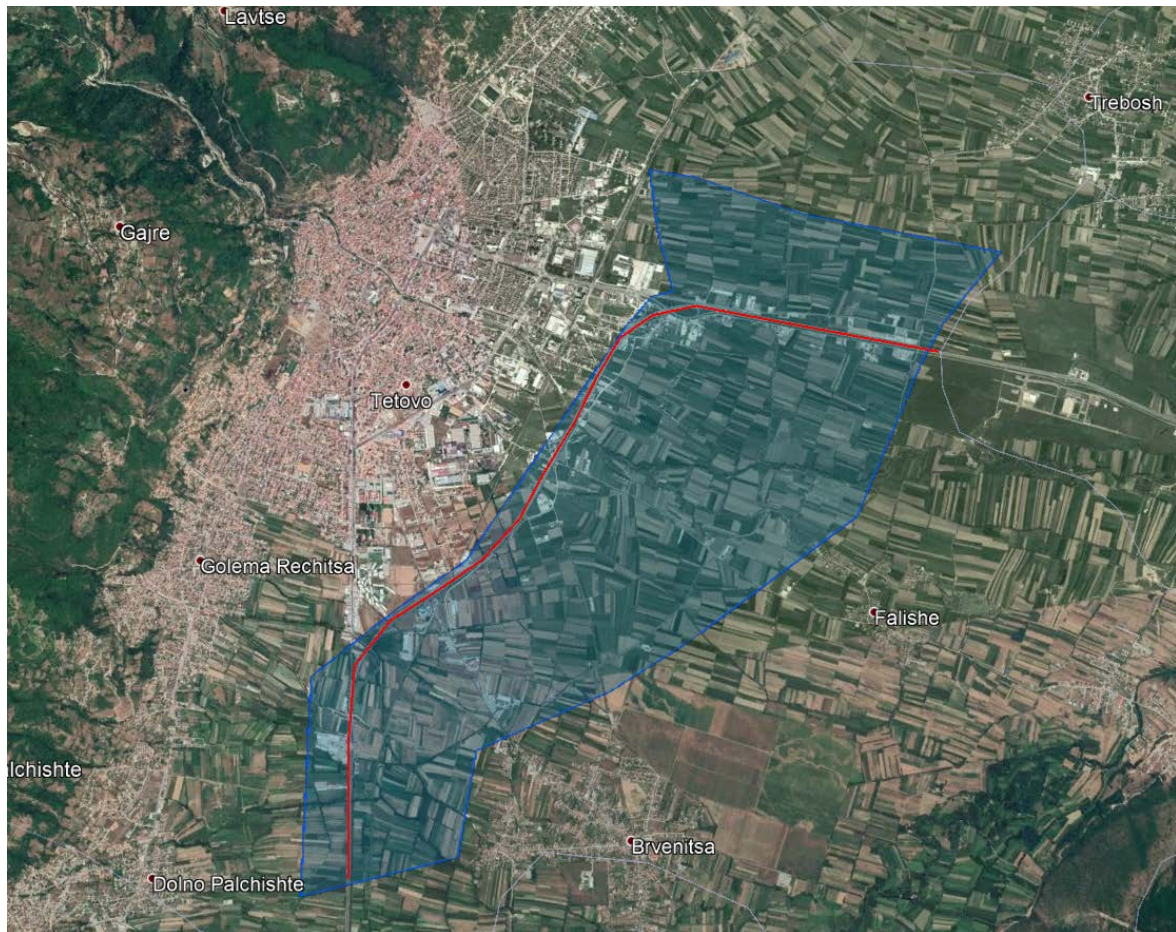


Figure 31 Search area for a transfer station east of Tetovo city

In a next step, the Tetovo Municipality shall propose one or more location(s) and provide information on land ownership and availability. The Consultant will then prepare an assessment of location(s) proposed by the municipality considering technical, financial, environmental and social criteria and make recommendations. Finally the selected site shall be approved by the municipality.

4.2.3 Costs for Waste Transportation and Transfer

4.2.3.1 Investment Costs

The investment costs of the transfer station in Tetovo are estimated to be 339,000 EUR (20.8 million MKD).

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Table 36 Estimated costs of transfer station construction

Item	Unit	Unit Price EUR	Quantity	Total	
				EUR	MKD
Surveys	lump sum	10,000	1	10,000	615,000
Earth works	m ²	4	5,000	20,000	1,230,000
Bituminous paved areas	m ²	36	3,000	108,000	6,642,000
Concrete paved areas	m ²	50	1,000	50,000	3,075,000
Ramp and wall, concrete works	lump sum	30,000	1	30,000	1,845,000
Ramp and wall, filling material	m ³	12	300	3,600	221,400
Utility connection	lump sum	10,000	1	10,000	615,000
Electrical works	lump sum	3,000	1.0	3,000	184,500
Steel works for shelter	lump sum	15,000	1	15,000	922,500
Profiled sheeting	m ²	15	1500	22,500	1,383,750
Fence and gate	m	50	260	13,000	799,500
Others	lump sum	3,000	1	3,000	184,500
Greening of the area	lump sum	5,000	1	5,000	307,500
Weighbridge		30,000	1	30,000	1,845,000
Control building		15,000	1	15,000	922,500
Total (rounded up)				339,000	20,848,500

The item “others” include the procurement of fire extinguishers, first aid kits, emergency instructions, and personal protective equipment.

As mentioned above, the mobile equipment to be procured will include 4 hook-lift trucks with trailers and 13 roll-on/off containers. The investment costs are estimated to be 558,000 EUR (34.3 million MKD). Thus the total investment costs required to implement the long distance transport concept will be about **897,000 EUR (55 million MKD)** without contingencies and taxes.

4.2.3.2 Operation Costs

The operating costs of the waste transfer and transport consist of fuel costs, maintenance costs of the equipment and infrastructure, salaries, and administrative costs. Furthermore, the highway toll between Tetovo and Gostivar is considered as well. The assumptions for the estimation of these costs are presented in the following table.

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Table 37 Assumptions for the estimation of the operating costs for waste transfer and transport

Parameter	Unit	Value
<u>Personnel costs</u>		
Salary supervisor	EUR	10,200
Salary weighbridge operator	EUR	9,000
Salary driver	EUR	9,000
Salary worker	EUR	6,000
Number of salaries per annum	No.	12
<u>Maintenance</u>		
Repair and maintenance of containers	% of investment	5%
Repair and maintenance of trucks	% of investment	8%
Maintenance of buildings	% of investment	1.5%
<u>Consumption</u>		
Fuel consumption	l/hr	24
Fuel price	EUR/l	1.10
Electricity consumption	kWh/d	20
Electricity price	EUR/kWh	0.14
Water consumption	m ³ /day	3
Water price	EUR/m ³	0.8
<u>Other</u>		
Expenditures for tools and uniforms	EUR/employee*annum	200
Other vehicle costs (e.g. insurance)	% of investment	2%
Highway toll	EUR one way	2
Highway toll trips per annum (2023 - 2042)	No.	2,571 – 3,744

On the base of the assumptions above, the operating costs over the 20 years are estimated as following.

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Table 38 Estimated operating costs of the waste transfer and transport

Year	Waste to be transported	Operating Costs				
		Personnel costs	Maintenance	Consumption	Other	Total
		t/a	€/a	€/a	€/a	€/a
2023	45,615	109,200	66,710	173,647	27,131	376,688
2024	46,274	109,200	66,710	176,090	27,295	379,295
2025	47,659	109,200	66,710	181,316	27,644	384,870
2026	49,701	109,200	66,710	189,051	28,161	393,123
2027	51,696	118,200	66,710	196,584	28,665	410,159
2028	53,559	118,200	66,710	203,574	29,133	417,617
2029	55,457	118,200	66,710	210,699	29,610	425,219
2030	57,390	118,200	66,710	218,028	30,100	433,038
2031	57,955	118,200	66,710	220,131	30,241	435,283
2032	58,526	118,200	66,710	222,303	30,386	437,599
2033	59,102	118,200	66,710	224,474	30,531	439,916
2034	59,684	118,200	66,710	226,646	30,677	442,233
2035	60,270	118,200	66,710	228,885	30,827	444,622
2036	60,862	118,200	66,710	231,124	30,976	447,011
2037	61,459	127,200	66,710	233,364	31,126	458,400
2038	62,062	127,200	66,710	235,604	31,276	460,790
2039	62,669	127,200	66,710	237,911	31,430	463,251
2040	63,283	127,200	66,710	240,218	31,585	465,713
2041	63,902	127,200	66,710	242,593	31,743	468,246
2042	64,526	127,200	66,710	244,900	31,898	470,709
Total	1,141,652	2,382,000	1,334,200	4,337,142	600,438	8,653,779

The waste amounts to be transported will increase from around 45,600 t/a in 2023 to around 64,500 t/a in 2042. The annual operating costs will be about 0.38 million EUR in 2023 and increase to about 0.47 million EUR in 2042.

4.3 Waste Treatment (Composting)

4.3.1 Conceptual Design for Green Waste Composting

As a result of the option analyses open windrow composting has been identified as the preferred solution for pilot green waste composting in the municipalities. Before designing the facilities, the catchment areas for the green waste as well as the input amounts to be treated in individual facilities need to be defined.

4.3.1.1 Catchment Area for Green Waste Composting

Green waste to be treated in the planned facilities includes garden waste, pruning, vegetable and fruit waste (e.g. from local markets) as well as pomace from juice and wine

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production. It is assumed that the green waste will be “clean”, which means that the waste is not polluted with residual waste, soil and construction debris, etc.

In order to avoid high transportation costs and to assure economy of scale for the equipment installed, the catchment area for the pilot measures will focus on the waste generation centres of Polog Region. In the table below, the calculated amounts of organic waste, generated in each municipality (in the reference year 2020) are presented.

Table 39 Organic waste generation and layout capacity for green waste composting

Municipality	Organic waste generation	Estimated amount of green waste ¹⁸	% of total	Layout capacity pilot composting	% of total
	[t/a]	[t/a]	[%]	[t/a]	[%]
Brvenitsa	2,832	943	5%		
Bogovinje	5,304	1,766	9%		
Gostivar	17,215	5,733	28%	4,200	21%
Jegunovtse	1,748	582	3%		
Mavrovo & Rostusha	1,513	504	2%		
Teartse	3,895	1,297	6%		
Tetovo	19,017	6,332	31%	4,200	21%
Vrapchishte	4,734	1,576	8%		
Zhelino	4,890	1,628	8%		
Total for Polog Region	61,148	20,362	100%		42%

As shown in the table above, about 60 % of the green waste in Polog Region is produced in Tetovo Municipality and Gostivar Municipality. It is proposed to start green waste composting in these two municipalities, with a design capacity of 4,200 tons per year for each of the two plants.

4.3.1.2 Collection and Transport of Green Waste to the Green Waste Composting Facilities

For the pilot composting in Polog Region over the planning horizon the following assumptions are made:

- The inhabitants can bring their green waste directly to the pilot plants free of charge,
- The municipalities will provide services for separated green waste from vegetable and fruit markets,

¹⁸ It is assumed that on average one third of the organic waste is composed of green waste.

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- Additional tours to collect green waste separately will be conducted by the municipalities in autumn und spring.

No special bins are foreseen at the beginning and the green waste will be handed over from the waste generator directly to the collection vehicle. One multi-purpose dump truck is foreseen for each composting plant, which will be used for the collection of the green waste and other tasks.

4.3.1.3 Pilot Plant for Green Waste Composting

Due to the small scale of the composting plants a fairly simple design is proposed, which in case of extension might be replaced/ supplemented by more sophisticated technologies. During the pilot operation windrow composting with turning by skip loader will be used. The process flow sheet of the composting plant is shown in the following figure.

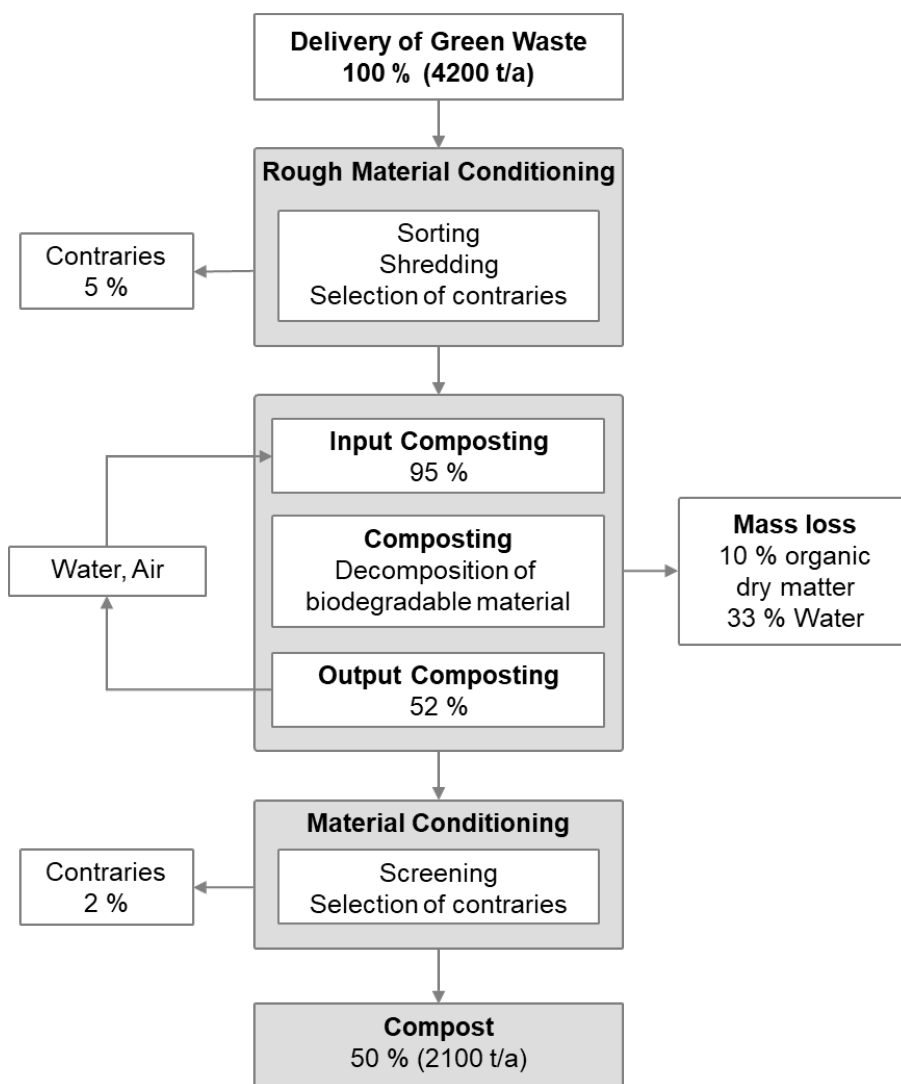


Figure 32 Process schema of the pilot composting plant



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To condition the separately collected biodegradable material, impurities and bulky materials (grain size > 500 mm) will be sorted out. While the material > 500 mm will be shredded, the material of up to 500 mm will remain in the heaps in order to allow passive aeration. The primary composting will take place over a period of 90 days. After this time the material will be sieved and allowed to cure for another 50 days before it can be screened again and distributed as a finished compost material.

To achieve a proper composting process the water content of the material is essential. A water content of about 50 % is most suitable while water content above 70 % will reduce the porosity of the heap too much to allow a free flow of air. Below a water content of 20 – 25 % the biological process will stop. From time to time water has to be added to the heaps to maintain the required moisture content. For this purpose a water tank with a pump will be used.

The design parameters of the pilot composting plant are shown in the following table.

Table 40 Design parameters of the pilot composting plant

Parameter	Explanation	Quantity
Design capacity	During the pilot phase	4,200 t/a
Required area	Delivery and screening area	1,150 m ²
	Composting area (composting time approximately 90 days, piles 1.5 m high and 3.0 wide)	2,400 m ²
	Curing area (curing time approximately 50 days)	550 m ²
	Storage area for finished compost (sufficient for ca. 1,500 tonnes)	500 m ²
	Other areas (parking area, areas for shredder and screen, interfaces)	400 m ²
Total area	Including open space between the different working areas	6,000 m ²

The area requirements may change in the course of the pilot operation if the delivered material and the process parameters vary.

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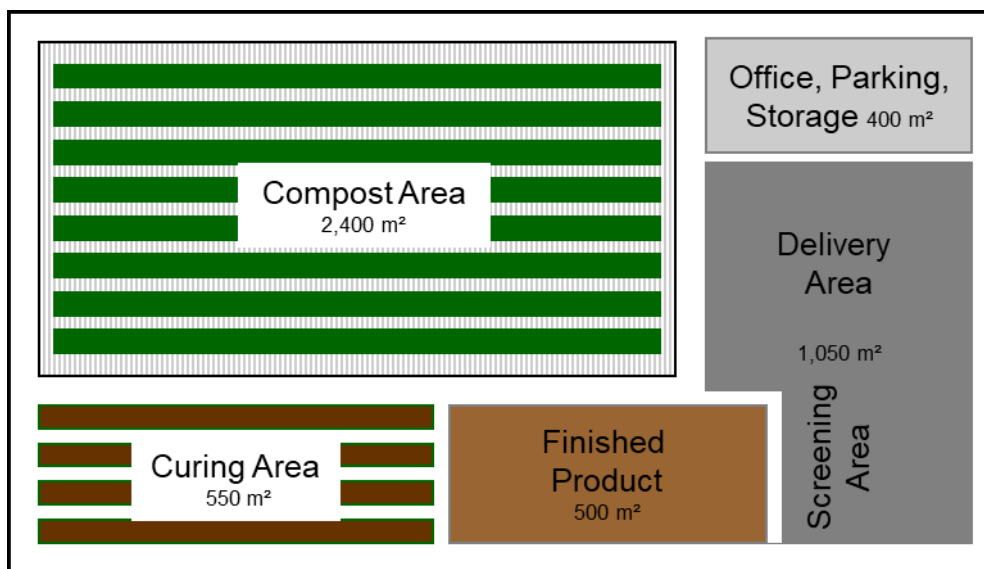


Figure 33 Layout of the pilot composting plant (without scale)

For the turning and transport of the material within the plant a skid loader will be used. The screening of the mature compost will be carried out in a screening machine. For the shredding of coarse parts (e.g. tree branches and trunks) a shredder is used. Small scale equipment like thermometer, pH-meter, CO₂-meter is required to control the composting process.

Quality and composition of the finished product will be analysed in an external laboratory, Parameters like dry matter content, grain size, density, grade of the composting, C/N ratio, salt content, share of impurities and pathogens and most important the content of the heavy metals will be investigated and recorded.

4.3.1.4 Potential for Composting Measures beyond Pilot Measures

The quality of the produced compost is highly dependent on the success of the separate collection. As a mid-term goal it is envisaged to sell the compost in the project area. In a first step the compost can be used by the municipalities in the project area as soil conditioner for public green areas. Also, farmers in the project area can receive the compost at a preferential price (or even free of charge) for testing its quality and use.

Experience from other countries shows, that the costs of composting usually cannot be covered from the revenues through marketing of compost. The decision for extension therefore should be based on

- a thorough analysis of costs and revenues,
- cooperation of the population,
- purity of the input and quality/marketability of the output.



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An extension to include organic waste from households (kitchen waste) would require a house to house collection and a more sophisticated treatment technology, thus substantially increasing the overall system costs.

4.3.2 Costs for Waste Treatment (Composting)

4.3.2.1 Investment Costs

The following table summarises the additional investment costs for construction works and equipment for the two pilot compost plants.

Table 41 Investment costs of the pilot compost plants

Item	Unit Price [EUR]	No of Units [EUR]	Costs [EUR]
Construction works	300,000	2	600,000
Water, electricity, leachate	15,000	2	30,000
Dump truck	40,000	2	80,000
Skid loader	40,000	2	80,000
Shredder	45,000	2	90,000
Screener	70,000	2	140,000
Support equipment	10,000	2	20,000
Office, sanitation etc.	10,000	2	20,000
Total			1,060,000

The required investment costs for the pilot composting plant over the planning horizon (2023 - 2042) are presented in the following table. The initial investment costs at the beginning of the implementation will be about 1,060,000 EUR (530,000 EUR for each plant; without contingencies and VAT). The total replacement costs will be about 460,000 EUR.

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Table 42 Investment costs of the pilot compost plant

Year	Initial investments [EUR/a]		Replacements [EUR/a]		Total Investments [EUR/a]		
	Civil works	Equipment	Civil works	Equipment	Initial	Renewal	Total
2022	600,000	460,000	0	0	1,060,000	0	1,060,000
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032							
2033	0	0	0	460,000	0	460,000	460,000
2034	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0
Total	600,000	460,000	0	460,000	1,060,000	460,000	1,520,000

4.3.2.2 Operation Costs

For the staffing of the facility, two full-time workers and a half-time manager will be necessary to operate the plant.

Other operating costs consist of costs for equipment use and maintenance and repair and product analysis. Furthermore, a lump sum of 5,000 EUR per municipality is calculated for additional green waste collection tours (staff and consumption costs) in spring and autumn.

The following table shows the operating costs over the planning horizon. The annual operating costs will be about 98,720 EUR.



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Table 43 Annual operating costs of the pilot compost plant¹⁹

Item	Waste Quantity	Unit Price	Annual costs
	[t/a]	[EUR/t]	[EUR/a]
Personnel			48,000
Consumption (3.5 €/t)	8400	3.5	29,400
Maintenance and repair (1.8 €/t)	8400	1.8	15,120
Other	8400	0.5	4,200
Collection of green waste (additional tours in spring and autumn)	2000	5	10,000
Total annual operating costs (for two plants)			98,720

The pilot compost plants will each produce about 2,100 tons of compost per year (4,200 in total). In order to cover the operating costs, the minimum selling price should be 25 EUR/t. Since there is no market for compost so far, at least at the beginning farmers and gardeners should get the material free of charge at the plant for testing its quality and use. If the compost shall be sold at a later stage intensive public relation activities are necessary. Thus, at the beginning of operation little income from revenues is expected.

¹⁹ The calculation of costs does not consider any price change over time (e.g. inflation).

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Table 44 Operating costs of the separate green waste collection [EUR]²⁰

Year	Total waste quantity	Operational costs				
		Consumption	Maintenance	Ins., tax, other	Personnel	Total
	t/a	€/a	€/a	€/a	€/a	€/a
2023	8,400	29,400	15,120	4,200	48,000	88,720
2024	8,400	29,400	15,120	4,200	48,000	88,720
2025	8,400	29,400	15,120	4,200	48,000	88,720
2026	8,400	29,400	15,120	4,200	48,000	88,720
2027	8,400	29,400	15,120	4,200	48,000	88,720
2028	8,400	29,400	15,120	4,200	48,000	88,720
2029	8,400	29,400	15,120	4,200	48,000	88,720
2030	8,400	29,400	15,120	4,200	48,000	88,720
2031	8,400	29,400	15,120	4,200	48,000	88,720
2032	8,400	29,400	15,120	4,200	48,000	88,720
2033	8,400	29,400	15,120	4,200	48,000	88,720
2034	8,400	29,400	15,120	4,200	48,000	88,720
2035	8,400	29,400	15,120	4,200	48,000	88,720
2036	8,400	29,400	15,120	4,200	48,000	88,720
2037	8,400	29,400	15,120	4,200	48,000	88,720
2038	8,400	29,400	15,120	4,200	48,000	88,720
2039	8,400	29,400	15,120	4,200	48,000	88,720
2040	8,400	29,400	15,120	4,200	48,000	88,720
2041	8,400	29,400	15,120	4,200	48,000	88,720
2042	8,400	29,400	15,120	4,200	48,000	88,720
Total	168,000	588,000	302,400	84,000	960,000	1,934,400

4.4 Waste Disposal

4.4.1 General Design Parameters

4.4.1.1 Legal Framework and Guidelines

According to the Terms of Reference (ToR, chapter 2.3) “the landfill site at Rusino is the designated site (as by the National Waste Management Plan) for the regional sanitary landfill”. The Rusino site is located in a distance of about 8 km mainly south of Gostivar and at an altitude of about 800 m above sea level on the slopes of mountain Bukovik.

²⁰ The calculation of costs does not consider any price change over time (e.g. inflation).

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The new sanitary landfill will be mainly located on top of the existing dumpsite (thus on top of the existing waste body) and will be designed for household (and similar) waste, only. Its lifetime is defined to be about 10 years, thus needing a total capacity of about 1,000,000 m³.

The general waste management policy is established in the Law on Environment, in the National Environmental Programmes (NEAP 1996/2007) and in particular in the Law on Solid Waste Management. The Law on Solid Waste Management settles the framework and provides general rules for all types of waste and provides the legal basis for the secondary legislation.

The landfill will be designed according to the specifications of the Macedonian Law on Solid Waste Management and the Rulebook on conditions that have to be fulfilled by the landfills (Official Gazette No. 78/09), as well as the EU Landfill Directive 1999/31/EC (including the Council Decision 2003/33/EC).

The Rulebook on conditions that have to be fulfilled by the landfills includes conditions, inter alia for design of a bottom sealing and leachate collection system, that are similar, if not identical, to those included in the EU landfill directive. As a result the key elements of the landfill will be the base and surface sealing system, the leachate collection and treatment system to avoid groundwater contamination and the landfill gas collection and treatment system to avoid greenhouse gas emissions (methane).

4.4.1.2 Basic Data for Landfill Design

Climate and Hydrological Conditions

A hydrological report was prepared in August 2019 which describes the hydrological situation on site and shows the climate conditions.

The following table shows the given climate data for the site area. The presented data are from Mavrovo meteor station and represents the time period of 1981 to 2010.

Table 45 Climate data for Rusino landfill site area

Meteorological Elements	Station	MONTHS												Sum
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Temperature [°C],	Mavrovo average													8
Monthly average rainfall [mm]	Mavrovo average	97	92	86	86	72	52	48	44	68	97	124	126	993
Maximum rainfall [mm]	Day													42
	Hour													25



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It is assumed that there is no difference between the rainfall in Mavrovo and Rusino.

Big storm water events appear mainly in summer time (winter time normally shows rain falls of longer duration but lower intensity). For the calculation of ditches, pipes etc. a rain event which happens once in 5 years is assessed.

Data for evaporation per month will not be used. It is assumed that the yearly evaporation is in the same range as the yearly amount of rainfall and no additional rain water has to be taken in to account for open leachate ponds.

Surface Water

At the north-western and at the south-eastern side of the site valleys are located. Both valleys belong to river Sushica which is of an intermittent type that dries up during the summer months.

The catchment area of the River Sushica to the south-east amounts to about 34 ha and to the north-west to about 35 ha.

Waste Quantity and Resulting Landfill Volume

The waste quantities of the project area can be summarized as follow.

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Table 46 Total waste collected for disposal and required landfill capacity

Year	Waste for Disposal	Cover Material	Landfill Capacity	Cumulated
	t/a	t/a	t/a	t/a
2023	90,103	4,505	94,608	94,608
2024	90,788	4,539	95,328	189,936
2025	92,908	4,645	97,554	287,490
2026	96,305	4,815	101,120	388,610
2027	99,459	4,973	104,432	493,042
2028	102,062	5,103	107,165	600,207
2029	104,707	5,235	109,942	710,149
2030	107,394	5,370	112,764	822,912
2031	108,400	5,420	113,820	936,732
2032	109,414	5,471	114,885	1,051,617
2033	110,437	5,522	115,959	1,167,576
2034	111,468	5,573	117,042	1,284,617
2035	112,508	5,625	118,133	1,402,751
2036	113,556	5,678	119,234	1,521,985
2037	114,613	5,731	120,344	1,642,328
2038	115,679	5,784	121,463	1,763,791
2039	116,753	5,838	122,591	1,886,382
2040	117,837	5,892	123,728	2,010,111
2041	118,929	5,946	124,875	2,134,986
2042	120,030	6,002	126,032	2,261,018

A waste density of 1.0 t/m³ for the waste/cover material can be assumed at the end of the operational time of a landfill. Waste will normally be disposed with a density of about 0.6 - 0.8 t/m³ when it will be built in with compaction. However, due to settlements caused by additional loads of new waste and by decomposition of organic waste, the final density of the municipal waste is expected to be 1.0 t/m³. Consequently the required landfill capacity for a 20 years-period is estimated to be 2.3 million m³.

Ownership

The landfill site area is mainly state owned. However, there are a few privately owned plots (see Figure 34). These plots will need to be acquired prior to landfill construction. The Municipality of Gostivar has agreed to speed up the procedure for such²¹.

²¹ On 12 September 2019 a meeting was held with the Mayor of Gostivar. The Mayor announced that he will ask urban planning sector to speed up the procedure for clarification of the landownership. Goal is to arrange for full public ownership before allocation of funds for the next project phase.

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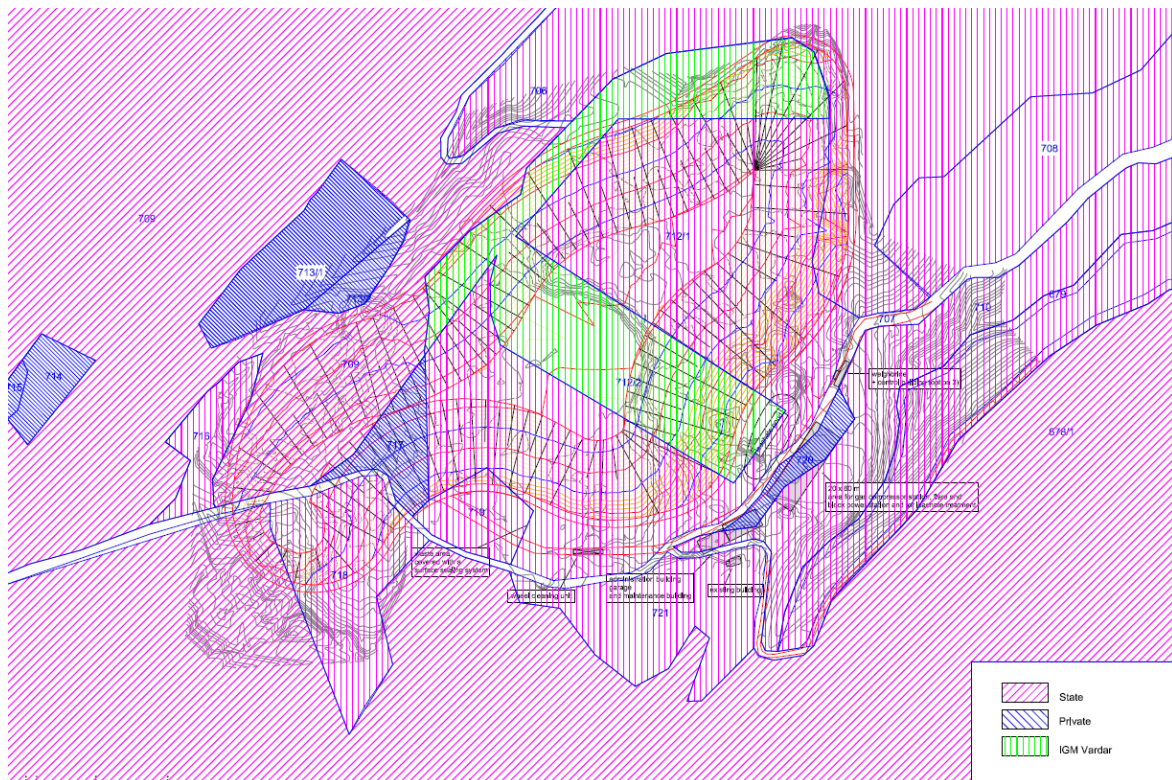


Figure 34 Land ownership at Rusino site

4.4.2 Description of Landfill Design

4.4.2.1 Site Location and Surrounding Area

The site is located at a distance of about 8 km south of Gostivar (10 km driving distance from Gostivar centre). The current access road extends some 5 km from the Mikro Kalcit production facility (southern border of Gostivar city) directly to the landfill.

The centre of the proposed sanitary landfill site has the following coordinates (RNM national grid):

X: 489600 Y: 4621450 Z: ~765 m above sea level (asl)

The access road was resurfaced in 2019 over about half of its length (towards north direction). However, as the old access road is in a very poor condition the remaining section has to be resurfaced as well.

Close to the existing dumpsite there are two vacated buildings.

4.4.2.2 Topographic Plans of Site

The area is located in a mild depression at the beginning of the Suva Reka valley. The location has relatively minor water catchment areas. The site is slightly opened to the



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north. The area used for waste disposal is located in a former clay pit, is mainly flat (except the actual filling area) and is not fenced. The surrounding of the site is a natural forest terrain and is visually hidden to all directions.

According to the results of the pre-feasibility study prepared by REC Macedonia in 2008, the site base consists of clay layers with minimum thickness of 2.5 m.

No permanent rivers have to be regarded at Rusino site. However, north-west and south east of the site two valleys are located which discharges all rainwater from the surroundings down towards Gostivar. The slopes of the valley reach up to about 100 %.

South-west of the site a moderate sloped hill (slopes about 20 to 30 %) follows. The adjacent areas towards north-east are relatively flat.

4.4.2.3 Results of Hydro-geological and Geotechnical Survey

The geological and hydro-geological investigations (executed by Geos, supported by the Faculty of Civil Engineering staffs, 2019) led to the following main results:

- The deposited material in the observed area is actually solid waste and its mixture with soil. The thickness of the layer of deposited material measures 2 to 8 m;
- The soil is of Palaeozoic phyllite shales. There are quite weathered rocks with clearly expressed foliation, moderately crushed, light to dark grey and green colour;
- Groundwater is present at a depth of 4 m.
- The clayey subsoil (underneath the dumpsite) can be considered as a geological barrier. Also, the metamorphic schist's complex beneath the clayey material can be considered as a geological barrier.
- From the seismic aspect the site suits to a group of relatively stable sites. Correspondingly to Mercalli-Cancani-Zieberg scale, the zone is a part of territory with intensity $I = VIII^0$ MCS with depth of occurrence around 10 km.

Summarised it can be stated that the geological situation does not cause problems for the landfill design. However, the areas intended for construction of buildings shall be cleared from the existing deposits, and backfilled with suitable material with compaction in layers of 20 to 30 cm, until the compaction ratio reaches 45 MPa at least.

4.4.2.4 Proposed Site Lay Out with Infrastructure and Staged Filling Plan

Based on the topographical survey and the accumulated waste quantity, a conceptual design of the landfill has been prepared. The (conceptual) design drawings for the landfill are shown in Annex 2 – L-P-01 to L-P-11. Especially to minimize the leachate amount, the



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landfill will be divided into two cells respectively construction stages. The following table shows the basic design data for the construction stages (cells) and the final situation after complete filling of the landfill.

Table 47 Base data of the designed disposal area

Cells	Basis area	Surface area	Volume of landfill
	[m ²]	[m ²]	[m ³]
Cell 1	44,200	40,800	605,000
Cell 2	37,100	42,200	445,000
Total	81,300	83,000	1,050,000

According to the landfill design a total waste volume of about 1,050,000 m³ is available at Rusino site. Thus the lifetime of the Rusino landfill will be in total 10 years. The lifetime of the individual cells will be as following:

Cell 1: Lifetime 5.5 years (from 2023 – mid 2028)

Cell 2: Lifetime 4.5 years (from mid-2028 – 2032)

The required area for the base sealing system amounts to about 81,300 m² and for the surface sealing system to about 83,000 m². The difference is due to the fact that a clayey dike will be built as part of the quick win measures (towards the north-western valley) which, during landfill construction, will be integrated in the base sealing system.

The maximum height of the filled waste amounts to about 20 m.

The maximum length inside the disposal area amounts to about 490 m (from south-west to north-east); the maximum width is about 220 m.

Due to the limited area and the steep slopes towards the valley a ring road around the landfill is not provided.

As already described, the new sanitary landfill will be constructed on top of the existing waste body. To allow the base sealing construction in parallel to the required waste filling, the design considered a remaining waste volume of 150,000 m³ which can be still disposed at the existing dump site until the new landfill will be commissioned (assumed for 2023).

For infrastructure facilities only the area along the access road is available. The landfill area itself will be separated by a gate to avoid uncontrolled truck access to the site.

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Between the gate and the landfill the entrance area (control building etc.) and the infrastructure area (buildings, container area etc.) are realised. The infrastructure area also includes the leachate pond, the gas station and the leachate treatment units.

The following Table 48 presents a rough overview of the different areas of the landfill, including its infrastructure.

Table 48 Overview infrastructure area

	Area [m ²]
Total size of the landfill area (fenced area)	117,850
- thereof: area for landfill	83,000
- thereof: total size of infrastructure area	10,390
thereof: entrance area	1,700
thereof: buildings	480
thereof: leachate pond / area between landfill and road	3,700
thereof: paved area for gas and leachate treatment	1,200
thereof: paved areas within fenced area	3,310
- - thereof: not used green areas	24,460

4.4.2.5 Designs of Bottom Lining and Top Cover Systems

To provide a controlled collection and drainage of leachate by gravity, the lowest point of the leachate collection system inside the landfill is planned to be at the edge (in the north-east) of the landfill.

The bottom area of the landfill will have slopes of 4.4 % (mainly from west to east direction). Towards north-west and south-east direction slopes with an inclination of 1:3 are required. The slopes of the north-western dike will have an inclination of 1:1.5 both inside and outside the landfill (only limited height of about 2 m) (see Annex 2 – L-P-03 and L-P-08).

Profiling the landfill base requires shifting of waste in a volume of about 30,000 m³. The complete waste shifting will be done within the work of construction phase 1. The surface of the shifted waste shows the necessary longitudinal and transversal slopes for the base sealing system (see Annex 2 – L-P-03).

The design is prepared in such a way that a waste volume of about 150,000 m³ can be disposed until the new sanitary landfill will be operated (remaining waste volume of the existing dumpsite).



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Base Sealing System

The new landfill is designed and shall be constructed and operated in accordance with the EU-Directive 1999/31/EC and the Council Decision 2003/33/EC. As a result, the bottom liner system should consist of a clay layer and a geo-membrane (two different sealing systems).

However, at the Rusino site there is the special situation which is called “landfill on top of landfill”. As the actual waste disposal within the existing dump site is done without any compaction substantial settlements have to be anticipated within the dumped waste, especially as soon as the new sanitary landfill is constructed and operated on top of the dumpsite. In this case, a double bottom liner system, especially the geomembrane (made of PE-HD), will get stability problems caused by settlements. In extreme cases the geomembrane might crack and lose its function as a sealing system.

Contrary to the geomembrane the mineral sealing layer (clay layer) is more flexible, can adjust to settlements and shows a self-healing effect (after settlements).

Therefore it is suggested to substitute the geomembrane by an additional mineral sealing layer. This approach supported by the fact that the existing subsoil under the dumpsite can be regarded as a natural geological barrier, which under normal soil conditions would lead to a single artificial bottom sealing system (EU-directive, Annex 1).

The structure of the bottom sealing system will be as follow (see details below):

- Levelled and surface compacted waste of existing dumpsite
- 100 cm compensation layer between waste and bottom sealing system
- 75 cm clay ($k_f < 5 \times 10^{-10}$ m/s – 3 layers, 25 cm each)
- Geo-textile
- 50 cm drainage layer (gravel 8 / 16 or 16 / 32 mm)

The bottom sealing system indicates a maximum inclination of 33 % (1:3) in the sloped area towards north-west and south-east and about 4.4 % (in flow direction) in the bottom area towards the deepest point of the landfill.

Leachate drain pipes run from west to east and have an inclination of 4.4 %. Distances between the drain pipes measure between 30 m and 40 m. A roof profile with an inclination of 3 %, as a minimum, is constructed between the drain pipes. This profile stimulates a leachate flow towards the drain pipes. Outside the landfill all leachate is collected in a main leachate pipe and transported to the leachate treatment plant.



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In the following, all proposed materials for the base sealing system will be described briefly.

a.) Compensation layer

The compensation layer is constructed with a thickness of 100 cm. This layer levels out unevenness's of the existing waste body, serves as a discharge layer of gas coming from the dumped waste and serves as a compacted support layer for the base sealing system.

A well graded, soil of low plasticity (mainly sandy material) has to be used for the compensation layer.

The compaction degree (D_{pr}) on the plane surface of the compensation layer has to be more than 95 %.

b.) Mineral sealing layer

The mineral sealing layer will be incorporated in three layers of at least 25 cm each. A good coherent material (suitable combination of coarse and fine particles) has to be used. The material will only be built in, when weather conditions allow a good compaction of the material (no frost, no rain). The following quality demands have to be considered.

- at least 10 mass-% of clay particles with a high adsorptive capacity,
- maximum 5 mass-% of organic substances and
- maximum 15 mass-% of carbonate.

The permeability (k) of the clay layers has to be less than 5×10^{-10} m/s.

For the material and its incorporation the following requirements must be guaranteed:

- homogenous material that shows a homogenous water content and homogenous incorporation of the material,
- proctor density of each layer of $D_{pr} \geq 95$ % and
- water content (w) must be higher than the proctor water content (w_{pr}).

c.) Geo-textile

To avoid a pressing of the coarse material of the drainage layer into the clayey mineral sealing layer, a geo-textile (weight about 300 to 400 g/m²) must be applied.

The geo-textiles are delivered exclusively according to manufacturer's transportation and storage instructions. A storage area must be prepared on site according to manufacturer's instruction. The prescribed overlapping widths must be adhered to. The geo-textile must



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be laid in longitudinal roll direction with the inclination of the embankments and bottom area.

The following material requirements have to be fulfilled for the geotextiles respectively the following tests have to be proved prior to construction:

- Weight of geo-textile: > 325 g/m²
- Puncture resistance > 3 kN
- Proof of (grap) tensile strength > 1 kN
- Manufacturer certificate, product name
- Static proof (prove of slope stability)

d.) Drainage Layer

A drainage layer, consisting of gravel with a grain size of 8/16 mm or 16/32 mm will be applied to assist drainage of leachate. Gravel will consist of uniform sizes and be washed to ensure a high permeability. Perforated HD-PE leachate drain pipes will be embedded in the drainage layer. The thickness of the drainage layer will be at least 50 cm.

The chemical/ physical and mechanical stability of the material selected for the drainage layer must ensure that there is no negative effect on the drainage efficiency from the chemical and physical leachate characteristics and the mechanical load.

The gravel has to fulfil the following quality standards:

- permeability $k \geq 1 \times 10^{-3}$ m/s
- undersize < 10 %
- maximum 30 mass-% of carbonate

Surface Sealing System

For sanitary landfills for municipal (non-hazardous) solid waste EU standards demand a single liner surface sealing system. It is suggested that a mineral clay layer should be used as sealing layer. The main components of this surface sealing system are:

- 50 cm compensation layer
- 50 cm clay ($k_f < 1 \times 10^{-9}$ m/s – 2 layers, 25 cm each)
- 50 cm drainage layer
- geo-textile
- 100 cm re-cultivation layer



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In order to achieve a disposal volume of about 1,050,000 m³ waste has to be disposed with a maximal inclination of 1:2.5 up to a height of about 20 m above base sealing. Next to the slopes, the flat plateau area with an inclination of about 4.5 % in flow direction follows. The mentioned inclinations represent the situation before the waste has settled (before settlement). The inclinations of the landfill surface will be 3 %, as a minimum, after settlement.

After reaching the highest levels of each infilling phase, a final cover has to be placed over the waste body. The surface sealing system will be constructed with a maximum slope of 40 % (1:2.5, see Annex 2 – L-P-04).

In the following, all materials for the suggested surface sealing system will be briefly described.

a.) Compensation Layer

After completing the waste filling, the waste surface will be profiled exactly according to the planned inclination of the surface sealing system. Above the waste surface, the compensation layer made of a homogenous non-binding material will be applied. The thickness of the layer will be at least 50 cm. Within the compensation layer, gas will be directed to the gas collection system (described below). The layer will be the foundation for the sealing layer.

Permeability of the layer should be about 10⁻⁴ m/s to 10⁻⁵ m/s to allow suitable gas flow towards the collection system.

b.) Mineral Sealing Layer (clay layer)

The mineral sealing layer will be incorporated in two layers of at least 25 cm each. A good binding material (suitable combination of coarse and fine particles) has to be used. The clayey material has to fulfil the same quality standards as described for the mineral sealing layer of the base sealing system; except for the permeability (kf < 1 x 10⁻⁹ m/s is sufficient).

c.) Drainage Layer

The drainage layer consisting of gravel with a grain size of 8/16 mm or 16/32 mm will be used for discharging the rainwater which will infiltrate into the re-cultivation layer (see below). The thickness of the drainage layer will be at least 50 cm. The gravel has to fulfil the same quality standards as described for the drainage layer of the base sealing system.



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d.) Geo-textile (mechanically bonded filter fleece)

To separate the drainage layer from the re-cultivation layer and to avoid infiltration of fine particles into the drainage layer, a filter layer will be placed on top of the drainage layer. A needle-punched, non-woven geotextile will be used.

The filter characteristics have to be proofed by a competent testing institute. Weight of the layer will be about 300 to 400 g/m²

e.) Re-cultivation Layer

The re-cultivation layer (topsoil) will be used for the final restoration of the site. Plants will be placed similarly to the normal flora in the vicinity of the site (mainly grass). In order to protect the sealing system, deep rooting plants must be avoided. The plants have to protect the total sealing system against wind and water erosion and have to minimise rainwater infiltration. The re-cultivation layer will have a thickness of at least 100 cm.

4.4.2.6 Description of Landfill Operating Routines and Interim Cover Systems

The division of the landfill into the two filling cells is presented in Annex 2 – L-P-05 and L-P-08. The cells will be separated by a separation dam, see Annex 2 – L-P-10.

The maximum waste slope will be 1:2.5 and the minimum will be about 4.5 % in final situation. The slope of cell one towards cell two (temporally situation) will be 1:1.5, as maximum.

All cells will be filled from “bottom to top”. Waste will be filled layer by layer (each layer maximum 2 m) until the maximum, design infilling height is reached.

Waste filling starts in filling cell 1 at the north-eastern border. With the beginning of waste disposal a delivery ramp from the access road to cell 1 has to be constructed (located on top of the waste of the dump site). As soon as the waste filling starts in cell 2, a direct access to the cell from the access road is possible.

Trucks unload the waste nearby the slopes of the ramp and the waste will be transported and spread in the filling area by the compactor. The ramps have to be adapted according the filled waste height.

The waste should be compacted by a steel wheeled compactor in order to reduce the required volume. Unloading of waste should be carried out in a distance of about 20 m from the actual disposal (filling) segment. Transport to the filling segment will be done using the compactor (partly supported by the bulldozer). The waste will be incorporated by the compactor in layers with a maximum thickness of 50 cm.



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The size of the actual disposal segment amounts to about 3,000 m², in maximum. After reaching a filling height of 2 m the next disposal segment follows. Therefore each filling cell will be filled up horizontally in layers of 2 m. The first 2 m directly on top of the drainage layer will be brought in in one layer and without a compaction by a compactor.

At those areas where waste remains uncovered for a period of 30 days or more, soil material will be used for temporary coverage. In order to minimise emissions of the following procedure shall be followed:

- Areas where no waste will be placed for a longer time (from about 30 days up) are covered with a soil layer of about 20 cm in thickness. The soil cover is applied in these areas immediately after waste filling.
- Before filling continues, most of the soil cover shall be removed (except for a few centimetres). The soil shall be re-used for covering purposes.

The coverage material must consist of sandy or gritty material to avoid impermeable layers inside the waste body. Debris, e.g. C&D waste, should be used, as far as possible.

To avoid too much soil use for coverage a daily coverage of the tipping face is not envisaged. However, to avoid emissions and to reduce the amount of leachate the final filled cells will be covered with soil material on its outer slopes. Materials should be used that can later be integrated into the compensation layer. The amount of cover material is estimated to be 10% of the waste disposed.

In this way odour emissions are minimised. Flying paper or other waste drifts, from waste build-in (incorporation) with the compactor, are reduced.

4.4.2.7 Overall Earth Materials Balance for Site

Since the landfill is located on top of the existing dump site only waste shifts are required and no earthworks for profiling the landfill plane are required.

However, limited earthworks are required for the area of the leachate pond (area between landfill and access road). The design of the landfill led to the following earthwork (fills and cuts):

cut and re-fill of material: 4,000 m³

fill of material (to be imported): 2,000 m³

As the ground mainly consists of clay and loam (no rocky material) earth works can be executed with normal machines and efforts. All earthworks will be done within the work of construction phase 1.



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For profiling the plane, the earth from the areas where material will be cut will be incorporated and compacted in layers with a thickness of about 50 cm in the filling areas. Afterwards, the cut areas will be compacted as well. The compaction degree (D_{pr}) on the plane surface has to be more than 95 %.

Profiling the plane of landfill base requires shifting a waste volume of about 30,000 m³.

Profiling the plane for the entrance area requires earthworks, too. The following earthwork (fills and cuts) has to be done for preparing the plane:

- cut of material: about 8000 m³
- fill of material: 7000 m³

All in all an amount of about 1000 m³ has to be transported to the site.

4.4.2.8 Leachate Collection, Treatment and Disposal System

Leachate Collection

Due to the placement of untreated waste, infiltration of precipitation and bio-chemical reactions in the landfill body, leachate will be generated which has to be collected, transported and treated. The following basic data were chosen for the leachate collection:

- The leachate which is generated in the landfill body and the rain water which is seeping through the waste will accumulate in the drainage layer above the base sealing system.
- Inside the drainage layer, 11 leachate drain pipes will be located to collect and discharge all leachate out of the landfill body. The pipes will have a distance of 30 m respectively 40 m with a roof profile between the pipes ensuring that all accumulated leachate flows towards the drain pipes; inclination of drain pipes about 4.4 %).
- Due to shape of the bottom sealing system on top of the old dumpsite, leachate has to be collected from the point where the bottom liner meets the surrounding dike (north-western and south-eastern side; see Annex L-P-10). Two perimeter PE-HD drainage pipes (internal diameter: 200 mm) are installed for this purpose. These two pipes only serve a small leachate catchment area but are necessary to avoid a leachate accumulation at the landfill border. The pipes connect to the main leachate pipe at their deepest point.
- All collected leachate will be led by gravity via the drain pipes to two main leachate pipes which are located outside the landfill.
- The main leachate pipes lead to the deepest point close to the leachate pond (south-east of the landfill). The main pipe along the northern, eastern and south-



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eastern border collects about 75 % of all leachate whereas the second pipe, located at the southern landfill border collects the remaining 25%. Both pipes will be constructed with an inclination of 1 %, as a minimum and will be equipped with manholes providing access every 50 to 60 m.

- All leachate drain pipes are 2/3 perforated, have an internal diameter of 200 mm and made of PE-HD.
- The main leachate pipe is not perforated, has an internal diameter of 400 mm and is made out of PE-HD.
- At the top point of each drain pipe access points are constructed to allow for cleaning of the drains. For this purpose the pipes will be led through the surface sealing system as a pipe without perforation. The pipes will be closed at the ends.
- Access to the main leachate pipe will be provided by a large manhole at the lowest point. Inside this manhole a slide valve will be installed in the main leachate pipe, which in case of extreme storm water events. Leachate can accumulate inside the landfill during such event and an overflow of the leachate pond will be avoided.

The described collection and discharge of leachate can be seen in Annex 2 – L-P-04 and L-P-10.

A final calculation of the required pipe diameters will be done during the detailed design. A **preliminary calculation** has been made on the following basis:

- The average inflow is used for calculating the dimensions of the leachate pipes. For cost saving reasons, a worst case scenario (first waste is filled, remaining landfill is open) should not be regarded. Calculation with the average inflow means, that for a short period of time excess leachate in the drain layer may have to be accepted. It is assumed that in all cases the leachate must be discharged within 2 hours.
- Calculations are made under the assumption of a precipitation of 25 mm in one hour.
- Inclination of leachate pipes: 4.4 % for primary leachate drain pipes, 1 % for perimeter drain pipes and 1.0 % for the main leachate pipe
- Internal diameters of 400 mm for the main leachate pipes and 200 mm for the leachate drain pipes are chosen.
- The necessary pressure classes for the PE-HD pipes have to be calculated during the detailed design for a load of 22 m (waste height: 20 m, height of surface sealing: about 2 m). It is now assumed a pressure class of SDR 11 (former PN 10) is required.



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Assessment of chosen diameters:

- a. leachate drain pipes
- | | |
|---------------------------|--------------------------------------------------------------|
| maximum catch area: | $A = 300 \times 40 \text{ m}^2 = 12,000 \text{ m}^2$ |
| runoff coefficient: | $c = 0.9$ |
| intensity of rain water: | $i = 25 \text{ mm}$ |
| flow to drainage layer: | $Q = i \cdot c \cdot A = 270 \text{ m}^3$ |
| discharge within 2 hours: | $Q(\text{in}) = 135 \text{ m}^3/\text{h} = 37.5 \text{ l/s}$ |

possible discharge to main leachate pipe $Q(\text{max})$, according to formula of Prandtl/
Colebrook with an internal diameter of 200 mm and an inclination of 4 %:

$$Q(\text{max}) \approx 66 \text{ l/s} > Q(\text{in}) = 37.5 \text{ l/s}$$

- perimeter drain pipe
- | | |
|-----------------------------|--------------------------------------------------------------|
| maximum catch area: | $A = 400 \times 15 \text{ m}^2 = 6,000 \text{ m}^2$ |
| runoff coefficient: | $c = 0.9$ |
| intensity of rain water: | $i = 25 \text{ mm}$ |
| effluent to drainage layer: | $Q = i \cdot c \cdot A = 135 \text{ m}^3$ |
| discharge within 2 hours: | $Q(\text{in}) = 68 \text{ m}^3/\text{h} \sim 19 \text{ l/s}$ |

possible discharge in main leachate pipe $Q(\text{max})$, according to formula of Prandtl/
Colebrook with an internal diameter of 200 mm and an inclination of 1 %

$$Q(\text{max}) \approx 33 \text{ l/s} > Q(\text{in}) = 19 \text{ l/s}$$

- b. leachate main pipe
- | | |
|-----------------------------|----------------------------------------------------------------|
| maximum catch area: | $A (75\%) = 81,300 \times 0.75 \sim 61,000 \text{ m}^2$ |
| runoff coefficient: | $c = 0.9$ |
| intensity of rain water: | $i = 25 \text{ mm}$ |
| effluent to drainage layer: | $Q = i \cdot c \cdot A = 1,372 \text{ m}^3$ |
| discharge within 4 hours: | $Q(\text{in}) = 686 \text{ m}^3/\text{h} \sim 191 \text{ l/s}$ |

possible discharge in main leachate pipe, according to formula of Prandtl/ Colebrook
with an internal diameter of 400 mm and an inclination of 1 %

$$Q(\text{max}) \approx 210 \text{ l/s} > Q(\text{in}) = 191 \text{ l/s}$$

The calculation shows that the chosen pipe diameters are sufficient, as long as temporary excess leachate inside the drainage layer is accepted.

Leachate Amount and Treatment

For the Feasibility Study a leachate treatment system will be considered that allows the best possible treatment (independent of the pollutants coming from the waste) and ensures that groundwater in the surroundings won't be negatively affected.

Remarks to discharge of treated leachate:

- The (containerised) leachate treatment plant is located south-east of the landfill respectively the leachate pond on a paved area (size about 20 x 60 m²). Therefore all treated leachate is discharged towards the south-eastern valley.
- For designing a leachate treatment the amount of leachate has to be calculated in a first step. In a second step the treatment method can be chosen.

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a.) Calculation of Treatment Amount

The Bavarian Authority for Water suggests in its technical bulletin “discharge and storage of leachate – alternatives, approaches for dimensioning, technical requirements” (Bavarian LfW, bulletin number 3.6-4, June 22, 1995) to use the following coefficients (c) that represents the portion of precipitation which will infiltrate and will thus contribute to leachate generation:

- Areas with a surface sealing: 0.01 – 0.10 chosen: c = 0.05
- Areas with waste filling up to 4 m 0.70 – 0.90 chosen: c = 0.80
- Areas with waste filling from 4 to 10 m 0.50 – 0.70 chosen: c = 0.60
- Areas with waste filling > 10 m 0.30 – 0.50 chosen: c = 0.40

The following basic data are applied for a first calculation (calculation with the whole area of each construction stage):

- intensity of rain: $i = 993$ mm per year
- Flowrate of leachate: $L(\text{out}) = i \cdot \Sigma (c \cdot A)$ [mm/h·ha = m/h·m²·10] in which A = landfill area

Table 49 Estimated leachate quantity

	open area c = 0.8	waste area c = 0.4	closed area c = 0.05	$\Sigma (c \cdot A)$	L(out) (per year)
Beginning 1. cell	44,200 m ²	0 m ²	0 m ²	3.54	35,110 m ³
End of 1. cell	0 m ²	44,200 m ²	0 m ²		
Beginning 2. cell	37,100 m ²	4,300 m ²	39,900 m ²	3,34	33,160 m ³
End of 2. cell	0 m ²	0 m ²	81,300 m ²		

As a result, a leachate amount of about 35,100 m³ per year during operating the first construction stage with a life time of 4 to 5 years has to be anticipated. During operation of cell 2 the amount of leachate will be slightly reduced to about 33,200 m³ per year.

Assuming an availability of a treatment plant of 90 % (10 % for repair and maintenance) a plant with a capacity of about 39,000 m³/y, is required.

b.) Decision about leachate treatment

In general, there are two possibilities (variants) for leachate treatment:

6. Construction of a leachate pond which is designed with an appropriate volume and size such that all leachate can be evaporated
7. Construction of a leachate pond and an appropriate leachate treatment plant (to treat all generated leachate)



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In view of the climatic conditions in the Polog Region of RN Macedonia (a relative high amount of rainfall during the whole year) only variant 2 can realistically be applied.

In the following Table 50 the volume of a leachate pond is calculated under the assumption that all leachate will be treated. For the calculation, the beginning of landfill operation in cell 1 is taken as basis. The calculation is prepared without regarding the rain fall directly on the pond and via the following formula:

$$L = (4.42 \times 0.8 \times 10) \times P = 35.36 \times P, \text{ in which } L \text{ is leachate volume and } P \text{ the precipitation in mm.}$$

Table 50 Calculation of leachate pond

Month	precipitation P, [mm]	Leachate volume L [m ³]	Evaporation Ev [m ³]	leachate treatment [m ³]	Remaining untreated leachate [m ³]
January	97	3,430	0	-3,200	230
February	92	3,253	0	-3,200	283
March	86	3,041	0	-3,200	124
April	87	3,076	0	-3,200	0
May	72	2,546	0	-3,200	0
June	52	1,839	0	-3,200	0
July	48	1,697	0	-3,200	0
August	44	1,555	0	-3,200	0
September	68	2,404	0	-3,200	0
October	97	3,430	0	-3,200	230
November	124	4,385	0	-3,200	1,415
December	126	4,455	0	-3,200	2,670
Sum	993	35,111	0	-38,400	

Extending the calculations to following years shows a maximum amount of untreated leachate in any month of 2,953 m³ but that over the year all leachate can be treated. Therefore a leachate pond with a volume of 2,953 m³ is required. A pond of 2,500 m² and a depth of 1.25 m (available volume: 3,125 m³) will be realised, allowing for a safety margin of approximately 5%.

In view of the above, a plant with a capacity of about 105 m³/d (38,400 / 365) or about 5 m³/h will be required.

c.) Overview on alternatives for leachate treatment

The following table shows different alternatives used for the treatment of leachate.

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Table 51 Methods of leachate treatment

Method	short description of the method	suitable substances	unsuited substances	Products/ residues of method
Biological treatment aerobic / anaerobic	biological reaction of dismantling compounds in - storage basins - aeration basins - closed aerated reactors - closed non-aerated reactors	biodegradable compounds	toxic substances, salts (salt compounds)	sludge surplus - disposal/landfill - thermal treatment
Flocculation and coagulation	dissolved substances will be transformed and separated in undissolved substances by reactive agent	heavy metals and suspended matters	water containing complex forming compounds	sludge - disposal - thermal treatment
Oxidation method	organic substances will be dismantled with oxidising agents	organic compounds	inorganic compounds	carbon dioxide respectively organic products/residues of decomposition
Membrane filter method	concentrate of pollutants and cleaned water will be produced by means of pressure and semi-permeable (diaphragm) membrane	molecular (well dissolved) solutions	special organic compounds (e.g. acids, alcohol)	concentrate - further treatment - evaporation
Adsorption on activated carbon or adsorbing resins	pollutants will be adsorbed in tanks	organic compounds	salts, metals, ammonium	contaminated activated carbon or adsorbing resins - regeneration - thermal treatment - disposal/landfill
Evaporation/ concentration	evaporation of water and generation of salts	basically for all	Volatile chlorinated hydrocarbons	salts - disposal/landfill - exhaust air - incineration
Incineration	incineration of water and generation of cinders or dusts	basically for all	cadmium and mercury	cinders and dusts - disposal/landfill

The above treatment technologies require the combination of different alternatives to reach a sufficient purification of leachate. These combinations mainly require high technical efforts leading to high investment and operation costs.

d.) Suggested Leachate Treatment

In order to get a first impression of how high the leachate is polluted, 3 leachate samples were taken and analysed. Based on the analysis results and the table above, the following techniques can be used for the planned landfill site:

(i) The adsorption on granular activated carbon can be operated easily. Adsorption is a physical-chemical separation process. Adsorption is the addition of a component (adsorptive) from a gaseous or liquid mixture to the surface of a solid substance (adsorbent).

For wastewater treatment, adsorption processes are used when it comes to eliminating biologically resistant substances or absorbing shock loads or avoiding toxic influences.

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Activated carbon has long been used for drinking water treatment. In recent years, however, it has become increasingly important in industrial wastewater and leachate treatment (see Figure 35).

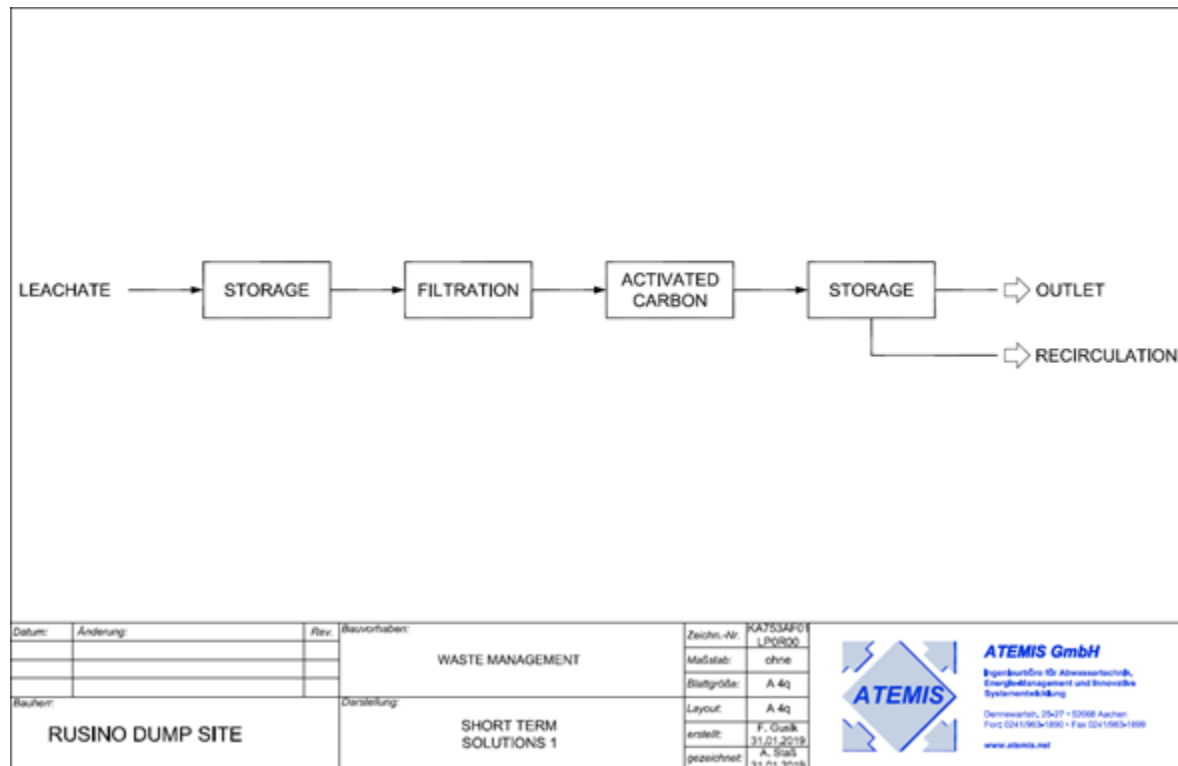


Figure 35 Scheme for activated carbon adsorption

The following pollutants can be reduced: COD, AOX

The required auxiliaries are: Activated Carbon, Electrical Energy, Trained Personal (low level)

The accumulated residues are: Activated Carbon (loaded with pollutants)

(ii) By a biological wastewater treatment, organic and inorganic pollutants are mineralized by the metabolism by selected microorganisms. The presence of pollutants is a necessary (obligatory) condition for the proliferation of these organisms.

In a biological leachate treatment system the degradation of the following compounds has to be taken into account: organic compounds (COD, BOD5, DOC, TOC, and AOX), nitrogen (ammonium and nitrate), iron and calcium, buffering capacity and conductivity.

In addition to the above described activated carbon treatment, a SBR (sequenced batch reactor) could be installed (see Figure 36).

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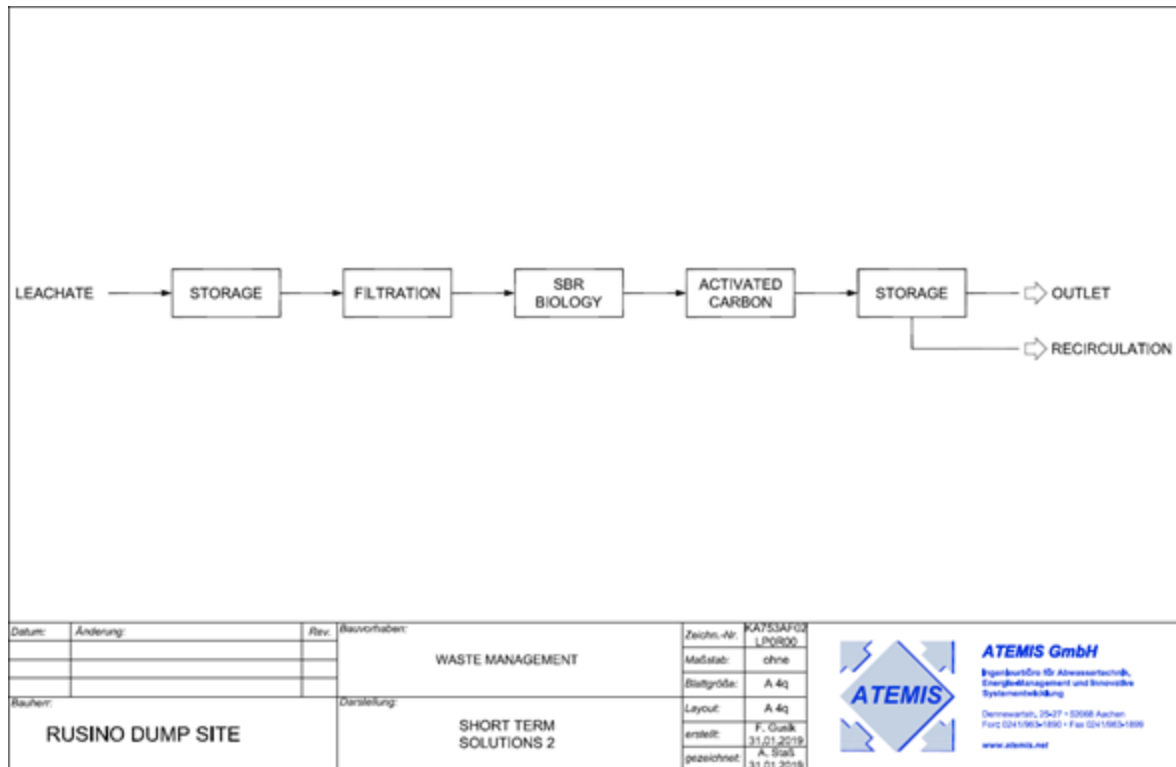


Figure 36 Scheme for activated carbon adsorption with SBR

Following pollutants can be reduced: COD, AOX, Nitrogen, and Carbon Compounds.

The required auxiliaries are: Activated Carbon, Atmospheric Oxygen, Carbon Source, Electrical Energy, Trained Personal (mid-level)

The accumulated residues are: Activated Carbon (loaded with pollutants), Excess Sludge

(iii) Membrane technologies, especially nano-filtration and reverse osmosis, are physical treatment processes which are pressure operated and use semipermeable membranes. The natural process of osmosis is inverted by applying a higher pressure than the natural prevailing osmotic pressure.

By applying a pressure higher than the osmotic pressure the process can be inverted, so that the concentrated solution is being dehydrated and further concentrated.

This process is called reverse osmosis. In addition to the two techniques mentioned above a reverse osmosis could be integrated in the leachate treatment system as illustrated in Figure 37.

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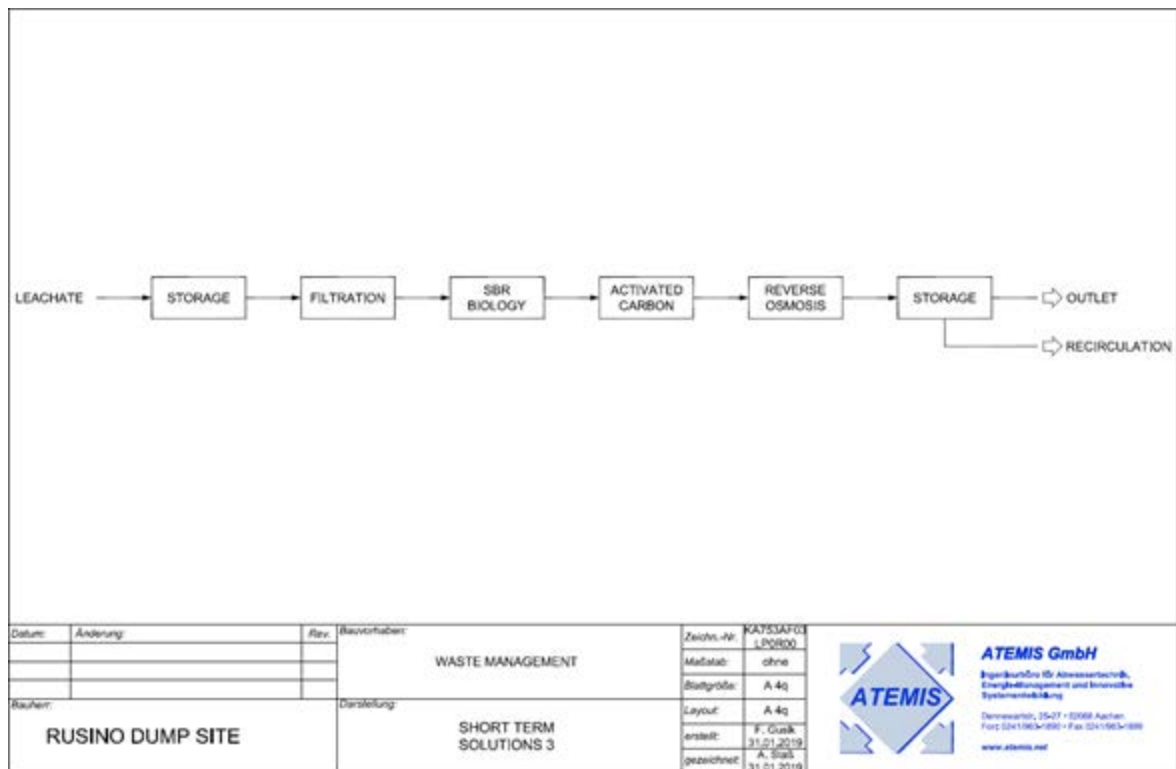


Figure 37 Scheme for activated carbon adsorption with SBR and reverse osmosis

Following pollutants can be reduced: COD, AOX, Nitrogen, Carbon Compounds, Salt Formers, and Heavy Metals

The required auxiliaries are: Activated Carbon, Atmospheric Oxygen, Carbon Source, Acid / Lye (pH adjustment), Electrical Energy, Trained Personal (high level)

The accumulated residues are: Activated Carbon (loaded with pollutants), Excess Sludge, and Concentrate (brine).

All mentioned techniques (i - iii) could be integrated into the future leachate treatment plant.

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The following Figure 38 shows an example of the installation of the containers for the biological treatment of leachate.

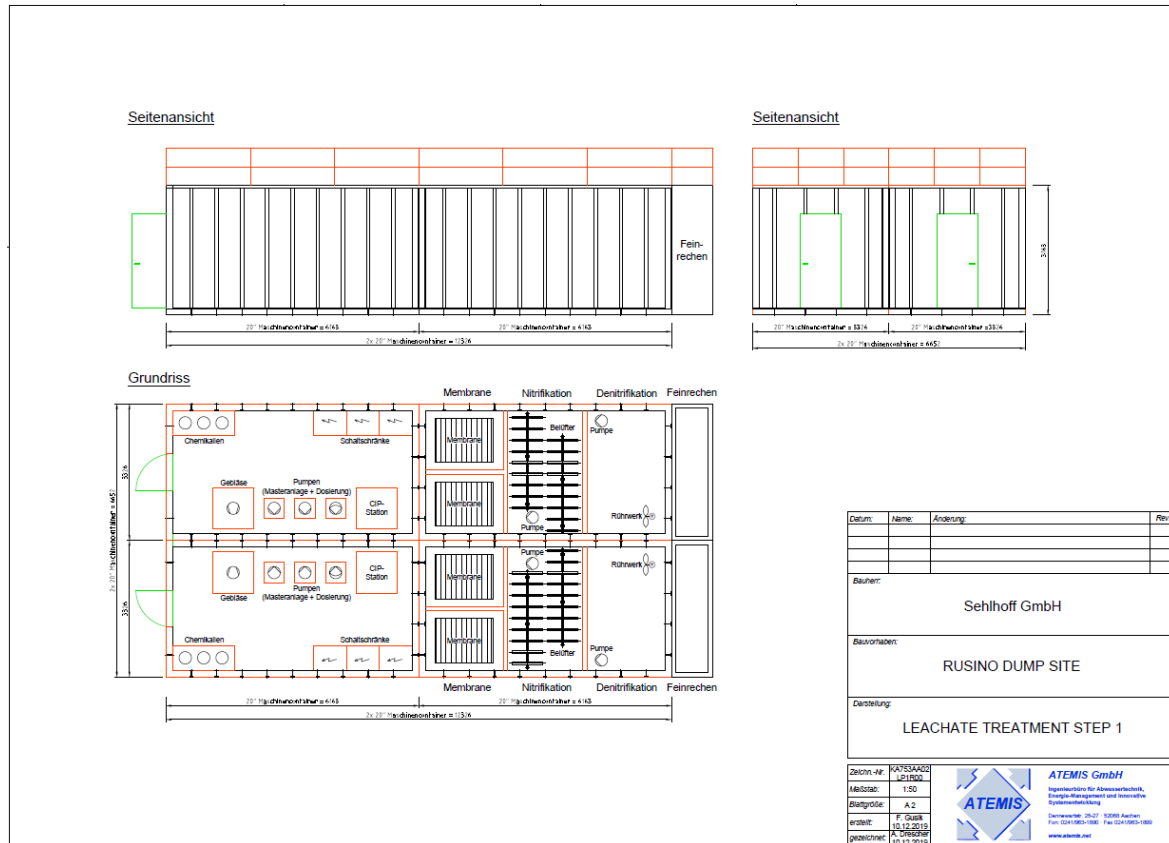


Figure 38 Scheme for the biological treatment of leachate

The footprint is approximately 6.5 by 12.5 meters.

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Figure 39 shows the exemplary installation of an activated carbon adsorber.

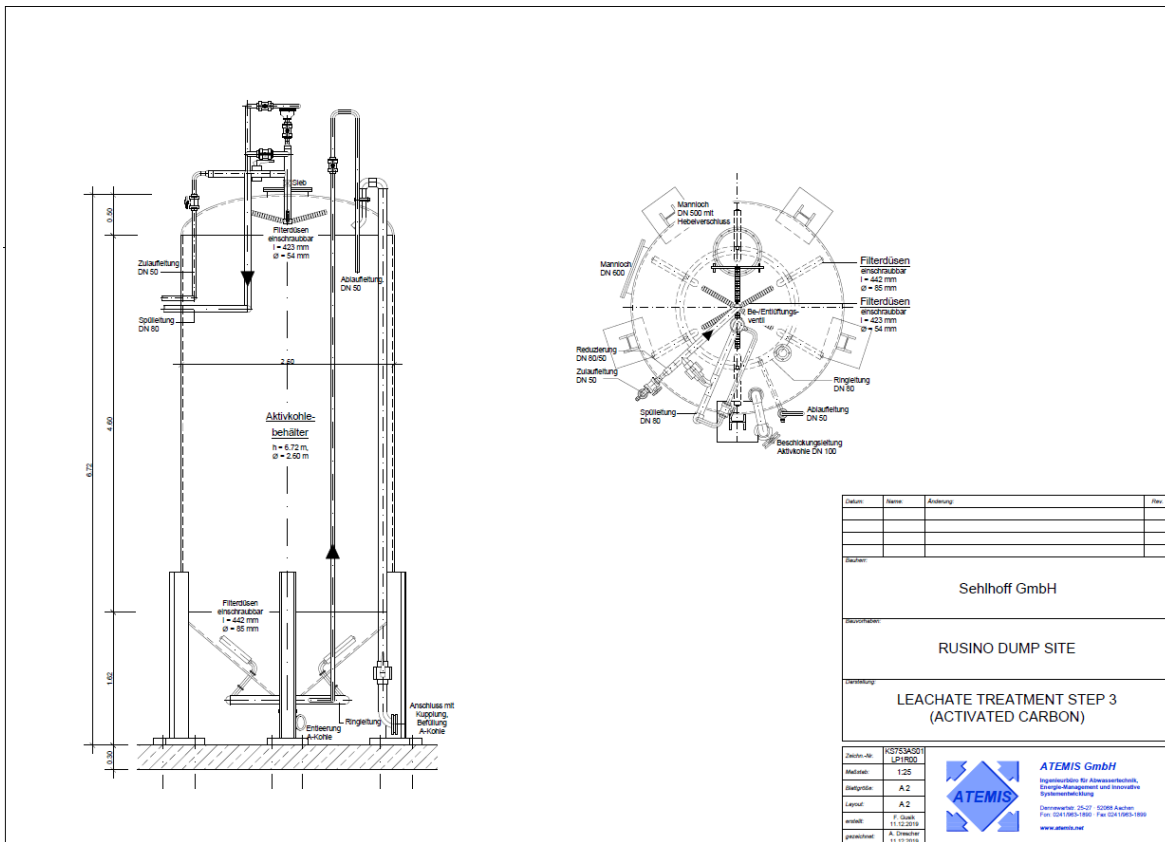


Figure 39 Scheme for the treatment of leachate with activated carbon

The required area is about 3 by 6 meters (due to the two-way design of the system technology, two adsorbers are useful in this case).

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The exemplary structure of the membrane technology is shown in Figure 40.

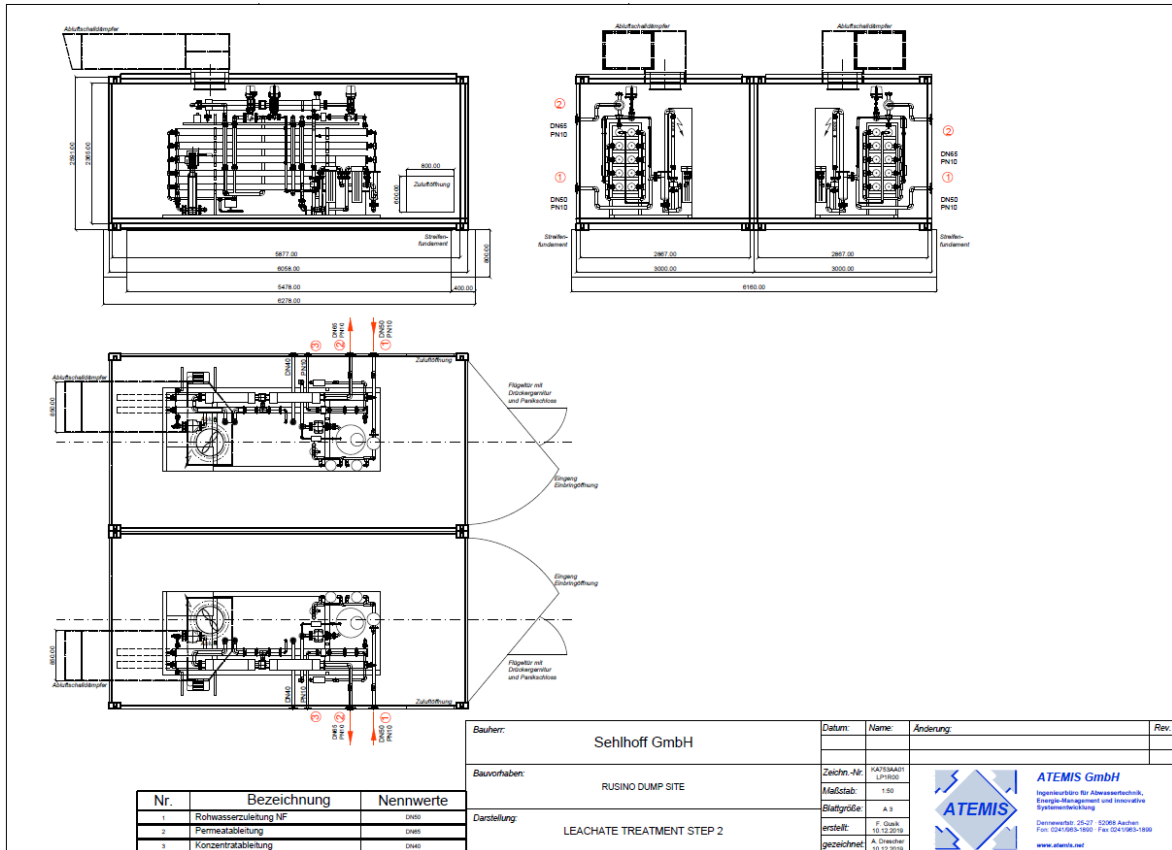


Figure 40 Scheme for the treatment of leachate with membrane technology

Approximately 6.5 by 6.5 meters of space is required for this process step.

All three process steps together have an electrical connection requirement of approximately 50 kilowatts.

With the three treatment methods described above, the leachate will be purified in such a way that it can be discharged to the valley.

Between the leachate pond and the treatment facilities a pump station (shaft) has to be constructed which will feed the first treatment plant (biological treatment).

At the end of the treatment plant a control shaft is installed. This shaft allows for samples to be taken before the cleaned water is discharged to the valley.

4.4.2.9 Gas Ventilation or Collection/ Utilization System

The following basic data are chosen for the **gas collection and treatment**:

- waste reaching the landfill is not pre-treated

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- collection of gas in vertical gas vents with a perforated PE-HD pipe inside
- compensation layer where gas can be collected under the surface sealing
- degasifying in an active way (with negative pressure)
- incineration of the remaining gas (which is not used for electricity production) e.g. by use of a gas flare which as well destroys other toxic components of the landfill gas.
- use of collected gas for electricity production (via a block power station)

A forecast of gas production has been made using the formula according to Rettenberger (see Production Manager Manual for Landfill Gas, Trier, 1995). The gas forecast is based on the following basic data:

- Total waste quantity (for the remaining life time) $m = 1,050,000$ Mg
- Organic carbon portion for whole landfill lifetime: $C = 250$ kg/Mg
- Temperature: $T = 30$ °C
- Decomposition parameter: $k = 0.04$

Based on these data, a gas quantity of

$$G = 1.868 \times C \times m \times (0.014 \times T + 0.28) \approx 343 \text{ Mio. m}^3$$

will be produced during the total lifetime of the landfill.

A yearly gas amount calculation was calculated with the following results, assuming that waste disposal lasts from 2023 to 2032 and gas production starts in 2024 and the gas collection factor is 50 %.

Table 52 Calculation of yearly gas amount

Year	2024	2028	2033	2038	2043	2048	2053	2058	2063
Collected amount of gas [m ³ /h]	176	792	1,393	879	555	350	221	89	0

The landfill is actively degasified by means of a vertical gas collecting system. In total, 20 vertical gas wells are built within the waste body. Each well has a collection radius of approximately 25 to 35 m. The gas wells are constructed gradually during waste filling.

According to the above mentioned decomposition parameter, a time of about 7.5 years has to be calculated for a 50 % decomposition of the organic fraction in the waste.

Installation of gas wells will start when a waste-filling height of 2.0 m is reached. For this purpose, a PE-HD filter pipe (perforated, internal diameter 150 mm) is embedded on a



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support cone, and a steel drawing pipe (pull pipe, DN 800, length: 4 m) is placed over it. The annular space between the steel and filter pipe is filled with broken stones free from lime. In the course of waste filling the filter pipe is extended accordingly and the steel pipe is drawn. A new filter pipe will be linked to the existing filter pipe and the annular space will be refilled again.

Finally the filter pipe will be led through the surface sealing system as a non-perforated pipe (PE-HD pipe, internal diameter 250 mm) and the steel pipe will be removed (and can be used for another gas well). Because of the non-perforated pipe and the sealing system, a penetration of atmosphere from the outside into the gas collection system will be minimised.

The landfill gas will be collected inside the broken stones (gravel-filled drain trench) and led via the PE-HD pipes out of the landfill body towards gas collection stations and finally to the gas compression station. Between the waste and the mineral surface sealing a compensation layer, in which gas can flow easily and which allows supply to the gas vents, will be applied.

A vacuum pump which is located inside the gas compression station will provide the required “vacuum” in the landfill body which guarantees active degasifying at a high gas collection rate. The gas will be directed from the compression station to a landfill gas flare where the gas will be incinerated at temperatures of about 800 – 1,000° C. All collected gas will be burned via the flare. The flare will be equipped with a back-up ignition system.

At the beginning of waste disposal it is not planned to use the landfill gas for electricity production. However, as the waste will be disposed untreated, the gas quantity and quality (methane portion probably about 50 %) a gas motor can be installed in year 2028 (at the end of operation year 5). In year 2027 the first cell is filled and the final PE-HD end pipes can be laid.

Remark:

Landfill gas production begins as soon as waste has been deposited, but anaerobic methane production only occurs when all of the available oxygen has been absorbed. In general the gas production can be divided into 4 phases (aerobic fermentation, anaerobic acid fermentation, anaerobic unstable methane formation and anaerobic stable methane fermentation). Only the anaerobic stable methane formation (phase 4) supplies a gas with a suitable quality and quantity that allows gas utilization. It can be assumed that it takes about 3 years until phase 4 starts. Therefore it is suggested to start gas utilization (as well as gas burning) in operation year 5.

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Regarding a life time of about 10 years for a block power station (BPS) the following time schedule is suggested (assumption: methane portion 50 %, motor under full load):

Table 53 Time schedule for gas utilization

Year	No. of BPS	Electricity production	Used gas amount	Running period	Available gas amount
2027	1	1,700 kW	800 m ³ /h	2028 – 2033	792 m ³ /h
2032	1	1,700 kW	800 m ³ /h	2028 – 2033	879 m ³ /h
2037	1	470 kW	290 m ³ /h	2038 – 2043	555 m ³ /h
2042	1	470 kW	290 m ³ /h	2043 – 2048	350 m ³ /h
2047	1	310 kW	200 m ³ /h	2048 – 2053	221 m ³ /h

As it is described above a gas utilisation starts with one motor. After 10 years the first BPS will be removed and an additional BPS will be installed. Again 10 years later the second BPS is removed and an additional (third) BPS will be installed. This principle will be continued till the gas amount has reduced to a level that no longer allow for gas utilisation.

The block power station with an electricity production of 1,710 kW and 470 kW can be operated in an economical way. The profitableness of one BPS normally amounts to about 7 to 8 years.

For the cost calculation one BPS with an electricity production of 1,700 kW will be regarded.

4.4.2.10 Surface Water Management Scheme

The following discharge system is chosen for surface water collection and discharge:

- All rain water from the landfill and its surrounding has to be discharged by gravity to the north-western or south-eastern valley.
- Rain water from the north-western landfill slopes and the adjacent eastern area can flow wide-spread to the adjacent valley (no trench necessary).
- The landfill area shows a limited water catchment area towards south-west direction. Rainwater from this area is discharged via a trench which is located along the surrounding landfill dike towards the east. As soon as the trench meets the access road an existing trench (south of the road) can be used for discharging all water towards the south-eastern valley.
- Rainwater coming from the flat plateau area and the complete eastward orientated slopes has to be collected in a trench which is located in along the landfill surrounding dike. This trench will be constructed with its deepest point north of the leachate pond. From this point all collected water will be discharged in a concrete culvert (underneath the entrance area) towards the south-eastern valley.

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- Around the leachate pond a ditch will be constructed. From the ditch, all rain water will flow towards the south-eastern valley by gravity.
- Roads and all other facilities inside the infrastructure area are always positioned as embankment dams with a height difference of about 0.5 m to the surrounding. As far as the required roads blocks the water discharge culverts will be constructed at the appropriate locations.

Summarized it can be stated that all rain water can be discharged by gravity downwards to Sushica River.

Non-polluted surface water consists of rainwater which is collected from the paved roads and the buildings, from the covered landfill surfaces, from the landfill areas which are not in operation and from the surrounding areas outside the landfill. Areas which are not in operation are areas where

- the base sealing system is just under construction and
- disposal areas that are not used.

To minimise leachate, disposal areas which are not used (not under operation) will be temporarily covered (waste coverage).

The dimensioning of all ditches and culverts should be calculated taking a rain event of 25 mm per hour into consideration. The following data are available:

The calculations are made using the following formula: $Q = A \times c \times i$

with:

- i = intensity of rain ($i = 25$ mm within 60 minutes)
- c = runoff coefficient ($c = 0.9$, for paved areas)
- c = runoff coefficient ($c = 0.4$, for sealed areas)
- c = runoff coefficient ($c = 0.02$, for adjacent areas which show only low inclinations and therefore a long flow time)
- A = area for landfill, paved areas, surrounding etc.

The following estimated surface water amounts have to be anticipated for the final situation:

Infrastructure area (excluding leachate pond: $A = 0.5$ ha (4,500 m² paved areas, 500 m² buildings):

$$Q = A \times c \times i = 0.025 \times 0.9 \times 5,000 = 112.5 \text{ m}^3/\text{h} \sim 31 \text{ l/s}$$

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Landfill area (towards south-east direction $A = 57,800 \text{ m}^2$):

$$Q = A \times c \times i = 0.025 \times 0.9 \times 57,800 = 1300.5 \text{ m}^3/\text{h} \sim 361 \text{ l/s}$$

Surrounding area towards landfill (about 18 ha = $\frac{1}{2}$ of catchment area):

$$Q = A \times c \times i = 180,000 \times 0.025 \times 0.02 = 90 \text{ m}^3/\text{h} \sim 25 \text{ l/s}$$

For the chosen rain fall, in maximum an amount of about 25 l/s runs from south-west direction (water catchment area) to the site area.

Assuming a precipitation of 25 mm in one hour, a maximum amount of about 417 l/s will run into the Sushica River (after the landfill has been finally covered with a surface sealing system at the end of operations).

For culverts a pipe diameter of 600 mm is required which is able to discharge about 570 l/s (pipe inclination $> 1 \%$).

The ditch along the south-eastern landfill border will be designed for a water discharge of about 200 l/s.

Landfill areas where the plane is only roughly profiled are separated from the waste filling area with small dikes (height about 2 m, in maximum). A temporary pump discharges all water towards west direction (to the inner ditch) out of the landfill area. The pump should have a capacity of 10 l/s.

4.4.2.11 Site Infrastructure

Access Road

Gostivar is located on the main traffic corridor linking the capital city of Skopje with Ohrid and the border with Republic of Albania. The national road M65 is also providing a modern link to Tetovo and other municipalities of the Polog Region.

Parallel to the M65 road, there are alternative routes in the Polog Valley in the outskirts of Sharr Planina, road M4, and the eastern route 404 that goes on the right side of Vardar River.

The location of Rusino landfill is on South of Gostivar. The route of the waste transporting vehicles goes throughout streets of Gostivar and Gorna Banjica, road M4 K4, reaching the junction to the village of Mitroj Krsti and village of Sushica / Rusino.

This junction is in the area of Mikro Kalcit factory, and the distance to the landfill is 5 km.



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In 2019 the road to Sushica was renovated. Cleaning, concrete works, road underpasses and resurfacing on the length of 2.3 km were financed by the Centre for Development of Polog Region. Along the road, there is a wire fence to prevent illegal waste dumping into the riverbed of Sushica River. The rest of the route with a length of 2.7 km to Rusino landfill needs to be also brought to the same standard.

According to the knowledge of the Consultant, an outline design for an alternative access road is currently under preparation. It is recommended that the road designer receives the design of the landfill entrance area as a planning basis, as the access road connection to the landfill must definitely be in the southeast.

Infrastructure Area

The infrastructure for the whole landfill shall provide due functions in accepting the vehicles from the municipalities, registration of deliveries, including weighing, as well as proper management of discharge of the solid waste into the waste body. Also, functions related to the needs of personnel and machinery shall be accommodated on the site.

The infrastructure for the whole landfill has to be divided into an entrance (control) area and an infrastructure area.

The entrance area includes

- a gate with an entrance building (control building) for waste inspection, registration and site security,
- a weighing bridge of 18 m length allowing for a maximum load of 60 Mg (including a data link to the waste registration office in the entrance building), and
- a wheel cleaning unit for trucks leaving the landfill area (cleaning with water).

Remark: The control building and the weighing bridge will be constructed within the “quick-win-measure” project (not part of this Feasibility Study).

The infrastructure area includes

- an administration (operation) building including sanitary facilities and a weather station,
- a parking area for landfill staff (close to the administration building),
- a maintenance building which serves also as a shelter for all mechanical equipment to be used at the landfill and
- a waste inspection area, a container area and a public drop off area.



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Inside the infrastructure area a septic tank (close to the operation building) and a fuel tank as well as a generator as stand-by unit (both close to the vehicle maintenance) is installed.

The infrastructure area also includes (for landfill operation)

- a control chamber for the collected leachate,
- a leachate pond and a leachate treatment unit, and
- a gas compression station, a flare and sufficient space for various block power stations.

To set-up a sanitary landfill, the following supplies have to be prepared for operation the landfill. For the supply of water, electricity and telecommunication only the base data (possible links etc.) will be given.

Water

The daily amount of the potable water averages out to about 1.0 m³ (about 80 litres per person and day).

A well in the riverbed of Sushica River will be constructed as a supply of fresh water. There will be a submersible pump with filter for delivery of the water to the tank of 3 m³. It shall be equipped with a chlorine dosing pump for disinfection of the potable water.

Water supply network will go from the tank to all the consumers through a pressure boosting plant. The underground line will go to the workshop building, and the administrative building will have regular distribution network to all the consumers.

For non-potable water (firefighting and irrigation) rain water will be used. Therefore a cistern of 20,000 l, with a separate pressure boosting plant will be constructed. The quantity of 10,000 l shall be maintained as a fire reserve.

Electricity and Telecom

Electricity supply shall be by high voltage aerial line connected to the nearest point defined by the public electricity utility. The public electricity utility will be responsible for construction, cost will be charged to landfill realisation.

Local transformer shall provide the supply of three phases 380V in the whole compound.

Each of the buildings shall have own switchboard according to the related consumers.



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CCTV

CCTV surveillance cameras will be installed on the entrance, and administrative building. They shall be integrated in the system for observation in the real time, and have recording capability of one week.

Roads and other Paved Areas

The road within the landfill compound will be improved, on the same alignment as existing. There will be a carriageway of 6 m asphalted surface, with necessary dewatering slopes and associated auxiliaries.

Paved areas, such as parking and pedestrian walkways will be of concrete paving elements laid on the compacted sand. The substructure shall have bearing capacity adequate for moving of vehicles.

A **waste inspection area** is located in the infrastructure area (300 m², at least), which will serve to identify the waste coming to the landfill, in order to inspect, to control the source as well as to segregate and to restrict the undefined waste coming to the landfill.

Beside the waste inspection two other concrete-paved areas (**container area and public drop off area**) will be constructed. Both areas will have a size of 300 m² (respectively 10 m x 30 m). The frost-protected substructure for this area will be done in the same way as for the waste inspection area.

Temporarily used streets and roads will be paved with a gravel layer (roads in the landfill body and – after filling – on top of the surface sealing, called operation path). The width of these roads varies between 3 to 4 m. Thickness of the gravel layer will be 50 cm.

Wheel Cleaning Unit

Wheel cleaning unit will be installed on the outgoing path of the vehicles.

A simple wheel cleaning unit for vehicles leaving the landfill site is envisaged. The wheel cleaning is assured by driving through the water filled unit.

The cleaning unit consists of concrete with a horizontal steel grid inside the concrete structures. The emptying will be done by a flexible pump and a loader.



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Administration / Operation Building

The area of the administration building amounts to 156 m², whilst useful area is 122 m². The length of this building will be about 20 m, its width about 8 m. The building space includes:

- a meeting room,
- toilets, including one for the people with special needs,
- dressing rooms (including showers),
- laboratory,
- a kitchen with a rest room for staff,
- a sanitary room, and
- two offices.

The building shall be single floor, built in situ, of traditional building materials: reinforced concrete frame structure, with walls of clay blocks, and roofing of corrugated steel sheet over timber structure. Characteristics of the building shall be in line with all requirements, including seismic resistance, and energy efficiency.

Entrance is separated for the administration and site personnel, with possibility of primary cleaning of clothes, shoes and tools outside of the building.

Building services will have a regular water supply, electric installation, and heating / cooling system based on heat pump.

Workshop and Garage (Vehicle Maintenance Building)

This building serves as the shelter for all mechanical equipment to be used at the landfill (except landfill compactor). The total area of the workshop and garage is 156 m², with a useable area of 148 m².

Besides the garage area for all vehicles of the landfill (except compactor), this building includes storage room, and restroom, a toilet and a separated working room.

As there will be vehicle repairs inside the building, inlets for cleaning will be installed in the floor of these rooms. To avoid a direct flow of the oil-spilt cleaning water an oil separator will be located between the inlets and the septic tank.

The construction of the workshop and garage building will be the same as the one of the operation building.

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The building is of steel structure, external walls and roof of sandwich panels. Partitions of the small office are of gypsum boards.

Fence

The whole landfill site, consisting of waste disposal area, entrance and infrastructure area, will be surrounded (about 1,400 m) by a fence. The fence will have a height of 2.0 m and will be constructed out of concrete columns and wire netting fence.

4.4.2.12 Equipment

The following table indicates the required mobile equipment for landfill operation.

Table 54 Mobile equipment for landfill operation

Mobile Landfill Equipment		Power (kW)	Number
Steel wheeled compactor	28 t	200	1
Bulldozer	18 t	130	1
Wheel Loader	15 t, 3m ³ shovel	130	1
Pick-up truck	1,5 t	50	1

The function of the equipment is as follows:

- Steel wheeled compactor and bulldozer will be used for waste compaction and soil works.
- The wheel loader will be used for various loading activities related to landfill operation.
- The pick-up truck will be used for transportation of staff and equipment.

4.4.2.13 Staffing

The required staff for landfill operation is summarised in the following table. It is based on a two shift system which covers a period of 7 days a week. The safety control of the new landfill has to be ensured 24 hours / 7 days (task of the guards).

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Table 55 Staff for landfill operation (two shift operation)

Function	Qualification	Number
Landfill Manager	Engineer	1
Technician, leachate treatment	Technician	1
Supervisor, foreman	Technician	1
Mechanic	Skilled and trained labourer	1
Drivers	Skilled and trained labourer	3
Entrance Control (weighbridge)	Labourer	3
Workers	Labourer	2
Guards	Labourer	10
Total		22

The **landfill manager** is responsible for the overall management and operation of the landfill site and compliance with the permit conditions and regulations. He gives instructions to the technician and the supervisor. The manager also performs the tasks of the supervisor in his absence.

The **technician** is responsible for the operation and maintenance of the leachate treatment plant and ensures that the discharged effluent is in compliance with the permit conditions and regulation.

The **supervisor** is responsible for the further landfill staff. He will follow up a keeping of orders of the director and the security regulations. The supervisor has to prepare the daily, monthly and annual reports. He is taking care of following the required control and is supporting the further landfill staff. The supervisor replaces the landfill manager in his absence.

The **mechanic** is responsible for the maintenance, wear and tear of the mobile equipment and other equipment like, e. g. leachate collection, gas collection and treatment. In case of emergency (weekend and holidays), he is available for repairs on waste collection vehicles.

The **drivers** (for compactor, bulldozer etc.) are responsible for the operation of the mobile equipment (refuse compactor, bulldozer, wheel loader, truck, pickup and – as far as necessary – special truck for the leachate pipes).

The **entrance control** controls all incoming trucks (weight registration, check of delivered waste) and vehicles and informs the truck drivers about the location of waste placing respectively informs the landfill staff.



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The entrance control is responsible for registering and control (weighing and registering of entering and leaving waste collection trucks; this includes date, hour, load, kind of waste, verification of a disposal permission based on a computerised list of permitted waste deliverers). In addition the staff will check the kind of waste by spot checks (at the waste inspection area) in case of doubts of the loaded waste. Furthermore they assist in the required landfill administration issues.

The **workers and the guards** are supporting the drivers and the entrance control in guiding the waste collection trucks to the envisaged location for placing their load. They are doing the cleaning (checking the intact conditions of the fence, removing paper and plastic from the fence). In addition, they are supporting the technicians during their work.

4.4.2.14 Monitoring Program

The following control measures have to be done regularly respectively if required on the landfill (during landfill operation phase):

- Control of the delivering vehicles (every vehicle)
- Visual inspection and if applicable further analysis of suspicious waste
- Rinsing and regular control of leachate pipes (once a year)
- Gas analysis (once a year)
- Leachate analysis (once a year) and quantity control of leachate
- Regular inspection and control of the leachate treatment facilities
- Regular inspection and control of the gas facilities
- Inspection of all roads in the site area and of the fence (daily)
- Topographical survey (once a year)

Suitable equipment has to be provided for maintenance (rinsing and cleaning) of the leachate pipes and camera control if necessary. It is suggested that this equipment will not be purchased as it will be only used once per year. The task might be conducted for a certain period by the Contractor or the landfill works (as an additional obligation in the warranty phase) or might be supplied via a contracted private sector company on a case by case base.

Daily reports have to be prepared which contain:

- Atmospheric conditions (temperature, rainfall, wind direction)
- Special events like accidents, fire, machine failures, downtimes
- Re-cultivation measures



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- Usage of staff and machinery
- Compilation of data regarding the excepted waste
- Compilation of results from controlling of machinery.

Monitoring of environmental parameters shall be carried out on regular basis in order to detect possible failures and impacts to the environment caused by the landfill.

Environmental monitoring shall include:

Groundwater quality

Generally three monitoring wells e.g. one upstream and two downstream of the site should be used for monitoring.

Air quality (i.a. odour, dust)

Regular monitoring of air quality parameters by quantitative measures is difficult and expensive. Therefore it is recommended that dust and odour be measured in a qualitative fashion and through regular interviewing of local residents or drivers of waste collection vehicles.

Landfill gas

The major constituents of landfill gas are methane and carbon dioxide, both of which are colourless and odourless. Landfill gas may cause a risk if allowed to accumulate with the potential for explosions or flash fires.

Monitoring should be carried out on-site, to determine the local effectiveness of gas collection equipment and to detect gas concentrations that necessitate appropriate remedial actions. For on-site measurement methane-detectors have to be used.

Noise

Considering the large distance to settlements a regular monitoring of noise emissions is probably not necessary.

In case of complains from neighbouring villages noise levels should be identified. If these measurements prove impacts on settlements measures for noise reduction have to be elaborated.

The following fire protection measures are suggested:

- Soil material of a volume of at least 200 m³ will be stored near the waste filling area for fire-fighting.
- A utility water pipe with a link to the rain water cistern will be constructed for fighting fires inside the infrastructure area.
- Smoking is only allowed in the staff room of the administration building.
- In all buildings fire extinguisher have to be fixed.



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Safety boots, safety gloves, weather protection clothes, ear protection and warning clothes for the staff guiding the truck to the place of disposal are available for every person who has to work on the landfill.

4.4.2.15 Aftercare Procedures

The following control measures have to be done regularly respectively if required on the landfill during the aftercare phase:

- Rinsing and regular control of leachate pipes (once a year)
- Gas analysis (once a year)
- Leachate analysis (once a year) and quantity control of leachate
- Regular inspection and control of the leachate treatment facility
- Regular inspection and control of the gas facilities
- Inspection of all roads in the landfill area, the fence and the re-cultivated areas after closing time (weekly)
- Topographical survey after closing (once in 2 years)

Weekly reports have to be prepared which contain:

- Atmospheric conditions (temperature, rainfall, wind direction)
- Special events like accidents, fire, machine failures, downtimes
- Re-cultivation measures

Environmental monitoring during the aftercare phase shall include:

- Water quality (see monitoring program, above)
- Landfill gas (see monitoring program, above)

4.4.3 Costs for Waste Disposal

4.4.3.1 Investment Costs

The investment requirement for the construction of the sanitary landfill, the related infrastructure and the facilities has been estimated based on similar waste implementation projects in the region.

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Table 56 Total investment costs [EUR]

Year	2022	2028	2029	2033	Total
Off-site infrastructure	569.000				569.000
On-site infrastructure	295.000				295.000
Utilities	194.000				194.000
Functional items	2.010.000				2.010.000
Base sealing system	1.979.000	1.375.000			3.354.000
Surface sealing system			1.273.000	1.300.000	2.573.000
Mobile equipment	675.000				
Investment costs	5.722.000	1.375.000	1.273.000	1.300.000	9.670.000
Replacement	0	0		0	
Total costs	5.722.000	1.375.000	1.273.000	1.300.000	9.670.000

The initial investment costs for the construction of the infrastructural facilities, first construction phase of landfill (base sealing system of cell 1) and procurement of mobile equipment will be about 5.7 million EUR. According to the project timetable, these costs will be incurred in 2022. In 2028 the costs for the construction of the base sealing system of cell 2 will be incurred. In 2029 the construction of the surface sealing system in cell 1 and in 2033 in cell 2 follows.

In order to make an overall assessment over the planning horizon, it is assumed that a new landfill will be constructed for the time period after 2032. The investment costs of this landfill are assumed to be 6 million EUR. Thus over 20 years, following investment costs are estimated.



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Table 57 Estimated investment costs for the disposal of waste [EUR]

Year	Waste Quantities	Initial Investment Costs		Replacement Costs		Total Investments		
		Civil Works	Mobile Equipment	Civil Works	Mobile Equipment	Initial investments	Replacements	Total
		t/a	€a	€a	€a	€a	€a	€a
2022	0	5,047,000	860,000	0	0	5,907,000	0	5,907,000
2023	108,783	0	0	0	0	0	0	0
2024	112,906	0	0	0	0	0	0	0
2025	117,120	0	0	0	0	0	0	0
2026	121,425	0	0	0	0	0	0	0
2027	125,476	0	0	0	0	0	0	0
2028	128,909	1,375,000	0	0	0	1,375,000	0	1,375,000
2029	132,412	1,273,000	0	0	0	1,273,000	0	1,273,000
2030	135,988	0	0	0	0	0	0	0
2031	137,606	0	0	0	0	0	0	0
2032	139,244	6,000,000	0	0	215,000	6,000,000	215,000	6,215,000
2033	140,902	1,300,000	0	0	0	1,300,000	0	1,300,000
2034	142,581	0	0	0	0	0	0	0
2035	144,281	0	0	0	0	0	0	0
2036	146,003	0	0	0	0	0	0	0
2037	147,746	1,300,000	0	0	0	1,300,000	0	1,300,000
2038	149,511	0	0	0	0	0	0	0
2039	151,298	0	0	0	0	0	0	0
2040	153,107	0	0	0	0	0	0	0
2041	154,939	0	0	0	0	0	0	0
2042	156,794	1,600,000	0	0	0	1,600,000	0	1,600,000
Total	2,747,031	17,895,000	860,000	0	215,000	18,755,000	215,000	18,970,000

4.4.3.2 Operation Costs

Operation Costs

The operating costs of the landfill include the costs of the personnel, operation and maintenance costs of the mobile equipment, costs of the operation and maintenance of the leachate and gas treatment facilities, costs for laboratory analysis and monitoring and for regular training of staff.

Based on similar projects, the following operation costs have been calculated for the financial model under consideration of typical local cost figures. The operating costs of the new landfill are assumed to be on the same calculation basis.

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Table 58 Operating costs of the sanitary landfill over the planning horizon [EUR]

Year	Operating Costs					
	Personnel costs	Maintenance	Consumption	Leachate Treatment	Other	Total
	€/a	€/a	€/a	€/a	€/a	€/a
2023	165,000	114,800	235,468	64,909	30,575	610,752
2024	165,000	115,235	235,954	67,309	30,575	614,074
2025	165,000	115,673	237,459	64,909	30,575	613,615
2026	165,000	116,112	239,868	67,309	30,575	618,865
2027	165,000	116,554	242,107	64,909	30,575	619,145
2028	165,000	116,998	274,614	67,309	30,575	654,496
2029	165,000	117,444	276,491	64,909	30,575	654,419
2030	165,000	117,893	278,397	67,309	30,575	659,174
2031	165,000	118,344	279,111	64,909	30,575	657,939
2032	165,000	118,797	279,831	67,309	30,575	661,512
2033	165,000	119,252	374,939	64,909	30,575	754,675
2034	165,000	130,479	377,527	67,309	30,575	770,890
2035	165,000	130,992	380,136	64,909	30,575	771,613
2036	165,000	131,509	382,767	67,309	30,575	777,160
2037	165,000	132,027	385,419	64,909	30,575	777,931
2038	165,000	132,549	388,094	67,309	30,575	783,527
2039	165,000	133,073	390,790	64,909	30,575	784,347
2040	165,000	133,599	393,509	67,309	30,575	789,992
2041	165,000	134,129	396,250	64,909	30,575	790,862
2042	165,000	134,661	399,013	67,309	30,575	796,558
Total	3,300,000	2,480,120	6,447,744	1,322,184	611,500	14,161,548

The operating costs will increase from about 610,000 EUR (in 2023) to about 796,000 EUR (in 2042) including contingencies.

After finalizing the waste filling time the operating costs will reduce to about 201,000 EUR including 10,000 EUR for environmental monitoring costs. It is assumed that the aftercare operating costs will decrease by 15% per year over an aftercare period of 30 years.

Revenues

As described in subchapter 4.4.2.9 above, the gas generated in the landfill will be collected and used for electricity production. It is suggested to start gas utilization in the fifth year of operation, because by that time a gas with a suitable quality and quantity that allows gas utilization (derived the anaerobic stable methane formation) will be available.

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The gas will be utilised by means of a BPS for electricity production of 1,700 kW (capacity per hour). This will allow the generation of revenues as detailed in the following table, based on assumed electricity price of 0.04 EUR/ kWh.

Table 59 Revenues from gas utilisation [EUR]

Year	Capacity Gas Engines [kW]	Electricity generated [kW/a]	Revenues [EUR]
2022 - 2027			0
2028	1700	11,913,600	476,544
2029	1700	11,913,600	476,544
2030	1700	11,913,600	476,544
2031	1700	11,913,600	476,544
2032	1700	11,913,600	476,544
2033	1700	11,913,600	476,544
2034	1700	11,913,600	476,544
2035	1700	11,913,600	476,544
2036	1700	11,913,600	476,544
2037	1700	11,913,600	476,544
2038	470	3,293,760	131,750
2039	470	3,293,760	131,750
2040	470	3,293,760	131,750
2041	470	3,293,760	131,750
2042	470	3,293,760	131,750
2043	470	3,293,760	131,750
2044	470	3,293,760	131,750
2045	470	3,293,760	131,750
2046	470	3,293,760	131,750
2047	470	3,293,760	131,750
2048	310	2,172,480	86,899
2049	310	2,172,480	86,899
2050	310	2,172,480	86,899
Total			6,343,642

The revenues will start with about 476,500 EUR in 2028 and end with about 86,900 EUR in 2050. In total the revenues are estimated to sum up to about 6.3 million EUR.

The revenues can be used to cover (part of) the operating costs of the sanitary landfill.

4.5 Closure of Dumpsites

4.5.1 Designs for Dumpsite Closure

Although the EU Landfill Directive does not apply to disposal sites that will be closed after transposition of the directive into national legislation, the guidelines listed in the annex of

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the directive for the closure of landfills have been taken into account. These guidelines are presented below.

Landfill category	Non-hazardous waste	Hazardous waste
Gas drainage layer	Required	Not required
Artificial sealing liner	Not required	Required
Impermeable mineral layer	Required	Required
Drainage layer > 0.5 m	Required	Required
Top soil cover \geq 1 m	Required	Required

The EU Landfill Directive further states that in case “it has been established that a landfill poses no potential hazard to soil, groundwater or surface water the requirements for the capping of landfills may be reduced accordingly. For landfills for inert waste, for instance, the above guidelines do not have to be applied.”

With regard to landfill gas, the EU landfill directive prescribes that at sites where landfill gas is generated it shall be utilised unless this is not economically feasible or not practical. In such case the gas shall be flared.

As a compromise between flaring and venting without treatment, partial treatment of passive vented landfill gas in compost filters can be included in the designs.

The approach for design should be based on the following aspects

- Measures to be taken shall be in proportion to the risks for the environment
- The designs shall be cost effective
- The designs shall be in line with the legal framework
- The measures to be designed shall reduce the footprint of the dumpsites and optimise run-off in order to minimise infiltration of precipitation and thus leachate generation
- Measures with low maintenance needs are preferred

The dumpsites can be classified into the following categories:

- Category 1: **Sites with a significant impact on the environment** especially in the form of landfill gas with the possibility of waste fires with corresponding emissions of toxic compounds. The impacts from these sites need to be mitigated and therefore a top cover is proposed that follows to a large extent the guidelines from the EU landfill directive for non-hazardous waste landfills. A gas drainage layer, comprising of gravel or coarse sand, shall be supplemented by vertical gas wells and horizontal gas drainage pipes. Drainage pipes will be led into compost filters in order to enable biodegradation of methane. Alternatively a flare can be installed. The designs should further include slopes to be shaped to a 1:3 angle



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and a top of the waste body which gently leads at a 1% to 5% angle towards the slopes. As compared to the EU directive, the thickness of drainage layer and top soil cover can be slightly reduced.

- A second category of sites can be regarded as **medium impact sites**. At these sites some landfill gas is generated, thus having an impact on air quality and having a risk of waste fires which could result in the emission of toxic compounds including dioxins. For these sites, application of a top cover is proposed in combination with shaping the site with slopes with a 1:3 angle. The entire landfill area is proposed to be shaped as a sphere in order to maximise run-off and minimise precipitation infiltration. For the top cover a top soil rich in organic matter, in the form of humus, compost, manure or sewage treatment sludge is proposed in order to maximise bacterial growth which will ensure maximum biodegradation of landfill gas (CH₄) by methanogenic bacteria.
- The third category are **sites with the least impact on the environment** is formed by sites where the waste material is practically inert and therefore minimal remediation measures have to be taken. For all these sites it is proposed to concentrate the waste present on a limited area which is to be shaped with gentle slopes. Subsequently a layer of top soil shall be applied which should have qualities required to sustain plant growth.

As alternative for the above described remediation measures, waste can be removed from the site for disposal elsewhere (i.e. on a landfill or on a dumpsite for which in-situ rehabilitation following the one of the above options will be carried out.)

4.5.2 Costs of Dumpsite Closure

For the calculation of dumpsite closure costs the following unit prices have been used.

Table 60 Unit prices for dumpsite closure

Item	Unit	Unit price
Waste excavation	m ³	€ 4.00
Waste transportation	t	€ 10.00
Waste density	t/m ³	0.8
Covering of waste	m ²	€ 12.00
Capping of waste	m ²	€ 25.00
Stabilisation	m ²	€ 7,00
Applying vegetation	m ²	€ 1.00
Installation of flare	number	€ 1,500
Disposal at Drisla landfill	t	€ 15.00

It is further assumed that in case of in-situ rehabilitation, covering or capping, the surface area of the dumpsite will be reduced by heaping of waste till an average height of 6 meter or, in case current height is above this level, the existing average height.



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Waste of dumpsites, from which waste is to be removed, is assumed to be disposed at other dumpsites that will be rehabilitated in-situ.

Based on these assumptions and the recommendations made in section 3.5.2, the cost of rehabilitation of the dumpsites listed in section 3.5.2, Table 16, have been estimated to amount to €3 million excluding contingencies and excluding VAT. In case disposal of waste at Drisla landfill, from sites to be rehabilitated by removal of waste, the costs will increase to approximately €4.3 million. Since probably not all waste to be removed can be disposed at dumpsites for which in-situ rehabilitation is planned, the cost will be with the range of €3 million to €4.3 million excluding contingencies and excluding VAT.



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5 Institutional Set-up

5.1 Recommend Institutional Set-up and Responsibilities

In principle various options for the institutional set-up for solid waste management in the Polog Region exist. In the current situation, all SWM activities are the responsibility of the nine municipalities, and conducted by local public utility enterprises or private operators. On the other end of the spectrum, one regional entity could be formed and made responsible for all SWM activities in the entire region. However, discussions with stakeholders in the Region have shown that this is currently not a feasible option.

The recommended institutional set-up concerns therefore partial regionalisation whereby the Municipalities, through their local public utility enterprises or private operators, remain responsible for waste collection and transport of waste to the nearest transfer station or, for municipalities for which no transfer station is foreseen, to the regional disposal facility Rusino. An inter-municipal Joint Public Enterprise, or JPE, will manage and operate the joint facilities including the transfer stations and the regional landfill. In a later stage other regional waste management facilities such as MBT, AD or even an incinerator may be added to the system and managed by the JPE.

5.1.1 Institutional Set-up at Regional Level

Based on the Law on waste management, a Regional Waste Management Centre or, once the new draft Law on Waste Management is adopted, an Operational Unit for Regional Waste Management within the Centre for Development of the Polog Planning Region, shall oversee regional waste management activities. The Centre or Unit shall perform the following tasks:

- Prepare the regional waste management plan, including annual targets and goals;
- Prepare and propose projects and other activities for the implementation of the regional plan including other projects of interest for the development of the regional system;
- Implement and manage projects and undertake other activities related to the implementation of the regional plan and development of the regional system;
- Provide contractual services and capacities for waste management in the regional system;
- Prepare and implement procedures for selection of operator of the regional system and proposes selection of operator of the regional system;



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- Implement and manage investment projects for stimulating the development of regional management of municipal and other non-hazardous waste, from sources identified in Article 103 of the draft Law;
- Oversee the fulfilment of obligations, waste management providers of services designated by the municipality of the city of Skopje, which are of relevance for the functioning of the regional system, and initiates procedure for inspection supervision before competent inspection authorities for rectifying non-compliance;
- Monitor the scope and quality of services performed within the regional system;

A Regional Waste Management Centre has not been established in the Polog Region (or in any other region of RN Macedonia). Instead a Project Management Unit for the Project Solid Waste Management in Polog Region has been established within the Centre for Development of the Polog Planning Region as precursor to the above mentioned Operational Unit. The PMU is staffed with four employees, which is considered sufficient also for the future Operational Unit.

5.1.2 Institutional Set-up at Municipal Level

The municipalities shall retain responsibility for waste collection and transport to a transfer station or the regional landfill and in practice delegate this task to either their local PUE or a private operator. Within the Municipalities an employee, or in larger municipalities several employees, shall be assigned with the task of monitoring the performance of the PUE or private operator. These employees are most likely the environmental inspectors in the municipalities, although the financial departments will also have some monitoring tasks.

The PUE and private operator are or shall be structured to the need of the waste collection and transportation tasks. Staff numbers will highly depend on the size of the PUE or private operator.

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Table 61 Personnel requirements for SWM in PUE or private company

Position	Indicative number of staff
Director	1
Head of Finance and Procurement	1
Head of operations	1
Dispatch officer	Depending on size of PUE or private company
Maintenance staff	Depending on size of PUE or private company
Drivers	Depending on size of PUE or private company
Crew of waste collection vehicles	Depending on size of PUE or private company

In addition, the collective handlers responsible for implementation of the EPR scheme play a role at the municipal level. Within the municipal organisation and/or the PUE or private companies, a liaison person shall be appointed for cooperation with the collective handlers. The way in which Municipalities and collective handlers will cooperate will depend on contractual arrangements between the two and the legal provisions concerning the EPR scheme, which are currently being reviewed within the framework of the process of adoption of a new law on waste management.

5.1.3 Organisational Structure of JPE “Rusino”

The JPE “Rusino” is envisaged be formed early 2020 and will start operations as a small enterprise operating the Rusino dumpsite, improved by the implementation of Quick-Win-Measures, on behalf of the nine Municipalities of the Polog Region. In a later phase, once the landfill has been upgraded to meet the standards as prescribed by EU and national legislation, the JPE will, in a larger and more definite form, operate the landfill as well as transfer station(s).

The organisational objective for the JPE “Rusino” is a sustainable corporate system and an effective management that is able to coordinate and develop its core business processes to add maximum value for its clients/shareholders.

5.1.3.1 Initial Structure

Figure 41 illustrates the functional organisation for the JPE “Rusino” at the start of its operation during which the JPE will cover all management, financial and administrative functions with its own personnel.

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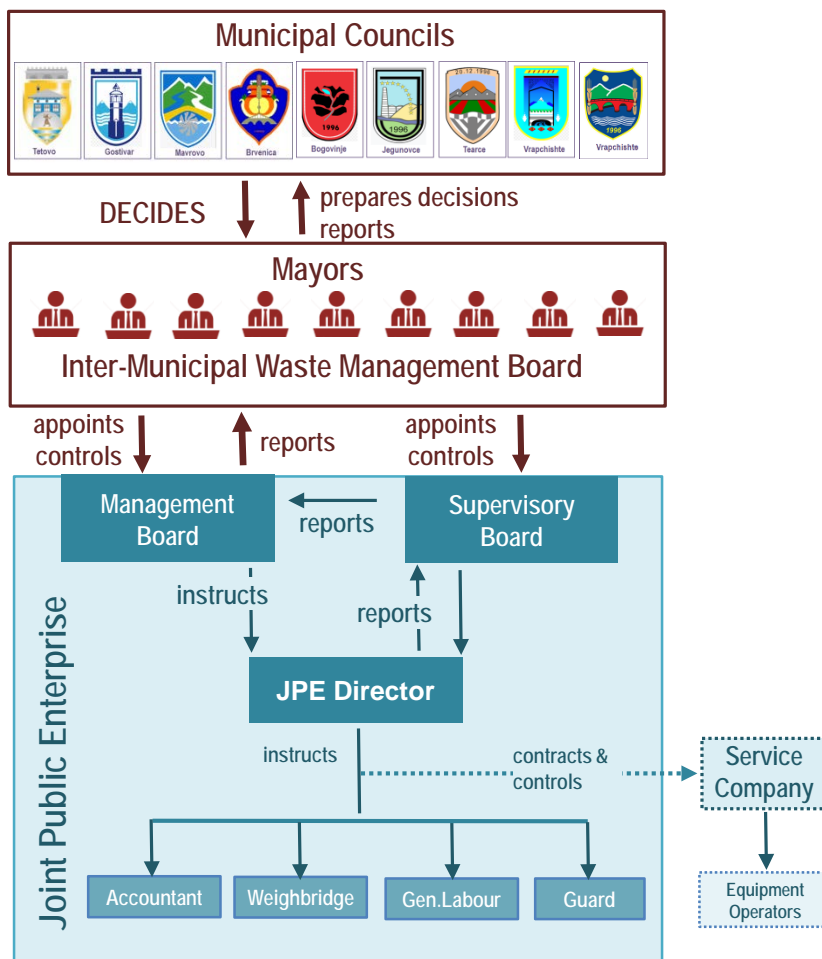


Figure 41 Initial Organisational Structure of JPE "Rusino"

Because the newly established JPE "Rusino" is yet not provided with heavy landfill equipment the physical operations, which are primarily related to the spreading of waste after it is discharged from the waste collection vehicles, and covering the waste with soil to be excavated at site, shall be contracted to a private service provider. The contractor shall employ a heavy equipment operator and ensure that waste is spread according to the site management plan. The contract shall be concluded on a lump sum basis which covers the following services:

- Provision and operation of a bulldozer by a skilled heavy equipment operator as well as regular maintenance and repair with provision of required consumables (fuel, oil), supplies and spare parts.
- Provision and operation of a tipper truck and a back-hoe loader for excavating soil and transporting it to the work face where it shall be spread to cover the waste by the bulldozer. It is assumed that excavating soil is available nearby the working face and does not cost anything except for equipment operation.

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The tender should be launched latest by March 2020 to ensure contracting of the best bidder from June 2020 onwards. The contract shall run out when the JPE is ready to take over also such technical operations at the landfill, i.e. when they can operate a sanitary landfill site with own staff and equipment from the year 2023 onwards.

5.1.3.2 More Definite Organisational Structure

After upgrade of the landfill to EU standards, the JPE “Rusino” will take over all operations at the landfill and will also manage transfer station(s) and transfer operations. The organisational set-up will be adjusted to the additional tasks. The organisational structure of the JPE “Rusino” will include several departments and sub-departments as illustrated in Figure 42. The tasks and function of each part of the organisation is described below.

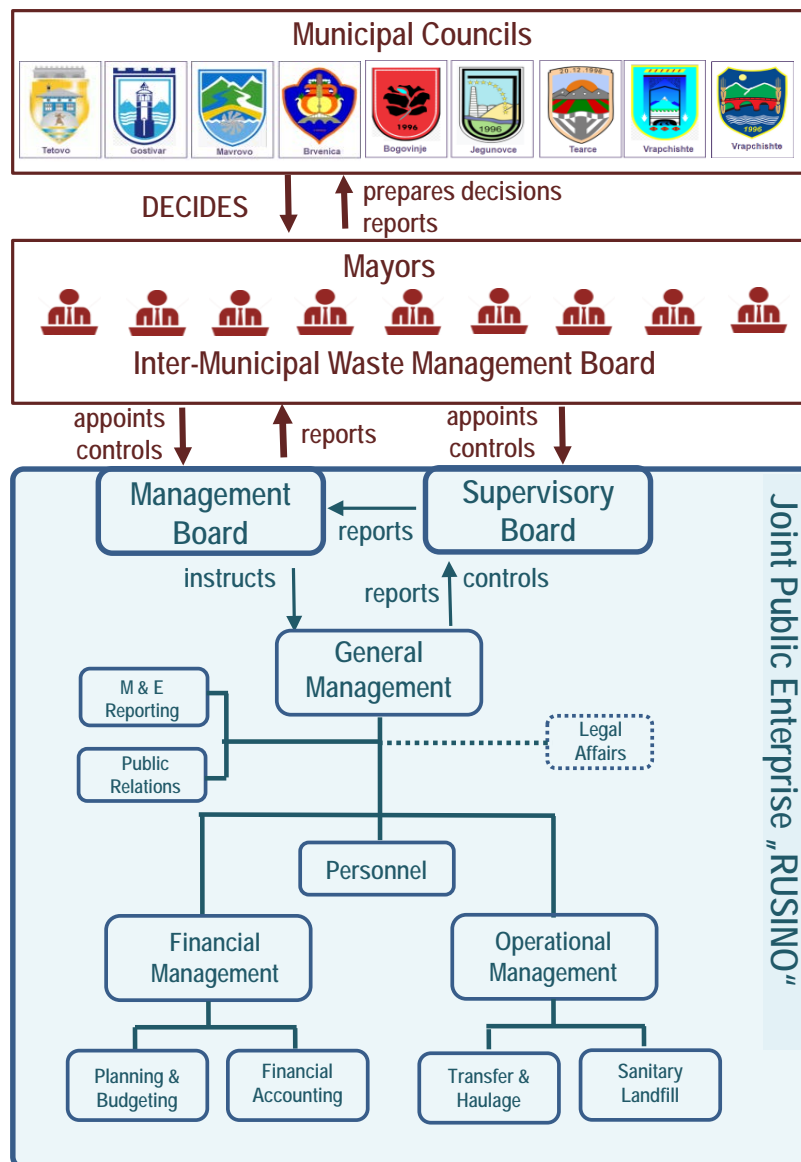


Figure 42 Organisational Structure of JPE “Rusino” once fully established and operational



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The functional organisation shall be set up in a traditional way of organising people by functions with a hierarchical arrangement of lines of authority, rights and duties that determine how the roles and responsibilities are assigned, controlled and coordinated, and how information flows between the different levels.

At decision making level the Municipal Councils of the 9 founding municipalities of Polog Region are the supreme authorities. The Mayors are acting as the hierarchical superiors and controlling the performance of the JPE.

At the executive level, the Management Board is the administrative body which defines the business policy and adopts programs for operation and development of the JPE.

The JPE Director executes the decisions of the Management Board at the company level, conducts those activities envisaged by the development programme, manages and coordinates the working activities, and delivers the results in financial terms. Certain functions and responsibilities are delegated by the Director to lower levels in the hierarchy, and the departments and divisions may have different degrees of competencies.

The Supervisory Board controls the material-financial operations of the JPE through audits reviews of the annual reports and gives their opinion to the Management Board.

General Management

The JPE “Rusino” will be tasked by its founders with the General Management of the regional SWM tasks in the Polog Region that are complementary and supportive to those municipal SWM services provided by the responsible local administrations. With this wider spectrum of responsibilities this mandate includes:

- Profiling of the company based on a common understanding of its strategic, institutional and operational objectives and tasks;
- Personnel management and developing the human resources (HR) in hiring and developing employee motivation and work discipline so that their potential is fully utilised for implementation of the Company’s tasks and objectives;
- Planning and managing workflows related to the main operational processes of the Company and shall enhance effective workflows with delegation of tasks and allocation of budgets and lines of accountability.
- Monitoring and evaluation (M&E) of performance by systematic and continuous collection and processing of performance data that allows decision makers to improve ongoing operations to provide the information necessary to plan future investments.



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- Legal competencies to implement and enforce all aspects of its regional SWM services, from charging fees for transfer, haulage and disposal, to enforcing penalties for non-compliance; legal inputs are also required for preparation of all legally obliging documents of company management and operation, such as contracts and internal regulatory acts.
- Public relations addresses maintaining communication and liaison with the public and the media, dealing with complaints, communicating with stakeholder's about performance and success, but also about defaults and risk mitigation measures.

Operational Management

Operational Management governs the core business of JPE "Rusino" in providing SWM services to its clients, and thus creating the primary value stream. The core processes of the company are:²²

- Sanitary landfill operations which shall comply with the EU Landfill Directive and the National Waste Law and subsidiary legislation and regulations. Operations are performed with qualified staff and all necessary on-site facilities and equipment for entrance control and waste acceptance, weighing procedure, waste discharge and emplacement, daily cover, intermediate cover, final cover, landfill cell development, surface water and drainage control, leachate control and treatment, landfill gas management, environmental monitoring system, site closure and after-care.²³
- Transfer stations and long haul operations are anticipated and will have to be agreed upon by the founders of JPE "Rusino" assuming that consolidating waste from multiple collection vehicles into larger, high-volume transfer vehicles would make the transport of wastes from waste collection areas to the distant landfill site more efficient and economical, with less disruption and environmental impacts.

Financial Management

Advanced Financial Management is understood as a process of communicating relevant information about both financial and physical performance of the business to various users, and it serves three purposes:

- Planning and budgeting are routines for making management and operational decisions more transparent, both for the employed staff as well as for providing relevant information about physical and financial performance to external auditors

²² Contracting-out some of the operational activities at the regional landfill, could be envisaged. However, the responsibility for management of the facility, control over acceptance of waste, record keeping at the weighbridge, and adhering to the operational plan should be rested with JPE "Rusino".

²³ More detailed process descriptions in the form of guidelines and procedures will have to be elaborated in a comprehensive Landfill Operations, Maintenance and Management Plan.

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and to the board members. The mode and frequency of reporting depends on specific management instructions to operational level and on agreements between the management and the boards.

- Financial accounting contains standard bookkeeping processes to fulfil public duties and to meet the requirements of the laws by reporting on the company's financial performance to its stakeholders, tax authorities, and creditors or lenders. These financial statements require to be scrutinised by external auditors on an annual basis.

5.1.3.3 Staff Concept

Staff Structure and Positions

The employment and positioning of permanent staff is related to the functions and roles which the JPE "Rusino" has to fulfil on a routine basis. Figure 43 gives an overview on the proposed staff structure. For each post the respective tasks are outlined in the following sections.

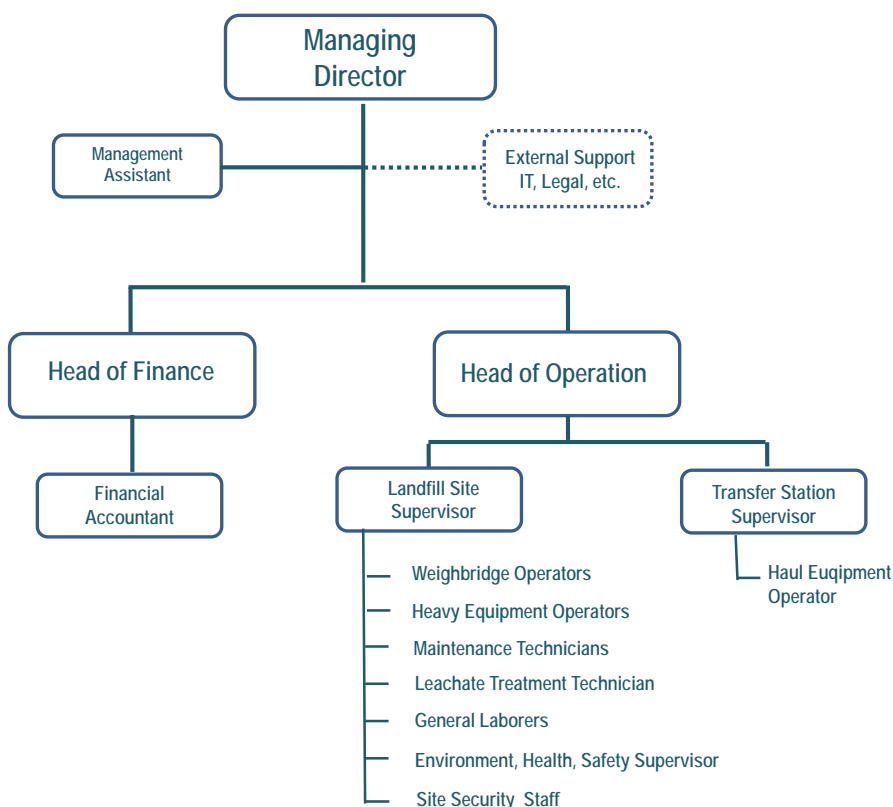


Figure 43 Proposed Staff Concept for JPE "Rusino"

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Managing Director

Following the policy of the JPE “Rusino” the Managing Director (MD) represents the company in front of third parties and reports to the Management and Supervisory Board. He is responsible for overall management of the JPE “Rusino” business. He takes over self-responsibility for Personnel Management and instructs his assistant staff to cover functions related to M&E and Reporting, and PR and Communication. He can also assign temporary staff and hire special expertise if needed, e.g. IT Support, advice in Legal Affairs, or others.

He delegates all responsibilities for Financial Management (i.e. planning and budgeting, financial accounting) to the Head of Finance. He delegates all responsibilities for Operational Management (i.e. landfill operations, transfer and haulage) to the Head of Operations.

Management Assistant

The Management Assistant is bound by instructions of the MD and in charge of:

- Human resources administration, such as keeping employee files up-to-date, addressing grievances and resolving conflicts between employees;
- Monitoring, evaluation the performance of all relevant business processes, by use of the available IT systems;
- Preparing reports on request of the company and external stakeholders;
- Public relations to promote and communicate the image, aims and objectives of JPE “Rusino” through transparent communication with the company’s stakeholders and representatives of the media.

For certain tasks which would require particular additional know-how and skills and which cannot be covered by the Management Assistant, external staff may be employed on a temporary or special contract basis, such as for maintaining the IT system, for advice in legal affairs, and support in particular PR activities, and others.

Head of Finance

The Head of Finance (HF) has been entrusted by the MD with the full responsibility for all financial affairs of the Company which are related to the main functions of Planning and Budgeting and Financial Accounting.

The HF takes over self-responsibility for all processes which are related to Planning and Budgeting, and instructs and supervises the Financial Accountant to undertake those tasks related to Financial Accounting.



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Financial Accountant

The Financial Accountant is obliged to follow the instructions of the HF, with special tasks related to Financial Accounting, i.e. in performing and the accounting system including assets valuation, maintaining accounts payable/receivable, payroll accounts, and preparing financial statements.

In particular, he/she shall

- maintain accounting procedures and system, including proper filing system, and primary accounting documentation;
- prepare all due payments of salaries and wages, including of insurances and taxes within the deadlines defined by the legislation;
- prepare all due payments which are related to the procurement of supplies and services;
- prepare annual accounting reports, financial statements and the notes to the financial statements;
- sign together with the HF the documents related to financial issues and participate in development of contracts;
- secure financial information by completing data base backups, and report to the defects in the system operation.

Head of Operations

The Head of Operations (HO) is entrusted by the MD with the full responsibility for all technical operation processes of the Company which are related to the main functions Sanitary Landfill and Transfer and Haulage.

The HO takes over responsibility for all processes related to Sanitary Landfill, instructs and supervises the staff allocated to the related operations, i.e. Weighbridge Operator, Heavy Equipment Operator, Maintenance Technician, Leachate Treatment Technician, General Worker, Environment/Health and Safety Supervisor, and Site Security Staff. In this case, the HO also takes over function of Site Supervision the corresponding responsibilities are to be included in HO's job profile.

The HO takes also over responsibility for all processes related to Transfer and Haulage, instructs and supervises the staff allocated to the related positions of Transfer Station Operator, and Transfer and Haulage Equipment Operator.



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Landfill Site Supervisor

The Landfill Site Supervisor will report to and receive direction from the HO, and is responsible for supervising and directing all sanitary landfill operations staff, infrastructure and equipment. In particular, he is responsible for overall security at the disposal site, and he shall ensure that the disposal site is operated in accordance with the waste disposal plan prepared for the site and direct and supervise the staff to control the admission of wastes, movements of vehicles within the site, and discharge of wastes in the designated area.

Landfill Operations Staff

The landfill operations staff report to and receive direction from the Landfill Operations Supervisor, and have no personnel management responsibilities. This applies to the following posts: Weighbridge Operator, Heavy Equipment Operator, Maintenance Technician, Leachate Treatment Technician, General Labourer, Environment, Health and Safety Supervisor, Landfill Site Security Staff.

Weighbridge Operator

The Weighbridge Operator reports to and receives direction from the Landfill Supervisor, is responsible for processing waste collection vehicles entering the landfill by inspecting loads and recording vehicle and waste acceptance data.

In particular, he shall

- be always on time and present at the weighbridge according to work schedule;
- operate the entrance control and weight measurement system including the load scales and the electronic data collection systems;
- register all incoming trucks (zone, truck number) according to the coding list and make sure that every truck is weighed (no truck is allowed to empty its load without weighing);
- at the end of each shift, prepare tonnage records specified by time and date of each delivery, and details to identify the vehicle and identify the load (and type of waste) on the vehicle and issue waste receipt tickets to vehicle drivers;
- check for any malfunctioning of the weighbridge each shift and ensuring that there is clean space between the plate and its surrounding frame, ensure that the weighbridge is properly balanced when unloaded and the indicator shows zero;
- monitor and ensure efficient traffic movement before and after entrance of vehicles to the site, and clean regularly the entrance area to avoid dirt building-up;
- hand over all weighing data to JPE head office.



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Equipment Operator

The Equipment Operator reports to and receives direction from the Landfill Supervisor. He is responsible handling building waste into the waste body, and covering the waste with cover material. Specifically he shall

- Operate the landfill equipment in line with the instructions of the landfill supervisor and the manufacturer/supplier of the equipment.
- Ensure that the landfill equipment is in working order by daily inspection of the equipment in line with the instructions of the landfill supervisor and the manufacturer/supplier of the equipment and to ensure periodic maintenance and repairs is carried out.
- To handle, compact and cover waste in line with the instructions of the landfill supervisor and the landfill infilling plan.

General Labourer

The General Labourer reports to and receives direction from the Landfill Supervisor. He is responsible maintenance and upkeep of the site, its access road and entrance area, on-site facilities and infrastructure. Specifically he shall

- ensure proper traffic flow and safe working conditions under the direction of the weighbridge operator;
- direct waste delivery vehicles to proper disposal areas according to fill plan;
- perform various maintenance operations including proper watering, cultivation, and litter control;
- clear draining ditches and pipelines on a regular basis;
- ensure regular recirculation of leachate from the leachate pond to the dump by use of the pump system. It is assumed that pump cycles are required for 4 hours per week during dry seasons (March-September) and for 2 hours per day during rainy/winter seasons (October-February).
- assist equipment operators in manoeuvring and unloading procedures;
- assist in identifying and removing all hazardous and salvageable materials;
- ensure that the unloading area is clear of materials at end of working day.



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Guard

The Guard reports to and receives direction from the Landfill Supervisor. He shall maintain safe and secure environment for customers and employees by patrolling and monitoring premises and personnel. In particular, he shall

- ensure site security, prevent unauthorised tipping of waste materials and any access for unauthorized persons from entering the site;
- control traffic by directing drivers of waste collection vehicles;
- monitor operational equipment, inspect buildings and access points, permitting entry to authorized persons;
- report to the Director on defects in the system operation.

Transfer Station Operator

The Transfer Station Operator reports to and receives direction from the HO and is responsible for supervising and directing all waste transfer station and haulage operations staff, infrastructure and equipment.

Haulage Equipment Operator

Haulage Equipment Operator reports to and receives direction from the HO and is responsible for the operation and maintenance of the item of equipment designated to them, mainly being waste haulage vehicles and containers.

5.1.4 The Role of Collective Handlers

Collective handlers, like PAKOMAK and ELKOLEKT, are responsible for the implementation of the extended producer responsibility (EPR) schemes regulated by the Law on Waste Management and as such responsible for the management of recyclable waste fractions such as packaging waste and WEEE. They are responsible for organisation of their separate collection and recycling and for funding investments and operations of the separate collection. They are however not allowed to conduct the separate collection themselves but have to work with either public or private licensed waste collectors. For the institutional set-up for waste management in the Polog Region this implies cooperation between the collective handlers and the Public Utility Enterprises respectively private concessionaires. The cooperation between collective handlers and the municipalities, i.e. PUEs and private companies, is, based on legal requirements, formalised through contracts.

It is anticipated that with the adoption of the new Law on Waste Management, the role of the collective handlers will become more important and it could be that they will organise



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the separate collection of recyclable waste fractions (i.e. packaging waste) on a regional scale by engaging a private operator and contracting this operator for collection of recyclable waste in the entire Polog Region. In such case the Municipalities will be responsible for managing only mixed waste (also referred to as residual waste) and organic waste. This scenario is however not likely to materialise in the near future.

5.2 Costs of Future Institutional Set-up

5.2.1 Cost at Municipal Level

The costs for waste collection and transportation by the local PUE and private operators have presented in section 4.1 of this document. These costs include the costs for the institutional set-up at municipal level which have been assessed to be 7% of the operational costs.

5.2.2 Cost at the Centre for Development of the Polog Region

The costs of the PMU and, in future, the Organisational Unit for Regional Waste Management, are included in the overall costs for the Centre for Development of the Polog Region and covered by the nine municipalities.

5.2.3 Initial Cost of the JPE

5.2.3.1 JPE Staff

The initial, annual staff requirements are calculated on the basis of the following assumptions:

- The Director shall be recruited on full-time basis and set on his post latest in May 2020 in order to get acquainted with his tasks
- The Accountant shall be recruited on part-time basis (50%) and set on post latest in May 2020 in order to get acquainted with the tasks.
- 2 weighbridge operators shall be in place working for 8 hours per day over 365 days and set on post in May 2020 to get acquainted with the tasks.
- 1 general labourer shall be in place working for 8 hours per day over 365 days, from June 2020 onwards.
- In order to ensure site security around the clock 3 guards shall be placed at the site and 3 guards shall be at the access road for 8 hours per day each thus providing 24 hours per day security over 365 days, from June 2020 onwards.
- Since the standard working time is given with 230 days per year and 8 hours per day, the gap of 135 days is taken into account for determining the total number of employees which is calculated for each position (except for the Director and



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Accountant) by applying a factor of 1.6 to the above basic staff numbers and then rounded. Time gaps due to rounding are covered by overtime. Consequently, JPE “Rusino” will initially have to employ 3 weighbridge operators, 2 general labourers, and 10 guards.

- The employment costs for the total staff employed by JPE “Rusino” are calculated on the basis of adequate basic salaries and wages for each position and corresponding surcharges which are prescribed by law, such as pension insurance (18.4%), health insurance (7.4%), supplementary health insurance (0.5%), and unemployment insurance (1.2%).

With the above assumptions the total staff cost of JPE “Rusino” are calculated in the following table.

Table 62 JPE Staff Cost

Staff Postion	Basic Salary (before tax) €/pers/month	Social Insurance Contributions (% of gross salary)				Gross Salaries & Wages		
		Pension 18.4%	Health 7.4%	Supplem. Health 0.5%	Unemployment 1.2%	€/pers/month	€/year	MKD/year
1 JPE Director	1,088 €	276 €	111 €	8 €	18 €	1,500 €	18,000 €	1,107,000 MKD
1 Accountant 50.0%	363 €	92 €	37 €	3 €	6 €	500 €	3,000 €	184,500 MKD
3 Weighbridge Operators	544 €	138 €	56 €	4 €	9 €	750 €	27,000 €	1,660,500 MKD
2 General Labourers	363 €	92 €	37 €	3 €	6 €	500 €	12,000 €	738,000 MKD
10 Guards	544 €	138 €	56 €	4 €	9 €	750 €	90,000 €	5,535,000 MKD
Total Staff Costs						150,000 €	9,225,000 MKD	

1.00 € = 61.50 MKD

All gross salaries are subject to social insurances with the following percentages: Pension Fund 18%, Health Insurance Fund 7.3%, Unemployment Fund 1.2%, Disability Insurance: 0.5%, all deductible from the employee’s gross salary but payable by the employer on his/her behalf.²⁴ In addition to the social insurance deductibles, an income tax has to be paid (10% on salaries up to 90,000 MKD/month; 18% for all income above 90,000 MKD).

5.2.3.2 Contracted Equipment Operations

It is assumed that the JPE enters into a contract with a private company which provides the required equipment (1 bulldozer, 1 tipper truck, one back-hoe loader) and operates the equipment with skilled staff according during the agreed operating hours. The contractor shall also provide the required consumables (fuel, oil, etc.) and ensures always

²⁴ Depending on the particular income level, the employer is obliged to pay also the corresponding taxes concurrently with the payment of net salaries.



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operational condition by regular maintenance and repair. It is assumed that the equipment is operated for 4 hours per day during 6 days of the week.

The contract shall be concluded on a lump sum basis with assumed unit prices. For the bulldozer the unit price list published by Drisla Landfill, Skopje has been, the unit price for the mobile pump system is an estimate. The unit prices are containing all costs, including the operator and consumables, even depreciation of the machine and profit margin, only VAT (7%) is added.

Table 63 Contracted Equipment Operating Cost

Equipment Operations		Operating Hours			Operating Cost		
		h/day	days/week	h/year	€/h	€/year	MKD/year
1	Bulldozer Hanomag 25t	4.0	7.0	1,456	75.00 €	109,200 €	6,713,616 MKD
1	Back Hoe Loader	4.0	7.0	1,456	35.00 €	50,960 €	3,133,021 MKD
1	Tipper Truck	4.0	7.0	1,456	25.00 €	36,400 €	2,237,872 MKD
Net Operating Cost					196,560 €	12,084,509 MKD	
VAT					7.0%	13,759 €	845,916 MKD
Total Operating Cost					210,319 €	12,930,424 MKD	

5.2.3.3 Other Expenses

Tools and Supplies

A provision is made for a set of small equipment such as brooms, shovels, push carts, for cleaning of the entrance area and the weighbridge. In addition, appropriate working cloths (uniform, safety boots) and hygiene items shall be provided. An amount of 500 € per year shall be allocated for such items.

JPE Office Rent

Renting of an office space would be the best option as a transparent expense to the participating municipalities. Also in case the office can be located within the Gostivar City Hall or the Gostivar Public Enterprise, rental cost should be taken into consideration. The rent is calculated with 400 €/month, from May 2020 onwards.

Office Equipment and Supplies

Office equipment shall be procured before start-up (in May 2020) including the following items:

- 2 desks 100 €/unit
- 6 chairs 60 €/unit



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- 1 meeting table 500 €/unit
- 1 computer with printer 1,000 €/unit
- 1 internet connection 200 €/unit

Stationary and other small items are calculated at 100 €/month.

5.2.3.4 Operational Cost in FY 2020 and FY 2021

The total cost for waste disposal operations at the “Rusino” site are summarized below.

Table 64 Total Operational Cost in FY 2020 and FY 2021

Cost Components	Operational Cost in FY 2020		Operational Cost in FY 2021	
	€a	MKD/year	€a	MKD/year
JPE Staff Cost	87,106 €	5,355,246 MKD	142,325 €	8,750,110 MKD
Contracted Equipment Operating Cost	122,686 €	7,542,748 MKD	210,319 €	12,930,424 MKD
Other Expenses	6,160 €	378,717 MKD	6,000 €	368,880 MKD
Net Operating Cost	215,952 €	13,276,711 MKD	358,644 €	22,049,415 MKD
Contingencies 10.0%	21,595 €	1,327,671 MKD	35,864 €	2,204,941 MKD
Total Annual Operating Cost	237,547 €	14,604,382 MKD	394,508 €	24,254,356 MKD

The operational costs for the fiscal years 2020 and 2021 (and, although still to be agreed, 2022) will be covered by the nine Municipalities of the Polog Region. For 50% the costs will be covered on a lump sum basis (in proportion to the number of inhabitants) and for the remaining 50% a gate fee per tonne will be charged. These costs are therefore not considered in the financial analysis presented in chapter 6.

5.2.4 Cost of the JPE Once Fully Established

The actual number of staff needed to fulfil all the tasks will depend on the allocation of roles to the individual persons and their capacity to cope with the work requirement during standard working hours. So it may turn out that several jobs can be performed by one person only, or that several persons will perform similar tasks while working in shifts. According to the proposed job allocations as described in section 0, the staff requirements, under consideration of two-shift operation, are presented in Table 65.

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Table 65 Staff Cost Estimate for JPE “Rusino”

Service Area / Position		Permanent Staff	External Support	Daily Working Time			Gross Salaries / Staff Cost		
				1st Shift	2nd Shift	3rd Shift	€/pers/month	€/year	MKD/year
				08:00 - 16:00	16:00 - 24:00	00:00 - 08:00			
Management & Support	Managing Director	1		x			1,500	18,000	1,107,000
	Management Assistant	1		x			650	7,800	479,700
	PR & Communication Officer	1	x	x			750	9,000	553,500
	Head of Finance	1		x			1,000	12,000	738,000
	Financial Accountant	1		x			750	9,000	553,500
	Head of Operations	1		x			900	10,800	664,200
	Legal Affairs		x				100	1,200	73,800
	IT Maintenance		x				100	1,200	73,800
	Subtotal	6						69,000	4,243,500
Landfill	Landfill manager	1		x			900	10,800	664,200
	Landfill Site Supervisor	1					850	10,200	627,300
	Weighbridge Operator	3		x	x		750	27,000	1,660,500
	Heavy Equipment Operator / Driver	3		x	x		750	27,000	1,660,500
	Mechanic	1	x	x			750	9,000	553,500
	General Labourer	2		x	x		500	12,000	738,000
	Technician	1		x			750	9,000	553,500
	Site Security Staff	10		x	x	x	500	60,000	3,690,000
	Subtotal	22						165,000	10,147,500
Transfer	Transfer Station Supervisor	1		x			850	10,200	627,300
	Transfer driver	5					750	45,000	2,767,500
	Weighbridge operator	2					750	18,000	1,107,000
	General labourers	2					500	12,000	738,000
	Guard	4		x			500	24,000	1,476,000
	Subtotal	14						109,200	6,715,800
TOTAL STAFF		42					0	343,200	21,106,800

1.00 € = 61.50 MKD

5.2.5 JPE Cost to Be Taken into Account for Financial Analysis

The above costs overview for the JPE, include costs of operations of the landfill, the transfer station and the transfer vehicles. However, these costs have also been included in the operation and maintenance costs included in the sections 4.1 to 4.4. In order to avoid duplication of costs in the financial analysis only the costs for the management and administration of the JPE “Rusino” shall be taken into account. These “overhead” costs are presented in Table 66.



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Table 66 Administration and Management Costs

Service Area / Position	Permanent staff	External support	Gross salary per person and month (EUR)	Euro per year	MKD/year
Managing Director	1		1500	18,000	1,107,000
Management assistant	1		650	7,800	479,700
PR & communication officer	1		750	9,000	553,500
Head of finance	1		1000	12,000	738,000
Financial accountant	1		750	9,000	553,500
Head of Operations	1		900	10,800	664,200
Legal affairs		x	100	1,200	73,800
IT maintenance		x	100	1,200	73,800
Sub-total	6			69,000	4,243,500

5.2.6 Collective Handler Costs

The costs of the organisational activities of collective handlers in the Polog Region are covered by the member companies of these collective handlers, e.g. companies producing packaging or bringing packaging onto the market of North Macedonia and do not have to be taken into account in this feasibility study.

Costs incurred by the collective handlers, such as expenditures for investment in equipment, such as waste containers, for the separate collection of packaging waste and expenditures for engaging PUEs and private companies for collecting these waste fractions are important. However, these costs are part of the overall waste management system cost and will, in the end, have to be covered by the waste generator, either as part of the waste collection tariffs or as an increase of the price of (packed) products. For the affordability analysis, presented in the following sections of this document, the total system costs will be used thus, including costs incurred by the collective handlers.



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6 Financial and Economic Analysis

The financial / economic analysis of the Project is carried out considering the fact that the JPE "Rusino", the Public SWM Enterprise being established by decision of the municipal councils of all nine municipalities in Polog Region, shall be responsible for the implementation and operation of the Project. Thus, financial performance indicators and financial statements of the Project are projected for the JPE as a public entity being responsible for the project by taking over relevant SWM related tasks and responsibilities from the nine establishing municipalities.

The financial and economic analysis is based on the Guidelines to Cost-Benefit Analysis (CBA) of the EU. The main inputs are estimates of population, waste quantities, investment and operating costs as well as SWM tariff and other operating revenues over the whole life cycle of the Project.

The financial and economic assumptions, inputs and outcomes of the Project are presented together with required financing sources including grants calculated as a result of Cost-Benefit Analysis (CBA).

6.1 Financial Analysis

The main objective of the financial analysis is to demonstrate the capability of JPE "Rusino" to generate sufficient revenues over the economic lifetime of the Project to be able to cover project-related costs in accordance with the "polluter pays" principle. For this purpose, financial statements (Cash Flow Statements, Profit (-Loss) Statements, Balance Sheets) are projected on annual basis for the whole planning period. The main financial performance indicators calculated are the following:

- Financial Net Present Value (FNPV/C) and Financial Internal Rate of Return (FIRR/C) demonstrating the return on investment (without loan and grant financing for investments; only with project-related revenues).
- Financial Net Present Value (FNPV/K) and Financial Internal Rate of Return (FIRR/K) demonstrating the return on local capital (with local grant financing for investments and project-related revenues).



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The financial viability of the Project is assessed by calculating the Net Present Value (NPV) and Internal Rate of Return (IRR) of the Project's annual financial cash flows. In general, a Project is considered to be financially viable if annual financial cash flows generate the following results:

- NPV > 0 (NPV calculated by using Discounted Cash Flow Method at a Required Rate of Return (Discount Rate))
- IRR > Required Rate of Return (Opportunity Cost of Capital / Discount Rate)

The level of subsidy (Funding Gap Rate / Grant Rate) which is required for investment financing to make the project financially viable is also estimated as a result of cost benefit analysis (CBA). The grant rate that is required to make the project financially viable, while remaining within the affordability limits for households, is estimated.

6.1.1 Methodology and Main Financial Assumptions

The Discounted Cash Flow (DCF) methodology is used to calculate financial performance indicators and funding gap rate (grant rate). This means that only cash flows are taken into account; non-cash items such as allowances for depreciation costs are not considered.

Financial analysis of the Cost-Benefit Analysis (CBA) covers the economic lifetime of the Project between 2021 and 2042 of which:

- Investment Period is 2 years (2021-2022) and;
- Operation period is 20 years (2023-2042).

Consequently, cash flow, profit (-loss) statements and balance sheet projections as well as financial performance indicators of the Project covering the 2021 – 2042 period are developed on annual basis.

A real financial discount rate (opportunity cost of capital) of 4% p.a. in Euro terms is used for the financial and CBA analysis.

Exchange rate is taken to be 61.5 MKD/EURO.

Investment and O&M costs, determined separately for the following SWM service components, are considered:

8. Collection;
9. Recycling;
10. Composting;



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11. Transport;

12. Disposal.

Technical Assistance (TA) component for capacity building and strengthening of the JPE "Rusino" is added as an investment cost item to the above SWM service costs.

Both the financial and economic analyses are conducted on incremental basis by comparing the situation with Project and without Project. However, accurate and reliable information on SWM related revenues and costs could not be obtained from the municipalities. Some indicative SWM revenue and cost figures for the year 2018 obtained from Tetovo and Gostivar public enterprises responsible for SWM services are stated below:

- Tetovo:
 - Annual SWM Revenues: 78,336,781 MKD/Year (1,273,769 EURO/year)
 - Annual SWM Costs: 123,734,657 MKD/Year (2,011,946 EURO/year)
 - Annual SWM Surplus (-Deficit): -45,397,876 MKD/Year (-738,177 EURO/year)
- Gostivar
 - Annual SWM Revenues: 50,510,367 MKD/Year (821,307 EURO/year)
 - Annual SWM Costs: 49,124,649 MKD/Year (798,775 EURO/year)
 - Annual SWM Surplus (-Deficit): 1,385,718 MKD/Year (22,532 EURO/year)

While considerable deficits are generated in Tetovo, Gostivar seems to be able to cover its SWM costs from SWM revenues. It should however be noted that the listed revenues are billed amounts whereas the collected amounts are about 70% in Tetovo and 40% in Gostivar.

In smaller rural municipalities other than Tetovo and Gostivar where SWM services are mostly contracted-out to private operators, municipalities do not have any SWM related revenues and costs. Since private operators continue to provide SWM services in these municipalities it can be assumed that they can cover their SWM costs by the SWM tariff revenues collected from the waste generators.

Thus, in the absence of accurate and reliable data on current SWM revenues and costs of the Polog Region municipalities, it is assumed that current SWM costs are fully covered by current SWM tariff revenues (Current SWM Revenues = Current SWM Costs). Consequently, current SWM revenue / cost structure is assumed not to have any financial impact on Project finances and incremental Project revenues and costs will be comprised of only Project-related revenues and costs.

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Financial analysis is conducted at constant 2020 Euro prices. No inflationary adjustments are assumed throughout the whole planning period of 2020 - 2042.

Value Added Tax (VAT) is not taken into account since it is not a cost and revenue item.

No taxes and duties on imports foreign goods and services are foreseen assuming that they will be waived by the central government for this Project.

6.1.2 Investment Costs

Investment costs of the Project, as estimated in previous chapters are used in the financial and economic analysis with the following approach and assumptions:

- All investment costs are determined in year 2020 constant unit prices.
- Investment costs are estimated in constant prices on an annual basis for the 2021 – 2042 planning period.
- Investment period is 2021 - 2022.
- Investment costs are categorized under 6 components:
 - Collection
 - Recycling
 - Composting
 - Transport
 - Disposal
 - Technical Assistance (TA)
- Investment costs are segregated as civil works and mobile equipment (trucks, vehicles, containers, bins, etc.)
- Investment costs are also segregated as initial investment costs and replacements / renewals.
- Implementation consultancy costs are assumed to be equivalent to 8% of the initial investment costs. No implementation consultancy costs are assumed for the replacement / renewal investments.
- To be able to make allowances for unexpected investment cost increases, 10% contingencies are applied over the sum of physical investment costs and implementation consultancy and technical assistance (TA) costs.
- Residual value of each investment component is calculated as of 2042 by assuming certain economic lives for the assets (20 years for civil works, 20 years for technical assistance (TA), 10 years for trucks and mobile equipment)

Bill of quantities and unit prices of individual investment components are presented in detail in Chapter 4 above. Investment costs are presented in detail in Annex 3 – F-1.



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Investment cost totals are presented as both undiscounted total and discounted total (at financial discount rate of 4% p.a.) between 2021 and 2042.

Undiscounted and discounted total initial investment costs excluding contingencies have been estimated to be EUR 33,220,722 and EUR 25,826,071 respectively as shown in Table 67 below. Out of the total discounted initial investment costs 53.70% are for civil works (EUR 13,868,190) and 46.30% are for mobile equipment (EUR 11,957,880).

Table 67 Summary of Initial investments Costs Excluding Contingencies (Financial Discount Rate = 4% p.a.) (EUR)

YEARS	Civil Works	Mobile Equipment	Total Investments
2021	0	0	0
2022	6,483,600	11,114,514	17,598,114
2023	0	0	0
2024	0	0	0
2025	17,575	472,325	489,900
2026	0	0	0
2027	0	240,000	240,000
2028	1,438,525	316,125	1,754,650
2029	1,273,000	0	1,273,000
2030	0	0	0
2031	0	120,000	120,000
2032	6,000,000	0	6,000,000
2033	1,338,150	718,922	2,057,072
2034	0	0	0
2035	0	240,000	240,000
2036	0	0	0
2037	1,300,000	0	1,300,000
2038	40,575	267,411	307,986
2039	0	0	0
2040	0	0	0
2041	0	240,000	240,000
2042	1,600,000	0	1,600,000
Grand Total	19,491,425	13,729,297	33,220,722
Total (2021-2022)	6,483,600	11,114,514	17,598,114
Total (2023-2042)	13,007,825	2,614,783	15,622,608
Discounted Grand Total	13,868,190	11,957,880	25,826,071
Discounted Total (2021-2022)	5,994,453	10,275,993	16,270,446
Discounted Total (2023-2042)	7,873,738	1,681,887	9,555,625



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Undiscounted and discounted total replacement / renewal investment costs excluding contingencies are estimated to be EUR 14,414,064 and EUR 8,748,298 as shown in Table 68 below. All replacement / renewal costs are for mobile equipment.

Table 68 Summary of Replacement / Renewal Investment Costs Excluding Contingencies (Financial Discount Rate = 4% p.a.) (EUR)

YEARS	Civil Works	Mobile Equipment	Total Investments
2021	0	0	0
2022	0	0	0
2023	0	0	0
2024	0	0	0
2025	0	0	0
2026	0	0	0
2027	0	0	0
2028	0	2,067,014	2,067,014
2029	0	0	0
2030	0	232,325	232,325
2031	0	0	0
2032	0	1,027,500	1,027,500
2033	0	8,913,889	8,913,889
2034	0	0	0
2035	0	240,000	240,000
2036	0	0	0
2037	0	240,000	240,000
2038	0	1,573,336	1,573,336
2039	0	0	0
2040	0	0	0
2041	0	120,000	120,000
2042	0	0	0
Grand Total	0	14,414,064	14,414,064
Total (2021-2022)	0	0	0
Total (2023-2042)	0	14,414,064	14,414,064
Discounted Grand Total	0	8,748,298	8,748,298
Discounted Total (2021-2022)	0	0	0
Discounted Total (2023-2042)	0	8,748,298	8,748,298

Undiscounted and undiscounted total initial plus replacement / renewal investment costs excluding contingencies are estimated to be EUR 47,634,786 and EUR 34,574,368 respectively as shown in Table 69 below. Out of the total discounted initial and replacement / renewal investment costs, 40.11% are for civil works (EUR 13,868,190) and 59.89% are for mobile equipment (EUR 20,706,178).



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Table 69 Summary of Total Investment Costs (Initial + Replacement / Renewal) Excluding Contingencies (Financial Discount Rate = 4% p.a.) (EUR)

YEARS	Civil Works	Mobile Equipment	Total Investments
2021	0	0	0
2022	6,483,600	11,114,514	17,598,114
2023	0	0	0
2024	0	0	0
2025	17,575	472,325	489,900
2026	0	0	0
2027	0	240,000	240,000
2028	1,438,525	2,383,139	3,821,664
2029	1,273,000	0	1,273,000
2030	0	232,325	232,325
2031	0	120,000	120,000
2032	6,000,000	1,027,500	7,027,500
2033	1,338,150	9,632,811	10,970,961
2034	0	0	0
2035	0	480,000	480,000
2036	0	0	0
2037	1,300,000	240,000	1,540,000
2038	40,575	1,840,747	1,881,322
2039	0	0	0
2040	0	0	0
2041	0	360,000	360,000
2042	1,600,000	0	1,600,000
Grand Total	19,491,425	28,143,361	47,634,786
Total (2021-2022)	6,483,600	11,114,514	17,598,114
Total (2023-2042)	13,007,825	17,028,847	30,036,672
Discounted Grand Total	13,868,190	20,706,178	34,574,368
Discounted Total (2021-2022)	5,994,453	10,275,993	16,270,446
Discounted Total (2023-2042)	7,873,738	10,430,185	18,303,922

Total technical assistance cost is estimated to be 1,296,000 EUR excluding contingencies as presented in detail in Table 70 below. It is assumed that there will be 2 full time experts and a pool of experts in the TA contract providing a total input of 63 expert-months in the years 2021-2022. Reimbursable items are assumed to be equivalent to 50% of total expert fees.



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Table 70 Technical Assistance (TA) Costs Excluding Contingencies To Be Incurred in 2020 and 2021 (Financial Discount Rate = 4% p.a.)

STAFF POSITIONS	All-in Fee (€/expert/month)	Expert Number	Expert Input (Months/expert)	Total TA Cost
Team Leader	18,000	1.0	18.0	324,000
Deputy Team Leader	10,000	1.0	18.0	180,000
International Expert Pool	20,000	t.b.d.	9.0	180,000
National Expert Pool	10,000	t.b.d.	18.0	180,000
TOTAL EXPERT FEES			63.0	864,000
Reimbursable Items	Lump-sum (50% of total above)			432,000
TOTAL TA		4.0	63.0	1,296,000
2021 (70%)				907,200
2022 (30%)				388,800

Implementation consultancy fees are assumed to be 8% of initial investment costs adding up to EUR 2,657,658 for the years 2021-2042 (undiscounted total EUR 2,066,086).

Undiscounted and discounted total initial, replacement / renewal, implementation consultancy and technical assistance (TA) investment costs excluding contingencies are estimated to be EUR 51,588,444 and EUR 37,872,229 as shown in Table 71 below. Out of the total discounted investment costs, 91.29% are for investment costs excluding TA (EUR 34,574,368), 5.46% are for implementation consultancy (EUR 2,066,086) and 3.25% are for technical assistance (TA) (EUR 1,231,775).

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Table 71 Summary of Total Investment Costs (Initial + Replacement / Renewal + Implementation Consultancy + Technical Assistance (TA)) Excluding Contingencies (Financial Discount Rate = 4% p.a.) (EUR)

YEARS	Total Inv. Excluding Impl. Consultant	Impl. Cons.	Total Inv. Including Impl. Consultant	Technical Ass. (TA)	Total Inv. Including Impl. Cons. & TA
2021	0	0	0	907,200	907,200
2022	17,598,114	1,407,849	19,005,963	388,800	19,394,763
2023	0	0	0	0	0
2024	0	0	0	0	0
2025	489,900	39,192	529,092	0	529,092
2026	0	0	0	0	0
2027	240,000	19,200	259,200	0	259,200
2028	3,821,664	140,372	3,962,036	0	3,962,036
2029	1,273,000	101,840	1,374,840	0	1,374,840
2030	232,325	0	232,325	0	232,325
2031	120,000	9,600	129,600	0	129,600
2032	7,027,500	480,000	7,507,500	0	7,507,500
2033	10,970,961	164,566	11,135,527	0	11,135,527
2034	0	0	0	0	0
2035	480,000	19,200	499,200	0	499,200
2036	0	0	0	0	0
2037	1,540,000	104,000	1,644,000	0	1,644,000
2038	1,881,322	24,639	1,905,961	0	1,905,961
2039	0	0	0	0	0
2040	0	0	0	0	0
2041	360,000	19,200	379,200	0	379,200
2042	1,600,000	128,000	1,728,000	0	1,728,000
Grand Total	47,634,786	2,657,658	50,292,444	1,296,000	51,588,444
Total (2021-2022)	17,598,114	1,407,849	19,005,963	1,296,000	20,301,963
Total (2023-2042)	30,036,672	1,249,809	31,286,481	0	31,286,481
Discounted Grand Total	34,574,368	2,066,086	36,640,454	1,231,775	37,872,229
Discounted Total (2021-2022)	16,270,446	1,301,636	17,572,081	1,231,775	18,803,856
Discounted Total (2023-2042)	18,303,922	764,450	19,068,372	0	19,068,372

Undiscounted and discounted total initial, replacement / renewal, implementation consultancy and technical assistance (TA) investment costs including contingencies of 10% are estimated to be EUR 56,747,288 and EUR 41,659,452 as shown in Table 72

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below. Out of the total discounted investment costs including contingencies, 91.29% are for investment costs excluding TA (EUR 38,031,805), 5.46% are for implementation consultancy (EUR 2,272,694) and 3.25% are for technical assistance (TA) (EUR 1,354,953).



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Table 72 Summary of Total Investment Costs (Initial + Replacement / Renewal + Implementation Consultancy + Technical Assistance (TA) Including Contingencies of 10% (Financial Discount Rate = 4% p.a.) (EUR)

YEARS	Total Inv. Excluding Impl. Consultant	Impl. Cons.	Total Inv. Including Impl. Consultant	Technical Ass. (TA)	Total Inv. Including Impl. Cons. & TA
2021	0	0	0	997,920	997,920
2022	19,357,925	1,548,634	20,906,559	427,680	21,334,239
2023	0	0	0	0	0
2024	0	0	0	0	0
2025	538,890	43,111	582,001	0	582,001
2026	0	0	0	0	0
2027	264,000	21,120	285,120	0	285,120
2028	4,203,830	154,409	4,358,240	0	4,358,240
2029	1,400,300	112,024	1,512,324	0	1,512,324
2030	255,558	0	255,558	0	255,558
2031	132,000	10,560	142,560	0	142,560
2032	7,730,250	528,000	8,258,250	0	8,258,250
2033	12,068,057	181,022	12,249,079	0	12,249,079
2034	0	0	0	0	0
2035	528,000	21,120	549,120	0	549,120
2036	0	0	0	0	0
2037	1,694,000	114,400	1,808,400	0	1,808,400
2038	2,069,454	27,103	2,096,557	0	2,096,557
2039	0	0	0	0	0
2040	0	0	0	0	0
2041	396,000	21,120	417,120	0	417,120
2042	1,760,000	140,800	1,900,800	0	1,900,800
Grand Total	52,398,265	2,923,424	55,321,688	1,425,600	56,747,288
Total (2021-2022)	19,357,925	1,548,634	20,906,559	1,425,600	22,332,159
Total (2023-2042)	33,040,339	1,374,790	34,415,129	0	34,415,129
Discounted Grand Total	38,031,805	2,272,694	40,304,499	1,354,953	41,659,452
Discounted Total (2021-2022)	17,897,490	1,431,799	19,329,289	1,354,953	20,684,242
Discounted Total (2023-2042)	20,134,315	840,895	20,975,210	0	20,975,210

A breakdown of investment costs (initial, replacement / renewal and implementation consultancy investment costs) including contingencies of 10% and excluding TA by SWM services are shown in Table 73 below. Out of the total discounted investment costs

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including contingencies and excluding TA of EUR 40,304,499, 35.86% are for collection services (EUR 14,452,347), 16.61% are for recycling services (EUR 6,694,489), 3.64% are for composting services (EUR 1,468,166), 4.52% are for transport services (EUR 1,823,010) and 39.37% are for disposal services (EUR 15,866,487).



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Table 73 Summary of Total Investment Costs By SWM Services (Initial + Replacement / Renewal + Implementation Consultancy + Implementation Consultancy) Including Contingencies of 10% (Financial Discount Rate = 4% p.a.) (EUR)

YEARS	Collection	Recycling	Composting	Transport	Disposal	Total Inv. Including Impl. Consultant
2021	0	0	0	0	0	0
2022	8,366,804	2,894,978	1,259,280	1,367,982	7,017,516	20,906,559
2023	0	0	0	0	0	0
2024	0	0	0	0	0	0
2025	0	582,001	0	0	0	582,001
2026	0	0	0	0	0	0
2027	0	285,120	0	0	0	285,120
2028	1,509,163	1,215,577	0	0	1,633,500	4,358,240
2029	0	0	0	0	1,512,324	1,512,324
2030	0	255,558	0	0	0	255,558
2031	0	142,560	0	0	0	142,560
2032	0	0	0	893,750	7,364,500	8,258,250
2033	8,021,772	2,176,908	506,000	0	1,544,400	12,249,079
2034	0	0	0	0	0	0
2035	0	549,120	0	0	0	549,120
2036	0	0	0	0	0	0
2037	0	264,000	0	0	1,544,400	1,808,400
2038	1,613,296	483,261	0	0	0	2,096,557
2039	0	0	0	0	0	0
2040	0	0	0	0	0	0
2041	0	417,120	0	0	0	417,120
2042	0	0	0	0	1,900,800	1,900,800
Grand Total	19,511,034	9,266,202	1,765,280	2,261,732	22,517,440	55,321,688
Total (2021-2022)	8,366,804	2,894,978	1,259,280	1,367,982	7,017,516	20,906,559
Total (2023-2042)	11,144,231	6,371,224	506,000	893,750	15,499,924	34,415,129
Discounted Grand Total	14,452,347	6,694,489	1,468,166	1,823,010	15,866,487	40,304,499
Discounted Total (2021-2022)	7,735,580	2,676,570	1,164,275	1,264,776	6,488,088	19,329,289
Discounted Total (2023-2042)	6,716,767	4,017,919	303,890	558,234	9,378,399	20,975,210



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As shown in Table 74 below, residual value as of 2042 including and excluding contingencies of 10% is estimated to be EUR 5,694,094 and EUR 5,176,449, respectively.

Table 74 Residual Values Including and Excluding Contingencies of 10% as of 2042 (EUR)

Investment Components	Total Investments	Accumulated Depr. (-)	Residual Value (2042) (Inc. Cont.)	Residual Value (2042) (Excl. Cont.)
Collection	19,511,034	-18,655,662	855,372	777,611
Recycling	9,266,202	-7,674,509	1,591,693	1,446,994
Composting	1,765,280	1,765,280	0	0
Transport	2,261,732	2,261,732	0	0
Disposal	22,517,440	-19,270,412	3,247,028	2,951,844
Total Investment Costs Incl. Implementation Consultancy Excl. TA	55,321,688	-49,627,594	5,694,094	5,176,449
Technical Assistance (TA)	1,425,600	1,425,600	0	0
Total Investment Costs Incl. Implementation Consultancy and TA	56,747,288	-51,053,194	5,694,094	5,176,449

6.1.3 Operation and Maintenance (O&M) Costs

Annual operation and maintenance (O & M) costs, estimated separately for all Project components, have been used under the following assumptions:

- All O & M costs are in year 2020 unit prices.
- O & M costs shall be incurred in the years 2023-2042 following the commissioning of Project investments in the beginning of 2023.
- O & M costs include personnel, maintenance, fuel, electricity and other utility consumption, leachate treatment for landfill and miscellaneous operating costs. Personnel, maintenance and other costs are fixed costs whereas fuel, electricity and other utility consumption and leachate treatment for landfill costs are variable costs.
- Contingencies of 10% are added on top of the total O & M costs as allowance for unexpected O & M cost increases.
- Following gross salaries for the staff are assumed:
 - Supervisor: 10,200 EUR/year
 - Weighbridge Officer: 9,000 EUR/year
 - Driver: 9,000 EUR/year
 - Worker: 6,000 EUR/year



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- Fuel price is assumed to be 1.1 EURO/l.
- Electricity price is taken to be 0.14 EURO/kWh.
- Water price is assumed to be 0.80 EURO/m³.
- Annual repair and maintenance cost of trucks is assumed to be equivalent to 8% of truck purchase costs.
- Annual repair and maintenance cost of containers is assumed to be equivalent to 5% of container purchase costs.
- Annual repair and maintenance cost of other vehicle costs is assumed to be equivalent to 2% of other vehicle purchase costs.
- Annual repair and maintenance cost of buildings is assumed to be equivalent to 1.5% of building construction costs.
- After care costs of closed landfills are assumed to be incurred for 30 years between 2043 and 2072. NPV of total after care costs between 2043 and 2072 discounted to 2042 is estimated to be EUR 1,177,350 at financial discount rate of 4% p.a. NPV of total after care costs between 2043 and 2072 discounted to 2020 is estimated to be EUR 496,789 at financial discount rate of 4% p.a.

JPE "Rusino" is assumed to be administered by 6 permanent staff starting from 2022. For legal affairs and IT maintenance it is assumed that this will be outsourced. Total administrative staff cost is estimated to be 69,000 EUR/year between 2022 - 2042 as presented in detail in Table 75 below. Total administrative staff cost will be 24,000 EUR/year in 2021 since only the Managing Director (12 months) and Head of Finance (6 months) is expected to work during the initial project implementation period of 2021.

Other administrative costs are assumed to be equivalent to 10% of administrative staff costs. Consequently, total administration costs are estimated to be EUR 26,400 in 2021 and 75,900 EUR/year for the years 2022 - 2042.



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Table 75 Administrative Staff Costs (EUR)

A. Number of Permanent Staff

STAFF POSITIONS	Gross Salary (€person/month)	Permanent Staff No. (2021)	Permanent Staff No. (2022-2042)
Managing Director	1,500	1.0	1.0
Management assistant	650	-	1.0
PR & communication officer	750	-	1.0
Head of finance	1,000	0.5	1.0
Financial accountant	750	-	1.0
Head of Operations	900	-	1.0
TOTAL		1.5	6.0

B. Administrative Staff Cost

STAFF POSITIONS	Admin. Staff Cost (2021) (€year)	Admin. Staff Cost (2022-2042) (€year)
Managing Director	18,000.00	18,000.00
Management assistant	-	7,800.00
PR & communication officer	-	9,000.00
Head of finance	6,000.00	12,000.00
Financial accountant	-	9,000.00
Head of Operations	-	10,800.00
Legal affairs	-	1,200.00
IT maintenance	-	1,200.00
TOTAL	24,000.00	69,000.00

Annual development of O & M costs are presented in detail in Annex 3 – F-2.

Annual development of O & M costs (excluding depreciation) by type of cost is presented in Table 76 below. Undiscounted and discounted average O & M cost is 5,279,647 EUR/year and 3,245,480 EUR/year, respectively.

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**Table 76 Total O & M Costs by Type of Cost (Financial Discount Rate = 4% p.a.)
(EUR/year)**

YEARS	Personnel	Maint.	Consump.	Other	Conting. (10%)	GRAND TOTAL
2021	0	0	0	0	0	0
2022	0	0	0	0	0	0
2023	1,912,200	780,864	953,661	224,806	387,153	4,258,684
2024	1,996,200	802,749	989,947	229,570	401,847	4,420,312
2025	2,038,200	836,344	1,042,017	237,019	415,358	4,568,938
2026	2,071,200	846,035	1,070,209	240,336	422,778	4,650,558
2027	2,164,200	873,023	1,102,048	248,040	438,731	4,826,042
2028	2,197,200	899,826	1,164,262	254,108	451,540	4,966,935
2029	2,260,200	926,704	1,189,591	261,185	463,768	5,101,449
2030	2,302,200	932,933	1,210,855	263,975	470,996	5,180,959
2031	2,332,200	947,100	1,230,012	267,316	477,663	5,254,290
2032	2,344,200	961,260	1,241,499	270,261	481,722	5,298,943
2033	2,365,200	963,480	1,343,312	271,006	494,300	5,437,299
2034	2,398,200	976,563	1,360,501	271,952	500,722	5,507,937
2035	2,407,200	990,791	1,378,373	274,702	505,107	5,556,172
2036	2,428,200	1,005,226	1,416,397	277,851	512,767	5,640,442
2037	2,437,200	1,007,699	1,422,709	278,001	514,561	5,660,170
2038	2,458,200	1,016,748	1,433,662	280,951	518,956	5,708,517
2039	2,500,200	1,019,223	1,447,761	282,305	524,949	5,774,438
2040	2,521,200	1,013,074	1,468,502	281,760	528,454	5,812,990
2041	2,554,200	1,063,670	1,502,313	292,518	541,270	5,953,971
2042	2,575,200	1,081,624	1,513,576	296,773	546,717	6,013,891
Grand Total	46,263,000	18,944,936	25,481,205	5,304,438	9,599,358	105,592,936
Yearly Average	2,313,150	947,247	1,274,060	265,222	479,968	5,279,647
Discounted Grand Total	28,538,849	11,672,254	15,520,064	3,277,558	5,900,872	64,909,597
Discounted Yearly Average	1,426,942	583,613	776,003	163,878	295,044	3,245,480

Annual development of O & M costs (excluding depreciation) by type fixed and variable cost breakdown is presented in Table 77 below. Out of the total discounted O & M cost 67.00% is comprised of fixed costs and 23.91% variable costs.

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Table 77 Total O & M Costs by Fixed and Variable Cost Breakdown (Financial Discount Rate = 4% p.a.) (EUR/year)

YEARS	Fixed	Variable	Contingencies (10%)	GRAND TOTAL
2021	0	0	0	0
2022	0	0	0	0
2023	2,917,870	953,661	387,153	4,258,684
2024	3,028,519	989,947	401,847	4,420,312
2025	3,111,563	1,042,017	415,358	4,568,938
2026	3,157,571	1,070,209	422,778	4,650,558
2027	3,285,263	1,102,048	438,731	4,826,042
2028	3,351,134	1,164,262	451,540	4,966,935
2029	3,448,089	1,189,591	463,768	5,101,449
2030	3,499,108	1,210,855	470,996	5,180,959
2031	3,546,616	1,230,012	477,663	5,254,290
2032	3,575,721	1,241,499	481,722	5,298,943
2033	3,599,687	1,343,312	494,300	5,437,299
2034	3,646,714	1,360,501	500,722	5,507,937
2035	3,672,693	1,378,373	505,107	5,556,172
2036	3,711,277	1,416,397	512,767	5,640,442
2037	3,722,900	1,422,709	514,561	5,660,170
2038	3,755,899	1,433,662	518,956	5,708,517
2039	3,801,728	1,447,761	524,949	5,774,438
2040	3,816,034	1,468,502	528,454	5,812,990
2041	3,910,388	1,502,313	541,270	5,953,971
2042	3,953,598	1,513,576	546,717	6,013,891
Grand Total	70,512,373	25,481,205	9,599,358	105,592,936
Yearly Average	3,525,619	1,274,060	479,968	5,279,647
Discounted Grand Total	43,488,661	15,520,064	5,900,872	64,909,597
Discounted Yearly Average	2,174,433	776,003	295,044	3,245,480

Annual development of O & M costs (excluding depreciation) by SWM services is presented in Table 78 below. Out of the total discounted O & M cost 51.91% is for collection, 22.21% is for recycling, 2.06% for composting, 9.07% is for transfer & transport and 14.74% is for disposal services.

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Table 78 O & M Costs by SWM Services (Financial Discount Rate = 4% p.a.) (EUR/year)

YEARS	Collection	Recycling	Composting	Transport	Disposal	GRAND TOTAL
2021	0	0	0	0	0	0
2022	0	0	0	0	0	0
2023	2,334,656	731,451	106,392	414,357	671,828	4,258,684
2024	2,386,346	834,869	106,392	417,224	675,481	4,420,312
2025	2,394,160	970,052	106,392	423,357	674,977	4,568,938
2026	2,433,559	997,421	106,392	432,435	680,751	4,650,558
2027	2,529,412	1,058,003	106,392	451,175	681,060	4,826,042
2028	2,590,207	1,091,012	106,392	459,378	719,946	4,966,935
2029	2,674,885	1,132,570	106,392	467,741	719,861	5,101,449
2030	2,732,792	1,140,342	106,392	476,341	725,092	5,180,959
2031	2,762,280	1,183,075	106,392	478,811	723,733	5,254,290
2032	2,780,517	1,203,012	106,392	481,359	727,663	5,298,943
2033	2,806,646	1,210,210	106,392	483,907	830,143	5,437,299
2034	2,846,232	1,220,878	106,392	486,456	847,979	5,507,937
2035	2,848,716	1,263,207	106,392	489,084	848,774	5,556,172
2036	2,851,113	1,336,349	106,392	491,712	854,876	5,640,442
2037	2,853,654	1,340,160	106,392	504,240	855,724	5,660,170
2038	2,889,541	1,343,835	106,392	506,869	861,880	5,708,517
2039	2,915,808	1,379,880	106,392	509,576	862,782	5,774,438
2040	2,931,087	1,394,235	106,392	512,284	868,992	5,812,990
2041	2,965,311	1,497,249	106,392	515,071	869,949	5,953,971
2042	3,012,234	1,501,272	106,392	517,779	876,214	6,013,891
Grand Total	54,539,155	23,829,081	2,127,840	9,519,157	15,577,702	105,592,936
Yearly Average	2,726,958	1,191,454	106,392	475,958	778,885	5,279,647
Discounted Grand Total	33,696,368	14,416,565	1,336,818	5,890,247	9,569,600	64,909,597
Discounted Yearly Average	1,684,818	720,828	66,841	294,512	478,480	3,245,480

6.1.4 Discounted Total Costs (NPV) and Dynamic Prime Costs (DPC)

The Net Present Value (NPV) of Project investment costs including implementation consultancy and technical assistance (TA) fees, 10% contingencies and O & M costs over the lifecycle of the Project (2021 – 2042) are calculated by taking the residual value at year 2042 into account at different financial discount rates ranging between 0% and 10% p.a. to be able to assess the impact of unexpected cost increases (financial risks).

As being the best proxy of long-term marginal cost, Dynamic Prime Cost (DPC) (alternatively named as Average Incremental Cost (AIC) and Levelised Unit Cost (LUC))



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of the Project (unit marginal cost per ton of solid waste collected over the life cycle of the Project), which should be reflected as an incremental cost to the beneficiaries in accordance with the “polluter pays” principle in case there is no grant component, is calculated. DPC is calculated before grant financing of investment costs as if all costs shall be covered by SWM tariff revenues to be able to determine the level of full cost recovery tariff that must be charged to the waste generators.

The results of NPV and DPC calculations before grant financing are presented in Table 79 below at financial discount rate of 4% p.a. NPV of total costs is calculated to be EUR 105,712,428 over the planning period of 2021-2042. DPC is calculated to be 62.67 EUR/Ton of which 62.86% is for O&M costs (39.40 EUR/Ton) and 37.14% is for investment costs net off residual value as of 2042 (23.27 EUR/Ton). This implies that if all investment costs are to be financed by investment grants, then at least the total O&M, after care and administrative costs must be reflected to the waste generators making average SWM tariff to be charged 39.40 EUR/Ton.

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Table 79 Net Present Value (NPV in EURO) Dynamic Prime Cost (DPC in EURO/Ton) of the Project before Grant Financing (Financial Discount Rate = 4% p.a.) (Total Waste Quantity Collected: 1,686,767 Tons to be billed between 2023-2042) (EUR/year)

PROJECT COMPONENTS	DISC. COST (EUR)	DPC (EUR/TON)	% of Total
O & M COSTS			
Collection	33,696,368	19.98	31.88
Recycling	14,416,565	8.55	13.64
Composting	1,336,818	0.79	1.26
Transport	5,890,247	3.49	5.57
Disposal	9,569,600	5.67	9.05
TOTAL OPERATING SERVICE COSTS	64,909,597	38.48	61.40
Aftercare Costs	496,789	0.29	0.47
Administrative Costs	1,049,243	0.62	0.99
Total After Care and Administrative Costs	1,546,033	0.92	1.46
Total O & M After Care & Administrative Costs	66,455,630	39.40	62.86
INVESTMENT COSTS			0.00
Collection	14,452,347	8.57	13.67
Recycling	6,694,489	3.97	6.33
Composting	1,468,166	0.87	1.39
Transport	1,823,010	1.08	1.72
Disposal	15,866,487	9.41	15.01
Technical Assistance	1,354,953	0.80	1.28
TOTAL INVESTMENT COSTS INCL. TA	41,659,452	24.70	39.41
Residual Value (-)	-2,402,654	-1.42	-2.27
TOTAL NET INVESTMENT COSTS	39,256,798	23.27	37.14
TOTAL NET INVESTMENT + O&M COSTS BEFORE GRANTS	105,712,428	62.67	100.00

6.1.5 Sensitivity / Risk Analysis of Total Costs (NPV) and Unit Costs (DPC)

To be able to conduct a sensitivity / risk analysis, NPV and DPC are calculated at different financial discount rates of 0% (Table 80), 2% (Table 81), 6% (Table 82), 8% (Table 83) and 10% (Table 84). The higher the financial discount rate the higher the DPC to provide risk coverage for cost recovery. Consequently, the lowest DPC is at 0% financial discount rate at 58.18 EUR/Ton (O&M Cost: 39.60 EUR/Ton; Net Investment Cost: 18.58 EUR/Ton) and the highest DPC is at 10% financial discount rate at 70.52 EUR/Ton (O&M Cost: 39.34 EUR/Ton; Net Investment Cost: 31.18 EUR/Ton).

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Table 80 Net Present Value (NPV in EURO) Dynamic Prime Cost (DPC in EURO/Ton) of the Project before Grant Financing (Financial Discount Rate = 0% p.a.) (Discounted Total Waste Quantity Collected: 2,747,031 Tons Billed between 2023-2042) (EUR/year)

PROJECT COMPONENTS	DISC. COST (EUR)	DPC (EUR/TON)	% of Total
O & M COSTS			
Collection	54,539,155	19.85	34.12
Recycling	23,829,081	8.67	14.91
Composting	2,127,840	0.77	1.33
Transport	9,519,157	3.47	5.96
Disposal	15,577,702	5.67	9.75
TOTAL OPERATING SERVICE COSTS	105,592,936	38.44	66.06
Aftercare Costs	1,565,547	0.57	0.98
Administrative Costs	1,620,300	0.59	1.01
Total After Care and Administrative Costs	3,185,847	1.16	1.99
Total O & M After Care & Administrative Costs	108,778,783	39.60	68.06
INVESTMENT COSTS			0.00
Collection	19,511,034	7.10	12.21
Recycling	9,266,202	3.37	5.80
Composting	1,765,280	0.64	1.10
Transport	2,261,732	0.82	1.42
Disposal	22,517,440	8.20	14.09
Technical Assistance	1,425,600	0.52	0.89
TOTAL INVESTMENT COSTS INCL. TA	56,747,288	20.66	35.50
Residual Value (-)	-5,694,094	-2.07	-3.56
TOTAL NET INVESTMENT COSTS	51,053,194	18.58	31.94
TOTAL NET INVESTMENT + O&M COSTS BEFORE GRANTS	159,831,977	58.18	100.00

Unit O&M cost is slightly lower than 40 EUR/Ton at all financial discount rates since O&M costs are variable and gradually increase each year in line with the growth of waste quantities billed.

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Table 81 Net Present Value (NPV in EURO) Dynamic Prime Cost (DPC in EURO/Ton) of the Project before Grant Financing (Financial Discount Rate = 2% p.a.) (Discounted Total Waste Quantity Collected: 2,134,065 Tons Billed Between 2023-2042) (EUR/year)

PROJECT COMPONENTS	DISC. COST (EUR)	DPC (EUR/TON)	% of Total
O & M COSTS			
Collection	42,501,071	19.92	33.00
Recycling	18,375,532	8.61	14.27
Composting	1,672,109	0.78	1.30
Transport	7,423,606	3.48	5.76
Disposal	12,103,466	5.67	9.40
TOTAL OPERATING SERVICE COSTS	82,075,783	38.46	63.74
Aftercare Costs	869,655	0.41	0.68
Administrative Costs	1,291,716	0.61	1.00
Total After Care and Administrative Costs	2,161,372	1.01	1.68
Total O & M After Care & Administrative Costs	84,237,154	39.47	65.41
INVESTMENT COSTS			0.00
Collection	16,660,621	7.81	12.94
Recycling	7,812,627	3.66	6.07
Composting	1,601,535	0.75	1.24
Transport	2,019,577	0.95	1.57
Disposal	18,737,833	8.78	14.55
Technical Assistance	1,389,426	0.65	1.08
TOTAL INVESTMENT COSTS INCL. TA	48,221,619	22.60	37.45
Residual Value (-)	-3,683,162	-1.73	-2.86
TOTAL NET INVESTMENT COSTS	44,538,456	20.87	34.59
TOTAL NET INVESTMENT + O&M COSTS BEFORE GRANTS	128,775,611	60.34	100.00

On the contrary, unit investment cost varies between 18.58 EUR/Ton and 31.18 EUR/ton as financial discount rate increases due to investments incurred in bulk at certain years.

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Table 82 Net Present Value (NPV in EURO) Dynamic Prime Cost (DPC in EURO/Ton) of the Project before Grant Financing (Financial Discount Rate = 6% p.a.) (Discounted Total Waste Quantity Collected: 1,355,095 Tons Billed between 2023-2042) (EUR/year)

PROJECT COMPONENTS	DISC. COST (EUR)	DPC (EUR/TON)	% of Total
O & M COSTS			
Collection	27,152,231	20.04	30.75
Recycling	11,496,674	8.48	13.02
Composting	1,086,070	0.80	1.23
Transport	4,750,019	3.51	5.38
Disposal	7,691,764	5.68	8.71
TOTAL OPERATING SERVICE COSTS	52,176,758	38.50	59.10
Aftercare Costs	290,645	0.21	0.33
Administrative Costs	867,258	0.64	0.98
Total After Care and Administrative Costs	1,157,903	0.85	1.31
Total O & M After Care & Administrative Costs	53,334,661	39.36	60.41
INVESTMENT COSTS			0.00
Collection	12,719,421	9.39	14.41
Recycling	5,821,309	4.30	6.59
Composting	1,357,987	1.00	1.54
Transport	1,661,665	1.23	1.88
Disposal	13,650,607	10.07	15.46
Technical Assistance	1,322,068	0.98	1.50
TOTAL INVESTMENT COSTS INCL. TA	36,533,057	26.96	41.38
Residual Value (-)	-1,580,140	-1.17	-1.79
TOTAL NET INVESTMENT COSTS	34,952,917	25.79	39.59
TOTAL NET INVESTMENT + O&M COSTS BEFORE GRANTS	88,287,578	65.15	100.00



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Table 83 Net Present Value (NPV in EURO) Dynamic Prime Cost (DPC in EURO/Ton) of the Project before Grant Financing (Financial Discount Rate = 8% p.a.) (Discounted Total Waste Quantity Collected: 1,105,299 Tons Billed between 2023-2042) (EUR/year)

PROJECT COMPONENTS	DISC. COST (EUR)	DPC (EUR/TON)	% of Total
O & M COSTS			
Collection	22,211,702	20.10	29.65
Recycling	9,309,603	8.42	12.43
Composting	895,552	0.81	1.20
Transport	3,888,744	3.52	5.19
Disposal	6,278,223	5.68	8.38
TOTAL OPERATING SERVICE COSTS	42,583,824	38.53	56.85
Aftercare Costs	173,575	0.16	0.23
Administrative Costs	728,403	0.66	0.97
Total After Care and Administrative Costs	901,979	0.82	1.20
Total O & M After Care & Administrative Costs	43,485,803	39.34	58.05
INVESTMENT COSTS			0.00
Collection	11,341,854	10.26	15.14
Recycling	5,129,394	4.64	6.85
Composting	1,265,685	1.15	1.69
Transport	1,527,744	1.38	2.04
Disposal	11,914,911	10.78	15.91
Technical Assistance	1,290,667	1.17	1.72
TOTAL INVESTMENT COSTS INCL. TA	32,470,255	29.38	43.35
Residual Value (-)	-1,047,375	-0.95	-1.40
TOTAL NET INVESTMENT COSTS	31,422,880	28.43	41.95
TOTAL NET INVESTMENT + O&M COSTS BEFORE GRANTS	74,908,683	67.77	100.00

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Table 84 Net Present Value (NPV in EURO) Dynamic Prime Cost (DPC in EURO/Ton) of the Project before Grant Financing (Financial Discount Rate = 10% p.a.) (Discounted Total Waste Quantity Collected: 914,310 Tons Billed between 2023-2042) (EUR/year)

PROJECT COMPONENTS	DISC. COST (EUR)	DPC (EUR/TON)	% of Total
O & M COSTS			
Collection	18,425,127	20.15	28.58
Recycling	7,646,697	8.36	11.86
Composting	748,574	0.82	1.16
Transport	3,228,259	3.53	5.01
Disposal	5,197,960	5.69	8.06
TOTAL OPERATING SERVICE COSTS	35,246,618	38.55	54.66
Aftercare Costs	105,537	0.12	0.16
Administrative Costs	620,760	0.68	0.96
Total After Care and Administrative Costs	726,297	0.79	1.13
Total O & M After Care & Administrative Costs	35,972,915	39.34	55.79
INVESTMENT COSTS			0.00
Collection	10,232,536	11.19	15.87
Recycling	4,573,346	5.00	7.09
Composting	1,187,297	1.30	1.84
Transport	1,415,340	1.55	2.20
Disposal	10,535,984	11.52	16.34
Technical Assistance	1,260,655	1.38	1.96
TOTAL INVESTMENT COSTS INCL. TA	29,205,158	31.94	45.29
Residual Value (-)	-699,497	-0.77	-1.08
TOTAL NET INVESTMENT COSTS	28,505,661	31.18	44.21
TOTAL NET INVESTMENT + O&M COSTS BEFORE GRANTS	64,478,576	70.52	100.00

Considering the fact that the investment costs would be financed, to a large extent, by grants, incremental cost of the Project to be reflected to the waste generators would be slightly over the unit O & M cost (about 40 EUR/ton) only.

6.1.6 Tariff Affordability Analysis

The concept of “affordability” of SWM tariffs for households refers to the SWM bill as percentage of average household income in the Project area. Tariff Affordability Analysis is carried out to assess whether current and to-be-charged tariffs can be paid by households or not.



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A commonly accepted residential affordability ratio for SWM services is 1% to 1.5% of the average disposable household income. In the following 1% is assumed.

To be able to conduct the tariff affordability analysis, the following parameters and assumptions are used:

- Specific per capita residential solid waste production as of 2023 (overall): 382 kg/capita*year
- Specific per capita residential solid waste production as of 2023 (urban): 414 kg/capita*year
- Specific per capita residential solid waste production as of 2023 (rural): 344 kg/capita*year
- Specific per capita residential solid waste production as of 2042 (overall): 446 kg/capita*year
- Specific per capita residential solid waste production as of 2042 (urban): 478 kg/capita*year
- Specific per capita residential solid waste production as of 2042 (rural): 409 kg/capita*year
- Average household size (overall average): 4.43 persons/household
- Average household size (urban): 4.40 persons/household
- Average household size (rural): 4.47 persons/household
- Average disposable household income as of 2023:
 - Overall Average: 5,834.76 EUR/HH/Year
 - Urban: 6,107.17 EUR/HH/Year
 - Rural: 5,507.49 EUR/HH/Year

Disposable household income is estimated to grow by 1% p.a. both in urban and rural areas. Consequently, average disposable household income is estimated to increase by 20.8% until 2043 as shown in Table 85 below.

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**Table 85 Assumed Disposable Household Income between 2023-2042
(EUR/Household/Year)**

	HH Disposable Income Growth Rate	Household Income (Overall)	Household Income (Urban)	Household Income (Rural)
Years	(% p.a.)	(EUR/HH/Year)	(EUR/HH/Year)	(EUR/HH/Year)
2023	1.00	5,834.76	6,107.17	5,507.49
2024	1.00	5,892.86	6,168.24	5,562.56
2025	1.00	5,951.57	6,229.92	5,618.19
2026	1.00	6,010.84	6,292.22	5,674.37
2027	1.00	6,070.71	6,355.14	5,731.12
2028	1.00	6,131.17	6,418.69	5,788.43
2029	1.00	6,192.24	6,482.88	5,846.31
2030	1.00	6,253.97	6,547.71	5,904.77
2031	1.00	6,316.29	6,613.19	5,963.82
2032	1.00	6,379.24	6,679.32	6,023.46
2033	1.00	6,442.81	6,746.11	6,083.69
2034	1.00	6,507.02	6,813.57	6,144.53
2035	1.00	6,571.87	6,881.71	6,205.98
2036	1.00	6,637.37	6,950.52	6,268.04
2037	1.00	6,703.50	7,020.03	6,330.72
2038	1.00	6,770.30	7,090.23	6,394.02
2039	1.00	6,838.01	7,161.13	6,457.96
2040	1.00	6,906.39	7,232.74	6,522.54
2041	1.00	6,975.44	7,305.07	6,587.77
2042	1.00	7,046.45	7,378.12	6,653.65

Residential SWM tariffs excluding VAT of 5% currently charged in Polog Region as of 2020 are the following:

- Overall Average: 26.37 EUR/Ton
- Urban: 32.5 EUR/Ton
- Rural: 19.0 EUR/Ton

Current affordability rate (residential SWM cost / average household income) based on currently charged SWM tariffs excluding VAT of 5% in Polog Region as of 2020 are the following:

- Overall Average: 0.81%
- Urban: 1.03%
- Rural: 0.57%

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By assuming an residential tariff increase of 1% p.a. in urban areas and 2% p.a. in rural areas, overall affordability ratio will reach 1% in 2042. The assumed cumulative residential tariff increase excluding VAT of 5% is estimated to be 28.85% between 2023 and 2042 (20.81% in urban areas; 45.68% in rural areas) as shown in Table 86 below.

Table 86 Assumed Development of Residential Tariffs Excluding VAT of 5% between 2023-2042 (EUR/Ton)

Years	Urban Residential Tariff Inc. (% p.a.)	Rural Residential Tariff Inc. (% p.a.)	Residential Tariff Excl. VAT (Overall) (€/Ton)	Residential Tariff Excl. VAT (Urban) (€/Ton)	Residential Tariff Excl. VAT (Rural) (€/Ton)
2023	1.00	2.00	26.72	32.83	19.38
2024	1.00	2.00	27.07	33.15	19.77
2025	1.00	2.00	27.42	33.48	20.16
2026	1.00	2.00	27.78	33.82	20.57
2027	1.00	2.00	28.15	34.16	20.98
2028	1.00	2.00	28.52	34.50	21.40
2029	1.00	2.00	28.90	34.84	21.83
2030	1.00	2.00	29.28	35.19	22.26
2031	1.00	2.00	29.68	35.54	22.71
2032	1.00	2.00	30.07	35.90	23.16
2033	1.00	2.00	30.47	36.26	23.62
2034	1.00	2.00	30.88	36.62	24.10
2035	1.00	2.00	31.30	36.99	24.58
2036	1.00	2.00	31.72	37.36	25.07
2037	1.00	2.00	32.15	37.73	25.57
2038	1.00	2.00	32.58	38.11	26.08
2039	1.00	2.00	33.03	38.49	26.60
2040	1.00	2.00	33.48	38.87	27.14
2041	1.00	2.00	33.94	39.26	27.68
2042	1.00	2.00	34.43	39.66	28.23

Development of the affordability rate (residential SWM cost / average household income) between 2023 and 2042 is shown in Table 87 below. Overall affordability rate is expected to increase from 0.81% in 2023 to 1.01% in 2042. In the same period while the affordability rate in urban areas is estimated to increase from 1.03% to 1.19% that in rural areas is estimated to increase from 0.57% to 0.81%.

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Table 87 Assumed Development of SWM Bill Including VAT of 5% and Affordability Rate between 2023-2042 (EUR/Ton)

	SWM Bill Incl. VAT (Overall)	SWM Bill Incl. VAT (Urban)	SWM Bill Incl. VAT (Rural)	Affordability Rate (Overall)	Affordability Rate (Urban)	Affordability Rate (Rural)
Years	(EUR/HH/Year)	(EUR/HH/Year)	(EUR/HH/Year)	(%)	(%)	(%)
2023	47.51	62.81	31.32	0.81%	1.03%	0.57%
2024	48.52	63.91	32.23	0.82%	1.04%	0.58%
2025	49.56	65.04	33.18	0.83%	1.04%	0.59%
2026	50.62	66.18	34.15	0.84%	1.05%	0.60%
2027	51.70	67.34	35.15	0.85%	1.06%	0.61%
2028	52.81	68.53	36.18	0.86%	1.07%	0.63%
2029	53.94	69.73	37.24	0.87%	1.08%	0.64%
2030	55.10	70.96	38.33	0.88%	1.08%	0.65%
2031	56.29	72.20	39.45	0.89%	1.09%	0.66%
2032	57.51	73.47	40.61	0.90%	1.10%	0.67%
2033	58.75	74.76	41.80	0.91%	1.11%	0.69%
2034	60.02	76.08	43.02	0.92%	1.12%	0.70%
2035	61.32	77.41	44.28	0.93%	1.12%	0.71%
2036	62.65	78.77	45.58	0.94%	1.13%	0.73%
2037	64.02	80.16	46.91	0.95%	1.14%	0.74%
2038	65.41	81.57	48.28	0.97%	1.15%	0.76%
2039	66.85	83.00	49.70	0.98%	1.16%	0.77%
2040	68.32	84.46	51.15	0.99%	1.17%	0.78%
2041	69.82	85.94	52.65	1.00%	1.18%	0.80%
2042	71.42	87.45	54.19	1.01%	1.19%	0.81%

6.1.7 Tariff Revenues (Billed and Collected)

Billed tariff revenues are calculated by multiplying the solid waste quantities billed (Ton/Year) with the solid waste tariffs (EUR/Ton) applied. Development of billed and collected tariff revenues is presented in detail in Annex 3 – F-3.

Average amount of solid waste to be billed is estimated to be 137,352 ton/year between 2023 and 2042 of which 59.92% will be billed in urban areas (82,296 ton/year) and 40.08% in the rural areas (55,056 ton/year) as shown in Table 88 below. Out of the total amount billed 86.01% is for residential customers (118,140 ton/year) and 13.99% is for commercial customers (19,212 ton/year).



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Table 88 Assumed Development of the Quantity of Solid Waste Billed Between 2023-2042 (Ton/Year)

YEARS	Total Waste Billed	Total Waste Billed (Urban)	Total Waste Billed (Rural)	Total Waste Billed (Residential)	Total Waste Billed (Commercial)
2023	108,783	74,254	34,530	92,206	16,577
2024	112,906	75,047	37,859	96,004	16,902
2025	117,120	75,850	41,270	99,886	17,233
2026	121,425	76,660	44,764	103,854	17,570
2027	125,476	77,480	47,996	107,580	17,896
2028	128,909	78,308	50,600	110,717	18,192
2029	132,412	79,146	53,267	113,920	18,492
2030	135,988	79,992	55,996	117,190	18,798
2031	137,606	80,848	56,758	118,598	19,007
2032	139,244	81,712	57,531	120,025	19,219
2033	140,902	82,586	58,316	121,469	19,433
2034	142,581	83,470	59,112	122,932	19,650
2035	144,281	84,363	59,919	124,413	19,868
2036	146,003	85,265	60,738	125,913	20,090
2037	147,746	86,178	61,568	127,432	20,314
2038	149,511	87,100	62,411	128,970	20,541
2039	151,298	88,032	63,266	130,528	20,770
2040	153,107	88,974	64,133	132,105	21,001
2041	154,939	89,926	65,013	133,703	21,236
2042	156,794	90,727	66,067	135,345	21,449
TOTAL	2,747,031	1,645,919	1,101,112	2,362,791	384,239
Yearly Average	137,352	82,296	55,056	118,140	19,212

Both residential and commercial SWM tariffs are assumed to be increased between 2023 and 2042 by 1% p.a. in urban areas and 2% p.a. in rural areas as shown in Table 89 below. Due to considerably lower tariffs currently charged in rural areas, the cumulative tariff increase between 2023 and 2042 in rural areas is assumed to be 145.68% whereas the cumulative tariff increase in urban areas will be 120.81%.



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Table 89 Assumed Development of Residential and Commercial SWM Tariffs to Be Charged Excluding VAT between 2023-2042 (EUR/Ton)

YEARS	Residential Tariff Excl. VAT (Urban)	Residential Tariff Excl. VAT (Rural)	Commercial Tariff Excl. VAT (Urban)	Commercial Tariff Excl. VAT (Rural)
2023	32.83	19.38	50.50	29.82
2024	33.15	19.77	51.01	30.41
2025	33.48	20.16	51.52	31.02
2026	33.82	20.57	52.03	31.64
2027	34.16	20.98	52.55	32.27
2028	34.50	21.40	53.08	32.92
2029	34.84	21.83	53.61	33.58
2030	35.19	22.26	54.14	34.25
2031	35.54	22.71	54.68	34.93
2032	35.90	23.16	55.23	35.63
2033	36.26	23.62	55.78	36.34
2034	36.62	24.10	56.34	37.07
2035	36.99	24.58	56.90	37.81
2036	37.36	25.07	57.47	38.57
2037	37.73	25.57	58.05	39.34
2038	38.11	26.08	58.63	40.13
2039	38.49	26.60	59.22	40.93
2040	38.87	27.14	59.81	41.75
2041	39.26	27.68	60.41	42.58
2042	39.26	27.68	61.01	43.44

Total SWM tariff revenues billed is expected to increase cumulatively by 192.29% from 4,834,563 EUR/Year in 2023 to 9,296,368 EUR/Year in 2042 as shown in Table 90 below. Undiscounted and discounted yearly average SWM tariff revenues billed between 2023 and 2042 is estimated to be 7,149,360 EUR/year and 4,306,535 EUR/year, respectively. Out of the discounted total yearly average SWM revenues billed (4,306,535 EUR/Year), 55.44% is from urban areas (2,387,382 EUR/Year) and 44.56% is from rural areas (1,909,153 EUR/Year).

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Table 90 Assumed Development of the SWM Tariff Revenues Billed Between 2023-2042 (EUR/Year) (Financial Discount Rate = 4% p.a.)

YEARS	Total Res. + Comm. Tariff Rev. Billed (€Year)	Res. + Comm. Tariff Rev. Billed (Urban) (€Year)	Res. + Comm. Tariff Rev. Billed (Rural) (€Year)
2023	4,834,563	3,187,344	1,647,219
2024	5,095,791	3,253,626	1,842,165
2025	5,369,592	3,321,289	2,048,303
2026	5,656,529	3,390,362	2,266,167
2027	5,939,225	3,460,874	2,478,350
2028	6,197,962	3,532,856	2,665,106
2029	6,467,992	3,606,339	2,861,653
2030	6,749,797	3,681,353	3,068,445
2031	6,930,349	3,757,930	3,172,419
2032	7,116,055	3,836,104	3,279,951
2033	7,307,070	3,915,907	3,391,163
2034	7,503,556	3,997,374	3,506,182
2035	7,705,679	4,080,539	3,625,140
2036	7,913,611	4,165,438	3,748,172
2037	8,127,528	4,252,107	3,875,421
2038	8,347,615	4,340,583	4,007,031
2039	8,574,059	4,430,904	4,143,154
2040	8,807,054	4,523,108	4,283,946
2041	9,046,803	4,617,235	4,429,568
2042	9,296,368	4,704,930	4,591,438
Undiscounted Total	142,987,197	78,056,204	64,930,994
Discounted Total	86,130,699	47,747,638	38,383,062
Undiscounted Yearly Average	7,149,360	3,902,810	3,246,550
Discounted Yearly Average	4,306,535	2,387,382	1,919,153

SWM tariff revenue collection ratio is anticipated to increase from its current level of 55% to 83% in 2042. Consequently, total SWM tariff revenues collected is expected to be increased cumulatively by 290.18% from 2,659,010 EUR/Year in 2023 to 7,715,985 EUR/Year in 2042 as shown in Table 91 below. Undiscounted and discounted yearly average SWM tariff revenues collected between 2023 and 2042 is estimated to be 4,881,882 EUR/year and 3,093,180 EUR/year, respectively. Out of the discounted total yearly average SWM revenues collected (3,093,180 EUR/Year), 54.97% is from urban areas (1,700,426 EUR/Year) and 45.03% is from rural areas (1,392,754 EUR/Year).

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Table 91 Assumed Development of the SWM Tariff Revenues Collected Between 2023-2042 (EUR/Year) (Financial Discount Rate = 4% p.a.)

YEARS	Revenue Collection Rate (%)	Total Res. + Comm. Tariff Rev. Collected (€Year)	Res. + Comm. Tariff Rev. Collected (Urban) (€Year)	Res. + Comm. Tariff Rev. Collected (Rural) (€Year)
2023	55.00%	2,659,010	1,753,039	905,971
2024	56.00%	2,853,643	1,822,030	1,031,613
2025	57.00%	3,060,667	1,893,135	1,167,533
2026	58.00%	3,280,787	1,966,410	1,314,377
2027	59.00%	3,504,143	2,041,916	1,462,227
2028	60.00%	3,718,777	2,119,714	1,599,064
2029	61.00%	3,945,475	2,199,867	1,745,608
2030	62.00%	4,184,874	2,282,439	1,902,436
2031	63.00%	4,366,120	2,367,496	1,998,624
2032	64.00%	4,554,275	2,455,106	2,099,169
2033	65.00%	4,749,595	2,545,340	2,204,256
2034	67.00%	5,027,382	2,678,241	2,349,142
2035	69.00%	5,316,918	2,815,572	2,501,346
2036	71.00%	5,618,664	2,957,461	2,661,202
2037	73.00%	5,933,096	3,104,038	2,829,057
2038	75.00%	6,260,711	3,255,437	3,005,274
2039	77.00%	6,602,025	3,411,796	3,190,229
2040	79.00%	6,957,573	3,573,256	3,384,317
2041	81.00%	7,327,911	3,739,961	3,587,950
2042	83.00%	7,715,985	3,905,092	3,810,894
Undiscounted Total	68.28%	97,637,632	52,887,345	44,750,287
Discounted Total	66.41%	61,863,593	34,008,516	27,855,078
Undiscounted Yearly Average		4,881,882	2,644,367	2,237,514
Discounted Yearly Average		3,093,180	1,700,426	1,392,754

6.1.8 Recyclable Material Sales Revenues

Quantity of recycled materials is assumed to increase cumulatively by 275.91% from 10,280 Ton/Year in 2023 to 28,364 Ton/Year in 2042 as shown in Table 33.

The following selling prices are assumed for the recycled materials:

- Paper and Cardboard: 29 EUR/Ton
- Plastic: 57 EUR/Ton



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- Glass: 5 EUR/Ton
- Metals: 350 EUR/Ton

It is assumed that the collection rate of recycled sales revenues is 100%.

Total recycled material sales revenues is expected to increase cumulatively by 275.96% from 554,445 EUR/Year in 2023 to 1,529,703 EUR/Year in 2042 as shown in Table 92 below. Undiscounted and discounted yearly average recycled materials sales revenue between 2023 and 2042 is estimated to be 1,147,779 EUR/year and 685,518 EUR/year, respectively. Out of the discounted total yearly average recycled materials sales revenues (685,518 EUR/Year), 11.95% is from paper and cardboard (81,922 EUR/Year), 62.64% from plastics (429,385 EUR/Year), 1.37% from glass (9,416 EUR/Year) and 24.04% from metals (164,795 EUR/Year).

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**Table 92 Assumed Recycled Material Sales Revenues between 2023-2042 (EUR/Year)
(Financial Discount Rate = 4% p.a.)**

YEARS	Total Recycled Material Sales Revenues	Paper & Cardboard	Plastics	Glass	Metals
2023	554,445	66,236	347,244	7,615	133,350
2024	739,705	88,392	463,353	10,160	177,800
2025	852,806	101,906	534,090	11,710	205,100
2026	901,555	107,764	564,756	12,385	216,650
2027	949,865	113,535	595,080	13,050	228,200
2028	994,653	118,871	623,067	13,665	239,050
2029	1,041,040	124,410	652,080	14,300	250,250
2030	1,089,031	130,152	682,119	14,960	261,800
2031	1,122,109	134,096	702,753	15,410	269,850
2032	1,155,716	138,098	723,843	15,875	277,900
2033	1,189,814	142,187	745,332	16,345	285,950
2034	1,224,758	146,363	767,220	16,825	294,350
2035	1,260,548	150,626	789,507	17,315	303,100
2036	1,296,886	154,976	812,250	17,810	311,850
2037	1,333,696	159,384	835,392	18,320	320,600
2038	1,371,495	163,908	859,047	18,840	329,700
2039	1,409,756	168,490	883,101	19,365	338,800
2040	1,448,925	173,159	907,611	19,905	348,250
2041	1,489,078	177,944	932,634	20,450	358,050
2042	1,529,703	182,787	958,056	21,010	367,850
Undiscounted Total	22,955,584	2,743,284	14,378,535	315,315	5,518,450
Discounted Total	13,710,361	1,638,443	8,587,691	188,324	3,295,902
Undiscounted Yearly Average	1,147,779	137,164	718,927	15,766	275,923
Discounted Yearly Average	685,518	81,922	429,385	9,416	164,795

6.1.9 Electricity Sales Revenues

Electricity revenues are expected to be generated from landfill gas between 2028-2052 as shown in Table 93 below. Expected revenues between 2043 and 2052 are discounted to 2042 by using financial discount rate of 4% p.a.



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Table 93 Assumed Electricity Sales Revenues between 2023-2042 (EUR/Year) (Financial Discount Rate = 4% p.a.)

YEARS	Electricity Sales Revenues (EUR/Year)
2021	0
2022	0
2023	0
2024	0
2025	0
2026	0
2027	0
2028	476,544
2029	476,544
2030	476,544
2031	476,544
2032	476,544
2033	476,544
2034	476,544
2035	476,544
2036	476,544
2037	476,544
2038	131,750
2039	131,750
2040	131,750
2041	131,750
2042	1,036,250 (*)
Undiscounted Total	6,328,692
Discounted Total	3,620,000

(*) EUR 131,750 + EUR 904,500 (sum of discounted revenues between 2043 and 2052)

6.1.10 Compost Sales Revenues

There is no market in North Macedonia for compost sales currently and compost produced during the project period is assumed to be provided to users free of charge.

Thus, no compost sales revenues are assumed for in the financial calculations covering the 2021-2042 planning period by taking a conservative approach.



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6.1.11 Funding Gap Calculation

With regard to revenue – generating projects, Gap Analysis (or alternatively referred to as Cost – Benefit Analysis – CBA) is conducted to determine the required rate of assistance from the Grant Funds (e.g. SECO, EU, etc.). CBA is conducted with the objective of showing that the Project is desirable from an economic point of view but that a contribution of Grant Funds is needed for the Project to be financially viable.

The determination of the level of Grant assistance is based on the “Funding Gap” rate (R) of the Project, defined as the portion of the discounted cost of the investment (Discounted Investment Cost – DIC) not covered by the Discounted Net Revenue (DNR) of the Project:

$$\text{Funding Gap Rate (R)} = (\text{DIC} - \text{DNR}) / \text{DIC}$$

R is maximum when DNR = 0 or negative, implying that the Project is not a “revenue – generating” but a “cost – generating” Project.

Generally, a “Project” in the solid waste sector does generate revenues, in particular via SWM tariffs charged, sales revenues from recycled materials and electricity generation from landfill gas. This is also the case for the Polog SWM Project.

The following methodology is used in calculating the Grant Rate:

- Total annual Project cost is defined as the sum of annual incremental investment and O & M costs of the related Project components for the planning period covering 2021 to 2042 expressed in constant 2020 prices.
- Total annual incremental Project revenues are taken to be the SWM tariff revenues collected, recyclable sales revenues and electricity sales revenues in the 2023-2042 period. The share of residential (household) waste of the total quantity of waste collected is assumed to be 80% in urban areas and 95% in rural areas, the rest being the commercial waste whose service fee (commercial tariff) is taken to be 50% higher than that of the residential SWM tariff in each year of the planning period to be able to cross-subsidize the households. SWM tariff collection ratio is assumed to increase from 55% in 2023 gradually up to 83% in 2042, the average collection rate being 73.7% between 2023 and 2042. Collection rate of both recyclable sales revenues and electricity sales revenues is taken to be 100% in each year between 2023 and 2042.
- Financial discount rate of 4% p.a. in real terms is used to calculate the discounted Project cost and revenue figures in the 2021 – 2042 planning period.
- All initial investment costs are taken to be Eligible investment cost (EC).
- All replacement / renewal investment costs are considered under O & M costs.
- All investment costs are taken into account excluding contingencies of 10%.



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- Discounted investment cost (DIC) is the NPV of annual Project investment costs excluding replacements / renewals estimated to be incurred between 2021 and 2042. Replacement / renewal investments estimated to take place in 2028 and 2041 for the replacement / renewal of the heavy duty vehicles, containers, bins and machinery and electro-mechanical equipment of the plants are regarded as O & M costs for the purpose of calculating the Funding Gap Rate and Grant Rate. While calculating the Grant Rate investment costs excluding 10% contingencies are taken into account.
- Discounted net revenue (DNR) is the NPV of the sum of the annual Project revenues (2023 – 2042) and residual values of Project-related assets (2042) less the NPV of the incremental O & M costs (2023 – 2042) including replacement / renewal investment costs. Project-related incremental revenues are assumed to be generated starting from 2023 onwards due to the charging of SWM tariffs, recyclable sales revenues and electricity sales revenues.
- Eligible Expenditure (EE) = DIC – DNR
- Funding Gap Rate (R) = EE / DIC
- Decision Amount (DA) (€) = EC * R
- Co – funding Rate (CR) = 85%
- Donor Grant (€) = DA * CR
- Donor Grant (%) = DA * CR / EC

The results of the Gap Analysis conducted at financial discount rate of 4% are presented in detail in Annex 3 – F-4 and summarized in Table 94 below. Since DNR (Discounted Net Revenues – Discounted Operating Cost + Discounted Residual Value) is positive (Euro 74,526,731 – Euro 75,203,927 + Euro 2,184,231 = Euro 1,507,034) the Project is a “revenue – generating” Project and the Funding Gap Rate is calculated to be **94.41%**. At Co-funding Rate of 85%, the Grant Rate is calculated to be **80.25%**.



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Table 94 Results of the Gap Analysis of the Project (Financial Discount Rate = 4% p.a.)

MAIN ELEMENTS AND PARAMETERS	UNIT	VALUE
Reference Period	Years	22
Financial Discount Rate (Real)	% p.a.	4.0%
Total Investment Cost Excluding Contingencies (Undiscounted)	Euro	37,174,380
Discounted Investment Cost (DIC)	Euro	26,939,701
Discounted Net Revenue (DNR)	Euro	1,507,034
- <i>Discounted Revenues</i>	<i>Euro</i>	<i>74,526,731</i>
- <i>Discounted Operating Costs (Including Replacements)</i>	<i>Euro</i>	<i>-75,203,927</i>
- <i>Discounted Residual Value</i>	<i>Euro</i>	<i>2,184,231</i>
Eligible Expenditure (EE) (DIC-DNR)	Euro	25,432,666
Funding Gap Rate (R) (EE/DIC)	%	94.41%
Eligible Cost Percentage (EC %)	%	100.00%
Eligible Cost Amount (EC)	Euro	37,174,380
Decision Amount (DA) (EC * R)	Euro	35,094,807
Co-funding Rate (CR)	%	85.00%
Grant (DA * CR)	Euro	29,830,586
Grant (DA * CR / Investment) (%)	%	80.25%

Consequently, 80.25% of the undiscounted amount of initial investment costs (excluding replacement / renewal investment costs) is to be acquired throughout the planning period of 2021 and 2042.

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As described in section 5.1.4, in the new Law on Waste Management expected to be adopted in the near future, the role of the collective handlers will become more important and, over time, they may take over the responsibility for managing the recyclable waste fractions, i.e. packaging waste. Although this situation is not expected to materialise soon, funding of CAPEX and OPEX for managing packaging waste by the collective handlers would have a positive impact on the financial performance of the waste management system in the Polog Region. This system would only have to deal with mixed waste and the organic waste fraction while waste tariffs would be the same (only revenues from sale of recyclables would no longer be available for the system).

If the collective handlers would cover the investments and operation and maintenance costs for managing the recyclable fractions, the parameters would be as presented in Table 94.

Consequently, only 39.53% of the undiscounted amount of initial investment costs (excluding replacement / renewal investment costs) would have to be acquired throughout the planning period of 2021 and 2042. As mentioned, this scenario is however not expected to materialise in the near future.

Figure 44 Textbox: Involvement of collective handlers for managing the recyclable fractions

Table 95 Result of gap analysis of the project, assuming that collective handlers would manage the recyclable fractions (Financial Discount Rate = 4% p.a.)

MAIN ELEMENTS AND PARAMETERS	UNIT	VALUE
Reference Period	Years	22
Financial Discount Rate (Real)	% p.a.	4.0%
Total Investment Cost (Undiscounted, Excl. Contingencies)	Euro	32,374,860
Discounted Investment Cost (DIC)	Euro	23,696,423
Discounted Net Revenue Cost (DNR)	Euro	12,675,714
- <i>Discounted Revenues</i>	<i>Euro</i>	<i>69,657,357</i>
- <i>Discounted Operating Costs (Including Replacements)</i>	<i>Euro</i>	<i>-58,555,308</i>
- <i>Discounted Residual Value</i>	<i>Euro</i>	<i>1,573,664</i>
Eligible Expenditure (EE) (DIC-DNR)	Euro	11,020,709
Funding Gap Rate (R) (EE/DIC)	%	46.51%
Eligible Cost Percentage (EC %)	%	100.00%
Eligible Cost Amount (EC)	%	32,374,860
Decision Amount (DA) (EC * R)	Euro	15,056,868
Co-funding Rate (CR)	%	85.00%
Grant (DA * CR)	Euro	12,798,338
Grant (DA * CR / Investment)	%	39.53%



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6.1.12 Financing Plan of Initial Investment Costs

The financing plan for the initial investment costs of the Project is prepared based on the following approach:

- The investment financing plan is prepared by taking into account undiscounted initial investment costs including contingencies of 10%.
- 80.25% of the total financing is assumed to be secured by grants including SECO, EU and/or other donor and local grants.
- SECO grant in the amount of CHF 7,000,000 (EUR 6,551,240 at exchange rate of 1.0685 EUR/CHF) is assumed to be used for financing initial investment costs in 2021 and 2022.
- Donor grant in the amount of EUR 11,369,204 is assumed to be used in 2022 to finance the portion of initial investment costs not financed by SECO grant. No donor grants are assumed during the remaining planning period between 2023 and 2042.
- Remaining amount of financing not provided through SECO and Donor grants in 2021 and 2022 are assumed to be financed by an IFI loan in the total amount of EUR 4,411,715 (EUR 197,139 in 2021; EUR 4,214,576 in 2022).
- 80.25% of the initial investment costs to be incurred after 2022 (between 2025 and 2042) are assumed to be financed by local grants (national and municipal contributions).
- Total amount of IFI loans to be used for the financing of initial investment costs between 2021 and 2042 is EUR 7,561,857 whose annual utilization is provided below:
 - EUR 4,411,715: 2021 + 2022
 - EUR 171,300: 2025 + 2025
 - EUR 1,890,908: 2032 + 2033
 - EUR 377,377: 2037 + 2038
- Remaining initial investment financing requirement is assumed to be secured by internally-generated (own) funds of Polog SWM Public Enterprise in the total amount of EUR 516,316 whose annual requirement is provided below:
 - EUR 28,163: 2031
 - EUR 56,325: 2035
 - EUR 56,325: 2041
 - EUR 375,503: 2042

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Financing plan of the initial investment costs of the Project between 2021 and 2042 is shown in Table 96 below. Total initial investment financing requirement including contingencies of 10% in the amount of EUR 40,891,818 between 2021 and 2042 is assumed to be financed by the following sources:

- 16.02% by SECO Grant (EUR 6,551,240) (2021-2022)
- 27.80% by Donor Grant (EUR 11,369,204) (2022)
- 18.49% by IFI loans (EUR 7,561,857) (2022-2038)
- 36.42% by national and local grants (EUR 14,893,200) (2025-2042)
- 1.26% by internally-generated (own) funds of Polog SWM Public Enterprise (2031-2042).

Initial investment costs between 2021 and 2022 in the total amount of EUR 22,332,159 are assumed to be financed by the following sources:

- 29.34% by SECO Grant (EUR 6,551,240) (EUR 800,781 in 2021; EUR 5,750,459 in 2022)
- 50.91% by Donor Grant (EUR 11,369,204) (2022)
- 19.75% by IFI loans (EUR 4,411,715) (2022)



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Table 96 Financing Plan of the Initial Investment Costs of the Project (Financial Discount Rate = 4% p.a.)

A. Financing Sources: Grant Financing (EUR)

YEARS	SECO Grant	Donor Grant	Local Grants	Total Grants
2021	800,781	0	0	800,781
2022	5,750,459	11,369,204	0	17,119,663
2023	0	0	0	0
2024	0	0	0	0
2025	0	0	467,027	467,027
2026	0	0	0	0
2027	0	0	228,795	228,795
2028	0	0	1,672,727	1,672,727
2029	0	0	1,213,565	1,213,565
2030	0	0	0	0
2031	0	0	114,397	114,397
2032	0	0	5,719,865	5,719,865
2033	0	0	1,961,029	1,961,029
2034	0	0	0	0
2035	0	0	228,795	228,795
2036	0	0	0	0
2037	0	0	1,239,304	1,239,304
2038	0	0	293,606	293,606
2039	0	0	0	0
2040	0	0	0	0
2041	0	0	228,795	228,795
2042	0	0	1,525,297	1,525,297
TOTAL (2021-2042)	6,551,240	11,369,204	14,893,200	32,813,644
TOTAL (2021-2022)	6,551,240	11,369,204	0	17,920,444
TOTAL (2023-2042)	0	0	14,893,200	14,893,200
DISCOUNTED TOTAL	6,086,604	10,511,468	9,109,480	25,707,553
DISCOUNTED TOTAL (2021-2022)	6,086,604	10,511,468	0	16,598,073
DISCOUNTED TOTAL (2023-2042)	0	0	9,109,480	9,109,480



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B. Financing Sources: IFI Loans and Internally-generated Own Funds (EUR)

YEARS	IFI Loans	Internally-generated (Own) Funds	Total Investment Financing
2021	197,139	0	997,920
2022	4,214,576	0	21,334,239
2023	0	0	0
2024	0	0	0
2025	114,974	0	582,001
2026	0	0	0
2027	56,325	0	285,120
2028	411,797	0	2,084,524
2029	298,759	0	1,512,324
2030	0	0	0
2031	0	28,163	142,560
2032	1,408,135	0	7,128,000
2033	482,773	0	2,443,802
2034	0	0	0
2035	0	56,325	285,120
2036	0	0	0
2037	305,096	0	1,544,400
2038	72,281	0	365,887
2039	0	0	0
2040	0	0	0
2041	0	56,325	285,120
2042	0	375,503	1,900,800
TOTAL (2021-2042)	7,561,857	516,316	40,891,818
TOTAL (2021-2022)	4,411,715	0	22,332,159
TOTAL (2023-2042)	3,150,142	516,316	18,559,658
DISCOUNTED TOTAL	6,096,039	232,732	32,036,324
DISCOUNTED TOTAL (2021-2022)	4,086,169	0	20,684,242
DISCOUNTED TOTAL (2023-2042)	2,009,870	232,732	11,352,082

6.1.13 Financing Costs of IFI Loans

Following terms and conditions are assumed for the IFI loans:

- Grace Period: 2 years
- Repayment Period (shorter repayment period is assumed for IFI loans to be used after 2031 to be able to ensure full repayment of all loans within the project planning period):
 - 13 years for two project loans to be utilized between 2021-2029



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- (9 years for IFI project loan to be used in 2032-2033; 4 years for the IFI loan to be used in 2037-2038)
- Number of Instalments: 26 semi-annual equal payments (Total Loan Amount / 26)
- Interest Rate: 6-month EURIBOR + 1% p.a.
- Fixed Interest Rate Used: 1.5% p.a. (since 6-month EURIBOR is negative currently (-0.338%), it is assumed that this situation will not prevail in the future and, as a conservative approach, fixed interest rate of 1.5% p.a. is used in the loan cost calculations)
- Commitment Fee: 0.5% (over undisbursed portion of the loan)
- Management Fee: 1.0% (one-time lump-sum payment, payable in advance at the time of signing of the loan agreement)

Based on assumed terms and conditions, all-in cost of the IFI loans is 1.74% p.a.

Tentative loan repayment schedules and financing costs for each of the five IFI loans assumed to be used for the financing of initial investment costs are presented in detail in Annex 3 – F-5 and summarized in Table 97 below.

Total amount of financing costs to be incurred between 2021 and 2042 is estimated to be EUR 935,114 of which 87.15% is the interest costs (EUR 814,968), 4.76% is the commitment fees (EUR 44,528) and 8.09% is the management fees (EUR 75,619).

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Table 97 Financing Costs and Repayment Schedules of the IFI Loans (Sum of 5 separate loans in the total amount of EUR 7,561,857)

YEARS	Beg.-of-Year Loan Amount	Loan Utilizations	Loan Repaym.	End-of-Year Loan Amount	Interest Costs	Comm. Fees	Man. Fees	Total Financing Costs	Debt Service
2021	0	197,139	0	197,139	1,479	21,566	0	23,044	23,044
2022	197,139	4,214,576	0	4,411,715	34,566	10,536	44,117	89,220	89,220
2023	4,411,715	0	0	4,411,715	66,176	0	0	66,176	66,176
2024	4,411,715	0	339,363	4,072,353	63,631	0	0	63,631	402,993
2025	4,072,353	114,974	339,363	3,847,964	59,402	569	1,713	61,684	401,047
2026	3,847,964	0	339,363	3,508,601	55,174	0	0	55,174	394,537
2027	3,508,601	56,325	339,363	3,225,564	50,506	141	0	50,647	390,010
2028	3,225,564	411,797	353,638	3,283,724	48,820	2,523	7,106	58,449	412,086
2029	3,283,724	298,759	353,638	3,228,846	48,844	747	0	49,591	403,229
2030	3,228,846	0	408,296	2,820,550	45,370	0	0	45,370	453,666
2031	2,820,550	0	408,296	2,412,254	39,246	0	0	39,246	447,542
2032	2,412,254	1,408,135	408,296	3,412,093	43,683	5,934	18,909	68,526	476,822
2033	3,412,093	482,773	408,296	3,486,570	51,740	1,207	0	52,947	461,243
2034	3,486,570	0	618,397	2,868,173	47,661	0	0	47,661	666,057
2035	2,868,173	0	618,397	2,249,777	38,385	0	0	38,385	656,781
2036	2,249,777	0	618,397	1,631,380	29,109	0	0	29,109	647,505
2037	1,631,380	305,096	279,034	1,657,442	24,666	1,124	3,774	29,564	308,598
2038	1,657,442	72,281	279,034	1,450,689	23,311	181	0	23,492	302,526
2039	1,450,689	0	373,378	1,077,310	18,960	0	0	18,960	392,338
2040	1,077,310	0	359,103	718,207	13,466	0	0	13,466	372,570
2041	718,207	0	359,103	359,103	8,080	0	0	8,080	367,183
2042	359,103	0	359,103	0	2,693	0	0	2,693	361,797
TOTAL		7,561,857	7,561,857		814,968	44,528	75,619	935,114	8,496,971

6.1.14 Impact of Grant Financing on Total Costs (NPV) and Unit Costs (DPC)

As a result of grant financing (based on Grant Rate of 80.25% to be applied on initial investment costs), total cost (NPV) and unit cost (DPC - EUR/Ton) shall be reduced considerably which implies that the SWM tariff to be charged to waste generators shall decrease.

NPV of grants to be used between 2021 and 2042 is calculated to be EUR 25,707,553 at financial discount rate of 4% p.a., which corresponds to 15.24 EUR/Ton as shown in Table 98 below. Due to investment grants, net unit investment cost of the Project will decrease from 23.27 EUR/Ton to 8.03 EUR/Ton.

As a result of grant financing, total DPC including net investment and O & M costs will decrease by 24.32% from 62.67 EUR/Ton to 47.43 EUR/Ton.



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Thus, to be able to ensure full cost recovery, average unit tariff that must be reflected to the waste generators shall be 47.43 EUR/Ton after grant financing of initial investment costs.

Table 98 Net Present Value (NPV in EURO) Dynamic Prime Cost (DPC in EURO/Ton) of the Project after Grant Financing (Financial Discount Rate = 4% p.a.) (Grant Rate: 80.25%) (Total Waste Quantity Collected: 1,686,767 Tons to be billed between 2023 and 2042)

PROJECT COMPONENTS	DISC. COST (EUR)	DPC (EUR/TON)	% of Total
O & M COSTS			
Collection	33,696,368	19.98	42.12
Recycling	14,416,565	8.55	18.02
Composting	1,336,818	0.79	1.67
Transport	5,890,247	3.49	7.36
Disposal	9,569,600	5.67	11.96
TOTAL OPERATING SERVICE COSTS	64,909,597	38.48	81.13
Aftercare Costs	496,789	0.29	0.62
Administrative Costs	1,049,243	0.62	1.31
Total After Care and Administrative Costs	1,546,033	0.92	1.93
Total O & M After Care & Administrative Costs	66,455,630	39.40	83.06
INVESTMENT COSTS			
Collection	14,452,347	8.57	18.06
Recycling	6,694,489	3.97	8.37
Composting	1,468,166	0.87	1.84
Transport	1,823,010	1.08	2.28
Disposal	15,866,487	9.41	19.83
Technical Assistance	1,354,953	0.80	1.69
TOTAL INVESTMENT COSTS INCL. TA	41,659,452	24.70	52.07
Residual Value (-)	-2,402,654	-1.42	-3.00
TOTAL NET INVESTMENT COSTS	39,256,798	23.27	49.07
TOTAL NET INVESTMENT + O&M COSTS BEFORE GRANTS	105,712,428	62.67	132.13
GRANT FINANCING OF INVESTMENT COSTS	-25,707,553	-15.24	-32.13
TOTAL NET INVESTMENT COSTS AFTER GRANT FINANCE	13,549,245	8.03	16.94
TOTAL NET INVESTMENT + O&M COSTS AFTER GRANTS	80,004,875	47.43	100.00

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6.1.15 Financial Profitability Analysis (FNPV/C and FRR/C)

Project Financial Profitability Analysis (Financial Rate of Return of the Investment) is conducted with the objective of calculating Project's Financial IRR (FRR/C) and Financial NPV (FNPV/C) by taking all Project-related incremental investment and O & M costs and incremental revenues into account.

If FNPV/C is positive and FRR/C is above the financial discount rate of 4% then this means that the Project is commercially viable and can be implemented without grant financing.

To be able to assess whether Project-related revenues are sufficient to cover the Project-related revenues (to verify the commercial viability of the Project), no grant and loan financing is assumed for the funding of investment costs. Thus, all initial and replacement / renewal investment costs are assumed to be financed by internally-generated (own) funds of the Project. Residual value of investments as of 2042 are assumed to be cashed out at the end of the Project period 2042 (assets are assumed to be sold and proceeds are taken into account as cash inflows).

Cash flows for the financial profitability analysis (FNPV/C and FRR/C) are presented in detail in Annex 3 – F-6 and summarized in Table 99 below.

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Table 99 Cash Flows for the Financial Profitability Analysis (FNPV/C, FRR/C) of the Project Before Grant and Loan Financing of Investment Costs (Financial Discount Rate = 4% p.a.) (EURO/Year)

Year	Total Revenues Collected	Total Operating Costs	Total Inv. Incl. Impl. Consultant & TA and Residual Value	Net Cash Flow Before Finance	Cumulative Net Cash Flow Before Finance
2021	0	-26,400	-907,200	-933,600	-933,600
2022	0	-75,900	-19,394,763	-19,470,663	-20,404,263
2023	3,213,455	-4,334,584	0	-1,121,129	-21,525,392
2024	3,593,348	-4,496,212	0	-902,864	-22,428,256
2025	3,913,473	-4,644,838	-529,092	-1,260,457	-23,688,713
2026	4,182,342	-4,726,458	0	-544,116	-24,232,829
2027	4,454,008	-4,901,942	-259,200	-707,134	-24,939,964
2028	5,189,974	-5,042,835	-3,962,036	-3,814,896	-28,754,860
2029	5,463,059	-5,177,349	-1,374,840	-1,089,130	-29,843,990
2030	5,750,449	-5,256,859	-232,325	261,266	-29,582,724
2031	5,964,773	-5,330,190	-129,600	504,983	-29,077,741
2032	6,186,535	-5,374,843	-7,507,500	-6,695,808	-35,773,549
2033	6,415,953	-5,513,199	-11,135,527	-10,232,772	-46,006,321
2034	6,728,684	-5,583,837	0	1,144,847	-44,861,474
2035	7,054,010	-5,632,072	-499,200	922,738	-43,938,735
2036	7,392,094	-5,716,342	0	1,675,751	-42,262,984
2037	7,743,336	-5,736,070	-1,644,000	363,266	-41,899,718
2038	7,763,956	-5,784,417	-1,905,961	73,579	-41,826,139
2039	8,143,531	-5,850,338	0	2,293,193	-39,532,946
2040	8,538,248	-5,888,890	0	2,649,359	-36,883,587
2041	8,948,739	-6,029,871	-379,200	2,539,668	-34,343,920
2042	10,281,939	-7,267,141	3,448,449	6,463,246	-27,880,673
Undiscounted Total (2021-2042)	126,921,907	-108,390,586	-46,411,995	-27,880,673	
Discounted Total (2021-2042)	74,526,731	-66,455,630	-35,687,998	-27,616,897	

FNPV/C is EUR -27,616,897 at financial discount rate of 4% p.a. and FRR/C is - 7.28%.

Both FNPV/C and FRR/C is negative due to the negative net cash flows especially in the beginning of the planning period and in years when considerable amount of investments / reinvestments are required. This implies that the Project is not commercially viable (FNPV/C is negative and FRR/C is lower than the financial discount rate of 4.0%) since incremental Project revenues cannot cover incremental Project costs (investment + O & M). Thus, the Project should not be implemented if grant financing cannot be secured and

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if the Economic Analysis proves that the Project cannot generate sufficient economic benefits in the region and the country which exceed the economic costs of the Project.

Thus, if the Project is viable from an economical point of view to be assessed as a result of Economic Analysis, then it must be implemented and the investment costs need to be financed by grants.

6.1.16 Return on Local Capital (FNPV/K and FRR/K)

Financial Internal Rate of Return on Local Capital (FRR/K) and Financial Net Present Value on Local Capital (FNPV/K) are also calculated with the inclusion of loan financing and local grant financing of initial investment costs and debt services of assumed IFI loans taken into account but without considering the assumed SECO and other Donor Grant.

Cash flows for the Return on Local Capital analysis (FNPV/K and FRR/K) are presented in detail in Annex 3 – F-7 and summarized in Table 100 below.



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Table 100 Cash Flows for the Return on Local Capital Analysis (FNPV/C, FRR/C) of the Project After Local Grant and Loan Financing of Investment Costs (Financial Discount Rate = 4% p.a.) (EURO/Year)

A. Cash Inflows (EUR/Year)

Year	Total Tariff, Recyclable Material & Electricity Sales Rev.	Loan Utilizations	Local Grants	TOTAL CASH INFLOWS
2021	0	197,139	0	197,139
2022	0	4,214,576	0	4,214,576
2023	3,213,455	0	0	3,213,455
2024	3,593,348	0	0	3,593,348
2025	3,913,473	114,974	467,027	4,495,474
2026	4,182,342	0	0	4,182,342
2027	4,454,008	56,325	228,795	4,739,128
2028	5,189,974	411,797	1,672,727	7,274,499
2029	5,463,059	298,759	1,213,565	6,975,383
2030	5,750,449	0	0	5,750,449
2031	5,964,773	0	114,397	6,079,170
2032	6,186,535	1,408,135	5,719,865	13,314,535
2033	6,415,953	482,773	1,961,029	8,859,755
2034	6,728,684	0	0	6,728,684
2035	7,054,010	0	228,795	7,282,805
2036	7,392,094	0	0	7,392,094
2037	7,743,336	305,096	1,239,304	9,287,736
2038	7,763,956	72,281	293,606	8,129,844
2039	8,143,531	0	0	8,143,531
2040	8,538,248	0	0	8,538,248
2041	8,948,739	0	228,795	9,177,534
2042	10,281,939	0	1,525,297	11,807,236
Undiscounted Total (2021-2042)	126,921,907	7,561,857	14,893,200	149,376,965
Discounted Total (2021-2042)	74,526,731	6,096,039	9,109,480	89,732,251

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B. Cash Outflows (EUR/Year)

Year	Total Operating Costs	Total Net Inv. Incl. Impl. Cons. & TA and Res. Value	Total Debt Service	TOTAL CASH OUTFLOWS	Net Cash Flow After IFI & Local Grant Finance	Cumulative Net Cash Flow After IFI & Local Grant Finance
2021	-26,400	-907,200	-23,044	-956,644	-759,505	-759,505
2022	-75,900	-19,394,763	-89,220	-19,559,883	15,345,307	-16,104,812
2023	-4,334,584	0	-66,176	-4,400,760	-1,187,305	-17,292,117
2024	-4,496,212	0	-402,993	-4,899,205	-1,305,857	-18,597,974
2025	-4,644,838	-529,092	-401,047	-5,574,977	-1,079,503	-19,677,477
2026	-4,726,458	0	-394,537	-5,120,995	-938,653	-20,616,130
2027	-4,901,942	-259,200	-390,010	-5,551,152	-812,024	-21,428,154
2028	-5,042,835	-3,962,036	-412,086	-9,416,957	-2,142,458	-23,570,613
2029	-5,177,349	-1,374,840	-403,229	-6,955,417	19,966	-23,550,647
2030	-5,256,859	-232,325	-453,666	-5,942,850	-192,401	-23,743,048
2031	-5,330,190	-129,600	-447,542	-5,907,332	171,838	-23,571,210
2032	-5,374,843	-7,507,500	-476,822	-13,359,165	-44,630	-23,615,839
2033	-5,513,199	-11,135,527	-461,243	-17,109,968	-8,250,213	-31,866,052
2034	-5,583,837	0	-666,057	-6,249,894	478,790	-31,387,263
2035	-5,632,072	-499,200	-656,781	-6,788,054	494,751	-30,892,511
2036	-5,716,342	0	-647,505	-6,363,848	1,028,246	-29,864,265
2037	-5,736,070	-1,644,000	-308,598	-7,688,668	1,599,068	-28,265,198
2038	-5,784,417	-1,905,961	-302,526	-7,992,903	136,941	-28,128,257
2039	-5,850,338	0	-392,338	-6,242,676	1,900,855	-26,227,402
2040	-5,888,890	0	-372,570	-6,261,460	2,276,789	-23,950,613
2041	-6,029,871	-379,200	-367,183	-6,776,255	2,401,279	-21,549,334
2042	-7,267,141	3,448,449	-361,797	-4,180,489	7,626,747	-13,922,587
Undiscounted Total (2021-2042)	-108,390,586	-46,411,995	-8,496,971	163,299,552	13,922,587	
Discounted Total (2021-2042)	-66,455,630	-35,687,998	-5,275,050	107,418,678	17,686,427	

FNPV/K is EUR -17,686,427 at financial discount rate of 4% p.a. and FRR/K is -4.02%.

Since FNPV/K is negative and FRR/K is below financial discount rate of 4% SECO and other Donor grant financing is necessary for the implementation of the Project.

Thus, the Project should be implemented if SECO and other Donor grant financing can be secured and if Economic Analysis demonstrates that Project can generate sufficient economic benefits in the region and the country which exceed economic costs of the Project.



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6.1.17 Projected Profit (-Loss) Statements

Projected Profit (-Loss) Statements of JPE “Rusino” are developed by using the following methodology:

- Collected SWM tariff revenues and recyclable and electricity sales revenues are considered as operating revenues.
- Investment grants are reflected to the Profit (-Loss) Statement (not deducted directly from Investment Costs which will hide the actual costs by reducing the depreciation costs) and considered as non-operating revenues. Annual investment grants are calculated by assuming 20 years of amortization period (i.e. Annual Investment Grant = Total Amount of Grants / 20).
- Depreciation costs are added to the operating costs as a non-cash cost item (while depreciation costs are excluded in cash flow projections).
- Total financing costs include interest costs, commitment and management fees. Principle repayments are not included in the Profit (-Loss) Statements since they are cash outflow items not profit (-loss) items.

Projected Profit (-Loss) Statements are presented in detail in Annex 3 – F-8 and summarized in Table 101 below.

Decreasing amount of losses is expected to be generated between 2023 and 2035 mainly due to high depreciation costs. Profits are expected to be generated starting from 2036. Discounted total of losses between 2021 and 2042 is estimated to be EUR 8,621,610 (on the average 391,891 EUR/Year) which corresponds to 11.57% of the discounted total of operating revenues.

However, if non-cash cost item of depreciation costs are excluded discounted total surplus of EUR 22,646,697 (on the average 1,029,395 EUR/year), which corresponds to 30.39% of the discounted total of operating revenues, is expected to be generated

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**Table 101 Projected Profit (-Loss) Statements (Financial Discount Rate = 4% p.a.)
(EURO/Year)**

A. Revenues and Operating Costs (EUR/Year)

Year	TOTAL REVENUES	Total Operating Service Costs	Depr. Costs	Aftercare Costs	Admin. Costs	TOTAL NET OPERATING COSTS	Total Operating Revenues- Total O & M Costs
2021	0	0	0	0	-26,400	-26,400	-26,400
2022	0	0	0	0	-75,900	-75,900	-75,900
2023	3,213,455	-4,258,684	-2,034,565	0	-75,900	-6,369,149	-3,155,695
2024	3,593,348	-4,420,312	-2,034,565	0	-75,900	-6,530,778	-2,937,429
2025	3,913,473	-4,568,938	-2,034,565	0	-75,900	-6,679,403	-2,765,930
2026	4,182,342	-4,650,558	-2,089,643	0	-75,900	-6,816,101	-2,633,760
2027	4,454,008	-4,826,042	-2,089,643	0	-75,900	-6,991,585	-2,537,578
2028	5,189,974	-4,966,935	-2,259,977	0	-75,900	-7,302,812	-2,112,838
2029	5,463,059	-5,101,449	-2,503,686	0	-75,900	-7,681,034	-2,217,975
2030	5,750,449	-5,180,959	-2,660,537	0	-75,900	-7,917,396	-2,166,946
2031	5,964,773	-5,254,290	-2,686,093	0	-75,900	-8,016,283	-2,051,510
2032	6,186,535	-5,298,943	-2,699,821	0	-75,900	-8,074,663	-1,888,128
2033	6,415,953	-5,437,299	-2,513,316	0	-75,900	-8,026,515	-1,610,561
2034	6,728,684	-5,507,937	-2,879,402	0	-75,900	-8,463,239	-1,734,555
2035	7,054,010	-5,556,172	-2,879,402	0	-75,900	-8,511,474	-1,457,464
2036	7,392,094	-5,640,442	-2,881,303	0	-75,900	-8,597,645	-1,205,551
2037	7,743,336	-5,660,170	-2,881,303	0	-75,900	-8,617,372	-874,037
2038	7,763,956	-5,708,517	-3,045,564	0	-75,900	-8,829,980	-1,066,024
2039	8,143,531	-5,774,438	-2,839,304	0	-75,900	-8,689,642	-546,110
2040	8,538,248	-5,812,990	-2,688,054	0	-75,900	-8,576,943	-38,695
2041	8,948,739	-5,953,971	-2,662,498	0	-75,900	-8,692,369	256,370
2042	10,281,939	-6,013,891	-2,689,954	1,177,350	-75,900	-9,957,095	324,844
Undiscounted Total (2021-2042)	126,921,907	105,592,936	51,053,194	1,177,350	1,620,300	159,443,780	32,521,873
Discounted Total (2021-2042)	74,526,731	-64,909,597	31,268,307	-496,789	1,049,243	-97,723,937	23,197,206
Undiscounted Yearly Average	6,346,095	-5,557,523	-2,687,010	-61,966	-85,279	-8,391,778	-1,711,678
Discounted Yearly Average	3,726,337	-3,416,295	-1,645,700	-26,147	-55,223	-5,143,365	-1,220,906



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B. Financing Costs, Investment Grants and Profit (-Loss) For Period (EUR/Year)

Year	Interest Costs	Comm. Fees	Man. Fees	Total Financing Costs	Investment Grants	PROFIT (-LOSS)	PROFIT (-LOSS) + DEPRECIATION COSTS
2021	-1,479	21,566	0	-23,044	0	-49,444	-49,444
2022	-34,566	10,536	44,117	-89,220	0	-165,120	-165,120
2023	-66,176	0	0	-66,176	896,022	2,325,848	-291,283
2024	-63,631	0	0	-63,631	896,022	2,105,038	-70,472
2025	-59,402	-569	-1,713	-61,684	919,374	1,908,241	126,324
2026	-55,174	0	0	-55,174	919,374	1,769,560	320,083
2027	-50,506	-141	0	-50,647	930,813	1,657,411	432,232
2028	-48,820	-2,523	-7,106	-58,449	1,014,450	1,156,836	1,103,141
2029	-48,844	-747	0	-49,591	1,075,128	1,192,439	1,311,247
2030	-45,370	0	0	-45,370	1,075,128	1,137,189	1,523,348
2031	-39,246	0	0	-39,246	1,080,848	1,009,908	1,676,185
2032	-43,683	-5,934	18,909	-68,526	1,366,841	-589,813	2,110,007
2033	-51,740	-1,207	0	-52,947	1,464,892	-198,616	2,314,700
2034	-47,661	0	0	-47,661	1,464,892	-317,323	2,562,079
2035	-38,385	0	0	-38,385	1,476,332	-19,517	2,859,886
2036	-29,109	0	0	-29,109	1,476,332	241,672	3,122,975
2037	-24,666	-1,124	-3,774	-29,564	1,538,297	634,697	3,515,999
2038	-23,311	-181	0	-23,492	1,552,978	463,462	3,509,026
2039	-18,960	0	0	-18,960	1,552,978	987,908	3,827,211
2040	-13,466	0	0	-13,466	1,552,978	1,500,816	4,188,870
2041	-8,080	0	0	-8,080	1,564,417	1,812,707	4,475,205
2042	-2,693	0	0	-2,693	1,640,682	1,962,833	4,652,786
Undiscounted Total (2021-2042)	814,968	44,528	75,619	-935,114	25,458,778	7,998,210	43,054,985
Discounted Total (2021-2042)	570,278	38,519	61,137	-669,933	15,245,529	8,621,610	22,646,697
Undiscounted Yearly Average	-42,893	-2,344	-3,980	-49,217	1,272,939	-363,555	1,957,045
Discounted Yearly Average	-30,015	-2,027	-3,218	-35,260	762,276	-391,891	1,029,395



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6.1.18 Projected Cash Flow Statements

To be able to assess financial sustainability cash flows statements of the JPE “Rusino” are projected for the whole planning period of 2021 - 2042.

Projected Cash Flow Statements are developed by using the following methodology:

- Collected SWM tariff revenues and recyclable and electricity sales revenues are considered as cash inflows.
- SECO, other Donor and local grants as well as IFI loans used for the financing of the initial investment costs are considered as cash flows.
- Operating service costs, aftercare and administration costs are regarded as cash outflow. Depreciation costs are excluded in cash flow projections since they are non-cash items.
- Investment costs including contingencies and TA are taken into account as cash outflows. Residual value of assets as of 2042 is considered as a cash inflow item.
- Debt service obligations (total financing costs including interest costs, commitment and management fees and principle repayments) are taken into account as cash outflows.
- Annual cash surplus (-deficit) is calculated by deduction total cash outflows from cash inflows. Cumulative cash surplus (-deficit) is the sum of all annual cash surpluses (-deficits) up to the current years.
- Cumulative cash deficit in any year of the planning period (2021-2042) shows the amount of financing needed temporarily from the JPE member municipalities.

Projected Cash Flow Statements are presented in detail in Annex 3 – F-9 and summarized in Table 102 below.

Annual cash deficits are expected to be generated in 2033 resulting in total cash deficit of EUR 18,274,252 which needs to be financed temporarily by the JPE member municipalities. Starting from 2034 onwards after the accomplishment of major replacements annual surpluses are estimated to be generated continuously.

Between 2034 and 2042 cash surpluses are expected to add up to EUR 17,845,474 (on the average 1,982,830 EUR/Year) which shall be used to pay back their prior financing contributions to member municipalities. Consequently, total amount of deficit as of year-end 2042 is estimated to be EUR 428,778.

Thus, to ensure financial sustainability of the Project without cancelling or delaying any investment / replacement requirements, JPE member municipalities should provide



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financing of around EUR 18 million on temporary basis until 2034 which shall be paid back afterwards.

**Table 102 Projected Cash Flow Statements (Financial Discount Rate = 4% p.a.)
(EURO/Year)**

A. Revenues Collected and Investment Financing (EUR/Year)

Year	Total SWM Tariff and Sales Rev. Collected	SECO Grant	EU Grant	IFI Loans	Local Grants	Total Investment Financing
2021	0	800,781	0	197,139	0	997,920
2022	0	5,750,459	11,369,204	4,214,576	0	21,334,239
2023	3,213,455	0	0	0	0	0
2024	3,593,348	0	0	0	0	0
2025	3,913,473	0	0	114,974	467,027	582,001
2026	4,182,342	0	0	0	0	0
2027	4,454,008	0	0	56,325	228,795	285,120
2028	5,189,974	0	0	411,797	1,672,727	2,084,524
2029	5,463,059	0	0	298,759	1,213,565	1,512,324
2030	5,750,449	0	0	0	0	0
2031	5,964,773	0	0	0	114,397	114,397
2032	6,186,535	0	0	1,408,135	5,719,865	7,128,000
2033	6,415,953	0	0	482,773	1,961,029	2,443,802
2034	6,728,684	0	0	0	0	0
2035	7,054,010	0	0	0	228,795	228,795
2036	7,392,094	0	0	0	0	0
2037	7,743,336	0	0	305,096	1,239,304	1,544,400
2038	7,763,956	0	0	72,281	293,606	365,887
2039	8,143,531	0	0	0	0	0
2040	8,538,248	0	0	0	0	0
2041	8,948,739	0	0	0	228,795	228,795
2042	10,281,939	0	0	0	1,525,297	1,525,297
Discounted Total (2021-2042)	126,921,907	6,551,240	11,369,204	7,561,857	14,893,200	40,375,501
Discounted Total (2021-2042)	74,526,731	6,086,604	10,511,468	6,096,039	9,109,480	31,803,592
Undiscounted Yearly Average (2021-2042)	6,346,095	327,562	568,460	378,093	744,660	2,018,775
Discounted Yearly Average (2021-2042)	3,726,337	304,330	525,573	304,802	455,474	1,590,180



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B. Financing Provided by JPE “Rusino” Member Municipalities to Finance Interest Costs during Construction and Administrative Costs in 2021-2022 (EUR/Year)

Year	IDC Financing By Municipalities	Administrative Cost Financing By Municipalities	TOTAL CASH INFLOWS
2021	23,044	26,400	1,047,364
2022	89,220	75,900	21,499,359
2023	0	0	3,213,455
2024	0	0	3,593,348
2025	0	0	4,495,474
2026	0	0	4,182,342
2027	0	0	4,739,128
2028	0	0	7,274,499
2029	0	0	6,975,383
2030	0	0	5,750,449
2031	0	0	6,079,170
2032	0	0	13,314,535
2033	0	0	8,859,755
2034	0	0	6,728,684
2035	0	0	7,282,805
2036	0	0	7,392,094
2037	0	0	9,287,736
2038	0	0	8,129,844
2039	0	0	8,143,531
2040	0	0	8,538,248
2041	0	0	9,177,534
2042	0	0	11,807,236
Discounted Total (2021-2042)	112,264	102,300	167,511,973
Discounted Total (2021-2042)	104,647	95,558	106,530,529
Undiscounted Yearly Average (2021-2042)	5,613	5,115	8,375,599
Discounted Yearly Average (2021-2042)	5,232	4,778	5,326,526



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C. Operating Costs, Net Investment Costs and Debt Service (EUR/Year)

Year	Total Operating Costs	Total Inv. Incl. Impl. Consultant, TA & Res. Value	Loan Repaym.	Total Financing Costs	Debt Service
2021	-26,400	-997,920	0	-23,044	-23,044
2022	-75,900	-21,334,239	0	-89,220	-89,220
2023	-4,334,584	0	0	-66,176	-66,176
2024	-4,496,212	0	-339,363	-63,631	-402,993
2025	-4,644,838	-582,001	-339,363	-61,684	-401,047
2026	-4,726,458	0	-339,363	-55,174	-394,537
2027	-4,901,942	-285,120	-339,363	-50,647	-390,010
2028	-5,042,835	-4,358,240	-353,638	-58,449	-412,086
2029	-5,177,349	-1,512,324	-353,638	-49,591	-403,229
2030	-5,256,859	-255,558	-408,296	-45,370	-453,666
2031	-5,330,190	-142,560	-408,296	-39,246	-447,542
2032	-5,374,843	-8,258,250	-408,296	-68,526	-476,822
2033	-5,513,199	-12,249,079	-408,296	-52,947	-461,243
2034	-5,583,837	0	-618,397	-47,661	-666,057
2035	-5,632,072	-549,120	-618,397	-38,385	-656,781
2036	-5,716,342	0	-618,397	-29,109	-647,505
2037	-5,736,070	-1,808,400	-279,034	-29,564	-308,598
2038	-5,784,417	-2,096,557	-279,034	-23,492	-302,526
2039	-5,850,338	0	-373,378	-18,960	-392,338
2040	-5,888,890	0	-359,103	-13,466	-372,570
2041	-6,029,871	-417,120	-359,103	-8,080	-367,183
2042	-7,267,141	3,793,294	-359,103	-2,693	-361,797
Discounted Total (2021-2042)	-108,390,586	-51,053,194	-7,561,857	-935,114	-8,496,971
Discounted Total (2021-2042)	-66,455,630	-39,256,798	-4,605,116	-669,933	-5,275,050
Undiscounted Yearly Average (2021-2042)	-4,926,845	-2,320,600	-343,721	-42,505	-386,226
Discounted Yearly Average (2021-2042)	-3,020,710	-1,784,400	-209,323	-30,452	-239,775



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D. Net Annual and Cumulative Project Cash Flows (EUR/Year)

Year	TOTAL CASH OUTFLOWS	Net Project Cash Flows (Inflows - Outflows)	Cumulative Net Project Cash Flows (Inflows - Outflows)
2021	-1,047,364	0	0
2022	-21,499,359	0	0
2023	-4,400,760	-1,187,305	-1,187,305
2024	-4,899,205	-1,305,857	-2,493,162
2025	-5,627,886	-1,132,412	-3,625,574
2026	-5,120,995	-938,653	-4,564,227
2027	-5,577,072	-837,944	-5,402,171
2028	-9,813,161	-2,538,662	-7,940,833
2029	-7,092,901	-117,518	-8,058,352
2030	-5,966,083	-215,633	-8,273,985
2031	-5,920,292	158,878	-8,115,107
2032	-14,109,915	-795,380	-8,910,486
2033	-18,223,521	-9,363,766	-18,274,252
2034	-6,249,894	478,790	-17,795,462
2035	-6,837,974	444,831	-17,350,631
2036	-6,363,848	1,028,246	-16,322,385
2037	-7,853,068	1,434,668	-14,887,717
2038	-8,183,499	-53,656	-14,941,373
2039	-6,242,676	1,900,855	-13,040,518
2040	-6,261,460	2,276,789	-10,763,729
2041	-6,814,175	2,363,359	-8,400,370
2042	-3,835,644	7,971,592	-428,778
Undiscounted Total (2021-2042)	-167,940,752	-428,778	
Discounted Total (2021-2042)	-110,987,478	-4,456,949	
Undiscounted Yearly Average (2021-2042)	-7,633,671	-19,490	
Discounted Yearly Average (2021-2042)	-5,044,885	-202,589	



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As described in section 5.1.4 and the textbox in section 6.1.11 (Figure 44), the role of the collective handlers could be more important in future. In case they will finance investments and operating costs for managing recyclable waste, the financial performance of the waste management system in Polog Region would improve. However, also in this case the cumulative cash flow would be negative over most of the planning period with a minimum negative cumulative cash flow of 13.8 million EUR in 2033.

Figure 45 Textbox: Statement to project cash flow assuming that collective handlers would manage the recyclable fractions

6.1.19 Projected Balance Sheets

To be able to assess the development of the asset / liability structure of the JPE, Balance Sheets are projected for the whole planning period of 2021 - 2042.

Projected Balance Sheets are developed by using the following methodology:

- Cumulative outstanding amount of cash as of year-ends received from the Cash Flow projections are regarded as "cash and cash equivalents" under current assets.
- Investment / reinvestment costs are accumulated under gross fixed assets. Accumulated depreciation costs are the sum of annual depreciation cost allowances.
- Net Fixed Assets is the difference between gross fixed assets and accumulated depreciation.
- Total assets are the sum of "cash and cash equivalents" as being the only current asset item and net fixed assets.
- Current maturity of long-term loans (principle instalment repayment within one year) is assumed to be the only current liability item.
- Outstanding amount of long-term bank loans payable after one year are accounted for under long-term liabilities.
- Outstanding amount of Investment grants, which are reflected to the profit (-loss) statements as non-operating revenues for an amortization period of 20 years (5% per annum), are considered as long-term liabilities.
- Equities are comprised of annual profit (-loss) amounts and contribution of Polog SWM Public Enterprise member municipalities for the financing of interest costs during construction and administrative costs in 2021 and 2022.
- Total liabilities and equities is the sum of current liabilities (comprised of current maturity of long-term loans only), long-term liabilities (comprised of outstanding investment grants and long-term loans payable after one year) and equities (comprised of annual profits (-losses) and contribution of member municipalities for

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the financing of interest costs during construction and administrative costs in 2021 and 2022).

Projected Balance Sheets are presented in detail in Annex 3 – F-10 and summarized in Table 103 below.

Outstanding amount of cash and cash equivalents is expected to be negative throughout the whole planning period as a result of cash deficits accumulated until 2033 which shows the amount of working capital requirements that have to be provided by member municipalities of JPE to ensure financial sustainability of the Project. Fixed assets grow as results of investments materialized. Value of net fixed assets become nil as of year-end 2042 due to the assumption that all outstanding assets shall be sold at residual value at the end of the planning period.

Long-term bank loans shall be fully repaid as of 2042. Losses expected to be generated between 2021 and 2035 shall turn into profits starting from 2036 onwards. Accumulated deficits as of 2042 are estimated to be EUR 9,961,042.



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Table 103 Projected Balance Sheets (EURO)

A. Assets (EURO)

Year	Cash and Cash Equivalents	Gross Fixed Assets	Accumulated Depreciation (-)	Net Fixed Assets	Total Assets
2021	0	997,920	0	997,920	997,920
2022	0	22,332,159	0	22,332,159	22,332,159
2023	-1,187,305	22,332,159	-2,034,565	20,297,594	19,110,289
2024	-2,493,162	22,332,159	-4,069,131	18,263,029	15,769,866
2025	-3,625,574	22,914,161	-6,103,696	16,810,464	13,184,890
2026	-4,564,227	22,914,161	-8,193,340	14,720,821	10,156,594
2027	-5,402,171	23,199,281	-10,282,983	12,916,298	7,514,127
2028	-7,940,833	27,557,520	-12,542,960	15,014,560	7,073,727
2029	-8,058,352	29,069,844	-15,046,646	14,023,199	5,964,847
2030	-8,273,985	29,325,402	-17,707,183	11,618,219	3,344,234
2031	-8,115,107	29,467,962	-20,393,275	9,074,686	959,580
2032	-8,910,486	37,726,212	-23,093,096	14,633,116	5,722,629
2033	-18,274,252	49,975,291	-25,606,412	24,368,879	6,094,627
2034	-17,795,462	49,975,291	-28,485,814	21,489,477	3,694,014
2035	-17,350,631	50,524,411	-31,365,217	19,159,194	1,808,563
2036	-16,322,385	50,524,411	-34,246,519	16,277,892	-44,493
2037	-14,887,717	52,332,811	-37,127,822	15,204,989	317,272
2038	-14,941,373	54,429,368	-40,173,386	14,255,982	-685,391
2039	-13,040,518	54,429,368	-43,012,689	11,416,679	-1,623,839
2040	-10,763,729	54,429,368	-45,700,743	8,728,625	-2,035,104
2041	-8,400,370	54,846,488	-48,363,240	6,483,248	-1,917,123
2042	-428,778	51,053,194	-51,053,194	0	-428,778

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B. Liabilities and Equities (EURO)

Year	Current Maturity of Long-term Loans	Inv. Grants	Long-term Bank Loans	Profits (- Loss) For Period	Accum. Profits (- Losses)	IDC Financing By Mun.	Adm. Cost Financing By Mun.	Total Equities	Total Short/Long-term Liab.+ Equities
2021	0	800,781	197,139	-49,444	0	23,044	26,400	0	997,920
2022	0	17,920,444	4,411,715	-165,120	-49,444	112,264	102,300	0	22,332,159
2023	339,363	17,024,422	4,072,353	-2,325,848	-214,564	112,264	102,300	-2,325,848	19,110,289
2024	339,363	16,128,400	3,732,990	-2,105,038	-2,540,412	112,264	102,300	-4,430,886	15,769,866
2025	339,363	15,676,053	3,508,601	-1,908,241	-4,645,450	112,264	102,300	-6,339,127	13,184,890
2026	339,363	14,756,680	3,169,239	-1,769,560	-6,553,691	112,264	102,300	-8,108,687	10,156,594
2027	353,638	14,054,661	2,871,926	-1,657,411	-8,323,251	112,264	102,300	-9,766,098	7,514,127
2028	353,638	14,712,938	2,930,086	-1,156,836	-9,980,663	112,264	102,300	-10,922,935	7,073,727
2029	408,296	14,851,375	2,820,550	-1,192,439	-11,137,499	112,264	102,300	-12,115,374	5,964,847
2030	408,296	13,776,247	2,412,254	-1,137,189	-12,329,938	112,264	102,300	-13,252,562	3,344,234
2031	408,296	12,809,796	2,003,958	-1,009,908	-13,467,127	112,264	102,300	-14,262,471	959,580
2032	408,296	17,162,820	3,003,797	-589,813	-14,477,035	112,264	102,300	-14,852,284	5,722,629
2033	618,397	17,658,957	2,868,173	-198,616	-15,066,848	112,264	102,300	-15,050,900	6,094,627
2034	618,397	16,194,064	2,249,777	-317,323	-15,265,464	112,264	102,300	-15,368,223	3,694,014
2035	618,397	14,946,527	1,631,380	-19,517	-15,582,787	112,264	102,300	-15,387,740	1,808,563
2036	279,034	13,470,194	1,352,346	241,672	-15,602,304	112,264	102,300	-15,146,067	-44,493
2037	279,034	13,171,201	1,378,408	634,697	-15,360,632	112,264	102,300	-14,511,371	317,272
2038	373,378	11,911,830	1,077,310	463,462	-14,725,935	112,264	102,300	-14,047,909	-685,391
2039	359,103	10,358,852	718,207	987,908	-14,262,473	112,264	102,300	-13,060,001	-1,623,839
2040	359,103	8,805,875	359,103	1,500,816	-13,274,566	112,264	102,300	-11,559,185	-2,035,104
2041	359,103	7,470,252	0	1,812,707	-11,773,749	112,264	102,300	-9,746,478	-1,917,123
2042	0	7,354,867	0	1,962,833	-9,961,042	112,264	102,300	-7,783,645	-428,778

6.1.20 Debt Service Coverage Ratios

Debt Service Coverage Ratio (DSCR) is calculated as follows:

- $DSCR = \frac{\text{Operating Surplus Before Financial Costs}}{\text{Debt Service (Interest Costs + Commitment Fees + Management Fees + Loan Repayments (Principle Payments))}}$

As shown in Table 104 below, DSCR is estimated to be negative between 2021 and 2027 implying that that services obligations cannot be covered by operating surpluses which would require contributions from member municipalities of the JPE. Starting from 2028 onwards, debt service obligations are estimated to be covered by operating surpluses easily. Based on discounted total amounts between 2021 and 2042, operating surplus before financial expenses is expected to be 53% higher than the debt service obligations.

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Table 104 Debt Service Coverage Ratios

Year	Operating Surplus Before Financial Costs (€)	Interest Costs (€)	Comm. Fees (€)	Man. Fees (€)	Total Financing Costs (€)	Loan Repaym. (€)	Debt Service (€)	Debt Service Coverage Ratio (%)
2021	-26,400	1,479	21,566	0	23,044	0	23,044	-114.56
2022	-75,900	34,566	10,536	44,117	89,220	0	89,220	-85.07
2023	-1,121,129	66,176	0	0	66,176	0	66,176	-1,694.17
2024	-902,864	63,631	0	0	63,631	339,363	402,993	-224.04
2025	-731,365	59,402	569	1,713	61,684	339,363	401,047	-182.36
2026	-544,116	55,174	0	0	55,174	339,363	394,537	-137.91
2027	-447,934	50,506	141	0	50,647	339,363	390,010	-114.85
2028	147,140	48,820	2,523	7,106	58,449	353,638	412,086	35.71
2029	285,710	48,844	747	0	49,591	353,638	403,229	70.86
2030	493,591	45,370	0	0	45,370	408,296	453,666	108.80
2031	634,583	39,246	0	0	39,246	408,296	447,542	141.79
2032	811,692	43,683	5,934	18,909	68,526	408,296	476,822	170.23
2033	902,755	51,740	1,207	0	52,947	408,296	461,243	195.72
2034	1,144,847	47,661	0	0	47,661	618,397	666,057	171.88
2035	1,421,938	38,385	0	0	38,385	618,397	656,781	216.50
2036	1,675,751	29,109	0	0	29,109	618,397	647,505	258.80
2037	2,007,266	24,666	1,124	3,774	29,564	279,034	308,598	650.45
2038	1,979,540	23,311	181	0	23,492	279,034	302,526	654.34
2039	2,293,193	18,960	0	0	18,960	373,378	392,338	584.49
2040	2,649,359	13,466	0	0	13,466	359,103	372,570	711.10
2041	2,918,868	8,080	0	0	8,080	359,103	367,183	794.93
2042	3,014,797	2,693	0	0	2,693	359,103	361,797	833.29
Undiscounted Total (2021-2042)	18,531,321	814,968	44,528	75,619	935,114	7,561,857	8,496,971	218.09
Discounted Total (2021-2042)	8,071,101	570,278	38,519	61,137	669,933	4,605,116	5,275,050	153.01

6.1.21 O&M Cost Structure and Profitability Ratios

Depreciation expenses have the highest share in total O & M expenses including depreciation of around 32% as shown in Table 105 below. The ratio of depreciation costs to operating revenues is expected to decrease from 63.31% in 2023 down to 26.16% in 2042 due to growing revenue base.



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Table 105 Operating Cost Structure Ratios (%)

Year	Depreciation Costs / Grand Total O & M Expenses Incl. Depr.	Total Cash O & M Expenses / Operating Revenues	Depreciation Costs / Operating Revenues
2023	32.33	132.53	63.31
2024	31.52	123.01	56.62
2025	30.81	116.75	51.99
2026	31.00	111.20	49.96
2027	30.22	108.35	46.92
2028	31.27	95.70	43.55
2029	32.92	93.38	45.83
2030	33.93	90.10	46.27
2031	33.83	88.09	45.03
2032	33.75	85.65	43.64
2033	31.61	84.75	39.17
2034	34.33	81.86	42.79
2035	34.13	78.77	40.82
2036	33.81	76.30	38.98
2037	33.73	73.10	37.21
2038	34.79	73.53	39.23
2039	32.96	70.91	34.87
2040	31.62	68.08	31.48
2041	30.90	66.53	29.75
2042	30.91	58.49	26.16

Operating profit margin is expected to be negative between 2023 and 2027 which will turn into positive starting from 2028 onwards as shown in Table 106 below. Net profit margin is estimated to be negative between 2023 and 2035 and becomes positive starting from 2036 onwards due to growing revenues.

Since the ratio of total financing costs to operating revenues is expected to be less than 1% on the average between 2023 and 2042, losses are mainly due to high depreciation costs. The ratio of profits excluding depreciation expenses to operating revenues are expected to be positive starting from 2025 becoming as high as 50%.



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Table 106 Profitability Ratios (%)

Year	Operating Profit Margin (Operating Profit (-Loss) / Operating Rev.)	Total Financing Costs / Operating Revenues	Net Profit Margin (Profit (-Loss) For Period / Operating Rev.)	(Profit (-Loss) For Period excl. Depr. Costs / Operating Rev.)
2023	-34.89	2.06	-72.38	-9.06
2024	-25.13	1.77	-58.58	-1.96
2025	-18.69	1.58	-48.76	3.23
2026	-13.01	1.32	-42.31	7.65
2027	-10.06	1.14	-37.21	9.70
2028	2.84	1.13	-22.29	21.26
2029	5.23	0.91	-21.83	24.00
2030	8.58	0.79	-19.78	26.49
2031	10.64	0.66	-16.93	28.10
2032	13.12	1.11	-9.53	34.11
2033	14.07	0.83	-3.10	36.08
2034	17.01	0.71	-4.72	38.08
2035	20.16	0.54	-0.28	40.54
2036	22.67	0.39	3.27	42.25
2037	25.92	0.38	8.20	45.41
2038	25.50	0.30	5.97	45.20
2039	28.16	0.23	12.13	47.00
2040	31.03	0.16	17.58	49.06
2041	32.62	0.09	20.26	50.01
2042	29.32	0.03	19.09	45.25

6.2 Economic Analysis

The economic analysis provides an overview of the Project's contribution to the welfare of Polog Region and North Macedonia by taking Project-related economic costs and benefits into account.

Economic analysis is carried out to assess the Project's economic benefits and costs from the point of view of the whole society as opposed to the point of view of the Project owner as in the case of financial analysis.

If the Project is financially infeasible then economic analysis is carried out to assess whether the project is economically viable generating economic benefits higher than the economic costs, and thus, contributing to the economic wellbeing of the region and society.



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6.2.1 Approach and Main Economic Assumptions

The economic analysis of the Project requires adjustment of the market prices used in the financial analysis. Market prices are considered to be far from their long-term equilibrium due to numerous distortions including taxes, subsidies, import duties and other financial transfers. To reflect opportunity costs, economic figures must take into account externalities and remove all sorts of financial transfers.

Economic analysis is conducted at shadow prices by considering non-monetary impacts (e.g. savings in medical treatment costs due to protection of ground water sources by leachate treatment, savings in hospitalization time).

To determine economic cash flows, fiscal corrections need to be made on financial cash flows by excluding indirect taxes (e.g. VAT) and pure transfer payments (e.g. social security payments).

A standard conversion factor (SCF) is applied to internationally traded goods and services to adjust market prices and to calculate accounting prices reflecting opportunity costs. Prices on world markets represent the country's actual trading opportunities and thus, are appropriate measures of opportunity costs. The SCF conventionally reflects the weighted average divergence between border prices and domestic market prices for all traded goods and services in the economy. The standard conversion factor (SCF) is used by default when specific sectoral conversion factors are not available.

Shadow prices are calculated by applying SCF and sector specific conversion factors to financial prices. SCF used in economic analysis is 0.90.

Social discount rate used in calculating the Economic Net Present Value (ENPV) of the Project is 5% p.a.

As a result of the economic analysis the Project would be feasible from an economic point of view if the following holds:

- Economic Net Present Value (ENPV) of the annual economic cash flows of the Project calculated by using the social discount rate > 0 ;
- Economic Rate of Return (ERR) of the annual economic cash flows of the Project calculated $>$ social discount rate;
- Benefit - Cost Ratio (B/C) calculated by dividing the sum of the annual discounted economic cash inflows of the Project to the sum of the annual discounted economic cash outflows of the Project by using the social discount rate > 1 .

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Thus, if ENPV is greater than 0, then the Project must be implemented since it leads to a more efficient allocation of resources (the Project is economically desirable even though it is not financially viable). On the contrary, if ENPV is less than 0, then the Project must not be implemented since the region is better off without the Project (the Project is economically undesirable and financially unviable).

External costs and conversion factors are calculated to adjust financial flows which are intended to reflect real opportunity cost. Breakdown of economic costs and conversion factors applied to financial prices to turn them into accounting prices are shown in Table 107 below. Conversion factor of non-traded goods is taken to be equivalent to the SCF of 0.90.

Table 107 Breakdown of Economic Costs and Conversion Factors Used for the Economic Analysis of the Project

Breakdown of Economic Costs and Conversion Factors	Construction Costs (%)	Operation Costs (%)	Conversion Factors
Traded goods	20.0	15.0	1.00
Non-traded goods	10.0	5.0	0.90
Skilled Labour	20.0	25.0	1.00
Unskilled Labour	35.0	40.0	0.5386
Transfer Payments	15.0	15.0	0.00

Conversion factor of unskilled labour is calculated as follows:

- Conversion Factor of Unskilled Labour: $(1 - \text{Unemployment Rate}) * (1 - \text{Share of Taxes and Social Security Premiums in Minimum Official Wage})$

According to World Bank data (obtained from International Labour Organization, ILOSTAT database; data retrieved in December 2019), unemployment rate (unemployment as % of total labour force) in North Macedonia is 21.6%.

Share of Taxes and Social Security Premiums in Official Minimum Wage is calculated to be 31.30% as of 2020 as shown in Table 108 below.

Table 108 Gross and Net Amount of Official Minimum Wage in North Macedonia (2020)

Official Minimum Wage	Unit	Value
Monthly Gross Minimum Wage (Cost to Employer)	MKD/Month	21,107
Monthly Net Minimum Wage	MKD/Month	14,500
Monthly Gross Minimum Wage (Cost to Employer)	EUR/Month	343.20
Monthly Net Minimum Wage	EUR/Month	235.77
Share of Taxes and Social Security Premiums in Official Minimum Wage	%	31.30

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Conversion factor of unskilled labour is calculated to be 0.5386 $((1-0.216) * (1-0.313))$.

External benefits of SWM projects are comprised of environmental, social, health and economic development benefits as mentioned in the EU Guide on CBA. Most of the external benefits summarized below cannot be defined in a qualitative way:

- **Environmental Benefits:** Implementation of the Project will have positive effects on the quality of groundwater and soil in the Project area. Groundwater and soil contamination will be prevented. Rehabilitation of the Rusino disposal site will eliminate smells, insects and wild animals and thus reduce potential health problems. On the other hand, there can be some environmental costs such as noise, dust and smell during construction and operation of the new sanitary landfill and plants. However, due to long distances involved between the settlement areas and landfill / facilities such disturbances will be minimized.
- **Health Benefits:** Proper solid waste treatment will definitely have a positive impact on the health of the people living in the Project area since diseases originating from improper waste treatment will be eliminated. Consequently, economic benefits will increase due to less hospitalization reducing the number of absent/non-working days as well as less medical care and medicine costs.
- **Social Benefits:** Proper treatment of waste will have a positive impact on the self-esteem of the people living in the Project area. In addition, the job of scavengers will be formalized providing health, job and income security to them and reducing health risks of the people who are in touch with them.
- **Economic Benefits:** Rehabilitation of the Rusino disposal site and introduction of proper waste management will improve the quality of the environment and landscape positively and the Project area will attract more investments and tourists. Moreover, new jobs will be created during implementation and operation of the solid waste facilities providing direct income to workers. Indirect employment effects can also be expected for service providing sectors such as repair and maintenance of vehicles, machinery, equipment and plants.

External economic benefit of 30 Euro per capita per year is assumed for Polog Region by taking into account similar SWM projects.

6.2.2 Project Economic Viability (ENPV and ERR)

Discounted total economic benefits and costs in the 2021-2042 period are presented in Table 109 below.

The share of discounted total operating and investment costs in total discounted economic costs between 2021 and 2042 is 62.67% and 37.33%, respectively.



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Table 109 Benefits and Costs in Economic Terms (Discounted Totals Between 2021 and 2042 at Social Discount Rate of 5% p.a.)

Years	Discounted Totals (2021-2042) (EUR)	% of Total Economic Benefits	% of Total Economic Costs
BENEFITS IN ECONOMIC TERMS			
External Economic Benefits (30 €/capita/year)	114,728,731	100.00	120.97
Other External Benefits (0 €/capita/year)	0	0.00	0.00
Total External Economic Benefits	114,728,731	100.00	120.97
OPERATING COSTS IN ECONOMIC TERMS			
Traded goods	8,915,385	7.177	9.40
Non-traded goods	2,971,795	2.59	3.13
Skilled Labour	14,858,974	12.95	15.67
Unskilled Labour	23,774,359	20.72	25.07
Transfer Payments	8,915,385	7.77	9.40
Total Operating Costs	59,435,897	51.81	62.67
INVESTMENT COSTS IN ECONOMIC TERMS			
Traded goods	7,080,548	6.17	7.47
Non-traded goods	3,540,274	3.09	3.73
Skilled Labour	7,080,548	6.17	7.47
Unskilled Labour	12,390,959	10.80	13.07
Transfer Payments	5,310,411	4.63	5.60
Total Investment Costs	35,402,739	30.86	37.33
Total Operating & Investment Costs	94,838,636	82.66	100.00
Net Cash Flow in Economic Terms	19,890,095	17.34	20.97

As presented in Table 110 below, ENPV of the Project is EUR 19,890,095 at social discount rate of 5%, whereas ERR is 18.86% and Economic B/C is 1.2097.

Table 110 Results of the Economic Analysis (Social Discount Rate: 5% p.a.)

ECONOMIC PERFORMANCE INDICATORS	UNIT	Value
Economic NPV (ENPV)	EUR	19,890,095
Economic Rate of Return (ERR)	%	18.86
Economic Benefit-to-Cost Ratio (B/C)	No.	1.2097

Even though financially not viable, the Project should be implemented since it is economically feasible. ENPV is greater than "0", ERR is greater than the social discount rate of 5% p.a. and economic B/C is greater than "1" which means that the Project is good for the welfare of the Polog Region and North Macedonia and should be implemented from an economic point of view.

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6.2.3 Sensitivity / Risk Analysis

Sensitivity / risk analyses are conducted to be able to assess the impact of changes in financial / economic performance indicators.

Results of the economic sensitivity / risk analysis by changing the external economic benefits (€/capita/year) shown in Table 111 are summarized below:

- 10% increase in external economic benefit (Scenario-1) causes 57.68% increase in ENPV from EUR 19,890,095 to EUR 31,362,968 (ERR increases from 18.86% to 25.18%).
- 10% decrease in external economic benefit (Scenario-4) causes 57.68% decrease in ENPV from EUR 19,890,095 to EUR 8,417,221 (ERR decreases from 18.86% to 11.59%).
- Switching Value (Scenario-6): If external economic benefit decreases by 17.34% from 30 €/capita/year to 24.80 €/capita/year then ENPV becomes "0" and "ERR" becomes 5%. Consequently, if external economic benefit decreases below 24.80 €/capita/year, then the Project shall become economically infeasible and should not be implemented.

Table 111 Results of the Economic Sensitivity / Risk Analysis By Changing the External Economic Benefits (Social Discount Rate: 5% p.a.)

A. 10%, 15% and 20% Increase in External Economic Benefits (€/capita/year)

ECONOMIC SENSITIVITY ANALYSIS	Base Case	Scenario 1	Scenario 2	Scenario 3
External Economic Benefits (€/ca/year)	30.00	33.00 (+10%)	34.50 (+15%)	36.00 (+20%)
ENPV (EUR)	19,890,095	31,362,968 (+57.68%)	37,099,404 (+86.52%)	42,835,841 (+115.36%)
ERR (%)	18.86%	25.18%	28.14%	31.00%
B/C (No.)	1.2097	1.3307	1.3912	1.4517

B. 10%, 15% and 17.34% Decrease in External Economic Benefits (€/capita/year)

ECONOMIC SENSITIVITY ANALYSIS	Base Case	Scenario 4	Scenario 5	Scenario 6
External Economic Benefits (€/ca/year)	30.00	27.00 (-10%)	25.50 (-15%)	24.80 (-17.34%)
ENPV (EUR)	19,890,095	8,417,221 (-57.68%)	2,680,785 (-86.52%)	0
ERR (%)	18.86%	11.59%	7.28%	5.00%
B/C (No.)	1.2097	1.0888	1.0283	1.0000

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Results of the economic sensitivity / risk analysis by changing the investment costs shown in Table 112 are summarized below:

- 10% decrease in investment costs (Scenario-1) causes 17.80% increase in ENPV from EUR 19,890,095 to EUR 23,430,369 (ERR increases from 18.86% to 22.54%).
- 10% increase in investment costs (Scenario-4) causes 17.80% decrease in ENPV from EUR 19,890,095 to EUR 16,349,821 (ERR decreases from 18.86% to 15.69%).
- Switching Value (Scenario-6): If investment costs increase by 56.18%, then ENPV becomes "0" and "ERR" becomes 5%. Consequently, if investment costs increase above 56.18%, then the Project shall become economically infeasible and should not be implemented.

Table 112 Results of the Economic Sensitivity / Risk Analysis By Changing the Investment Costs (Social Discount Rate: 5% p.a.)

A. 10%, 20% and 30% Decrease in Investment Costs

ECONOMIC SENSITIVITY ANALYSIS	Base Case	Scenario 1	Scenario 2	Scenario 3
Investment Cost Decrease	0	-10%	-20%	-30%
ENPV (EUR)	19,890,095	23,430,369 (+17.80%)	26,970,642 (+35.60%)	30,510,916 (+53.40%)
ERR (%)	18.86%	22.54%	26.93%	32.31%
B/C (No.)	1.2097	1.2566	1.3073	1.3623

B. 10%, 20% and 56.18% Increase in Investment Costs

ECONOMIC SENSITIVITY ANALYSIS	Base Case	Scenario 4	Scenario 5	Scenario 6
Investment Cost Increase	0	+10%	+20%	+56.18%
ENPV (EUR)	19,890,095	16,349,821 (-17.80%)	12,809,547 (-35.60%)	0
ERR (%)	18.86%	15.69%	12.92%	5.00%
B/C (No.)	1.2097	1.1662	1.1257	1.0000

Results of the economic sensitivity / risk analysis by changing the O&M costs shown in Table 113 are summarized below:

- 10% decrease in O&M costs (Scenario-1) causes 29.88% increase in ENPV from EUR 19,890,095 to EUR 25,833,684 (ERR increases from 18.86% to 22.02%).
- 10% increase in O&M costs (Scenario-4) causes 29.88% decrease in ENPV from EUR 19,890,095 to EUR 13,946,505 (ERR decreases from 18.86% to 15.41%).
- Switching Value (Scenario-6): If O&M costs increase by 33.46%, then ENPV becomes "0" and "ERR" becomes 5%. Consequently, if O&M costs increase above

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33.46%, then the Project shall become economically infeasible and should not be implemented.

Table 113 Results of the Economic Sensitivity / Risk Analysis By Changing the O&M Costs (Social Discount Rate: 5% p.a.)

A. 10%, 20% and 30% Decrease in O&M Costs

ECONOMIC SENSITIVITY ANALYSIS	Base Case	Scenario 1	Scenario 2	Scenario 3
O&M Cost Decrease	0	-10%	-20%	-30%
ENPV (EUR)	19,890,095	25,833,684 (+29.88%)	31,777,274 (+59.76%)	37,720,864 (+89.65%)
ERR (%)	18.86%	22.02%	25.00%	27.82%
B/C (No.)	1.2097	1.2906	1.3831	1.4898

B. 10%, 20% and 56.18% Increase in O&M Costs

ECONOMIC SENSITIVITY ANALYSIS	Base Case	Scenario 4	Scenario 5	Scenario 6
O&M Cost Increase	0	+10%	+20%	+33.46%
ENPV (EUR)	19,890,095	13,946,505 (-29.88%)	8,002,915 (-59.76%)	0
ERR (%)	18.86%	15.41%	11.53%	5.00%
B/C (No.)	1.2097	1.1384	1.0750	1.0000

Results of the financial sensitivity / risk analysis by changing the O&M costs shown in Table 114 are summarized below:

- 10% increase in O&M costs (Scenario-1) causes 29.88% increase in FNPV/C from EUR -27,616,897 to EUR -34,262,460 (FRR/C decreases from -7.28% to -10.57%).
- 10% decrease in O&M costs (Scenario-4) causes 24.06% increase in FNPV/C from EUR -27,616,897 to EUR -20,971,334 (FRR/C increases from -7.28% to -4.29%).
- Switching Value (Scenario-6): If O&M costs decrease by 58.44%, then FNPV/C becomes "0" and "FRR/C" becomes 5%. Consequently, if O&M costs decrease more than 58.44%, then the Project shall become financially feasible and should be implemented without grants.

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Table 114 Results of the Financial Sensitivity / Risk Analysis By Changing the O&M Costs (Financial Discount Rate: 5% p.a.)

A. 10%, 20% and 30% Increase in O&M Costs

FINANCIAL SENSITIVITY ANALYSIS	Base Case	Scenario 1	Scenario 2	Scenario 3
O&M Cost Increase	0	+10%	+20%	+30%
FNPV/C (EUR)	-27,616,897	-34,262,460 (+29.88%)	-40,908,023 (+48.13%)	-47,553,586 (+72.19%)
FRR/C (%)	-7.28%	-10.57%	-14.31%	-18.72%

B. 10%, 20% and 58.44% Decrease in O&M Costs

FINANCIAL SENSITIVITY ANALYSIS	Base Case	Scenario 4	Scenario 5	Scenario 6
O&M Cost Decrease	0	-10%	-20%	-58.44%
FNPV/C (EUR)	-27,616,897	-20,971,334 (-24.06%)	-14,325,771 (-48.13%)	0
FRR/C (%)	-7.28%	-4.29%	-1.52%	4.0%

Results of the financial sensitivity / risk analysis by changing the investment costs shown in Table 6.49 are summarized below:

- 10% increase in O&M costs (Scenario-1) causes 29.88% increase in FNPV/C from EUR -27,616,897 to EUR -31,185,697 (FRR/C decreases from -7.28% to -8.04%).
- 10% decrease in O&M costs (Scenario-4) causes 24.06% increase in FNPV/C from EUR -27,616,897 to EUR -24,048,097 (FRR/C increases from -7.28% to -6.43%).
- Switching Value (Scenario-6): If investment costs decrease by 77.38%, then FNPV/C becomes "0" and "FRR/C" becomes 5%. Consequently, if investment costs decrease more than 77.38%, then the Project shall become financially feasible and should be implemented without grants.

Table 115 Results of the Financial Sensitivity / Risk Analysis By Changing the Investment Costs (Financial Discount Rate: 5% p.a.)

A. 10%, 20% and 30% Increase in Investment Costs

FINANCIAL SENSITIVITY ANALYSIS	Base Case	Scenario 1	Scenario 2	Scenario 3
O&M Cost Increase	0	+10%	+20%	+30%
FNPV/C (EUR)	-27,616,897	-31,185,697 (+12.92%)	-34,754,497 (+25.85%)	-38,323,296 (+38.77%)
FRR/C (%)	-7.28%	-8.04%	-8.73%	-9.36%

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B. 10%, 20% and 77.38% Decrease in Investment Costs

FINANCIAL SENSITIVITY ANALYSIS	Base Case	Scenario 4	Scenario 5	Scenario 6
O&M Cost Decrease	0	-10%	-20%	-77.38%
FNPV/C (EUR)	-27,616,897	-24,048,097 (-12.92%)	-20,479,297 (-25.85%)	0
FRR/C (%)	-7.28%	-6.43%	-5.47%	4.0%

Financial performance indicators are very sensitive to changes in tariff collection rate which has direct impact on operating revenues. Results of the financial sensitivity / risk analysis by changing the SWM tariff collection rates shown in Table 116 are summarized below:

- If overall SWM tariff increase rate between 2023-2042 increases from 73.68% to 77.83% (Scenario-1), then FNPV/C increases by 15.59% from EUR -27,616,897 to EUR -23,310,362 (FRR/C increases from -7.28% to -5.24%).
- If overall SWM tariff increase rate between 2023-2042 increases from 73.68% to 81.98% (Scenario-2), then FNPV/C increases by 31.19% from EUR -27,616,897 to EUR -19,003,827 (FRR/C increases from -7.28% to -3.33%).
- If overall SWM tariff increase rate between 2023-2042 increases from 73.68% to 86.13% (Scenario-3), then FNPV/C increases by 46.78% from EUR -27,616,897 to EUR -14,697,292 (FRR/C increases from -7.28% to -1.54%).

Table 116 Results of the Financial Sensitivity / Risk Analysis By Changing the Tariff Collection Rates (Financial Discount Rate: 5% p.a.)

A. 10%, 20% and 30% Increase in Tariff Collection Rates

FINANCIAL SENSITIVITY ANALYSIS	Base Case	Scenario 1	Scenario 2	Scenario 3
Overall Collection Rate between 2023-2042	73.68%	77.83%	81.98%	86.13%
Tariff Collection Rate (2023)	55.00%	60.00%	65.00%	70.00%
Tariff Collection Rate (2042)	83.00%	88.00%	93.00%	98.00%
FNPV/C (EUR)	-27,616,897	-23,310,362 (+15.59%)	-19,003,827 (+31.19%)	-14,697,292 (+46.78%)
FRR/C (%)	-7.28%	-5.24%	-3.33%	-1.54%

6.3 Conclusions

Based on the financial analysis carried out, it has to be concluded that the Project is not financially feasible based on SWM tariffs set at an affordability ratio of 1% since the FNPV/C, at a financial discount rate of 4%, is negative (EUR - 27,616,897) and the FRR/C is negative (-7.28%) as well.



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As a result of the CBA, and explained in the section above, the Funding Gap Rate and the associated Grant Rate have been calculated to be 94.41% and 80.25%, respectively. However, even with own national financing the Project is not feasible since FNPV/K is less than "0" and FRR/K is negative. Since FNPV/K is negative (EUR - 17,686,427) and FRR/K (-4.02%) is below the financial discount rate of 4%, grant financing is necessary for the implementation of the Project.

The financial analysis also shows that grant financing cannot avoid a negative, cumulative cash flow for all years of the Project period, accumulating to a short fall of more than 18.25 million Euros after ten years of operations. As described in the above sections of this chapter, the Municipalities could, in principle and on temporary basis, provide working capital during the initial 10 years of the Project, but in view of the magnitude of the deficit this cannot be regarded as a feasible solution.

In spite of the lacking financial feasibility, the Economic NPV (ENPV) of the Project is estimated to be EUR 19,890,095 at social discount rate of 5%, whereas ERR is 18.86% and Economic B/C is 1.2097. ENPV is greater than "0", ERR is greater than the social discount rate of 5% p.a. and economic B/C is greater than "1" which means that the Project is good for the welfare of the Polog Region and North Macedonia and should be implemented from an economic point of view.

In view of the economic desirability, additional financial analysis has been carried out, as presented in Annex 4 of this report. Assuming the same investment and O&M costs but higher SWM tariff (maximum affordability rates of overall 1.31%; urban: 1.55%; rural: 1.04%) and revenues, based a rapid increase of the tariff collection rate from the current 55% to 95% in 2030, a lower Grant Rate of 52.35% has been calculated. But, also under these less conservative assumptions, the results do not change the fact that a negative cumulative cash flow is forecasted for the entire Project period. Only the magnitude of the maximum cumulative negative cash flow is reduced from -18,274,252 Euros to -17,079,646 Euros. Still an amount, which cannot be expected to be covered by the Municipalities, even on loan basis. Even in case collective handlers would cover the investment and operating costs for managing the recyclable waste fractions, i.e. packaging waste, the maximum cumulative negative cash flow will, at -13.8 million EUR, remain more than substantial.

Further analysis showed that in order to reach positive cash flows, re-investments and O&M costs would have to be seriously reduced over the 2023-2028 period because in these years operational costs cannot be covered by SWM tariff revenues collected. In 2033 negative cash flow is mainly due the replacement of the mobile equipment of the collection services. In total reductions of an amount of some 17 million euro should be realised. However, while turning the project financially feasible, the technical feasibility

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would be seriously affected, simply because the system would run out of sufficient operational equipment.

For the financial and economic analysis presented in this report, the methodology as described in the Guidance on the methodology for carrying out cost-benefit analysis, working document 4, of the European Commission, has been used in accordance with the TOR for the assignment.

There are also other, alternative financial analysis approaches for instance those used by IFI's such as World Bank or EBRD. These other approaches focus on the question whether a projects can be implemented against affordable tariffs, assuming a certain project funding package, rather than determining the need for grants assuming certain revenues.

While within the framework of this feasibility study alternative financial analysis methods have not been applied, knowledge of these methods, combined with the results of the analyses and assessments that have been carried out, indicate that the Project can be implemented with positive cash flows, against affordable tariffs provided that:

- grant financing of around 50% of initial investment costs can be secured and the remaining initial investments are funded by preferential loans;
- tariffs are set close to the affordability limit (1.5% of average household income) from the start of project implementation; and
- a high tariff collection rate, of around 90%, is realised also right from the start.



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7 Environmental and Social Impacts

This chapter presents an overview of potential impacts from the implementation of the proposed measures. It concerns main and preliminary results. More detailed information on environmental impacts will be made available during the conduct of the Environmental Impact Assessment that will be prepared for the realisation of the sanitary landfill at the current Rusino disposal site.

7.1 Introduction

The implementation of the proposed project measures will improve the rate of waste collection, separately collected re-usable waste fraction and the environmentally soundness of waste disposal. In view of the current situation in which a significant percentage of the waste generators does not receive any waste collection services, re-use and recycling of waste is limited and all waste disposals depends on non-compliant landfills and dumpsites, the overall impacts of implementation of the project measures will be positive for both the environment and social aspects. However, some negative impacts may be caused including increased nuisance from traffic and reduced opportunities for the informal sector to generate income.

7.2 Environmental Impacts during Construction

During and as result of construction activities for the sanitary landfill, environmental impacts may be caused. These potential impacts are described in the following sections.

7.2.1 Impacts on Soil and Groundwater

During construction activities soil will be excavated and vegetation removed. Loss of humus and disturbance of the soil stability may be caused with the potential of landslides. Leakage of construction equipment, oil and/or fuel, may cause soil and groundwater pollution. Dispersion of excavated waste may also cause environmental pollution in the vicinity of the sites were construction works are conducted. Mitigative measures and proper maintenance of equipment will minimise the impacts.

7.2.2 Impacts on Surface Water

During construction works waste water will be generated in the form of communal waste water resulting from sanitary facilities for construction workers. If managed properly, this waste water will not form a threat to the environment.



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Run-off of precipitation from work sites may be contaminated with waste and dust but since storm water drainage will be implemented prior to or simultaneously with the implementation of the construction works and since the construction works will have a limited duration, environmental impacts will be minimal.

7.2.3 Impacts on Air

Emissions from construction equipment including NO_x, CO₂, CO and SO₂, will be unavoidable and may cause elevated concentrations of these substances at the worksites. However, the number of vehicles and plant will be limited and since the worksite is not located near residential areas, the impacts will be limited. Due to the temporary and intermittent character of the construction works, and the diffusion of contaminants by wind, elevated concentrations will not be such that health impacts have to be feared for.

In case works are implemented during dry period, dust emissions may be caused by the construction works. These can be mitigated by dust suppression measures such as sprinkling of water on roads and other areas with dust generating activities.

7.2.4 Impacts on Nature, Archaeological Values and Landscape

Since the works are not implemented in protected areas or areas with special natural, archaeological and landscape values, significant negative impacts of this nature are not expected. Moreover, biodiversity and nature impact screening will be conducted and, if necessary, a mitigation plan will be prepared and implemented. It should also be noted that the construction works for the landfill are implemented in an already affected area and the works will result in more positive than negative impacts.

7.2.5 Traffic

During construction works there will be an increase in traffic to the construction sites. Limiting traffic to and from the site to time period in which the least nuisance is caused can mitigate the impacts. A traffic management plan for the construction period may provide appropriate mitigation.

7.2.6 Social Impacts

Residents may be affected by nuisance caused by the construction works including noise, vibrations and increased traffic. Since residential areas are far from the construction sites, these impacts will be minimal.

Positive social impacts may be the employment opportunities that will arise during the construction phase. These impacts are however limited and temporary.



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7.3 Impacts during Operation

During operation of the landfill, environmental impacts may be caused. These are described in the following sub-sections

7.3.1 Impacts on Soil and Groundwater

Since the landfill will be constructed in compliance with all EU and National requirements, including those for pertaining to the bottom lining system, at the landfill all necessary measures will be taken to prevent pollution of soil and groundwater and negative impacts are therefore not expected. On the contrary, compared with the current situation in which leachate from disposed waste is freely flowing for the waste body, impacts on soil and ground water will be reduced.

The operation of the transfer station will take place on a fully paved surface area surrounded by storm water ditches. Because of these measures pollution of soil and groundwater will be avoided.

7.3.2 Impacts on Surface Water

Run-off of storm water can potentially be polluted with waste materials or leakage from equipment used at the landfill or the transfer station. However, the presence of storm water drainage at the sites will prevent the mixing of storm water with pollutants and minimise impacts. Waste water from sanitary facilities will be treated and managed in accordance with applicable standards and impacts on surface waters will be minimised if not avoided.

7.3.3 Impacts on Air

During operation of the landfill and transfer station, emissions of odours cannot be avoided. However, impacts can be minimised by mitigative measures including covering of waste by soil (at the landfill) or with tarpaulins (at the transfer station). In addition to odours, the landfill will emit landfill gas which can have an impact on the air quality and contributes to global warming. By active collection and utilisation of landfill gas during the landfill operation (and aftercare) phase, these impacts will be minimised.

In dry period, dust emissions may occur but these will be reduced by suppression of dust with water.

7.3.4 Impacts on Nature, Archaeological Values and Landscape

Impacts on nature and archaeological values will not be caused during operation of the landfill and the transfer station. If impacts occur these would have been caused already during the construction phase. During operation of the landfill, the waste body will

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gradually be raised and a hill shaped waste body will be realised having an impact on the landscape. However, the design of the landfill and its location ensure that the hill shaped waste body fits well into its surroundings.

7.3.5 Traffic

During operations both the landfill and the transfer station will attract heavy traffic in the form of waste collection vehicles and waste transfer vehicles. Especially the latter can, due to their size, potentially cause traffic obstructions and traffic jams especially in the centre of Gostivar. In addition the heavy traffic may damage roads which not necessarily have been designed for the type of vehicles transporting waste.

Mitigative measures, including adjusting the time of waste transportation and upgrading and maintaining road pavements may reduce the impact but they cannot be fully avoided. A traffic management plan for the operational period may provide further mitigation.

7.3.6 Social Impacts

Social impacts will mainly be caused by traffic since the location of the landfill and the transfer station are not close to residential areas. Nuisance caused by the landfill and the transfer station are therefore limited and will be, in comparison with the current situation at Rusino disposal site, be reduced.

Nuisance from traffic in the form of noise pollution, exhaust emissions and traffic obstructions will increase in the city of Gostivar mainly with the increased disposal of waste at the Rusino landfill. As described above mitigative measures, including adjusting the time of waste transportation and upgrading and maintaining road pavements, may reduce the impact but they cannot be fully avoided. In addition, an alternative access road, which is already being considered, providing a direct link between the disposal site and the M65 can substantially reduce the impacts from traffic.

The realisation of the landfill and the transfer station will provide employment opportunities. The JPE “Rusino” will employ about 40 staff members divided over the landfill and the transfer station.

7.4 Conclusion

Overall, the implementation of the RWMP and the realisation of the Rusino sanitary landfill and the transfer station will have long term positive impacts on the environment and the population of the Polog Region. Mitigative measures can provide further environmental protection and compliance. As compared to the current situation, the emissions from disposal will be reduced. Negative social impacts will however not be avoidable although

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they can largely be mitigated. Positive social impacts will be achieved as well and may result in a neutral balance.



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8 Risk Analysis

Possible risks for project implementation are summarised in the following table. Risks for the individual areas of SWM are presented as well as cross-sectional project risks. Respective suggestions for mitigation measures are provided per risk described.

Lack of financing is assumed to be one of the most relevant risks for project implementation. Successful project implementation is expected to depend on the readiness to increase waste tariffs, to allocate sufficient budget for regional and municipal SWM measures and to support the mode of financing for regional waste management facilities in the long-term.

Furthermore 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 omnipresent in the region. The population is even less used to handling of waste and their understanding for the need of (advanced) waste management (e.g. separation of waste) is assumed to be low as well.

Ensuring the engagement and support of the public is a prerequisite to reach the objectives and results envisaged with the proposed waste management system. Creating public awareness of the advantages and benefits offered by improved SWM will positively affect public participation and willingness to contribute towards its implementation, either through behaviour changes or financially.

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Table 117 Risk analysis

Risk description	Mitigation measures	Level of risk*
Development risk		
Waste collection		
Waste collection cannot be extended in/ to unserved/ rural areas, because of budget constraints/ low cost recovery.	Introduction of cost covering tariffs and improvement of fee collection. Enforcement from national level. Subsidies for rural waste collection services/ poor rural population.	2
Road conditions hinder proper waste collection/ extension of service area, especially in remote and mountainous areas.	Improvement of road infrastructure and winter services, in order to enable year-round accessibility. Municipalities to increase budgets for road maintenance. Ministry of Transport and Communication to support improvement of roads in the project region.	2
Collection costs will be higher than expected, because collection efficiency cannot be increased.	Improvement of waste collection services via performance monitoring system. Training of staff according to task.	2
Population does not cooperate in separation at source. Containers for separate collection of recyclables are not used as intended.	Conduction of respective PR and public awareness measures, in order to sensitise the population for respective behaviour. Modification of collection system.	3
Recyclables cannot be marketed successfully. Off-taker(s) are not interested in purchasing source separated recyclables.	Very little possibilities for mitigation. Investigation of possibilities for marketing of recyclables at the international market. Improvement of the quality of the products.	2
Recyclables are taken out of the recyclable containers by waste pickers/ informal sector, thus increasing the costs of the system (reducing the revenue).	Involvement (integration) of the waste pickers in the formal recycling scheme.	2



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Risk description	Mitigation measures	Level of risk*
Waste transportation and transfer		
(Detailed) Siting of transfer station as well as issuing of building permit and operation license are hampered by slow political, planning and approval processes, resulting in delayed implementation of transfer stations and thus higher transportation costs of collected waste to the landfill.	Very little possibilities for mitigation. Possibly implementation/ running of the regional SWM system without the transfer station under discussion.	2
Litter pollution at transfer station. Poor management of transfer station.	Frequent clean-up at transfer stations as operational routine. Training and capacity building measures for the staff. Recruitment of skilled personnel. Implementation of performance monitoring.	2
Collected waste is not delivered to the transfer stations due to increased costs in comparison to former waste disposal practices.	Enforcement from regional/ national level (e.g. abolition of municipal landfills and dumpsites, obligation to actively take part in regional SWM system). Implementation of unitary fee for all municipalities participating in the new SWM system, in order to equally share costs.	2
Waste treatment (composting)		
Population does not cooperate in separate collection of green waste and delivery to the sanitary landfill. Additional collection tours are not used as intended.	Conduction of respective PR and public awareness measures, in order to sensitise the population for respective behaviour. Modification of collection system.	2
Vegetable and fruit markets do not cooperate in providing separated green waste.	Conduction of knowledge transfer.	3
Poor quality of produced compost.	Training and capacity building measures for the staff. Improvement of input quality/ separate collection.	2
Compost cannot be marketed successfully.	Transferring operations/ marketing to the private sector. Improvement of product quality and diversification of products. Implementation of marketing concept.	2



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Risk description	Mitigation measures	Level of risk*
Waste disposal		
Resistance against traffic increase through Gostivar towards the disposal site resulting in blocking of waste collection vehicles heading to Rusino landfill.	Timing of waste delivery to the landfill to periods of low traffic. Construction of an alternative access road by-passing Gostivar city.	3
Construction permit and operation license will be delayed, resulting in delays in implementation.	Very little possibilities for mitigation.	2
Municipalities do not deliver their waste to the new regional sanitary landfill due to increased costs in comparison to their former waste disposal practices.	Enforcement from national/ regional level (e.g. abolition former decentralised dumpsites/ landfills; obligation to actively take part in regional SWM system). Implementation of unitary fee for both municipalities participating in the new ISWM system, in order to equally share the costs.	2
Poor management of regional sanitary landfill.	Training and capacity building measures for the staff. Recruitment of skilled personnel. Implementation of performance monitoring.	2
Institutional set-up		
The JPE cannot take over the regional tasks, due to different political decisions/ developments on national level.	Very little possibilities for mitigation. Development of a new institutional setup for implementation of the ISWM system is required.	2
Municipalities cannot take over all necessary responsibilities on local level (separate collection and marketing of recyclables, separate collection of green waste and composting).	Training and guidance through technical assistance during implementation phase.	2
Companies/ service providers, contracted for SWM service delivery on local level (waste collection), cannot fulfil their obligations due to financial and/ or personnel constraints.	Clear contracts and monitoring of service delivery. Contracting based on long-term contracts, in order to leave room for quality and efficiency monitoring and improvement measures.	2
Insufficient qualification of staff on regional and local level.	Training and guidance through technical assistance during implementation phase.	2
Acceptance risk		
Proposed SWM system is not accepted by the relevant (political) stakeholders on national, regional or local level.	Very little possibilities for mitigation.	2
	Communication of project concept and targets through extensive PR.	
Proposed SWM system is not accepted by the population concerned.	PR and awareness creation measures.	2



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Risk description	Mitigation measures	Level of risk*
Fiduciary and security risk		
Funds budgeted for project implementation are either not used as intended or not fully accounted for.	Implementation of a financial monitoring system, continuous financial monitoring during project implementation.	2
Natural disasters (mudflows, landslides, flooding) or incidents caused by poor infrastructure (traffic accidents) may pose danger to the safety of staff, experts and partners.	Follow security guidelines for Macedonia published by the Embassy of Switzerland in Macedonia or any other donor institution/ donor country during project implementation and National Guidelines thereafter.	1
Financial risk		
The municipalities cannot bear the elevated costs for the new SWM system.	Municipalities need to implement cost covering fees and improve fee collection. Fees to be determined at national level (regulator) rather than local level. Improvement of service efficiency by implementing cost and performance monitoring.	3
Population shows little willingness to pay (higher) SWM fees.	Awareness creation measures. Follow up on debts and implementation of enforcement measures. Assessment of other financing options including contributions by EPR scheme.	2
Insufficient budgets/ payments for SWM services on municipal level (waste collection, separate collection and marketing of recyclables, separate green waste collection and composting).	Improvement of cost recovery (cost covering tariffs and fee collection).	2
Insufficient budgets/ payments for JPE for providing SWM services on regional level (transfer and long-distance transportation, waste disposal).	Improvement of cost recovery (cost covering tariffs and fee collection).	2
Environmental risk		
In case of not properly implemented new SWM system, improperly disposed waste may cause environmental risks (air, soil water pollution).	Adequate staffing and training and capacity building of relevant staff.	1



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Risk description	Mitigation measures	Level of risk*
Social risk		
Exposure of workers in SWM to health or safety risks.	Training and guidance through technical assistance during implementation phase. Training and capacity building measures for the staff.	1
The poorest population cannot pay higher SWM fees. Exclusion of informal sector from recycling activities.	Assessment of other financing options. Formalisation of/ cooperation with waste pickers.	2
Population living close to the landfill might be affected, especially in case on operational shortfalls.	Training and guidance through technical assistance during implementation phase. Training and capacity building measures for the staff.	2

* Level of risk: (1) no or little risk, (2) medium risk, (3) high risk, (4) very high risk



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9 Project Implementation

In order to ensure the intended results and sustainability of the project measures proposed in addition to contracts to the implementation of recommended measures, technical assistance (TA) shall be provided.

The measures presented in chapter 4 of this document will be implemented in the Polog Region with the involvement of a number of different entities, including the Inter-municipal Waste Management Board (IMWMB), the Centre for the Development of the Polog Planning Region (i.e. the Regional Development Centre, RDC) and, in future, the organisational unit for regional waste management therein, the Joint Public Enterprise for management of Rusino landfill and regional transfer station(s) (JPE “Rusino”) and the nine Municipalities in the Polog Region. In addition the private sector and the collective handlers will play a role in waste collection and the management of recyclable waste fractions. Their exact involvement will depend on contractual arrangements with the municipalities and legal requirements, which are currently being revised, within the process of adoption of a new law on waste management. Other stakeholders are involved donor organisations and IFIs, the MoEPP and, most likely, the MoF as provider of national contributions to the required investments and guarantor for loans provided by one of more IFIs.

The exact involvement of the various entities in the contracting and implementation will depend on bi-lateral and multi-lateral agreements. In the agreement between the EU and North Macedonia, the Ministry of Finance is the Contracting Authority for IPA funded projects while in the bi-lateral agreement between Macedonia and Switzerland it has been agreed that the RDC is the contracting authority for SECO funded projects.

9.1 Implementation of Recommended Measures

The physical/ technical measures shall be implemented through a number of contracts including:

- a) A works contract for the upgrade of Rusino landfill to meet the standards prescribed in the Rulebook for the conditions that need to be fulfilled by landfills and the EU landfill directive.

Tendering on basis of international open tender. The contract is to be implemented on basis of the FIDIC Red Book conditions of contract, although parts of the works may be implemented under FIDIC Yellow Book, and will have an approximate value of 5.1 million EUR. The contract can be implemented within a period of 12 months, excluding a defects notification period of 12 months.

- b) A supply contract for the supply of landfill equipment (approx. 625,000 EUR)



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- c) A works contracts for compost plant construction (€ 0.6 million)
- d) A supply contract for equipment for compost plants (€ 0.46 million)
- e) A works contract for the construction of a transfer station (approx. 340,000 EUR)
- f) A supply contract for equipment for the transfer station (approx. 813,000 EUR)
- g) Supply contracts for the supply of waste collection vehicles and the provision of waste bins and containers (combined value approx. 6.6 million EUR)²⁵
- h) One or more work contracts for the closure of dumpsites

The contract for dumpsite closure is to be implemented on basis of the FIDIC Yellow Book conditions of contract and will have a total value of approximately €3 million. In principle the contract can be implemented within a period of 24 months, excluding a defects notification period of 12 months. However, it is recommended to implement dumpsite closure through several smaller contracts in order to allow implementation to be spread over a number of years such that implementation can be matched with available funding and to allow participation of local companies who can bid for the smaller contracts. By using smaller contracts, the timing of dumpsite closure can also be adjusted to the local circumstances and prevent that sites are closed before waste generators have access to and use regular waste collection services.

For more details on the content of works and supply tenders reference is made to previous sections, especially chapter 4.

9.2 Technical Assistance (TA)

Through an international open tender procedure a consultancy firm shall be engaged to provide technical assistance for project implementation, supervision of contract implementation and related services (approx. € 3.2 million):

- Supervision of works contracts in the capacity of FIDIC engineer/employer's representative.
- Management of supply contracts, verification of compliance with contract conditions
- Capacity building in the Organisational Unit in the RDC
- Capacity building in the JPE
- Conduct of public awareness activities
- Technical assistance for improvement of waste collection services

²⁵ The amount for waste collation equipment covers all nine municipalities in the Polog Region. In case the private sector will cover part of the investment costs, the amount will be reduced.



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- Conduct of a siting study for replacement of the Rusino landfill

It is recommended that the TA will be provided by a team of experts, which shall have extensive presence in the Polog Region. It is recommended that the team shall include a full time international team leader and a full time national deputy team leader, as well as full-time supervisors for supervision of construction works. Additional expertise can be provided by a pool of international and national short term experts.

9.2.1 Institutional Strengthening and Capacity Building Measures

The JPE “Rusino” is established in 2020 as a small organisation responsible for running of the Rusino disposal site. During implementation of Phase II of the RWMP, the JPE needs to be developed into a professional waste management organisation able to manage a sanitary landfill in accordance with EU and National Standards, ensure all environmental, health and safety standards are adhered to and that modern human resource management practices as well as well as modern financial management and accounting standards are followed. In addition to the landfill the organisation will operate the transfer station and the waste transport from the transfer station to the landfill.

In order to equip the JPE with the skills, capacities and capabilities to perform the above activities and tasks, skill development, capacity building and institutional strengthening will be required. It is recommended that the organisational development, i.e. skill development, capacity building and institutional strengthening, will include:

Formal Training

- Introduction to waste management
- Waste management standards, rules and regulations
- Landfill operations
- Transfer station operations and transport
- Preventive and regular maintenance
- Monitoring and planning
- Waste registration and reporting
- Financial management
- General management
- Human resource management
- Tendering and contract management



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The target groups for the above training modules will not always be the same although it is recommended that all staff of the JPE will be trained in a variety of subjects and not only in the subject most relevant for the position they are employed in. E.g. staff working in finance may benefit from attending training sessions on waste registration and reporting and should even have basic understanding of the operations of the JPE.

In addition to JPE staff, members of the Organisational Unit in the RDC and selected staff of the Municipalities shall be encouraged to attend the trainings. For Municipal staff, additional training modules in waste collection and waste collection routing as well as billing, fee collection and customer management and contract management for managing of concession contracts are recommended. Members of the organisational unit are encouraged to attend also these training sessions.

A training visit to waste management facilities in an EU country in the Region (e.g. Croatia or Slovenia) is proposed to be included in the formal training package.

Training on the Job and Coaching

Formal training is recommended to be supplemented by skill development through learning by doing, training on the job and coaching. It is recommended that the TA consultants will work with JPE staff, show how certain tasks are to be performed and provide feedback on job performance. In order to maximise effectiveness of this support to skill and capacity development, on-the-job training sessions should last a few hours to half a day but be repeated several times with intervals that increase over time and with development of proficiency. After project completion training and coaching shall continue and involvement of local/regional existing/future providers of such training/coaching services such as NALAS/ ZELS/ MASWA could be considered.

Target groups for on-the-job training and coaching are all staff of the JPE, staff of the Organisational Unit for SWM in The RDC and selected staff of Municipalities responsible for waste collection, e.g. supervisors and dispatch officers.

Although training on the job and coaching is less formal than the training modules presented above, it is important that a structured approach is followed. Therefore long term (several years) training plans for individual staff members need to be developed; goals need to be set and evaluation of progress need to be incorporated at predetermined intervals. The individual training plans shall be designed based on the position and the pre-training skill and capacity level of the individual staff members. The training plans shall be agreed upon by the trainee, the trainer and the superior of the trainee.



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9.2.2 Public Awareness and Information Measures

Participation of the general public and of commercial and institutional waste generators in the new integrated waste management system, including participation in waste segregation and including making the necessary payments for the waste management services provided, is essential for successful implementation of the RWMP and the sustainability of the new system. To increase motivate the general public and other waste generators to actively participate, a public awareness campaign is proposed which should include the elements described below. Public awareness activities should be organised and implemented by Municipalities as well as the JPE “Rusino” and cooperation with local NGO’s / civil society shall be sought as well as with the collective handlers and others participating in the implementation of the EPR schemes.

Visibility of the New System

With the aim that all waste generators in the Polog Region will be made aware of the introduction of a new, improved solid waste management system, visibility of the implementation activities for the new system is essential. This visibility includes of course inviting the media to the start of Phase II of RWMP implementation, to opening of the landfill, delivery of equipment and the like but the visibility must be more permanent and not only depend on events. Branding of the JPE “Rusino” with a strong, recognisable logo is one of the measures proposed. Regular and frequent postings with this logo in, inter alia, local newspapers and adding information leaflets with the logo to the utility bills that are send out on a monthly basis will ensure that residents and other waste generators will become familiar with the existence of the new JPE and the improved waste management system.

Link with Improvements

In order to have real impact, for all public awareness activities it is of the utmost importance that these are linked with real improvements on the ground. Informing waste generators on how they can reduce the environmental impact of the waste they generate without providing them with an (easy) way to actually improve their environmental behaviour will in most cases be counterproductive. Promoting segregation of recyclable waste fractions shall therefore only be done when at the same time, dedicated bins and bring-banks will be provided in ample amounts and close to the target group for the public awareness campaign. Cooperation and coordination with the collective handlers responsible for managing recyclable (e.g. packaging) waste fractions is, in this respect, of the utmost importance.



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Public Relation Centres

In Phase II of the implementation of the RWMP, it is recommended that at least in the two largest municipalities and the JPE, possibly combined, public relations centres will be established where waste generators can submit complaints, ask questions and receive information about waste management issues. The centres can also function as the counterparts of the TA Consultants and with support of the Consultants design and implement public awareness activities.

Means of Communication

Traditionally, public awareness campaigns use a variety of media to reach the general public and other waste generators. TV, and radio commercials, advertisements in newspapers and media events and workshops for NGOs are some of the examples. Also for the Phase II of RWMP implementations these means of communication can be used but since their effectiveness is often doubtful, it is important to include in the design for the awareness and public relation campaign, methods for evaluation of the effectiveness. Based on the evaluation, adjustments may have to and can be implemented.



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Annex 1 Polog Dumpsite Mapping Report

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

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

– Polog Dumpsite Mapping Report –



February 2020

Solid Waste Management in Polog Region, North Macedonia, Phase I Mapping of Dumpsites in the Polog Region, North Macedonia

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Solid Waste Management in Polog Region, North Macedonia, Phase I Mapping of Dumpsites in the Polog Region, North Macedonia

1 Dumpsite Mapping Municipality of Bogovinje

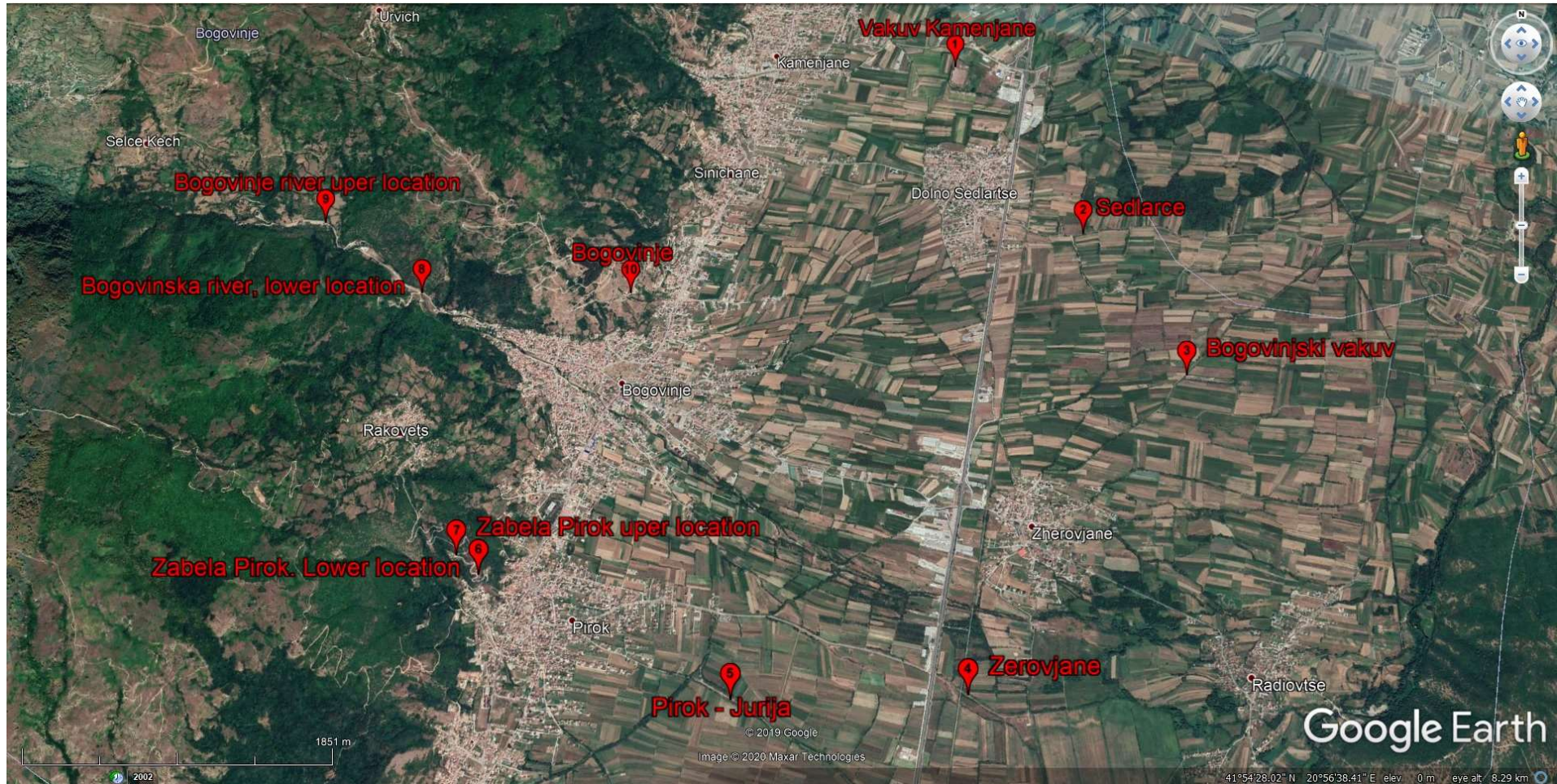
During the field identification of illegal landfills in the municipality of Bogovinje carried out by a project representative with the assistance of a municipal representative, 10 illegal landfills have been identified as significant by the local LSG representative, although there are other smaller waste accumulations in each settlement that may be removed or rehabilitated without significant investments.



All sites are identified with the GPS coordinates, and the type of waste that is disposed on each of them is identified. Additionally, the approximate surface of the dumps site is calculated, as well as its position, risk level and period of exploitation.

On the google map below all 10 sites are presented as a POI. For each dumpsite an additional Information sheet is presented as well as photo documentation.

Solid Waste Management in Polog Region, North Macedonia, Phase I Mapping of Dumpsites in the Polog Region, North Macedonia



**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	1.1 Kamnjane – Vakuv GPS coordinates: lat: 41.9446128 lng: 20.9433316		
Size of the waste area and amounts	6000m ² 120 000 m ³	Average height 2 m	Delivered waste quantity per day m ³ N/A - it is not used any more
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	Dumpsite is located on agricultural land located near the High school Jahaja Kemal and football stadium. There is additional dumping from time to time. It is mainly covered by vegetation. No significant environmental risks. Very bad visual effect. This area has been used for disposal of construction waste. There is no intensive disposal anymore, but it has been used for dumping construction, household and garden waste. There is no significant environmental risks because it is mainly inert waste and it is not used any more for regular dumping.
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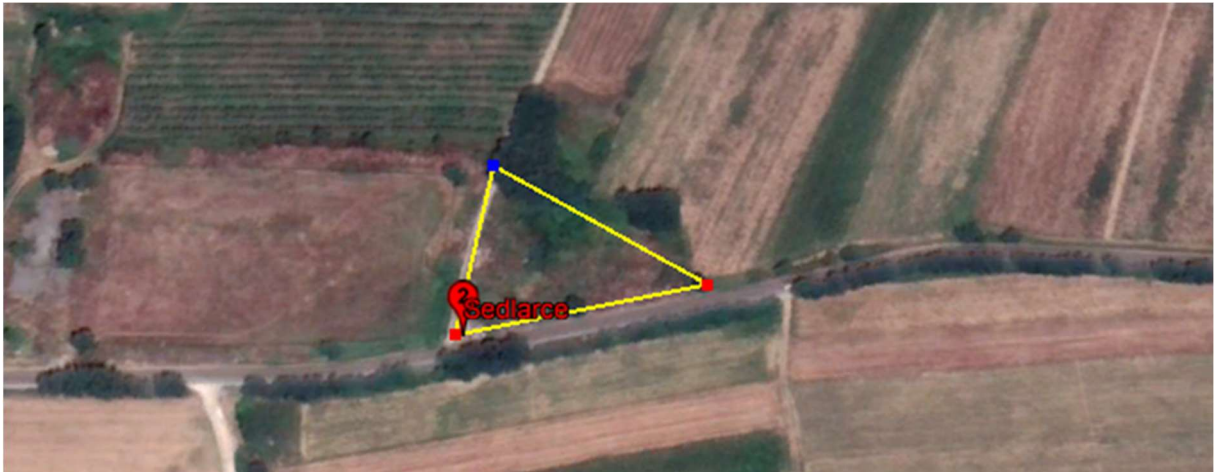


**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	1.2 Sedlarce GPS coordinates: lat: 41.9333332 lng: 20.9531529		
Size of the waste area and amounts	2 200 m ² 2 200 m ³	Average height 1 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 450 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 600 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

<p>Environmental impacts / remarks</p>	<p>Dumpsite older than 20 years, located on agricultural land. There is some additional dumping from time to time. No significant environmental risks. Very bad visual impact. In the neighbourhood on the south there is private operated sand and gravel separation plant which has additional construction waste disposed in the surroundings, but it is responsibility of the plant operator to remove that waste. This area has been used for disposal of MSW from the Sedlarce village. It is used for dumping household, garden and some construction waste. Located near the local asphalt road and mainly covered by vegetation. There is no significant environmental risks because it is mainly inert waste but it attracts dumping of MSW.</p>
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	1.3 Bogovinjski Vakuf GPS coordinates: lat: 41.9244348 lng: 20.9605323		
Size of the waste area and amounts	10 000 m ² 20 000 m ³	Average height 2 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input checked="" type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input checked="" type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 20 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 2000 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 2000 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

<p>Environmental impacts / remarks</p>	<p>MSW dumpsite older than 30 years historically operated by the LSG unit and located on agricultural land. There still is additional dumping from time to time. It has significant environmental risks. Very bad visual impact. The adjacent lands are used for intensive agricultural activities. The site is near a small spring and there is a very high underground water table. It should be subject to further environmental investigations.</p>
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	1.4 Zerovjane GPS coordinates: lat: 41.9061533 lng: 20.9425446		
Size of the waste area and amounts	5 000 m ² 15 000 m ³	Average height 2 - 3 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 2000 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 2000 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	Construction Waste dumpsite older than 30 years historically operated by the Bogovinje LSG unit and located on agricultural land near the railway line from Skopje to Gostivar. There is additional dumping from time to time. It is mainly construction waste historically dumped and covered with vegetation. Although the amount of waste is significant and it covers very long surface area, there is no significant environmental impact or leachate.
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Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Location of the dumpsite	1.5 Pirok - Jurija GPS coordinates: lat: 41.9058526 lng: 20.9252036		
Size of the waste area and amounts	3 000 m ² 5 000 m ³	Average height 2 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 2000 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 2000 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	Construction Waste dumpsite older than 30 years historically operated by the Bogovinje communal enterprise and located on agricultural land. There is additional dumping from time to time. It is mainly 6 big heaps of construction waste historically dumped and covered with vegetation. There is no significant environmental impact or leachate.
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	<p>1.6 Zabela Pirok, Lower location GPS coordinates: lat: 41.912597 lng: 20.9062056</p> <p>1.7 Zabela Pirok Upper location GPS coordinates: lat: 41.9136945 lng: 20.9044381</p>		
Size of the waste area and amounts	3000 m ² 7-8000 m ³ on both locations	Average height 5 m but it is on the slope.	Delivered waste quantity per day N/A
Description of the dumpsite	<p><input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank</p> <p>Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Used since (year) 1990</p> <p><input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:)</p> <p><input type="checkbox"/> Others: No</p>		
Available equipment, infrastructure and staff	<p><input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others</p> <p><input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily</p>		
Distance in meters to nearest	<p>River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter</p> <p>Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter</p> <p>Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter</p> <p>Forest <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m.</p> <p>Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter</p> <p>Single residential house <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Residential area <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter</p>		

**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:
Environmental impacts / remarks	<p>In this area on the distance of no more than 500 meters there are two wild dumps. This area has been used for disposal of MSW and construction waste by the residents of Pirok village. It is located near the road on the slope of the mountain above the village. It is used for dumping construction, household and garden waste from time to time. Municipality of Bogovinje is taking care to cover and clean it but there is dumping again. Since it is on the slope it could be risky under bad weather conditions. There is a possibility of environmental impacts and the risk of waste slides during heavy rains.</p>





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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

<p>Location of the dumpsite</p>	<p>1.8 Bogovinje river, Lower location GPS coordinates: lat: 41.9293634 lng: 20.9001606</p> <p>1.9 Bogovinje river Upper location GPS coordinates: lat: 41.9338762 lng: 20.8918501</p>		
<p>Size of the waste area and amounts</p>	<p>10 000 m² >20 000 m³ on both locations</p>	<p>Average height 2 m but it is on the slope.</p>	<p>Delivered waste quantity per day N/A</p>
<p>Description of the dumpsite</p>	<p><input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank</p> <p>Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990</p> <p><input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:)</p> <p><input type="checkbox"/> Others: No</p>		
<p>Available equipment, infrastructure and staff</p>	<p><input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others</p> <p><input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily</p>		
<p>Distance in meters to nearest</p>	<p>River <input checked="" type="checkbox"/> 5 meters <input type="checkbox"/> more than 5,000 meter</p> <p>Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter</p> <p>Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter</p> <p>Forest <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m.</p> <p>Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter</p> <p>Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Residential area <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter</p>		

**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:
Environmental impacts / remarks	In this area on the distance of no more than 500 meters there are two wild dumps. This area has been used for disposal of MSW and construction waste by the residents of Bogovinje and Selce village. It is located near the road and river on the slope of the mountain above the village. There are in fact a few -5-6 dumping locations within the sites which are used for dumping construction, household and garden waste. Located on the riverbanks they represent significant risk for the Bogovinje. Municipality of Bogovinje is taking care and trying to cover and clean the site but after cleanup there is dumping again. Since it is on a slope it could be risky under bad weather conditions. There is possibility for incidents (waste slides). Leachate is polluting the Bogovinje river.





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Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia



**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	1.10 Bogovinje Village on the road to Urvic vilage GPS coordinates: lat: 41.9293976 lng: 20.9167934		
Size of the waste area and amounts	1200 m ²	Average height 5 m	Delivered waste quantity per day N/A m ³
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	<p>This area has been used for disposal of construction waste. There is no significant active disposal anymore, but it is still used for dumping construction, household and garden waste from time to time. Municipality of Bogovinje is taking care to cover and clean it but there is dumping again. Since it is on the slope above the village, waste slides could occur during heavy rains and cause environmental and safety risk.</p>
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Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

2 Dumpsite Mapping Municipality of Brvenica

During the field identification of illegal landfills in the municipality of Brvenica carried out by a project representative with the assistance of a municipal representative, 8 illegal landfills have been identified as significant by the local LSG representative, although there are other smaller waste accumulations in each settlement that may be removed or rehabilitated without significant investments.



All sites are identified with the GPS coordinates and the type of waste that is disposed on each of them is identified. Additionally, approximate surface of the dumps site is assessed, as well as its position, risk level and period of exploitation.

On the google map below all 8 sites are presented as a POI. For each dump site an additional Information sheet is filled and photo documentation is presented.



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs,
Education and Research EAER
State Secretariat for Economic Affairs SECO

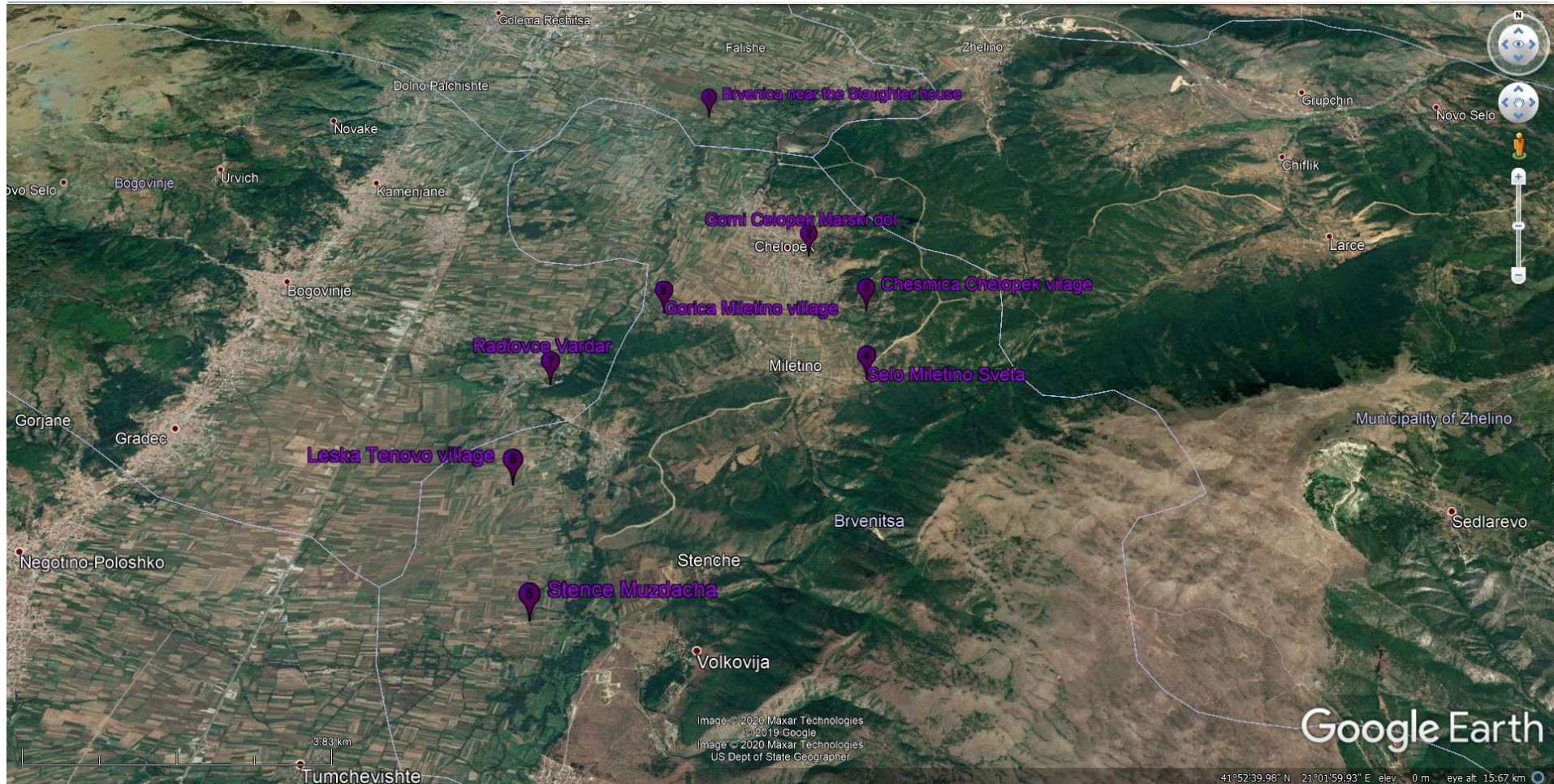


ЦЕНТАР ЗА РАЗВОЈ НА
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Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia



**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	2.1 Brvenica – Slaughterhouse GPS coordinates: lat: 41.9623469 lng: 20.9974089		
Size of the waste area and amounts	700 m ² 2 100 m ³	Average height 3 m	Delivered waste quantity per day m ³ N/A - it is not used any more
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2010 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input checked="" type="checkbox"/> Others: Bad visual effect		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 600 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 600 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	<p>This area has been used for disposal of construction waste. It is located near the local road mainly covered with asphalt. There is no intensive disposal anymore, but it is used for dumping construction and garden waste from time to time. It is located near a slaughterhouse owned by a private company at the distance of 300 meters. At the same distance of 300 meters, Vardar river is located to the east. The site is largely covered with vegetation because this parcel is abandoned. There is no significant environmental risks because it is mainly inert waste.</p>
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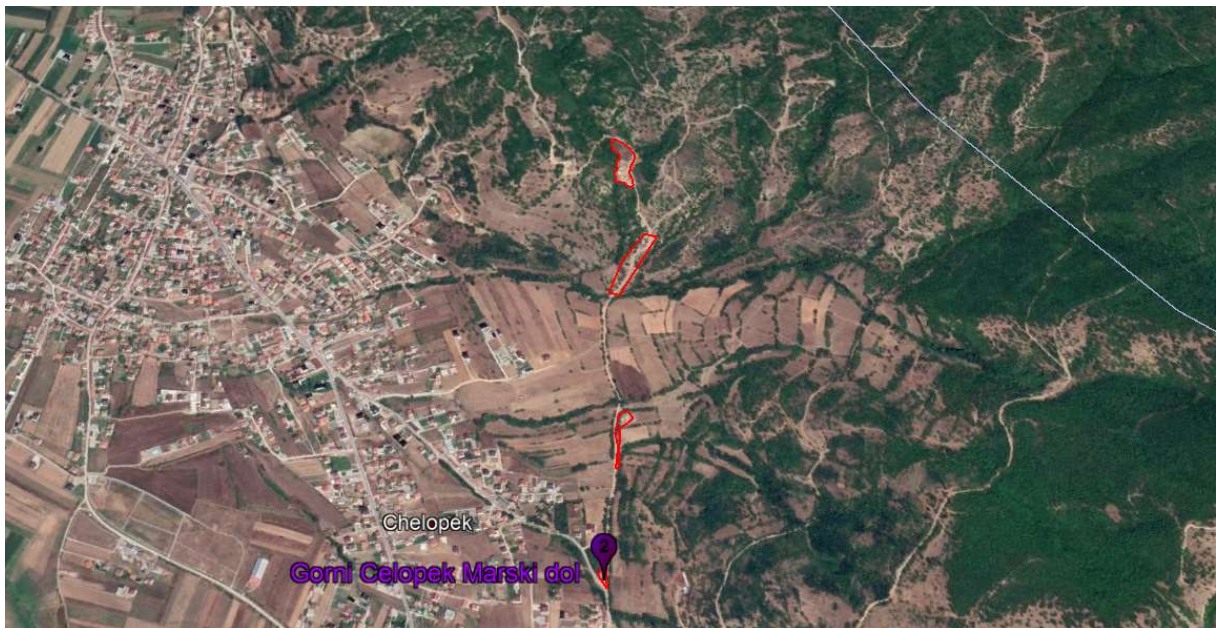
**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	2.2 Marski Dol - Celopek vilage GPS coordinates: lat: 41.9300086 lng: 21.0188667		
Size of the waste area and amounts	Few locations with 12 000 m ² 40 000 m ³	Average height 2 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input checked="" type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		



Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

<p>Environmental impacts / remarks</p>	<p>Dumpsite older than 30 years, located on the hills over Celopek village. Approach to this site is through local sandy road that can be used by tractors and heavy equipment, but not by car. There is still active dumping of construction waste, but amount per day of per annum cannot be estimated. No significant environmental risks. It has very bad visual effect. It is huge surface with poor vegetation covered with demolished construction materials.</p>
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	2.3 Cesmica – Celopek village GPS coordinates: lat: 41.9187857 lng: 21.0297482		
Size of the waste area and amounts	1 500 m ² 1 500 m ³	Average height 1 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input checked="" type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	MSW and C&D waste dumpsite older than 20 years located on the hill above Chelopek village. There is additional dumping from time to time. It has no significant environmental risks. Very bad visual effect. The surface is not big, and the height of waste is small.
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	2.4 Sveta – Miletino vilage GPS coordinates: lat: 41.9058368 vlng: 21.0291171		
Size of the waste area and amounts	4 000 m ² 4 000 m ³	Average height 1 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input checked="" type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental
impacts / remarks

MSW and Construction Waste dumpsite older than 30 years. It used by local households in the absence of SWM services. There is additional dumping from time to time. It is mainly construction waste historically dumped and covered with vegetation. There is no significant environmental impact or leachate, but it has very bad visual effects because of different construction materials and bags full with demolition waste and garden waste.



**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	2.5 Muzdaca – Stence village GPS coordinates: lat: 41.8679573 lng: 20.9729239		
Size of the waste area and amounts	16 000 m ² 20 000 m ³	Average height 1-1.5 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 2000 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 2000 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental
impacts / remarks

Dumpsite with Construction Waste and small amount of MSW, older than 30 years. Waste is generated by the neighbouring villages and located on agricultural land. There is still additional dumping from time to time. There is a presence of agricultural, green waste, even cardboard. There is no significant environmental impact or leachate visible. It has very bad visual impact because of its flat location.



**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	2.6 Leska – Tenovo Village GPS coordinates: lat: 41.8880515 lng: 20.9668096		
Size of the waste area and amounts	20 000 m ² 20 000 m ³	Average height 1 m	Delivered waste quantity per day N/A
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> 10 meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental
impacts / remarks

In this area there are few wild dumps. This area has been used for disposal of MSW and construction waste by the residents of Tenovo and other villages even from outside the Brvenica Municipality. There is no significant environmental impact since mainly construction waste is dumped, but the visual impact is very bad. Lots of plastic packaging waste was dumped not so long ago. This waste could be easily collected by an organised collector or the informal sector.



**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	2.7 Radiovce – near Vardar river GPS coordinates: lat: 41.9048311 lng: 20.9708443		
Size of the waste area and amounts	3 000 m ² 3 000 m ³ on both locations	Average height 1 m but it is on the river bank	Delivered waste quantity per day N/A
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 5 meters <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input checked="" type="checkbox"/> 10meter <input type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	<p>This area has been used for disposal of MSW and construction waste by the residents of Radiovce village. It is located near the road on the bank of the Vardar river near the bridge that leads to Radiovce village. Located on the riverbank it represents significant environmental and safety risk because of the possibility for flooding of the dumpsite area. Municipality of Brvenica has covered this dump on a few occasions but illegal dumping is going on. At the moment of the visit there were no significant amounts of newly dumped waste.</p>
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	2.8 Gorica – Miletino village GPS coordinates: lat: 41.9183254 lng: 20.9907531		
Size of the waste area and amounts	3500 m ² 7000 m ³	Average height 2 m	Delivered waste quantity per day N/A m ³
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 30 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	This area has been used for disposal of construction waste. There is no significant disposal anymore, but it is used for dumping construction, household and garden waste from time to time. There is mainly CD waste, so environmental risk is not significant. It is located on a hill over a flat area. The amount of waste is very difficult to assess because the site has been covered with soil few years ago.
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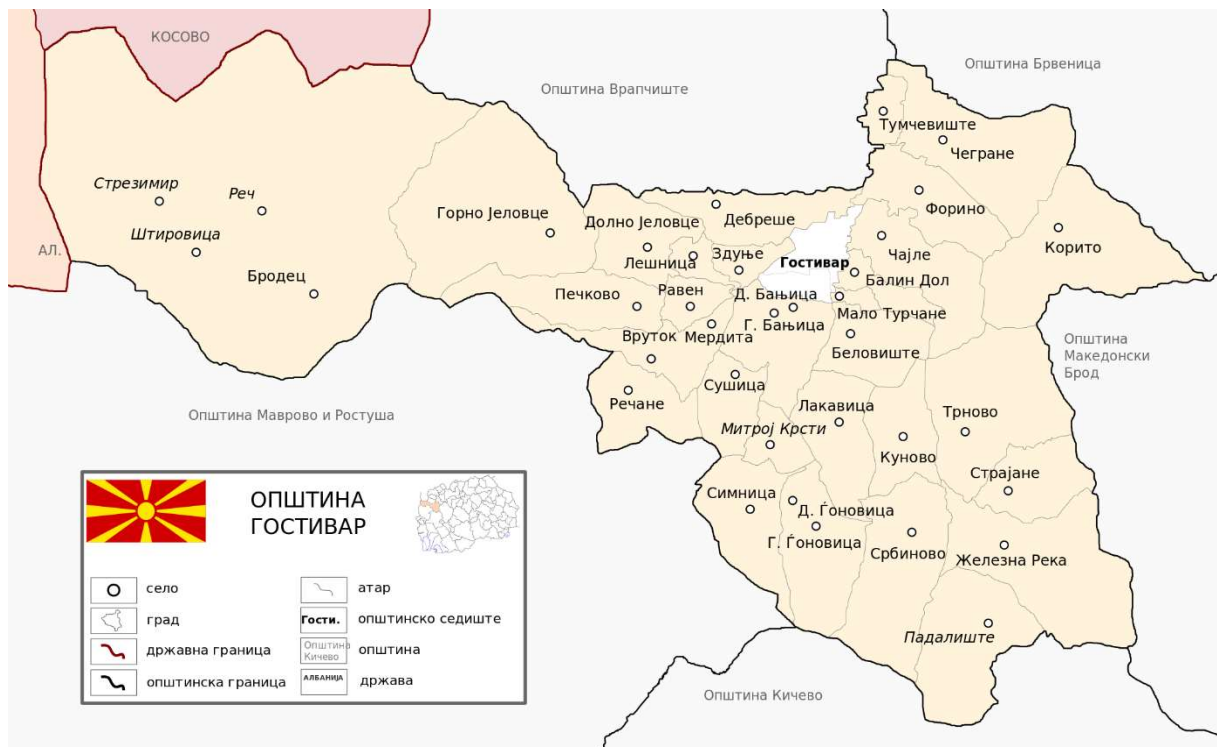




Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

3 Dumpsite Mapping Municipality of Gostivar

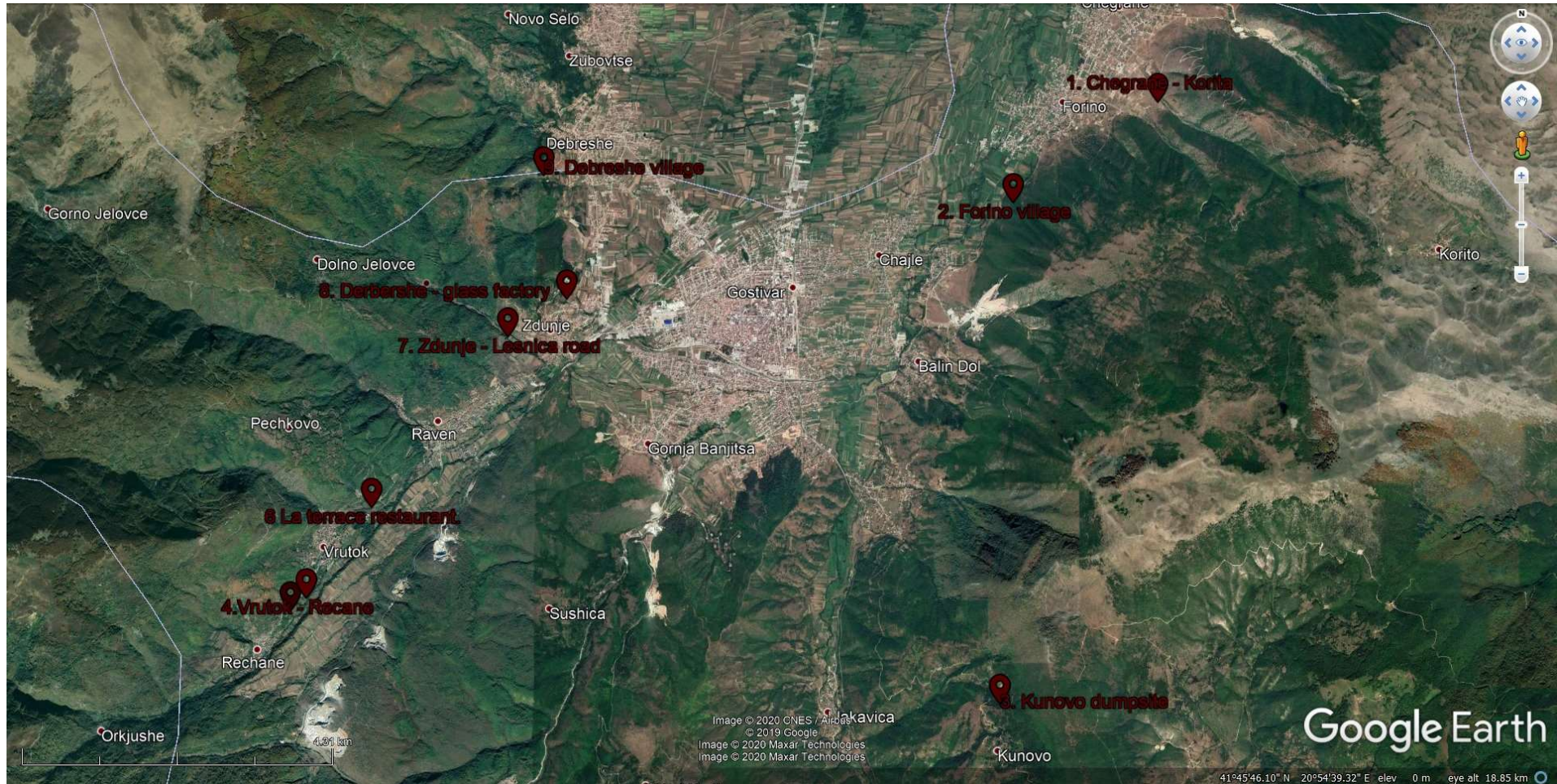
During the field identification of illegal landfills in the municipality of Gostivar carried out by a project representative with the assistance of a Gostivar municipality representative, 10 illegal landfills have been identified as significant by the local LSG representative, although there are other smaller waste accumulations in each settlement that may be removed or rehabilitated without significant investments.



All sites are identified with the GPS coordinates and the type of waste that is disposed on each of them is identified. Additionally, approximate surface of the dumps site is assessed, as well as its position, risk level and period of exploitation.

On the google map below all 10 sites are presented as a POI. For each dumpsite an additional Information sheet is filled and photo documentation presented.

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

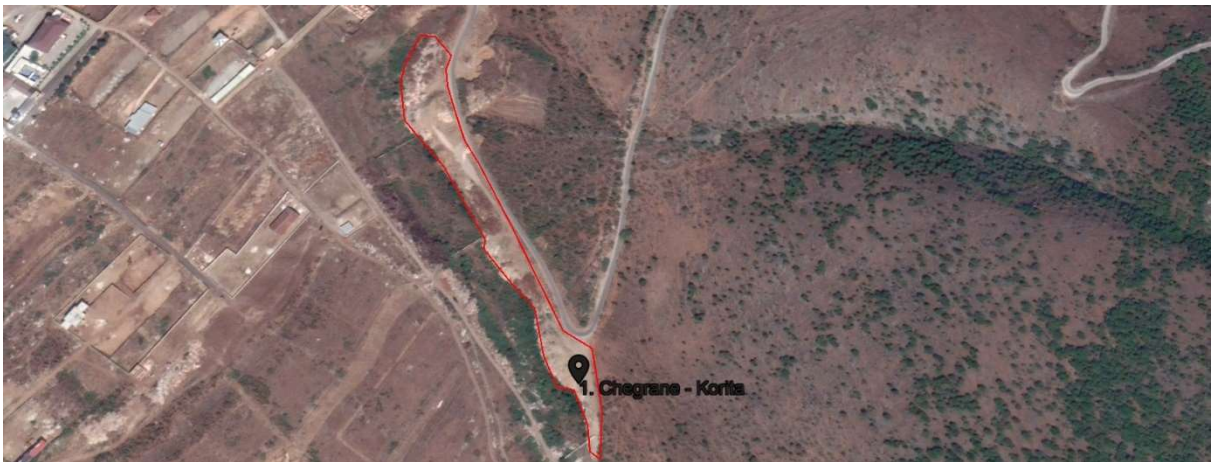


**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	3.1 Cegrane - Korita GPS coordinates: lat: 41.8261218lng: 20.9788453		
Size of the waste area and amounts	12 000 m ² 20 000 m ³	Average height 2 m	Delivered waste quantity per day m ³ N/A - it is not used any more
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	Big wild dump – mainly construction waste, but it attracts neighbouring households to dump MSW. It is located on the slope of the hill. Although it is very dry area, during heavy rains there is a possibility of the waste slides. Therefore there are some safety and environmental concerns but the risk is assessed not to be very significant.
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	<p>3.2 Forino over the village GPS coordinates: lat: 41.8129792 lng: 20.954115</p>		
Size of the waste area and amounts	<p>2500 m² 7000 m³</p>	Average height 2.5 m	<p>Delivered waste quantity per day m³ N/A – there is no data or monitoring</p>
Description of the dumpsite	<p><input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank</p> <p>Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990</p> <p><input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle)</p> <p><input type="checkbox"/> Others:</p>		
Available equipment, infrastructure and staff	<p><input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others</p> <p><input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily</p>		
Distance in meters to nearest	<p>River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 450 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 600 meter <input type="checkbox"/> more than 5,000 meter</p>		
Type of waste disposed	<p><input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste</p> <p><input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:</p>		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	Construction waste is dumped on the slope in the vicinity of the local dirt road linking the villages of Forino and Caile. The height is more than 2 meters, but it is obvious that no more waste is dumped here. Local community representatives have suggested that this waste should be cleared up because asphaltting is planned on the existing road. There is no major environmental risk at this location.
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	3.3 Kunovo dumpsite GPS coordinates: lat: 41.7498676 lng: 20.9521635		
Size of the waste area and amounts	1200 m ² 2400 m ³	Average height 2 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input checked="" type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input checked="" type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> 20 meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 1300 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 1500 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	<p>The illegal landfill in the village of Kunovo is the most remote location of Gostivar municipality. It was created due to the absence of a regular waste management service. It consists of construction and mixed municipal waste. Since it is located in a mountainous area and on a slope, it poses a significant environmental and safety risk due to the possibility of fire as well as its waste slides during heavy rains.</p>
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	<p>3.4 Vrutok – Recane 1 GPS coordinates: lat: 41.7618896 lng: 20.8354729</p> <p>3.5 Vrutok – Recane 2 GPS coordinates: lat: 41.760246 lng: 20.8328588</p>		
Size of the waste area and amounts	<p>First loc. 860 m²</p> <p>Second 1200 m²</p> <p>In total around 6000 m³</p>	Average height 2 - 3 m	<p>Delivered waste quantity per day m³</p> <p>N/A – there is no data or monitoring</p>
Description of the dumpsite	<p><input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/></p> <p>In river bed <input type="checkbox"/> On river bank</p> <p>Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Used since (year) 2000</p> <p><input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle)</p> <p><input type="checkbox"/> Others:</p>		
Available equipment, infrastructure and staff	<p><input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others</p> <p><input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily</p>		
Distance in meters to nearest	<p>River <input checked="" type="checkbox"/> 150 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter</p> <p>Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter</p> <p>Forest <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m.</p> <p>Main road <input checked="" type="checkbox"/> 20 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Protected area <input checked="" type="checkbox"/> 3000 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Single residential house <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Residential area <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter</p>		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:
Environmental impacts / remarks	<p>Both dumps are located between the villages of Vrutok and Recane on the left side of the Vardar River. Construction and municipal waste from both villages are combined. They are located on slopes in a mountainous area and they have potential for environmental and safety incidents because of the risk of waste sliding downhill during heavy rainfall which is typical of this part of Polog. The potential for waste and leachate pollution is quite large, especially for the upper flow of the Vardar River.</p>



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Information Sheet for Dumpsites in the Polog Region, North Macedonia

Location of the dumpsite	3.6 La Terrace restaurant GPS coordinates: lat: 41.7733081 lng: 20.8460228		
Size of the waste area and amounts	2500 m ² 2500 m ³	Average height 1 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2010 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> 20 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input checked="" type="checkbox"/> 4000 meter <input type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input checked="" type="checkbox"/> Other: Bulky waste		

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Information Sheet for Dumpsites in the Polog Region, North Macedonia**

<p>Environmental impacts / remarks</p>	<p>The wild dump located near the La Teraza restaurant contains construction and bulky waste, mainly furniture. This landfill does not exist long and was created after the restaurant opened, meaning less than 5 years. However, as it is on a slope and in a mountainous area and because of the possibility of sliding waste, it has a safety risk as well as an environmental risk for the village of Raven which is approximately 1000 meters away.</p>
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	3.7 Zdunje – Lesnica road GPS coordinates: lat: 41.795053 lng: 20.8683534		
Size of the waste area and amounts	1500 m ² 5000 m ³	Average height 1-5 m but it is on the slope.	Delivered waste quantity per day N/A
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: wild, dogs, cats...) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	This illegal dump is located on the road between the villages of Zdunje and Lesnica. It is located in a mountainous area and on a steep slope. It consists of construction and municipal waste in which there is a visible presence of large quantities of packaging waste. It is a safety risk and environmental because in heavy rain conditions the waste can move to the village of Zdunje. There is no visible leachate and great potential for environmental pollution in stabile conditions.
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	3.8 Debreshe – glass factory GPS coordinates: lat: 41.7999555 lng: 20.8782313		
Size of the waste area and amounts	14 000 m ² >10 000 m ³	Average height 1 m.	Delivered waste quantity per day N/A
Description of the dumpsite	<input type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: all kind of domestic animals) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> meters <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input checked="" type="checkbox"/> Other: Bulky waste		
Environmental impacts / remarks	This wild dump is located on a plateau in the mountains above the village of Debreshe. The site leads to the asphalt road and a short section of dirt road		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

accessible to heavy and off-road vehicles, but not to light vehicles. Obviously, there is a large amount of construction and a minimal amount of bulky waste. The plateau has a large surface area that is not fully filled. Construction waste is managed by construction machinery and does not pose a significant environmental risk, nor does it have the potential for safety impacts.



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Information Sheet for Dumpsites in the Polog Region, North Macedonia

Location of the dumpsite	3.9 Debreshe vilage GPS coordinates: lat: 41.8156936 lng: 20.8738664		
Size of the waste area and amounts	1200 m ²	Average height 2 m	Delivered waste quantity per day N/A m ³
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2010 <input checked="" type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental
impacts / remarks

This wild dump is located in a mountain range on a steep slope leading to a dirt road difficult to access by light vehicles. It is mainly used for construction waste, but the presence of packaging waste is also evident. It is not an significant environmental risk, but it has a very poor visual impact. Nearby is a forest of excellent condition which attractiveness is affected by illegal dumping.



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4 Dumpsite Mapping Municipality of Jegunovce

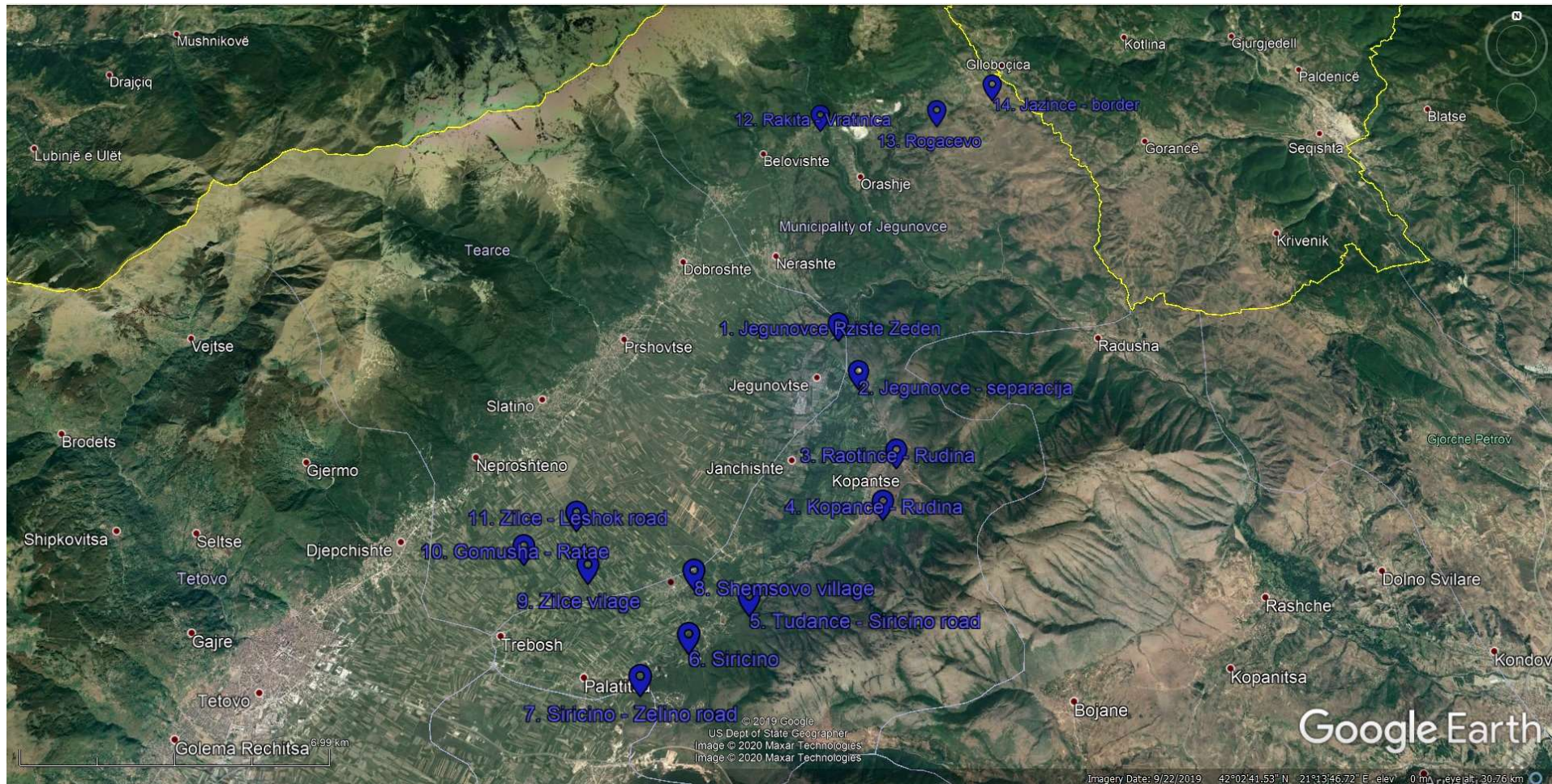
During the field identification of illegal landfills in the Municipality of Jegunovce carried out by a project representative with the assistance of a Jegunovce municipality representative, 14 most significant illegal landfills have been identified as significant by the M. of Jegunovce representative, although there are other smaller waste accumulations in each settlement that may be removed or rehabilitated without significant investments.



All sites are identified with the GPS coordinates and the type of waste that is disposed on each of them is identified. Additionally, approximate surface of the dumps site is assessed, as well as its position, risk level and period of exploitation.

On the google map below all 14 sites are presented as a POI. For each dump site and additional Information sheet is filled and photo documentation presented.

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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	4.1 Rziste - Zeden GPS coordinates: lat: 42.0863205 lng: 21.1288504		
Size of the waste area and amounts	4000 m ² 4000 m ³	Average height 1 m	Delivered waste quantity per day m ³ N/A - it is not used any more
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle, dogs) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input checked="" type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 300 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 3000 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 3000 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

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<p>Environmental impacts / remarks</p>	<p>This site is located on the banks of the river Vardar, near the water supply area of the Zeden massif. It contains construction waste from neighbouring settlements. To the site leads a sandy road made by the company that manages the limestone extraction concession near the illegal dumpsite. The site do not have significant environmental risk because only inert waste has been dumped. But, since it is on the river bank of Vardar river, it has the potential to cause some impact during heavy rain periods. The area may be flooded and waste may be washed away.</p> <p>Note: Near the dumpsite's location, on the other side of Vardar river, an industrial waste landfill is located on which, historically, waste has been landfilled from the company Jugohrom. This company has dumped large quantities of waste containing hexavalent chromium. This industrial landfill is under the responsibility of the Ministry of Environment and Physical Planning and not subject of this mapping exercise.</p>
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	<p>4.2 Jegunovce near the limestone separation GPS coordinates: lat: 42.0737632 lng: 21.1349627</p>		
Size of the waste area and amounts	<p>1500 m² 1500 m³</p>	Average height 1 m	<p>Delivered waste quantity per day m³ N/A – there is no data or monitoring</p>
Description of the dumpsite	<p><input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle, dogs, wild animals) <input type="checkbox"/> Others:</p>		
Available equipment, infrastructure and staff	<p><input type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input checked="" type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily</p>		
Distance in meters to nearest	<p>River <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 450 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter</p>		
Type of waste disposed	<p><input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:</p>		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	<p>This site is located on the banks of the river Vardar, near the water supply area of the Zeden massif. It contains construction waste from neighbouring settlements. To the site leads a sandy road made by the company that manages the limestone extraction concession near to the illegal dumpsite. Both household and construction waste is identified, as well as agricultural biodegradable waste. There is no visible leachate, but there is possibility for leachate to be generated. Since this dump is located on the Vardar riverbank, it has potential to pollute the river especially during heavy rain season.</p>
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	4.3 Raotince - Rudina GPS coordinates: lat: 42.0540575 lng: 21.1459084		
Size of the waste area and amounts	4-5000 m ² 2-4000 m ³	Average height 1 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle, dogs) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> 500 meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 150 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste		

**Solid Waste Management in Polog Region, North Macedonia, Phase I
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	<input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:
Environmental impacts / remarks	<p>This wild dump is located a short distance from the village of Raotince, almost next to the houses. It is connected to an earthen road, which is connected by an asphalt road. It is evident that there is construction and municipal waste with a large amount of packaging waste and biodegradable waste. The amount of waste is not large and landfill leachate has not been observed. There is no great safety or environmental risk but the risk may increase if dumping continues.</p>



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Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	4.4 Kopance - Rudina GPS coordinates: lat: 42.0417512 lng: 21.1414531		
Size of the waste area and amounts	8000 m ² 20 000 m ³	Average height 2 - 3 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input checked="" type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle, dogs, cats) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> 600 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 600 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	<p>This illegal dump is located on the hill above the village of Kopance. It is connected to a dirt road that leads to the asphalt road to the village. Used for a long time and covered several times. Often there was a fire. As it is covered with soil, it is not possible to determine the exact amount of waste. Mixed municipal waste and construction waste are generally disposed of. There is no visible leachate, but given the amount and period of use, it is possible to have a negative impact on the groundwater, although the substrate is clay and the area is dry.</p>
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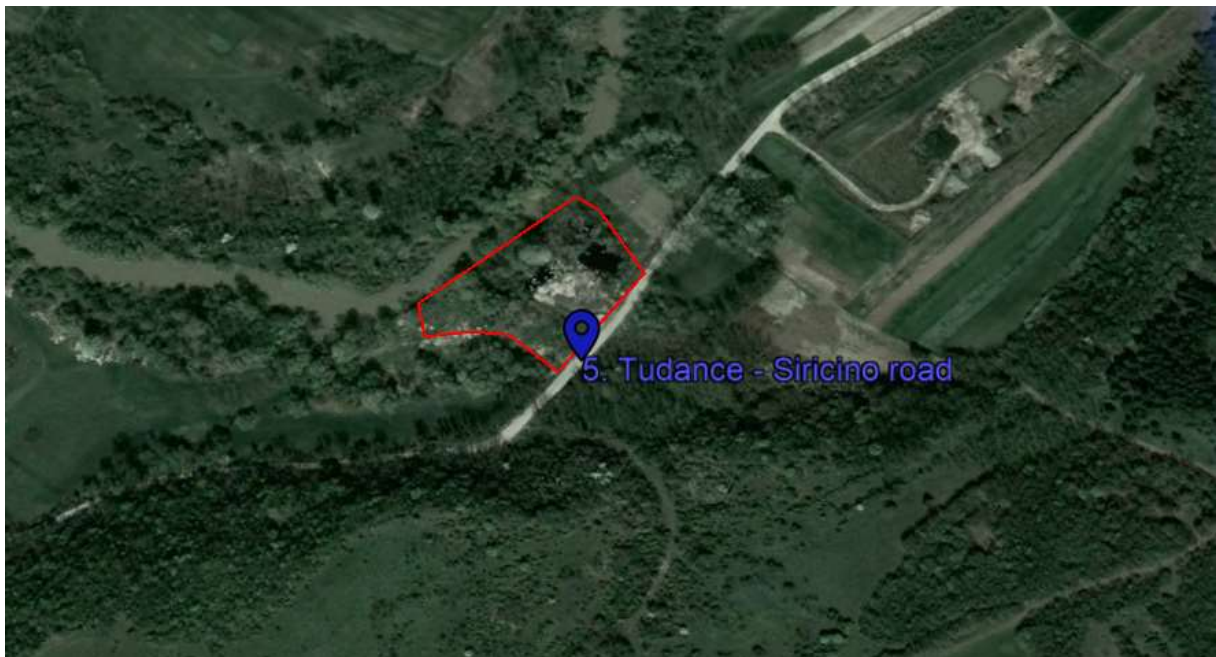
**Solid Waste Management in Polog Region, North Macedonia, Phase I
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Location of the dumpsite	4.5 Tudance – Siricino road GPS coordinates: lat: 42.0197785 lng: 21.1024329		
Size of the waste area and amounts	5 000 m ² 10 000 m ³	Average height 1 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input checked="" type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle, dogs, cats) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 20 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> 4000 meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input checked="" type="checkbox"/> Other: Bulky waste, Packaging waste		

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Environmental
impacts / remarks

This wild dump is located on the bank of the Vardar River and up the asphalt road that connects the villages Tudance and Siricino. It mainly consists of municipal and construction waste, but it is also visible that there is a large amount of packaging waste. Given that there is a large amount of biodegradable waste, it is certain that there is landfill leachate going directly into the Vardar River, given its proximity. The site pose **significant risks** as it is exposed to floods and can affect surface and groundwater in the area.



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Location of the dumpsite	4.6 Siricino GPS coordinates: lat: 42.0114727 lng: 21.086556		
Size of the waste area and amounts	17 500 m ² 10 000 m ³	Average height 1-2 m.	Delivered waste quantity per day N/A
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: wild, dogs, cats...) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 250 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input checked="" type="checkbox"/> Other: Bulky waste		



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<p>Environmental impacts / remarks</p>	<p>This illegal landfill is located in the vicinity of the village of Siricino on the bank of the Vardar River, on a flat surface subject to flooding. Although it covers a large area that is not completely covered with waste, it is evident that it is mainly construction waste, but also contains bulky waste, furniture pieces and small amounts of packaging waste. Although there is no visible discharge of leachate nor potential for its generation, however the site is part of the flood area of the Vardar River and presents a serious safety risk.</p>
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Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	4.7 Siricino – Zelino road GPS coordinates: lat: 42.0024442 lng: 21.0725167		
Size of the waste area and amounts	3 000 m ² 3 000 m ³	Average height 1 m.	Delivered waste quantity per day N/A
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: all kind of domestic anilams) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 10 meters <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 800 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 2000 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input checked="" type="checkbox"/> Other: Bulky waste		

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Environmental impacts / remarks	This wild dump is located on the bank of the Vardar River close to the local asphalt road from Siricino to Zelino. Construction waste is often disposed of, often cleaned or covered by the authorities, but due to its location and the habit of the local population, an illegal dump is being maintained which poses a safety risk due to the danger of flooding and the potential downstream movement of waste by the river Vardar.
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Location of the dumpsite	4.8 Semsevo vilage GPS coordinates: lat: 42.0254362 lng: 21.0863397		
Size of the waste area and amounts	5 000 m ² 20 000 m ³	Average height 4-5 m	Delivered waste quantity per day N/A m ³
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input checked="" type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input checked="" type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind: domestic – dogs, cats) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input checked="" type="checkbox"/> 20 meter <input type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 1 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste		

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Environmental
impacts / remarks

This wild dump is located in a mountain range on a steep slope leading to a dirt road difficult to access by light vehicles. It is mainly used for construction waste, but the presence of packaging waste is also evident. It is not an environmental risk, but it has a very poor visual impact. Nearby is a forest of excellent condition which attractiveness is affected by illegal dumping.



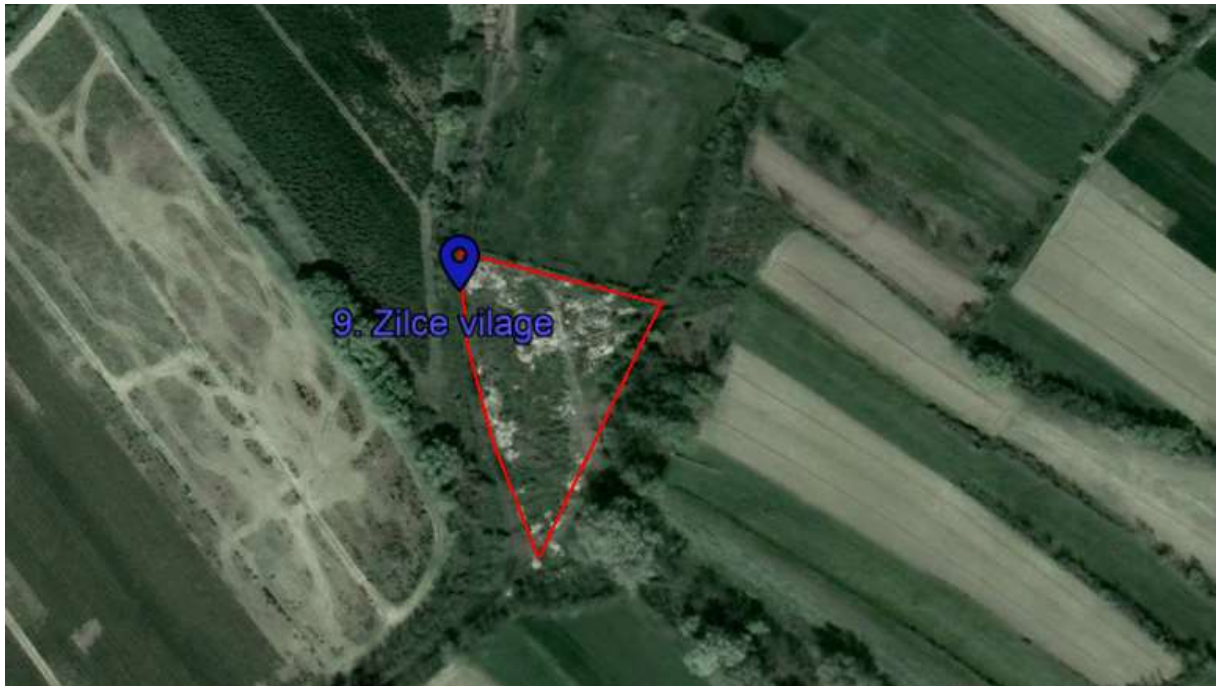
**Solid Waste Management in Polog Region, North Macedonia, Phase I
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Location of the dumpsite	4.9 Zilce vilage GPS coordinates: lat: 42.026502 lng: 21.0555771		
Size of the waste area and amounts	5 000 m ² 5 000 m ³	Average height 1 m.	Delivered waste quantity per day N/A
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input checked="" type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: all kind of domestic animals) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 3000 meters <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input checked="" type="checkbox"/> Other: Bulky waste, agricultural waste		
Environmental impacts / remarks	This wild dump is located near the Zilce village in the flat area. A sandy road which is connected to the asphalt road leads to the dump. There is		



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construction and agricultural, biodegradable waste present. There is no visible leachate. Although it has very bad visual effect, there is no significant environmental or safety risk.



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Location of the dumpsite	4.10 Ratae village - Gomusa GPS coordinates: lat: 42.0306342 lng: 21.0365007		
Size of the waste area and amounts	1 000 m ² 1 000 m ³	Average height 1 m.	Delivered waste quantity per day N/A
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: all kind of domestic animals) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> 10 meters <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> 10 meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 150 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 150 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input checked="" type="checkbox"/> Other: Biodegradable, agricultural waste		
Environmental impacts / remarks	This wild dump is located near of the Ratae village and contains household and agricultural waste. It is located in the area of intensive agricultural		



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activities. Due to its small size and volume, it is not significant by its environmental impacts. There is no visible leachate. There is no big potential for negative environmental impacts although it has very bad visual impact



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Location of the dumpsite	4.11 Zilce – Leshok road GPS coordinates: lat: 42.0384954 lng: 21.0510665		
Size of the waste area and amounts	1 500 m ² 1 500 m ³	Average height 1 m.	Delivered waste quantity per day N/A
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: all kind of domestic animals) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> ... meters <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> 10 meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 800 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 2000 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input checked="" type="checkbox"/> Other: Bulky waste		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

<p>Environmental impacts / remarks</p>	<p>This wild dump is located near the local road from Zilce to Leshok village. It is located along a sandy road that leads to the agricultural land. It mainly consists of MSW generated by local residents. The amount is small and there is no visible leachate nor other negative impacts. There is a significant percentage of packaging waste. It is not an environmental hazard but it does cause visual impact.</p>
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Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	4.12 Vratnica - Rakita river bridge GPS coordinates: lat: 42.1467053 lng: 21.1235547		
Size of the waste area and amounts	6 000 m ² 24 000 m ³	Average height 4-6 m.	Delivered waste quantity per day N/A
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input checked="" type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Used since (year) 2000 <input checked="" type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input checked="" type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: all kind of domestic animals) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 10 meters <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 20 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input checked="" type="checkbox"/> Other: Bulky waste, green waste		
Environmental impacts / remarks	This illegal dumpsite is located near the Rakita River bridge on the Tetovo-Jazhince road. It is located on the slope on the right side of the river and due		



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to the steep slope much of the waste that is dumped here slides downward and causes pollution. Due to the steep slope of the terrain, the site is difficult to access for clearing machinery. It is mainly mixed municipal waste with small amounts of construction waste. **Leachate is not visible, but given the large amount of landfilled waste and the long period of dumping, risks of environmental impacts and the risk of safety accidents are high.**



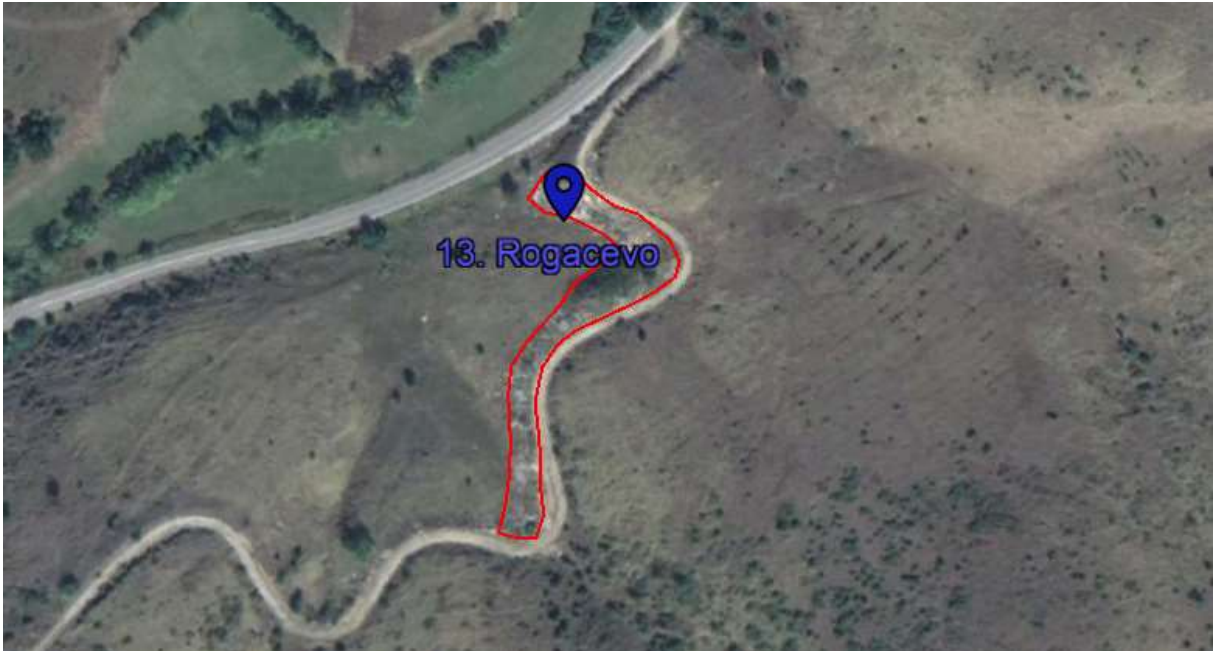
**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	4.13 Rogacevo GPS coordinates: lat: 42.1484682 lng: 21.1635132		
Size of the waste area and amounts	2 000 m ² 2 000 m ³	Average height 1 m.	Delivered waste quantity per day N/A
Description of the dumpsite	<input type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: all kind of domestic animals) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> ...meters <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> 50 meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 1500 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		
Environmental impacts / remarks	This wild dump is located in the mountainous area near Tetovo-Jazince road. It is located near a sandy mountain road. It is mainly construction and MSW		



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	<p>generated by nearby households. The area is very dry and there are no signs of leachate. It does not have big environmental and security risk</p>
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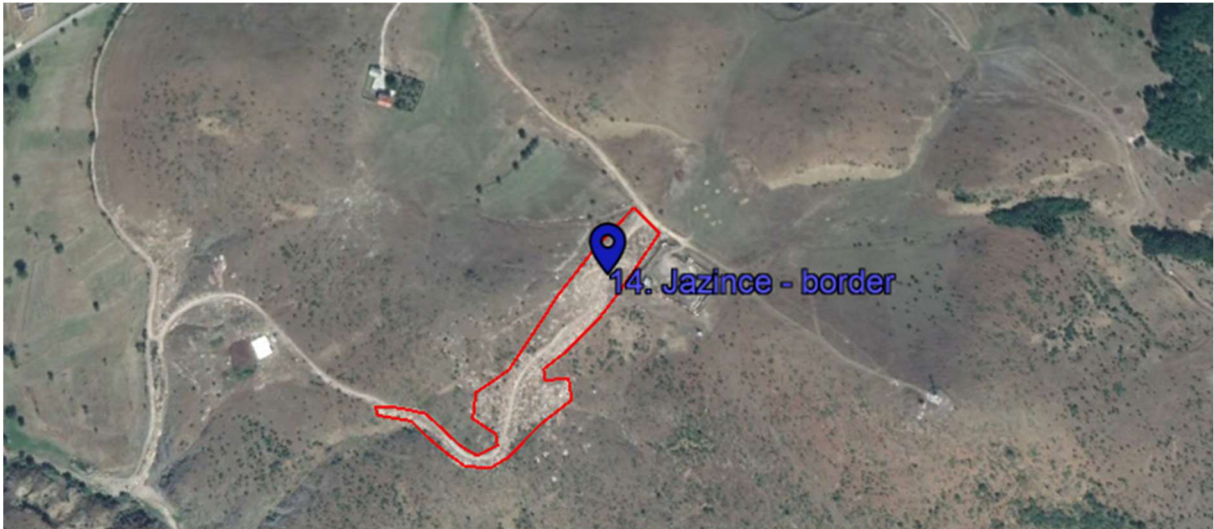
**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	4.14 Jazince - border GPS coordinates: lat: 42.156846 lng: 21.1832167		
Size of the waste area and amounts	15 000 m ² 30 000 m ³	Average height 2 m.	Delivered waste quantity per day N/A
Description of the dumpsite	<input type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> 10 meters <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> ... meter <input type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> 50 meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		
Environmental impacts / remarks	This wild dump is located near the army object on the border between Macedonia and Kosovo. There is road that leads directly to the dump. It		



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contains only construction waste and does not have significant environmental impact or risk. The visual effect is significant but since it is on the border the location is not attractive for visitors.

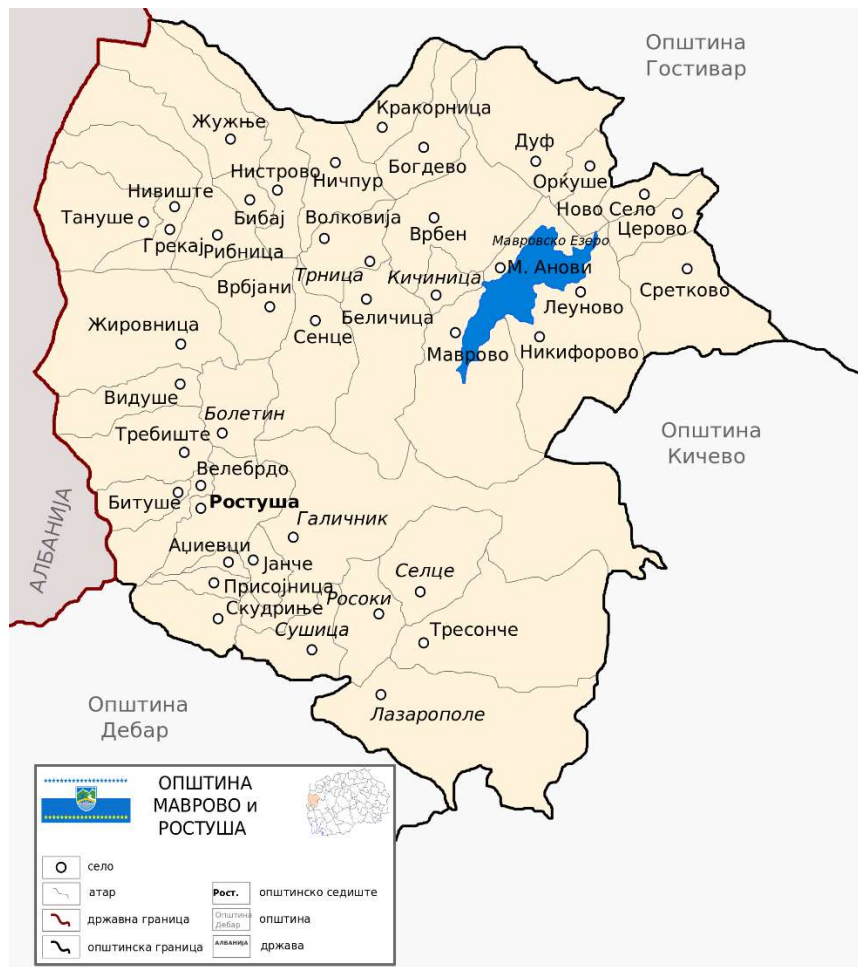




Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

5 Dumpsite Mapping Municipality of Mavrovo and Rostushe

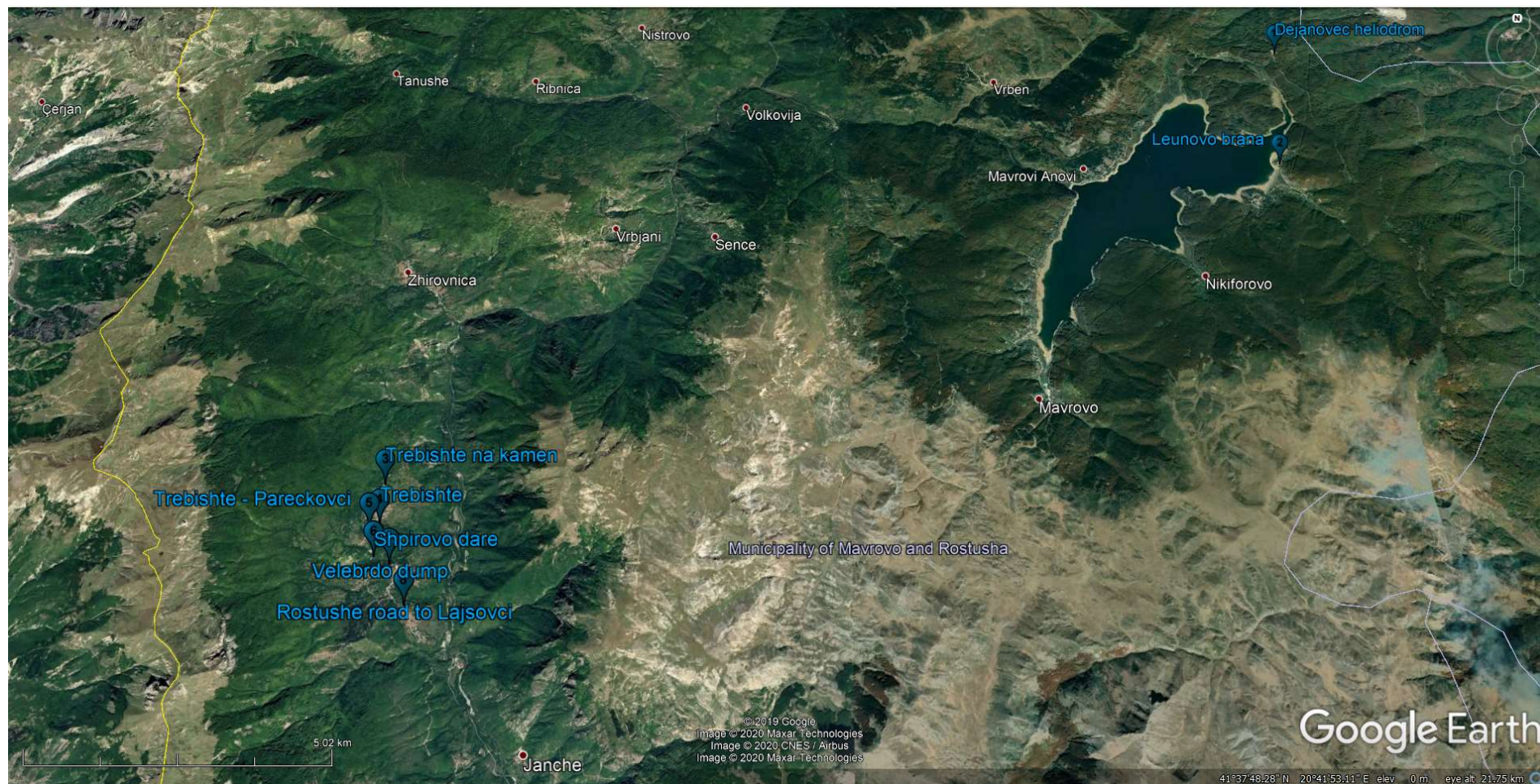
During the field identification of illegal landfills in the municipality of Mavrovo and Rostushe carried out by a project representative with the assistance of a Mavrovo and Rostushe municipality representative, 8 illegal landfills have been identified as significant by the local LSG representative, although there are other smaller waste accumulations in each settlement that may be removed or rehabilitated without significant investments.



All sites are identified with the GPS coordinates and the type of waste that is disposed on each of them is identified. Additionally, approximate surface of the dumps site is calculated, as well as its position, risk level and period of exploitation.

On the google map below all 8 sites are presented as a POI. For each dump site additional Information sheet is filled as well as photo documentation presented.

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Location of the dumpsite	5.1 Dejanovec heliodrom GPS coordinates: lat: 41.7309003 lng: 20.8048125		
Size of the waste area and amounts	5 800 m ² 11 000 m ³	Average height 2 m	Delivered waste quantity per day m ³ N/A - it is not used any more
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: Wild animals) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input checked="" type="checkbox"/> 1,400 meter <input type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input checked="" type="checkbox"/> 0 meter <input type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

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Environmental
impacts / remarks

This wild dump is located at the protected area - National Park Mavrovo and it contains a lot of construction waste which is generated by nearby residents. Sandy road connected with the asphalt road leads to this wild dump. Having in mind that it contains only construction waste this dump does not represent a significant environmental risk. It is located more than one kilometre from Mavrovo Lake and the nearest settlements although it is located in national park. Additionally, this location is used as an heliodrome, so it may need to be controlled and cleared for this reason.



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Location of the dumpsite	5.2 Leunovo Dam GPS coordinates: lat: 41.7024594 lng: 20.7996293		
Size of the waste area and amounts	7 000 m ² 14 000 m ³	Average height 2 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2010 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Wild Animals <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input checked="" type="checkbox"/> 150 meter <input type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 20meter <input type="checkbox"/> more than 5,000 meter Protected area <input checked="" type="checkbox"/> 0 meter <input type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 600 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 600 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		



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<p>Environmental impacts / remarks</p>	<p>Construction waste is dumped in a clay pit - exploitation site. It is located in protected area of NP Mavrovo. It has been used for a long time and covered a few times, so no large amount of waste is visible. Mainly it is construction waste, but there is bulky waste as well. No visible signs of leachate of other kind of pollutants. Although it is located in NP, it does not have significant environmental impact.</p>
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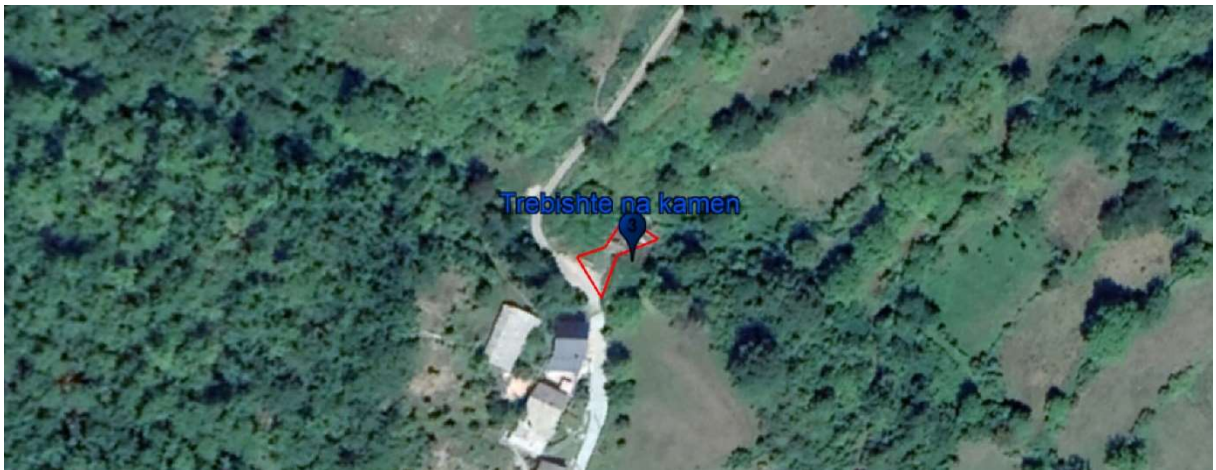


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Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	5.3 Trebishte Kamen GPS coordinates: lat: 41.6330973 lng: 20.5894945		
Size of the waste area and amounts	250 m ² 1000 m ³	Average height 5 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input checked="" type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: domestic and wild, bears sometimes) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> 20 meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> 50 meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste		

**Solid Waste Management in Polog Region, North Macedonia, Phase I
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	<input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:
Environmental impacts / remarks	<p>This illegal landfill is located above the village of Trebiste, on a slope in a mountainous area. It mainly contains construction and municipal waste. Although the amount of waste dumped is not large, as it is located in a national park, on a slope that does not guarantee stability and is exposed to the access of wild and domestic animals, it poses an environmental and safety risk. During heavy rains a waste slide may occur moving the waste into the lower parts of the village.</p>

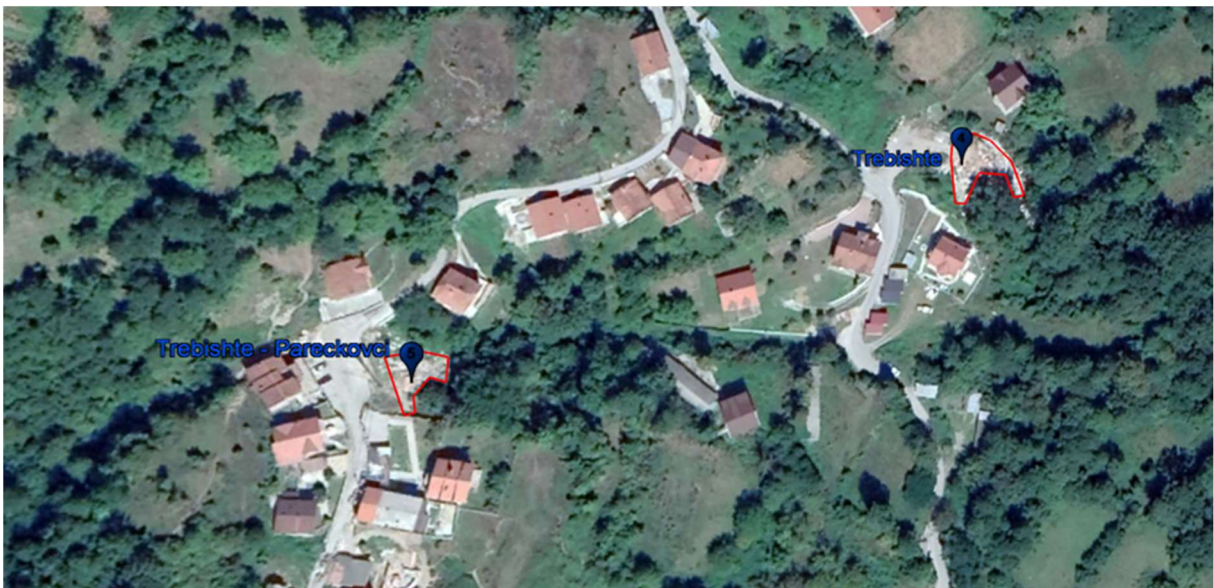


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Location of the dumpsite	<p>5.4 Trebishte GPS coordinates: lat: 41.6259091 lng: 20.5898954</p> <p>5.5 Trebishte - Pareckovci GPS coordinates: lat: 41.6251844 lng: 20.5878269</p>		
Size of the waste area and amounts	<p>First loc. 500 m²</p> <p>Second loc. 300 m²</p> <p>In total around 2000 to 3000 m³</p>	Average height 0 - 5 m	<p>Delivered waste quantity per day m³</p> <p>N/A – there is no data or monitoring</p>
Description of the dumpsite	<p><input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/></p> <p>In river bed <input type="checkbox"/> On river bank</p> <p>Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Used since (year) 2000</p> <p><input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle)</p> <p><input type="checkbox"/> Others:</p>		
Available equipment, infrastructure and staff	<p><input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others</p> <p><input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily</p>		
Distance in meters to nearest	<p>River <input checked="" type="checkbox"/> 1500 <input type="checkbox"/> more than 5,000 meter</p> <p>Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter</p> <p>Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter</p> <p>Forest <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m.</p> <p>Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Protected area <input checked="" type="checkbox"/> 0 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Single residential house <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter</p> <p>Residential area <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter</p>		

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<p>Type of waste disposed</p>	<p><input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:</p>
<p>Environmental impacts / remarks</p>	<p>Both locations are located within the village of Trebiste. Location 4 Trebishte is a wild landfill where it serves as a location where the municipal utilities containers are located. This site is regularly cleaned and upgraded and does not pose a significant threat to the environment. It is significant that there are churches and mosques in the immediate vicinity, so it is an unpleasant sight for visitors.</p> <p>The Pareckovci site is also located in the village itself on a slope between individual houses. It does not have a large surface but due to the slopes there is a risk of waste sliding under heavy rain.</p>



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Location of the dumpsite	<p>5.6 Shpirovo dare GPS coordinates: lat: 41.620275096777 lng: 20.589834339917</p>		
Size of the waste area and amounts	<p>300 m² 2-3000 m³</p>	Average height 10 m	<p>Delivered waste quantity per day m³ N/A – there is no data or monitoring</p>
Description of the dumpsite	<p><input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank</p> <p>Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2010</p> <p><input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Wild Animals (list what kind: cattle, wild animals)</p> <p><input type="checkbox"/> Others:</p>		
Available equipment, infrastructure and staff	<p><input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others</p> <p><input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily</p>		
Distance in meters to nearest	<p>River <input type="checkbox"/> 1500 meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> 20 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter Protected area <input checked="" type="checkbox"/> <input type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 250meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 250 meter <input type="checkbox"/> more than 5,000 meter</p>		
Type of waste disposed	<p><input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste</p> <p><input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:</p>		

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Environmental impacts / remarks	<p>This wild dump is located above the village of Velebrdo, on a slope in a mountainous area on the road to Trebishte. It mainly contains construction and municipal waste. Although the amount of waste dumped is not large, as it is located in a national park, on a slope that does not guarantee stability and is exposed to the access of wild and domestic animals, it poses an environmental and safety risk. During heavy rains it can slide and the waste may be moved to the lower parts of the village.</p>
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Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Location of the dumpsite	5.7 Velebrdo dump GPS coordinates: lat: 41.6190615 lng: 20.5934114		
Size of the waste area and amounts	2 000 m ² 10 000 m ³	Average height 1-5 m but it is on the slope.	Delivered waste quantity per day N/A
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: wild, dogs, cats...) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter Protected area <input checked="" type="checkbox"/> 0 meter <input type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		
Environmental impacts / remarks	This wild is located above the village of Velebrdo, on a slope near the road in a mountainous area. Slope leads to the mountain river which can be polluted by the waste. It mainly contains construction and municipal waste.		



Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Although the amount of waste dumped is not large, as it is located in a national park, on a slope that does not guarantee stability and is exposed to the access of wild and domestic animals, it poses an **environmental and safety risk**. During heavy rains waste slides may occur and the waste may end up in the river and where it will cause pollution. There is no visible leachate but the possibility for it to be generated is substantial, having in mind that mainly municipal waste is dumped.



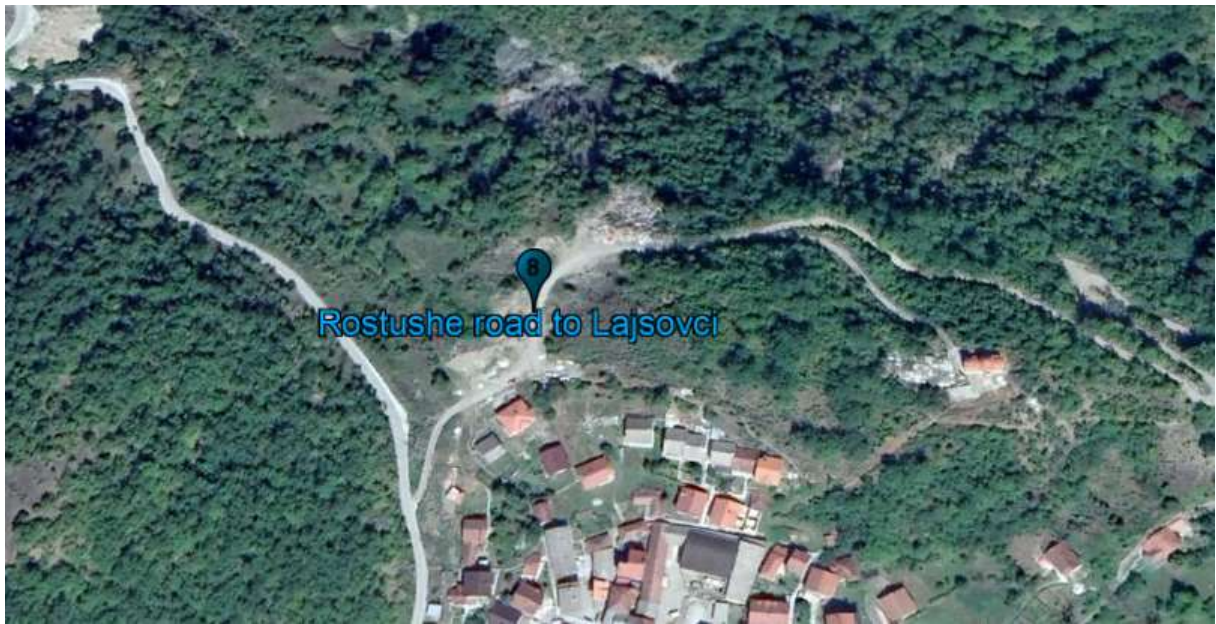
**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	5.8 Rostushe road to Lajsovci GPS coordinates: lat: 41.6122475 lng: 20.5979147		
Size of the waste area and amounts	1 300 m ² 4 000 - 5000 m ³	Average height 3 m.	Delivered waste quantity per day N/A
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2010 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: all kind of domestic animals) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 1500 meters <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter Protected area <input checked="" type="checkbox"/> meter <input type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input checked="" type="checkbox"/> Other: Bulky waste		
Environmental impacts / remarks	This wild dump is located above the village of Rostushe, on a slope in a mountainous area. It mainly contains construction and municipal waste.		



Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

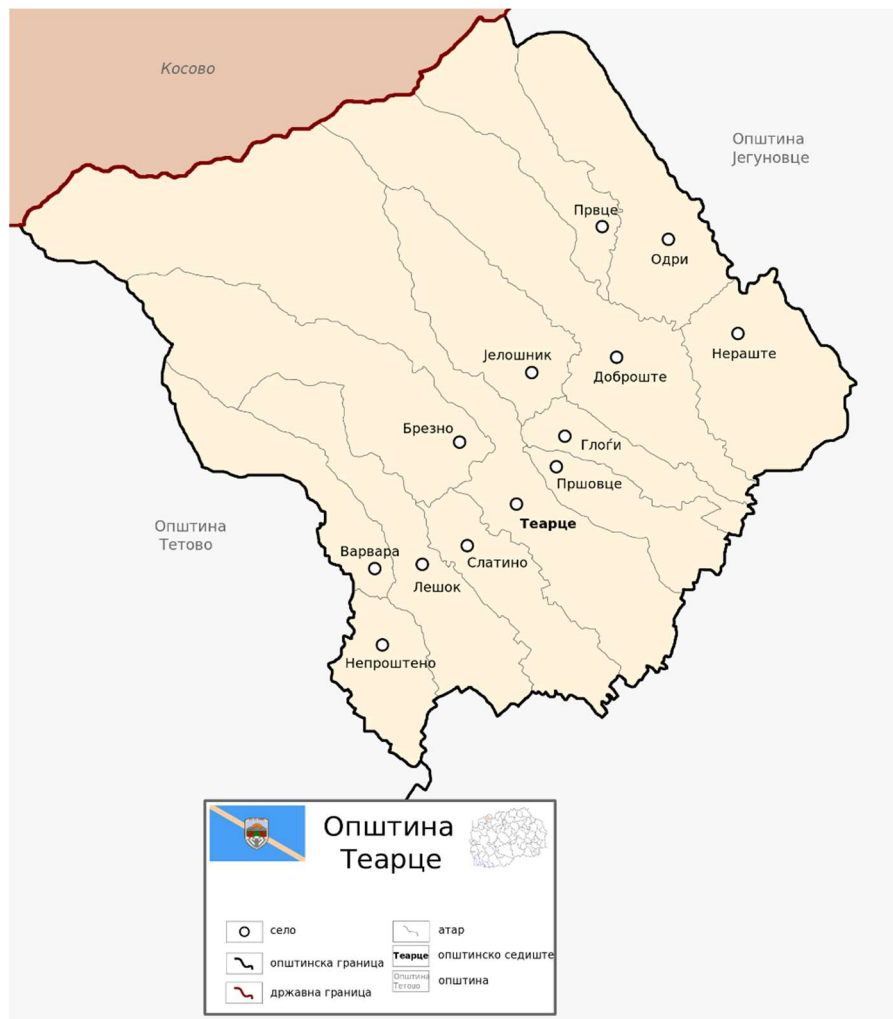
Although the amount of waste dumped is not large, as it is located in a national park, on a slope that does not guarantee stability and is exposed to the access of wild and domestic animals, it poses an **environmental and safety risk**. During heavy rains it can slide and distribute the waste to the lower parts of the village.



Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

6 Dumpsite Mapping Municipality of Tearce

During the field identification of illegal landfills in the Municipality of Tearce carried out by a project representative with the assistance of a Tearce municipality representative, 6 significant illegal landfills have been identified as significant by the M. of Tearce representative, although there are other smaller waste accumulations in each settlement that may be removed or rehabilitated without significant investments.



All sites are identified with the GPS coordinates and the type of waste that is disposed on each of them is identified. Additionally, approximate surface of the dumps site is calculated, as well as its position, risk level and period of exploitation.

On the google map below all 6 sites are presented as a POI. For each dump site an additional Information sheet is filled and photo documentation is presented.



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs,
Education and Research EAER
State Secretariat for Economic Affairs SECO



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Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia



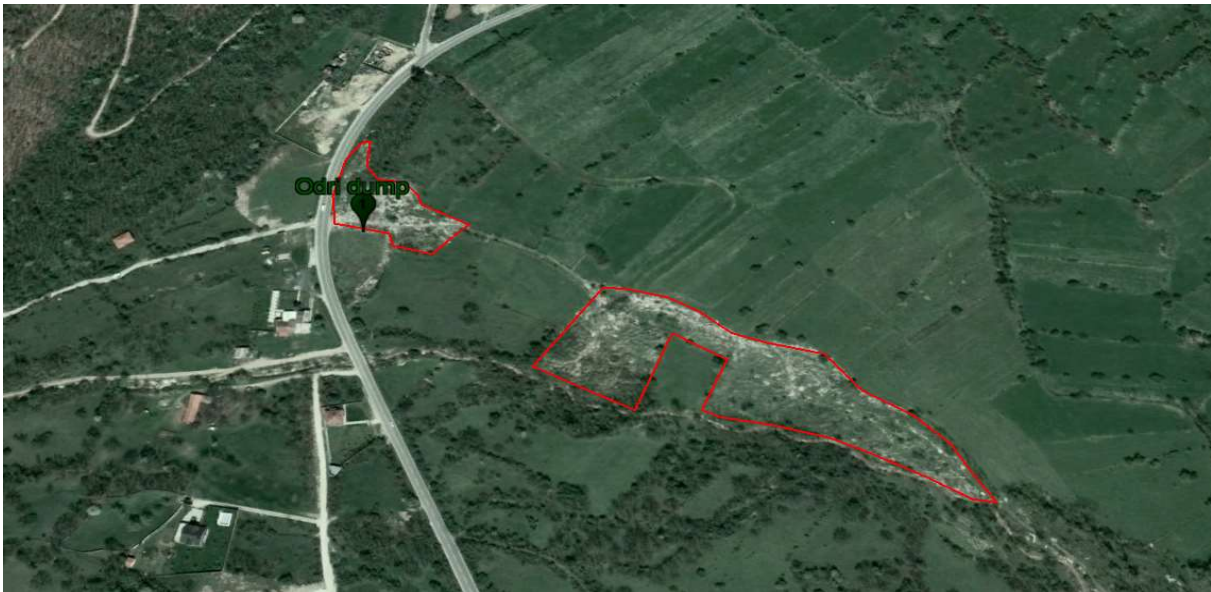
**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	6.1 Odri dump GPS coordinates: lat: 42.1150697 lng: 21.0828628		
Size of the waste area and amounts	24 000 m ² 50 000 m ³	Average height 2 - 3 m	Delivered waste quantity per day m ³ N/A
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 1990 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind: cattle, dogs) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 30 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 700 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		



Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	Very big construction waste dumpsite. Located on the Tetovo – Jazince road on very dry land. It is surrounded by agricultural land. It has been used since 1990 for dumping of CW which because of its inert characteristics does not create environmental or safety risks.
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	6.2 Dobroste upper location GPS coordinates: lat: 42.0986221 lng: 21.0631828		
Size of the waste area and amounts	2 000 m ² 3 000 m ³	Average height 2 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2005 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle, dogs, wild animals) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input checked="" type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 700 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		



Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental
impacts / remarks

This wild dump is located in the mountainous area. Next to a dirt road that is over 1000 meters long and is connected to an asphalt local road. The landfill is more recent, but construction and municipal waste is being dumped there, creating potential dangers for residents of the villages of Glogji and Dobroste, which are located below the landfill. There have been protests and demands from locals for its closure. **It can have significant environmental and safety impacts because of its slope location.**



**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	6.3 Glogji dump GPS coordinates: lat: 42.0939448 lng: 21.0673615		
Size of the waste area and amounts	25 000 m ² 50 -60 000 m ³	Average height 3-4 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2010 <input checked="" type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle, dogs) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 150 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

<p>Environmental impacts / remarks</p>	<p>Waste has been dumped at this site for almost 15 years, mainly construction but also municipal waste. It is located in the immediate vicinity of the village of Glogji. Next to it there is a sports field. Given the setup, several attempts have been made to cover and close it. The last attempt was made in 2017. Attempts are unsuccessful because locals continue to use this site for waste disposal. Its location above the village increases the risk of environmental and safety incidents. There is a demand for closure by locals.</p>
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	6.4 Prsovce - Orman GPS coordinates: lat: 42.0697325 lng: 21.081332		
Size of the waste area and amounts	50 000 m ² 150 000 m ³	Average height 3-4 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input checked="" type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2005 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> 500 meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 1500 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 1500 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input checked="" type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	<p>Large dumpsite for construction waste located along the road Jegunovce - Prshovce. It has been in existence for more than 15 years and has received a certain amount of waste from the Jugohrom industrial plant. The waste is located in and around the bed of the Bistrica River which is generally dry. Given the size and information that there is also industrial waste, environmental impacts may be assumed and further analysis is needed to determine the risk or extent of environmental damage.</p>
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	6.5 Slatino dump GPS coordinates: lat: 42.0580256 lng: 21.0513182		
Size of the waste area and amounts	20 000 m ² 40 000 m ³	Average height 2 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2005 <input checked="" type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle, dogs, cats) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 20 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 400 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 700 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other: Bulky waste, Packaging waste		



Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental
impacts / remarks

A site where more than 15 years construction, but also communal as well as agricultural - biodegradable wastes have been dumped. The site can be reached by a dirt road, which is followed by an asphalt road from the village of Slatino. Given the high content of biodegradable waste, although no landfill leachate is present, groundwater pollution is likely to have been caused in this area. Due to the lack of control, the possibility of fires is not excluded.



Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Location of the dumpsite	6.6 Neprosteno dump GPS coordinates: lat: 42.0566862 lng: 21.026113		
Size of the waste area and amounts	2 000 m ² 5 000 m ³	Average height 2-3 m.	Delivered waste quantity per day N/A
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: wild, dogs, cats...) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> 100 meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> 10 meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 250 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other: Bulky waste		
Environmental impacts / remarks	This wild dump is situated on a hill above Neprosteno village. It is reached by a 500m-long dirt road that is connected to an asphalt road leading to the village. The landfill has been in existence for more than 15 years and has		



Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

been covered several times. At the time of the inspection it was covered, such that there were no large quantities of waste visible, there was no visible generation of landfill leachate. Given the current situation it cannot be treated as a major environmental risk although it is unknown what the the waste content, generated and disposed over these 15-20 years exactly is.



Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

7 Dumpsite Mapping Municipality of Tetovo

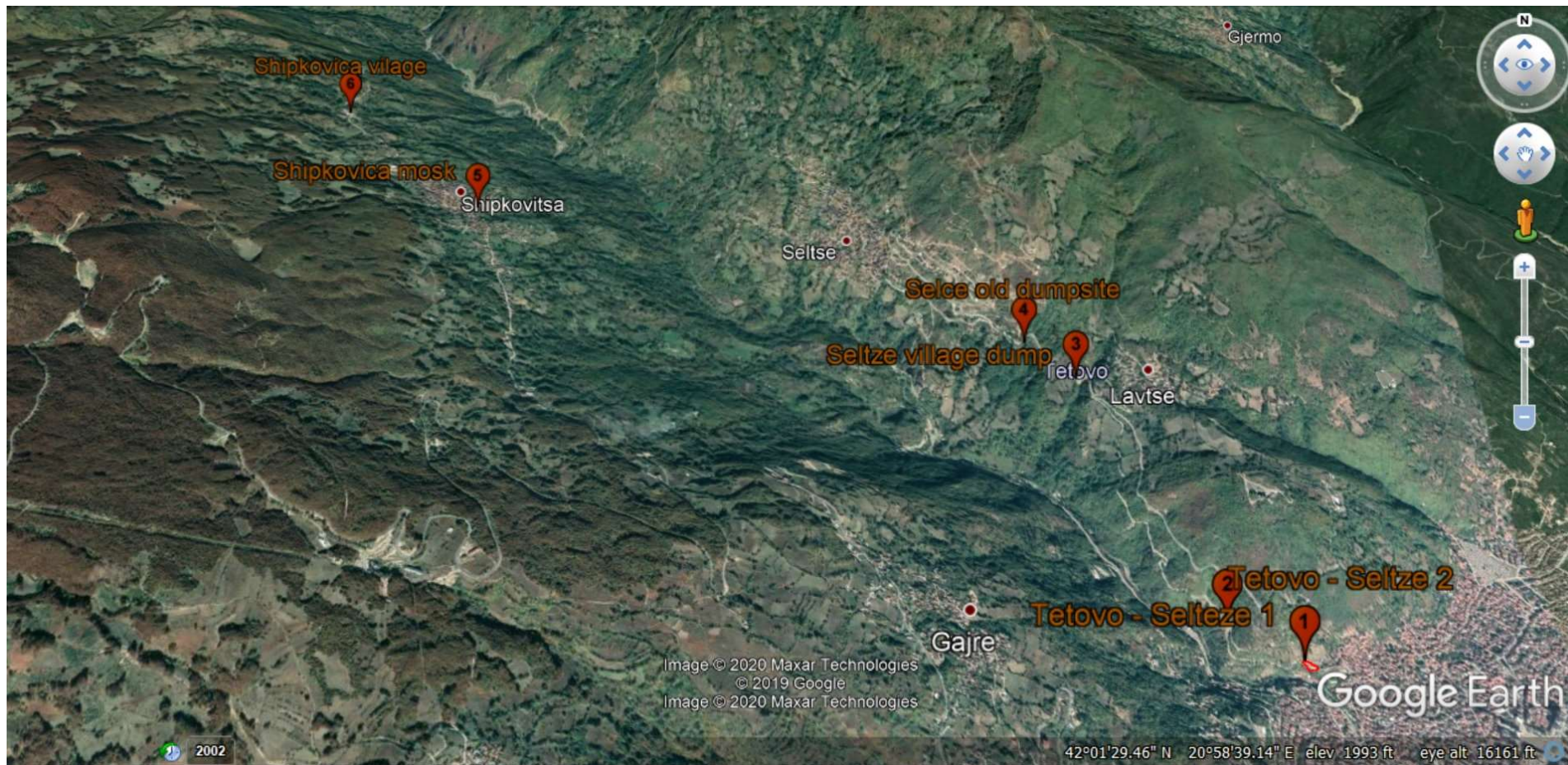
During the field identification of illegal landfills in the Municipality of Tetovo carried out by a project representative with the assistance of a Tetovo municipality representative, 6 significant illegal landfills have been identified by the M. of Tetovo representative, although there are other smaller waste accumulations in each settlement that may be removed or rehabilitated without significant investments.



All sites are identified with the GPS coordinates and the type of waste that is disposed on each of them is identified. Additionally, approximate surface of the dumps site is assessed, as well as its position, risk level and period of exploitation.

On the google map below all 6 sites are presented as a POI. For each dump site an additional Information sheet is filled and photo documentation is presented.

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia



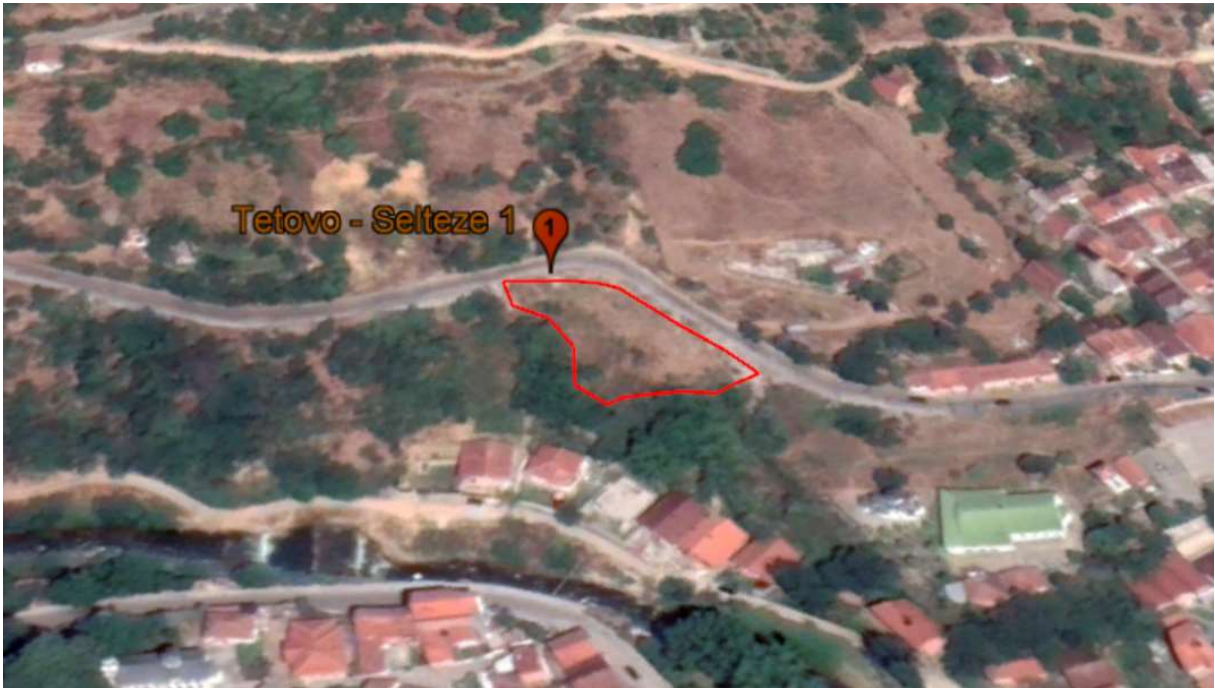
**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	<p>7.1 Tetovo – Selce 1 GPS coordinates: lat: 42.0131397 lng: 20.9609224</p>		
Size of the waste area and amounts	<p>1 200 m² 10 000 m³</p>	Average height 10 m	Delivered waste quantity per day m ³ N/A - it is not used any more
Description of the dumpsite	<p><input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2010 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: dogs, cats) <input type="checkbox"/> Others:</p>		
Available equipment, infrastructure and staff	<p><input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily</p>		
Distance in meters to nearest	<p>River <input checked="" type="checkbox"/> 60-70 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 20 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 200 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 2 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 20-30 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter</p>		
Type of waste disposed	<p><input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:</p>		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks

This illegal dumpsite is located along the local asphalt road leading from Tetovo to the village of Selce. The dump is set on a steep slope by the road nearly hundreds of meters above Tetovo near the church. At the bottom of the slope of the dump there are houses and the Pena River. Mainly construction, but also municipal waste has been dumped here. The landfill poses a major environmental and safety risk due to the fact that it is on a high and steep slope. **Bad weather and heavy rains can influence its stability and large amounts of waste may slide into the Pena River and onto the premises of nearby households.** An additional analysis of this site is needed due to its potential impact on increased flood risk.

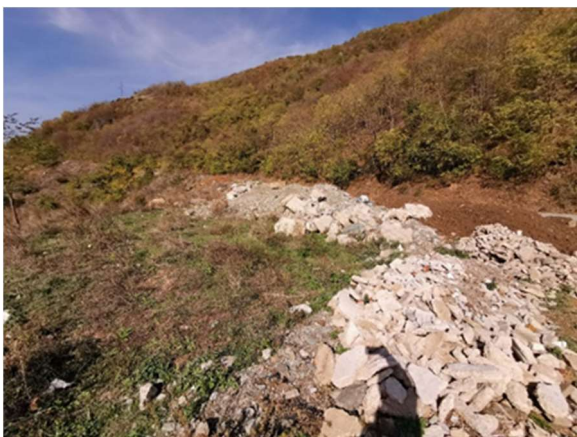


**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	7.2 Tetovo – Selce 2 GPS coordinates: lat: 42.014527 lng: 20.9575415		
Size of the waste area and amounts	1300 m ² 2 000 m ³	Average height 2 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2015 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:) <input checked="" type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 60 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 20 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 200 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 10meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 150 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 300 - 400 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	<p>This illegal dumpsite is located along the local asphalt road leading from Tetovo to the village of Selce. The dump is set on a steep slope by the road. At the bottom of the slope of the dump Pena River runs. Construction waste is dumped here. The landfill poses a major environmental and safety risk due to the fact that it is on a high, steep slope. Bad weather and heavy rains can influence its stability and large amounts of waste may slide into the Pena River. An additional analysis of this site is needed due to its potential impact on increased flood risk.</p>
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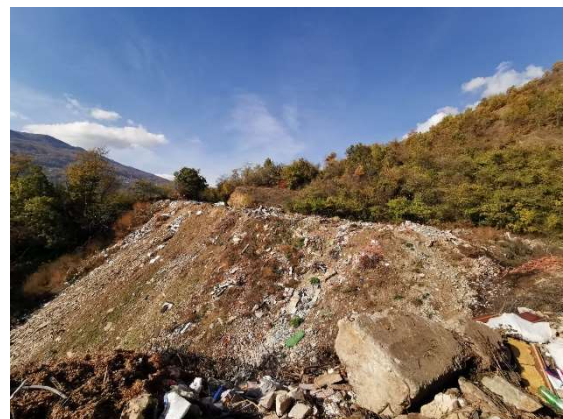
**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	7.3 Selce village dump GPS coordinates: lat: 42.026237 lng: 20.9523145		
Size of the waste area and amounts	4 000 m ² 30 000 m ³	Average height 5-10 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2005 <input checked="" type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: domestic and wild) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 700 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 30 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 200 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 2 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 60 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 150 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks

This illegal dumpsite is located on the local asphalt road leading from Tetovo to the village of Selce nearby village of Lavce. The dump is set on a large slope by the road. Mainly municipal, but as well construction waste is dumped here. Although it has been covered by sand few times by the communal enterprise of Tetovo, the landfill poses a major environmental and safety risk due to the fact that it is on the slope that leads to the Pena river valley. **Bad weather and heavy rains can influence its stability and slip large amounts of waste into the Pena River.** An additional analysis of this site is needed due to its potential impact on increased flood risk.

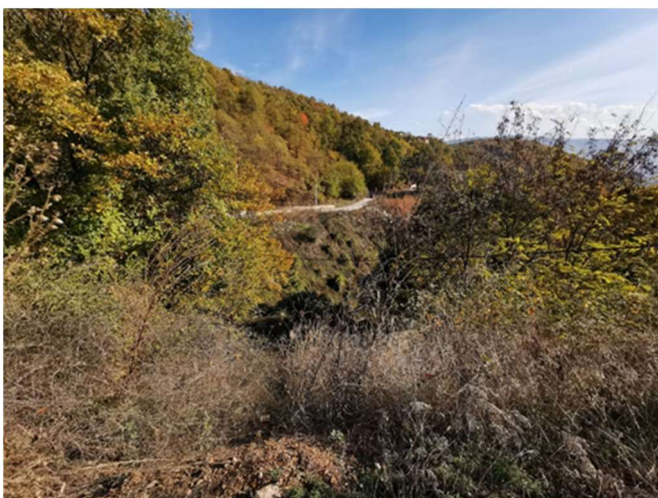


**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	7.4 Selce old dumpsite GPS coordinates: lat: 42.0283881lng: 20.949749		
Size of the waste area and amounts	10 000 m ² N/A Closed and covered site, but from time to time is used for dumping.	Average height 0 - 10 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000- 2015 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 700 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 30 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 700 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

	<input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:
Environmental impacts / remarks	<p>This illegal dumpsite is located on the entrance of Selce village along the local asphalt road leading from Tetovo to the village of Selce. The dump is set on a steep slope by the road. Mainly municipal, but also construction waste is dumped here. Although it has been covered with soil by the communal enterprise of Tetovo, the dump is still used from time to time by local residents. It does not pose environmental and safety risk due to the fact that it is not very actively used and it has been stabilised.</p>



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Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	7.5 Shipkovicva village GPS coordinates: lat: 41.620275096777 lng: 20.589834339917		
Size of the waste area and amounts	600 m ² 2 000 m ³	Average height 2-5 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input checked="" type="checkbox"/> <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2010 <input type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Wild Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 3 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 3 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		



Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

<p>Environmental impacts / remarks</p>	<p>This wild dump is located in the center of the village Shipkovica next to the mosque and stretches along the canal that regulates the mountain river that runs through the village. Since this village already has a history of flooding and human casualties, clearing this site containing only municipal waste is of great importance. The amount of waste is not large, but the configuration of the terrain consists of steep slopes which, in bad weather conditions, cannot provide safe waste containment and prevent pollution and accidents.</p>
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**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	7.6 Shipkovica Village GPS coordinates: lat: 42.0425121 lng: 20.9069659		
Size of the waste area and amounts	4 000 m ² 12 000m ³	Average height 2-4 m	Delivered waste quantity per day N/A
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: wild, dogs, cats...) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 20 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 500 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter Protected area <input checked="" type="checkbox"/> meter <input type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 800 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

<p>Environmental impacts / remarks</p>	<p>Located above the village of Sipkovicva, this dumpsite contains construction and municipal waste. Since it is not on a high slope and has a large amount of construction waste, it does not pose a great environmental risk, but having in mind the characteristics of the terrain and the climatic conditions it is necessary to carry out a detailed analysis of the potential for waste slides.</p>
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Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

8 Dumpsite Mapping Municipality of Vrapchishte

During the field identification of illegal landfills in the municipality of Vrapchiste carried out by a project representative with the assistance of a Vrapchiste municipality representative, 6 largest illegal landfills have been identified as significant by the local LSG representative, although there are other smaller waste accumulations in each settlement that may be removed or rehabilitated without significant investments.



All sites are identified with the GPS coordinates and the type of waste that is disposed on each of them is identified. Additionally, approximate surface of the dumps site is assessed, as well as its position, risk level and period of exploitation.

On the google map below all 6 sites are presented as a POI. For each dump site an additional Information sheet is filled and photo documentation is presented.

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia



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Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	8.1 Senokos – Potocane village GPS coordinates: lat: 41.8860282 lng: 20.8890165		
Size of the waste area and amounts	1 800 m ² 15 000 m ³	Average height 6-8 m	Delivered waste quantity per day m ³ N/A - it is not used any more
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2013 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 600 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 150 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

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Environmental impacts / remarks	This illegal dumpsite located on the slope above the Potocane village was used for municipal waste disposal, but at the time of the visit was covered by soil by the municipal public utility. There is no visible leachate or waste and no significant environmental risks have to be expected.
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Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Location of the dumpsite	8.2 Senokos - Gjurgjeviste road GPS coordinates: lat: 41.8846143 lng: 20.8871585		
Size of the waste area and amounts	2 000 m ² 20 000 m ³	Average height 10 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2005 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:) <input checked="" type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 100 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 2 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 400 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste		

**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

	<input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:
Environmental impacts / remarks	<p>Wild dump, located near the local road Senokos - Gjurevishte. It is located on a slope that does not provide stability but the risk of waste slides is small. It has been covered with soil several times by the local government. It was also partially covered at the time of the visit but new amounts of municipal waste were visible. Construction waste has also been disposed at the site. Given its location and the fact there are no visible discharges and other noticeable negative impacts, it does not have to be considered as an environmental hazard.</p>



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Location of the dumpsite	8.3 Logovina Gradec GPS coordinates: lat: 41.8761292 lng: 20.9374958		
Size of the waste area and amounts	14 000 m ² 28 000m ³	Average height 2 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input checked="" type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> 50 meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 3500 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 20 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 3000 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

	<input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input checked="" type="checkbox"/> Other: Bulky waste
Environmental impacts / remarks	<p>Wild dump located in the area of extensive agricultural production where mixed municipal waste and bulky waste are deposited. There is no visible leachate, but given the amount of biodegradable waste, pollution of subsoil and soil is expected. There is potential for environmental pollution.</p> <p>Additionally, large quantities of packaging waste and bulky waste are disposed of at this location.</p>



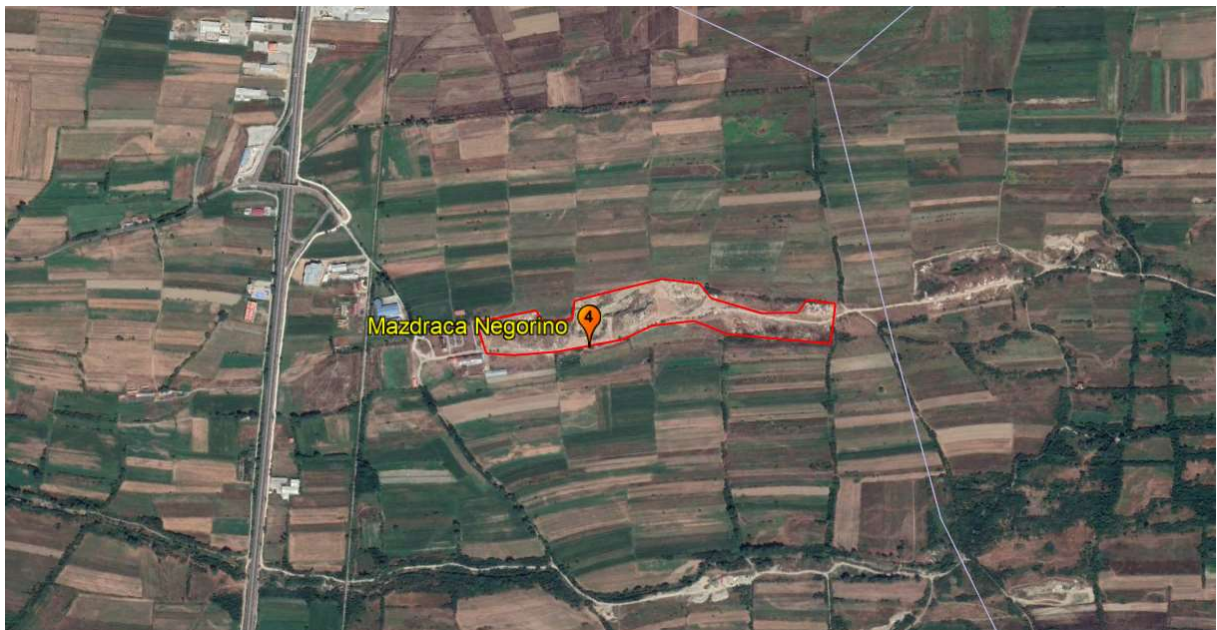
**Solid Waste Management in Polog Region, North Macedonia, Phase I
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Location of the dumpsite	8.4 Mazdraca Negotino GPS coordinates: lat: 41.8671651 lng: 20.9394568		
Size of the waste area and amounts	85 000 m ² 300 000 m ³	Average height 3-4 5 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2005 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 4000 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 10 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 120 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 3500 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental
impacts / remarks

Illegal landfill where construction waste is disposed of. It is located within a sand and gravel exploitation concession. Open holes are used to dispose of construction waste from all surrounding villages. Given that it is inert waste and that a concessionaire still controls the site, there is limited potential for environmental incidents. However, given that this site has potential but has not received permits for landfill, a permit application should be initiated.



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Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	8.5 Pozarane - Vrapciste road GPS coordinates: lat: 41.8453897 lng: 20.8832489		
Size of the waste area and amounts	1,000 m ² 4,000 m ³	Average height 4 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input type="checkbox"/> Flat area <input checked="" type="checkbox"/> Slope <input type="checkbox"/> Valley <input checked="" type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2010 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Wild Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 200 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 2 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 250meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 250 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

	<input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:
Environmental impacts / remarks	<p>Wild dump where mixed municipal and construction waste is deposited. It is set beside the local road Vrapciste – Pozarane on the slope which does not provide stability. There is no visible discharge and there is no evidence of soil contamination. However, environmental impacts cannot be excluded and further exploration of this location is necessary.</p>

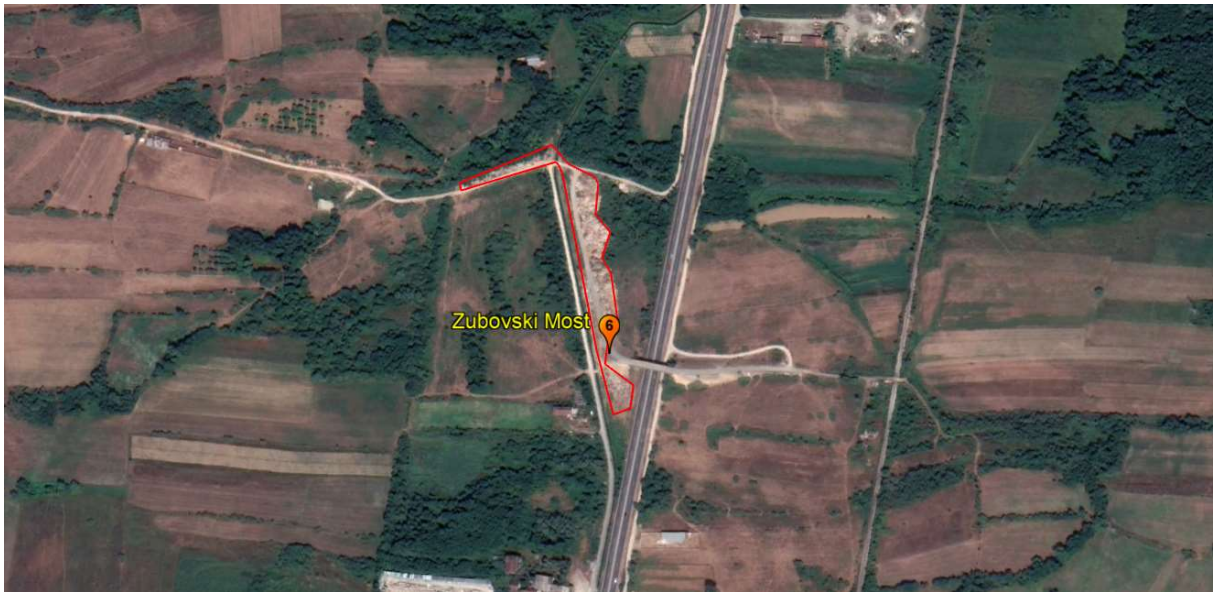


**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	8.6 Zubovski Most GPS coordinates: lat: 41.8309153 lng: 20.9198023		
Size of the waste area and amounts	8 000 m ² 24 000 m ³	Average height 3 m	Delivered waste quantity per day N/A
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 3000 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 2 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 20 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 2500 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	This wild dump is located near the to the Tetovo - Gostivar highway. It is surrounded by agricultural land intended for intensive agriculture. Construction waste has been dumped here. It has no negative impact on the environment, but given its location adjacent to the highway, it has a negative visual impact.
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Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

9 Dumpsite Mapping Municipality of Zelino

During the field identification of illegal landfills in the municipality of Zelino carried out by a project representative with the assistance of a Zelino municipality representative, 7 illegal landfills have been identified as significant by the local LSG representative, although there are other smaller waste accumulations in each settlement that may be removed or rehabilitated without significant investments.

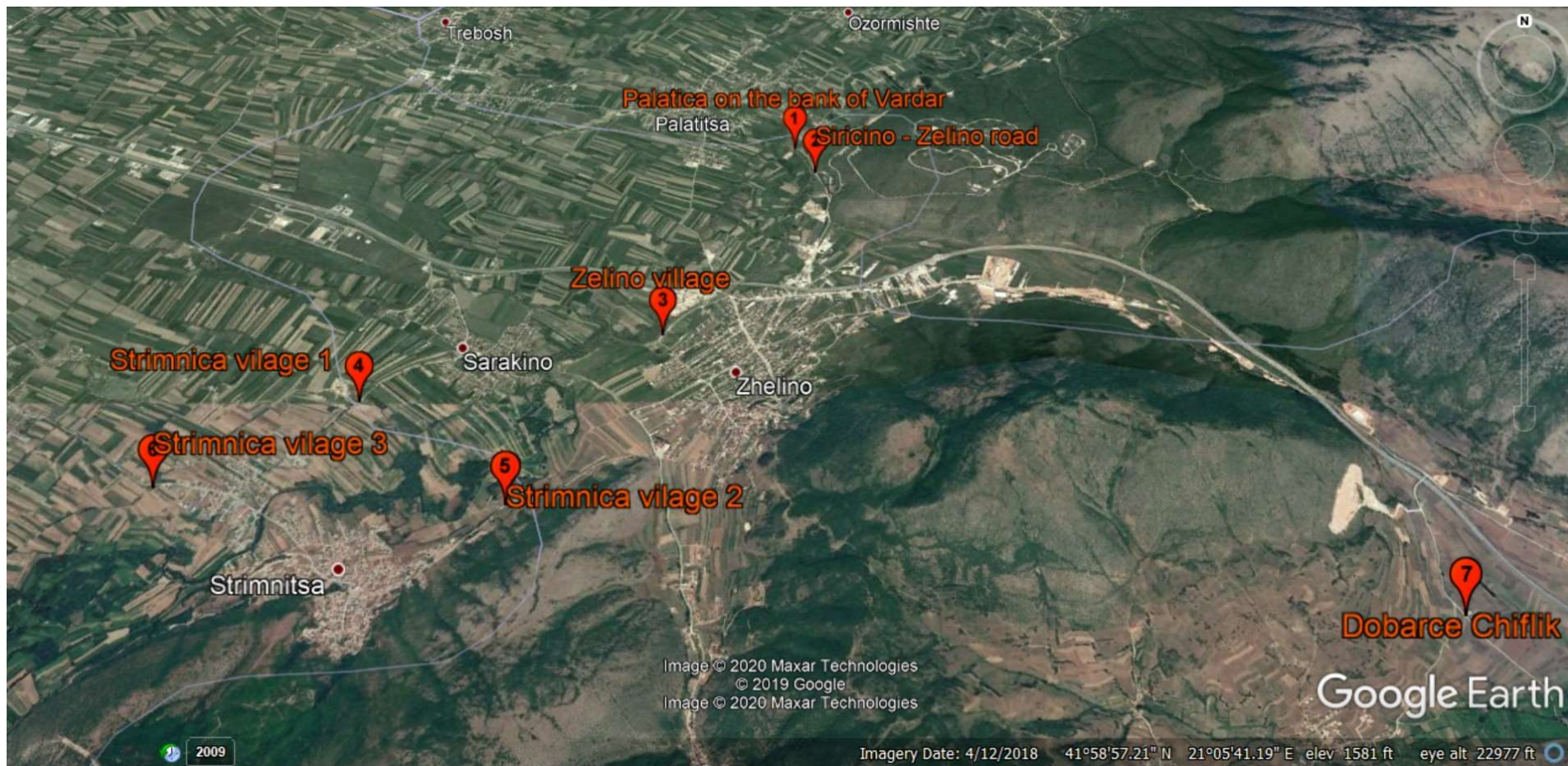


All sites are identified with the GPS coordinates and the type of waste that is disposed on each of them is identified. Additionally, approximate surface of the dumps site is assessed, as well as its position, risk level and period of exploitation.

On the google map below all 7 sites are presented as a POI. For each dump site an additional Information sheet is filled and photo documentation presented.

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

Information Sheet for Dumpsites in the Polog Region, North Macedonia



**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	9.1 Palatica on the bank of Vardar river GPS coordinates: lat: 41.999815 lng: 21.0654259		
Size of the waste area and amounts	5 000 m ² 15 000 m ³	Average height 3-4 m	Delivered waste quantity per day m ³ N/A - it is not used any more
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input checked="" type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2005 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind:) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 2 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> ... meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input checked="" type="checkbox"/> 20 meter <input type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 100 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	<p>This wild dump is located at the bank of Vardar river and under a former concession for the exploitation of sand and gravel that is often flooded by the river during adverse weather conditions. A few hundred meters of dirt road joining the asphalt road Zelino - Siricino leads to this location. Heaps of construction waste is generally disposed of, but municipal and bulk waste was also visible during the visit. Given that it is on the bank of the Vardar river itself, the potential for environmental and safety impacts is high. For this reason, further research is necessary to determine mitigative (closure) measures.</p>
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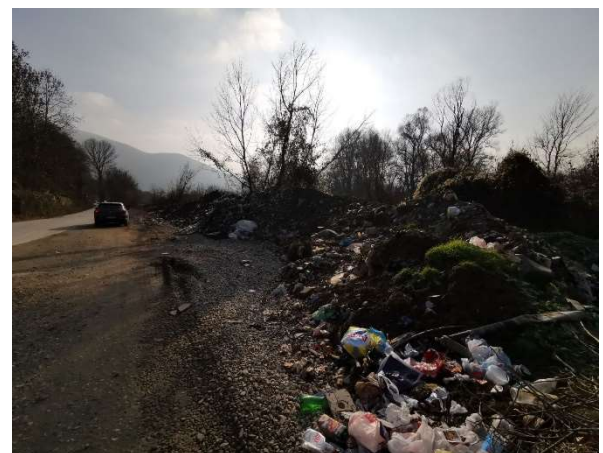
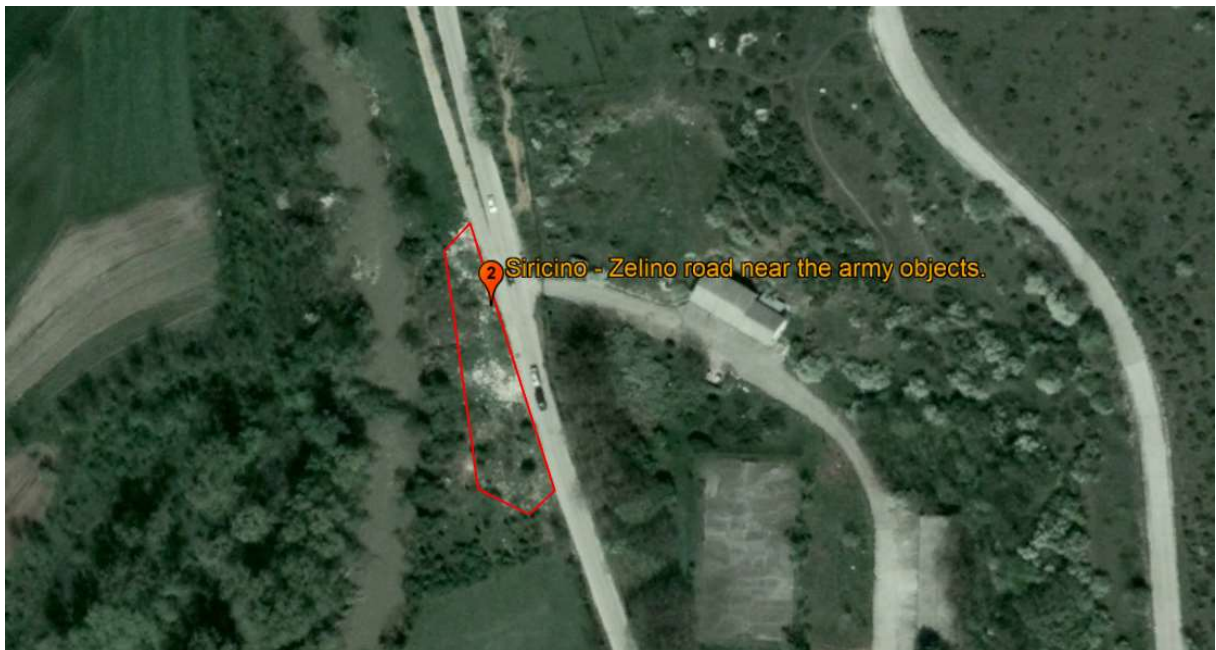


**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	<p>9.2 Siricino – Zelino road GPS coordinates: lat: 41.9975228 lng: 21.0671648</p>		
Size of the waste area and amounts	<p>1 000 m² 2 000 m³</p>	Average height 2-3 m	<p>Delivered waste quantity per day m³ N/A – there is no data or monitoring</p>
Description of the dumpsite	<p><input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2010 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:</p>		
Available equipment, infrastructure and staff	<p><input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily</p>		
Distance in meters to nearest	<p>River <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> 150 meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input checked="" type="checkbox"/> 10 meter <input type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 20 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 650 meter <input type="checkbox"/> more than 5,000 meter</p>		
Type of waste disposed	<p><input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:</p>		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	<p>This wild dump is located at the bank of Vardar river near the local road from Zelino to Siricino. It could be flooded by the river under adverse weather conditions. Heaps of construction waste are present, but municipal waste was also visible during the visit. Given that it is on the bank of the river itself, the potential for environmental and safety impacts is high. For this reason, further research is necessary.</p>
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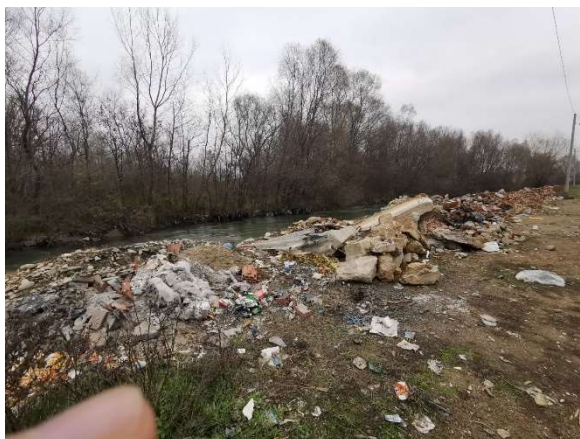
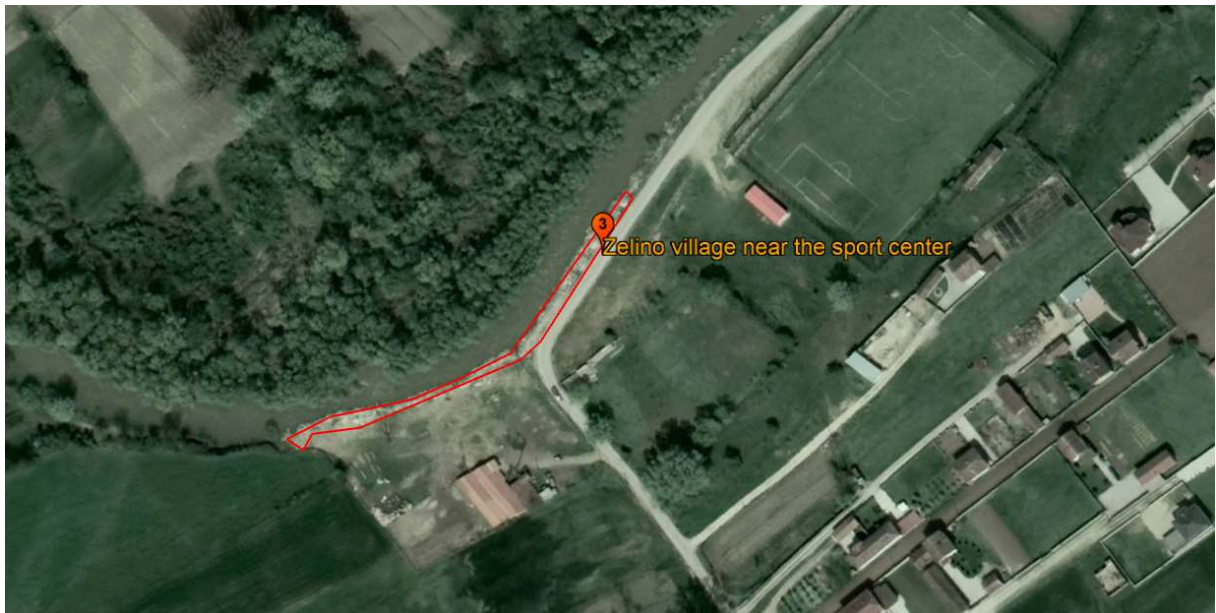
**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	9.3 Zelino village GPS coordinates: lat: 41.9837687 lng: 21.0551553		
Size of the waste area and amounts	800 m ² 1 000 m ³	Average height 1-2 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input checked="" type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2010 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 2 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input checked="" type="checkbox"/> 2 meter <input type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 3000 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 30 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 3 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 30 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 150 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental
impacts / remarks

This small wild dump is located at the bank of Vardar river and under a former concession for the exploitation of sand and gravel that is often flooded by the river under adverse weather conditions. It is near the village of Zelino and a football and other sport court. Heaps of construction waste are present near the road and river, but municipal and bulk waste was also visible during the visit. Given that it is on the bank of the river itself, the **potential for environmental and safety impacts is high**. For this reason, further research is necessary.



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Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	9.4 Strimnica village 1 GPS coordinates: lat: 41.978782 lng: 21.0330149		
Size of the waste area and amounts	1 500 m ² 4 500 m ³	Average height 3-4 m	Delivered waste quantity per day m ³ N/A – there is no data or monitoring
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 30 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 30 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 500 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	<p>This wild dump is located in the area of intensive agricultural production. A few hundred meters of dirt road joining the asphalt road from Sarakino and Strimnica village leads to this location. Heaps of construction waste are present, but lots of municipal and bulky waste were also visible during the visit. There was no visible leachate, but having in mind the high groundwater table on this location, the potential for pollution is high.</p>
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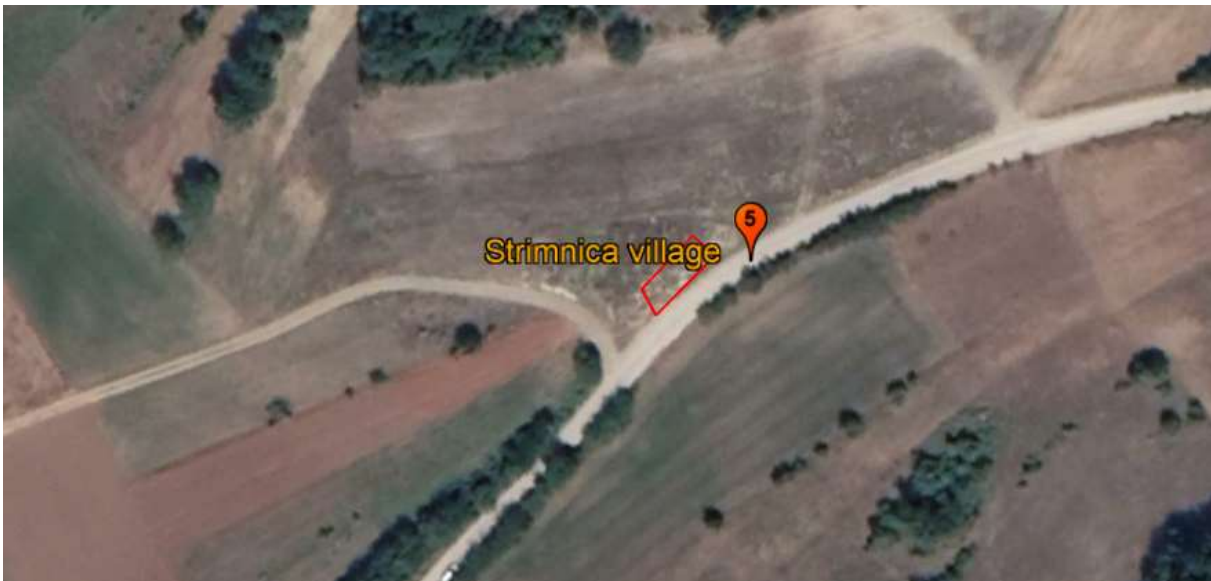


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Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	<p>9.5 Strimnica village 2 GPS coordinates: lat: 41.620275096777 lng: 20.589834339917</p>		
Size of the waste area and amounts	<p>1000 m² 1000 m³</p>	Average height 1 m	<p>Delivered waste quantity per day m³ N/A – there is no data or monitoring</p>
Description of the dumpsite	<p><input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2010 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: cattle) <input type="checkbox"/> Others:</p>		
Available equipment, infrastructure and staff	<p><input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily</p>		
Distance in meters to nearest	<p>River <input checked="" type="checkbox"/> 200 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 2 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 350meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 450 meter <input type="checkbox"/> more than 5,000 meter</p>		
Type of waste disposed	<p><input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:</p>		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	The small wild dump is along the asphalt road that leads from Strimnica to Zelino. There is mainly construction waste, but some amounts of MSW have been dumped as well. No visible leachate. No significant environmental impact has to be expected.
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Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia

Location of the dumpsite	9.6 Strimnica village 3 GPS coordinates: lat: 41.9730034 lng: 21.0200011		
Size of the waste area and amounts	1500 m ² 2 500 m ³	Average height 1.5 m	Delivered waste quantity per day N/A
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input type="checkbox"/> Bad smell <input type="checkbox"/> Leachate <input type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: wild, dogs, cats...) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input checked="" type="checkbox"/> None <input type="checkbox"/> Backhoe loader <input type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input type="checkbox"/> Fence <input type="checkbox"/> Gate <input type="checkbox"/> Staff (number) Permanent Temporarily		
Distance in meters to nearest	River <input checked="" type="checkbox"/> 1500 meter <input type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 5 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 100 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 300 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input type="checkbox"/> Other:		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

Environmental impacts / remarks	The wild dump along the asphalt road that leads from Strimnica to Falishe. There is mainly construction waste, but some amounts of MSW is dumped. No visible leachate. No environmental has to be expected.
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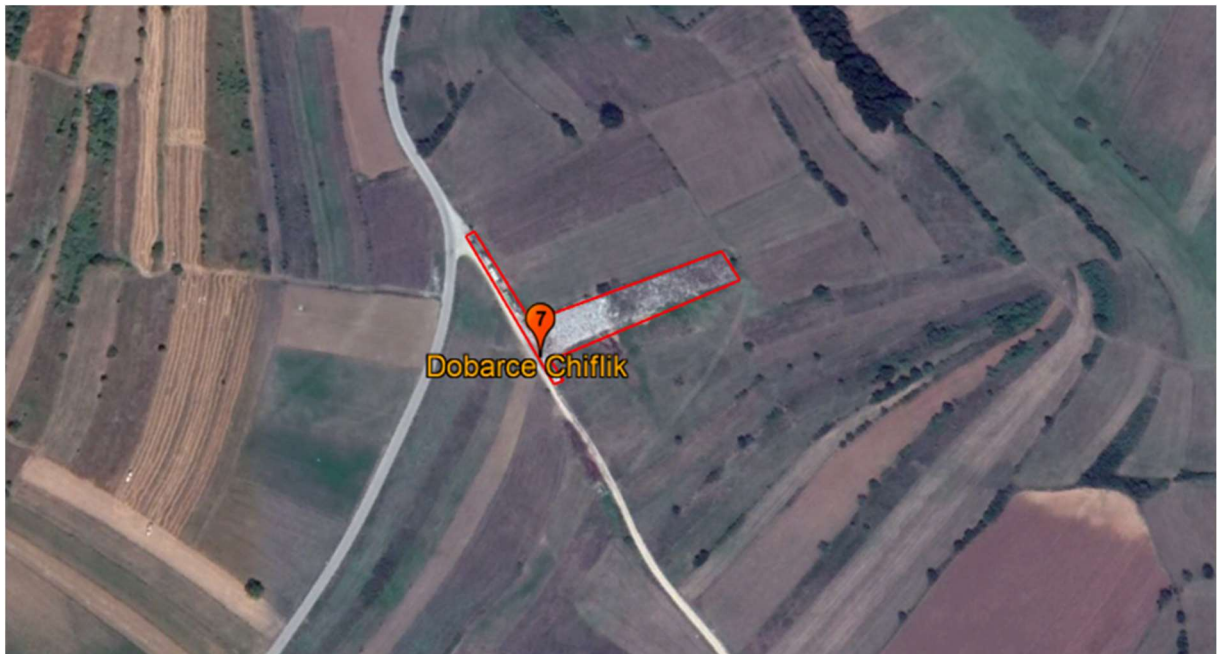


**Solid Waste Management in Polog Region, North Macedonia, Phase I
Information Sheet for Dumpsites in the Polog Region, North Macedonia**

Location of the dumpsite	9.7 Dobarce Chiflik GPS coordinates: lat: 41.9649453 lng: 21.1089159		
Size of the waste area and amounts	2 500 m ² 7 500 m ³	Average height 3 m.	Delivered waste quantity per day N/A
Description of the dumpsite	<input checked="" type="checkbox"/> Flat area <input type="checkbox"/> Slope <input type="checkbox"/> Valley <input type="checkbox"/> Mountainous area <input type="checkbox"/> Old mine or quarry <input type="checkbox"/> In river bed <input type="checkbox"/> On river bank Accessible by heavy equipment <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Used since (year) 2000 <input type="checkbox"/> Fires <input checked="" type="checkbox"/> Bad smell <input checked="" type="checkbox"/> Leachate <input checked="" type="checkbox"/> Waste pickers <input checked="" type="checkbox"/> Animals (list what kind: all kind of domestic animals) <input type="checkbox"/> Others: No		
Available equipment, infrastructure and staff	<input type="checkbox"/> None <input checked="" type="checkbox"/> Backhoe loader <input checked="" type="checkbox"/> Bulldozer <input type="checkbox"/> Others <input checked="" type="checkbox"/> Fence <input checked="" type="checkbox"/> Gate <input checked="" type="checkbox"/> Staff N/A Permanent Temporarily		
Distance in meters to nearest	River <input type="checkbox"/> meters <input checked="" type="checkbox"/> more than 5,000 meter Lake <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Area prone to flooding <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Forest <input checked="" type="checkbox"/> 1000 meter <input type="checkbox"/> more than 5,000 meter Land for agriculture or grazing animals <input checked="" type="checkbox"/> 50 m. <input type="checkbox"/> > 5,000 m. Main road <input checked="" type="checkbox"/> 50 meter <input type="checkbox"/> more than 5,000 meter Protected area <input type="checkbox"/> meter <input checked="" type="checkbox"/> more than 5,000 meter Single residential house <input checked="" type="checkbox"/> 700 meter <input type="checkbox"/> more than 5,000 meter Residential area <input checked="" type="checkbox"/> 700 meter <input type="checkbox"/> more than 5,000 meter		
Type of waste disposed	<input checked="" type="checkbox"/> Household waste <input checked="" type="checkbox"/> Construction & demolition waste <input type="checkbox"/> Medical waste <input type="checkbox"/> Industrial waste <input type="checkbox"/> Hazardous waste <input type="checkbox"/> Car batteries <input checked="" type="checkbox"/> Waste tyres <input type="checkbox"/> Waste vehicles <input checked="" type="checkbox"/> Other: Bulky waste		
Environmental impacts / remarks	This site is owned by the concessionaire who collects and transports waste from the municipality of Zelino. It was originally intended for recyclables to		

Solid Waste Management in Polog Region, North Macedonia, Phase I Information Sheet for Dumpsites in the Polog Region, North Macedonia

be selected by the concessionaire, who would, after separation, transport the remainder of the waste to Drisla or Rusino, but this did not happen. A large amount of mixed waste is stored here. There is visible leachate that flows on to the surrounding agricultural land. There is an unpleasant odor and potential for self-ignition. **This site is a major environmental and safety risk.** It is necessary to rehabilitate or clear the site, especially since it is not licensed and does not meet the conditions for such activity. This is also demanded by the local population.





Solid Waste Management in Polog Region, North Macedonia, Phase I Final Feasibility Study Report

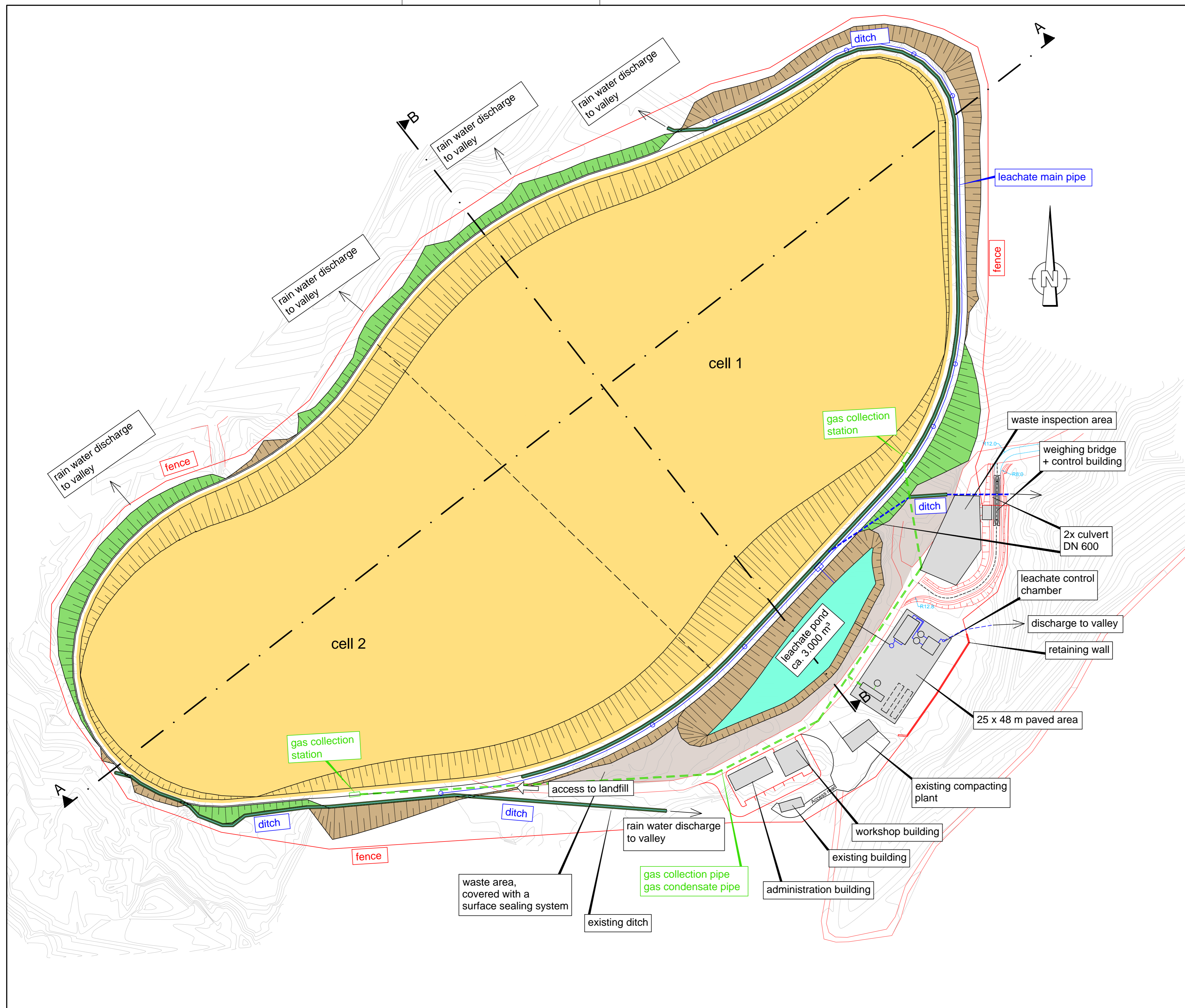
Annex 2 Design Drawings for the Landfill



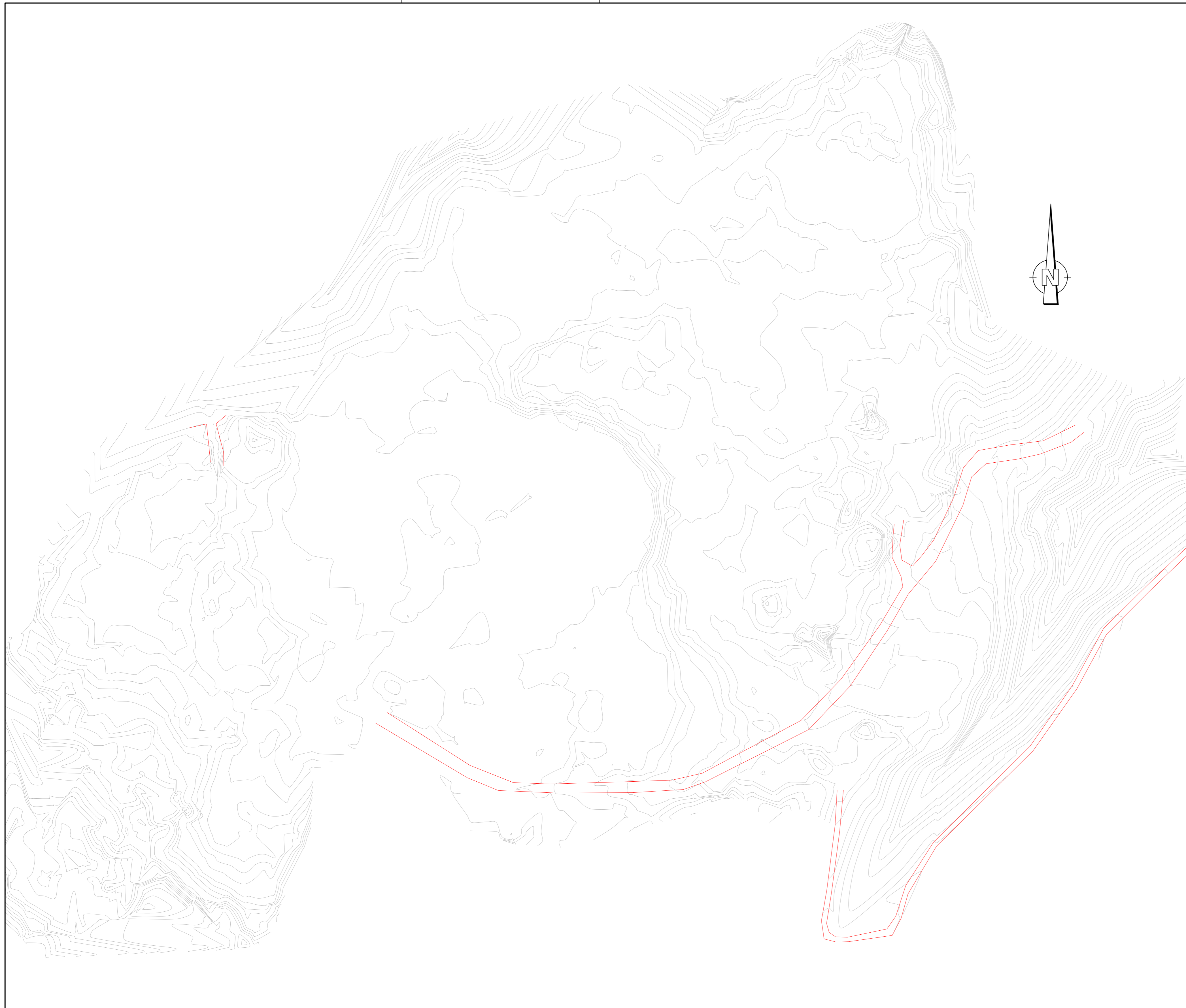
Solid Waste Management in Polog Region, North Macedonia, Phase I Final Feasibility Study Report

Annex 2: List of Drawings

L-P-01	site plan, site lay out (overview)
L-P-02	site plan, present situation
L-P-03	site plan, landfill plane
L-P-04	site plan, leachate collection system
L-P-05	site plan, 1.construction stage
L-P-06	site plan, surface of landfill
L-P-07	site plan, surface water derivation and gas collection
L-P-08	longitudinal and cross section landfill
L-P-09	detail plan, base and surface sealing system
L-P-10	detail plan, ending of base and surface sealing system
L-P-11	detail plan, leachate collection pond



SOLID WASTE MANAGEMENT IN POLOG REGION, NORTH-MACEDONIA PHASE I			
CLIENT	CENTRE FOR DEVELOPMENT OF POLOG PLANNING REGION	<small>УЧЕСТВАЈ ЗА ПАЗЕЉУ НА ПРОЈЕКТАТ РЕШАЊЕ НА АЛТЕРНАТИВНОСТИ 2008/2009 П. Мачево</small>	<small>ОПШТИНА ПЕР ДИВУЛИМ ТЕ РАЈОНИТ ПЛАНОВИ ТЕ ПОЛОГ АЛТЕРНАТИВНОСТИ 2008/2009 П. Мачево</small>
FUNDING AGENCY	State Secretariat of Economic Affairs (SECO)	<small>Schweizerische Eidgenossenschaft Confédération suisse Confederazione Svizzera Confederaziun Svizra Swiss Confederation</small>	<small>Federal Department of Economic Affairs, Education and Research EMER State Secretariat for Economic Affairs SECO</small>
CONTRACTOR	Consulting Consortium INFRASTRUKTUR & UMWELT / SEHLOFF GmbH / BAR		
PROJECT	Improvement of the Solid Waste Management Services in the Polog Region, North-Macedonia, Phase I		
PHASE	Feasibility Study		
LOCATION	Rusino Landfill, Polog Region, North-Macedonia		
site plan, site lay out (overview)			
CHANGES		SIGNATURE	DATE
1.)			
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3.)			
SCALE	PLAN NUMBER	DATE	SIGNATURE
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Julius-Reiber-Strasse 17 D 64283 Darmstadt / Germany Tel. +49-6151-8130-0 Fax +49-6151-8130-20 www.iu-info.de	Industriestraße 10 84137 Vilshuburg / Germany Tel.: +49.8741.96040 Fax: +49.8741.960499 www.sehloff.eu	Naroden Front 11/1-4 1000 Skopje Macedonia www.barece.com.mk	



**SOLID WASTE MANAGEMENT
IN POLOG REGION, NORTH-MACEDONIA PHASE I**

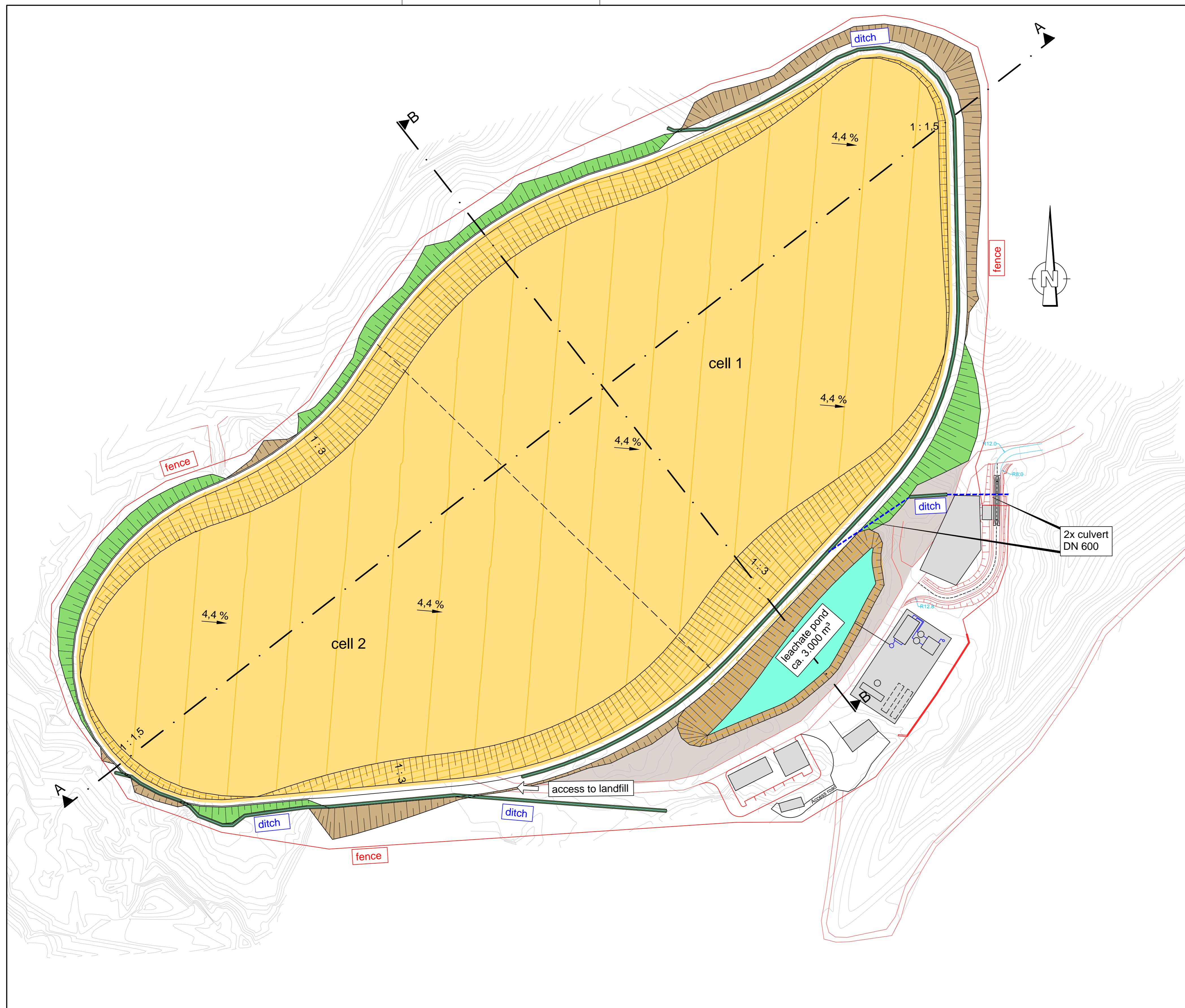
CLIENT	CENTRE FOR DEVELOPMENT OF POLOG PLANNING REGION	
FUNDING AGENCY	State Secretariat of Economic Affairs (SECO)	
CONTRACTOR	Consulting Consortium INFRASTRUKTUR & UMWELT / SEHLHOFF GmbH / BAR	
PROJECT	Improvement of the Solid Waste Management Services in the Polog Region, North-Macedonia, Phase I	
PHASE	Feasibility Study	
LOCATION	Rusino Landfill, Polog Region, North-Macedonia	




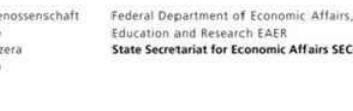



site plan, present situation

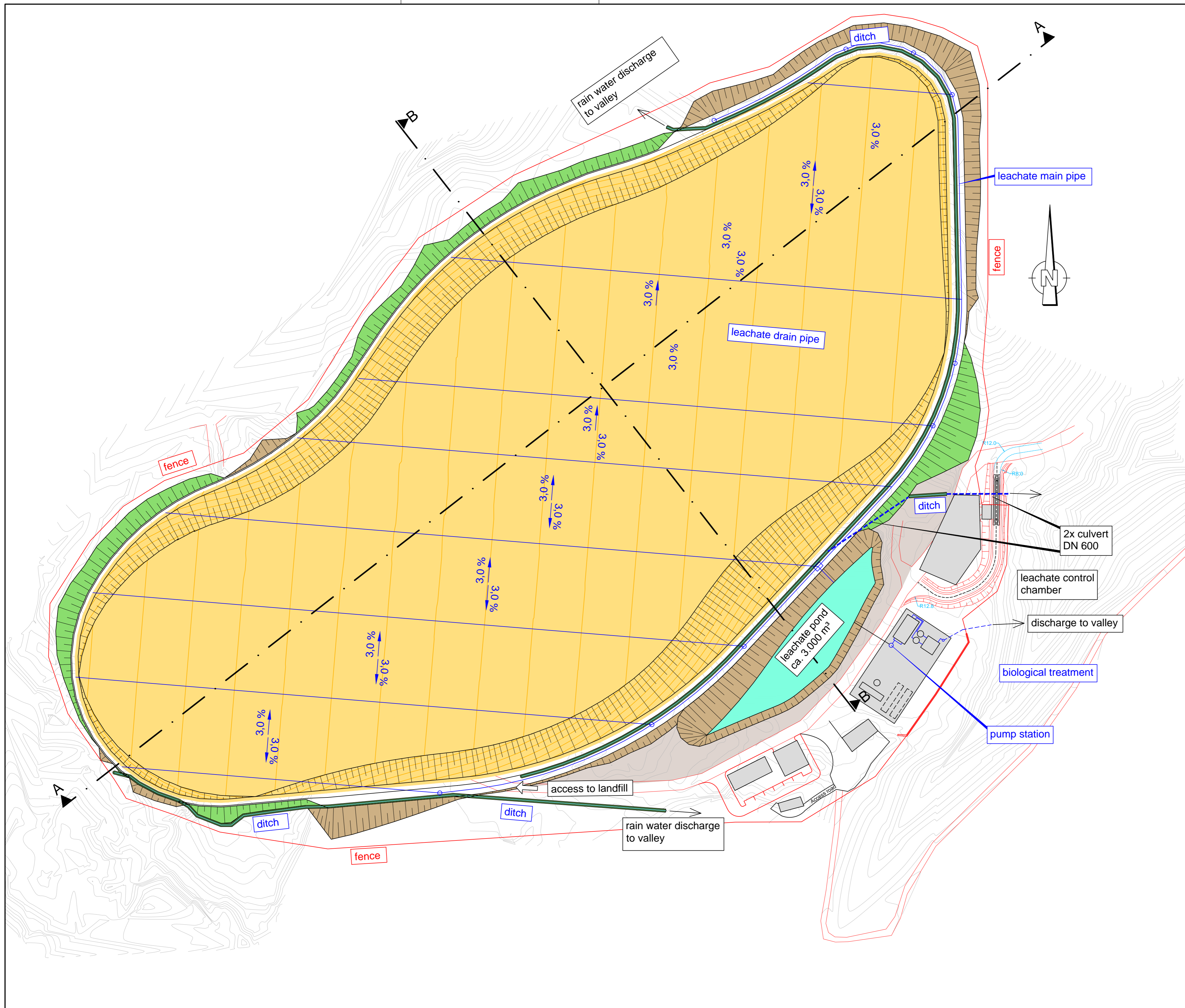
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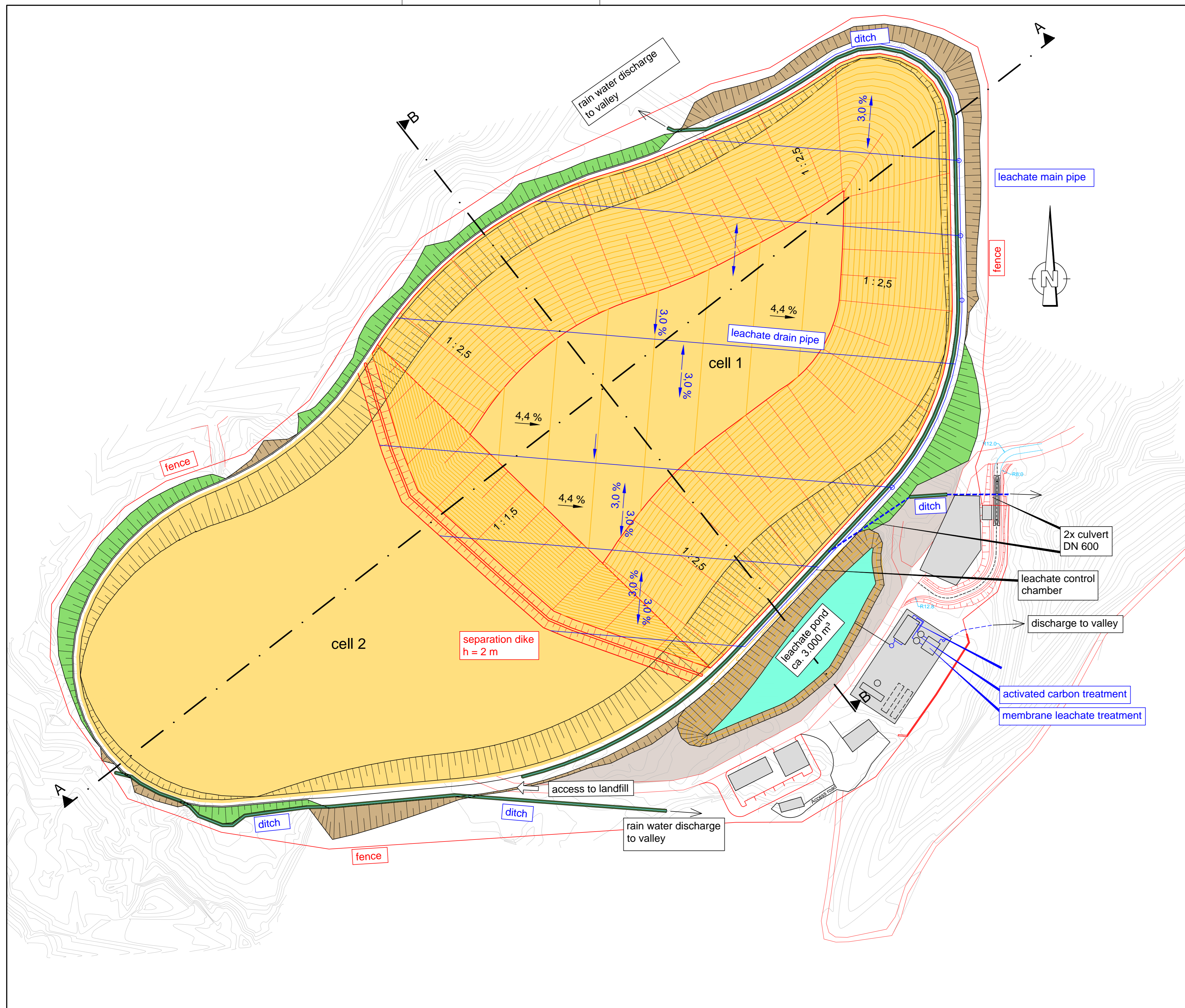
 Julius-Reiber-Strasse 17 D 64283 Darmstadt / Germany Tel. +49-6151-8130-0 Fax +49-6151-8130-20 www.iu-info.de	 Industriestraße 10 84137 Vilshiburg / Germany Tel.: +49.8741.96040 Fax: +49.8741.960499 www.sehloff.eu	 Naroden Front 11/1-4 1000 Skopje Macedonia www.barece.com.mk
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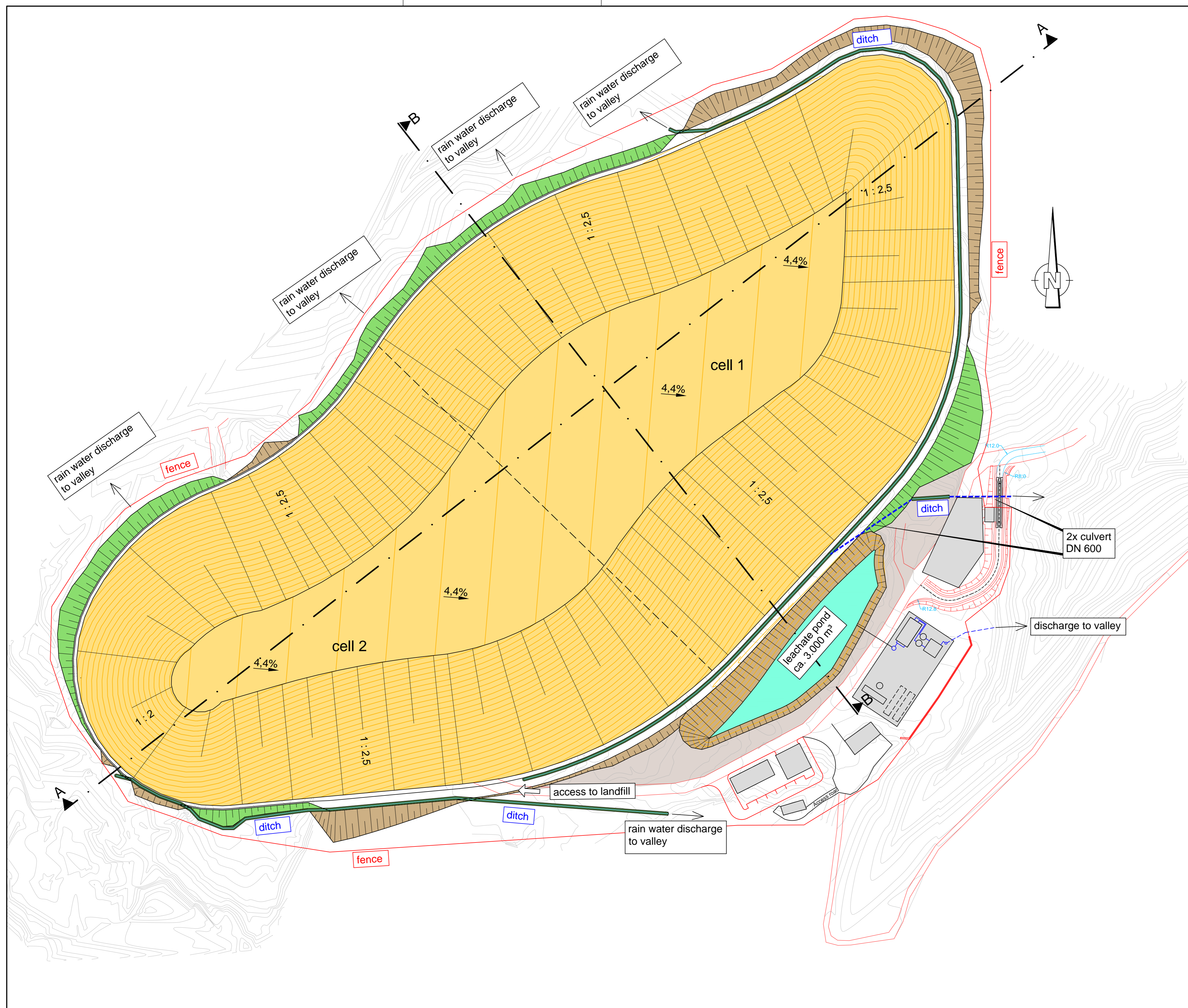
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CLIENT	CENTRE FOR DEVELOPMENT OF POLOG PLANNING REGION		
FUNDING AGENCY	State Secretariat of Economic Affairs (SECO)		
CONTRACTOR	Consulting Consortium INFRASTRUKTUR & UMWELT / SEHLOFF GmbH / BAR		
PROJECT	Improvement of the Solid Waste Management Services in the Polog Region, North-Macedonia, Phase I		
PHASE	Feasibility Study		
LOCATION	Rusino Landfill, Polog Region, North-Macedonia		
site plan, landfill plane			
CHANGES		SIGNATURE	DATE
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3.)			
SCALE	PLAN NUMBER	DATE	SIGNATURE
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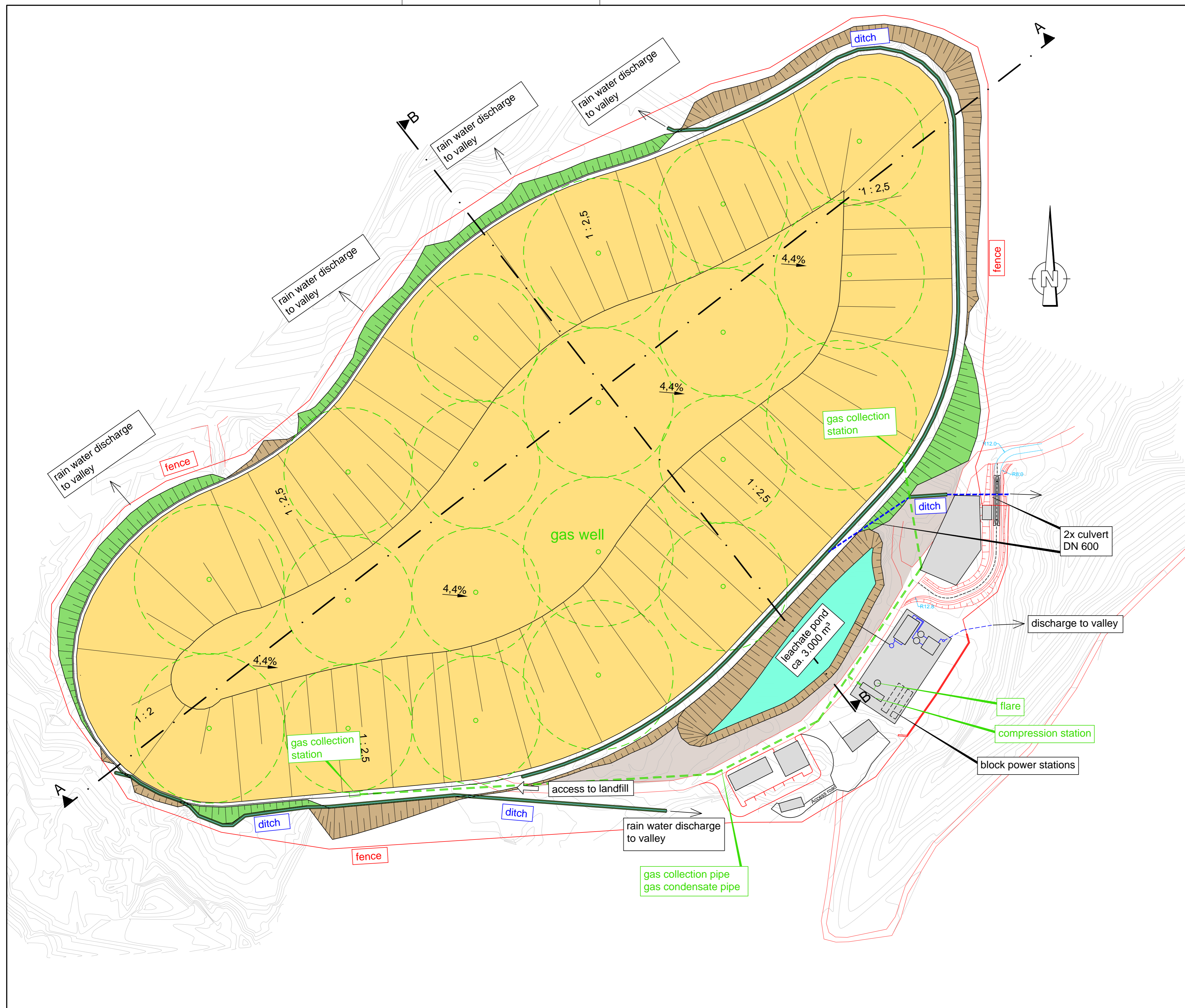
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CLIENT	CENTRE FOR DEVELOPMENT OF POLOG PLANNING REGION		
FUNDING AGENCY	State Secretariat of Economic Affairs (SECO)		
CONTRACTOR	Consulting Consortium INFRASTRUKTUR & UMWELT / SEHLHOFF GmbH / BAR		
PROJECT	Improvement of the Solid Waste Management Services in the Polog Region, North-Macedonia, Phase I		
PHASE	Feasibility Study		
LOCATION	Rusino Landfill, Polog Region, North-Macedonia		
site plan, leachate collection system			
CHANGES		SIGNATURE	DATE
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3.)			
SCALE	PLAN NUMBER	DATE	SIGNATURE
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Julius-Reiber-Strasse 17 D 64283 Darmstadt / Germany Tel. +49-6151-8130-0 Fax +49-6151-8130-20 www.iu-info.de	Industriestraße 10 84137 Vilshuburg / Germany Tel.: +49.8741.96040 Fax: +49.8741.960499 www.sehloff.eu	Naroden Front 11/1-4 1000 Skopje Macedonia www.barece.com.mk	



SOLID WASTE MANAGEMENT IN POLOG REGION, NORTH-MACEDONIA PHASE I			
CLIENT	CENTRE FOR DEVELOPMENT OF POLOG PLANNING REGION		
FUNDING AGENCY	State Secretariat of Economic Affairs (SECO)		
CONTRACTOR	Consulting Consortium INFRASTRUKTUR & UMWELT / SEHLHOFF GmbH / BAR		
PROJECT	Improvement of the Solid Waste Management Services in the Polog Region, North-Macedonia, Phase I		
PHASE	Feasibility Study		
LOCATION	Rusino Landfill, Polog Region, North-Macedonia		
site plan, 1. construction stage			
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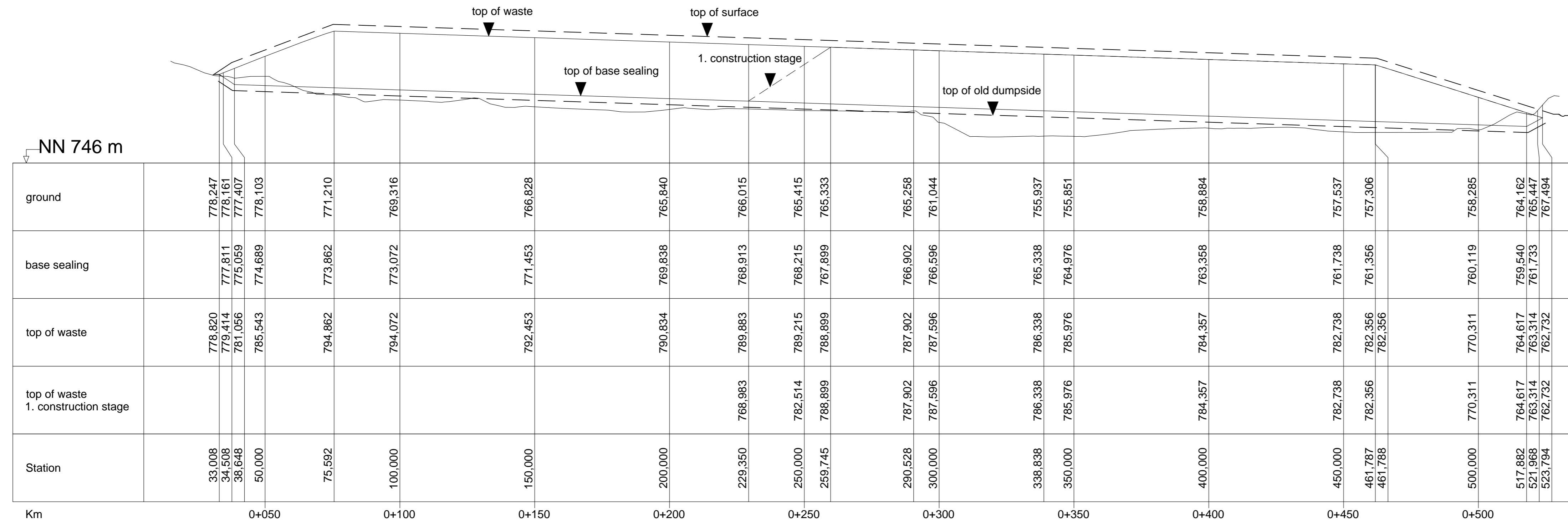
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FUNDING AGENCY	State Secretariat of Economic Affairs (SECO)		
CONTRACTOR	Consulting Consortium INFRASTRUKTUR & UMWELT / SEHLOFF GmbH / BAR		
PROJECT	Improvement of the Solid Waste Management Services in the Polog Region, North-Macedonia, Phase I		
PHASE	Feasibility Study		
LOCATION	Rusino Landfill, Polog Region, North-Macedonia		
site plan, surface of landfill			
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Julius-Reiber-Strasse 17 D 64283 Darmstadt / Germany Tel.: +49-6151-8130-0 Fax +49-6151-8130-20 www.iu-info.de	Industriestraße 10 84137 Vilshuburg / Germany Tel.: +49.8741.96040 Fax: +49.8741.960499 www.sehloff.eu	Naroden Front 11/1-4 1000 Skopje Macedonia www.barece.com.mk	



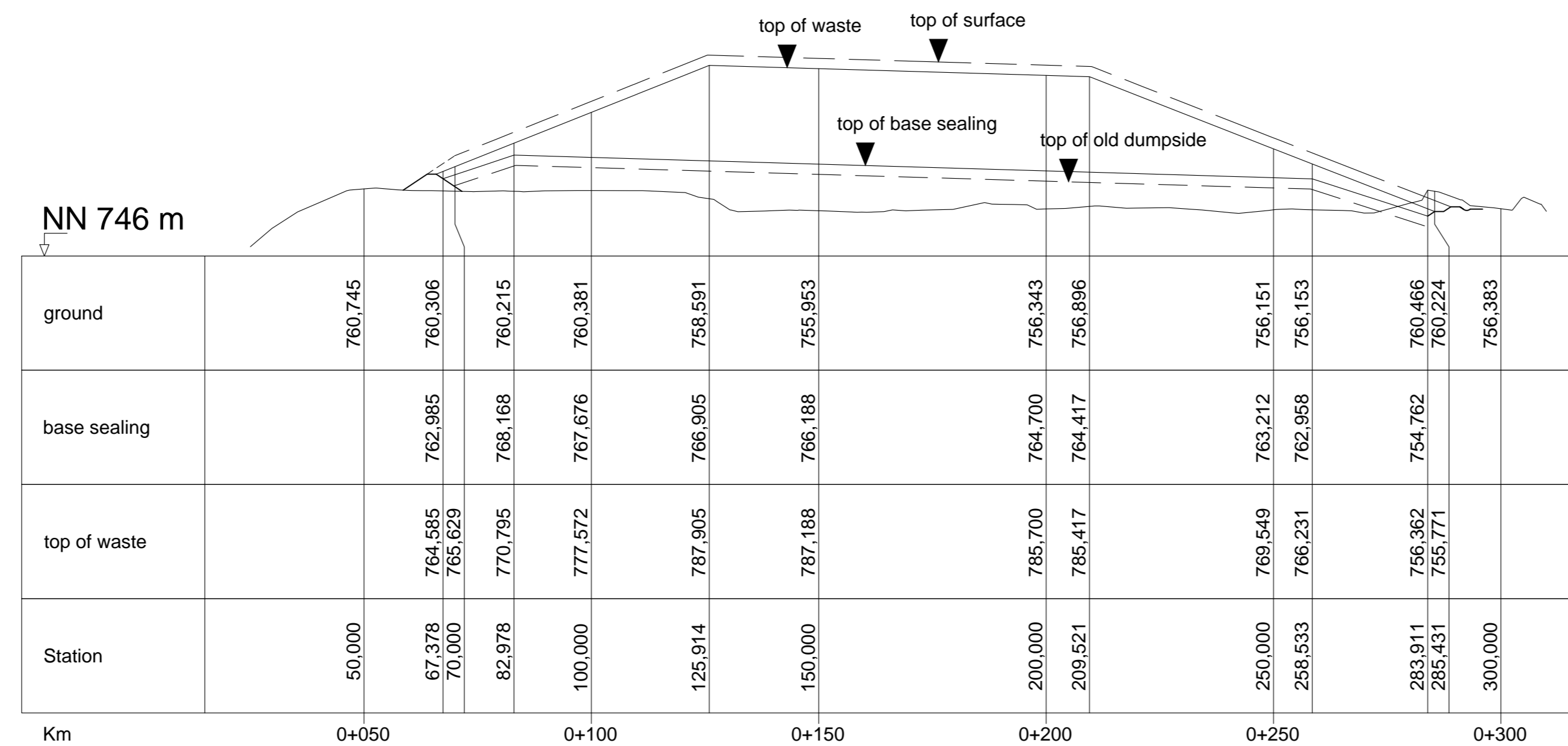
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FUNDING AGENCY	State Secretariat of Economic Affairs (SECO)
CONTRACTOR	Consulting Consortium INFRASTRUKTUR & UMWELT / SEHLOFF GmbH / BAR
PROJECT	Improvement of the Solid Waste Management Services in the Polog Region, North-Macedonia, Phase I
PHASE	Feasibility Study
LOCATION	Rusino Landfill, Polog Region, North-Macedonia

site plan, surface water derivation and gas collection			
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 INFRASTRUKTUR & UMWELT Professor Böhm und Partner Julius-Reiber-Strasse 17 D 64283 Darmstadt / Germany Tel.: +49-6151-8130-0 Fax +49-6151-8130-20 www.iu-info.de	 SEHLOFF GMBH Industriestraße 10 84137 Vilshuburg / Germany Tel.: +49.8741.96040 Fax: +49.8741.960499 www.sehloff.eu	 BAR E.C.E. Naroden Front 11/1-4 1000 Skopje Macedonia www.barece.com.mk	

cross section
A - A



cross section
B - B



SOLID WASTE MANAGEMENT
IN POLOG REGION, NORTH-MACEDONIA PHASE I

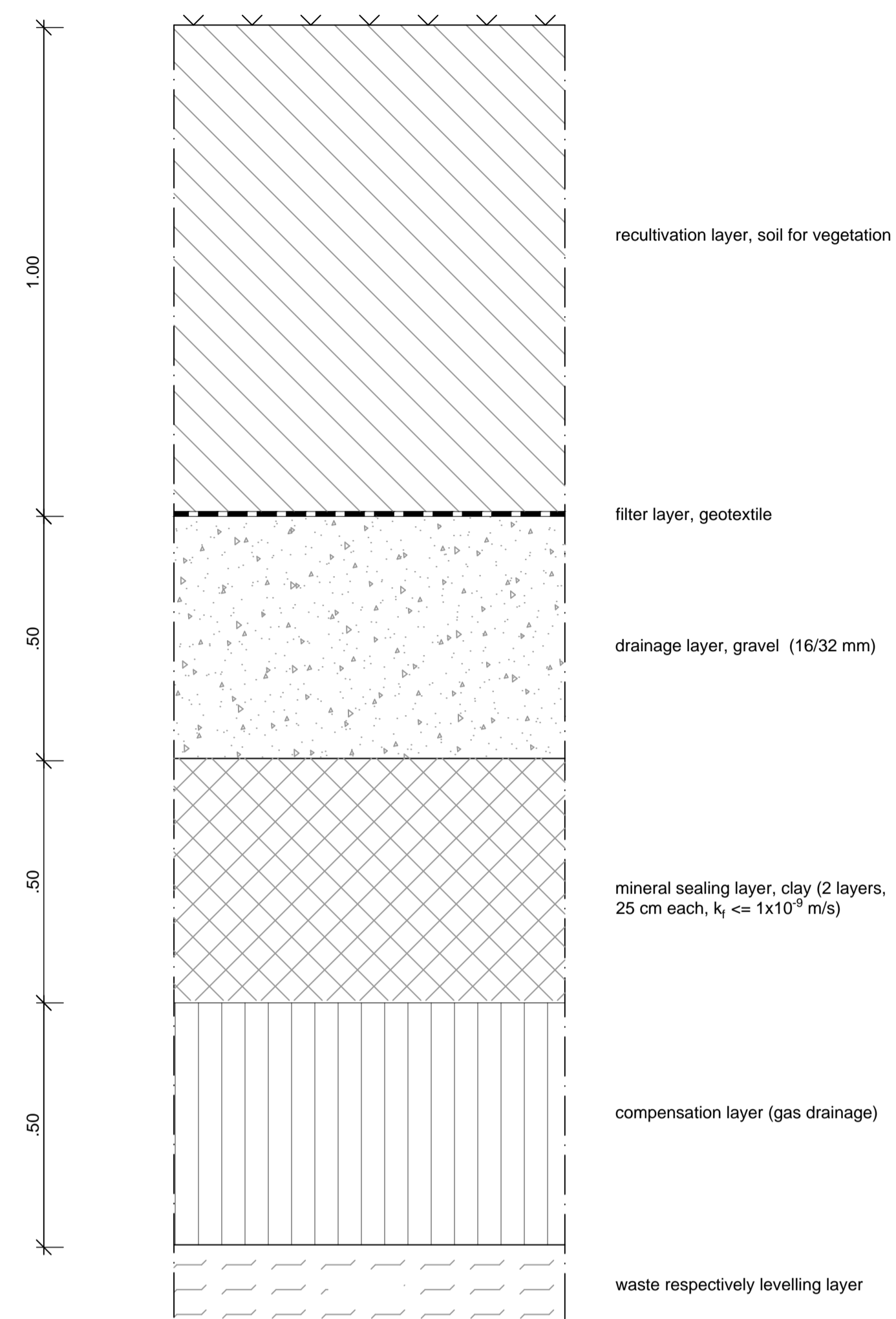
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CONTRACTOR	Consulting Consortium INFRASTRUKTUR & UMWELT / SEHLHOFF GmbH / BAR	
PROJECT	Improvement of the Solid Waste Management Services in the Polog Region, North-Macedonia, Phase I	
PHASE	Feasibility Study	
LOCATION	Rusino Landfill, Polog Region, North-Macedonia	

longitudinal and cross section landfill

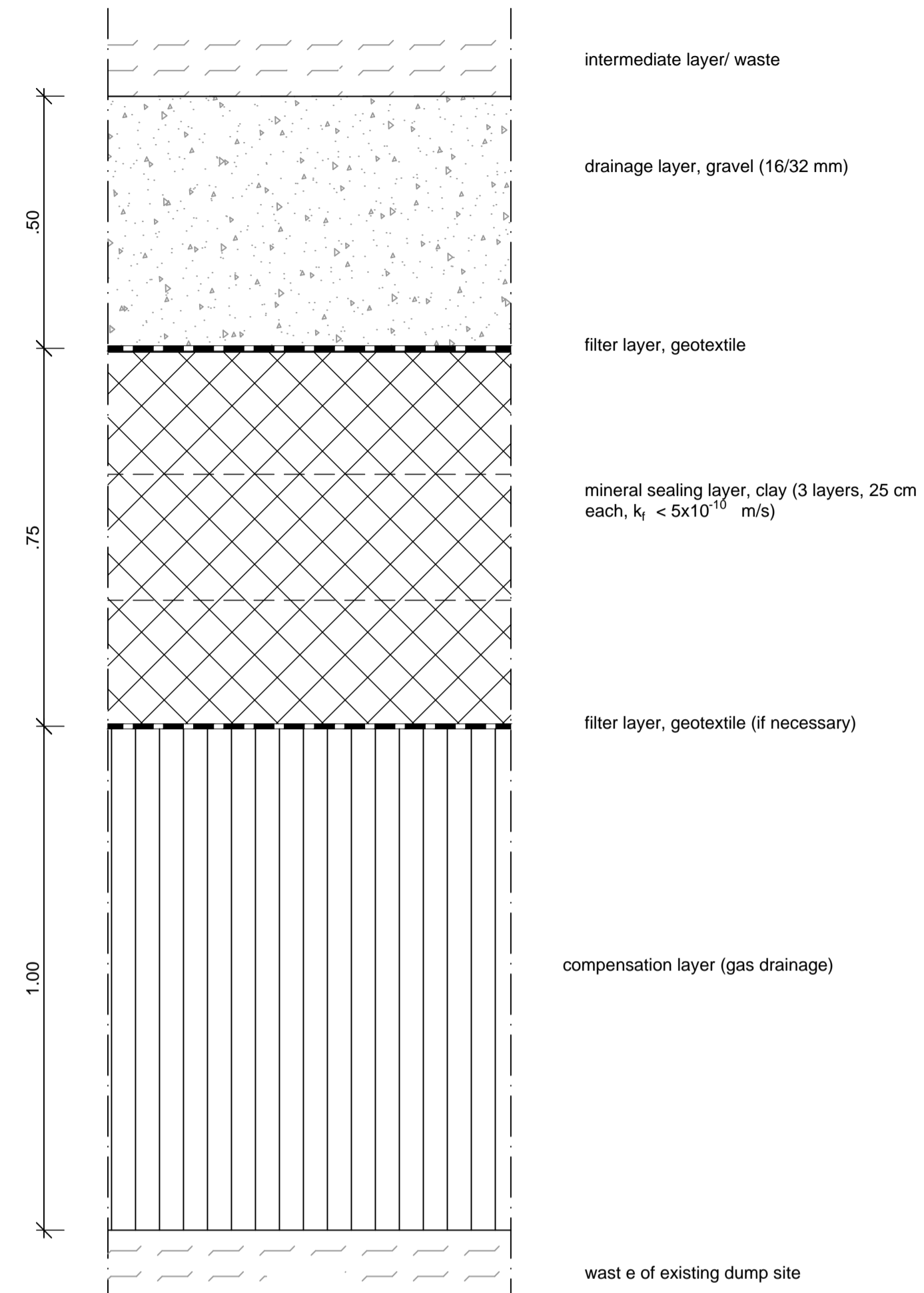
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 Julius-Reiber-Strasse 17 D 64293 Darmstadt / Germany Tel. +49-6151-8130-0 Fax +49-6151-8130-20 www.iu-info.de	 Industriestraße 10 84137 Vilshuburg / Germany Tel.: +49.8741.96040 Fax: +49.8741.960499 www.sehloff.eu	 Naroden Front 11/1-4 1000 Skopje Macedonia www.barece.com.mk
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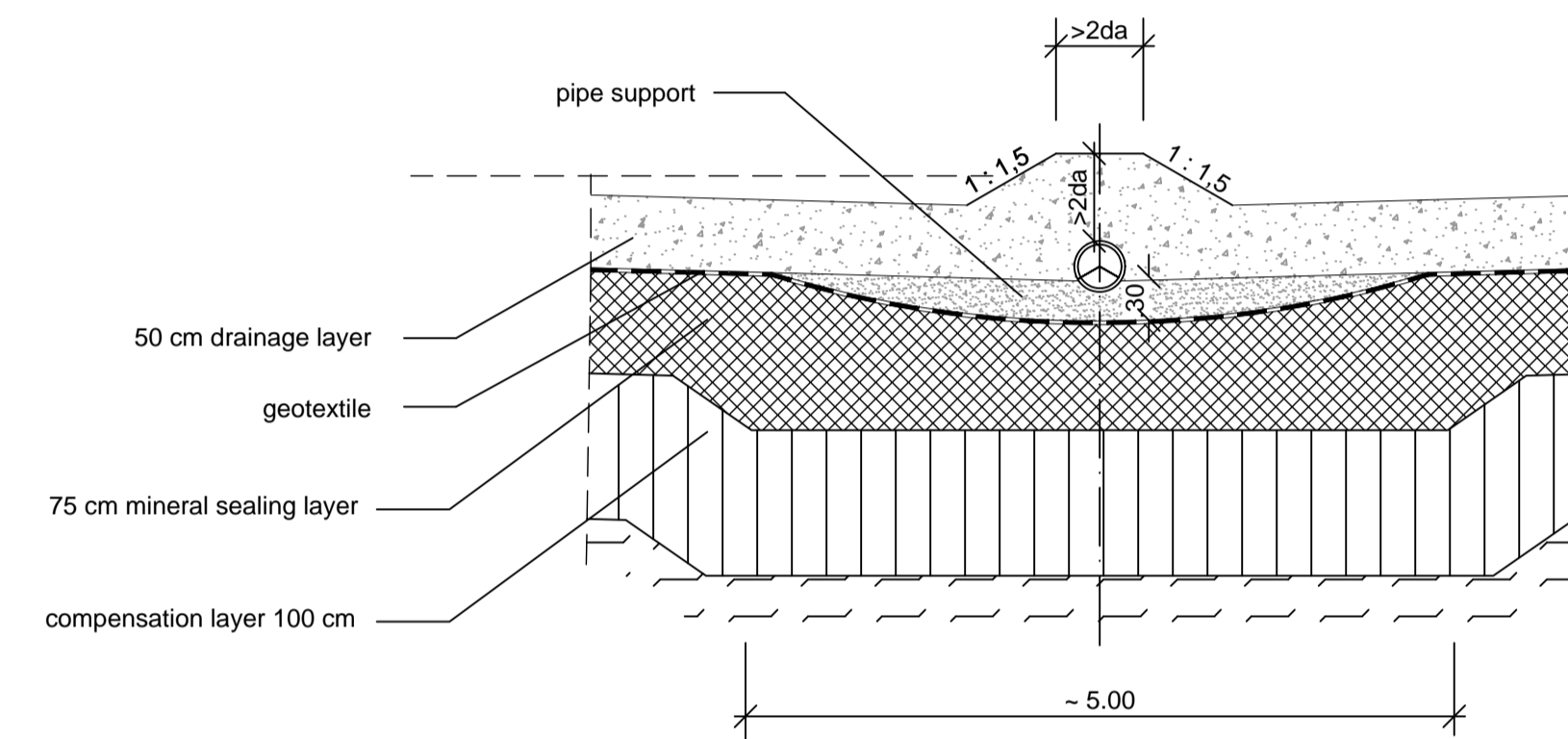
surface sealing system
scale 1 : 10



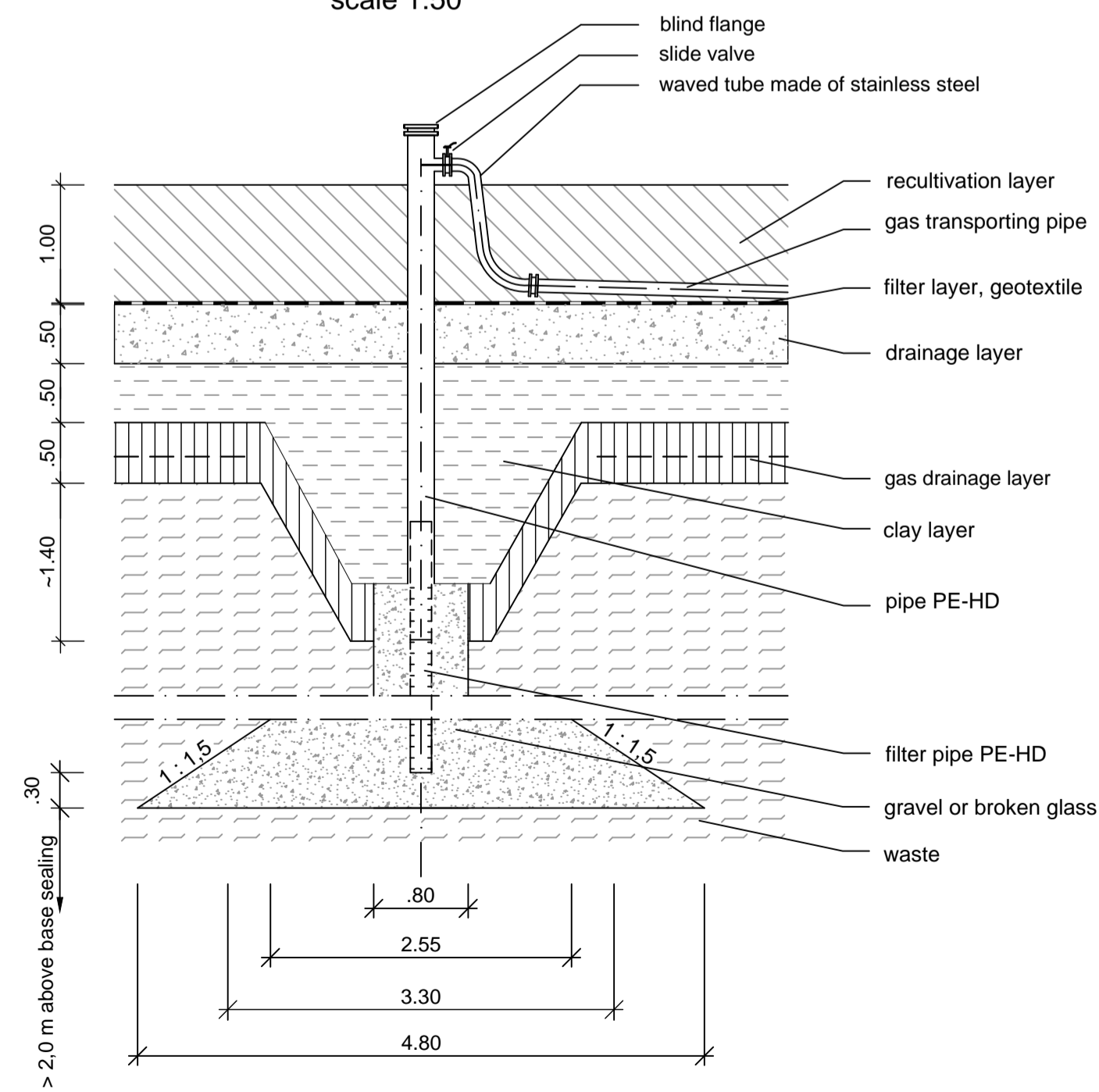
base sealing system
scale 1 : 10



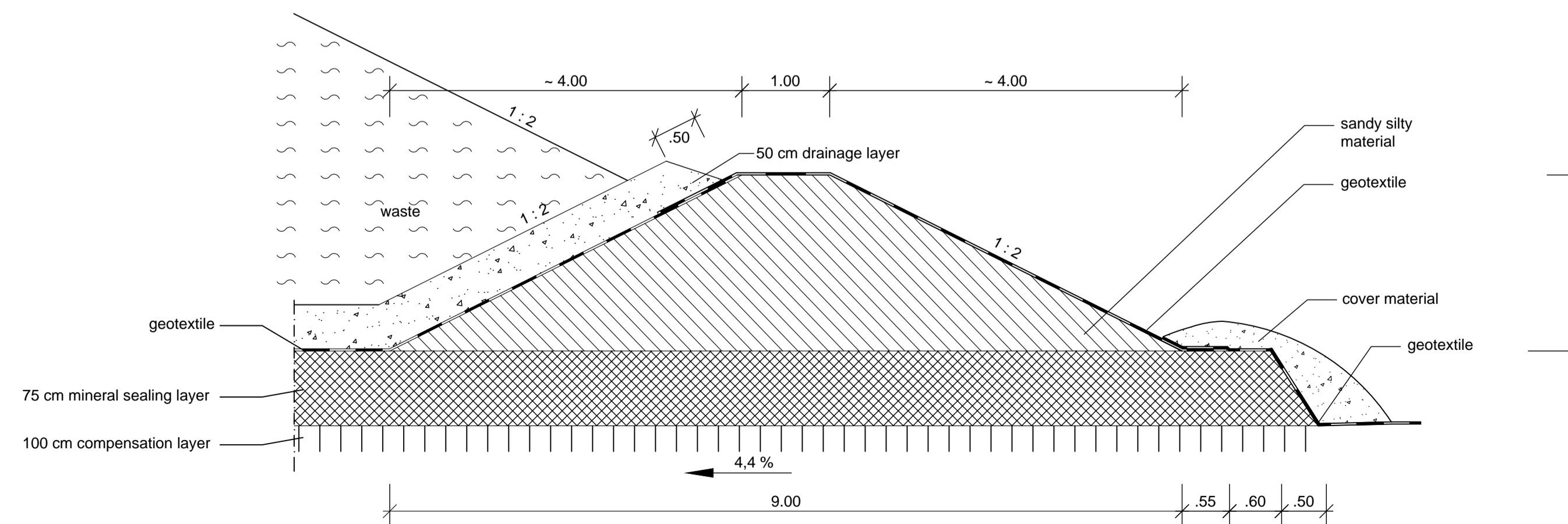
leachate pipes
scale 1:50



gas vent
scale 1:50



seperation dike
between construction stages
M 1:50

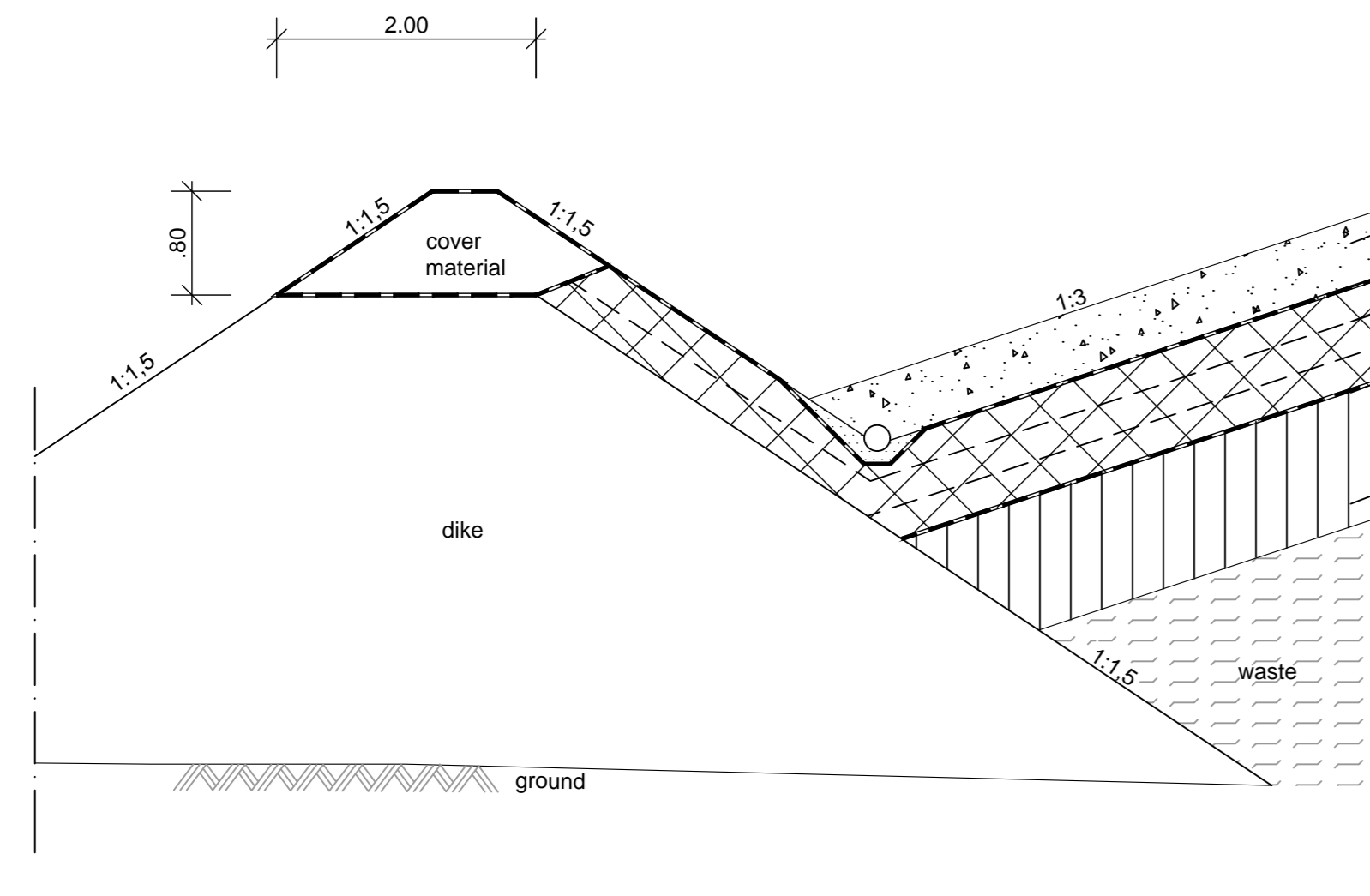


SOLID WASTE MANAGEMENT IN POLOG REGION, NORTH-MACEDONIA PHASE I			
CLIENT	CENTRE FOR DEVELOPMENT OF POLOG PLANNING REGION		
FUNDING AGENCY	State Secretariat of Economic Affairs (SECO)		
CONTRACTOR	Consulting Consortium INFRASTRUKTUR & UMWELT / SEHLHOFF GmbH / BAR		
PROJECT	Improvement of the Solid Waste Management Services in the Polog Region, North-Macedonia, Phase I		
PHASE	Feasibility Study		
LOCATION	Rusino Landfill, Polog Region, North-Macedonia		

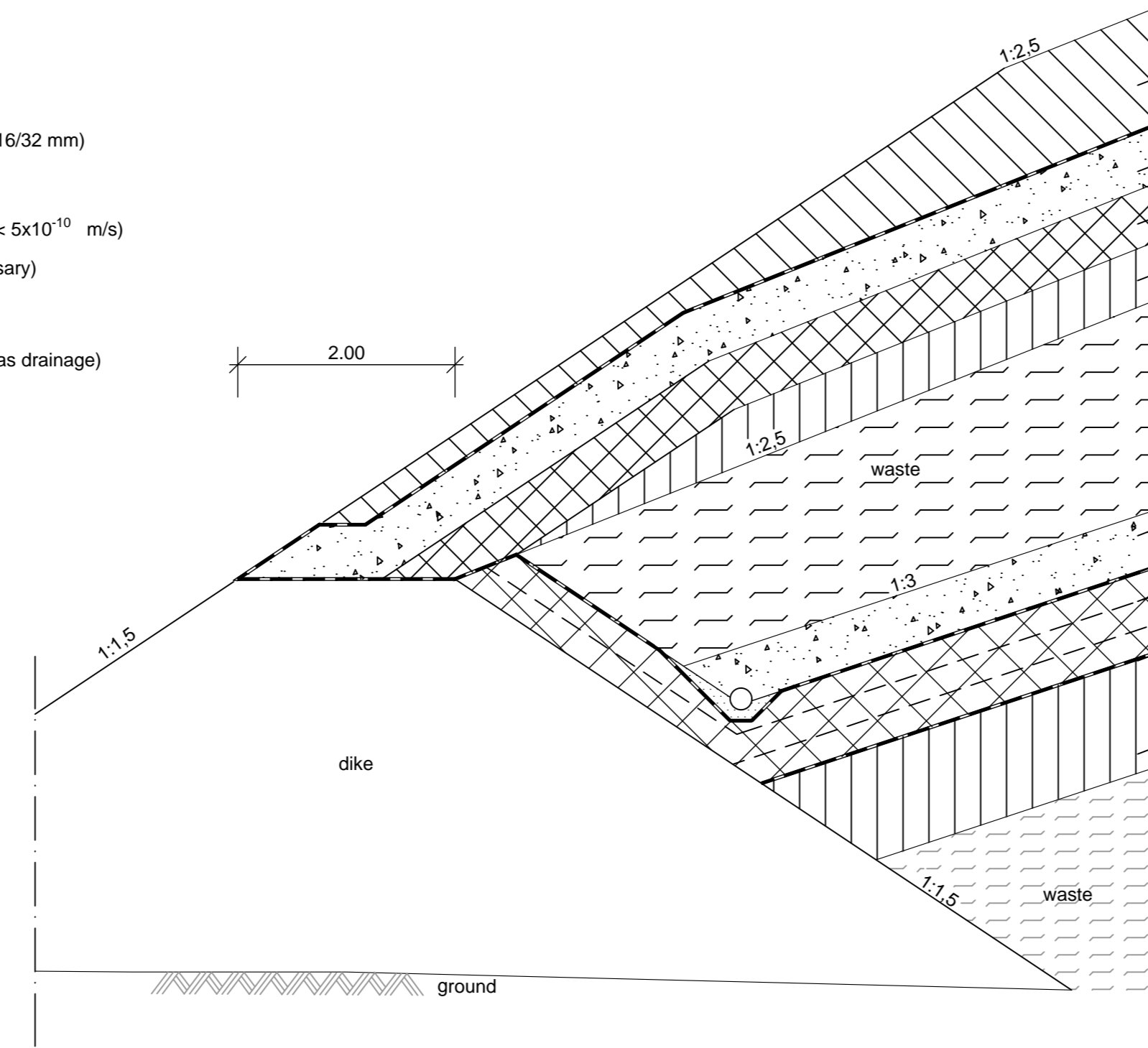
detail plan, base and surface sealing system

CHANGES		SIGNATURE	DATE
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2.)			
3.)			
SCALE	PLAN NUMBER	DATE	SIGNATURE
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Julius-Reiber-Strasse 17 D 64293 Darmstadt / Germany Tel.: +49-6151-8130-0 Fax: +49-6151-8130-20 www.iu-info.de	Industriestraße 10 84137 Vilsbiburg / Germany Tel.: +49-8741-96040 Fax: +49-8741-960499 www.sehloff.eu	Naroden Front 11/1-4 1000 Skopje Macedonia www.barece.com.mk	

ending of base sealing during filling
M 1:50
section B - B

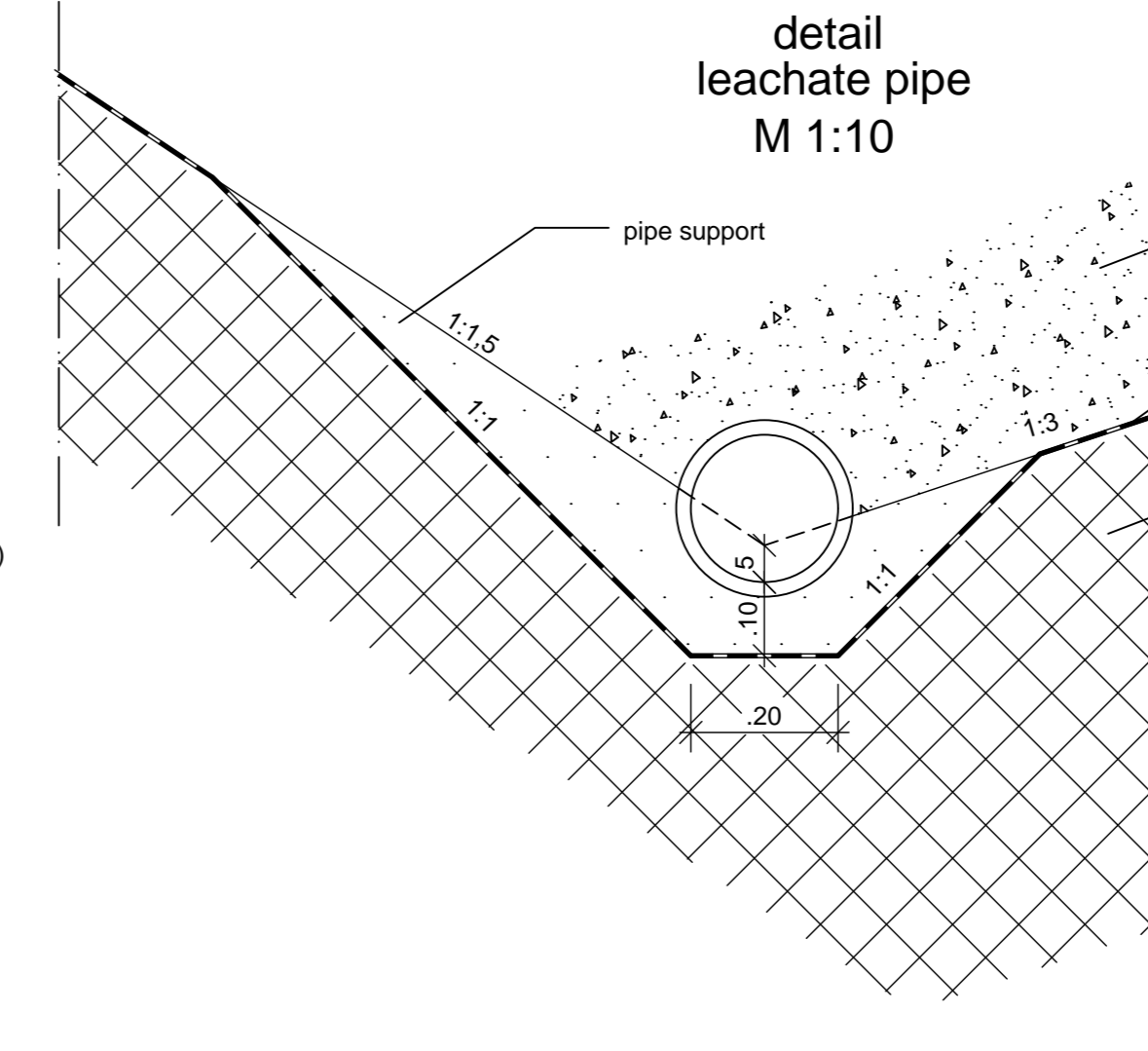


crossing of base and surface sealing after filling
M 1:50
section B - B



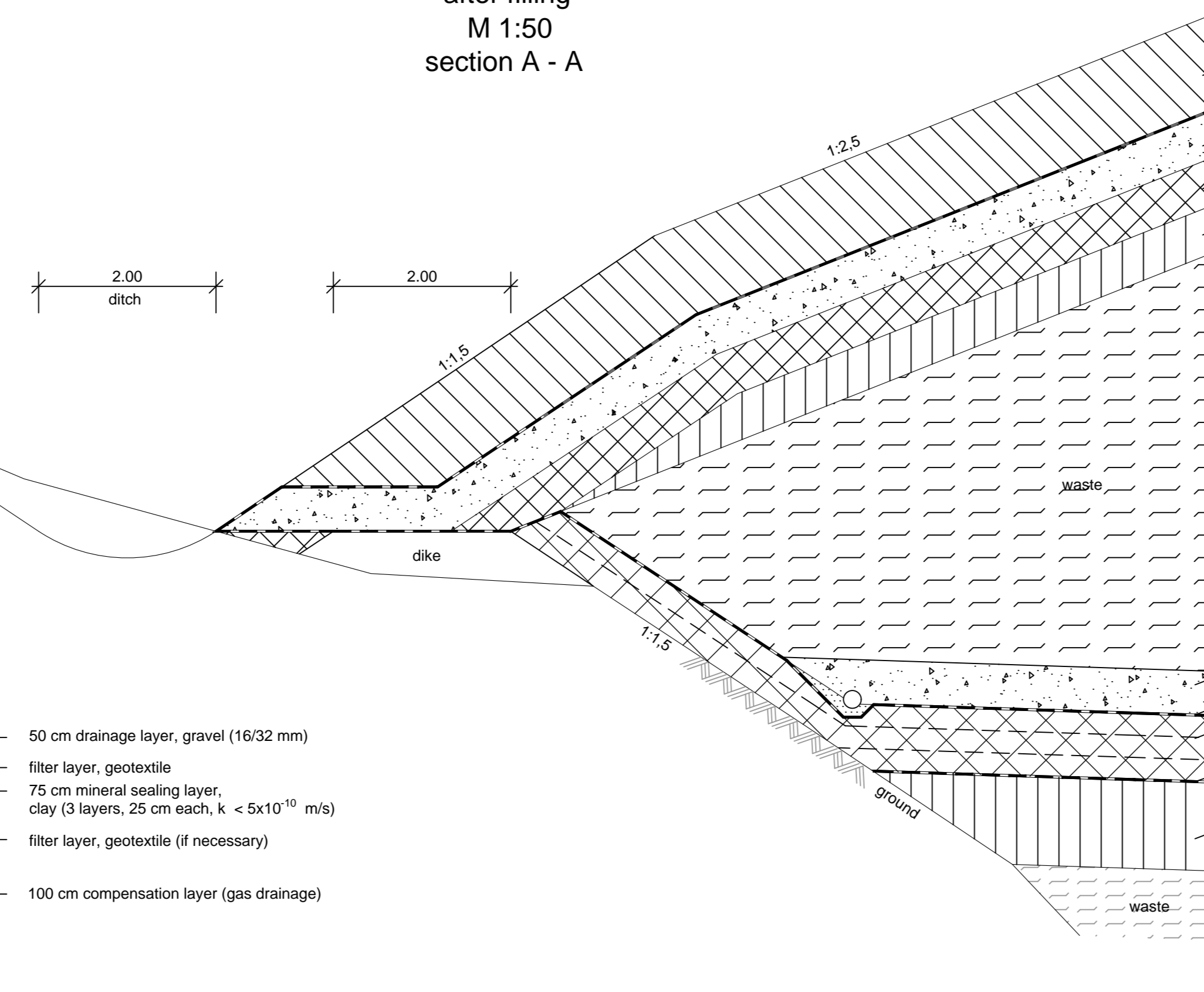
- 1 m recultivation layer, soil for vegetation
- filter layer, geotextile
- 50 cm drainage layer, gravel (16/32 mm)
- 50 cm mineral sealing layer, clay (2 layers, 25 cm each, $k_s \leq 1 \times 10^{-10}$ m/s)
- 50 cm compensation layer (gas drainage)
- 50 cm drainage layer, gravel (16/32 mm)
- filter layer, geotextile
- 50 cm mineral sealing layer, clay (3 layers, 25 cm each, $k_s < 5 \times 10^{-10}$ m/s)
- filter layer, geotextile (if necessary)
- 100 cm compensation layer (gas drainage)

detail
leachate pipe
M 1:10



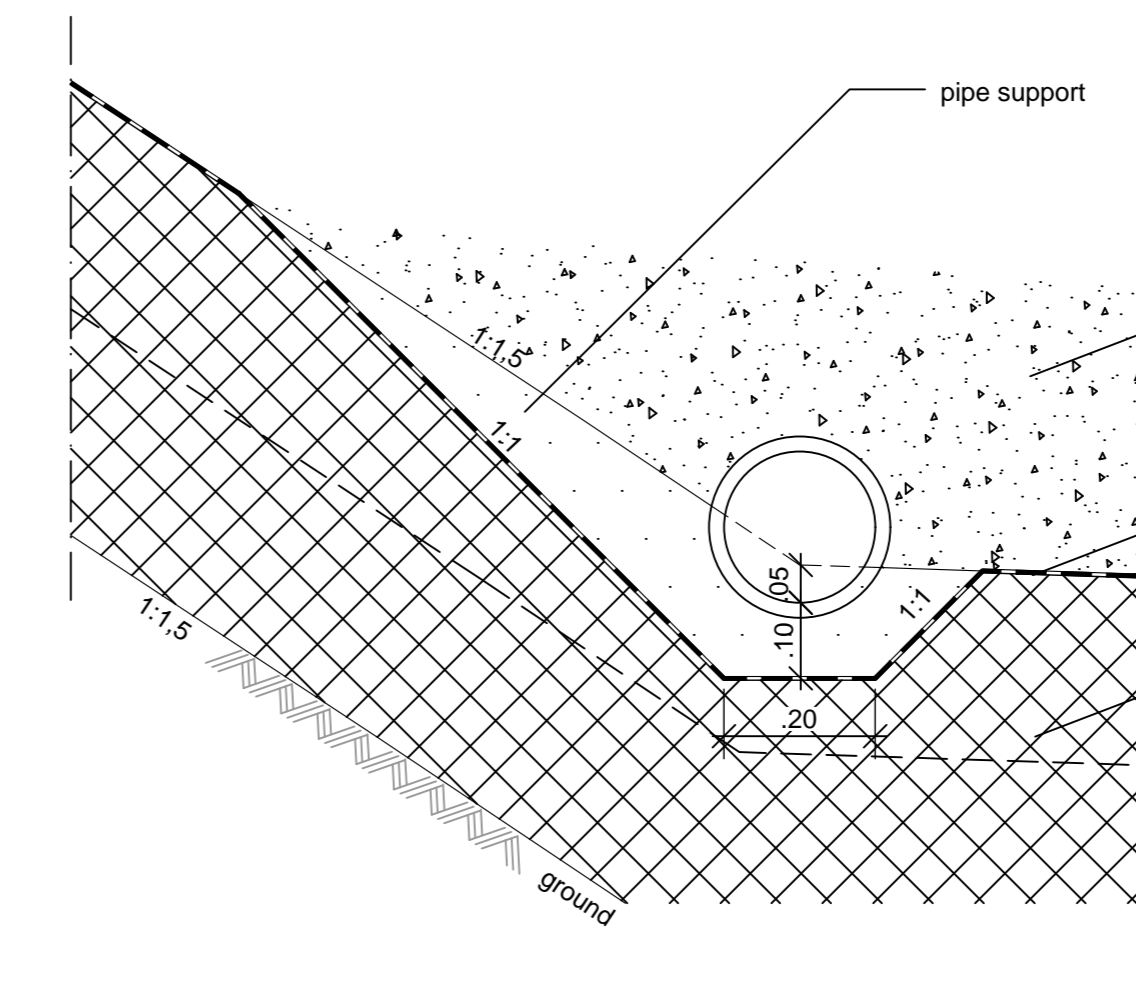
- 50 cm drainage layer, gravel (16/32 mm)
- filter layer, geotextile
- 75 cm mineral sealing layer, clay (3 layers, 25 cm each, $k_s < 5 \times 10^{-10}$ m/s)

crossing of base and surface sealing after filling
M 1:50
section A - A



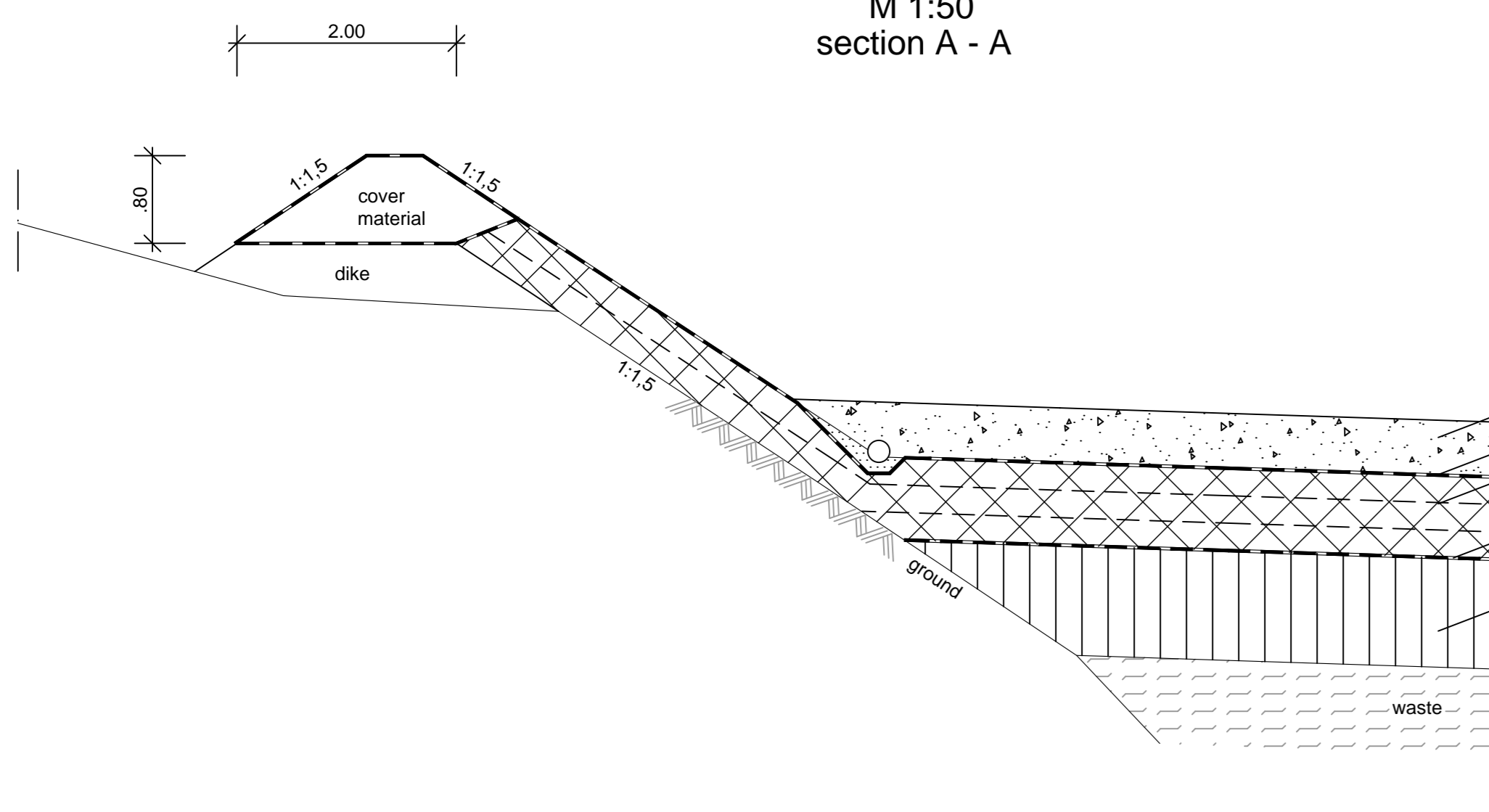
- 1 m recultivation layer, soil for vegetation
- filter layer, geotextile
- 50 cm drainage layer, gravel (16/32 mm)
- 50 cm mineral sealing layer, clay (2 layers, 25 cm each, $k_s \leq 1 \times 10^{-10}$ m/s)
- 50 cm compensation layer (gas drainage)

detail
leachate pipe
M 1:10



- 50 cm drainage layer, gravel (16/32 mm)
- filter layer, geotextile
- 75 cm mineral sealing layer, clay (3 layers, 25 cm each, $k_s < 5 \times 10^{-10}$ m/s)


ending of base sealing during filling
M 1:50
section A - A



- 50 cm drainage layer, gravel (16/32 mm)
- filter layer, geotextile
- 75 cm mineral sealing layer, clay (3 layers, 25 cm each, $k_s < 5 \times 10^{-10}$ m/s)
- filter layer, geotextile (if necessary)
- 100 cm compensation layer (gas drainage)

- 50 cm drainage layer, gravel (16/32 mm)
- filter layer, geotextile
- 75 cm mineral sealing layer, clay (3 layers, 25 cm each, $k_s < 5 \times 10^{-10}$ m/s)
- filter layer, geotextile (if necessary)
- 100 cm compensation layer (gas drainage)

SOLID WASTE MANAGEMENT
IN POLOG REGION, NORTH-MACEDONIA PHASE I

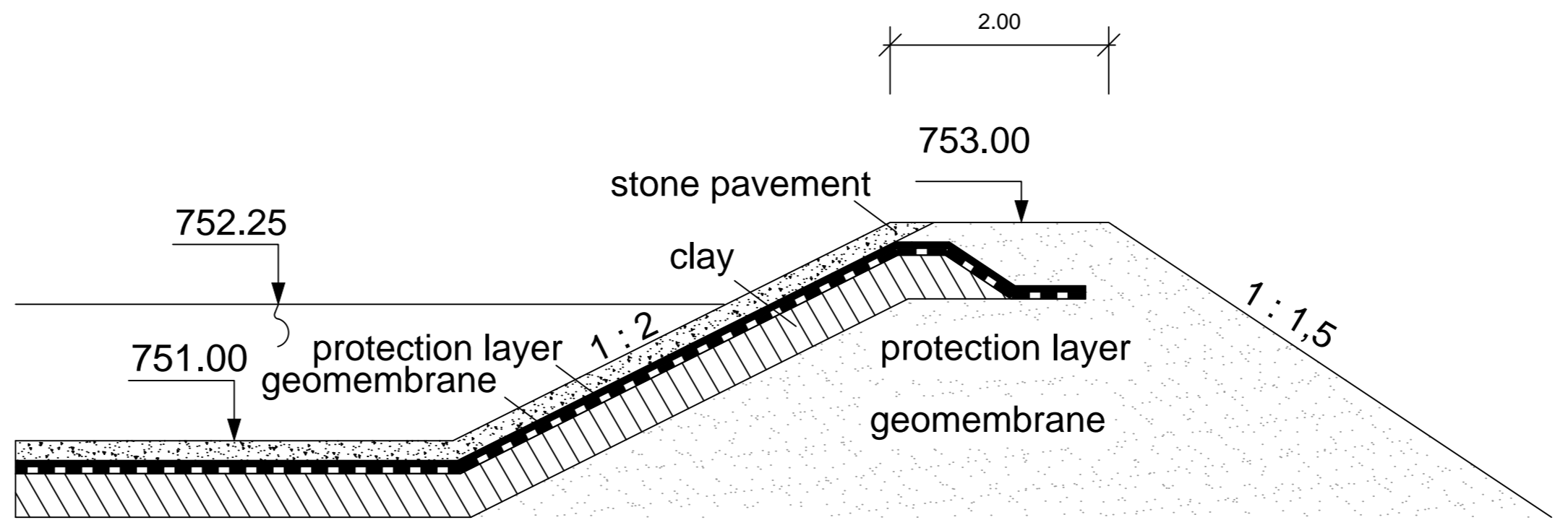
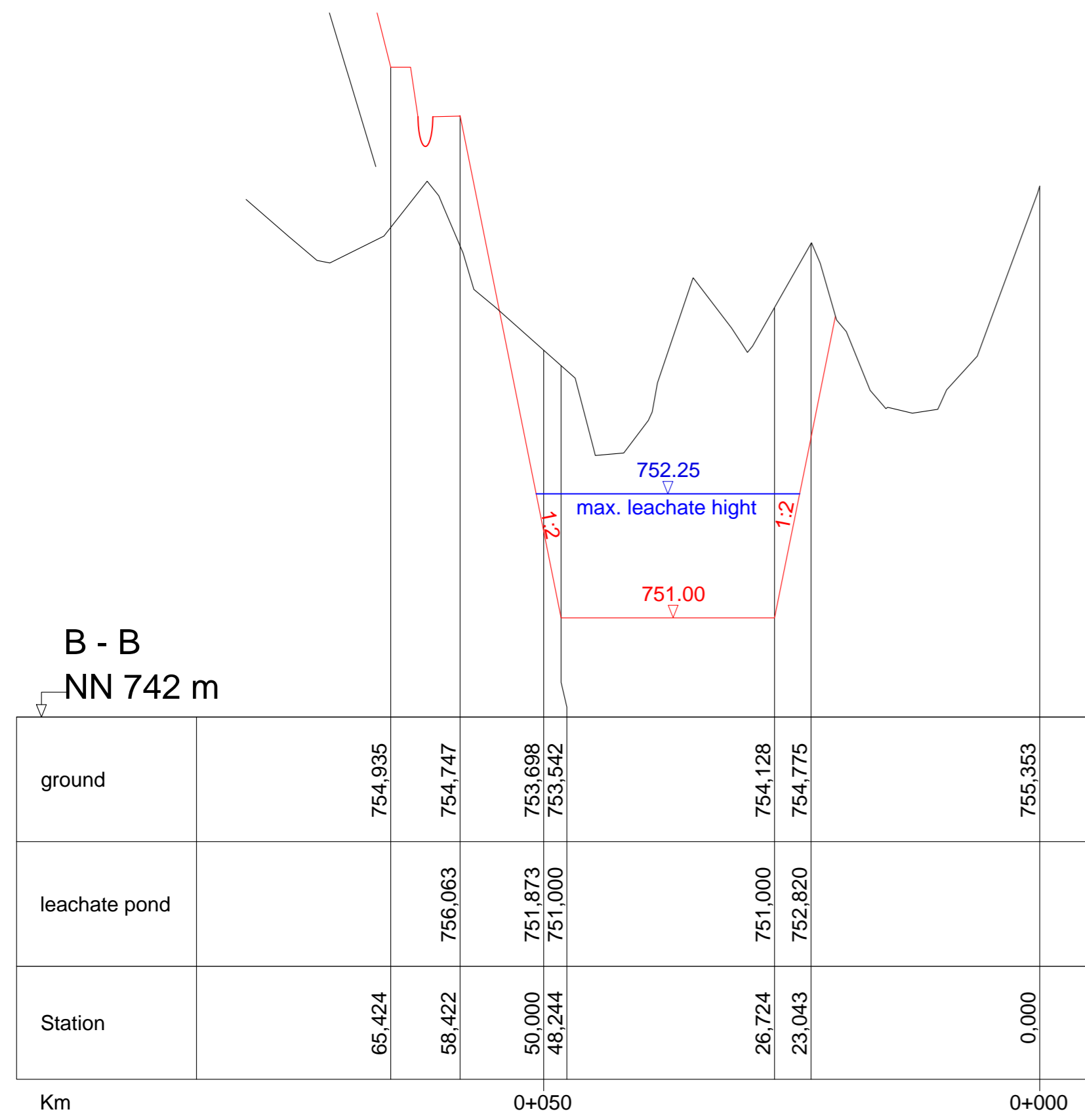
CLIENT	CENTRE FOR DEVELOPMENT OF POLOG PLANNING REGION	
FUNDING AGENCY	State Secretariat of Economic Affairs (SECO)	
CONTRACTOR	Consulting Consortium INFRASTRUKTUR & UMWELT / SEHLHOFF GmbH / BAR	
PROJECT	Improvement of the Solid Waste Management Services in the Polog Region, North-Macedonia, Phase I	
PHASE	Feasibility Study	
LOCATION	Rusino Landfill, Polog Region, North-Macedonia	

detail plan, ending of base and surface sealing system

CHANGES	SIGNATURE	DATE
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SCALE	PLAN NUMBER	DATE	SIGNATURE
1:50 / 1:10	L-P-10	2019-12-09	

 INFRASTRUKTUR & UMWELT Prof. Dr. Ingrid Wirth Julius-Reiber-Strasse 17 D 64293 Darmstadt / Germany Tel.: +49-6151-8130-0 Fax: +49-6151-8130-20 www.iu-info.de	 SEHLHOFF GMBH Industriestraße 10 84137 Vilsbiburg / Germany Tel.: +49-8741-96040 Fax: +49-8741-960499 www.sehloff.eu	 BAR E.C.E. Naroden Front 11/1-4 1000 Skopje Macedonia www.barece.com.mk
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SOLID WASTE MANAGEMENT IN POLOG REGION, NORTH-MACEDONIA PHASE I

CLIENT	CENTRE FOR DEVELOPMENT OF POLOG PLANNING REGION	
FUNDING AGENCY	State Secretariat of Economic Affairs (SECO)	
CONTRACTOR	Consulting Consortium INFRASTRUKTUR & UMWELT / SEHLHOFF GmbH / BAR	
PROJECT	Improvement of the Solid Waste Management Services in the Polog Region, North-Macedonia, Phase I	
PHASE	Feasibility Study	
LOCATION	Rusino Landfill, Polog Region, North-Macedonia	

detail plan, leachate collection pond

CHANGES	SIGNATURE	DATE
1.)		
2.)		
3.)		

SCALE	PLAN NUMBER	DATE	SIGNATURE
1: 50; 1:50/500	L-P-11	2019-12-09	

<p>INFRASTRUKTUR & UMWELT Professor Böhm und Partner</p> <p>Julius-Reiber-Strasse 17 D 64293 Darmstadt / Germany Tel.: +49-6151-8130-0 Fax: +49-6151-8130-20 www.iu-info.de</p>	<p>SEHLHOFF GMBH BREMEN • ANSBACH</p> <p>Industriestraße 10 84137 Vilsbiburg / Germany Tel.: +49.8741.96040 Fax: +49.8741.960499 www.sehloff.eu</p>	<p>BAR Engineering, Consulting & Environment E.C.E.</p> <p>Naroden Front 11/1-4 1000 Skopje Macedonia www.barece.com.mk</p>
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Solid Waste Management in Polog Region, North Macedonia, Phase I Final Feasibility Study Report

Annex 3 Financial and Economic Analysis



Solid Waste Management in Polog Region, North Macedonia, Phase I Final Feasibility Study Report

Annex 3: Financial and Economic Analysis (Base Scenario)

F1	INVESTMENT COSTS - GRAND TOTAL
F2	O&M COSTS - GRAND TOTAL
F3-1	SWM QUANTITIES COLLECTED/BILLED
F3-2	SWM TARIFFS
F3-3	SWM REVENUES
F3-4	REVENUES OTHER THAN SWM TARIFF REVENUES
F3-5	OVERALL SWM REVENUES BILLED AND COLLECTED
F4	GENERAL TERMS AND CONDITIONS OF IFI LOANS
F5-1	LOAN DISBURSEMENTS: 2021+2022
F5-2	LOAN DISBURSEMENTS: 2025-2027
F5-3	LOAN DISBURSEMENTS: 2028-2029
F5-4	LOAN DISBURSEMENTS: 2032-2033
F5-5	LOAN DISBURSEMENTS: 2037-2038
F5-6	ALL LOAN DISBURSEMENTS
F6	PROJECT FINANCIAL PROFITABILITY
F7	FINANCIAL RETURN ON INVESTED LOCAL CAPITAL
F8-1	PROJECT PROFIT (-LOSS) STATEMENTS
F8-2	PROJECT PROFIT (-LOSS) STATEMENTS (% OF TOTAL REVENUES)
F9	PROJECT CASH FLOWS
F10	PROJECT BALANCE SHEETS (EURO)

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
INVESTMENT COSTS - GRAND TOTAL

8,0%

YEARS	INITIAL INVESTMENT COSTS			REPLACEMENT INVESTMENT COSTS			TOTAL INVESTMENT COSTS			Implementation Consultant
	Civil Works	Mobile Equipment	Total Investments	Civil Works	Mobile Equipment	Total Investments	Civil Works	Mobile Equipment	Total Investments	
	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR
2021	0	0	0	0	0	0	0	0	0	0
2022	6.483.600	11.114.514	17.598.114	0	0	0	6.483.600	11.114.514	17.598.114	1.407.849
2023	0	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0	0
2025	17.575	472.325	489.900	0	0	0	17.575	472.325	489.900	39.192
2026	0	0	0	0	0	0	0	0	0	0
2027	0	240.000	240.000	0	0	0	0	240.000	240.000	19.200
2028	1.438.525	316.125	1.754.650	0	2.067.014	2.067.014	1.438.525	2.383.139	3.821.664	140.372
2029	1.273.000	0	1.273.000	0	0	0	1.273.000	0	1.273.000	101.840
2030	0	0	0	0	232.325	232.325	0	232.325	232.325	0
2031	0	120.000	120.000	0	0	0	0	120.000	120.000	9.600
2032	6.000.000	0	6.000.000	0	1.027.500	1.027.500	6.000.000	1.027.500	7.027.500	480.000
2033	1.338.150	718.922	2.057.072	0	8.913.889	8.913.889	1.338.150	9.632.811	10.970.961	164.566
2034	0	0	0	0	0	0	0	0	0	0
2035	0	240.000	240.000	0	240.000	240.000	0	480.000	480.000	19.200
2036	0	0	0	0	0	0	0	0	0	0
2037	1.300.000	0	1.300.000	0	240.000	240.000	1.300.000	240.000	1.540.000	104.000
2038	40.575	267.411	307.986	0	1.573.336	1.573.336	40.575	1.840.747	1.881.322	24.639
2039	0	0	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0	0	0
2041	0	240.000	240.000	0	120.000	120.000	0	360.000	360.000	19.200
2042	1.600.000	0	1.600.000	0	0	0	1.600.000	0	1.600.000	128.000
Grand Total	19.491.425	13.729.297	33.220.722	0	14.414.064	14.414.064	19.491.425	28.143.361	47.634.786	2.657.658
Total (2021-2022)	6.483.600	11.114.514	17.598.114	0	0	0	6.483.600	11.114.514	17.598.114	1.407.849
Total (2023-2042)	13.007.825	2.614.783	15.622.608	0	14.414.064	14.414.064	13.007.825	17.028.847	30.036.672	1.249.809
Total (2021-2022) (%)	33,26	80,95	52,97	0,00	0,00	0,00	33,26	39,49	36,94	52,97
Total (2023-2042) (%)	66,74	19,05	47,03	0,00	100,00	100,00	66,74	60,51	63,06	47,03

Real Financial Discount Rate (%)	4,00									
Discounted Grand Total	13.868.190	11.957.880	25.826.071	0	8.748.298	8.748.298	13.868.190	20.706.178	34.574.368	2.066.086
Discounted Total (2021-2022)	5.994.453	10.275.993	16.270.446	0	0	0	5.994.453	10.275.993	16.270.446	1.301.636
Discounted Total (2023-2042)	7.873.738	1.681.887	9.555.625	0	8.748.298	8.748.298	7.873.738	10.430.185	18.303.922	764.450
Total (2021-2022) (%)	43,22	85,93	63,00	0,00	0,00	0,00	43,22	49,63	47,06	63,00
Total (2023-2042) (%)	56,78	14,07	37,00	0,00	100,00	100,00	56,78	50,37	52,94	37,00

			10,0%	10,0%	10,0%	10,0%		
CONTINGENCIES								
Total Investments Including Implementation Consultant	Technical Assistance	Total Investments Including Impl. Consultant & TA	Civil Works	Mobile Equipment	Total Investments	Implementation Consultant	Total Investments Including Implementation Consultant	
EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR
0	907.200	907.200	0	0	0	0	0	0
19.005.963	388.800	19.394.763	648.360	1.111.451	1.759.811	140.785	1.900.596	
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
529.092	0	529.092	1.758	47.233	48.990	3.919	52.909	
0	0	0	0	0	0	0	0	0
259.200	0	259.200	0	24.000	24.000	1.920	25.920	
3.962.036	0	3.962.036	143.853	238.314	382.166	14.037	396.204	
1.374.840	0	1.374.840	127.300	0	127.300	10.184	137.484	
232.325	0	232.325	0	23.233	23.233	0	23.233	
129.600	0	129.600	0	12.000	12.000	960	12.960	
7.507.500	0	7.507.500	600.000	102.750	702.750	48.000	750.750	
11.135.527	0	11.135.527	133.815	963.281	1.097.096	16.457	1.113.553	
0	0	0	0	0	0	0	0	0
499.200	0	499.200	0	48.000	48.000	1.920	49.920	
0	0	0	0	0	0	0	0	0
1.644.000	0	1.644.000	130.000	24.000	154.000	10.400	164.400	
1.905.961	0	1.905.961	4.058	184.075	188.132	2.464	190.596	
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
379.200	0	379.200	0	36.000	36.000	1.920	37.920	
1.728.000	0	1.728.000	160.000	0	160.000	12.800	172.800	
50.292.444	1.296.000	51.588.444	1.949.143	2.814.336	4.763.479	265.766	5.029.244	
19.005.963	1.296.000	20.301.963	648.360	1.111.451	1.759.811	140.785	1.900.596	
31.286.481	0	31.286.481	1.300.783	1.702.885	3.003.667	124.981	3.128.648	
37,79	100,00	39,35	33,26	39,49	36,94	52,97	37,79	
62,21	0,00	60,65	66,74	60,51	63,06	47,03	62,21	

36.640.454	1.231.775	37.872.229	1.386.819	2.070.618	3.457.437	206.609	3.664.045	
17.572.081	1.231.775	18.803.856	599.445	1.027.599	1.627.045	130.164	1.757.208	
19.068.372	0	19.068.372	787.374	1.043.018	1.830.392	76.445	1.906.837	
47,96	100,00	49,65	43,22	49,63	47,06	63,00	47,96	
52,04	0,00	50,35	56,78	50,37	52,94	37,00	52,04	

						8,0%		
TOTAL INVESTMENT COSTS INCLUDING CONTINGENCIES								
Technical Assistance	Total Investments Including Impl. Consultant & TA	Civil Works	Mobile Equipment	Total Investments	Implementation Consultant	TOTAL INVESTMENT COSTS EXCL. TA	Technical Assistance	TOTAL INVESTMENT COSTS INCL. TA
EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR
90.720	90.720	0	0	0	0	0	997.920	997.920
38.880	1.939.476	7.131.960	12.225.965	19.357.925	1.548.634	20.906.559	427.680	21.334.239
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	52.909	19.333	519.558	538.890	43.111	582.001	0	582.001
0	0	0	0	0	0	0	0	0
0	25.920	0	264.000	264.000	21.120	285.120	0	285.120
0	396.204	1.582.378	2.621.453	4.203.830	154.409	4.358.240	0	4.358.240
0	137.484	1.400.300	0	1.400.300	112.024	1.512.324	0	1.512.324
0	23.233	0	255.558	255.558	0	255.558	0	255.558
0	12.960	0	132.000	132.000	10.560	142.560	0	142.560
0	750.750	6.600.000	1.130.250	7.730.250	528.000	8.258.250	0	8.258.250
0	1.113.553	1.471.965	10.596.092	12.068.057	181.022	12.249.079	0	12.249.079
0	0	0	0	0	0	0	0	0
0	49.920	0	528.000	528.000	21.120	549.120	0	549.120
0	0	0	0	0	0	0	0	0
0	164.400	1.430.000	264.000	1.694.000	114.400	1.808.400	0	1.808.400
0	190.596	44.633	2.024.822	2.069.454	27.103	2.096.557	0	2.096.557
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	37.920	0	396.000	396.000	21.120	417.120	0	417.120
0	172.800	1.760.000	0	1.760.000	140.800	1.900.800	0	1.900.800
129.600	5.158.844	21.440.568	30.957.697	52.398.265	2.923.424	55.321.688	1.425.600	56.747.288
129.600	2.030.196	7.131.960	12.225.965	19.357.925	1.548.634	20.906.559	1.425.600	22.332.159
0	3.128.648	14.308.608	18.731.732	33.040.339	1.374.790	34.415.129	0	34.415.129
100,00	39,35	33,26	39,49	36,94	52,97	37,79	100,00	39,35
0,00	60,65	66,74	60,51	63,06	47,03	62,21	0,00	60,65

123.178	3.787.223	15.255.009	22.776.795	38.031.805	2.272.694	40.304.499	1.354.953	41.659.452
123.178	1.880.386	6.593.898	11.303.592	17.897.490	1.431.799	19.329.289	1.354.953	20.684.242
0	1.906.837	8.661.111	11.473.203	20.134.315	840.895	20.975.210	0	20.975.210
100,00	49,65	43,22	49,63	47,06	63,00	47,96	100,00	49,65
0,00	50,35	56,78	50,37	52,94	37,00	52,04	0,00	50,35

TOTAL INVESTMENT COSTS INCLUDING CONTINGENCIES AND IMPLEMENTATION CONSULTANCY FEES							
Initial Inv. Costs - Civil Works	Initial Inv. Costs - Mobile Equipment	Replacement Inv. Costs - Civil Works	Replacement Inv. Costs - Mobile Equipment	Implementation Consultant	TOTAL INVESTMENT COSTS EXCL. TA	Technical Assistance	TOTAL INVESTMENT COSTS INCL. TA
EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR
0	0	0	0	0	0	997.920	997.920
7.131.960	12.225.965	0	0	1.548.634	20.906.559	427.680	21.334.239
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
19.333	519.558	0	0	43.111	582.001	0	582.001
0	0	0	0	0	0	0	0
0	264.000	0	0	21.120	285.120	0	285.120
1.582.378	347.738	0	2.273.715	154.409	4.358.240	0	4.358.240
1.400.300	0	0	0	112.024	1.512.324	0	1.512.324
0	0	0	255.558	0	255.558	0	255.558
0	132.000	0	0	10.560	142.560	0	142.560
6.600.000	0	0	1.130.250	528.000	8.258.250	0	8.258.250
1.471.965	790.814	0	9.805.278	181.022	12.249.079	0	12.249.079
0	0	0	0	0	0	0	0
0	264.000	0	264.000	21.120	549.120	0	549.120
0	0	0	0	0	0	0	0
1.430.000	0	0	264.000	114.400	1.808.400	0	1.808.400
44.633	294.152	0	1.730.670	27.103	2.096.557	0	2.096.557
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	264.000	0	132.000	21.120	417.120	0	417.120
1.760.000	0	0	0	140.800	1.900.800	0	1.900.800
21.440.568	15.102.227	0	15.855.470	2.923.424	55.321.688	1.425.600	56.747.288
7.131.960	12.225.965	0	0	1.548.634	20.906.559	1.425.600	22.332.159
14.308.608	2.876.261	0	15.855.470	1.374.790	34.415.129	0	34.415.129
33,26	80,95	0,00	0,00	52,97	37,79	100,00	39,35
66,74	19,05	0,00	100,00	47,03	62,21	0,00	60,65

15.255.009	13.153.668	0	9.623.127	2.272.694	40.304.499	1.354.953	41.659.452
6.593.898	11.303.592	0	0	1.431.799	19.329.289	1.354.953	20.684.242
8.661.111	1.850.076	0	9.623.127	840.895	20.975.210	0	20.975.210
43,22	85,93	0,00	0,00	63,00	47,96	100,00	49,65
56,78	14,07	0,00	100,00	37,00	52,04	0,00	50,35

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
INVESTMENT COSTS - GRAND TOTAL

	INVESTMENT COSTS		INVESTMENT COSTS		INVESTMENT COSTS		INVESTMENT COSTS	
	Collection	Recycling	Composting	Transport	Disposal	TOTAL INVESTMENT COSTS EXCL. TA	Technical Assistance	TOTAL INVESTMENT COSTS INCL. TA
YEARS	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR
2021	0	0	0	0	0	0	997.920	997.920
2022	8.366.804	2.894.978	1.259.280	1.367.982	7.017.516	20.906.559	427.680	21.334.239
2023	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0
2025	0	582.001	0	0	0	582.001	0	582.001
2026	0	0	0	0	0	0	0	0
2027	0	285.120	0	0	0	285.120	0	285.120
2028	1.509.163	1.215.577	0	0	1.633.500	4.358.240	0	4.358.240
2029	0	0	0	0	1.512.324	1.512.324	0	1.512.324
2030	0	255.558	0	0	0	255.558	0	255.558
2031	0	142.560	0	0	0	142.560	0	142.560
2032	0	0	0	893.750	7.364.500	8.258.250	0	8.258.250
2033	8.021.772	2.176.908	506.000	0	1.544.400	12.249.079	0	12.249.079
2034	0	0	0	0	0	0	0	0
2035	0	549.120	0	0	0	549.120	0	549.120
2036	0	0	0	0	0	0	0	0
2037	0	264.000	0	0	1.544.400	1.808.400	0	1.808.400
2038	1.613.296	483.261	0	0	0	2.096.557	0	2.096.557
2039	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0
2041	0	417.120	0	0	0	417.120	0	417.120
2042	0	0	0	0	1.900.800	1.900.800	0	1.900.800
Grand Total	19.511.034	9.266.202	1.765.280	2.261.732	22.517.440	55.321.688	1.425.600	56.747.288
Total (2021-2022)	8.366.804	2.894.978	1.259.280	1.367.982	7.017.516	20.906.559	1.425.600	22.332.159
Total (2023-2042)	11.144.231	6.371.224	506.000	893.750	15.499.924	34.415.129	0	34.415.129

Total (2021-2022) (%)	42,88	31,24	71,34	60,48	31,16	37,79	100,00	39,35
Total (2023-2042) (%)	57,12	68,76	28,66	39,52	68,84	62,21	0,00	60,65

Real Financial Discount Rate (%)								
Discounted Grand Total	14.452.347	6.694.489	1.468.166	1.823.010	15.866.487	40.304.499	1.354.953	41.659.452
Discounted Total (2021-2022)	7.735.580	2.676.570	1.164.275	1.264.776	6.488.088	19.329.289	1.354.953	20.684.242
Discounted Total (2023-2042)	6.716.767	4.017.919	303.890	558.234	9.378.399	20.975.210	0	20.975.210

Total (2021-2022) (%)	53,52	39,98	79,30	69,38	40,89	47,96	100,00	49,65
Total (2023-2042) (%)	46,48	60,02	20,70	30,62	59,11	52,04	0,00	50,35

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
O&M COSTS - GRAND TOTAL

YEARS	Personnel EUR	Maintenance EUR	Consumption EUR	Other EUR	10,0%	GRAND TOTAL EUR
					Contingencies EUR	
2021	0	0	0	0	0	0
2022	0	0	0	0	0	0
2023	1.912.200	780.864	953.661	224.806	387.153	4.258.684
2024	1.996.200	802.749	989.947	229.570	401.847	4.420.312
2025	2.038.200	836.344	1.042.017	237.019	415.358	4.568.938
2026	2.071.200	846.035	1.070.209	240.336	422.778	4.650.558
2027	2.164.200	873.023	1.102.048	248.040	438.731	4.826.042
2028	2.197.200	899.826	1.164.262	254.108	451.540	4.966.935
2029	2.260.200	926.704	1.189.591	261.185	463.768	5.101.449
2030	2.302.200	932.933	1.210.855	263.975	470.996	5.180.959
2031	2.332.200	947.100	1.230.012	267.316	477.663	5.254.290
2032	2.344.200	961.260	1.241.499	270.261	481.722	5.298.943
2033	2.365.200	963.480	1.343.312	271.006	494.300	5.437.299
2034	2.398.200	976.563	1.360.501	271.952	500.722	5.507.937
2035	2.407.200	990.791	1.378.373	274.702	505.107	5.556.172
2036	2.428.200	1.005.226	1.416.397	277.851	512.767	5.640.442
2037	2.437.200	1.007.699	1.422.709	278.001	514.561	5.660.170
2038	2.458.200	1.016.748	1.433.662	280.951	518.956	5.708.517
2039	2.500.200	1.019.223	1.447.761	282.305	524.949	5.774.438
2040	2.521.200	1.013.074	1.468.502	281.760	528.454	5.812.990
2041	2.554.200	1.063.670	1.502.313	292.518	541.270	5.953.971
2042	2.575.200	1.081.624	1.513.576	296.773	546.717	6.013.891
Grand Total	46.263.000	18.944.936	25.481.205	5.304.438	9.599.358	105.592.936
Total (2021-2022)	0	0	0	0	0	0
Total (2023-2042)	46.263.000	18.944.936	25.481.205	5.304.438	9.599.358	105.592.936

Total (2021-2022) (%)	0,00	0,00	0,00	0,00	0,00	0,00
Total (2023-2042) (%)	100,00	100,00	100,00	100,00	100,00	100,00

% Distribution	43,81%	17,94%	24,13%	5,02%	9,09%	100,00%
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Grand Total	43,81%	17,94%	24,13%	5,02%	9,09%	100,00%
Total (2021-2022) (%)	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Total (2023-2042) (%)	43,81%	17,94%	24,13%	5,02%	9,09%	100,00%

Yearly Average	2.313.150	947.247	1.274.060	265.222	479.968	5.279.647
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Real Financial Discount Rate (%)	4,00					
Discounted Grand Total	28.538.849	11.672.254	15.520.064	3.277.558	5.900.872	64.909.597
Discounted Total (2021-2022)	0	0	0	0	0	0
Discounted Total (2023-2042)	28.538.849	11.672.254	15.520.064	3.277.558	5.900.872	64.909.597

Total (2021-2022) (%)	0,00	0,00	0,00	0,00	0,00	0,00
Total (2023-2042) (%)	100,00	100,00	100,00	100,00	100,00	100,00

Discounted Yearly Average	1.426.942	583.613	776.003	163.878	295.044	3.245.480
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% Distribution	43,97%	17,98%	23,91%	5,05%	9,09%	100,00%
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DPC (AIC) (LUC) (€/TON)	16,92	6,92	9,20	1,94	3,50	38,48
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Fixed EUR	Variable EUR	Contingencies EUR	GRAND TOTAL EUR
0	0	0	0
0	0	0	0
2.917.870	953.661	387.153	4.258.684
3.028.519	989.947	401.847	4.420.312
3.111.563	1.042.017	415.358	4.568.938
3.157.571	1.070.209	422.778	4.650.558
3.285.263	1.102.048	438.731	4.826.042
3.351.134	1.164.262	451.540	4.966.935
3.448.089	1.189.591	463.768	5.101.449
3.499.108	1.210.855	470.996	5.180.959
3.546.616	1.230.012	477.663	5.254.290
3.575.721	1.241.499	481.722	5.298.943
3.599.687	1.343.312	494.300	5.437.299
3.646.714	1.360.501	500.722	5.507.937
3.672.693	1.378.373	505.107	5.556.172
3.711.277	1.416.397	512.767	5.640.442
3.722.900	1.422.709	514.561	5.660.170
3.755.899	1.433.662	518.956	5.708.517
3.801.728	1.447.761	524.949	5.774.438
3.816.034	1.468.502	528.454	5.812.990
3.910.388	1.502.313	541.270	5.953.971
3.953.598	1.513.576	546.717	6.013.891
70.512.373	25.481.205	9.599.358	105.592.936
0	0	0	0
70.512.373	25.481.205	9.599.358	105.592.936

0,00	0,00	0,00	0,00
100,00	100,00	100,00	100,00

66,78%	24,13%	9,09%	100,00%
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66,78%	24,13%	9,09%	100,00%
0,00%	0,00%	0,00%	0,00%
66,78%	24,13%	9,09%	100,00%

3.525.619	1.274.060	479.968	5.279.647
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	4,00		
43.488.661	15.520.064	5.900.872	64.909.597
0	0	0	0
43.488.661	15.520.064	5.900.872	64.909.597

0,00	0,00	0,00	0,00
100,00	100,00	100,00	100,00

2.174.433	776.003	295.044	3.245.480
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67,00%	23,91%	9,09%	100,00%
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25,78	9,20	3,50	38,48
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IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
O&M COSTS - GRAND TOTAL

	Collection	Recycling	Composting	Transport	Disposal	GRAND TOTAL
YEARS	EUR	EUR	EUR	EUR	EUR	EUR
2021	0	0	0	0	0	0
2022	0	0	0	0	0	0
2023	2.334.656	731.451	106.392	414.357	671.828	4.258.684
2024	2.386.346	834.869	106.392	417.224	675.481	4.420.312
2025	2.394.160	970.052	106.392	423.357	674.977	4.568.938
2026	2.433.559	997.421	106.392	432.435	680.751	4.650.558
2027	2.529.412	1.058.003	106.392	451.175	681.060	4.826.042
2028	2.590.207	1.091.012	106.392	459.378	719.946	4.966.935
2029	2.674.885	1.132.570	106.392	467.741	719.861	5.101.449
2030	2.732.792	1.140.342	106.392	476.341	725.092	5.180.959
2031	2.762.280	1.183.075	106.392	478.811	723.733	5.254.290
2032	2.780.517	1.203.012	106.392	481.359	727.663	5.298.943
2033	2.806.646	1.210.210	106.392	483.907	830.143	5.437.299
2034	2.846.232	1.220.878	106.392	486.456	847.979	5.507.937
2035	2.848.716	1.263.207	106.392	489.084	848.774	5.556.172
2036	2.851.113	1.336.349	106.392	491.712	854.876	5.640.442
2037	2.853.654	1.340.160	106.392	504.240	855.724	5.660.170
2038	2.889.541	1.343.835	106.392	506.869	861.880	5.708.517
2039	2.915.808	1.379.880	106.392	509.576	862.782	5.774.438
2040	2.931.087	1.394.235	106.392	512.284	868.992	5.812.990
2041	2.965.311	1.497.249	106.392	515.071	869.949	5.953.971
2042	3.012.234	1.501.272	106.392	517.779	876.214	6.013.891
Grand Total	54.539.155	23.829.081	2.127.840	9.519.157	15.577.702	105.592.936
Total (2021-2022)	0	0	0	0	0	0
Total (2023-2042)	54.539.155	23.829.081	2.127.840	9.519.157	15.577.702	105.592.936
Total (2021-2022) (%)	0,00	0,00	0,00	0,00	0,00	0,00
Total (2023-2042) (%)	100,00	100,00	100,00	100,00	100,00	100,00
% Distribution	51,65%	22,57%	2,02%	9,01%	14,75%	100,00%
Grand Total	51,65%	22,57%	2,02%	9,01%	14,75%	100,00%
Total (2021-2022) (%)	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Total (2023-2042) (%)	51,65%	22,57%	2,02%	9,01%	14,75%	100,00%
Yearly Average	2.726.958	1.191.454	106.392	475.958	778.885	5.279.647
Real Financial Discount Rate (%)	4,00					
Discounted Grand Total	33.696.368	14.416.565	1.336.818	5.890.247	9.569.600	64.909.597
Discounted Total (2021-2022)	0	0	0	0	0	0
Discounted Total (2023-2042)	33.696.368	14.416.565	1.336.818	5.890.247	9.569.600	64.909.597
Total (2021-2022) (%)	0,00	0,00	0,00	0,00	0,00	0,00
Total (2023-2042) (%)	100,00	100,00	100,00	100,00	100,00	100,00
Discounted Yearly Average	1.684.818	720.828	66.841	294.512	478.480	3.245.480
% Distribution	51,91%	22,21%	2,06%	9,07%	14,74%	100,00%
DPC (AIC) (LUC) (€/TON)	19,98	8,55	0,79	3,49	5,67	38,48

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
SWM QUANTITIES COLLECTED/BILLED

Financial Discount Rate (%)	4,00								
	Total Waste Collected/Billed	Total Waste Collected (Urban)	Total Waste Collected (Rural)	Quantity Collected - Residential (Urban)	Quantity Collected - Commercial (Urban)	Quantity Collected - Residential (Rural)	Quantity Collected - Commercial (Rural)	Quantity Collected - Residential (Total)	Quantity Collected - Commercial (Total)
YEARS	Ton/Year	Ton/Year	Ton/Year	Ton/Year	Ton/Year	Ton/Year	Ton/Year	Ton/Year	Ton/Year
2021	0	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0	0
2023	108.783	74.254	34.530	59.403	14.851	32.803	1.726	92.206	16.577
2024	112.906	75.047	37.859	60.038	15.009	35.966	1.893	96.004	16.902
2025	117.120	75.850	41.270	60.680	15.170	39.206	2.063	99.886	17.233
2026	121.425	76.660	44.764	61.328	15.332	42.526	2.238	103.854	17.570
2027	125.476	77.480	47.996	61.984	15.496	45.596	2.400	107.580	17.896
2028	128.909	78.308	50.600	62.647	15.662	48.070	2.530	110.717	18.192
2029	132.412	79.146	53.267	63.317	15.829	50.603	2.663	113.920	18.492
2030	135.988	79.992	55.996	63.994	15.998	53.196	2.800	117.190	18.798
2031	137.606	80.848	56.758	64.678	16.170	53.920	2.838	118.598	19.007
2032	139.244	81.712	57.531	65.370	16.342	54.655	2.877	120.025	19.219
2033	140.902	82.586	58.316	66.069	16.517	55.400	2.916	121.469	19.433
2034	142.581	83.470	59.112	66.776	16.694	56.156	2.956	122.932	19.650
2035	144.281	84.363	59.919	67.490	16.873	56.923	2.996	124.413	19.868
2036	146.003	85.265	60.738	68.212	17.053	57.701	3.037	125.913	20.090
2037	147.746	86.178	61.568	68.942	17.236	58.490	3.078	127.432	20.314
2038	149.511	87.100	62.411	69.680	17.420	59.290	3.121	128.970	20.541
2039	151.298	88.032	63.266	70.426	17.606	60.102	3.163	130.528	20.770
2040	153.107	88.974	64.133	71.179	17.795	60.926	3.207	132.105	21.001
2041	154.939	89.926	65.013	71.941	17.985	61.762	3.251	133.703	21.236
2042	156.794	90.727	66.067	72.582	18.145	62.764	3.303	135.345	21.449
TOTAL	2.747.031	1.645.919	1.101.112	1.316.735	329.184	1.046.056	55.056	2.362.791	384.239
DISCOUNTED TOTAL	1.686.767	1.019.930	666.837	815.944	203.986	633.495	33.342	1.449.439	237.328
Cum.Inc. (2042/2023)	144,13%	122,19%	191,33%	122,19%	122,19%	191,33%	191,33%	146,79%	129,39%
Average Inc. (% p.a.)	1,94%	1,06%	3,47%	1,06%	1,06%	3,47%	3,47%	2,04%	1,37%
Yearly Average	137.352	82.296	55.056	65.837	16.459	52.303	2.753	118.140	19.212
Discounted Yearly Average	84.338	50.997	33.342	40.797	10.199	31.675	1.667	72.472	11.866

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
SWM TARIFFS

Financial Discount Rate (%)	4,00
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	Urban Residential Tariff Inc.	Rural Residential Tariff Inc.	Average Residential Tariff Excl. VAT	Residential Tariff Excl. VAT (Overall)	Residential Tariff Excl. VAT (Urban)	Residential Tariff Excl. VAT (Rural)	Urban Commercial Tariff Inc.	Rural Commercial Tariff Inc.	Commercial Tariff Excl. VAT (Urban)	Commercial Tariff Excl. VAT (Rural)
YEARS	(% p.a.)	(% p.a.)	(€/Ton)	(€/Ton)	(€/Ton)	(€/Ton)	(% p.a.)	(% p.a.)	(€/Ton)	(€/Ton)
2021	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2022	0,00	0,00	27,70	26,37	32,50	19,00	0,00	0,00	50,00	29,23
2023	1,00	2,00	28,04	26,72	32,83	19,38	1,00	2,00	50,50	29,82
2024	1,00	2,00	28,14	27,07	33,15	19,77	1,00	2,00	51,01	30,41
2025	1,00	2,00	28,26	27,42	33,48	20,16	1,00	2,00	51,52	31,02
2026	1,00	2,00	28,39	27,78	33,82	20,57	1,00	2,00	52,03	31,64
2027	1,00	2,00	28,57	28,15	34,16	20,98	1,00	2,00	52,55	32,27
2028	1,00	2,00	28,81	28,52	34,50	21,40	1,00	2,00	53,08	32,92
2029	1,00	2,00	29,06	28,90	34,84	21,83	1,00	2,00	53,61	33,58
2030	1,00	2,00	29,32	29,28	35,19	22,26	1,00	2,00	54,14	34,25
2031	1,00	2,00	29,71	29,68	35,54	22,71	1,00	2,00	54,68	34,93
2032	1,00	2,00	30,10	30,07	35,90	23,16	1,00	2,00	55,23	35,63
2033	1,00	2,00	30,50	30,47	36,26	23,62	1,00	2,00	55,78	36,34
2034	1,00	2,00	30,90	30,88	36,62	24,10	1,00	2,00	56,34	37,07
2035	1,00	2,00	31,31	31,30	36,99	24,58	1,00	2,00	56,90	37,81
2036	1,00	2,00	31,73	31,72	37,36	25,07	1,00	2,00	57,47	38,57
2037	1,00	2,00	32,15	32,15	37,73	25,57	1,00	2,00	58,05	39,34
2038	1,00	2,00	32,58	32,58	38,11	26,08	1,00	2,00	58,63	40,13
2039	1,00	2,00	33,02	33,03	38,49	26,60	1,00	2,00	59,22	40,93
2040	1,00	2,00	33,46	33,48	38,87	27,14	1,00	2,00	59,81	41,75
2041	1,00	2,00	33,91	33,94	39,26	27,68	1,00	2,00	60,41	42,58
2042	1,00	2,00	34,36	34,43	39,66	28,23	1,00	2,00	61,01	43,44
TOTAL										
DISCOUNTED TOTAL										
Cum.Inc. (2042/2023)	100,00%	100,00%	122,53%	128,85%	120,81%	145,68%			120,81%	145,68%
Average Inc. (% p.a.)	0,00%	0,00%	1,08%	1,34%	1,00%	2,00%			1,00%	2,00%

Yearly Average
Discounted Yearly Average

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
SWM REVENUES

Financial Discount Rate (%)	4,00									
	SWM Tariff Revenues Billed			SWM Tariff Revenues Collected		QUANTITY OF RECYCLED MATERIALS				
	Total Residential Tariff Revenues	Total Commercial Tariff Revenues	Total Res. + Comm. Tariff Revenues	Tariff Collection Rate	Total Res. + Comm. Tariff Revenues	Total Quantity Recycled	Paper & Cardboard	Plastics	Glass	Metals
YEARS	(€/Year)	(€/Year)	(€/Year)	%	(€/Year)	Ton/Year	Ton/Year	Ton/Year	Ton/Year	Ton/Year
2021	0	0	0			0	0	0	0	0
2022	0	0	0			0	0	0	0	0
2023	3.106.564	1.728.000	4.834.563	55,00%	2.659.010	10.280	2.284	6.092	1.523	381
2024	3.236.447	1.859.345	5.095.791	56,00%	2.853.643	13.717	3.048	8.129	2.032	508
2025	3.371.932	1.997.660	5.369.592	57,00%	3.060.667	15.812	3.514	9.370	2.342	586
2026	3.513.260	2.143.269	5.656.529	58,00%	3.280.787	16.720	3.716	9.908	2.477	619
2027	3.653.381	2.285.844	5.939.225	59,00%	3.504.143	17.617	3.915	10.440	2.610	652
2028	3.784.295	2.413.667	6.197.962	60,00%	3.718.777	18.446	4.099	10.931	2.733	683
2029	3.920.335	2.547.657	6.467.992	61,00%	3.945.475	19.305	4.290	11.440	2.860	715
2030	4.061.708	2.688.090	6.749.797	62,00%	4.184.874	20.195	4.488	11.967	2.992	748
2031	4.162.507	2.767.843	6.930.349	63,00%	4.366.120	20.806	4.624	12.329	3.082	771
2032	4.265.971	2.850.083	7.116.055	64,00%	4.554.275	21.430	4.762	12.699	3.175	794
2033	4.372.177	2.934.893	7.307.070	65,00%	4.749.595	22.065	4.903	13.076	3.269	817
2034	4.481.202	3.022.354	7.503.556	67,00%	5.027.382	22.713	5.047	13.460	3.365	841
2035	4.593.125	3.112.554	7.705.679	69,00%	5.316.918	23.374	5.194	13.851	3.463	866
2036	4.708.030	3.205.580	7.913.611	71,00%	5.618.664	24.047	5.344	14.250	3.562	891
2037	4.826.001	3.301.527	8.127.528	73,00%	5.933.096	24.732	5.496	14.656	3.664	916
2038	4.947.126	3.400.489	8.347.615	75,00%	6.260.711	25.433	5.652	15.071	3.768	942
2039	5.071.495	3.502.564	8.574.059	77,00%	6.602.025	26.144	5.810	15.493	3.873	968
2040	5.199.201	3.607.854	8.807.054	79,00%	6.957.573	26.870	5.971	15.923	3.981	995
2041	5.330.339	3.716.464	9.046.803	81,00%	7.327.911	27.611	6.136	16.362	4.090	1.023
2042	5.463.159	3.833.209	9.296.368	83,00%	7.715.985	28.364	6.303	16.808	4.202	1.051
TOTAL	86.068.254	56.918.943	142.987.197	68,28%	97.637.632	425.681	94.596	252.255	63.063	15.767
DISCOUNTED TOTAL	52.106.018	34.024.681	86.130.699	66,41%	61.863.593					
Cum.Inc. (2042/2023)	175,86%	221,83%	192,29%	150,91%	290,18%	275,91%	275,96%	275,90%	275,90%	275,85%
Average Inc. (% p.a.)	3,02%	4,28%	3,50%	2,19%	5,77%	5,49%	5,49%	5,49%	5,49%	5,49%
Yearly Average	4.303.413	2.845.947	7.149.360		4.881.882	21.284	4.730	12.613	3.153	788
Discounted Yearly Average	2.605.301	1.701.234	4.306.535		3.093.180	0	0	0	0	0

Note: Currently, there is no market for compost in Macedonia, thus compost revenues can be neglected.

UNIT RECYCLABLE SALES REVENUES				TOTAL RECYCLABLE SALES REVENUES					COMPOST REVENUES			COMPOST REVENUES		ELECTRICITY SALES REVENUES
Paper & Cardboard	Plastics	Glass	Metals	Paper & Cardboard	Plastics	Glass	Metals	Total Recyclable Sales Revenues	Total Quantity Composted	Increase in Composed Price	Compost Sales Price	Compost Sales Revenues	Electricity Sales Revenues	
EURO/Ton	EURO/Ton	EURO/Ton	EURO/Ton	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	Ton/Year	% p.a.	EURO/Ton	EURO/Year	EURO/Year	
0,0	0,0	0,0	0,0	0	0	0	0	0	0,00	0,0	0,00	0,00	0	
29,0	57,0	5,0	350,0	0	0	0	0	0	0,00	0,0	0,00	0,00	0	
29,0	57,0	5,0	350,0	66.236	347.244	7.615	133.350	554.445	8.400,00	0,0	0,00	0,00	0	
29,0	57,0	5,0	350,0	88.392	463.353	10.160	177.800	739.705	8.400,00	0,0	0,00	0,00	0	
29,0	57,0	5,0	350,0	101.906	534.090	11.710	205.100	852.806	8.400,00	0,0	0,00	0,00	0	
29,0	57,0	5,0	350,0	107.764	564.756	12.385	216.650	901.555	8.400,00	0,0	0,00	0,00	0	
29,0	57,0	5,0	350,0	113.535	595.080	13.050	228.200	949.865	8.400,00	0,0	0,00	0,00	0	
29,0	57,0	5,0	350,0	118.871	623.067	13.665	239.050	994.653	8.400,00	0,0	0,00	0,00	476.544	
29,0	57,0	5,0	350,0	124.410	652.080	14.300	250.250	1.041.040	8.400,00	0,0	0,00	0,00	476.544	
29,0	57,0	5,0	350,0	130.152	682.119	14.960	261.800	1.089.031	8.400,00	0,0	0,00	0,00	476.544	
29,0	57,0	5,0	350,0	134.096	702.753	15.410	269.850	1.122.109	8.400,00	0,0	0,00	0,00	476.544	
29,0	57,0	5,0	350,0	138.098	723.843	15.875	277.900	1.155.716	8.400,00	0,0	0,00	0,00	476.544	
29,0	57,0	5,0	350,0	142.187	745.332	16.345	285.950	1.189.814	8.400,00	0,0	0,00	0,00	476.544	
29,0	57,0	5,0	350,0	146.363	767.220	16.825	294.350	1.224.758	8.400,00	0,0	0,00	0,00	476.544	
29,0	57,0	5,0	350,0	150.626	789.507	17.315	303.100	1.260.548	8.400,00	0,0	0,00	0,00	476.544	
29,0	57,0	5,0	350,0	154.976	812.250	17.810	311.850	1.296.886	8.400,00	0,0	0,00	0,00	476.544	
29,0	57,0	5,0	350,0	159.384	835.392	18.320	320.600	1.333.696	8.400,00	0,0	0,00	0,00	476.544	
29,0	57,0	5,0	350,0	163.908	859.047	18.840	329.700	1.371.495	8.400,00	0,0	0,00	0,00	131.750	
29,0	57,0	5,0	350,0	168.490	883.101	19.365	338.800	1.409.756	8.400,00	0,0	0,00	0,00	131.750	
29,0	57,0	5,0	350,0	173.159	907.611	19.905	348.250	1.448.925	8.400,00	0,0	0,00	0,00	131.750	
29,0	57,0	5,0	350,0	177.944	932.634	20.450	358.050	1.489.078	8.400,00	0,0	0,00	0,00	131.750	
29,0	57,0	5,0	350,0	182.787	958.056	21.010	367.850	1.529.703	8.400,00	0,0	0,00	0,00	1.036.250	
				2.743.284	14.378.535	315.315	5.518.450	22.955.584	168.000			0,00	6.328.692	
				1.638.444	8.587.691	188.324	3.295.902	13.710.361				0,00	3.620.000	
				275,96%	275,90%	275,90%	275,85%	275,90%	100,00%			0,00%	217,45%	
				5,49%	5,49%	5,49%	5,49%	5,49%	0,00%			0,00%	4,17%	
				137.164	718.927	15.766	275.923	1.147.779					316.435	
				81.922	429.385	9.416	164.795	685.518					181.000	

BILLED REVENUES		BILLED REVENUES		
Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES
EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
0	0	0	0	0
0	0	0	0	0
4.834.563	554.445	0	0	5.389.008
5.095.791	739.705	0	0	5.835.496
5.369.592	852.806	0	0	6.222.398
5.656.529	901.555	0	0	6.558.084
5.939.225	949.865	0	0	6.889.090
6.197.962	994.653	0	476.544	7.669.159
6.467.992	1.041.040	0	476.544	7.985.576
6.749.797	1.089.031	0	476.544	8.315.372
6.930.349	1.122.109	0	476.544	8.529.002
7.116.055	1.155.716	0	476.544	8.748.315
7.307.070	1.189.814	0	476.544	8.973.428
7.503.556	1.224.758	0	476.544	9.204.858
7.705.679	1.260.548	0	476.544	9.442.771
7.913.611	1.296.886	0	476.544	9.687.041
8.127.528	1.333.696	0	476.544	9.937.768
8.347.615	1.371.495	0	131.750	9.850.860
8.574.059	1.409.756	0	131.750	10.115.565
8.807.054	1.448.925	0	131.750	10.387.730
9.046.803	1.489.078	0	131.750	10.667.632
9.296.368	1.529.703	0	1.036.250	11.862.321
142.987.197,10	22.955.584,00	0,00	6.328.691,93	172.271.473,03
86.130.699,44	13.710.361,04	0,00	3.620.000,46	103.461.060,94
192,29%	275,90%	0,00%	217,45%	154,68%
3,50%	5,49%	0,00%	4,17%	2,32%
7.149.360	1.147.779	0	316.435	8.613.574
4.306.535	685.518	0	181.000	5.173.053

Revenue	COLLECTED REVENUES		COLLECTED REVENUES		
Tariff Collection Rate	Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES
%	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
0,00	0	0	0	0	0
0,00	0	0	0	0	0
55,0%	2.659.010	554.445	0	0	3.213.455
56,0%	2.853.643	739.705	0	0	3.593.348
57,0%	3.060.667	852.806	0	0	3.913.473
58,0%	3.280.787	901.555	0	0	4.182.342
59,0%	3.504.143	949.865	0	0	4.454.008
60,0%	3.718.777	994.653	0	476.544	5.189.974
61,0%	3.945.475	1.041.040	0	476.544	5.463.059
62,0%	4.184.874	1.089.031	0	476.544	5.750.449
63,0%	4.366.120	1.122.109	0	476.544	5.964.773
64,0%	4.554.275	1.155.716	0	476.544	6.186.535
65,0%	4.749.595	1.189.814	0	476.544	6.415.953
67,0%	5.027.382	1.224.758	0	476.544	6.728.684
69,0%	5.316.918	1.260.548	0	476.544	7.054.010
71,0%	5.618.664	1.296.886	0	476.544	7.392.094
73,0%	5.933.096	1.333.696	0	476.544	7.743.336
75,0%	6.260.711	1.371.495	0	131.750	7.763.956
77,0%	6.602.025	1.409.756	0	131.750	8.143.531
79,0%	6.957.573	1.448.925	0	131.750	8.538.248
81,0%	7.327.911	1.489.078	0	131.750	8.948.739
83,0%	7.715.985	1.529.703	0	1.036.250	10.281.939
68,28%	97.637.632	22.955.584	0	6.328.692	126.921.907
66,41%	57.196.370	13.710.361	0	3.620.000	74.526.731
	290,18%	275,90%	0,00%	217,45%	198,11%
	5,77%	5,49%	0,00%	4,17%	3,66%
	4.881.882	1.147.779	0	316.435	6.346.095
	2.859.818	685.518	0	181.000	3.726.337

UNIT REVENUE COLLECTED PER TON		UNIT REVENUE COLLECTED PER TON		
Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES
EUR/Ton	EUR/Ton	EUR/Ton	EUR/Ton	EUR/Ton
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
24,44	5,10	0,00	0,00	29,54
25,27	6,55	0,00	0,00	31,83
26,13	7,28	0,00	0,00	33,41
27,02	7,42	0,00	0,00	34,44
27,93	7,57	0,00	0,00	35,50
28,85	7,72	0,00	3,70	40,26
29,80	7,86	0,00	3,60	41,26
30,77	8,01	0,00	3,50	42,29
31,73	8,15	0,00	3,46	43,35
32,71	8,30	0,00	3,42	44,43
33,71	8,44	0,00	3,38	45,53
35,26	8,59	0,00	3,34	47,19
36,85	8,74	0,00	3,30	48,89
38,48	8,88	0,00	3,26	50,63
40,16	9,03	0,00	3,23	52,41
41,87	9,17	0,00	0,88	51,93
43,64	9,32	0,00	0,87	53,82
45,44	9,46	0,00	0,86	55,77
47,30	9,61	0,00	0,85	57,76
49,21	9,76	0,00	6,61	65,58
35,54	8,36	0,00	2,30	46,20
33,91	8,13	0,00	2,15	44,18
201,33%	191,42%	0,00%	178,78%	162,88%
3,75%	3,48%	0,00%	3,10%	2,60%

UNIT REVENUE COLLECTED PER CAPITA		UNIT REVENUE COLLECTED PER CAPITA		
Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES
EUR/capita/year	EUR/capita/year	EUR/capita/year	EUR/capita/year	EUR/capita/year
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
8,10	1,69	0,00	0,00	9,78
8,66	2,24	0,00	0,00	10,90
9,25	2,58	0,00	0,00	11,83
9,88	2,71	0,00	0,00	12,59
10,51	2,85	0,00	0,00	13,36
11,11	2,97	0,00	1,42	15,51
11,75	3,10	0,00	1,42	16,27
12,41	3,23	0,00	1,41	17,06
12,90	3,32	0,00	1,41	17,63
13,41	3,40	0,00	1,40	18,21
13,93	3,49	0,00	1,40	18,82
14,69	3,58	0,00	1,39	19,66
15,48	3,67	0,00	1,39	20,53
16,29	3,76	0,00	1,38	21,44
17,14	3,85	0,00	1,38	22,37
18,02	3,95	0,00	0,38	22,35
18,93	4,04	0,00	0,38	23,35
19,87	4,14	0,00	0,38	24,39
20,85	4,24	0,00	0,37	25,46
21,94	4,35	0,00	2,95	29,24
14,34	3,37	0,00	0,93	18,65
11,74	2,81	0,00	0,74	15,30
271,00%	257,66%	0,00%	206,90%	188,50%
5,39%	5,11%	0,00%	3,90%	3,39%

REVENUE COLLECTED AS PERCENTAGE OF TOTAL COLLECTIONS				
Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES
% of Total	% of Total	% of Total	% of Total	% of Total
0,00%	0,00%	0,00%	0,00%	0,00%
0,00%	0,00%	0,00%	0,00%	0,00%
82,75%	17,25%	0,00%	0,00%	100,00%
79,41%	20,59%	0,00%	0,00%	100,00%
78,21%	21,79%	0,00%	0,00%	100,00%
78,44%	21,56%	0,00%	0,00%	100,00%
78,67%	21,33%	0,00%	0,00%	100,00%
71,65%	19,16%	0,00%	9,18%	100,00%
72,22%	19,06%	0,00%	8,72%	100,00%
72,77%	18,94%	0,00%	8,29%	100,00%
73,20%	18,81%	0,00%	7,99%	100,00%
73,62%	18,68%	0,00%	7,70%	100,00%
74,03%	18,54%	0,00%	7,43%	100,00%
74,72%	18,20%	0,00%	7,08%	100,00%
75,37%	17,87%	0,00%	6,76%	100,00%
76,01%	17,54%	0,00%	6,45%	100,00%
76,62%	17,22%	0,00%	6,15%	100,00%
80,64%	17,66%	0,00%	1,70%	100,00%
81,07%	17,31%	0,00%	1,62%	100,00%
81,49%	16,97%	0,00%	1,54%	100,00%
81,89%	16,64%	0,00%	1,47%	100,00%
75,04%	14,88%	0,00%	10,08%	100,00%
76,93%	18,09%	0,00%	4,99%	100,00%

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
REVENUES OTHER THAN SWM TARIFF REVENUES**

Financial Discount Rate (%)	4,00								
YEARS	QUANTITY OF RECYCLED MATERIALS					UNIT RECYCLABLE SALES REVENUES			
	Total Quantity Recycled Ton/Year	Paper & Cardboard Ton/Year	Plastics Ton/Year	Glass Ton/Year	Metals Ton/Year	Paper & Cardboard EURO/Ton	Plastics EURO/Ton	Glass EURO/Ton	Metals EURO/Ton
2021	0	0	0	0	0	0,0	0,0	0,0	0,0
2022	0	0	0	0	0	29,0	57,0	5,0	350,0
2023	10.280	2.284	6.092	1.523	381	29,0	57,0	5,0	350,0
2024	13.717	3.048	8.129	2.032	508	29,0	57,0	5,0	350,0
2025	15.812	3.514	9.370	2.342	586	29,0	57,0	5,0	350,0
2026	16.720	3.716	9.908	2.477	619	29,0	57,0	5,0	350,0
2027	17.617	3.915	10.440	2.610	652	29,0	57,0	5,0	350,0
2028	18.446	4.099	10.931	2.733	683	29,0	57,0	5,0	350,0
2029	19.305	4.290	11.440	2.860	715	29,0	57,0	5,0	350,0
2030	20.195	4.488	11.967	2.992	748	29,0	57,0	5,0	350,0
2031	20.806	4.624	12.329	3.082	771	29,0	57,0	5,0	350,0
2032	21.430	4.762	12.699	3.175	794	29,0	57,0	5,0	350,0
2033	22.065	4.903	13.076	3.269	817	29,0	57,0	5,0	350,0
2034	22.713	5.047	13.460	3.365	841	29,0	57,0	5,0	350,0
2035	23.374	5.194	13.851	3.463	866	29,0	57,0	5,0	350,0
2036	24.047	5.344	14.250	3.562	891	29,0	57,0	5,0	350,0
2037	24.732	5.496	14.656	3.664	916	29,0	57,0	5,0	350,0
2038	25.433	5.652	15.071	3.768	942	29,0	57,0	5,0	350,0
2039	26.144	5.810	15.493	3.873	968	29,0	57,0	5,0	350,0
2040	26.870	5.971	15.923	3.981	995	29,0	57,0	5,0	350,0
2041	27.611	6.136	16.362	4.090	1.023	29,0	57,0	5,0	350,0
2042	28.364	6.303	16.808	4.202	1.051	29,0	57,0	5,0	350,0
TOTAL	425.681	94.596	252.255	63.063	15.767				
DISCOUNTED TOTAL									
Cum.Inc. (2042/2023)	275,91%	275,96%	275,90%	275,90%	275,85%				
Average Inc. (% p.a.)	5,49%	5,49%	5,49%	5,49%	5,49%				
Yearly Average	21.284	4.730	12.613	3.153	788				
Discounted Yearly Average	0	0	0	0	0				

Note: Currently, there is no market for compost in Macedonia, thus compost revenues can be neglected.

TOTAL RECYCLABLE SALES REVENUES					COMPOST REVENUES				ELECTRICITY SALES REVENUES
Paper & Cardboard	Plastics	Glass	Metals	Total Recyclable Sales Revenues	Total Quantity Composted	Increase in Composed Price	Compost Sales Price	Compost Sales Revenues	Electricity Sales Revenues
EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	Ton/Year	% p.a.	EURO/Ton	EURO/Year	EURO/Year
0	0	0	0	0	0,00	0,0	0,00	0,00	0
0	0	0	0	0	0,00	0,0	0,00	0,00	0
66.236	347.244	7.615	133.350	554.445	8.400,00	0,0	0,00	0,00	0
88.392	463.353	10.160	177.800	739.705	8.400,00	0,0	0,00	0,00	0
101.906	534.090	11.710	205.100	852.806	8.400,00	0,0	0,00	0,00	0
107.764	564.756	12.385	216.650	901.555	8.400,00	0,0	0,00	0,00	0
113.535	595.080	13.050	228.200	949.865	8.400,00	0,0	0,00	0,00	0
118.871	623.067	13.665	239.050	994.653	8.400,00	0,0	0,00	0,00	476.544
124.410	652.080	14.300	250.250	1.041.040	8.400,00	0,0	0,00	0,00	476.544
130.152	682.119	14.960	261.800	1.089.031	8.400,00	0,0	0,00	0,00	476.544
134.096	702.753	15.410	269.850	1.122.109	8.400,00	0,0	0,00	0,00	476.544
138.098	723.843	15.875	277.900	1.155.716	8.400,00	0,0	0,00	0,00	476.544
142.187	745.332	16.345	285.950	1.189.814	8.400,00	0,0	0,00	0,00	476.544
146.363	767.220	16.825	294.350	1.224.758	8.400,00	0,0	0,00	0,00	476.544
150.626	789.507	17.315	303.100	1.260.548	8.400,00	0,0	0,00	0,00	476.544
154.976	812.250	17.810	311.850	1.296.886	8.400,00	0,0	0,00	0,00	476.544
159.384	835.392	18.320	320.600	1.333.696	8.400,00	0,0	0,00	0,00	476.544
163.908	859.047	18.840	329.700	1.371.495	8.400,00	0,0	0,00	0,00	131.750
168.490	883.101	19.365	338.800	1.409.756	8.400,00	0,0	0,00	0,00	131.750
173.159	907.611	19.905	348.250	1.448.925	8.400,00	0,0	0,00	0,00	131.750
177.944	932.634	20.450	358.050	1.489.078	8.400,00	0,0	0,00	0,00	131.750
182.787	958.056	21.010	367.850	1.529.703	8.400,00	0,0	0,00	0,00	1.036.250
2.743.284	14.378.535	315.315	5.518.450	22.955.584	168.000			0,00	6.328.692
1.638.444	8.587.691	188.324	3.295.902	13.710.361				0,00	3.620.000
275,96%	275,90%	275,90%	275,85%	275,90%	100,00%			0,00%	217,45%
5,49%	5,49%	5,49%	5,49%	5,49%	0,00%			0,00%	4,17%
137.164	718.927	15.766	275.923	1.147.779					316.435
81.922	429.385	9.416	164.795	685.518					181.000

BILLED REVENUES		BILLED REVENUES		
Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES
EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
0	0	0	0	0
0	0	0	0	0
4.834.563	554.445	0	0	5.389.008
5.095.791	739.705	0	0	5.835.496
5.369.592	852.806	0	0	6.222.398
5.656.529	901.555	0	0	6.558.084
5.939.225	949.865	0	0	6.889.090
6.197.962	994.653	0	476.544	7.669.159
6.467.992	1.041.040	0	476.544	7.985.576
6.749.797	1.089.031	0	476.544	8.315.372
6.930.349	1.122.109	0	476.544	8.529.002
7.116.055	1.155.716	0	476.544	8.748.315
7.307.070	1.189.814	0	476.544	8.973.428
7.503.556	1.224.758	0	476.544	9.204.858
7.705.679	1.260.548	0	476.544	9.442.771
7.913.611	1.296.886	0	476.544	9.687.041
8.127.528	1.333.696	0	476.544	9.937.768
8.347.615	1.371.495	0	131.750	9.850.860
8.574.059	1.409.756	0	131.750	10.115.565
8.807.054	1.448.925	0	131.750	10.387.730
9.046.803	1.489.078	0	131.750	10.667.632
9.296.368	1.529.703	0	1.036.250	11.862.321
142.987.197,10	22.955.584,00	0,00	6.328.691,93	172.271.473,03
86.130.699,44	13.710.361,04	0,00	3.620.000,46	103.461.060,94
192,29%	275,90%	0,00%	217,45%	154,68%
3,50%	5,49%	0,00%	4,17%	2,32%

7.149.360	1.147.779	0	316.435	8.613.574
4.306.535	685.518	0	181.000	5.173.053

Revenue	COLLECTED REVENUES		COLLECTED REVENUES		
Tariff Collection Rate	Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES
%	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
0,00	0	0	0	0	0
0,00	0	0	0	0	0
55,0%	2.659.010	554.445	0	0	3.213.455
56,0%	2.853.643	739.705	0	0	3.593.348
57,0%	3.060.667	852.806	0	0	3.913.473
58,0%	3.280.787	901.555	0	0	4.182.342
59,0%	3.504.143	949.865	0	0	4.454.008
60,0%	3.718.777	994.653	0	476.544	5.189.974
61,0%	3.945.475	1.041.040	0	476.544	5.463.059
62,0%	4.184.874	1.089.031	0	476.544	5.750.449
63,0%	4.366.120	1.122.109	0	476.544	5.964.773
64,0%	4.554.275	1.155.716	0	476.544	6.186.535
65,0%	4.749.595	1.189.814	0	476.544	6.415.953
67,0%	5.027.382	1.224.758	0	476.544	6.728.684
69,0%	5.316.918	1.260.548	0	476.544	7.054.010
71,0%	5.618.664	1.296.886	0	476.544	7.392.094
73,0%	5.933.096	1.333.696	0	476.544	7.743.336
75,0%	6.260.711	1.371.495	0	131.750	7.763.956
77,0%	6.602.025	1.409.756	0	131.750	8.143.531
79,0%	6.957.573	1.448.925	0	131.750	8.538.248
81,0%	7.327.911	1.489.078	0	131.750	8.948.739
83,0%	7.715.985	1.529.703	0	1.036.250	10.281.939
68,28%	97.637.632	22.955.584	0	6.328.692	126.921.907
66,41%	57.196.370	13.710.361	0	3.620.000	74.526.731
	290,18%	275,90%	0,00%	217,45%	198,11%
	5,77%	5,49%	0,00%	4,17%	3,66%

4.881.882	1.147.779	0	316.435	6.346.095
2.859.818	685.518	0	181.000	3.726.337

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
OVERALL SWM REVENUES BILLED AND COLLECTED**

Financial Discount Rate (%)	4,00				
YEARS	BILLED REVENUES		BILLED REVENUES		
	Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES
	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
2021	0	0	0	0	0
2022	0	0	0	0	0
2023	4.834.563	554.445	0	0	5.389.008
2024	5.095.791	739.705	0	0	5.835.496
2025	5.369.592	852.806	0	0	6.222.398
2026	5.656.529	901.555	0	0	6.558.084
2027	5.939.225	949.865	0	0	6.889.090
2028	6.197.962	994.653	0	476.544	7.669.159
2029	6.467.992	1.041.040	0	476.544	7.985.576
2030	6.749.797	1.089.031	0	476.544	8.315.372
2031	6.930.349	1.122.109	0	476.544	8.529.002
2032	7.116.055	1.155.716	0	476.544	8.748.315
2033	7.307.070	1.189.814	0	476.544	8.973.428
2034	7.503.556	1.224.758	0	476.544	9.204.858
2035	7.705.679	1.260.548	0	476.544	9.442.771
2036	7.913.611	1.296.886	0	476.544	9.687.041
2037	8.127.528	1.333.696	0	476.544	9.937.768
2038	8.347.615	1.371.495	0	131.750	9.850.860
2039	8.574.059	1.409.756	0	131.750	10.115.565
2040	8.807.054	1.448.925	0	131.750	10.387.730
2041	9.046.803	1.489.078	0	131.750	10.667.632
2042	9.296.368	1.529.703	0	1.036.250	11.862.321
TOTAL	142.987.197,10	22.955.584,00	0,00	6.328.691,93	172.271.473,03
DISCOUNTED TOTAL	86.130.699,44	13.710.361,04	0,00	3.620.000,46	103.461.060,94
Cum.Inc. (2042/2023)	192,29%	275,90%	0,00%	217,45%	154,68%
Average Inc. (% p.a.)	3,50%	5,49%	0,00%	4,17%	2,32%
Yearly Average	7.149.360	1.147.779	0	316.435	8.613.574
Discounted Yearly Average	4.306.535	685.518	0	181.000	5.173.053

Note: Currently, there is no market for compost in Macedonia, thus compost revenues can be neglected.

Revenue	COLLECTED REVENUES		COLLECTED REVENUES		
Tariff Collection Rate	Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES
%	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
0,00	0	0	0	0	0
0,00	0	0	0	0	0
55,0%	2.659.010	554.445	0	0	3.213.455
56,0%	2.853.643	739.705	0	0	3.593.348
57,0%	3.060.667	852.806	0	0	3.913.473
58,0%	3.280.787	901.555	0	0	4.182.342
59,0%	3.504.143	949.865	0	0	4.454.008
60,0%	3.718.777	994.653	0	476.544	5.189.974
61,0%	3.945.475	1.041.040	0	476.544	5.463.059
62,0%	4.184.874	1.089.031	0	476.544	5.750.449
63,0%	4.366.120	1.122.109	0	476.544	5.964.773
64,0%	4.554.275	1.155.716	0	476.544	6.186.535
65,0%	4.749.595	1.189.814	0	476.544	6.415.953
67,0%	5.027.382	1.224.758	0	476.544	6.728.684
69,0%	5.316.918	1.260.548	0	476.544	7.054.010
71,0%	5.618.664	1.296.886	0	476.544	7.392.094
73,0%	5.933.096	1.333.696	0	476.544	7.743.336
75,0%	6.260.711	1.371.495	0	131.750	7.763.956
77,0%	6.602.025	1.409.756	0	131.750	8.143.531
79,0%	6.957.573	1.448.925	0	131.750	8.538.248
81,0%	7.327.911	1.489.078	0	131.750	8.948.739
83,0%	7.715.985	1.529.703	0	1.036.250	10.281.939
68,28%	97.637.632	22.955.584	0	6.328.692	126.921.907
66,41%	57.196.370	13.710.361	0	3.620.000	74.526.731
	290,18%	275,90%	0,00%	217,45%	198,11%
	5,77%	5,49%	0,00%	4,17%	3,66%
	4.881.882	1.147.779	0	316.435	6.346.095
	2.859.818	685.518	0	181.000	3.726.337

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
GENERAL TERMS AND CONDITIONS OF IFI LOANS**

IFI Loan	UNIT	DATA
TYPE OF LOAN	DESCRIPTION	IFI Loan
UTILIZATION RATIO OF LOAN IN THE FIRST HALF OF THE YEAR	%	50,0
SPREAD OF VARIABLE INTEREST RATE (EURIBOR / LIBOR +)	%	1,00
FIXED INTEREST RATE (0=VARIABLE INTEREST)	%	1,50
COMMITMENT FEES (over undisbursed portion of credit)	%	0,500
MANAGEMENT FEES (flat at credit agreement signing)	%	1,00
GRACE PERIOD	YEAR	2
PRINCIPAL REPAYMENT PERIOD (Bullet Payment<1)	YEAR	13,0
NUMBER OF SEMI-ANNUAL INSTALLMENTS	NO.	26,0

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
(LOAN DISBURSEMENTS: 2021+2022)**

IFI Loan-1	UNIT	DATA
TYPE OF LOAN	DESCRIPTION	IFI Loan-1
NAME OF LOAN SOURCE	DESCRIPTION	EBRD
UTILIZATION RATIO OF LOAN IN THE FIRST HALF OF THE YEAR	%	50,0
FIRST DISBURSEMENT YEAR OF CREDIT	YEAR	2022
LAST DISBURSEMENT YEAR OF CREDIT	YEAR	2022
SPREAD OF VARIABLE INTEREST RATE (EURIBOR / LIBOR +)	%	1,00
FIXED INTEREST RATE (0=VARIABLE INTEREST)	%	1,50
COMMITMENT FEES (over undisbursed portion of credit)	%	0,500
MANAGEMENT FEES (flat at credit agreement signing)	%	1,00
GRACE PERIOD	YEAR	2
PRINCIPAL REPAYMENT PERIOD (Bullet Payment<1)	YEAR	13,0
NUMBER OF SEMI-ANNUAL INSTALLMENTS	NO.	26,0
FIRST YEAR OF PRINCIPLE REPAYMENT	YEAR	2024
AMOUNT OF SEMI-ANNUAL INSTALLMENT PAYMENT	EUR	169.681,35
AMOUNT OF LOAN UTILIZATION	EUR	4.411.715,21
MANAGEMENT FEES (flat at credit agreement signing)	EUR	44.117,15
Alternative Cost of Capital (Discount Rate) (Constant Prices)	%	4,00
NET PRESENT VALUE OF CREDIT DEBT SERVICE	EUR	3.517.353,67
EFFECTIVE COST OF CREDIT	%	1,7420

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA

IFI Loan-1

TENTATIVE LOAN REPAYMENT SCHEDULE (EURO)

YEAR	PERIODS	Beg.-of-Period Loan Amount	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service	NET LOAN CASH FLOW	PERIODS	NPV DISC. FACTOR	NPV Debt Service
2021	1	0,00	98.569,48	0,00	98.569,48	369,64	10.906,08	0,00	11.275,71	11.275,71	-87.293,77	1	0,980392	11.054,62
2021	2	98.569,48	98.569,48	0,00	197.138,97	1.108,91	10.659,65	0,00	11.768,56	11.768,56	-86.800,92	2	0,961169	11.311,57
2022	1	197.138,97	2.107.288,12	0,00	2.304.427,09	9.380,87	7.902,33	22.058,58	39.341,78	39.341,78	-2.067.946,34	3	0,942322	37.072,64
2022	2	2.304.427,09	2.107.288,12	0,00	4.411.715,21	25.185,53	2.634,11	22.058,58	49.878,22	49.878,22	-2.057.409,90	4	0,923845	46.079,77
2023	1	4.411.715,21	0,00	0,00	4.411.715,21	33.087,86	0,00	0,00	33.087,86	33.087,86	33.087,86	5	0,905731	29.968,70
2023	2	4.411.715,21	0,00	0,00	4.411.715,21	33.087,86	0,00	0,00	33.087,86	33.087,86	33.087,86	6	0,887971	29.381,08
2024	1	4.411.715,21	0,00	169.681,35	4.242.033,86	32.451,56	0,00	0,00	32.451,56	202.132,91	202.132,91	7	0,870560	175.968,87
2024	2	4.242.033,86	0,00	169.681,35	4.072.352,50	31.178,95	0,00	0,00	31.178,95	200.860,30	200.860,30	8	0,853490	171.432,33
2025	1	4.072.352,50	0,00	169.681,35	3.902.671,15	29.906,34	0,00	0,00	29.906,34	199.587,69	199.587,69	9	0,836755	167.006,05
2025	2	3.902.671,15	0,00	169.681,35	3.732.989,80	28.633,73	0,00	0,00	28.633,73	198.315,08	198.315,08	10	0,820348	162.687,44
2026	1	3.732.989,80	0,00	169.681,35	3.563.308,44	27.361,12	0,00	0,00	27.361,12	197.042,47	197.042,47	11	0,804263	158.473,98
2026	2	3.563.308,44	0,00	169.681,35	3.393.627,09	26.088,51	0,00	0,00	26.088,51	195.769,86	195.769,86	12	0,788493	154.363,20
2027	1	3.393.627,09	0,00	169.681,35	3.223.945,73	24.815,90	0,00	0,00	24.815,90	194.497,25	194.497,25	13	0,773033	150.352,70
2027	2	3.223.945,73	0,00	169.681,35	3.054.264,38	23.543,29	0,00	0,00	23.543,29	193.224,64	193.224,64	14	0,757875	146.440,13
2028	1	3.054.264,38	0,00	169.681,35	2.884.583,02	22.270,68	0,00	0,00	22.270,68	191.952,03	191.952,03	15	0,743015	142.623,19
2028	2	2.884.583,02	0,00	169.681,35	2.714.901,67	20.998,07	0,00	0,00	20.998,07	190.679,42	190.679,42	16	0,728446	138.899,63
2029	1	2.714.901,67	0,00	169.681,35	2.545.220,32	19.725,46	0,00	0,00	19.725,46	189.406,81	189.406,81	17	0,714163	135.267,25
2029	2	2.545.220,32	0,00	169.681,35	2.375.538,96	18.452,85	0,00	0,00	18.452,85	188.134,20	188.134,20	18	0,700159	131.723,93
2030	1	2.375.538,96	0,00	169.681,35	2.205.857,61	17.180,24	0,00	0,00	17.180,24	186.861,59	186.861,59	19	0,686431	128.267,54
2030	2	2.205.857,61	0,00	169.681,35	2.036.176,25	15.907,63	0,00	0,00	15.907,63	185.588,98	185.588,98	20	0,672971	124.896,06
2031	1	2.036.176,25	0,00	169.681,35	1.866.494,90	14.635,02	0,00	0,00	14.635,02	184.316,37	184.316,37	21	0,659776	121.607,48
2031	2	1.866.494,90	0,00	169.681,35	1.696.813,54	13.362,41	0,00	0,00	13.362,41	183.043,76	183.043,76	22	0,646839	118.399,85
2032	1	1.696.813,54	0,00	169.681,35	1.527.132,19	12.089,80	0,00	0,00	12.089,80	181.771,15	181.771,15	23	0,634156	115.271,25
2032	2	1.527.132,19	0,00	169.681,35	1.357.450,83	10.817,19	0,00	0,00	10.817,19	180.498,54	180.498,54	24	0,621721	112.219,82
2033	1	1.357.450,83	0,00	169.681,35	1.187.769,48	9.544,58	0,00	0,00	9.544,58	179.225,93	179.225,93	25	0,609531	109.243,74
2033	2	1.187.769,48	0,00	169.681,35	1.018.088,13	8.271,97	0,00	0,00	8.271,97	177.953,32	177.953,32	26	0,597579	106.341,22
2034	1	1.018.088,13	0,00	169.681,35	848.406,77	6.999,36	0,00	0,00	6.999,36	176.680,71	176.680,71	27	0,585862	103.510,52
2034	2	848.406,77	0,00	169.681,35	678.725,42	5.726,75	0,00	0,00	5.726,75	175.408,10	175.408,10	28	0,574375	100.749,95
2035	1	678.725,42	0,00	169.681,35	509.044,06	4.454,14	0,00	0,00	4.454,14	174.135,49	174.135,49	29	0,563112	98.057,84
2035	2	509.044,06	0,00	169.681,35	339.362,71	3.181,53	0,00	0,00	3.181,53	172.862,88	172.862,88	30	0,552071	95.432,56
2036	1	339.362,71	0,00	169.681,35	169.681,35	1.908,92	0,00	0,00	1.908,92	171.590,27	171.590,27	31	0,541246	92.872,54
2036	2	169.681,35	0,00	169.681,35	0,00	636,31	0,00	0,00	636,31	170.317,66	170.317,66	32	0,530633	90.376,22
2037	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	33	0,520229	0,00
2037	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	34	0,510028	0,00
2038	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	35	0,500028	0,00
2038	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	36	0,490223	0,00
2039	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	37	0,480611	0,00
2039	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	38	0,471187	0,00
2040	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	39	0,461948	0,00
2040	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	40	0,452890	0,00
2041	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	41	0,444010	0,00
2041	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	42	0,435304	0,00
2042	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	43	0,426769	0,00
2042	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	44	0,418401	0,00
	TOTAL		4.411.715,21	4.411.715,21		532.362,91	32.102,17	44.117,15	608.582,23	5.020.297,44	608.582,23			3.517.353,67

ANNUAL PROJECT LOAN COST AND REPAYMENT SCHEDULE (EURO)

YEARS	Beg.-of-Period Loan Amount	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service
2021	0,00	197.138,97	0,00	197.138,97	1.478,54	21.565,73	0,00	23.044,27	23.044,27
2022	197.138,97	4.214.576,25	0,00	4.411.715,21	34.566,41	10.536,44	44.117,15	89.220,00	89.220,00
2023	4.411.715,21	0,00	0,00	4.411.715,21	66.175,73	0,00	0,00	66.175,73	66.175,73
2024	4.411.715,21	0,00	339.362,71	4.072.352,50	63.630,51	0,00	0,00	63.630,51	402.993,22
2025	4.072.352,50	0,00	339.362,71	3.732.989,80	58.540,07	0,00	0,00	58.540,07	397.902,78
2026	3.732.989,80	0,00	339.362,71	3.393.627,09	53.449,63	0,00	0,00	53.449,63	392.812,34
2027	3.393.627,09	0,00	339.362,71	3.054.264,38	48.359,19	0,00	0,00	48.359,19	387.721,89
2028	3.054.264,38	0,00	339.362,71	2.714.901,67	43.268,75	0,00	0,00	43.268,75	382.631,45
2029	2.714.901,67	0,00	339.362,71	2.375.538,96	38.178,30	0,00	0,00	38.178,30	377.541,01
2030	2.375.538,96	0,00	339.362,71	2.036.176,25	33.087,86	0,00	0,00	33.087,86	372.450,57
2031	2.036.176,25	0,00	339.362,71	1.696.813,54	27.997,42	0,00	0,00	27.997,42	367.360,13
2032	1.696.813,54	0,00	339.362,71	1.357.450,83	22.906,98	0,00	0,00	22.906,98	362.269,69
2033	1.357.450,83	0,00	339.362,71	1.018.088,13	17.816,54	0,00	0,00	17.816,54	357.179,25
2034	1.018.088,13	0,00	339.362,71	678.725,42	12.726,10	0,00	0,00	12.726,10	352.088,81
2035	678.725,42	0,00	339.362,71	339.362,71	7.635,66	0,00	0,00	7.635,66	346.998,37
2036	339.362,71	0,00	339.362,71	0,00	2.545,22	0,00	0,00	2.545,22	341.907,93
2037	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2038	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2039	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2040	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2041	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2042	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TOTAL		4.411.715,21	4.411.715,21		532.362,91	32.102,17	44.117,15	608.582,23	5.020.297,44

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
(LOAN DISBURSEMENTS: 2025-2027)**

IFI Loan-2	UNIT	DATA
TYPE OF LOAN	DESCRIPTION	IFI Loan-2
NAME OF LOAN SOURCE	DESCRIPTION	EBRD
UTILIZATION RATIO OF LOAN IN THE FIRST HALF OF THE YEAR	%	50,0
FIRST DISBURSEMENT YEAR OF CREDIT	YEAR	2025
LAST DISBURSEMENT YEAR OF CREDIT	YEAR	2027
SPREAD OF VARIABLE INTEREST RATE (EURIBOR / LIBOR +)	%	1,00
FIXED INTEREST RATE (0=VARIABLE INTEREST)	%	1,50
COMMITMENT FEES (over undisbursed portion of credit)	%	0,500
MANAGEMENT FEES (flat at credit agreement signing)	%	1,00
GRACE PERIOD	YEAR	3
PRINCIPAL REPAYMENT PERIOD (Bullet Payment<1)	YEAR	12,0
NUMBER OF SEMI-ANNUAL INSTALLMENTS	NO.	24,0
FIRST YEAR OF PRINCIPLE REPAYMENT	YEAR	2028
AMOUNT OF SEMI-ANNUAL INSTALLMENT PAYMENT	EUR	7.137,49
AMOUNT OF LOAN UTILIZATION	EUR	171.299,68
MANAGEMENT FEES (flat at credit agreement signing)	EUR	1.713,00
Alternative Cost of Capital (Discount Rate) (Constant Prices)	%	4,00
NET PRESENT VALUE OF CREDIT DEBT SERVICE	EUR	117.971,49
EFFECTIVE COST OF CREDIT	%	1,7039

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
IFI Loan-2
TENTATIVE LOAN REPAYMENT SCHEDULE (EURO)

YEAR	PERIODS	Beg.-of- Period Loan	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service	NET LOAN CASH FLOW	PERIODS	NPV DISC. FACTOR	NPV Debt Service
2021	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1	0,980392	0,00
2021	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2	0,961169	0,00
2022	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3	0,942322	0,00
2022	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4	0,923845	0,00
2023	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	5	0,905731	0,00
2023	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6	0,887971	0,00
2024	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	7	0,870560	0,00
2024	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	8	0,853490	0,00
2025	1	0,00	57.487,13	0,00	57.487,13	215,58	356,39	856,50	1.428,47	1.428,47	-56.058,67	9	0,836755	1.195,28
2025	2	57.487,13	57.487,13	0,00	114.974,26	646,73	212,67	856,50	1.715,90	1.715,90	-55.771,23	10	0,820348	1.407,64
2026	1	114.974,26	0,00	0,00	114.974,26	862,31	0,00	0,00	862,31	862,31	862,31	11	0,804263	693,52
2026	2	114.974,26	0,00	0,00	114.974,26	862,31	0,00	0,00	862,31	862,31	862,31	12	0,788493	679,92
2027	1	114.974,26	28.162,71	0,00	143.136,97	967,92	105,61	0,00	1.073,53	1.073,53	-27.089,18	13	0,773033	829,87
2027	2	143.136,97	28.162,71	0,00	171.299,68	1.179,14	35,20	0,00	1.214,34	1.214,34	-26.948,37	14	0,757875	920,32
2028	1	171.299,68	0,00	7.137,49	164.162,19	1.257,98	0,00	0,00	1.257,98	8.395,47	8.395,47	15	0,743015	6.237,96
2028	2	164.162,19	0,00	7.137,49	157.024,71	1.204,45	0,00	0,00	1.204,45	8.341,94	8.341,94	16	0,728446	6.076,65
2029	1	157.024,71	0,00	7.137,49	149.887,22	1.150,92	0,00	0,00	1.150,92	8.288,41	8.288,41	17	0,714163	5.919,27
2029	2	149.887,22	0,00	7.137,49	142.749,73	1.097,39	0,00	0,00	1.097,39	8.234,88	8.234,88	18	0,700159	5.765,73
2030	1	142.749,73	0,00	7.137,49	135.612,25	1.043,86	0,00	0,00	1.043,86	8.181,34	8.181,34	19	0,686431	5.615,93
2030	2	135.612,25	0,00	7.137,49	128.474,76	990,33	0,00	0,00	990,33	8.127,81	8.127,81	20	0,672971	5.469,79
2031	1	128.474,76	0,00	7.137,49	121.337,27	936,80	0,00	0,00	936,80	8.074,28	8.074,28	21	0,659776	5.327,22
2031	2	121.337,27	0,00	7.137,49	114.199,79	883,26	0,00	0,00	883,26	8.020,75	8.020,75	22	0,646839	5.188,13
2032	1	114.199,79	0,00	7.137,49	107.062,30	829,73	0,00	0,00	829,73	7.967,22	7.967,22	23	0,634156	5.052,46
2032	2	107.062,30	0,00	7.137,49	99.924,81	776,20	0,00	0,00	776,20	7.913,69	7.913,69	24	0,621721	4.920,11
2033	1	99.924,81	0,00	7.137,49	92.787,33	722,67	0,00	0,00	722,67	7.860,16	7.860,16	25	0,609531	4.791,01
2033	2	92.787,33	0,00	7.137,49	85.649,84	669,14	0,00	0,00	669,14	7.806,63	7.806,63	26	0,597579	4.665,08
2034	1	85.649,84	0,00	7.137,49	78.512,35	615,61	0,00	0,00	615,61	7.753,09	7.753,09	27	0,585862	4.542,24
2034	2	78.512,35	0,00	7.137,49	71.374,87	562,08	0,00	0,00	562,08	7.699,56	7.699,56	28	0,574375	4.422,43
2035	1	71.374,87	0,00	7.137,49	64.237,38	508,55	0,00	0,00	508,55	7.646,03	7.646,03	29	0,563112	4.305,58
2035	2	64.237,38	0,00	7.137,49	57.099,89	455,01	0,00	0,00	455,01	7.592,50	7.592,50	30	0,552071	4.191,60
2036	1	57.099,89	0,00	7.137,49	49.962,41	401,48	0,00	0,00	401,48	7.538,97	7.538,97	31	0,541246	4.080,44
2036	2	49.962,41	0,00	7.137,49	42.824,92	347,95	0,00	0,00	347,95	7.485,44	7.485,44	32	0,530633	3.972,02
2037	1	42.824,92	0,00	7.137,49	35.687,43	294,42	0,00	0,00	294,42	7.431,91	7.431,91	33	0,520229	3.866,29
2037	2	35.687,43	0,00	7.137,49	28.549,95	240,89	0,00	0,00	240,89	7.378,38	7.378,38	34	0,510028	3.763,18
2038	1	28.549,95	0,00	7.137,49	21.412,46	187,36	0,00	0,00	187,36	7.324,85	7.324,85	35	0,500028	3.662,63
2038	2	21.412,46	0,00	7.137,49	14.274,97	133,83	0,00	0,00	133,83	7.271,31	7.271,31	36	0,490223	3.564,57
2039	1	14.274,97	0,00	7.137,49	7.137,49	80,30	0,00	0,00	80,30	7.217,78	7.217,78	37	0,480611	3.468,95
2039	2	7.137,49	0,00	7.137,49	0,00	26,77	0,00	0,00	26,77	7.164,25	7.164,25	38	0,471187	3.375,70
2040	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	39	0,461948	0,00
2040	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	40	0,452890	0,00
2041	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	41	0,444010	0,00
2041	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	42	0,435304	0,00
2042	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	43	0,426769	0,00
2042	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	44	0,418401	0,00
	TOTAL		171.299,68	171.299,68		20.150,95	709,88	1.713,00	22.573,82	193.873,50	22.573,82			117.971,49

ANNUAL PROJECT LOAN COST AND REPAYMENT SCHEDULE (EURO)

YEARS	Beg.-of-Period Loan Amount	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service
2021	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2022	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2023	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2024	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2025	0,00	114.974,26	0,00	114.974,26	862,31	569,06	1.713,00	3.144,37	3.144,37
2026	114.974,26	0,00	0,00	114.974,26	1.724,61	0,00	0,00	1.724,61	1.724,61
2027	114.974,26	56.325,42	0,00	171.299,68	2.147,05	140,81	0,00	2.287,87	2.287,87
2028	171.299,68	0,00	14.274,97	157.024,71	2.462,43	0,00	0,00	2.462,43	16.737,41
2029	157.024,71	0,00	14.274,97	142.749,73	2.248,31	0,00	0,00	2.248,31	16.523,28
2030	142.749,73	0,00	14.274,97	128.474,76	2.034,18	0,00	0,00	2.034,18	16.309,16
2031	128.474,76	0,00	14.274,97	114.199,79	1.820,06	0,00	0,00	1.820,06	16.095,03
2032	114.199,79	0,00	14.274,97	99.924,81	1.605,93	0,00	0,00	1.605,93	15.880,91
2033	99.924,81	0,00	14.274,97	85.649,84	1.391,81	0,00	0,00	1.391,81	15.666,78
2034	85.649,84	0,00	14.274,97	71.374,87	1.177,69	0,00	0,00	1.177,69	15.452,66
2035	71.374,87	0,00	14.274,97	57.099,89	963,56	0,00	0,00	963,56	15.238,53
2036	57.099,89	0,00	14.274,97	42.824,92	749,44	0,00	0,00	749,44	15.024,41
2037	42.824,92	0,00	14.274,97	28.549,95	535,31	0,00	0,00	535,31	14.810,28
2038	28.549,95	0,00	14.274,97	14.274,97	321,19	0,00	0,00	321,19	14.596,16
2039	14.274,97	0,00	14.274,97	0,00	107,06	0,00	0,00	107,06	14.382,04
2040	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2041	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2042	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TOTAL		171.299,68	171.299,68		20.150,95	709,88	1.713,00	22.573,82	193.873,50

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
(LOAN DISBURSEMENTS: 2028-2029)**

IFI Loan-3	UNIT	DATA
TYPE OF LOAN	DESCRIPTION	IFI Loan-3
NAME OF LOAN SOURCE	DESCRIPTION	EBRD
UTILIZATION RATIO OF LOAN IN THE FIRST HALF OF THE YEAR	%	50,0
FIRST DISBURSEMENT YEAR OF CREDIT	YEAR	2028
LAST DISBURSEMENT YEAR OF CREDIT	YEAR	2029
SPREAD OF VARIABLE INTEREST RATE (EURIBOR / LIBOR +)	%	1,00
FIXED INTEREST RATE (0=VARIABLE INTEREST)	%	1,50
COMMITMENT FEES (over undisbursed portion of credit)	%	0,500
MANAGEMENT FEES (flat at credit agreement signing)	%	1,00
GRACE PERIOD	YEAR	2
PRINCIPAL REPAYMENT PERIOD (Bullet Payment<1)	YEAR	13,0
NUMBER OF SEMI-ANNUAL INSTALLMENTS	NO.	26,0
FIRST YEAR OF PRINCIPLE REPAYMENT	YEAR	2030
AMOUNT OF SEMI-ANNUAL INSTALLMENT PAYMENT	EUR	27.329,11
AMOUNT OF LOAN UTILIZATION	EUR	710.556,90
MANAGEMENT FEES (flat at credit agreement signing)	EUR	7.105,57
Alternative Cost of Capital (Discount Rate) (Constant Prices)	%	4,00
NET PRESENT VALUE OF CREDIT DEBT SERVICE	EUR	441.576,14
EFFECTIVE COST OF CREDIT	%	1,7171

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
IFI Loan-3
TENTATIVE LOAN REPAYMENT SCHEDULE (EURO)

YEAR	PERIODS	Beg.-of-Period Loan Amount	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service	NET LOAN CASH FLOW	PERIODS	NPV DISC. FACTOR	NPV Debt Service
2021	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1	0,980392	0,00
2021	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2	0,961169	0,00
2022	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3	0,942322	0,00
2022	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4	0,923845	0,00
2023	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	5	0,905731	0,00
2023	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6	0,887971	0,00
2024	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	7	0,870560	0,00
2024	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	8	0,853490	0,00
2025	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	9	0,836755	0,00
2025	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	10	0,820348	0,00
2026	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	11	0,804263	0,00
2026	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	12	0,788493	0,00
2027	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	13	0,773033	0,00
2027	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	14	0,757875	0,00
2028	1	0,00	205.898,74	0,00	205.898,74	772,12	1.519,02	3.552,78	5.843,92	5.843,92	-200.054,82	15	0,743015	4.342,12
2028	2	205.898,74	205.898,74	0,00	411.797,49	2.316,36	1.004,27	3.552,78	6.873,42	6.873,42	-199.025,33	16	0,728446	5.006,91
2029	1	411.797,49	149.379,71	0,00	561.177,19	3.648,66	560,17	0,00	4.208,83	4.208,83	-145.170,88	17	0,714163	3.005,79
2029	2	561.177,19	149.379,71	0,00	710.556,90	4.769,00	186,72	0,00	4.955,73	4.955,73	-144.423,98	18	0,700159	3.469,80
2030	1	710.556,90	0,00	27.329,11	683.227,79	5.226,69	0,00	0,00	5.226,69	32.555,80	32.555,80	19	0,686431	22.347,31
2030	2	683.227,79	0,00	27.329,11	655.898,67	5.021,72	0,00	0,00	5.021,72	32.350,84	32.350,84	20	0,672971	21.771,19
2031	1	655.898,67	0,00	27.329,11	628.569,56	4.816,76	0,00	0,00	4.816,76	32.145,87	32.145,87	21	0,659776	21.209,07
2031	2	628.569,56	0,00	27.329,11	601.240,45	4.611,79	0,00	0,00	4.611,79	31.940,90	31.940,90	22	0,646839	20.660,62
2032	1	601.240,45	0,00	27.329,11	573.911,34	4.406,82	0,00	0,00	4.406,82	31.735,93	31.735,93	23	0,634156	20.125,53
2032	2	573.911,34	0,00	27.329,11	546.582,23	4.201,85	0,00	0,00	4.201,85	31.530,96	31.530,96	24	0,621721	19.603,48
2033	1	546.582,23	0,00	27.329,11	519.253,12	3.996,88	0,00	0,00	3.996,88	31.325,99	31.325,99	25	0,609531	19.094,16
2033	2	519.253,12	0,00	27.329,11	491.924,01	3.791,91	0,00	0,00	3.791,91	31.121,03	31.121,03	26	0,597579	18.597,28
2034	1	491.924,01	0,00	27.329,11	464.594,89	3.586,95	0,00	0,00	3.586,95	30.916,06	30.916,06	27	0,585862	18.112,54
2034	2	464.594,89	0,00	27.329,11	437.265,78	3.381,98	0,00	0,00	3.381,98	30.711,09	30.711,09	28	0,574375	17.639,67
2035	1	437.265,78	0,00	27.329,11	409.936,67	3.177,01	0,00	0,00	3.177,01	30.506,12	30.506,12	29	0,563112	17.178,37
2035	2	409.936,67	0,00	27.329,11	382.607,56	2.972,04	0,00	0,00	2.972,04	30.301,15	30.301,15	30	0,552071	16.728,38
2036	1	382.607,56	0,00	27.329,11	355.278,45	2.767,07	0,00	0,00	2.767,07	30.096,18	30.096,18	31	0,541246	16.289,44
2036	2	355.278,45	0,00	27.329,11	327.949,34	2.562,10	0,00	0,00	2.562,10	29.891,22	29.891,22	32	0,530633	15.861,27
2037	1	327.949,34	0,00	27.329,11	300.620,23	2.357,14	0,00	0,00	2.357,14	29.686,25	29.686,25	33	0,520229	15.443,64
2037	2	300.620,23	0,00	27.329,11	273.291,11	2.152,17	0,00	0,00	2.152,17	29.481,28	29.481,28	34	0,510028	15.036,28
2038	1	273.291,11	0,00	27.329,11	245.962,00	1.947,20	0,00	0,00	1.947,20	29.276,31	29.276,31	35	0,500028	14.638,96
2038	2	245.962,00	0,00	27.329,11	218.632,89	1.742,23	0,00	0,00	1.742,23	29.071,34	29.071,34	36	0,490223	14.251,45
2039	1	218.632,89	0,00	27.329,11	191.303,78	1.537,26	0,00	0,00	1.537,26	28.866,37	28.866,37	37	0,480611	13.873,49
2039	2	191.303,78	0,00	27.329,11	163.974,67	1.332,29	0,00	0,00	1.332,29	28.661,41	28.661,41	38	0,471187	13.504,89
2040	1	163.974,67	0,00	27.329,11	136.645,56	1.127,33	0,00	0,00	1.127,33	28.456,44	28.456,44	39	0,461948	13.145,40
2040	2	136.645,56	0,00	27.329,11	109.316,45	922,36	0,00	0,00	922,36	28.251,47	28.251,47	40	0,452890	12.794,82
2041	1	109.316,45	0,00	27.329,11	81.987,33	717,39	0,00	0,00	717,39	28.046,50	28.046,50	41	0,444010	12.452,93
2041	2	81.987,33	0,00	27.329,11	54.658,22	512,42	0,00	0,00	512,42	27.841,53	27.841,53	42	0,435304	12.119,53
2042	1	54.658,22	0,00	27.329,11	27.329,11	307,45	0,00	0,00	307,45	27.636,56	27.636,56	43	0,426769	11.794,42
2042	2	27.329,11	0,00	27.329,11	0,00	102,48	0,00	0,00	102,48	27.431,60	27.431,60	44	0,418401	11.477,40
	TOTAL		710.556,90	710.556,90		80.785,44	3.270,19	7.105,57	91.161,19	801.718,09	91.161,19			441.576,14

ANNUAL PROJECT LOAN COST AND REPAYMENT SCHEDULE (EURO)

YEARS	Beg.-of-Period Loan Amount	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service
2021	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2022	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2023	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2024	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2025	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2026	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2027	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2028	0,00	411.797,49	0,00	411.797,49	3.088,48	2.523,29	7.105,57	12.717,34	12.717,34
2029	411.797,49	298.759,41	0,00	710.556,90	8.417,66	746,90	0,00	9.164,56	9.164,56
2030	710.556,90	0,00	54.658,22	655.898,67	10.248,42	0,00	0,00	10.248,42	64.906,64
2031	655.898,67	0,00	54.658,22	601.240,45	9.428,54	0,00	0,00	9.428,54	64.086,77
2032	601.240,45	0,00	54.658,22	546.582,23	8.608,67	0,00	0,00	8.608,67	63.266,89
2033	546.582,23	0,00	54.658,22	491.924,01	7.788,80	0,00	0,00	7.788,80	62.447,02
2034	491.924,01	0,00	54.658,22	437.265,78	6.968,92	0,00	0,00	6.968,92	61.627,15
2035	437.265,78	0,00	54.658,22	382.607,56	6.149,05	0,00	0,00	6.149,05	60.807,27
2036	382.607,56	0,00	54.658,22	327.949,34	5.329,18	0,00	0,00	5.329,18	59.987,40
2037	327.949,34	0,00	54.658,22	273.291,11	4.509,30	0,00	0,00	4.509,30	59.167,53
2038	273.291,11	0,00	54.658,22	218.632,89	3.689,43	0,00	0,00	3.689,43	58.347,65
2039	218.632,89	0,00	54.658,22	163.974,67	2.869,56	0,00	0,00	2.869,56	57.527,78
2040	163.974,67	0,00	54.658,22	109.316,45	2.049,68	0,00	0,00	2.049,68	56.707,91
2041	109.316,45	0,00	54.658,22	54.658,22	1.229,81	0,00	0,00	1.229,81	55.888,03
2042	54.658,22	0,00	54.658,22	0,00	409,94	0,00	0,00	409,94	55.068,16
TOTAL		710.556,90	710.556,90		80.785,44	3.270,19	7.105,57	91.161,19	801.718,09

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
(LOAN DISBURSEMENTS: 2032-2033)**

IFI Loan-4	UNIT	DATA
TYPE OF LOAN	DESCRIPTION	IFI Loan-4
NAME OF LOAN SOURCE	DESCRIPTION	EBRD
UTILIZATION RATIO OF LOAN IN THE FIRST HALF OF THE YEAR	%	50,0
FIRST DISBURSEMENT YEAR OF CREDIT	YEAR	2032
LAST DISBURSEMENT YEAR OF CREDIT	YEAR	2033
SPREAD OF VARIABLE INTEREST RATE (EURIBOR / LIBOR +)	%	1,00
FIXED INTEREST RATE (0=VARIABLE INTEREST)	%	1,50
COMMITMENT FEES (over undisbursed portion of credit)	%	0,500
MANAGEMENT FEES (flat at credit agreement signing)	%	1,00
GRACE PERIOD	YEAR	2
PRINCIPAL REPAYMENT PERIOD (Bullet Payment<1)	YEAR	9,0
NUMBER OF SEMI-ANNUAL INSTALLMENTS	NO.	18,0
FIRST YEAR OF PRINCIPLE REPAYMENT	YEAR	2034
AMOUNT OF SEMI-ANNUAL INSTALLMENT PAYMENT	EUR	105.050,45
AMOUNT OF LOAN UTILIZATION	EUR	1.890.908,16
MANAGEMENT FEES (flat at credit agreement signing)	EUR	18.909,08
Alternative Cost of Capital (Discount Rate) (Constant Prices)	%	4,00
NET PRESENT VALUE OF CREDIT DEBT SERVICE	EUR	1.046.285,41
EFFECTIVE COST OF CREDIT	%	1,7633

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
IFI Loan-4
TENTATIVE LOAN REPAYMENT SCHEDULE (EURO)

YEAR	PERIODS	Beg.-of-Period Loan Amount	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service	NET LOAN CASH FLOW	PERIODS	NPV DISC. FACTOR	NPV Debt Service
2021	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1	0,980392	0,00
2021	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2	0,961169	0,00
2022	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3	0,942322	0,00
2022	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4	0,923845	0,00
2023	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	5	0,905731	0,00
2023	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6	0,887971	0,00
2024	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	7	0,870560	0,00
2024	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	8	0,853490	0,00
2025	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	9	0,836755	0,00
2025	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	10	0,820348	0,00
2026	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	11	0,804263	0,00
2026	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	12	0,788493	0,00
2027	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	13	0,773033	0,00
2027	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	14	0,757875	0,00
2028	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	15	0,743015	0,00
2028	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	16	0,728446	0,00
2029	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	17	0,714163	0,00
2029	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	18	0,700159	0,00
2030	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	19	0,686431	0,00
2030	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	20	0,672971	0,00
2031	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	21	0,659776	0,00
2031	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	22	0,646839	0,00
2032	1	0,00	704.067,74	0,00	704.067,74	2.640,25	3.847,19	9.454,54	15.941,98	15.941,98	-688.125,76	23	0,634156	10.109,70
2032	2	704.067,74	704.067,74	0,00	1.408.135,48	7.920,76	2.087,02	9.454,54	19.462,32	19.462,32	-684.605,42	24	0,621721	12.100,14
2033	1	1.408.135,48	241.386,34	0,00	1.649.521,82	11.466,21	905,20	0,00	12.371,41	12.371,41	-229.014,93	25	0,609531	7.540,76
2033	2	1.649.521,82	241.386,34	0,00	1.890.908,16	13.276,61	301,73	0,00	13.578,35	13.578,35	-227.807,99	26	0,597579	8.114,14
2034	1	1.890.908,16	0,00	105.050,45	1.785.857,70	13.787,87	0,00	0,00	13.787,87	118.838,33	118.838,33	27	0,585862	69.622,86
2034	2	1.785.857,70	0,00	105.050,45	1.680.807,25	12.999,99	0,00	0,00	12.999,99	118.050,45	118.050,45	28	0,574375	67.805,17
2035	1	1.680.807,25	0,00	105.050,45	1.575.756,80	12.212,12	0,00	0,00	12.212,12	117.262,57	117.262,57	29	0,563112	66.032,00
2035	2	1.575.756,80	0,00	105.050,45	1.470.706,35	11.424,24	0,00	0,00	11.424,24	116.474,69	116.474,69	30	0,552071	64.302,29
2036	1	1.470.706,35	0,00	105.050,45	1.365.655,89	10.636,36	0,00	0,00	10.636,36	115.686,81	115.686,81	31	0,541246	62.615,02
2036	2	1.365.655,89	0,00	105.050,45	1.260.605,44	9.848,48	0,00	0,00	9.848,48	114.898,93	114.898,93	32	0,530633	60.969,20
2037	1	1.260.605,44	0,00	105.050,45	1.155.554,99	9.060,60	0,00	0,00	9.060,60	114.111,05	114.111,05	33	0,520229	59.363,85
2037	2	1.155.554,99	0,00	105.050,45	1.050.504,53	8.272,72	0,00	0,00	8.272,72	113.323,18	113.323,18	34	0,510028	57.798,01
2038	1	1.050.504,53	0,00	105.050,45	945.454,08	7.484,84	0,00	0,00	7.484,84	112.535,30	112.535,30	35	0,500028	56.270,76
2038	2	945.454,08	0,00	105.050,45	840.403,63	6.696,97	0,00	0,00	6.696,97	111.747,42	111.747,42	36	0,490223	54.781,17
2039	1	840.403,63	0,00	105.050,45	735.353,17	5.909,09	0,00	0,00	5.909,09	110.959,54	110.959,54	37	0,480611	53.328,37
2039	2	735.353,17	0,00	105.050,45	630.302,72	5.121,21	0,00	0,00	5.121,21	110.171,66	110.171,66	38	0,471187	51.911,48
2040	1	630.302,72	0,00	105.050,45	525.252,27	4.333,33	0,00	0,00	4.333,33	109.383,78	109.383,78	39	0,461948	50.529,64
2040	2	525.252,27	0,00	105.050,45	420.201,81	3.545,45	0,00	0,00	3.545,45	108.595,91	108.595,91	40	0,452890	49.182,04
2041	1	420.201,81	0,00	105.050,45	315.151,36	2.757,57	0,00	0,00	2.757,57	107.808,03	107.808,03	41	0,444010	47.867,87
2041	2	315.151,36	0,00	105.050,45	210.100,91	1.969,70	0,00	0,00	1.969,70	107.020,15	107.020,15	42	0,435304	46.586,31
2042	1	210.100,91	0,00	105.050,45	105.050,45	1.181,82	0,00	0,00	1.181,82	106.232,27	106.232,27	43	0,426769	45.336,61
2042	2	105.050,45	0,00	105.050,45	0,00	393,94	0,00	0,00	393,94	105.444,39	105.444,39	44	0,418401	44.118,01
	TOTAL		1.890.908,16	1.890.908,16		162.940,14	7.141,13	18.909,08	188.990,36	2.079.898,52	188.990,36			1.046.285,41

ANNUAL PROJECT LOAN COST AND REPAYMENT SCHEDULE (EURO)

YEARS	Beg.-of-Period Loan Amount	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service
2021	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2022	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2023	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2024	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2025	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2026	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2027	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2028	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2029	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2030	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2031	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2032	0,00	1.408.135,48	0,00	1.408.135,48	10.561,02	5.934,20	18.909,08	35.404,30	35.404,30
2033	1.408.135,48	482.772,68	0,00	1.890.908,16	24.742,83	1.206,93	0,00	25.949,76	25.949,76
2034	1.890.908,16	0,00	210.100,91	1.680.807,25	26.787,87	0,00	0,00	26.787,87	236.888,77
2035	1.680.807,25	0,00	210.100,91	1.470.706,35	23.636,35	0,00	0,00	23.636,35	233.737,26
2036	1.470.706,35	0,00	210.100,91	1.260.605,44	20.484,84	0,00	0,00	20.484,84	230.585,74
2037	1.260.605,44	0,00	210.100,91	1.050.504,53	17.333,32	0,00	0,00	17.333,32	227.434,23
2038	1.050.504,53	0,00	210.100,91	840.403,63	14.181,81	0,00	0,00	14.181,81	224.282,72
2039	840.403,63	0,00	210.100,91	630.302,72	11.030,30	0,00	0,00	11.030,30	221.131,20
2040	630.302,72	0,00	210.100,91	420.201,81	7.878,78	0,00	0,00	7.878,78	217.979,69
2041	420.201,81	0,00	210.100,91	210.100,91	4.727,27	0,00	0,00	4.727,27	214.828,18
2042	210.100,91	0,00	210.100,91	0,00	1.575,76	0,00	0,00	1.575,76	211.676,66
TOTAL		1.890.908,16	1.890.908,16		162.940,14	7.141,13	18.909,08	188.990,36	2.079.898,52

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
(LOAN DISBURSEMENTS: 2037-2038)**

IFI Loan-5	UNIT	DATA
TYPE OF LOAN	DESCRIPTION	IFI Loan-5
NAME OF LOAN SOURCE	DESCRIPTION	EBRD
UTILIZATION RATIO OF LOAN IN THE FIRST HALF OF THE YEAR	%	50,0
FIRST DISBURSEMENT YEAR OF CREDIT	YEAR	2037
LAST DISBURSEMENT YEAR OF CREDIT	YEAR	2038
SPREAD OF VARIABLE INTEREST RATE (EURIBOR / LIBOR +)	%	1,00
FIXED INTEREST RATE (0=VARIABLE INTEREST)	%	1,50
COMMITMENT FEES (over undisbursed portion of credit)	%	0,500
MANAGEMENT FEES (flat at credit agreement signing)	%	1,00
GRACE PERIOD	YEAR	2
PRINCIPAL REPAYMENT PERIOD (Bullet Payment<1)	YEAR	4,0
NUMBER OF SEMI-ANNUAL INSTALLMENTS	NO.	8,0
FIRST YEAR OF PRINCIPLE REPAYMENT	YEAR	2039
AMOUNT OF SEMI-ANNUAL INSTALLMENT PAYMENT	EUR	47.172,13
AMOUNT OF LOAN UTILIZATION	EUR	377.377,02
MANAGEMENT FEES (flat at credit agreement signing)	EUR	3.773,77
Alternative Cost of Capital (Discount Rate) (Constant Prices)	%	4,00
NET PRESENT VALUE OF CREDIT DEBT SERVICE	EUR	180.935,65
EFFECTIVE COST OF CREDIT	%	1,9319

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
IFI Loan-5
TENTATIVE LOAN REPAYMENT SCHEDULE (EURO)

YEAR	PERIODS	Beg.-of-Period Loan Amount	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service	NET LOAN CASH FLOW	PERIODS	NPV DISC. FACTOR	NPV Debt Service
2021	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1	0,980392	0,00
2021	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2	0,961169	0,00
2022	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3	0,942322	0,00
2022	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4	0,923845	0,00
2023	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	5	0,905731	0,00
2023	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6	0,887971	0,00
2024	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	7	0,870560	0,00
2024	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	8	0,853490	0,00
2025	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	9	0,836755	0,00
2025	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	10	0,820348	0,00
2026	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	11	0,804263	0,00
2026	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	12	0,788493	0,00
2027	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	13	0,773033	0,00
2027	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	14	0,757875	0,00
2028	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	15	0,743015	0,00
2028	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	16	0,728446	0,00
2029	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	17	0,714163	0,00
2029	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	18	0,700159	0,00
2030	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	19	0,686431	0,00
2030	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	20	0,672971	0,00
2031	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	21	0,659776	0,00
2031	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	22	0,646839	0,00
2032	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	23	0,634156	0,00
2032	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	24	0,621721	0,00
2033	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	25	0,609531	0,00
2033	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	26	0,597579	0,00
2034	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	27	0,585862	0,00
2034	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	28	0,574375	0,00
2035	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	29	0,563112	0,00
2035	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	30	0,552071	0,00
2036	1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	31	0,541246	0,00
2036	2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	32	0,530633	0,00
2037	1	0,00	152.548,01	0,00	152.548,01	572,06	752,76	1.886,89	3.211,70	3.211,70	-149.336,31	33	0,520229	1.670,82
2037	2	152.548,01	152.548,01	0,00	305.096,02	1.716,17	371,39	1.886,89	3.974,44	3.974,44	-148.573,57	34	0,510028	2.027,08
2038	1	305.096,02	36.140,50	0,00	341.236,52	2.423,75	135,53	0,00	2.559,27	2.559,27	-33.581,23	35	0,500028	1.279,71
2038	2	341.236,52	36.140,50	0,00	377.377,02	2.694,80	45,18	0,00	2.739,98	2.739,98	-33.400,52	36	0,490223	1.343,20
2039	1	377.377,02	0,00	47.172,13	330.204,90	2.653,43	0,00	0,00	2.653,43	49.825,56	49.825,56	37	0,480611	23.946,71
2039	2	330.204,90	0,00	47.172,13	283.032,77	2.299,64	0,00	0,00	2.299,64	49.471,77	49.471,77	38	0,471187	23.310,46
2040	1	283.032,77	0,00	47.172,13	235.860,64	1.945,85	0,00	0,00	1.945,85	49.117,98	49.117,98	39	0,461948	22.689,96
2040	2	235.860,64	0,00	47.172,13	188.688,51	1.592,06	0,00	0,00	1.592,06	48.764,19	48.764,19	40	0,452890	22.084,83
2041	1	188.688,51	0,00	47.172,13	141.516,38	1.238,27	0,00	0,00	1.238,27	48.410,40	48.410,40	41	0,444010	21.494,71
2041	2	141.516,38	0,00	47.172,13	94.344,26	884,48	0,00	0,00	884,48	48.056,61	48.056,61	42	0,435304	20.919,24
2042	1	94.344,26	0,00	47.172,13	47.172,13	530,69	0,00	0,00	530,69	47.702,81	47.702,81	43	0,426769	20.358,07
2042	2	47.172,13	0,00	47.172,13	0,00	176,90	0,00	0,00	176,90	47.349,02	47.349,02	44	0,418401	19.810,87
	TOTAL		377.377,02	377.377,02		18.728,08	1.304,85	3.773,77	23.806,70	401.183,72	23.806,70			180.935,65

ANNUAL PROJECT LOAN COST AND REPAYMENT SCHEDULE (EURO)

YEARS	Beg.-of-Period Loan Amount	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service
2021	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2022	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2023	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2024	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2025	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2026	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2027	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2028	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2029	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2030	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2031	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2032	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2033	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2034	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2035	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2036	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2037	0,00	305.096,02	0,00	305.096,02	2.288,22	1.124,15	3.773,77	7.186,14	7.186,14
2038	305.096,02	72.281,00	0,00	377.377,02	5.118,55	180,70	0,00	5.299,25	5.299,25
2039	377.377,02	0,00	94.344,26	283.032,77	4.953,07	0,00	0,00	4.953,07	99.297,33
2040	283.032,77	0,00	94.344,26	188.688,51	3.537,91	0,00	0,00	3.537,91	97.882,17
2041	188.688,51	0,00	94.344,26	94.344,26	2.122,75	0,00	0,00	2.122,75	96.467,00
2042	94.344,26	0,00	94.344,26	0,00	707,58	0,00	0,00	707,58	95.051,84
TOTAL		377.377,02	377.377,02		18.728,08	1.304,85	3.773,77	23.806,70	401.183,72

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
(ALL LOAN DISBURSEMENTS: 2021 + 2022 + 2025 + 2027 + 2028 + 2029 + 2032 + 2033 + 2037 + 2038)**

IFI Loan-1+2+3+4+5	UNIT	DATA
TYPE OF LOAN	DESCRIPTION	FI Loan-1+2+3+4+5
NAME OF LOAN SOURCE	DESCRIPTION	EBRD
UTILIZATION RATIO OF LOAN IN THE FIRST HALF OF THE YEAR	%	50,0
SPREAD OF VARIABLE INTEREST RATE (EURIBOR / LIBOR +)	%	1,00
FIXED INTEREST RATE (0=VARIABLE INTEREST)	%	1,50
COMMITMENT FEES (over undisbursed portion of credit)	%	0,500
MANAGEMENT FEES (flat at credit agreement signing)	%	1,00
AMOUNT OF LOAN UTILIZATION	EUR	7.561.856,97
MANAGEMENT FEES (flat at credit agreement signing)	EUR	75.618,57
Alternative Cost of Capital (Discount Rate) (Constant Prices)	%	4,00
NET PRESENT VALUE OF CREDIT DEBT SERVICE	EUR	5.304.122,37
EFFECTIVE COST OF CREDIT	%	1,7462

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA

IFI Loan-1+2+3+4+5

TENTATIVE LOAN REPAYMENT SCHEDULE (EURO)

YEAR	PERIODS	Beg.-of-Period Loan Amount	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service	NET LOAN CASH FLOW	PERIODS	NPV DISC. FACTOR	NPV Debt Service
2021	1	0,00	98.569,48	0,00	98.569,48	369,64	10.906,08	0,00	11.275,71	11.275,71	-87.293,77	1	0,980392	11.054,62
2021	2	98.569,48	98.569,48	0,00	197.138,97	1.108,91	10.659,65	0,00	11.768,56	11.768,56	-86.800,92	2	0,961169	11.311,57
2022	1	197.138,97	2.107.288,12	0,00	2.304.427,09	9.380,87	7.902,33	22.058,58	39.341,78	39.341,78	-2.067.946,34	3	0,942322	37.072,64
2022	2	2.304.427,09	2.107.288,12	0,00	4.411.715,21	25.185,53	2.634,11	22.058,58	49.878,22	49.878,22	-2.057.409,90	4	0,923845	46.079,77
2023	1	4.411.715,21	0,00	0,00	4.411.715,21	33.087,86	0,00	0,00	33.087,86	33.087,86	33.087,86	5	0,905731	29.968,70
2023	2	4.411.715,21	0,00	0,00	4.411.715,21	33.087,86	0,00	0,00	33.087,86	33.087,86	33.087,86	6	0,887971	29.381,08
2024	1	4.411.715,21	0,00	169.681,35	4.242.033,86	32.451,56	0,00	0,00	32.451,56	202.132,91	202.132,91	7	0,870560	175.968,87
2024	2	4.242.033,86	0,00	169.681,35	4.072.352,50	31.178,95	0,00	0,00	31.178,95	200.860,30	200.860,30	8	0,853490	171.432,33
2025	1	4.072.352,50	57.487,13	169.681,35	3.960.158,28	30.121,92	356,39	856,50	31.334,80	201.016,16	143.529,03	9	0,836755	168.201,33
2025	2	3.960.158,28	57.487,13	169.681,35	3.847.964,06	29.280,46	212,67	856,50	30.349,63	200.030,98	142.543,85	10	0,820348	164.095,08
2026	1	3.847.964,06	0,00	169.681,35	3.678.282,70	28.223,43	0,00	0,00	28.223,43	197.904,78	197.904,78	11	0,804263	159.167,50
2026	2	3.678.282,70	0,00	169.681,35	3.508.601,35	26.950,82	0,00	0,00	26.950,82	196.632,17	196.632,17	12	0,788493	155.043,12
2027	1	3.508.601,35	28.162,71	169.681,35	3.367.082,70	25.783,82	105,61	0,00	25.889,43	195.570,78	167.408,07	13	0,773033	151.182,57
2027	2	3.367.082,70	28.162,71	169.681,35	3.225.564,06	24.722,43	35,20	0,00	24.757,63	194.438,98	166.276,27	14	0,757875	147.360,45
2028	1	3.225.564,06	205.898,74	176.818,84	3.254.643,96	24.300,78	1.519,02	3.552,78	29.372,58	206.191,42	292,68	15	0,743015	153.203,27
2028	2	3.254.643,96	205.898,74	176.818,84	3.283.723,86	24.518,88	1.004,27	3.552,78	29.075,94	205.894,78	-3,97	16	0,728446	149.983,19
2029	1	3.283.723,86	149.379,71	176.818,84	3.256.284,73	24.525,03	560,17	0,00	25.085,21	201.904,05	52.524,34	17	0,714163	144.192,31
2029	2	3.256.284,73	149.379,71	176.818,84	3.228.845,59	24.319,24	186,72	0,00	24.505,96	201.324,80	51.945,10	18	0,700159	140.959,45
2030	1	3.228.845,59	0,00	204.147,95	3.024.697,64	23.450,79	0,00	0,00	23.450,79	227.598,74	227.598,74	19	0,686431	156.230,78
2030	2	3.024.697,64	0,00	204.147,95	2.820.549,69	21.919,68	0,00	0,00	21.919,68	226.067,63	226.067,63	20	0,672971	152.137,03
2031	1	2.820.549,69	0,00	204.147,95	2.616.401,74	20.388,57	0,00	0,00	20.388,57	224.536,52	224.536,52	21	0,659776	148.143,77
2031	2	2.616.401,74	0,00	204.147,95	2.412.253,78	18.857,46	0,00	0,00	18.857,46	223.005,41	223.005,41	22	0,646839	144.248,60
2032	1	2.412.253,78	704.067,74	204.147,95	2.912.173,57	19.966,60	3.847,19	9.454,54	33.268,33	237.416,28	-466.651,46	23	0,634156	150.558,94
2032	2	2.912.173,57	704.067,74	204.147,95	3.412.093,36	23.716,00	2.087,02	9.454,54	35.257,56	239.405,51	-464.662,23	24	0,621721	148.843,55
2033	1	3.412.093,36	241.386,34	204.147,95	3.449.331,74	25.730,34	905,20	0,00	26.635,54	230.783,50	-10.602,84	25	0,609531	140.669,66
2033	2	3.449.331,74	241.386,34	204.147,95	3.486.570,13	26.009,63	301,73	0,00	26.311,36	230.459,32	-10.927,02	26	0,597579	137.717,71
2034	1	3.486.570,13	0,00	309.198,41	3.177.371,72	24.989,78	0,00	0,00	24.989,78	334.188,19	334.188,19	27	0,585862	195.788,17
2034	2	3.177.371,72	0,00	309.198,41	2.868.173,32	22.670,79	0,00	0,00	22.670,79	331.869,20	331.869,20	28	0,574375	190.617,22
2035	1	2.868.173,32	0,00	309.198,41	2.558.974,91	20.351,81	0,00	0,00	20.351,81	329.550,21	329.550,21	29	0,563112	185.573,78
2035	2	2.558.974,91	0,00	309.198,41	2.249.776,51	18.032,82	0,00	0,00	18.032,82	327.231,22	327.231,22	30	0,552071	180.654,83
2036	1	2.249.776,51	0,00	309.198,41	1.940.578,10	15.713,83	0,00	0,00	15.713,83	324.912,24	324.912,24	31	0,541246	175.857,44
2036	2	1.940.578,10	0,00	309.198,41	1.631.379,70	13.394,84	0,00	0,00	13.394,84	322.593,25	322.593,25	32	0,530633	171.178,72
2037	1	1.631.379,70	152.548,01	139.517,05	1.644.410,66	12.284,21	752,76	1.886,89	14.923,86	154.440,91	1.892,90	33	0,520229	80.344,60
2037	2	1.644.410,66	152.548,01	139.517,05	1.657.441,61	12.381,95	371,39	1.886,89	14.640,22	154.157,27	1.609,26	34	0,510028	78.624,55
2038	1	1.657.441,61	36.140,50	139.517,05	1.554.065,06	12.043,15	135,53	0,00	12.178,68	151.695,73	115.555,23	35	0,500028	75.852,05
2038	2	1.554.065,06	36.140,50	139.517,05	1.450.688,51	11.267,83	45,18	0,00	11.313,00	150.830,05	114.689,55	36	0,490223	73.940,38
2039	1	1.450.688,51	0,00	186.689,18	1.263.999,33	10.180,08	0,00	0,00	10.180,08	196.869,26	196.869,26	37	0,480611	94.617,52
2039	2	1.263.999,33	0,00	186.689,18	1.077.310,16	8.779,91	0,00	0,00	8.779,91	195.469,09	195.469,09	38	0,471187	92.102,53
2040	1	1.077.310,16	0,00	179.551,69	897.758,46	7.406,51	0,00	0,00	7.406,51	186.958,20	186.958,20	39	0,461948	86.365,01
2040	2	897.758,46	0,00	179.551,69	718.206,77	6.059,87	0,00	0,00	6.059,87	185.611,56	185.611,56	40	0,452890	84.061,70
2041	1	718.206,77	0,00	179.551,69	538.655,08	4.713,23	0,00	0,00	4.713,23	184.264,92	184.264,92	41	0,444010	81.815,51
2041	2	538.655,08	0,00	179.551,69	359.103,39	3.366,59	0,00	0,00	3.366,59	182.918,29	182.918,29	42	0,435304	79.625,09
2042	1	359.103,39	0,00	179.551,69	179.551,69	2.019,96	0,00	0,00	2.019,96	181.571,65	181.571,65	43	0,426769	77.489,11
2042	2	179.551,69	0,00	179.551,69	0,00	673,32	0,00	0,00	673,32	180.225,01	180.225,01	44	0,418401	75.406,28
	TOTAL		7.561.856,97	7.561.856,97		814.967,52	44.528,22	75.618,57	935.114,30	8.496.971,27	935.114,30			5.304.122,37

ANNUAL PROJECT LOAN COST AND REPAYMENT SCHEDULE (EURO)

YEARS	Beg.-of-Period Loan Amount	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service
2021	0	197.139	0	197.139	1.479	21.566	0	23.044	23.044
2022	197.139	4.214.576	0	4.411.715	34.566	10.536	44.117	89.220	89.220
2023	4.411.715	0	0	4.411.715	66.176	0	0	66.176	66.176
2024	4.411.715	0	339.363	4.072.353	63.631	0	0	63.631	402.993
2025	4.072.353	114.974	339.363	3.847.964	59.402	569	1.713	61.684	401.047
2026	3.847.964	0	339.363	3.508.601	55.174	0	0	55.174	394.537
2027	3.508.601	56.325	339.363	3.225.564	50.506	141	0	50.647	390.010
2028	3.225.564	411.797	353.638	3.283.724	48.820	2.523	7.106	58.449	412.086
2029	3.283.724	298.759	353.638	3.228.846	48.844	747	0	49.591	403.229
2030	3.228.846	0	408.296	2.820.550	45.370	0	0	45.370	453.666
2031	2.820.550	0	408.296	2.412.254	39.246	0	0	39.246	447.542
2032	2.412.254	1.408.135	408.296	3.412.093	43.683	5.934	18.909	68.526	476.822
2033	3.412.093	482.773	408.296	3.486.570	51.740	1.207	0	52.947	461.243
2034	3.486.570	0	618.397	2.868.173	47.661	0	0	47.661	666.057
2035	2.868.173	0	618.397	2.249.777	38.385	0	0	38.385	656.781
2036	2.249.777	0	618.397	1.631.380	29.109	0	0	29.109	647.505
2037	1.631.380	305.096	279.034	1.657.442	24.666	1.124	3.774	29.564	308.598
2038	1.657.442	72.281	279.034	1.450.689	23.311	181	0	23.492	302.526
2039	1.450.689	0	373.378	1.077.310	18.960	0	0	18.960	392.338
2040	1.077.310	0	359.103	718.207	13.466	0	0	13.466	372.570
2041	718.207	0	359.103	359.103	8.080	0	0	8.080	367.183
2042	359.103	0	359.103	0	2.693	0	0	2.693	361.797
TOTAL		7.561.857	7.561.857		814.968	44.528	75.619	935.114	8.496.971

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
PROJECT FINANCIAL PROFITABILITY ANALYSIS (FINANCIAL RATE OF RETURN OF THE INVESTMENT (FNPV/C - FRR/C))

Financial Discount Rate (%)	4,0
FNPV/C (EUR)	-27.616.897
FRR/C (%)	-7,28

	Collected Revenues	Collected Revenues	Collected Revenues	Collected Revenues	Collected Revenues	O&M Costs	O&M Costs	O&M Costs
	Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL CASH INFLOWS	Collection	Recycling	Composting
Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
2021	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0
2023	2.659.010	554.445	0	0	3.213.455	-2.334.656	-731.451	-106.392
2024	2.853.643	739.705	0	0	3.593.348	-2.386.346	-834.869	-106.392
2025	3.060.667	852.806	0	0	3.913.473	-2.394.160	-970.052	-106.392
2026	3.280.787	901.555	0	0	4.182.342	-2.433.559	-997.421	-106.392
2027	3.504.143	949.865	0	0	4.454.008	-2.529.412	-1.058.003	-106.392
2028	3.718.777	994.653	0	476.544	5.189.974	-2.590.207	-1.091.012	-106.392
2029	3.945.475	1.041.040	0	476.544	5.463.059	-2.674.885	-1.132.570	-106.392
2030	4.184.874	1.089.031	0	476.544	5.750.449	-2.732.792	-1.140.342	-106.392
2031	4.366.120	1.122.109	0	476.544	5.964.773	-2.762.280	-1.183.075	-106.392
2032	4.554.275	1.155.716	0	476.544	6.186.535	-2.780.517	-1.203.012	-106.392
2033	4.749.595	1.189.814	0	476.544	6.415.953	-2.806.646	-1.210.210	-106.392
2034	5.027.382	1.224.758	0	476.544	6.728.684	-2.846.232	-1.220.878	-106.392
2035	5.316.918	1.260.548	0	476.544	7.054.010	-2.848.716	-1.263.207	-106.392
2036	5.618.664	1.296.886	0	476.544	7.392.094	-2.851.113	-1.336.349	-106.392
2037	5.933.096	1.333.696	0	476.544	7.743.336	-2.853.654	-1.340.160	-106.392
2038	6.260.711	1.371.495	0	131.750	7.763.956	-2.889.541	-1.343.835	-106.392
2039	6.602.025	1.409.756	0	131.750	8.143.531	-2.915.808	-1.379.880	-106.392
2040	6.957.573	1.448.925	0	131.750	8.538.248	-2.931.087	-1.394.235	-106.392
2041	7.327.911	1.489.078	0	131.750	8.948.739	-2.965.311	-1.497.249	-106.392
2042	7.715.985	1.529.703	0	1.036.250	10.281.939	-3.012.234	-1.501.272	-106.392
UNDISCOUNTED TOTAL (2021-2042)	97.637.632	22.955.584	0	6.328.692	126.921.907	-54.539.155	-23.829.081	-2.127.840
DISCOUNTED TOTAL (2021-2042)	57.196.370	13.710.361	0	3.620.000	74.526.731	-33.696.368	-14.416.565	-1.336.818

O&M Costs	O&M Costs	O&M Costs	O&M Costs	O&M Costs	O&M Costs	Operating Profits	INVESTMENT COSTS EXCLUDING CONTINGENCIES			
Transport	Disposal	TOTAL OPERATING SERVICE COSTS	Aftercare Costs	Administrative Costs	TOTAL NET OPERATING COSTS	Total Operating Revenues-Total O & M Costs	Total Investments Including Implementation Consultant	Technical Assistance	Total Investments Including Impl. Consultant & TA	Residual Value
EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)
0	0	0	0	-26.400	-26.400	-26.400	0	-907.200	-907.200	0
0	0	0	0	-75.900	-75.900	-75.900	-19.005.963	-388.800	-19.394.763	0
-414.357	-671.828	-4.258.684	0	-75.900	-4.334.584	-1.121.129	0	0	0	0
-417.224	-675.481	-4.420.312	0	-75.900	-4.496.212	-902.864	0	0	0	0
-423.357	-674.977	-4.568.938	0	-75.900	-4.644.838	-731.365	-529.092	0	-529.092	0
-432.435	-680.751	-4.650.558	0	-75.900	-4.726.458	-544.116	0	0	0	0
-451.175	-681.060	-4.826.042	0	-75.900	-4.901.942	-447.934	-259.200	0	-259.200	0
-459.378	-719.946	-4.966.935	0	-75.900	-5.042.835	147.140	-3.962.036	0	-3.962.036	0
-467.741	-719.861	-5.101.449	0	-75.900	-5.177.349	285.710	-1.374.840	0	-1.374.840	0
-476.341	-725.092	-5.180.959	0	-75.900	-5.256.859	493.591	-232.325	0	-232.325	0
-478.811	-723.733	-5.254.290	0	-75.900	-5.330.190	634.583	-129.600	0	-129.600	0
-481.359	-727.663	-5.298.943	0	-75.900	-5.374.843	811.692	-7.507.500	0	-7.507.500	0
-483.907	-830.143	-5.437.299	0	-75.900	-5.513.199	902.755	-11.135.527	0	-11.135.527	0
-486.456	-847.979	-5.507.937	0	-75.900	-5.583.837	1.144.847	0	0	0	0
-489.084	-848.774	-5.556.172	0	-75.900	-5.632.072	1.421.938	-499.200	0	-499.200	0
-491.712	-854.876	-5.640.442	0	-75.900	-5.716.342	1.675.751	0	0	0	0
-504.240	-855.724	-5.660.170	0	-75.900	-5.736.070	2.007.266	-1.644.000	0	-1.644.000	0
-506.869	-861.880	-5.708.517	0	-75.900	-5.784.417	1.979.540	-1.905.961	0	-1.905.961	0
-509.576	-862.782	-5.774.438	0	-75.900	-5.850.338	2.293.193	0	0	0	0
-512.284	-868.992	-5.812.990	0	-75.900	-5.888.890	2.649.359	0	0	0	0
-515.071	-869.949	-5.953.971	0	-75.900	-6.029.871	2.918.868	-379.200	0	-379.200	0
-517.779	-876.214	-6.013.891	-1.177.350	-75.900	-7.267.141	3.014.797	-1.728.000	0	-1.728.000	5.176.449
-9.519.157	-15.577.702	-105.592.936	-1.177.350	-1.620.300	-108.390.586	18.531.321	-50.292.444	-1.296.000	-51.588.444	5.176.449
-5.890.247	-9.569.600	-64.909.597	-496.789	-1.049.243	-66.455.630	8.071.101	-36.640.454	-1.231.775	-37.872.229	2.184.231

	Total Costs	Annual Cash Flows	Cumulative Cash Flows
Total Inv. Incl. Impl. Consultant & TA and Residual Value	TOTAL CASH OUTFLOWS	Net Cash Flow Before Finance	Cumulative Net Cash Flow Before Finance
(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)
-907.200	-933.600	-933.600	-933.600
-19.394.763	-19.470.663	-19.470.663	-20.404.263
0	-4.334.584	-1.121.129	-21.525.392
0	-4.496.212	-902.864	-22.428.256
-529.092	-5.173.930	-1.260.457	-23.688.713
0	-4.726.458	-544.116	-24.232.829
-259.200	-5.161.142	-707.134	-24.939.964
-3.962.036	-9.004.871	-3.814.896	-28.754.860
-1.374.840	-6.552.189	-1.089.130	-29.843.990
-232.325	-5.489.184	261.266	-29.582.724
-129.600	-5.459.790	504.983	-29.077.741
-7.507.500	-12.882.343	-6.695.808	-35.773.549
-11.135.527	-16.648.725	-10.232.772	-46.006.321
0	-5.583.837	1.144.847	-44.861.474
-499.200	-6.131.272	922.738	-43.938.735
0	-5.716.342	1.675.751	-42.262.984
-1.644.000	-7.380.070	363.266	-41.899.718
-1.905.961	-7.690.377	73.579	-41.826.139
0	-5.850.338	2.293.193	-39.532.946
0	-5.888.890	2.649.359	-36.883.587
-379.200	-6.409.071	2.539.668	-34.343.920
3.448.449	-3.818.692	6.463.246	-27.880.673
-46.411.995	-154.802.581	-27.880.673	
-35.687.998	-102.143.628	-27.616.897	

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
FINANCIAL RETURN ON INVESTED LOCAL CAPITAL (FNPV/K - FRR/K) (LOAN FINANCING AND LOCAL GRANT FINANCING CONSIDERED)

Financial Discount Rate (%)	4,0
FNPV/K (EUR)	-17.686.427
FRR/K (%)	-4,02

	Collected Revenues	Collected Revenues	Collected Revenues	Collected Revenues	Collected Revenues	Loan Utilizations	Local Grants	
	Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES	Loan Utilizations	Local Grants	TOTAL CASH INFLOWS
Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
2021	0	0	0	0	0	197.139	0	197.139
2022	0	0	0	0	0	4.214.576	0	4.214.576
2023	2.659.010	554.445	0	0	3.213.455	0	0	3.213.455
2024	2.853.643	739.705	0	0	3.593.348	0	0	3.593.348
2025	3.060.667	852.806	0	0	3.913.473	114.974	467.027	4.495.474
2026	3.280.787	901.555	0	0	4.182.342	0	0	4.182.342
2027	3.504.143	949.865	0	0	4.454.008	56.325	228.795	4.739.128
2028	3.718.777	994.653	0	476.544	5.189.974	411.797	1.672.727	7.274.499
2029	3.945.475	1.041.040	0	476.544	5.463.059	298.759	1.213.565	6.975.383
2030	4.184.874	1.089.031	0	476.544	5.750.449	0	0	5.750.449
2031	4.366.120	1.122.109	0	476.544	5.964.773	0	114.397	6.079.170
2032	4.554.275	1.155.716	0	476.544	6.186.535	1.408.135	5.719.865	13.314.535
2033	4.749.595	1.189.814	0	476.544	6.415.953	482.773	1.961.029	8.859.755
2034	5.027.382	1.224.758	0	476.544	6.728.684	0	0	6.728.684
2035	5.316.918	1.260.548	0	476.544	7.054.010	0	228.795	7.282.805
2036	5.618.664	1.296.886	0	476.544	7.392.094	0	0	7.392.094
2037	5.933.096	1.333.696	0	476.544	7.743.336	305.096	1.239.304	9.287.736
2038	6.260.711	1.371.495	0	131.750	7.763.956	72.281	293.606	8.129.844
2039	6.602.025	1.409.756	0	131.750	8.143.531	0	0	8.143.531
2040	6.957.573	1.448.925	0	131.750	8.538.248	0	0	8.538.248
2041	7.327.911	1.489.078	0	131.750	8.948.739	0	228.795	9.177.534
2042	7.715.985	1.529.703	0	1.036.250	10.281.939	0	1.525.297	11.807.236
UNDISCOUNTED TOTAL (2021-2042)	97.637.632	22.955.584	0	6.328.692	126.921.907	7.561.857	14.893.200	149.376.965
DISCOUNTED TOTAL (2021-2042)	57.196.370	13.710.361	0	3.620.000	74.526.731	6.096.039	9.109.480	89.732.251

O&M Costs	O&M Costs	O&M Costs	O&M Costs	O&M Costs	O&M Costs	O&M Costs	O&M Costs	O&M Costs	Operating Profits
Collection	Recycling	Composting	Transport	Disposal	TOTAL OPERATING SERVICE COSTS	Aftercare Costs	Administrative Costs	TOTAL NET OPERATING COSTS	Total Operating Revenues-Total O & M Costs
EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
0	0	0	0	0	0	0	-26.400	-26.400	-26.400
0	0	0	0	0	0	0	-75.900	-75.900	-75.900
-2.334.656	-731.451	-106.392	-414.357	-671.828	-4.258.684	0	-75.900	-4.334.584	-1.121.129
-2.386.346	-834.869	-106.392	-417.224	-675.481	-4.420.312	0	-75.900	-4.496.212	-902.864
-2.394.160	-970.052	-106.392	-423.357	-674.977	-4.568.938	0	-75.900	-4.644.838	-731.365
-2.433.559	-997.421	-106.392	-432.435	-680.751	-4.650.558	0	-75.900	-4.726.458	-544.116
-2.529.412	-1.058.003	-106.392	-451.175	-681.060	-4.826.042	0	-75.900	-4.901.942	-447.934
-2.590.207	-1.091.012	-106.392	-459.378	-719.946	-4.966.935	0	-75.900	-5.042.835	147.140
-2.674.885	-1.132.570	-106.392	-467.741	-719.861	-5.101.449	0	-75.900	-5.177.349	285.710
-2.732.792	-1.140.342	-106.392	-476.341	-725.092	-5.180.959	0	-75.900	-5.256.859	493.591
-2.762.280	-1.183.075	-106.392	-478.811	-723.733	-5.254.290	0	-75.900	-5.330.190	634.583
-2.780.517	-1.203.012	-106.392	-481.359	-727.663	-5.298.943	0	-75.900	-5.374.843	811.692
-2.806.646	-1.210.210	-106.392	-483.907	-830.143	-5.437.299	0	-75.900	-5.513.199	902.755
-2.846.232	-1.220.878	-106.392	-486.456	-847.979	-5.507.937	0	-75.900	-5.583.837	1.144.847
-2.848.716	-1.263.207	-106.392	-489.084	-848.774	-5.556.172	0	-75.900	-5.632.072	1.421.938
-2.851.113	-1.336.349	-106.392	-491.712	-854.876	-5.640.442	0	-75.900	-5.716.342	1.675.751
-2.853.654	-1.340.160	-106.392	-504.240	-855.724	-5.660.170	0	-75.900	-5.736.070	2.007.266
-2.889.541	-1.343.835	-106.392	-506.869	-861.880	-5.708.517	0	-75.900	-5.784.417	1.979.540
-2.915.808	-1.379.880	-106.392	-509.576	-862.782	-5.774.438	0	-75.900	-5.850.338	2.293.193
-2.931.087	-1.394.235	-106.392	-512.284	-868.992	-5.812.990	0	-75.900	-5.888.890	2.649.359
-2.965.311	-1.497.249	-106.392	-515.071	-869.949	-5.953.971	0	-75.900	-6.029.871	2.918.868
-3.012.234	-1.501.272	-106.392	-517.779	-876.214	-6.013.891	-1.177.350	-75.900	-7.267.141	3.014.797
-54.539.155	-23.829.081	-2.127.840	-9.519.157	-15.577.702	-105.592.936	-1.177.350	-1.620.300	-108.390.586	18.531.321
-33.696.368	-14.416.565	-1.336.818	-5.890.247	-9.569.600	-64.909.597	-496.789	-1.049.243	-66.455.630	8.071.101

INVESTMENT COSTS EXCLUDING CONTINGENCIES					FINANCING COSTS		FINANCING COSTS	
Total Investments Including Implementation Consultant	Technical Assistance	Total Investments Including Impl. Consultant & TA	Residual Value	Total Net Investments Including Impl. Cons. & TA and Residual Value	Loan Repayments	Interest Costs	Commitment Fees	Management Fees
(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)
0	-907.200	-907.200	0	-907.200	0	-1.479	-21.566	0
-19.005.963	-388.800	-19.394.763	0	-19.394.763	0	-34.566	-10.536	-44.117
0	0	0	0	0	0	-66.176	0	0
0	0	0	0	0	-339.363	-63.631	0	0
-529.092	0	-529.092	0	-529.092	-339.363	-59.402	-569	-1.713
0	0	0	0	0	-339.363	-55.174	0	0
-259.200	0	-259.200	0	-259.200	-339.363	-50.506	-141	0
-3.962.036	0	-3.962.036	0	-3.962.036	-353.638	-48.820	-2.523	-7.106
-1.374.840	0	-1.374.840	0	-1.374.840	-353.638	-48.844	-747	0
-232.325	0	-232.325	0	-232.325	-408.296	-45.370	0	0
-129.600	0	-129.600	0	-129.600	-408.296	-39.246	0	0
-7.507.500	0	-7.507.500	0	-7.507.500	-408.296	-43.683	-5.934	-18.909
-11.135.527	0	-11.135.527	0	-11.135.527	-408.296	-51.740	-1.207	0
0	0	0	0	0	-618.397	-47.661	0	0
-499.200	0	-499.200	0	-499.200	-618.397	-38.385	0	0
0	0	0	0	0	-618.397	-29.109	0	0
-1.644.000	0	-1.644.000	0	-1.644.000	-279.034	-24.666	-1.124	-3.774
-1.905.961	0	-1.905.961	0	-1.905.961	-279.034	-23.311	-181	0
0	0	0	0	0	-373.378	-18.960	0	0
0	0	0	0	0	-359.103	-13.466	0	0
-379.200	0	-379.200	0	-379.200	-359.103	-8.080	0	0
-1.728.000	0	-1.728.000	5.176.449	3.448.449	-359.103	-2.693	0	0
-50.292.444	-1.296.000	-51.588.444	5.176.449	-46.411.995	-7.561.857	-814.968	-44.528	-75.619
-36.640.454	-1.231.775	-37.872.229	2.184.231	-35.687.998	-4.605.116	-570.278	-38.519	-61.137

FINANCING COSTS		Total Costs	Annual Cash Flows	Cumulative Cash Flows
Total Financing Costs	Debt Service	TOTAL CASH OUTFLOWS	Net Cash Flow After IFI & Local Grant Finance	Cumulative Net Cash Flow After IFI & Local Grant Finance
(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)
-23.044	-23.044	-956.644	-759.505	-759.505
-89.220	-89.220	-19.559.883	-15.345.307	-16.104.812
-66.176	-66.176	-4.400.760	-1.187.305	-17.292.117
-63.631	-402.993	-4.899.205	-1.305.857	-18.597.974
-61.684	-401.047	-5.574.977	-1.079.503	-19.677.477
-55.174	-394.537	-5.120.995	-938.653	-20.616.130
-50.647	-390.010	-5.551.152	-812.024	-21.428.154
-58.449	-412.086	-9.416.957	-2.142.458	-23.570.613
-49.591	-403.229	-6.955.417	19.966	-23.550.647
-45.370	-453.666	-5.942.850	-192.401	-23.743.048
-39.246	-447.542	-5.907.332	171.838	-23.571.210
-68.526	-476.822	-13.359.165	-44.630	-23.615.839
-52.947	-461.243	-17.109.968	-8.250.213	-31.866.052
-47.661	-666.057	-6.249.894	478.790	-31.387.263
-38.385	-656.781	-6.788.054	494.751	-30.892.511
-29.109	-647.505	-6.363.848	1.028.246	-29.864.265
-29.564	-308.598	-7.688.668	1.599.068	-28.265.198
-23.492	-302.526	-7.992.903	136.941	-28.128.257
-18.960	-392.338	-6.242.676	1.900.855	-26.227.402
-13.466	-372.570	-6.261.460	2.276.789	-23.950.613
-8.080	-367.183	-6.776.255	2.401.279	-21.549.334
-2.693	-361.797	-4.180.489	7.626.747	-13.922.587
-935.114	-8.496.971	-163.299.552	-13.922.587	
-669.933	-5.275.050	-107.418.678	-17.686.427	

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
PROJECT PROFIT (-LOSS) STATEMENTS**

Financial Discount Rate (%)	4,0									
	COLLECTED REVENUES			COLLECTED REVENUES			OPERATING COST		OPERATING COST	
	Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES	Collection	Recycling	Composting	Transport	
Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	
2021	0	0	0	0	0	0	0	0	0	
2022	0	0	0	0	0	0	0	0	0	
2023	2.659.010	554.445	0	0	3.213.455	-2.334.656	-731.451	-106.392	-414.357	
2024	2.853.643	739.705	0	0	3.593.348	-2.386.346	-834.869	-106.392	-417.224	
2025	3.060.667	852.806	0	0	3.913.473	-2.394.160	-970.052	-106.392	-423.357	
2026	3.280.787	901.555	0	0	4.182.342	-2.433.559	-997.421	-106.392	-432.435	
2027	3.504.143	949.865	0	0	4.454.008	-2.529.412	-1.058.003	-106.392	-451.175	
2028	3.718.777	994.653	0	476.544	5.189.974	-2.590.207	-1.091.012	-106.392	-459.378	
2029	3.945.475	1.041.040	0	476.544	5.463.059	-2.674.885	-1.132.570	-106.392	-467.741	
2030	4.184.874	1.089.031	0	476.544	5.750.449	-2.732.792	-1.140.342	-106.392	-476.341	
2031	4.366.120	1.122.109	0	476.544	5.964.773	-2.762.280	-1.183.075	-106.392	-478.811	
2032	4.554.275	1.155.716	0	476.544	6.186.535	-2.780.517	-1.203.012	-106.392	-481.359	
2033	4.749.595	1.189.814	0	476.544	6.415.953	-2.806.646	-1.210.210	-106.392	-483.907	
2034	5.027.382	1.224.758	0	476.544	6.728.684	-2.846.232	-1.220.878	-106.392	-486.456	
2035	5.316.918	1.260.548	0	476.544	7.054.010	-2.848.716	-1.263.207	-106.392	-489.084	
2036	5.618.664	1.296.886	0	476.544	7.392.094	-2.851.113	-1.336.349	-106.392	-491.712	
2037	5.933.096	1.333.696	0	476.544	7.743.336	-2.853.654	-1.340.160	-106.392	-504.240	
2038	6.260.711	1.371.495	0	131.750	7.763.956	-2.889.541	-1.343.835	-106.392	-506.869	
2039	6.602.025	1.409.756	0	131.750	8.143.531	-2.915.808	-1.379.880	-106.392	-509.576	
2040	6.957.573	1.448.925	0	131.750	8.538.248	-2.931.087	-1.394.235	-106.392	-512.284	
2041	7.327.911	1.489.078	0	131.750	8.948.739	-2.965.311	-1.497.249	-106.392	-515.071	
2042	7.715.985	1.529.703	0	1.036.250	10.281.939	-3.012.234	-1.501.272	-106.392	-517.779	
UNDISCOUNTED TOTAL (2021-2042)	97.637.632	22.955.584	0	6.328.692	126.921.907	-54.539.155	-23.829.081	-2.127.840	-9.519.157	
DISCOUNTED TOTAL (2021-2042)	57.196.370	13.710.361	0	3.620.000	74.526.731	-33.696.368	-14.416.565	-1.336.818	-5.890.247	
DISCOUNTED TOTAL (%) (2021-2042)	76,75%	18,40%	0,00%	4,86%	100,00%	-45,21%	-19,34%	-1,79%	-7,90%	
UNDISCOUNTED YEARLY AVERAGE	4.881.882	1.147.779	0	316.435	6.346.095	-2.870.482	-1.254.162	-111.992	-501.008	
DISCOUNTED YEARLY AVERAGE	2.859.818	685.518	0	181.000	3.726.337	-1.773.493	-758.767	-70.359	-310.013	

OPERATING COST		OPERATING COST			OPERATING COST	Operating Surplus	Operating Surplus
Disposal	TOTAL OPERATING SERVICE COSTS	DEPRECIATION COSTS	Aftercare Costs	Administrative Costs	TOTAL NET OPERATING COSTS	Total Operating Revenues-Total O & M Costs	Total Operating Revenues-Total O & M Costs + Depr. Costs
EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	(EURO/year)	(EURO/m3 Billed)
0	0	0	0	-26.400	-26.400	-26.400	-26.400
0	0	0	0	-75.900	-75.900	-75.900	-75.900
-671.828	-4.258.684	-2.034.565	0	-75.900	-6.369.149	-3.155.695	-1.121.129
-675.481	-4.420.312	-2.034.565	0	-75.900	-6.530.778	-2.937.429	-902.864
-674.977	-4.568.938	-2.034.565	0	-75.900	-6.679.403	-2.765.930	-731.365
-680.751	-4.650.558	-2.089.643	0	-75.900	-6.816.101	-2.633.760	-544.116
-681.060	-4.826.042	-2.089.643	0	-75.900	-6.991.585	-2.537.578	-447.934
-719.946	-4.966.935	-2.259.977	0	-75.900	-7.302.812	-2.112.838	147.140
-719.861	-5.101.449	-2.503.686	0	-75.900	-7.681.034	-2.217.975	285.710
-725.092	-5.180.959	-2.660.537	0	-75.900	-7.917.396	-2.166.946	493.591
-723.733	-5.254.290	-2.686.093	0	-75.900	-8.016.283	-2.051.510	634.583
-727.663	-5.298.943	-2.699.821	0	-75.900	-8.074.663	-1.888.128	811.692
-830.143	-5.437.299	-2.513.316	0	-75.900	-8.026.515	-1.610.561	902.755
-847.979	-5.507.937	-2.879.402	0	-75.900	-8.463.239	-1.734.555	1.144.847
-848.774	-5.556.172	-2.879.402	0	-75.900	-8.511.474	-1.457.464	1.421.938
-854.876	-5.640.442	-2.881.303	0	-75.900	-8.597.645	-1.205.551	1.675.751
-855.724	-5.660.170	-2.881.303	0	-75.900	-8.617.372	-874.037	2.007.266
-861.880	-5.708.517	-3.045.564	0	-75.900	-8.829.980	-1.066.024	1.979.540
-862.782	-5.774.438	-2.839.304	0	-75.900	-8.689.642	-546.110	2.293.193
-868.992	-5.812.990	-2.688.054	0	-75.900	-8.576.943	-38.695	2.649.359
-869.949	-5.953.971	-2.662.498	0	-75.900	-8.692.369	256.370	2.918.868
-876.214	-6.013.891	-2.689.954	-1.177.350	-75.900	-9.957.095	324.844	3.014.797
-15.577.702	-105.592.936	-51.053.194	-1.177.350	-1.620.300	-159.443.780	-32.521.873	18.531.321
-9.569.600	-64.909.597	-31.268.307	-496.789	-1.049.243	-97.723.937	-23.197.206	8.071.101
-12,84%	-87,10%	-41,96%	-0,67%	-1,41%	-131,13%	-31,13%	10,83%
-819.879	-5.557.523	-2.687.010	-61.966	-85.279	-8.391.778	-1.711.678	975.333
-503.663	-3.416.295	-1.645.700	-26.147	-55.223	-5.143.365	-1.220.906	424.795

FINANCING COSTS		FINANCING COSTS		GRANTS	PROFIT (-LOSS)	PROFIT (-LOSS)
Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Investment Grants	PROFIT (-LOSS)	PROFIT (-LOSS) + DEPRECIATION COSTS
(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)
-1.479	-21.566	0	-23.044	0	-49.444	-49.444
-34.566	-10.536	-44.117	-89.220	0	-165.120	-165.120
-66.176	0	0	-66.176	896.022	-2.325.848	-291.283
-63.631	0	0	-63.631	896.022	-2.105.038	-70.472
-59.402	-569	-1.713	-61.684	919.374	-1.908.241	126.324
-55.174	0	0	-55.174	919.374	-1.769.560	320.083
-50.506	-141	0	-50.647	930.813	-1.657.411	432.232
-48.820	-2.523	-7.106	-58.449	1.014.450	-1.156.836	1.103.141
-48.844	-747	0	-49.591	1.075.128	-1.192.439	1.311.247
-45.370	0	0	-45.370	1.075.128	-1.137.189	1.523.348
-39.246	0	0	-39.246	1.080.848	-1.009.908	1.676.185
-43.683	-5.934	-18.909	-68.526	1.366.841	-589.813	2.110.007
-51.740	-1.207	0	-52.947	1.464.892	-198.616	2.314.700
-47.661	0	0	-47.661	1.464.892	-317.323	2.562.079
-38.385	0	0	-38.385	1.476.332	-19.517	2.859.886
-29.109	0	0	-29.109	1.476.332	241.672	3.122.975
-24.666	-1.124	-3.774	-29.564	1.538.297	634.697	3.515.999
-23.311	-181	0	-23.492	1.552.978	463.462	3.509.026
-18.960	0	0	-18.960	1.552.978	987.908	3.827.211
-13.466	0	0	-13.466	1.552.978	1.500.816	4.188.870
-8.080	0	0	-8.080	1.564.417	1.812.707	4.475.205
-2.693	0	0	-2.693	1.640.682	1.962.833	4.652.786
-814.968	-44.528	-75.619	-935.114	25.458.778	-7.998.210	43.054.985
-570.278	-38.519	-61.137	-669.933	15.245.529	-8.621.610	22.646.697
-0,77%	-0,05%	-0,08%	-0,90%	20,46%	-11,57%	30,39%
-42.893	-2.344	-3.980	-49.217	1.272.939	-363.555	1.957.045
-30.015	-2.027	-3.218	-35.260	762.276	-391.891	1.029.395

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
PROJECT PROFIT (-LOSS) STATEMENTS (% OF TOTAL REVENUES)

Financial Discount Rate (%)	4,0									
	COLLECTED REVENUES			COLLECTED REVENUES			OPERATING COST		OPERATING COST	
	Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES	Collection	Recycling	Composting	Transport	
Year	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	
2021	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	
2022	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	
2023	82,75	17,25	0,00	0,00	100,00	-72,65	-22,76	-3,31	-12,89	
2024	79,41	20,59	0,00	0,00	100,00	-66,41	-23,23	-2,96	-11,61	
2025	78,21	21,79	0,00	0,00	100,00	-61,18	-24,79	-2,72	-10,82	
2026	78,44	21,56	0,00	0,00	100,00	-58,19	-23,85	-2,54	-10,34	
2027	78,67	21,33	0,00	0,00	100,00	-56,79	-23,75	-2,39	-10,13	
2028	71,65	19,16	0,00	9,18	100,00	-49,91	-21,02	-2,05	-8,85	
2029	72,22	19,06	0,00	8,72	100,00	-48,96	-20,73	-1,95	-8,56	
2030	72,77	18,94	0,00	8,29	100,00	-47,52	-19,83	-1,85	-8,28	
2031	73,20	18,81	0,00	7,99	100,00	-46,31	-19,83	-1,78	-8,03	
2032	73,62	18,68	0,00	7,70	100,00	-44,94	-19,45	-1,72	-7,78	
2033	74,03	18,54	0,00	7,43	100,00	-43,74	-18,86	-1,66	-7,54	
2034	74,72	18,20	0,00	7,08	100,00	-42,30	-18,14	-1,58	-7,23	
2035	75,37	17,87	0,00	6,76	100,00	-40,38	-17,91	-1,51	-6,93	
2036	76,01	17,54	0,00	6,45	100,00	-38,57	-18,08	-1,44	-6,65	
2037	76,62	17,22	0,00	6,15	100,00	-36,85	-17,31	-1,37	-6,51	
2038	80,64	17,66	0,00	1,70	100,00	-37,22	-17,31	-1,37	-6,53	
2039	81,07	17,31	0,00	1,62	100,00	-35,81	-16,94	-1,31	-6,26	
2040	81,49	16,97	0,00	1,54	100,00	-34,33	-16,33	-1,25	-6,00	
2041	81,89	16,64	0,00	1,47	100,00	-33,14	-16,73	-1,19	-5,76	
2042	75,04	14,88	0,00	10,08	100,00	-29,30	-14,60	-1,03	-5,04	
UNDISCOUNTED TOTAL (2021-2042)	76,93	18,09	0,00	4,99	100,00	-42,97	-18,77	-1,68	-7,50	
DISCOUNTED TOTAL (2021-2042)	76,75	18,40	0,00	4,86	100,00	-45,21	-19,34	-1,79	-7,90	

OPERATING COST		OPERATING COST			OPERATING COST	Operating Surplus	Operating Surplus	FINANCING COSTS	
Disposal	TOTAL OPERATING SERVICE COSTS	DEPRECIATION COSTS	Aftercare Costs	Administrative Costs	TOTAL NET OPERATING COSTS	Total Operating Revenues-Total O & M Costs	Total Operating Revenues-Total O & M Costs + Depr. Costs	Interest Costs	Commitment Fees
% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
-20,91	-132,53	-63,31	0,00	-2,36	-198,20	-98,20	-34,89	-2,06	0,00
-18,80	-123,01	-56,62	0,00	-2,11	-181,75	-81,75	-25,13	-1,77	0,00
-17,25	-116,75	-51,99	0,00	-1,94	-170,68	-70,68	-18,69	-1,52	-0,01
-16,28	-111,20	-49,96	0,00	-1,81	-162,97	-62,97	-13,01	-1,32	0,00
-15,29	-108,35	-46,92	0,00	-1,70	-156,97	-56,97	-10,06	-1,13	0,00
-13,87	-95,70	-43,55	0,00	-1,46	-140,71	-40,71	2,84	-0,94	-0,05
-13,18	-93,38	-45,83	0,00	-1,39	-140,60	-40,60	5,23	-0,89	-0,01
-12,61	-90,10	-46,27	0,00	-1,32	-137,68	-37,68	8,58	-0,79	0,00
-12,13	-88,09	-45,03	0,00	-1,27	-134,39	-34,39	10,64	-0,66	0,00
-11,76	-85,65	-43,64	0,00	-1,23	-130,52	-30,52	13,12	-0,71	-0,10
-12,94	-84,75	-39,17	0,00	-1,18	-125,10	-25,10	14,07	-0,81	-0,02
-12,60	-81,86	-42,79	0,00	-1,13	-125,78	-25,78	17,01	-0,71	0,00
-12,03	-78,77	-40,82	0,00	-1,08	-120,66	-20,66	20,16	-0,54	0,00
-11,56	-76,30	-38,98	0,00	-1,03	-116,31	-16,31	22,67	-0,39	0,00
-11,05	-73,10	-37,21	0,00	-0,98	-111,29	-11,29	25,92	-0,32	-0,01
-11,10	-73,53	-39,23	0,00	-0,98	-113,73	-13,73	25,50	-0,30	0,00
-10,59	-70,91	-34,87	0,00	-0,93	-106,71	-6,71	28,16	-0,23	0,00
-10,18	-68,08	-31,48	0,00	-0,89	-100,45	-0,45	31,03	-0,16	0,00
-9,72	-66,53	-29,75	0,00	-0,85	-97,14	2,86	32,62	-0,09	0,00
-8,52	-58,49	-26,16	-11,45	-0,74	-96,84	3,16	29,32	-0,03	0,00
-12,27	-83,20	-40,22	-0,93	-1,28	-125,62	-25,62	14,60	-0,64	-0,04
-12,84	-87,10	-41,96	-0,67	-1,41	-131,13	-31,13	10,83	-0,77	-0,05

FINANCING COSTS		GRANTS	PROFIT (-LOSS)	PROFIT (-LOSS)
Management Fees	Total Financing Costs	Investment Grants	PROFIT (-LOSS)	PROFIT (-LOSS) + DEPRECIATION COSTS
% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
0,00	-2,06	27,88	-72,38	-9,06
0,00	-1,77	24,94	-58,58	-1,96
-0,04	-1,58	23,49	-48,76	3,23
0,00	-1,32	21,98	-42,31	7,65
0,00	-1,14	20,90	-37,21	9,70
-0,14	-1,13	19,55	-22,29	21,26
0,00	-0,91	19,68	-21,83	24,00
0,00	-0,79	18,70	-19,78	26,49
0,00	-0,66	18,12	-16,93	28,10
-0,31	-1,11	22,09	-9,53	34,11
0,00	-0,83	22,83	-3,10	36,08
0,00	-0,71	21,77	-4,72	38,08
0,00	-0,54	20,93	-0,28	40,54
0,00	-0,39	19,97	3,27	42,25
-0,05	-0,38	19,87	8,20	45,41
0,00	-0,30	20,00	5,97	45,20
0,00	-0,23	19,07	12,13	47,00
0,00	-0,16	18,19	17,58	49,06
0,00	-0,09	17,48	20,26	50,01
0,00	-0,03	15,96	19,09	45,25
-0,06	-0,74	20,06	-6,30	33,92
-0,08	-0,90	20,46	-11,57	30,39

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
PROJECT CASH FLOWS**

Year	COLLECTED REVENUES		COLLECTED REVENUES			FINANCING OF INVESTMENT COSTS		
	Total Res. + Comm. Tariff Revenues EURO/Year	Total Recyclable Sales Revenues EURO/Year	Compost Sales Revenues EURO/Year	Electricity Sales Revenues EURO/Year	TOTAL REVENUES EURO/Year	SECO Grant EURO/Year	EU Grant EURO/Year	IFI Loans EURO/Year
2021	0	0	0	0	0	800.781	0	197.139
2022	0	0	0	0	0	5.750.459	11.369.204	4.214.576
2023	2.659.010	554.445	0	0	3.213.455	0	0	0
2024	2.853.643	739.705	0	0	3.593.348	0	0	0
2025	3.060.667	852.806	0	0	3.913.473	0	0	114.974
2026	3.280.787	901.555	0	0	4.182.342	0	0	0
2027	3.504.143	949.865	0	0	4.454.008	0	0	56.325
2028	3.718.777	994.653	0	476.544	5.189.974	0	0	411.797
2029	3.945.475	1.041.040	0	476.544	5.463.059	0	0	298.759
2030	4.184.874	1.089.031	0	476.544	5.750.449	0	0	0
2031	4.366.120	1.122.109	0	476.544	5.964.773	0	0	0
2032	4.554.275	1.155.716	0	476.544	6.186.535	0	0	1.408.135
2033	4.749.595	1.189.814	0	476.544	6.415.953	0	0	482.773
2034	5.027.382	1.224.758	0	476.544	6.728.684	0	0	0
2035	5.316.918	1.260.548	0	476.544	7.054.010	0	0	0
2036	5.618.664	1.296.886	0	476.544	7.392.094	0	0	0
2037	5.933.096	1.333.696	0	476.544	7.743.336	0	0	305.096
2038	6.260.711	1.371.495	0	131.750	7.763.956	0	0	72.281
2039	6.602.025	1.409.756	0	131.750	8.143.531	0	0	0
2040	6.957.573	1.448.925	0	131.750	8.538.248	0	0	0
2041	7.327.911	1.489.078	0	131.750	8.948.739	0	0	0
2042	7.715.985	1.529.703	0	1.036.250	10.281.939	0	0	0
UNDISCOUNTED TOTAL (2021-2042)	97.637.632	22.955.584	0	6.328.692	126.921.907	6.551.240	11.369.204	7.561.857
DISCOUNTED TOTAL (2021-2042)	57.196.370	13.710.361	0	3.620.000	74.526.731	6.086.604	10.511.468	6.096.039
DISCOUNTED TOTAL (%) (2021-2042)	53,69%	12,87%	0,00%	3,40%	69,96%	5,71%	9,87%	5,72%
UNDISCOUNTED YEARLY AVERAGE	4.438.074	1.043.436	0	287.668	5.769.178	297.784	516.782	343.721
DISCOUNTED YEARLY AVERAGE	2.599.835	623.198	0	164.545	3.387.579	276.664	477.794	277.093

		IDC Financing	Admin. Cost Financing	CASH INFLOWS	OPERATING COST			OPERATING COST			
Local Grants	Total Investment Financing	IDC Financing By Municipalities	Administrative Cost Financing By Municipalities	TOTAL CASH INFLOWS	Collection	Recycling	Composting	Transport	Disposal	TOTAL OPERATING SERVICE COSTS	
EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	
0	997.920	23.044	26.400	1.047.364	0	0	0	0	0	0	
0	21.334.239	89.220	75.900	21.499.359	0	0	0	0	0	0	
0	0	0	0	3.213.455	-2.334.656	-731.451	-106.392	-414.357	-671.828	-4.258.684	
0	0	0	0	3.593.348	-2.386.346	-834.869	-106.392	-417.224	-675.481	-4.420.312	
467.027	582.001	0	0	4.495.474	-2.394.160	-970.052	-106.392	-423.357	-674.977	-4.568.938	
0	0	0	0	4.182.342	-2.433.559	-997.421	-106.392	-432.435	-680.751	-4.650.558	
228.795	285.120	0	0	4.739.128	-2.529.412	-1.058.003	-106.392	-451.175	-681.060	-4.826.042	
1.672.727	2.084.524	0	0	7.274.499	-2.590.207	-1.091.012	-106.392	-459.378	-719.946	-4.966.935	
1.213.565	1.512.324	0	0	6.975.383	-2.674.885	-1.132.570	-106.392	-467.741	-719.861	-5.101.449	
0	0	0	0	5.750.449	-2.732.792	-1.140.342	-106.392	-476.341	-725.092	-5.180.959	
114.397	114.397	0	0	6.079.170	-2.762.280	-1.183.075	-106.392	-478.811	-723.733	-5.254.290	
5.719.865	7.128.000	0	0	13.314.535	-2.780.517	-1.203.012	-106.392	-481.359	-727.663	-5.298.943	
1.961.029	2.443.802	0	0	8.859.755	-2.806.646	-1.210.210	-106.392	-483.907	-830.143	-5.437.299	
0	0	0	0	6.728.684	-2.846.232	-1.220.878	-106.392	-486.456	-847.979	-5.507.937	
228.795	228.795	0	0	7.282.805	-2.848.716	-1.263.207	-106.392	-489.084	-848.774	-5.556.172	
0	0	0	0	7.392.094	-2.851.113	-1.336.349	-106.392	-491.712	-854.876	-5.640.442	
1.239.304	1.544.400	0	0	9.287.736	-2.853.654	-1.340.160	-106.392	-504.240	-855.724	-5.660.170	
293.606	365.887	0	0	8.129.844	-2.889.541	-1.343.835	-106.392	-506.869	-861.880	-5.708.517	
0	0	0	0	8.143.531	-2.915.808	-1.379.880	-106.392	-509.576	-862.782	-5.774.438	
0	0	0	0	8.538.248	-2.931.087	-1.394.235	-106.392	-512.284	-868.992	-5.812.990	
228.795	228.795	0	0	9.177.534	-2.965.311	-1.497.249	-106.392	-515.071	-869.949	-5.953.971	
1.525.297	1.525.297	0	0	11.807.236	-3.012.234	-1.501.272	-106.392	-517.779	-876.214	-6.013.891	
14.893.200	40.375.501	112.264	102.300	167.511.973	-54.539.155	-23.829.081	-2.127.840	-9.519.157	-15.577.702	-105.592.936	
9.109.480	31.803.592	104.647	95.558	106.530.529	-33.696.368	-14.416.565	-1.336.818	-5.890.247	-9.569.600	-64.909.597	
8,55%	29,85%	0,10%	0,09%	100,00%	30,36%	12,99%	1,20%	5,31%	8,62%	58,48%	
676.964	1.835.250	5.103	4.650	7.614.181	-2.479.053	-1.083.140	-96.720	-432.689	-708.077	-4.799.679	
414.067	1.445.618	4.757	4.344	4.842.297	-1.531.653	-655.298	-60.764	-267.738	-434.982	-2.950.436	

OPERATING COST		OPERATING COST	Operating Surplus
Aftercare Costs	Administrative Costs	TOTAL NET OPERATING COSTS	Total Operating Revenues-Total O & M Costs
EURO/Year	EURO/Year	EURO/Year	(EURO/year)
0	-26.400	-26.400	-26.400
0	-75.900	-75.900	-75.900
0	-75.900	-4.334.584	-1.121.129
0	-75.900	-4.496.212	-902.864
0	-75.900	-4.644.838	-731.365
0	-75.900	-4.726.458	-544.116
0	-75.900	-4.901.942	-447.934
0	-75.900	-5.042.835	147.140
0	-75.900	-5.177.349	285.710
0	-75.900	-5.256.859	493.591
0	-75.900	-5.330.190	634.583
0	-75.900	-5.374.843	811.692
0	-75.900	-5.513.199	902.755
0	-75.900	-5.583.837	1.144.847
0	-75.900	-5.632.072	1.421.938
0	-75.900	-5.716.342	1.675.751
0	-75.900	-5.736.070	2.007.266
0	-75.900	-5.784.417	1.979.540
0	-75.900	-5.850.338	2.293.193
0	-75.900	-5.888.890	2.649.359
0	-75.900	-6.029.871	2.918.868
-1.177.350	-75.900	-7.267.141	3.014.797
-1.177.350	-1.620.300	-108.390.586	18.531.321
-496.789	-1.049.243	-66.455.630	8.071.101
0,45%	0,95%	59,88%	-7,27%
-53.516	-73.650	-4.926.845	842.333
-22.581	-47.693	-3.020.710	366.868

INVESTMENT COST		INVESTMENT COST	INVESTMENT COST			
Collection	Recycling	Composting	Transport	Disposal	Technical Assistance	Residual Value
(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)
0	0	0	0	0	-997.920	0
-8.366.804	-2.894.978	-1.259.280	-1.367.982	-7.017.516	-427.680	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	-582.001	0	0	0	0	0
0	0	0	0	0	0	0
0	-285.120	0	0	0	0	0
-1.509.163	-1.215.577	0	0	-1.633.500	0	0
0	0	0	0	-1.512.324	0	0
0	-255.558	0	0	0	0	0
0	-142.560	0	0	0	0	0
0	0	0	-893.750	-7.364.500	0	0
-8.021.772	-2.176.908	-506.000	0	-1.544.400	0	0
0	0	0	0	0	0	0
0	-549.120	0	0	0	0	0
0	0	0	0	0	0	0
0	-264.000	0	0	-1.544.400	0	0
-1.613.296	-483.261	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	-417.120	0	0	0	0	0
0	0	0	0	-1.900.800	0	5.694.094
-19.511.034	-9.266.202	-1.765.280	-2.261.732	-22.517.440	-1.425.600	5.694.094
-14.452.347	-6.694.489	-1.468.166	-1.823.010	-15.866.487	-1.354.953	2.402.654
13,02%	6,03%	1,32%	1,64%	14,30%	1,22%	-2,16%
-886.865	-421.191	-80.240	-102.806	-1.023.520	-64.800	258.822
-656.925	-304.295	-66.735	-82.864	-721.204	-61.589	109.212

Total Inv. Incl. Impl. Consultant & TA and Residual Value (EURO/year)	FINANCING COSTS		FINANCING COSTS		FINANCING COSTS		CASH OUTFLOWS
	Loan Repayments (EURO/year)	Interest Costs (EURO/year)	Commitment Fees (EURO/year)	Management Fees (EURO/year)	Total Financing Costs (EURO/year)	Debt Service (EURO/year)	TOTAL CASH OUTFLOWS (EURO/year)
-997.920	0	-1.479	-21.566	0	-23.044	-23.044	-1.047.364
-21.334.239	0	-34.566	-10.536	-44.117	-89.220	-89.220	-21.499.359
0	0	-66.176	0	0	-66.176	-66.176	-4.400.760
0	-339.363	-63.631	0	0	-63.631	-402.993	-4.899.205
-582.001	-339.363	-59.402	-569	-1.713	-61.684	-401.047	-5.627.886
0	-339.363	-55.174	0	0	-55.174	-394.537	-5.120.995
-285.120	-339.363	-50.506	-141	0	-50.647	-390.010	-5.577.072
-4.358.240	-353.638	-48.820	-2.523	-7.106	-58.449	-412.086	-9.813.161
-1.512.324	-353.638	-48.844	-747	0	-49.591	-403.229	-7.092.901
-255.558	-408.296	-45.370	0	0	-45.370	-453.666	-5.966.083
-142.560	-408.296	-39.246	0	0	-39.246	-447.542	-5.920.292
-8.258.250	-408.296	-43.683	-5.934	-18.909	-68.526	-476.822	-14.109.915
-12.249.079	-408.296	-51.740	-1.207	0	-52.947	-461.243	-18.223.521
0	-618.397	-47.661	0	0	-47.661	-666.057	-6.249.894
-549.120	-618.397	-38.385	0	0	-38.385	-656.781	-6.837.974
0	-618.397	-29.109	0	0	-29.109	-647.505	-6.363.848
-1.808.400	-279.034	-24.666	-1.124	-3.774	-29.564	-308.598	-7.853.068
-2.096.557	-279.034	-23.311	-181	0	-23.492	-302.526	-8.183.499
0	-373.378	-18.960	0	0	-18.960	-392.338	-6.242.676
0	-359.103	-13.466	0	0	-13.466	-372.570	-6.261.460
-417.120	-359.103	-8.080	0	0	-8.080	-367.183	-6.814.175
3.793.294	-359.103	-2.693	0	0	-2.693	-361.797	-3.835.644
-51.053.194	-7.561.857	-814.968	-44.528	-75.619	-935.114	-8.496.971	-167.940.752
-39.256.798	-4.605.116	-570.278	-38.519	-61.137	-669.933	-5.275.050	-110.987.478
35,37%	4,15%	0,51%	0,03%	0,06%	0,60%	4,75%	100,00%
-2.320.600	-343.721	-37.044	-2.024	-3.437	-42.505	-386.226	-7.633.671
-1.784.400	-209.323	-25.922	-1.751	-2.779	-30.452	-239.775	-5.044.885

NET CASH FLOWS	
Net Project Cash Flows (EURO/year)	Cumulative Net Project Cash Flows (EURO/year)
0	0
0	0
-1.187.305	-1.187.305
-1.305.857	-2.493.162
-1.132.412	-3.625.574
-938.653	-4.564.227
-837.944	-5.402.171
-2.538.662	-7.940.833
-117.518	-8.058.352
-215.633	-8.273.985
158.878	-8.115.107
-795.380	-8.910.486
-9.363.766	-18.274.252
478.790	-17.795.462
444.831	-17.350.631
1.028.246	-16.322.385
1.434.668	-14.887.717
-53.656	-14.941.373
1.900.855	-13.040.518
2.276.789	-10.763.729
2.363.359	-8.400.370
7.971.592	-428.778
-428.778	
-4.456.949	
-19.490	
-202.589	

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
PROJECT BALANCE SHEETS (EURO)**

	Current Assets	Long-term Assets				Current Liab.	Long-term Liab.	Long-term Liab.	Long-term Liab.	Equities
	Cash and Cash Equivalents	Gross Fixed Assets	Accumulated Depreciation (-)	Net Fixed Assets	Total Assets	Current Maturity of Long-term Loans	Investment Grants	Long-term Bank Loans	Total Long-term Liabilities	Profits (-Loss) For Period
Year	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR
2021	0	997.920	0	997.920	997.920	0	800.781	197.139	997.920	-49.444
2022	0	22.332.159	0	22.332.159	22.332.159	0	17.920.444	4.411.715	22.332.159	-165.120
2023	-1.187.305	22.332.159	-2.034.565	20.297.594	19.110.289	339.363	17.024.422	4.072.353	21.096.775	-2.325.848
2024	-2.493.162	22.332.159	-4.069.131	18.263.029	15.769.866	339.363	16.128.400	3.732.990	19.861.390	-2.105.038
2025	-3.625.574	22.914.161	-6.103.696	16.810.464	13.184.890	339.363	15.676.053	3.508.601	19.184.655	-1.908.241
2026	-4.564.227	22.914.161	-8.193.340	14.720.821	10.156.594	339.363	14.756.680	3.169.239	17.925.918	-1.769.560
2027	-5.402.171	23.199.281	-10.282.983	12.916.298	7.514.127	353.638	14.054.661	2.871.926	16.926.587	-1.657.411
2028	-7.940.833	27.557.520	-12.542.960	15.014.560	7.073.727	353.638	14.712.938	2.930.086	17.643.024	-1.156.836
2029	-8.058.352	29.069.844	-15.046.646	14.023.199	5.964.847	408.296	14.851.375	2.820.550	17.671.924	-1.192.439
2030	-8.273.985	29.325.402	-17.707.183	11.618.219	3.344.234	408.296	13.776.247	2.412.254	16.188.501	-1.137.189
2031	-8.115.107	29.467.962	-20.393.275	9.074.686	959.580	408.296	12.809.796	2.003.958	14.813.754	-1.009.908
2032	-8.910.486	37.726.212	-23.093.096	14.633.116	5.722.629	408.296	17.162.820	3.003.797	20.166.617	-589.813
2033	-18.274.252	49.975.291	-25.606.412	24.368.879	6.094.627	618.397	17.658.957	2.868.173	20.527.130	-198.616
2034	-17.795.462	49.975.291	-28.485.814	21.489.477	3.694.014	618.397	16.194.064	2.249.777	18.443.841	-317.323
2035	-17.350.631	50.524.411	-31.365.217	19.159.194	1.808.563	618.397	14.946.527	1.631.380	16.577.906	-19.517
2036	-16.322.385	50.524.411	-34.246.519	16.277.892	-44.493	279.034	13.470.194	1.352.346	14.822.540	241.672
2037	-14.887.717	52.332.811	-37.127.822	15.204.989	317.272	279.034	13.171.201	1.378.408	14.549.609	634.697
2038	-14.941.373	54.429.368	-40.173.386	14.255.982	-685.391	373.378	11.911.830	1.077.310	12.989.140	463.462
2039	-13.040.518	54.429.368	-43.012.689	11.416.679	-1.623.839	359.103	10.358.852	718.207	11.077.059	987.908
2040	-10.763.729	54.429.368	-45.700.743	8.728.625	-2.035.104	359.103	8.805.875	359.103	9.164.978	1.500.816
2041	-8.400.370	54.846.488	-48.363.240	6.483.248	-1.917.123	359.103	7.470.252	0	7.470.252	1.812.707
2042	-428.778	51.053.194	-51.053.194	0	-428.778	0	7.354.867	0	7.354.867	1.962.833

Equities	Equities	Equities	Equities	Liab.+Equities
Accumulated Profits (-Losses)	IDC Financing By Municipalities	Administrative Cost Financing By Municipalities	Total Equities	Total Short/Long-term Liab.+ Equities
EUR	EUR	EUR	EUR	EUR
0	23.044	26.400	0	997.920
-49.444	112.264	102.300	0	22.332.159
-214.564	112.264	102.300	-2.325.848	19.110.289
-2.540.412	112.264	102.300	-4.430.886	15.769.866
-4.645.450	112.264	102.300	-6.339.127	13.184.890
-6.553.691	112.264	102.300	-8.108.687	10.156.594
-8.323.251	112.264	102.300	-9.766.098	7.514.127
-9.980.663	112.264	102.300	-10.922.935	7.073.727
-11.137.499	112.264	102.300	-12.115.374	5.964.847
-12.329.938	112.264	102.300	-13.252.562	3.344.234
-13.467.127	112.264	102.300	-14.262.471	959.580
-14.477.035	112.264	102.300	-14.852.284	5.722.629
-15.066.848	112.264	102.300	-15.050.900	6.094.627
-15.265.464	112.264	102.300	-15.368.223	3.694.014
-15.582.787	112.264	102.300	-15.387.740	1.808.563
-15.602.304	112.264	102.300	-15.146.067	-44.493
-15.360.632	112.264	102.300	-14.511.371	317.272
-14.725.935	112.264	102.300	-14.047.909	-685.391
-14.262.473	112.264	102.300	-13.060.001	-1.623.839
-13.274.566	112.264	102.300	-11.559.185	-2.035.104
-11.773.749	112.264	102.300	-9.746.478	-1.917.123
-9.961.042	112.264	102.300	-7.783.645	-428.778

Solid Waste Management in Polog Region, North Macedonia, Phase I Final Feasibility Study Report

Annex 4 Financial and Economic Analysis – Alternative Scenario



Solid Waste Management in Polog Region, North Macedonia, Phase I Final Feasibility Study Report

Annex 4: Financial and Economic Analysis (Alternative Scenario – Key Annexes)

F1	Residential SWM Tariffs-Affordability
F2	Gap Analysis-Grant Rate
F3	Financing of Initial Investment Costs
F4	Cost of Repayment Schedule of IFI Loans
F5	FNPV-C & FRR-C
F6	FNPV-K & FRR-K
F7	CASH FLOW PROJECTIONS
F8	PROJECT PROFIT (-LOSS) STATEMENTS
F9	PROJECT PROFIT (-LOSS) STATEMENTS (% OF TOTAL REVENUES)
F10	PROJECT BALANCE SHEETS (EURO)
F11	PROJECT BALANCE SHEETS (AS % OF TOTAL ASSETS / LIABILITIES)

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
ALTERNATIVE SCENARIO (GRANT RATE: 52.35%)
HOUSEHOLD AFFORDABILITY ANALYSIS

	Residential Tariffs Excluding VAT of 5,0%						Value Added Tax (VAT)	5,00%	Residential Tariffs Excluding VAT of 5,0%	
	Urban Residential Tariff Inc.	Rural Residential Tariff Inc.	Average Residential Tariff Excl. VAT	Residential Tariff Excl. VAT (Overall)	Residential Tariff Excl. VAT (Urban)	Residential Tariff Excl. VAT (Rural)	Residential Tariff Incl. VAT (Overall)	Residential Tariff Incl. VAT (Urban)	Residential Tariff Incl. VAT (Rural)	
Years	(% p.a.)	(% p.a.)	(€/Ton)	(€/Ton)	(€/Ton)	(€/Ton)	(€/Ton)	(€/Ton)	(€/Ton)	
2021	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	
2022	0,00	0,00	29,66	28,19	35,00	20,00	29,60	36,75	21,00	
2023	5,00	3,00	31,00	29,41	36,75	20,60	30,88	38,59	21,63	
2024	5,00	3,00	32,08	30,69	38,59	21,22	32,23	40,52	22,28	
2025	5,00	3,00	33,19	32,03	40,52	21,85	33,63	42,54	22,95	
2026	5,00	3,00	34,34	33,42	42,54	22,51	35,09	44,67	23,64	
2027	5,00	3,00	35,56	34,88	44,67	23,19	36,62	46,90	24,34	
2028	1,00	3,00	35,90	35,43	45,12	23,88	37,20	47,37	25,08	
2029	1,00	3,00	36,25	35,99	45,57	24,60	37,79	47,85	25,83	
2030	1,00	3,00	36,63	36,57	46,02	25,34	38,40	48,32	26,60	
2031	1,00	3,00	37,21	37,16	46,48	26,10	39,02	48,81	27,40	
2032	1,00	3,00	37,81	37,77	46,95	26,88	39,65	49,30	28,22	
2033	1,00	3,00	38,42	38,38	47,42	27,68	40,30	49,79	29,07	
2034	1,00	3,00	39,04	39,01	47,89	28,52	40,96	50,29	29,94	
2035	1,00	3,00	39,68	39,66	48,37	29,37	41,64	50,79	30,84	
2036	1,00	3,00	40,33	40,32	48,85	30,25	42,33	51,30	31,76	
2037	1,00	3,00	41,00	40,99	49,34	31,16	43,04	51,81	32,72	
2038	1,00	3,00	41,68	41,68	49,84	32,09	43,77	52,33	33,70	
2039	1,00	3,00	42,38	42,40	50,34	33,06	44,52	52,85	34,71	
2040	1,00	3,00	43,10	43,12	50,84	34,05	45,28	53,38	35,75	
2041	1,00	3,00	43,83	43,87	51,35	35,07	46,06	53,91	36,82	
2042	1,00	3,00	44,56	44,66	51,86	36,12	46,89	54,45	37,93	
TOTAL										
% INCREASE (2023 / 2042)	-80,00%	0,00%	43,73%	51,82%	41,12%	75,35%	51,82%	41,12%	75,35%	

						Funding Gap Rate (R) (EE/DIC)			
						Grant Rate	61,59%		
						52,35%			
Annual Total SWM Bill / Disposable Household Income (%)									
SWM Bill Excl. VAT (Overall)	SWM Bill Excl. VAT (Urban)	SWM Bill Excl. VAT (Rural)	SWM Bill Incl. VAT (Overall)	SWM Bill Incl. VAT (Urban)	SWM Bill Incl. VAT (Rural)	Affordability Rate (Overall)	Affordability Rate (Urban)	Affordability Rate (Rural)	
(EUR/HH/Year)	(EUR/HH/Year)	(EUR/HH/Year)	(EUR/HH/Year)	(EUR/HH/Year)	(EUR/HH/Year)	(%)	(%)	(%)	
0,00	0,00	0,00	0,00	0,00	0,00	0,00%	0,00%	0,00%	
0,00	0,00	0,00	0,00	0,00	0,00	0,00%	0,00%	0,00%	
49,82	66,97	31,70	52,31	70,32	33,29	0,90%	1,15%	0,60%	
52,40	70,85	32,95	55,02	74,39	34,60	0,93%	1,21%	0,62%	
55,12	74,95	34,25	57,88	78,69	35,96	0,97%	1,26%	0,64%	
57,99	79,28	35,60	60,89	83,25	37,38	1,01%	1,32%	0,66%	
61,01	83,87	37,00	64,06	88,07	38,85	1,06%	1,39%	0,68%	
62,47	85,35	38,46	65,60	89,61	40,38	1,07%	1,40%	0,70%	
63,98	86,85	39,97	67,18	91,19	41,97	1,08%	1,41%	0,72%	
65,54	88,37	41,54	68,82	92,79	43,62	1,10%	1,42%	0,74%	
67,14	89,93	43,18	70,49	94,42	45,34	1,12%	1,43%	0,76%	
68,78	91,51	44,88	72,22	96,08	47,12	1,13%	1,44%	0,78%	
70,47	93,12	46,65	74,00	97,77	48,98	1,15%	1,45%	0,81%	
72,21	94,75	48,48	75,83	99,49	50,91	1,17%	1,46%	0,83%	
74,01	96,42	50,39	77,71	101,24	52,91	1,18%	1,47%	0,85%	
75,85	98,11	52,38	79,64	103,02	55,00	1,20%	1,48%	0,88%	
77,74	99,84	54,44	81,63	104,83	57,16	1,22%	1,49%	0,90%	
79,70	101,59	56,58	83,68	106,67	59,41	1,24%	1,50%	0,93%	
81,72	103,38	58,81	85,80	108,54	61,75	1,25%	1,52%	0,96%	
83,80	105,19	61,13	87,99	110,45	64,18	1,27%	1,53%	0,98%	
85,94	107,04	63,53	90,24	112,39	66,71	1,29%	1,54%	1,01%	
88,22	108,92	66,03	92,64	114,37	69,34	1,31%	1,55%	1,04%	
77,10%	62,64%	108,28%	77,10%	62,64%	108,28%	46,65%	34,63%	72,41%	

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
ALTERNATIVE SCENARIO (GRANT RATE: 52.35%)
GAP ANALYSIS

Year	TOTAL INVESTMENT COSTS			TOTAL O & M COSTS		TOTAL O & M COSTS			TOTAL COSTS (€/Year)
	Investment Excl. Cont. (€/Year)	Residual Value (-) Year	TOTAL INVESTMENT COSTS (€/Year)	O & M (SWM Services) (€/Year)	O & M (Replacement Investments) (€/Year)	Administrative Costs (€/Year)	Aftercare Costs (€/Year)	TOTAL O&M COSTS (€/Year)	
2021	907.200	0	907.200	0	0	26.400	0	26.400	933.600
2022	19.394.763	0	19.394.763	0	0	75.900	0	75.900	19.470.663
2023	0	0	0	4.258.684	0	75.900	0	4.334.584	4.334.584
2024	0	0	0	4.420.312	0	75.900	0	4.496.212	4.496.212
2025	529.092	0	529.092	4.568.938	0	75.900	0	4.644.838	5.173.930
2026	0	0	0	4.650.558	0	75.900	0	4.726.458	4.726.458
2027	259.200	0	259.200	4.826.042	0	75.900	0	4.901.942	5.161.142
2028	1.895.022	0	1.895.022	4.966.935	2.067.014	75.900	0	7.109.849	9.004.871
2029	1.374.840	0	1.374.840	5.101.449	0	75.900	0	5.177.349	6.552.189
2030	0	0	0	5.180.959	232.325	75.900	0	5.489.184	5.489.184
2031	129.600	0	129.600	5.254.290	0	75.900	0	5.330.190	5.459.790
2032	6.480.000	0	6.480.000	5.298.943	1.027.500	75.900	0	6.402.343	12.882.343
2033	2.221.638	0	2.221.638	5.437.299	8.913.889	75.900	0	14.427.088	16.648.725
2034	0	0	0	5.507.937	0	75.900	0	5.583.837	5.583.837
2035	259.200	0	259.200	5.556.172	240.000	75.900	0	5.872.072	6.131.272
2036	0	0	0	5.640.442	0	75.900	0	5.716.342	5.716.342
2037	1.404.000	0	1.404.000	5.660.170	240.000	75.900	0	5.976.070	7.380.070
2038	332.625	0	332.625	5.708.517	1.573.336	75.900	0	7.357.753	7.690.377
2039	0	0	0	5.774.438	0	75.900	0	5.850.338	5.850.338
2040	0	0	0	5.812.990	0	75.900	0	5.888.890	5.888.890
2041	259.200	0	259.200	5.953.971	120.000	75.900	0	6.149.871	6.409.071
2042	1.728.000	-5.176.449	-3.448.449	6.013.891	0	75.900	1.177.350	7.267.141	3.818.692
UNDISCOUNTED TOTAL	37.174.380	-5.176.449	31.997.931	105.592.936	14.414.064	1.620.300	1.177.350	122.804.650	154.802.581
DISCOUNTED TOTAL	29.123.931	-2.184.231	26.939.701	64.909.597	8.748.298	1.049.243	496.789	75.203.927	102.143.628

Note: Investment costs exclude 10% physical contingencies. Re-investments (renewals/replacements) are considered under O & M costs.

Net Revenues = Revenues-O & M Cost+Res.Value	10.348.022
- Discounted Revenues	83.367.719
- Discounted Operating Costs	-75.203.927
- Discounted Residual Value	2.184.231
Non-eligible Cost	0

CALCULATION OF GRANT

Reference Period (Years)	22
FINANCIAL DISCOUNT RATE (%)	4,0
Total Investment Cost (Undiscounted, Excl. Contingencies) (€)	37.174.380
Discounted Investment Cost (DIC) (€)	26.939.701
Discounted Net Revenue Cost (DNR) (€)	10.348.022
Eligible Expenditure (EE) (DIC-DNR) (€)	16.591.679
Funding Gap Rate (R) (EE/DIC)	61,59%
Eligible Cost Percentage (EC %)	100,00%
Eligible Cost Amount (EC) (€)	37.174.380
Decision Amount (DA) (EC * R)	22.895.034
Co-funding Rate (CR)	85,00%
Grant (DA * CR) (€)	19.460.779
Grant (DA * CR / Investment) (%)	52,35%

Grant Rate	52,35%	Funding Gap Rate (R) (EE/DIC)	61,59%				
FRR/C (%)	-3,05%						
TOTAL REVENUES	TOTAL REVENUES	TOTAL REVENUES	TOTAL REVENUES	TOTAL REVENUES	TOTAL REVENUES	TOTAL REVENUES	CASH FLOW
Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES	Tariff Collection Rate	TOTAL REVENUES COLLECTED	Net Annual Cash Flow
(€/Year)	(€/Year)	(€/Year)	(€/Year)	(€/Year)	%	(€/Year)	(€/Year)
0	0	0	0	0	55,0%	0	-933.600
0	0	0	0	0	55,0%	0	-19.470.663
3.730.801	554.445	0	0	4.285.246	61,0%	2.830.234	-1.504.350
4.008.855	739.705	0	0	4.748.560	67,0%	3.425.638	-1.070.574
4.304.993	852.806	0	0	5.157.799	73,0%	3.995.451	-1.178.479
4.620.322	901.555	0	0	5.521.877	79,0%	4.551.609	-174.848
4.947.748	949.865	0	0	5.897.613	84,0%	5.105.973	-55.169
5.166.884	994.653	0	476.544	6.638.081	89,0%	6.069.724	-2.935.147
5.397.521	1.041.040	0	476.544	6.915.105	94,0%	6.591.254	39.065
5.640.298	1.089.031	0	476.544	7.205.873	95,0%	6.923.858	1.434.674
5.841.557	1.122.109	0	476.544	7.440.210	95,0%	7.148.133	1.688.342
6.051.582	1.155.716	0	476.544	7.683.842	95,0%	7.381.263	-5.501.080
6.270.810	1.189.814	0	476.544	7.937.168	95,0%	7.623.627	-9.025.098
6.499.702	1.224.758	0	476.544	8.201.004	95,0%	7.876.019	2.292.182
6.738.746	1.260.548	0	476.544	8.475.838	95,0%	8.138.900	2.007.628
6.988.453	1.296.886	0	476.544	8.761.883	95,0%	8.412.461	2.696.119
7.249.367	1.333.696	0	476.544	9.059.607	95,0%	8.697.138	1.317.069
7.522.056	1.371.495	0	131.750	9.025.301	95,0%	8.649.198	958.821
7.807.123	1.409.756	0	131.750	9.348.629	95,0%	8.958.273	3.107.935
8.105.202	1.448.925	0	131.750	9.685.877	95,0%	9.280.617	3.391.727
8.416.963	1.489.078	0	131.750	10.037.791	95,0%	9.616.943	3.207.872
8.737.880	1.529.703	0	1.036.250	11.303.833	95,0%	10.866.939	7.048.247
124.046.862	22.955.584	0	6.328.692	153.331.138	92,70%	142.143.253	-12.659.328
73.858.152	13.710.361	0	3.620.000	91.188.513		83.367.719	-18.775.910

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
ALTERNATIVE SCENARIO (GRANT RATE: 52.35%)
FINANCING OF INVESTMENT COSTS INCLUDING CONTINGENCIES**

Grant Rate	52,35%
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PHASE-1 (2021-2022)		CHF	EURO/CHF	EURO
TOTAL SECO GRANT		7.000.000	1,0685	6.551.240

FINANCING OF INITIAL INVESTMENT COSTS INCLUDING CONTINGENCIES (EURO)

YEARS	UNIT	SECO Grant	EU Grant	IFI Loans	Local Grants	generated (Own) Funds	Total Investment Financing	Total Initial Inv. Costs Incl. Conting.	Total Grants
2021	EURO	522.411	0	475.509	0	0	997.920	997.920	522.411
2022	EURO	6.028.829	5.139.640	10.165.770	0	0	21.334.239	21.334.239	11.168.469
2023	EURO	0	0	0	0	0	0	0	0
2024	EURO	0	0	0	0	0	0	0	0
2025	EURO	0	0	277.324	304.677	0	582.001	582.001	304.677
2026	EURO	0	0	0	0	0	0	0	0
2027	EURO	0	0	135.860	149.260	0	285.120	285.120	149.260
2028	EURO	0	0	993.276	1.091.248	0	2.084.524	2.084.524	1.091.248
2029	EURO	0	0	720.623	791.701	0	1.512.324	1.512.324	791.701
2030	EURO	0	0	0	0	0	0	0	0
2031	EURO	0	0	0	74.630	67.930	142.560	142.560	74.630
2032	EURO	0	0	3.396.494	3.731.506	0	7.128.000	7.128.000	3.731.506
2033	EURO	0	0	1.164.472	1.279.330	0	2.443.802	2.443.802	1.279.330
2034	EURO	0	0	0	0	0	0	0	0
2035	EURO	0	0	0	149.260	135.860	285.120	285.120	149.260
2036	EURO	0	0	0	0	0	0	0	0
2037	EURO	0	0	0	808.493	735.907	1.544.400	1.544.400	808.493
2038	EURO	0	0	0	191.542	174.345	365.887	365.887	191.542
2039	EURO	0	0	0	0	0	0	0	0
2040	EURO	0	0	0	0	0	0	0	0
2041	EURO	0	0	0	149.260	135.860	285.120	285.120	149.260
2042	EURO	0	0	0	995.068	905.732	1.900.800	1.900.800	995.068
TOTAL (2021-2042)	EURO	6.551.240	5.139.640	17.329.327	9.715.977	2.155.633	40.891.818	40.891.818	21.406.857
TOTAL (2021-2022)	EURO	6.551.240	5.139.640	10.641.279	0	0	22.332.159	22.332.159	11.690.880
TOTAL (2023-2042)	EURO	0	0	6.688.048	9.715.977	2.155.633	18.559.658	18.559.658	9.715.977

Total Financing = Total Investment Costs Including Contingencies

DISCOUNTED TOTAL	EURO	6.076.310	4.751.886	14.240.097	5.942.813	1.025.219	32.036.324	32.036.324	16.771.008
DISCOUNTED TOTAL (2021-2022)	EURO	6.076.310	4.751.886	9.856.046	0	0	20.684.242	20.684.242	10.828.196
DISCOUNTED TOTAL (2023-2042)	EURO	0	0	4.384.051	5.942.813	1.025.219	11.352.082	11.352.082	5.942.813

DISTRIBUTION OF FINANCING SOURCES (%)

YEARS	UNIT	% of Total SECO Grant	% of Total EU Grant	% of Total IFI Loans	% of Total Local Grants	% of Total Internally-generated (Own) Funds	% of Total Total Investment Financing	% of Total Total Initial Inv. Costs Incl. Conting.	% of Total Total Grants
TOTAL (2021-2042)	%	16,02%	12,57%	42,38%	23,76%	5,27%	100,00%	100,00%	52,35%
TOTAL (2021-2022)	%	29,34%	23,01%	47,65%	0,00%	0,00%	100,00%	100,00%	52,35%
TOTAL (2023-2042)	%	0,00%	0,00%	36,04%	52,35%	11,61%	100,00%	100,00%	52,35%

**IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
ALTERNATIVE SCENARIO (GRANT RATE: 52.35%)
(LOAN DISBURSEMENTS: 2021 + 2022 + 2025 + 2027 + 2028 + 2029 + 2032 + 2033)**

Grant Rate	52,35%
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IFI Loan-1+2+3	UNIT	DATA
TYPE OF LOAN	DESCRIPTION	IFI Loan-1+2+3
NAME OF LOAN SOURCE	DESCRIPTION	EBRD
UTILIZATION RATIO OF LOAN IN THE FIRST HALF OF THE YEAR	%	50,0
FIRST DISBURSEMENT YEAR OF CREDIT	YEAR	2022
LAST DISBURSEMENT YEAR OF CREDIT	YEAR	2033
SPREAD OF VARIABLE INTEREST RATE (EURIBOR / LIBOR +)	%	1,00
FIXED INTEREST RATE (0=VARIABLE INTEREST)	%	1,50
COMMITMENT FEES (over undisbursed portion of credit)	%	0,500
MANAGEMENT FEES (flat at credit agreement signing)	%	1,00
GRACE PERIOD	YEAR	2
PRINCIPAL REPAYMENT PERIOD (Bullet Payment<1)	YEAR	13,0
NUMBER OF SEMI-ANNUAL INSTALLMENTS	NO.	26,0
FIRST YEAR OF PRINCIPLE REPAYMENT	YEAR	2024
AMOUNT OF SEMI-ANNUAL INSTALLMENT PAYMENT	EUR	666.512,59
AMOUNT OF LOAN UTILIZATION	EUR	17.329.327,22
MANAGEMENT FEES (flat at credit agreement signing)	EUR	173.293,27
Alternative Cost of Capital (Discount Rate) (Constant Prices)	%	4,00
NET PRESENT VALUE OF CREDIT DEBT SERVICE	EUR	12.357.384,20
EFFECTIVE COST OF CREDIT	%	1,7426

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
IFI Loan-1+2+3
TENTATIVE LOAN REPAYMENT SCHEDULE (EURO)

YEAR	PERIODS	Beg.-of-Period Loan Amount	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service	NET LOAN CASH FLOW	PERIODS	NPV DISC. FACTOR	NPV Debt Service
2021	1	0,00	237.754,56	0,00	237.754,56	891,58	26.306,00	0,00	27.197,58	27.197,58	-210.556,97	1	0,980392	26.664,30
2021	2	237.754,56	237.754,56	0,00	475.509,11	2.674,74	25.711,62	0,00	28.386,36	28.386,36	-209.368,20	2	0,961169	27.284,08
2022	1	475.509,11	5.082.885,01	0,00	5.558.394,12	22.627,14	19.060,82	53.206,40	94.894,35	94.894,35	-4.987.990,66	3	0,942322	89.421,07
2022	2	5.558.394,12	5.082.885,01	0,00	10.641.279,12	60.748,77	6.353,61	53.206,40	120.308,78	120.308,78	-4.962.576,23	4	0,923845	111.146,71
2023	1	10.641.279,12	0,00	0,00	10.641.279,12	79.809,59	0,00	0,00	79.809,59	79.809,59	79.809,59	5	0,905731	72.286,01
2023	2	10.641.279,12	0,00	0,00	10.641.279,12	79.809,59	0,00	0,00	79.809,59	79.809,59	79.809,59	6	0,887971	70.868,63
2024	1	10.641.279,12	0,00	409.279,97	10.231.999,16	78.274,79	0,00	0,00	78.274,79	487.554,76	487.554,76	7	0,870560	424.445,76
2024	2	10.231.999,16	0,00	409.279,97	9.822.719,19	75.205,19	0,00	0,00	75.205,19	484.485,16	484.485,16	8	0,853490	413.503,42
2025	1	9.822.719,19	138.661,85	409.279,97	9.552.101,08	72.655,58	859,63	2.065,92	75.581,12	484.861,09	346.199,24	9	0,836755	405.710,07
2025	2	9.552.101,08	138.661,85	409.279,97	9.281.482,97	70.625,94	512,98	2.065,92	73.204,83	482.484,80	343.822,95	10	0,820348	395.805,59
2026	1	9.281.482,97	0,00	409.279,97	8.872.203,00	68.076,32	0,00	0,00	68.076,32	477.356,29	477.356,29	11	0,804263	383.920,02
2026	2	8.872.203,00	0,00	409.279,97	8.462.923,03	65.006,72	0,00	0,00	65.006,72	474.286,69	474.286,69	12	0,788493	373.971,82
2027	1	8.462.923,03	67.929,87	409.279,97	8.121.572,94	62.191,86	254,74	0,00	62.446,60	471.726,56	403.796,69	13	0,773033	364.659,98
2027	2	8.121.572,94	67.929,87	409.279,97	7.780.222,85	59.631,73	84,91	0,00	59.716,65	468.996,61	401.066,74	14	0,757875	355.440,82
2028	1	7.780.222,85	496.638,13	426.495,94	7.850.365,03	58.614,70	3.663,95	8.569,49	70.848,15	497.344,09	705,96	15	0,743015	369.533,99
2028	2	7.850.365,03	496.638,13	426.495,94	7.920.507,22	59.140,77	2.422,35	8.569,49	70.132,62	496.628,56	-9,57	16	0,728446	361.767,00
2029	1	7.920.507,22	360.311,37	426.495,94	7.854.322,65	59.155,61	1.351,17	0,00	60.506,78	487.002,72	126.691,36	17	0,714163	347.799,11
2029	2	7.854.322,65	360.311,37	426.495,94	7.788.138,07	58.659,23	450,39	0,00	59.109,62	485.605,56	125.294,19	18	0,700159	340.001,29
2030	1	7.788.138,07	0,00	492.415,14	7.295.722,93	56.564,48	0,00	0,00	56.564,48	548.979,61	548.979,61	19	0,686431	376.836,49
2030	2	7.295.722,93	0,00	492.415,14	6.803.307,80	52.871,37	0,00	0,00	52.871,37	545.286,50	545.286,50	20	0,672971	366.962,18
2031	1	6.803.307,80	0,00	492.415,14	6.310.892,66	49.178,25	0,00	0,00	49.178,25	541.593,39	541.593,39	21	0,659776	357.330,22
2031	2	6.310.892,66	0,00	492.415,14	5.818.477,53	45.485,14	0,00	0,00	45.485,14	537.900,27	537.900,27	22	0,646839	347.934,89
2032	1	5.818.477,53	1.698.246,82	492.415,14	7.024.309,21	48.160,45	9.279,61	22.804,83	80.244,88	572.660,02	-1.125.586,80	23	0,634156	363.155,74
2032	2	7.024.309,21	1.698.246,82	492.415,14	8.230.140,90	57.204,19	5.033,99	22.804,83	85.043,00	577.458,14	-1.120.788,68	24	0,621721	359.018,13
2033	1	8.230.140,90	582.236,00	492.415,14	8.319.961,76	62.062,88	2.183,38	0,00	64.246,27	556.661,41	-25.574,59	25	0,609531	339.302,31
2033	2	8.319.961,76	582.236,00	492.415,14	8.409.782,63	62.736,54	727,79	0,00	63.464,34	555.879,47	-26.356,53	26	0,597579	332.182,06
2034	1	8.409.782,63	0,00	745.802,12	7.663.980,51	60.276,61	0,00	0,00	60.276,61	806.078,73	806.078,73	27	0,585862	472.250,93
2034	2	7.663.980,51	0,00	745.802,12	6.918.178,39	54.683,10	0,00	0,00	54.683,10	800.485,21	800.485,21	28	0,574375	459.778,34
2035	1	6.918.178,39	0,00	745.802,12	6.172.376,28	49.089,58	0,00	0,00	49.089,58	794.891,70	794.891,70	29	0,563112	447.613,30
2035	2	6.172.376,28	0,00	745.802,12	5.426.574,16	43.496,06	0,00	0,00	43.496,06	789.298,18	789.298,18	30	0,552071	435.748,55
2036	1	5.426.574,16	0,00	745.802,12	4.680.772,05	37.902,55	0,00	0,00	37.902,55	783.704,66	783.704,66	31	0,541246	424.176,99
2036	2	4.680.772,05	0,00	745.802,12	3.934.969,93	32.309,03	0,00	0,00	32.309,03	778.111,15	778.111,15	32	0,530633	412.891,69
2037	1	3.934.969,93	0,00	336.522,15	3.598.447,78	28.250,32	0,00	0,00	28.250,32	364.772,47	364.772,47	33	0,520229	189.765,12
2037	2	3.598.447,78	0,00	336.522,15	3.261.925,63	25.726,40	0,00	0,00	25.726,40	362.248,55	362.248,55	34	0,510028	184.756,96
2038	1	3.261.925,63	0,00	336.522,15	2.925.403,48	23.202,48	0,00	0,00	23.202,48	359.724,63	359.724,63	35	0,500028	179.872,25
2038	2	2.925.403,48	0,00	336.522,15	2.588.881,33	20.678,57	0,00	0,00	20.678,57	357.200,72	357.200,72	36	0,490223	175.108,06
2039	1	2.588.881,33	0,00	336.522,15	2.252.359,18	18.154,65	0,00	0,00	18.154,65	354.676,80	354.676,80	37	0,480611	170.461,55
2039	2	2.252.359,18	0,00	336.522,15	1.915.837,03	15.630,74	0,00	0,00	15.630,74	352.152,89	352.152,89	38	0,471187	165.929,93
2040	1	1.915.837,03	0,00	319.306,17	1.596.530,86	13.171,38	0,00	0,00	13.171,38	332.477,55	332.477,55	39	0,461948	153.587,41
2040	2	1.596.530,86	0,00	319.306,17	1.277.224,69	10.776,58	0,00	0,00	10.776,58	330.082,76	330.082,76	40	0,452890	149.491,32
2041	1	1.277.224,69	0,00	319.306,17	957.918,52	8.381,79	0,00	0,00	8.381,79	327.687,96	327.687,96	41	0,444010	145.496,80
2041	2	957.918,52	0,00	319.306,17	638.612,34	5.986,99	0,00	0,00	5.986,99	325.293,16	325.293,16	42	0,435304	141.601,46
2042	1	638.612,34	0,00	319.306,17	319.306,17	3.592,19	0,00	0,00	3.592,19	322.898,37	322.898,37	43	0,426769	137.802,93
2042	2	319.306,17	0,00	319.306,17	0,00	1.197,40	0,00	0,00	1.197,40	320.503,57	320.503,57	44	0,418401	134.098,93
	TOTAL		17.329.327,22	17.329.327,22		1.920.569,60	104.256,94	173.293,27	2.198.119,81	19.527.447,02	2.198.119,81			12.357.384,20

ANNUAL PROJECT LOAN COST AND REPAYMENT SCHEDULE (EURO)

YEARS	Beg.-of-Period Loan Amount	Loan Utilizations	Loan Repayments	End-of-Period Loan Amount	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service
2021	0	475.509	0	475.509	3.566	52.018	0	55.584	55.584
2022	475.509	10.165.770	0	10.641.279	83.376	25.414	106.413	215.203	215.203
2023	10.641.279	0	0	10.641.279	159.619	0	0	159.619	159.619
2024	10.641.279	0	818.560	9.822.719	153.480	0	0	153.480	972.040
2025	9.822.719	277.324	818.560	9.281.483	143.282	1.373	4.132	148.786	967.346
2026	9.281.483	0	818.560	8.462.923	133.083	0	0	133.083	951.643
2027	8.462.923	135.860	818.560	7.780.223	121.824	340	0	122.163	940.723
2028	7.780.223	993.276	852.992	7.920.507	117.755	6.086	17.139	140.981	993.973
2029	7.920.507	720.623	852.992	7.788.138	117.815	1.802	0	119.616	972.608
2030	7.788.138	0	984.830	6.803.308	109.436	0	0	109.436	1.094.266
2031	6.803.308	0	984.830	5.818.478	94.663	0	0	94.663	1.079.494
2032	5.818.478	3.396.494	984.830	8.230.141	105.365	14.314	45.610	165.288	1.150.118
2033	8.230.141	1.164.472	984.830	8.409.783	124.799	2.911	0	127.711	1.112.541
2034	8.409.783	0	1.491.604	6.918.178	114.960	0	0	114.960	1.606.564
2035	6.918.178	0	1.491.604	5.426.574	92.586	0	0	92.586	1.584.190
2036	5.426.574	0	1.491.604	3.934.970	70.212	0	0	70.212	1.561.816
2037	3.934.970	0	673.044	3.261.926	53.977	0	0	53.977	727.021
2038	3.261.926	0	673.044	2.588.881	43.881	0	0	43.881	716.925
2039	2.588.881	0	673.044	1.915.837	33.785	0	0	33.785	706.830
2040	1.915.837	0	638.612	1.277.225	23.948	0	0	23.948	662.560
2041	1.277.225	0	638.612	638.612	14.369	0	0	14.369	652.981
2042	638.612	0	638.612	0	4.790	0	0	4.790	643.402
TOTAL		17.329.327	17.329.327		1.920.570	104.257	173.293	2.198.120	19.527.447

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
PROJECT FINANCIAL PROFITABILITY ANALYSIS (FINANCIAL RATE OF RETURN OF THE INVESTMENT (FNPV/C - FRR/C))

Financial Discount Rate (%)	4,0
FNPV/C (EUR)	-18.775.910
FRR/C (%)	-3,05

	Collected Revenues	Collected Revenues	Collected Revenues	Collected Revenues	Collected Revenues	O&M Costs	O&M Costs	O&M Costs
	Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL CASH INFLOWS	Collection	Recycling	Composting
Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
2021	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0
2023	2.275.789	554.445	0	0	2.830.234	-2.334.656	-731.451	-106.392
2024	2.685.933	739.705	0	0	3.425.638	-2.386.346	-834.869	-106.392
2025	3.142.645	852.806	0	0	3.995.451	-2.394.160	-970.052	-106.392
2026	3.650.054	901.555	0	0	4.551.609	-2.433.559	-997.421	-106.392
2027	4.156.108	949.865	0	0	5.105.973	-2.529.412	-1.058.003	-106.392
2028	4.598.527	994.653	0	476.544	6.069.724	-2.590.207	-1.091.012	-106.392
2029	5.073.670	1.041.040	0	476.544	6.591.254	-2.674.885	-1.132.570	-106.392
2030	5.358.283	1.089.031	0	476.544	6.923.858	-2.732.792	-1.140.342	-106.392
2031	5.549.480	1.122.109	0	476.544	7.148.133	-2.762.280	-1.183.075	-106.392
2032	5.749.003	1.155.716	0	476.544	7.381.263	-2.780.517	-1.203.012	-106.392
2033	5.957.269	1.189.814	0	476.544	7.623.627	-2.806.646	-1.210.210	-106.392
2034	6.174.717	1.224.758	0	476.544	7.876.019	-2.846.232	-1.220.878	-106.392
2035	6.401.808	1.260.548	0	476.544	8.138.900	-2.848.716	-1.263.207	-106.392
2036	6.639.031	1.296.886	0	476.544	8.412.461	-2.851.113	-1.336.349	-106.392
2037	6.886.898	1.333.696	0	476.544	8.697.138	-2.853.654	-1.340.160	-106.392
2038	7.145.953	1.371.495	0	131.750	8.649.198	-2.889.541	-1.343.835	-106.392
2039	7.416.767	1.409.756	0	131.750	8.958.273	-2.915.808	-1.379.880	-106.392
2040	7.699.942	1.448.925	0	131.750	9.280.617	-2.931.087	-1.394.235	-106.392
2041	7.996.115	1.489.078	0	131.750	9.616.943	-2.965.311	-1.497.249	-106.392
2042	8.300.986	1.529.703	0	1.036.250	10.866.939	-3.012.234	-1.501.272	-106.392
UNDISCOUNTED TOTAL (2021-2042)	112.858.977	22.955.584	0	6.328.692	142.143.253	-54.539.155	-23.829.081	-2.127.840
DISCOUNTED TOTAL (2021-2042)	66.037.357	13.710.361	0	3.620.000	83.367.719	-33.696.368	-14.416.565	-1.336.818

O&M Costs	O&M Costs	O&M Costs	O&M Costs	O&M Costs	O&M Costs	Operating Profits	INVESTMENT COSTS EXCLUDING CONTINGENCIES			
Transport	Disposal	TOTAL OPERATING SERVICE COSTS	Aftercare Costs	Administrative Costs	TOTAL NET OPERATING COSTS	Total Operating Revenues-Total O & M Costs	Total Investments Including Implementation Consultant	Technical Assistance	Total Investments Including Impl. Consultant & TA	Residual Value
EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)
0	0	0	0	-26.400	-26.400	-26.400	0	-907.200	-907.200	0
0	0	0	0	-75.900	-75.900	-75.900	-19.005.963	-388.800	-19.394.763	0
-414.357	-671.828	-4.258.684	0	-75.900	-4.334.584	-1.504.350	0	0	0	0
-417.224	-675.481	-4.420.312	0	-75.900	-4.496.212	-1.070.574	0	0	0	0
-423.357	-674.977	-4.568.938	0	-75.900	-4.644.838	-649.387	-529.092	0	-529.092	0
-432.435	-680.751	-4.650.558	0	-75.900	-4.726.458	-174.848	0	0	0	0
-451.175	-681.060	-4.826.042	0	-75.900	-4.901.942	204.031	-259.200	0	-259.200	0
-459.378	-719.946	-4.966.935	0	-75.900	-5.042.835	1.026.889	-3.962.036	0	-3.962.036	0
-467.741	-719.861	-5.101.449	0	-75.900	-5.177.349	1.413.905	-1.374.840	0	-1.374.840	0
-476.341	-725.092	-5.180.959	0	-75.900	-5.256.859	1.666.999	-232.325	0	-232.325	0
-478.811	-723.733	-5.254.290	0	-75.900	-5.330.190	1.817.942	-129.600	0	-129.600	0
-481.359	-727.663	-5.298.943	0	-75.900	-5.374.843	2.006.420	-7.507.500	0	-7.507.500	0
-483.907	-830.143	-5.437.299	0	-75.900	-5.513.199	2.110.429	-11.135.527	0	-11.135.527	0
-486.456	-847.979	-5.507.937	0	-75.900	-5.583.837	2.292.182	0	0	0	0
-489.084	-848.774	-5.556.172	0	-75.900	-5.632.072	2.506.828	-499.200	0	-499.200	0
-491.712	-854.876	-5.640.442	0	-75.900	-5.716.342	2.696.119	0	0	0	0
-504.240	-855.724	-5.660.170	0	-75.900	-5.736.070	2.961.069	-1.644.000	0	-1.644.000	0
-506.869	-861.880	-5.708.517	0	-75.900	-5.784.417	2.864.782	-1.905.961	0	-1.905.961	0
-509.576	-862.782	-5.774.438	0	-75.900	-5.850.338	3.107.935	0	0	0	0
-512.284	-868.992	-5.812.990	0	-75.900	-5.888.890	3.391.727	0	0	0	0
-515.071	-869.949	-5.953.971	0	-75.900	-6.029.871	3.587.072	-379.200	0	-379.200	0
-517.779	-876.214	-6.013.891	-1.177.350	-75.900	-7.267.141	3.599.798	-1.728.000	0	-1.728.000	5.176.449
-9.519.157	-15.577.702	-105.592.936	-1.177.350	-1.620.300	-108.390.586	33.752.667	-50.292.444	-1.296.000	-51.588.444	5.176.449
-5.890.247	-9.569.600	-64.909.597	-496.789	-1.049.243	-66.455.630	16.912.089	-36.640.454	-1.231.775	-37.872.229	2.184.231

	Total Costs	Annual Cash Flows	Cumulative Cash Flows
Total Inv. Incl. Impl. Consultant & TA and Residual Value	TOTAL CASH OUTFLOWS	Net Cash Flow Before Finance	Cumulative Net Cash Flow Before Finance
(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)
-907.200	-933.600	-933.600	-933.600
-19.394.763	-19.470.663	-19.470.663	-20.404.263
0	-4.334.584	-1.504.350	-21.908.613
0	-4.496.212	-1.070.574	-22.979.187
-529.092	-5.173.930	-1.178.479	-24.157.666
0	-4.726.458	-174.848	-24.332.515
-259.200	-5.161.142	-55.169	-24.387.684
-3.962.036	-9.004.871	-2.935.147	-27.322.830
-1.374.840	-6.552.189	39.065	-27.283.765
-232.325	-5.489.184	1.434.674	-25.849.091
-129.600	-5.459.790	1.688.342	-24.160.749
-7.507.500	-12.882.343	-5.501.080	-29.661.829
-11.135.527	-16.648.725	-9.025.098	-38.686.927
0	-5.583.837	2.292.182	-36.394.745
-499.200	-6.131.272	2.007.628	-34.387.117
0	-5.716.342	2.696.119	-31.690.998
-1.644.000	-7.380.070	1.317.069	-30.373.930
-1.905.961	-7.690.377	958.821	-29.415.109
0	-5.850.338	3.107.935	-26.307.174
0	-5.888.890	3.391.727	-22.915.446
-379.200	-6.409.071	3.207.872	-19.707.575
3.448.449	-3.818.692	7.048.247	-12.659.328
-46.411.995	-154.802.581	-12.659.328	
-35.687.998	-102.143.628	-18.775.910	

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
ALTERNATIVE SCENARIO (GRANT RATE: 52.35%)
FINANCIAL RETURN ON INVESTED LOCAL CAPITAL (FNPV/K - FRR/K) (LOAN FINANCING AND LOCAL GRANT FINANCING CONSIDERED)

Financial Discount Rate (%)	4,0
FNPV/K (EUR)	-10.881.194
FRR/K (%)	-1,67

	Collected Revenues	Collected Revenues	Collected Revenues	Collected Revenues	Collected Revenues	Loan Utilizations	Local Grants		O&M Costs
	Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES	Loan Utilizations	Local Grants	TOTAL CASH INFLOWS	Collection
Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
2021	0	0	0	0	0	475.509	0	475.509	0
2022	0	0	0	0	0	10.165.770	0	10.165.770	0
2023	2.275.789	554.445	0	0	2.830.234	0	0	2.830.234	-2.334.656
2024	2.685.933	739.705	0	0	3.425.638	0	0	3.425.638	-2.386.346
2025	3.142.645	852.806	0	0	3.995.451	277.324	304.677	4.577.452	-2.394.160
2026	3.650.054	901.555	0	0	4.551.609	0	0	4.551.609	-2.433.559
2027	4.156.108	949.865	0	0	5.105.973	135.860	149.260	5.391.093	-2.529.412
2028	4.598.527	994.653	0	476.544	6.069.724	993.276	1.091.248	8.154.248	-2.590.207
2029	5.073.670	1.041.040	0	476.544	6.591.254	720.623	791.701	8.103.578	-2.674.885
2030	5.358.283	1.089.031	0	476.544	6.923.858	0	0	6.923.858	-2.732.792
2031	5.549.480	1.122.109	0	476.544	7.148.133	0	74.630	7.222.763	-2.762.280
2032	5.749.003	1.155.716	0	476.544	7.381.263	3.396.494	3.731.506	14.509.263	-2.780.517
2033	5.957.269	1.189.814	0	476.544	7.623.627	1.164.472	1.279.330	10.067.429	-2.806.646
2034	6.174.717	1.224.758	0	476.544	7.876.019	0	0	7.876.019	-2.846.232
2035	6.401.808	1.260.548	0	476.544	8.138.900	0	149.260	8.288.161	-2.848.716
2036	6.639.031	1.296.886	0	476.544	8.412.461	0	0	8.412.461	-2.851.113
2037	6.886.898	1.333.696	0	476.544	8.697.138	0	808.493	9.505.631	-2.853.654
2038	7.145.953	1.371.495	0	131.750	8.649.198	0	191.542	8.840.740	-2.889.541
2039	7.416.767	1.409.756	0	131.750	8.958.273	0	0	8.958.273	-2.915.808
2040	7.699.942	1.448.925	0	131.750	9.280.617	0	0	9.280.617	-2.931.087
2041	7.996.115	1.489.078	0	131.750	9.616.943	0	149.260	9.766.204	-2.965.311
2042	8.300.986	1.529.703	0	1.036.250	10.866.939	0	995.068	11.862.007	-3.012.234
UNDISCOUNTED TOTAL (2021-2042)	112.858.977	22.955.584	0	6.328.692	142.143.253	17.329.327	9.715.977	169.188.557	-54.539.155
DISCOUNTED TOTAL (2021-2042)	66.037.357	13.710.361	0	3.620.000	83.367.719	14.240.097	5.942.813	103.550.628	-33.696.368

O&M Costs	O&M Costs	O&M Costs	O&M Costs	O&M Costs	O&M Costs	O&M Costs	O&M Costs	Operating Profits	
Recycling	Composting	Transport	Disposal	TOTAL OPERATING SERVICE COSTS	Aftercare Costs	Administrative Costs	TOTAL NET OPERATING COSTS	Total Operating Revenues-Total O & M Costs	Total Investments Including Implementation Consultant
EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	(EURO/year)
0	0	0	0	0	0	-26.400	-26.400	-26.400	0
0	0	0	0	0	0	-75.900	-75.900	-75.900	-19.005.963
-731.451	-106.392	-414.357	-671.828	-4.258.684	0	-75.900	-4.334.584	-1.504.350	0
-834.869	-106.392	-417.224	-675.481	-4.420.312	0	-75.900	-4.496.212	-1.070.574	0
-970.052	-106.392	-423.357	-674.977	-4.568.938	0	-75.900	-4.644.838	-649.387	-529.092
-997.421	-106.392	-432.435	-680.751	-4.650.558	0	-75.900	-4.726.458	-174.848	0
-1.058.003	-106.392	-451.175	-681.060	-4.826.042	0	-75.900	-4.901.942	204.031	-259.200
-1.091.012	-106.392	-459.378	-719.946	-4.966.935	0	-75.900	-5.042.835	1.026.889	-3.962.036
-1.132.570	-106.392	-467.741	-719.861	-5.101.449	0	-75.900	-5.177.349	1.413.905	-1.374.840
-1.140.342	-106.392	-476.341	-725.092	-5.180.959	0	-75.900	-5.256.859	1.666.999	-232.325
-1.183.075	-106.392	-478.811	-723.733	-5.254.290	0	-75.900	-5.330.190	1.817.942	-129.600
-1.203.012	-106.392	-481.359	-727.663	-5.298.943	0	-75.900	-5.374.843	2.006.420	-7.507.500
-1.210.210	-106.392	-483.907	-830.143	-5.437.299	0	-75.900	-5.513.199	2.110.429	-11.135.527
-1.220.878	-106.392	-486.456	-847.979	-5.507.937	0	-75.900	-5.583.837	2.292.182	0
-1.263.207	-106.392	-489.084	-848.774	-5.556.172	0	-75.900	-5.632.072	2.506.828	-499.200
-1.336.349	-106.392	-491.712	-854.876	-5.640.442	0	-75.900	-5.716.342	2.696.119	0
-1.340.160	-106.392	-504.240	-855.724	-5.660.170	0	-75.900	-5.736.070	2.961.069	-1.644.000
-1.343.835	-106.392	-506.869	-861.880	-5.708.517	0	-75.900	-5.784.417	2.864.782	-1.905.961
-1.379.880	-106.392	-509.576	-862.782	-5.774.438	0	-75.900	-5.850.338	3.107.935	0
-1.394.235	-106.392	-512.284	-868.992	-5.812.990	0	-75.900	-5.888.890	3.391.727	0
-1.497.249	-106.392	-515.071	-869.949	-5.953.971	0	-75.900	-6.029.871	3.587.072	-379.200
-1.501.272	-106.392	-517.779	-876.214	-6.013.891	-1.177.350	-75.900	-7.267.141	3.599.798	-1.728.000
-23.829.081	-2.127.840	-9.519.157	-15.577.702	-105.592.936	-1.177.350	-1.620.300	-108.390.586	33.752.667	-50.292.444
-14.416.565	-1.336.818	-5.890.247	-9.569.600	-64.909.597	-496.789	-1.049.243	-66.455.630	16.912.089	-36.640.454

INVESTMENT COSTS EXCLUDING CONTINGENCIES				FINANCING COSTS					
Technical Assistance	Total Investments Including Impl. Consultant & TA	Residual Value	Total Net Investments Including Impl. Cons. & TA and Residual Value	Loan Repayments	Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Debt Service
(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)
-907.200	-907.200	0	-907.200	0	-3.566	-52.018	0	-55.584	-55.584
-388.800	-19.394.763	0	-19.394.763	0	-83.376	-25.414	-106.413	-215.203	-215.203
0	0	0	0	0	-159.619	0	0	-159.619	-159.619
0	0	0	0	-818.560	-153.480	0	0	-153.480	-972.040
0	-529.092	0	-529.092	-818.560	-143.282	-1.373	-4.132	-148.786	-967.346
0	0	0	0	-818.560	-133.083	0	0	-133.083	-951.643
0	-259.200	0	-259.200	-818.560	-121.824	-340	0	-122.163	-940.723
0	-3.962.036	0	-3.962.036	-852.992	-117.755	-6.086	-17.139	-140.981	-993.973
0	-1.374.840	0	-1.374.840	-852.992	-117.815	-1.802	0	-119.616	-972.608
0	-232.325	0	-232.325	-984.830	-109.436	0	0	-109.436	-1.094.266
0	-129.600	0	-129.600	-984.830	-94.663	0	0	-94.663	-1.079.494
0	-7.507.500	0	-7.507.500	-984.830	-105.365	-14.314	-45.610	-165.288	-1.150.118
0	-11.135.527	0	-11.135.527	-984.830	-124.799	-2.911	0	-127.711	-1.112.541
0	0	0	0	-1.491.604	-114.960	0	0	-114.960	-1.606.564
0	-499.200	0	-499.200	-1.491.604	-92.586	0	0	-92.586	-1.584.190
0	0	0	0	-1.491.604	-70.212	0	0	-70.212	-1.561.816
0	-1.644.000	0	-1.644.000	-673.044	-53.977	0	0	-53.977	-727.021
0	-1.905.961	0	-1.905.961	-673.044	-43.881	0	0	-43.881	-716.925
0	0	0	0	-673.044	-33.785	0	0	-33.785	-706.830
0	0	0	0	-638.612	-23.948	0	0	-23.948	-662.560
0	-379.200	0	-379.200	-638.612	-14.369	0	0	-14.369	-652.981
0	-1.728.000	5.176.449	3.448.449	-638.612	-4.790	0	0	-4.790	-643.402
-1.296.000	-51.588.444	5.176.449	-46.411.995	-17.329.327	-1.920.570	-104.257	-173.293	-2.198.120	-19.527.447
-1.231.775	-37.872.229	2.184.231	-35.687.998	-10.700.021	-1.354.079	-91.302	-142.792	-1.588.173	-12.288.194

Total Costs	Annual Cash Flows	Cumulative Cash Flows
TOTAL CASH OUTFLOWS	Net Cash Flow After IFI & Local Grant Finance	Cumulative Net Cash Flow After IFI & Local Grant Finance
(EURO/year)	(EURO/year)	(EURO/year)
-989.184	-513.675	-513.675
-19.685.866	-9.520.096	-10.033.771
-4.494.203	-1.663.969	-11.697.741
-5.468.252	-2.042.614	-13.740.355
-6.141.276	-1.563.824	-15.304.178
-5.678.101	-1.126.491	-16.430.670
-6.101.865	-710.772	-17.141.442
-9.998.844	-1.844.595	-18.986.037
-7.524.797	578.781	-18.407.256
-6.583.450	340.408	-18.066.848
-6.539.284	683.479	-17.383.369
-14.032.461	476.802	-16.906.567
-17.761.266	-7.693.837	-24.600.405
-7.190.401	685.618	-23.914.787
-7.715.462	572.699	-23.342.088
-7.278.158	1.134.303	-22.207.785
-8.107.091	1.398.541	-20.809.245
-8.407.303	433.438	-20.375.807
-6.557.168	2.401.105	-17.974.702
-6.551.450	2.729.167	-15.245.535
-7.062.053	2.704.151	-12.541.384
-4.462.094	7.399.913	-5.141.471
-174.330.028	-5.141.471	
-114.431.822	-10.881.194	

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
ALTERNATIVE SCENARIO (GRANT RATE: 52.35%)
PROJECT CASH FLOWS

Grant Rate	52,35%		COLLECTED REVENUES			FINANCING OF INVESTMENT COSTS		
	Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES	SECO Grant	EU Grant	IFI Loans
Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
2021	0	0	0	0	0	522.411	0	475.509
2022	0	0	0	0	0	6.028.829	5.139.640	10.165.770
2023	2.275.789	554.445	0	0	2.830.234	0	0	0
2024	2.685.933	739.705	0	0	3.425.638	0	0	0
2025	3.142.645	852.806	0	0	3.995.451	0	0	277.324
2026	3.650.054	901.555	0	0	4.551.609	0	0	0
2027	4.156.108	949.865	0	0	5.105.973	0	0	135.860
2028	4.598.527	994.653	0	476.544	6.069.724	0	0	993.276
2029	5.073.670	1.041.040	0	476.544	6.591.254	0	0	720.623
2030	5.358.283	1.089.031	0	476.544	6.923.858	0	0	0
2031	5.549.480	1.122.109	0	476.544	7.148.133	0	0	0
2032	5.749.003	1.155.716	0	476.544	7.381.263	0	0	3.396.494
2033	5.957.269	1.189.814	0	476.544	7.623.627	0	0	1.164.472
2034	6.174.717	1.224.758	0	476.544	7.876.019	0	0	0
2035	6.401.808	1.260.548	0	476.544	8.138.900	0	0	0
2036	6.639.031	1.296.886	0	476.544	8.412.461	0	0	0
2037	6.886.898	1.333.696	0	476.544	8.697.138	0	0	0
2038	7.145.953	1.371.495	0	131.750	8.649.198	0	0	0
2039	7.416.767	1.409.756	0	131.750	8.958.273	0	0	0
2040	7.699.942	1.448.925	0	131.750	9.280.617	0	0	0
2041	7.996.115	1.489.078	0	131.750	9.616.943	0	0	0
2042	8.300.986	1.529.703	0	1.036.250	10.866.939	0	0	0
UNDISCOUNTED TOTAL (2021-2042)	112.858.977	22.955.584	0	6.328.692	142.143.253	6.551.240	5.139.640	17.329.327
DISCOUNTED TOTAL (2021-2042)	66.037.357	13.710.361	0	3.620.000	83.367.719	6.076.310	4.751.886	14.240.097
DISCOUNTED TOTAL (%) (2021-2042)	57,56%	11,95%	0,00%	3,16%	72,67%	5,30%	4,14%	12,41%
UNDISCOUNTED YEARLY AVERAGE	5.129.953	1.043.436	0	287.668	6.461.057	297.784	233.620	787.697
DISCOUNTED YEARLY AVERAGE	3.001.698	623.198	0	164.545	3.789.442	276.196	215.995	647.277

		IDC Financing	Admin. Cost Financing	CASH INFLOWS	OPERATING COST			OPERATING COST		
Local Grants	Total Investment Financing	IDC Financing By Municipalities	Administrative Cost Financing By Municipalities	TOTAL CASH INFLOWS	Collection	Recycling	Composting	Transport	Disposal	TOTAL OPERATING SERVICE COSTS
EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
0	997.920	55.584	26.400	1.079.904	0	0	0	0	0	0
0	21.334.239	215.203	75.900	21.625.343	0	0	0	0	0	0
0	0	0	0	2.830.234	-2.334.656	-731.451	-106.392	-414.357	-671.828	-4.258.684
0	0	0	0	3.425.638	-2.386.346	-834.869	-106.392	-417.224	-675.481	-4.420.312
304.677	582.001	0	0	4.577.452	-2.394.160	-970.052	-106.392	-423.357	-674.977	-4.568.938
0	0	0	0	4.551.609	-2.433.559	-997.421	-106.392	-432.435	-680.751	-4.650.558
149.260	285.120	0	0	5.391.093	-2.529.412	-1.058.003	-106.392	-451.175	-681.060	-4.826.042
1.091.248	2.084.524	0	0	8.154.248	-2.590.207	-1.091.012	-106.392	-459.378	-719.946	-4.966.935
791.701	1.512.324	0	0	8.103.578	-2.674.885	-1.132.570	-106.392	-467.741	-719.861	-5.101.449
0	0	0	0	6.923.858	-2.732.792	-1.140.342	-106.392	-476.341	-725.092	-5.180.959
74.630	74.630	0	0	7.222.763	-2.762.280	-1.183.075	-106.392	-478.811	-723.733	-5.254.290
3.731.506	7.128.000	0	0	14.509.263	-2.780.517	-1.203.012	-106.392	-481.359	-727.663	-5.298.943
1.279.330	2.443.802	0	0	10.067.429	-2.806.646	-1.210.210	-106.392	-483.907	-830.143	-5.437.299
0	0	0	0	7.876.019	-2.846.232	-1.220.878	-106.392	-486.456	-847.979	-5.507.937
149.260	149.260	0	0	8.288.161	-2.848.716	-1.263.207	-106.392	-489.084	-848.774	-5.556.172
0	0	0	0	8.412.461	-2.851.113	-1.336.349	-106.392	-491.712	-854.876	-5.640.442
808.493	808.493	0	0	9.505.631	-2.853.654	-1.340.160	-106.392	-504.240	-855.724	-5.660.170
191.542	191.542	0	0	8.840.740	-2.889.541	-1.343.835	-106.392	-506.869	-861.880	-5.708.517
0	0	0	0	8.958.273	-2.915.808	-1.379.880	-106.392	-509.576	-862.782	-5.774.438
0	0	0	0	9.280.617	-2.931.087	-1.394.235	-106.392	-512.284	-868.992	-5.812.990
149.260	149.260	0	0	9.766.204	-2.965.311	-1.497.249	-106.392	-515.071	-869.949	-5.953.971
995.068	995.068	0	0	11.862.007	-3.012.234	-1.501.272	-106.392	-517.779	-876.214	-6.013.891
9.715.977	38.736.184	270.787	102.300	181.252.524	-54.539.155	-23.829.081	-2.127.840	-9.519.157	-15.577.702	-105.592.936
5.942.813	31.011.106	252.413	95.558	114.726.796	-33.696.368	-14.416.565	-1.336.818	-5.890.247	-9.569.600	-64.909.597
5,18%	27,03%	0,22%	0,08%	100,00%	28,56%	12,22%	1,13%	4,99%	8,11%	55,01%
441.635	1.760.736	12.309	4.650	8.238.751	-2.479.053	-1.083.140	-96.720	-432.689	-708.077	-4.799.679
270.128	1.409.596	11.473	4.344	5.214.854	-1.531.653	-655.298	-60.764	-267.738	-434.982	-2.950.436

OPERATING COST		OPERATING COST	Operating Surplus
Aftercare Costs	Administrative Costs	TOTAL NET OPERATING COSTS	Total Operating Revenues-Total O & M Costs
EURO/Year	EURO/Year	EURO/Year	(EURO/year)
0	-26.400	-26.400	-26.400
0	-75.900	-75.900	-75.900
0	-75.900	-4.334.584	-1.504.350
0	-75.900	-4.496.212	-1.070.574
0	-75.900	-4.644.838	-649.387
0	-75.900	-4.726.458	-174.848
0	-75.900	-4.901.942	204.031
0	-75.900	-5.042.835	1.026.889
0	-75.900	-5.177.349	1.413.905
0	-75.900	-5.256.859	1.666.999
0	-75.900	-5.330.190	1.817.942
0	-75.900	-5.374.843	2.006.420
0	-75.900	-5.513.199	2.110.429
0	-75.900	-5.583.837	2.292.182
0	-75.900	-5.632.072	2.506.828
0	-75.900	-5.716.342	2.696.119
0	-75.900	-5.736.070	2.961.069
0	-75.900	-5.784.417	2.864.782
0	-75.900	-5.850.338	3.107.935
0	-75.900	-5.888.890	3.391.727
0	-75.900	-6.029.871	3.587.072
-1.177.350	-75.900	-7.267.141	3.599.798
-1.177.350	-1.620.300	-108.390.586	33.752.667
-496.789	-1.049.243	-66.455.630	16.912.089

0,42%	0,89%	56,32%	-14,33%
-53.516	-73.650	-4.926.845	1.534.212
-22.581	-47.693	-3.020.710	768.731

INVESTMENT COST		INVESTMENT COST	INVESTMENT COST			
Collection	Recycling	Composting	Transport	Disposal	Technical Assistance	Residual Value
(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)
0	0	0	0	0	-997.920	0
-8.366.804	-2.894.978	-1.259.280	-1.367.982	-7.017.516	-427.680	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	-582.001	0	0	0	0	0
0	0	0	0	0	0	0
0	-285.120	0	0	0	0	0
-1.509.163	-1.215.577	0	0	-1.633.500	0	0
0	0	0	0	-1.512.324	0	0
0	-255.558	0	0	0	0	0
0	-142.560	0	0	0	0	0
0	0	0	-893.750	-7.364.500	0	0
-8.021.772	-2.176.908	-506.000	0	-1.544.400	0	0
0	0	0	0	0	0	0
0	-549.120	0	0	0	0	0
0	0	0	0	0	0	0
0	-264.000	0	0	-1.544.400	0	0
-1.613.296	-483.261	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	-417.120	0	0	0	0	0
0	0	0	0	-1.900.800	0	5.694.094
-19.511.034	-9.266.202	-1.765.280	-2.261.732	-22.517.440	-1.425.600	5.694.094
-14.452.347	-6.694.489	-1.468.166	-1.823.010	-15.866.487	-1.354.953	2.402.654

12,25%	5,67%	1,24%	1,54%	13,45%	1,15%	-2,04%
-886.865	-421.191	-80.240	-102.806	-1.023.520	-64.800	258.822
-656.925	-304.295	-66.735	-82.864	-721.204	-61.589	109.212

Total Inv. Incl. Impl. Consultant & TA and Residual Value (EURO/year)	FINANCING COSTS		FINANCING COSTS		FINANCING COSTS		CASH OUTFLOWS
	Loan Repayments (EURO/year)	Interest Costs (EURO/year)	Commitment Fees (EURO/year)	Management Fees (EURO/year)	Total Financing Costs (EURO/year)	Debt Service (EURO/year)	TOTAL CASH OUTFLOWS (EURO/year)
-997.920	0	-3.566	-52.018	0	-55.584	-55.584	-1.079.904
-21.334.239	0	-83.376	-25.414	-106.413	-215.203	-215.203	-21.625.343
0	0	-159.619	0	0	-159.619	-159.619	-4.494.203
0	-818.560	-153.480	0	0	-153.480	-972.040	-5.468.252
-582.001	-818.560	-143.282	-1.373	-4.132	-148.786	-967.346	-6.194.185
0	-818.560	-133.083	0	0	-133.083	-951.643	-5.678.101
-285.120	-818.560	-121.824	-340	0	-122.163	-940.723	-6.127.785
-4.358.240	-852.992	-117.755	-6.086	-17.139	-140.981	-993.973	-10.395.047
-1.512.324	-852.992	-117.815	-1.802	0	-119.616	-972.608	-7.662.281
-255.558	-984.830	-109.436	0	0	-109.436	-1.094.266	-6.606.682
-142.560	-984.830	-94.663	0	0	-94.663	-1.079.494	-6.552.244
-8.258.250	-984.830	-105.365	-14.314	-45.610	-165.288	-1.150.118	-14.783.211
-12.249.079	-984.830	-124.799	-2.911	0	-127.711	-1.112.541	-18.874.819
0	-1.491.604	-114.960	0	0	-114.960	-1.606.564	-7.190.401
-549.120	-1.491.604	-92.586	0	0	-92.586	-1.584.190	-7.765.382
0	-1.491.604	-70.212	0	0	-70.212	-1.561.816	-7.278.158
-1.808.400	-673.044	-53.977	0	0	-53.977	-727.021	-8.271.491
-2.096.557	-673.044	-43.881	0	0	-43.881	-716.925	-8.597.899
0	-673.044	-33.785	0	0	-33.785	-706.830	-6.557.168
0	-638.612	-23.948	0	0	-23.948	-662.560	-6.551.450
-417.120	-638.612	-14.369	0	0	-14.369	-652.981	-7.099.973
3.793.294	-638.612	-4.790	0	0	-4.790	-643.402	-4.117.249
-51.053.194	-17.329.327	-1.920.570	-104.257	-173.293	-2.198.120	-19.527.447	-178.971.227
-39.256.798	-10.700.021	-1.354.079	-91.302	-142.792	-1.588.173	-12.288.194	-118.000.621
33,27%	9,07%	1,15%	0,08%	0,12%	1,35%	10,41%	100,00%
-2.320.600	-787.697	-87.299	-4.739	-7.877	-99.915	-887.611	-8.135.056
-1.784.400	-486.365	-61.549	-4.150	-6.491	-72.190	-558.554	-5.363.665

NET CASH FLOWS	
Net Project Cash Flows (EURO/year)	Cumulative Net Project Cash Flows (EURO/year)
0	0
0	0
-1.663.969	-1.663.969
-2.042.614	-3.706.583
-1.616.733	-5.323.316
-1.126.491	-6.449.808
-736.692	-7.186.500
-2.240.799	-9.427.299
441.297	-8.986.002
317.175	-8.668.826
670.519	-7.998.308
-273.948	-8.272.255
-8.807.390	-17.079.646
685.618	-16.394.028
522.779	-15.871.249
1.134.303	-14.736.946
1.234.141	-13.502.806
242.842	-13.259.964
2.401.105	-10.858.859
2.729.167	-8.129.692
2.666.231	-5.463.461
7.744.758	2.281.297
2.281.297	
-3.273.825	

103.695
-148.810

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
ALTERNATIVE SCENARIO (GRANT RATE: 52.35%)
PROJECT PROFIT (-LOSS) STATEMENTS

Grant Rate	52,35%						
Financial Discount Rate (%)	4,0						
	COLLECTED REVENUES		COLLECTED REVENUES			OPERATING COST	
	Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES	Collection	Recycling
Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year
2021	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0
2023	2.275.789	554.445	0	0	2.830.234	-2.334.656	-731.451
2024	2.685.933	739.705	0	0	3.425.638	-2.386.346	-834.869
2025	3.142.645	852.806	0	0	3.995.451	-2.394.160	-970.052
2026	3.650.054	901.555	0	0	4.551.609	-2.433.559	-997.421
2027	4.156.108	949.865	0	0	5.105.973	-2.529.412	-1.058.003
2028	4.598.527	994.653	0	476.544	6.069.724	-2.590.207	-1.091.012
2029	5.073.670	1.041.040	0	476.544	6.591.254	-2.674.885	-1.132.570
2030	5.358.283	1.089.031	0	476.544	6.923.858	-2.732.792	-1.140.342
2031	5.549.480	1.122.109	0	476.544	7.148.133	-2.762.280	-1.183.075
2032	5.749.003	1.155.716	0	476.544	7.381.263	-2.780.517	-1.203.012
2033	5.957.269	1.189.814	0	476.544	7.623.627	-2.806.646	-1.210.210
2034	6.174.717	1.224.758	0	476.544	7.876.019	-2.846.232	-1.220.878
2035	6.401.808	1.260.548	0	476.544	8.138.900	-2.848.716	-1.263.207
2036	6.639.031	1.296.886	0	476.544	8.412.461	-2.851.113	-1.336.349
2037	6.886.898	1.333.696	0	476.544	8.697.138	-2.853.654	-1.340.160
2038	7.145.953	1.371.495	0	131.750	8.649.198	-2.889.541	-1.343.835
2039	7.416.767	1.409.756	0	131.750	8.958.273	-2.915.808	-1.379.880
2040	7.699.942	1.448.925	0	131.750	9.280.617	-2.931.087	-1.394.235
2041	7.996.115	1.489.078	0	131.750	9.616.943	-2.965.311	-1.497.249
2042	8.300.986	1.529.703	0	1.036.250	10.866.939	-3.012.234	-1.501.272
UNDISCOUNTED TOTAL (2021-2042)	112.858.977	22.955.584	0	6.328.692	142.143.253	-54.539.155	-23.829.081
DISCOUNTED TOTAL (2021-2042)	66.037.357	13.710.361	0	3.620.000	83.367.719	-33.696.368	-14.416.565
DISCOUNTED TOTAL (%) (2021-2042)	79,21%	16,45%	0,00%	4,34%	100,00%	-40,42%	-17,29%
UNDISCOUNTED YEARLY AVERAGE	5.642.949	1.147.779	0	316.435	7.107.163	-2.870.482	-1.254.162
DISCOUNTED YEARLY AVERAGE	3.301.868	685.518	0	181.000	4.168.386	-1.773.493	-758.767

OPERATING COST		OPERATING COST		OPERATING COST		OPERATING COST		Operating Surplus	Operating Surplus
Composting	Transport	Disposal	TOTAL OPERATING SERVICE COSTS	DEPRECIATION COSTS	Aftercare Costs	Administrative Costs	TOTAL NET OPERATING COSTS	Total Operating Revenues-Total O & M Costs	Total Operating Revenues-Total O & M Costs + Depr. Costs
EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	EURO/Year	(EURO/year)	(EURO/m3 Billed)
0	0	0	0	0	0	-26.400	-26.400	-26.400	-26.400
0	0	0	0	0	0	-75.900	-75.900	-75.900	-75.900
-106.392	-414.357	-671.828	-4.258.684	-2.034.565	0	-75.900	-6.369.149	-3.538.916	-1.504.350
-106.392	-417.224	-675.481	-4.420.312	-2.034.565	0	-75.900	-6.530.778	-3.105.139	-1.070.574
-106.392	-423.357	-674.977	-4.568.938	-2.034.565	0	-75.900	-6.679.403	-2.683.952	-649.387
-106.392	-432.435	-680.751	-4.650.558	-2.089.643	0	-75.900	-6.816.101	-2.264.492	-174.848
-106.392	-451.175	-681.060	-4.826.042	-2.089.643	0	-75.900	-6.991.585	-1.885.612	204.031
-106.392	-459.378	-719.946	-4.966.935	-2.259.977	0	-75.900	-7.302.812	-1.233.088	1.026.889
-106.392	-467.741	-719.861	-5.101.449	-2.503.686	0	-75.900	-7.681.034	-1.089.780	1.413.905
-106.392	-476.341	-725.092	-5.180.959	-2.660.537	0	-75.900	-7.917.396	-993.538	1.666.999
-106.392	-478.811	-723.733	-5.254.290	-2.686.093	0	-75.900	-8.016.283	-868.150	1.817.942
-106.392	-481.359	-727.663	-5.298.943	-2.699.821	0	-75.900	-8.074.663	-693.400	2.006.420
-106.392	-483.907	-830.143	-5.437.299	-2.513.316	0	-75.900	-8.026.515	-402.887	2.110.429
-106.392	-486.456	-847.979	-5.507.937	-2.879.402	0	-75.900	-8.463.239	-587.220	2.292.182
-106.392	-489.084	-848.774	-5.556.172	-2.879.402	0	-75.900	-8.511.474	-372.574	2.506.828
-106.392	-491.712	-854.876	-5.640.442	-2.881.303	0	-75.900	-8.597.645	-185.184	2.696.119
-106.392	-504.240	-855.724	-5.660.170	-2.881.303	0	-75.900	-8.617.372	79.766	2.961.069
-106.392	-506.869	-861.880	-5.708.517	-3.045.564	0	-75.900	-8.829.980	-180.782	2.864.782
-106.392	-509.576	-862.782	-5.774.438	-2.839.304	0	-75.900	-8.689.642	268.631	3.107.935
-106.392	-512.284	-868.992	-5.812.990	-2.688.054	0	-75.900	-8.576.943	703.674	3.391.727
-106.392	-515.071	-869.949	-5.953.971	-2.662.498	0	-75.900	-8.692.369	924.574	3.587.072
-106.392	-517.779	-876.214	-6.013.891	-2.689.954	-1.177.350	-75.900	-9.957.095	909.844	3.599.798
-2.127.840	-9.519.157	-15.577.702	-105.592.936	-51.053.194	-1.177.350	-1.620.300	-159.443.780	-17.300.527	33.752.667
-1.336.818	-5.890.247	-9.569.600	-64.909.597	-31.268.307	-496.789	-1.049.243	-97.723.937	-14.356.219	16.912.089
-1,60%	-7,07%	-11,48%	-77,86%	-37,51%	-0,60%	-1,26%	-117,22%	-17,22%	20,29%
-111.992	-501.008	-819.879	-5.557.523	-2.687.010	-61.966	-85.279	-8.391.778	-910.554	1.776.456
-70.359	-310.013	-503.663	-3.416.295	-1.645.700	-26.147	-55.223	-5.143.365	-755.590	890.110

FINANCING COSTS		FINANCING COSTS		GRANTS	PROFIT (-LOSS)	PROFIT (-LOSS)
Interest Costs	Commitment Fees	Management Fees	Total Financing Costs	Investment Grants	PROFIT (-LOSS)	PROFIT (-LOSS) + DEPRECIATION COSTS
(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)	(EURO/year)
-3.566	-52.018	0	-55.584	0	-81.984	-81.984
-83.376	-25.414	-106.413	-215.203	0	-291.103	-291.103
-159.619	0	0	-159.619	584.544	-3.113.991	-1.079.425
-153.480	0	0	-153.480	584.544	-2.674.075	-639.510
-143.282	-1.373	-4.132	-148.786	599.778	-2.232.960	-198.395
-133.083	0	0	-133.083	599.778	-1.797.797	291.846
-121.824	-340	0	-122.163	607.241	-1.400.534	689.109
-117.755	-6.086	-17.139	-140.981	661.803	-712.265	1.547.712
-117.815	-1.802	0	-119.616	701.388	-508.009	1.995.677
-109.436	0	0	-109.436	701.388	-401.585	2.258.951
-94.663	0	0	-94.663	705.120	-257.694	2.428.399
-105.365	-14.314	-45.610	-165.288	891.695	33.007	2.732.828
-124.799	-2.911	0	-127.711	955.662	425.064	2.938.380
-114.960	0	0	-114.960	955.662	253.482	3.132.884
-92.586	0	0	-92.586	963.125	497.965	3.377.367
-70.212	0	0	-70.212	963.125	707.729	3.589.032
-53.977	0	0	-53.977	1.003.549	1.029.339	3.910.641
-43.881	0	0	-43.881	1.013.126	788.463	3.834.027
-33.785	0	0	-33.785	1.013.126	1.247.972	4.087.276
-23.948	0	0	-23.948	1.013.126	1.692.852	4.380.906
-14.369	0	0	-14.369	1.020.589	1.930.795	4.593.292
-4.790	0	0	-4.790	1.070.343	1.975.397	4.665.351
-1.920.570	-104.257	-173.293	-2.198.120	16.608.713	-2.889.934	48.163.260
-1.354.079	-91.302	-142.792	-1.588.173	9.945.828	-5.998.563	25.269.744
-1,62%	-0,11%	-0,17%	-1,91%	11,93%	-7,20%	30,31%
-101.083	-5.487	-9.121	-115.691	830.436	-131.361	2.189.239
-71.267	-4.805	-7.515	-83.588	497.291	-272.662	1.148.625

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
ALTERNATIVE SCENARIO (GRANT RATE: 52.35%)
PROJECT PROFIT (-LOSS) STATEMENTS (% OF TOTAL REVENUES)

Grant Rate		52,35%									
Financial Discount Rate (%)		4,0									
		COLLECTED REVENUES			COLLECTED REVENUES			OPERATING COST		OPERATING COST	
		Total Res. + Comm. Tariff Revenues	Total Recyclable Sales Revenues	Compost Sales Revenues	Electricity Sales Revenues	TOTAL REVENUES	Collection	Recycling	Composting	Transport	
Year	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	
2021	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	
2022	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	
2023	80,41	19,59	0,00	0,00	100,00	-82,49	-25,84	-3,76	-14,64		
2024	78,41	21,59	0,00	0,00	100,00	-69,66	-24,37	-3,11	-12,18		
2025	78,66	21,34	0,00	0,00	100,00	-59,92	-24,28	-2,66	-10,60		
2026	80,19	19,81	0,00	0,00	100,00	-53,47	-21,91	-2,34	-9,50		
2027	81,40	18,60	0,00	0,00	100,00	-49,54	-20,72	-2,08	-8,84		
2028	75,76	16,39	0,00	7,85	100,00	-42,67	-17,97	-1,75	-7,57		
2029	76,98	15,79	0,00	7,23	100,00	-40,58	-17,18	-1,61	-7,10		
2030	77,39	15,73	0,00	6,88	100,00	-39,47	-16,47	-1,54	-6,88		
2031	77,64	15,70	0,00	6,67	100,00	-38,64	-16,55	-1,49	-6,70		
2032	77,89	15,66	0,00	6,46	100,00	-37,67	-16,30	-1,44	-6,52		
2033	78,14	15,61	0,00	6,25	100,00	-36,82	-15,87	-1,40	-6,35		
2034	78,40	15,55	0,00	6,05	100,00	-36,14	-15,50	-1,35	-6,18		
2035	78,66	15,49	0,00	5,86	100,00	-35,00	-15,52	-1,31	-6,01		
2036	78,92	15,42	0,00	5,66	100,00	-33,89	-15,89	-1,26	-5,85		
2037	79,19	15,33	0,00	5,48	100,00	-32,81	-15,41	-1,22	-5,80		
2038	82,62	15,86	0,00	1,52	100,00	-33,41	-15,54	-1,23	-5,86		
2039	82,79	15,74	0,00	1,47	100,00	-32,55	-15,40	-1,19	-5,69		
2040	82,97	15,61	0,00	1,42	100,00	-31,58	-15,02	-1,15	-5,52		
2041	83,15	15,48	0,00	1,37	100,00	-30,83	-15,57	-1,11	-5,36		
2042	76,39	14,08	0,00	9,54	100,00	-27,72	-13,82	-0,98	-4,76		
UNDISCOUNTED TOTAL (2021-2042)	79,40	16,15	0,00	4,45	100,00	-38,37	-16,76	-1,50	-6,70		
DISCOUNTED TOTAL (2021-2042)	79,21	16,45	0,00	4,34	100,00	-40,42	-17,29	-1,60	-7,07		

OPERATING COST		OPERATING COST			OPERATING COST	Operating Surplus	Operating Surplus	FINANCING COSTS	
Disposal	TOTAL OPERATING SERVICE COSTS	DEPRECIATION COSTS	Aftercare Costs	Administrative Costs	TOTAL NET OPERATING COSTS	Total Operating Revenues-Total O & M Costs	Total Operating Revenues-Total O & M Costs + Depr. Costs	Interest Costs	Commitment Fees
% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
-23,74	-150,47	-71,89	0,00	-2,68	-225,04	-125,04	-53,15	-5,64	0,00
-19,72	-129,04	-59,39	0,00	-2,22	-190,64	-90,64	-31,25	-4,48	0,00
-16,89	-114,35	-50,92	0,00	-1,90	-167,18	-67,18	-16,25	-3,59	-0,03
-14,96	-102,17	-45,91	0,00	-1,67	-149,75	-49,75	-3,84	-2,92	0,00
-13,34	-94,52	-40,93	0,00	-1,49	-136,93	-36,93	4,00	-2,39	-0,01
-11,86	-81,83	-37,23	0,00	-1,25	-120,32	-20,32	16,92	-1,94	-0,10
-10,92	-77,40	-37,98	0,00	-1,15	-116,53	-16,53	21,45	-1,79	-0,03
-10,47	-74,83	-38,43	0,00	-1,10	-114,35	-14,35	24,08	-1,58	0,00
-10,12	-73,51	-37,58	0,00	-1,06	-112,15	-12,15	25,43	-1,32	0,00
-9,86	-71,79	-36,58	0,00	-1,03	-109,39	-9,39	27,18	-1,43	-0,19
-10,89	-71,32	-32,97	0,00	-1,00	-105,28	-5,28	27,68	-1,64	-0,04
-10,77	-69,93	-36,56	0,00	-0,96	-107,46	-7,46	29,10	-1,46	0,00
-10,43	-68,27	-35,38	0,00	-0,93	-104,58	-4,58	30,80	-1,14	0,00
-10,16	-67,05	-34,25	0,00	-0,90	-102,20	-2,20	32,05	-0,83	0,00
-9,84	-65,08	-33,13	0,00	-0,87	-99,08	0,92	34,05	-0,62	0,00
-9,96	-66,00	-35,21	0,00	-0,88	-102,09	-2,09	33,12	-0,51	0,00
-9,63	-64,46	-31,69	0,00	-0,85	-97,00	3,00	34,69	-0,38	0,00
-9,36	-62,64	-28,96	0,00	-0,82	-92,42	7,58	36,55	-0,26	0,00
-9,05	-61,91	-27,69	0,00	-0,79	-90,39	9,61	37,30	-0,15	0,00
-8,06	-55,34	-24,75	-10,83	-0,70	-91,63	8,37	33,13	-0,04	0,00
-10,96	-74,29	-35,92	-0,83	-1,14	-112,17	-12,17	23,75	-1,35	-0,07
-11,48	-77,86	-37,51	-0,60	-1,26	-117,22	-17,22	20,29	-1,62	-0,11

FINANCING COSTS		GRANTS	PROFIT (-LOSS)	PROFIT (-LOSS)
Management Fees	Total Financing Costs	Investment Grants	PROFIT (-LOSS)	PROFIT (-LOSS) + DEPRECIATION COSTS
% OF REV.	% OF REV.	% OF REV.	% OF REV.	% OF REV.
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
0,00	-5,64	20,65	-110,03	-38,14
0,00	-4,48	17,06	-78,06	-18,67
-0,10	-3,72	15,01	-55,89	-4,97
0,00	-2,92	13,18	-39,50	6,41
0,00	-2,39	11,89	-27,43	13,50
-0,28	-2,32	10,90	-11,73	25,50
0,00	-1,81	10,64	-7,71	30,28
0,00	-1,58	10,13	-5,80	32,63
0,00	-1,32	9,86	-3,61	33,97
-0,62	-2,24	12,08	0,45	37,02
0,00	-1,68	12,54	5,58	38,54
0,00	-1,46	12,13	3,22	39,78
0,00	-1,14	11,83	6,12	41,50
0,00	-0,83	11,45	8,41	42,66
0,00	-0,62	11,54	11,84	44,96
0,00	-0,51	11,71	9,12	44,33
0,00	-0,38	11,31	13,93	45,63
0,00	-0,26	10,92	18,24	47,20
0,00	-0,15	10,61	20,08	47,76
0,00	-0,04	9,85	18,18	42,93
-0,12	-1,55	11,68	-2,03	33,88
-0,17	-1,91	11,93	-7,20	30,31

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
ALTERNATIVE SCENARIO (GRANT RATE: 52.35%)
PROJECT BALANCE SHEETS (EURO)

Grant Rate	52,35%									
	Current Assets	Long-term Assets					Current Liab.	Long-term Liab.	Long-term Liab.	Long-term Liab.
	Cash and Cash Equivalents	Gross Fixed Assets	Accumulated Depreciation (-)	Net Fixed Assets	Total Assets	Current Maturity of Long-term Loans	Investment Grants	Long-term Bank Loans	Total Long-term Liabilities	
Year	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	EUR	
2021	0	997.920	0	997.920	997.920	0	522.411	475.509	997.920	
2022	0	22.332.159	0	22.332.159	22.332.159	0	11.690.880	10.641.279	22.332.159	
2023	-1.663.969	22.332.159	-2.034.565	20.297.594	18.633.625	818.560	11.106.336	9.822.719	20.929.055	
2024	-3.706.583	22.332.159	-4.069.131	18.263.029	14.556.445	818.560	10.521.792	9.004.159	19.525.952	
2025	-5.323.316	22.914.161	-6.103.696	16.810.464	11.487.148	818.560	10.226.692	8.462.923	18.689.615	
2026	-6.449.808	22.914.161	-8.193.340	14.720.821	8.271.013	818.560	9.626.914	7.644.363	17.271.277	
2027	-7.186.500	23.199.281	-10.282.983	12.916.298	5.729.798	852.992	9.168.933	6.927.231	16.096.164	
2028	-9.427.299	27.557.520	-12.542.960	15.014.560	5.587.262	852.992	9.598.378	7.067.515	16.665.893	
2029	-8.986.002	29.069.844	-15.046.646	14.023.199	5.037.197	984.830	9.688.691	6.803.308	16.491.999	
2030	-8.668.826	29.325.402	-17.707.183	11.618.219	2.949.393	984.830	8.987.303	5.818.478	14.805.780	
2031	-7.998.308	29.467.962	-20.393.275	9.074.686	1.076.379	984.830	8.356.813	4.833.647	13.190.460	
2032	-8.272.255	37.726.212	-23.093.096	14.633.116	6.360.860	984.830	11.196.624	7.245.311	18.441.935	
2033	-17.079.646	49.975.291	-25.606.412	24.368.879	7.289.234	1.491.604	11.520.292	6.918.178	18.438.470	
2034	-16.394.028	49.975.291	-28.485.814	21.489.477	5.095.449	1.491.604	10.564.630	5.426.574	15.991.204	
2035	-15.871.249	50.524.411	-31.365.217	19.159.194	3.287.945	1.491.604	9.750.766	3.934.970	13.685.736	
2036	-14.736.946	50.524.411	-34.246.519	16.277.892	1.540.946	673.044	8.787.641	3.261.926	12.049.567	
2037	-13.502.806	52.332.811	-37.127.822	15.204.989	1.702.184	673.044	8.592.585	2.588.881	11.181.466	
2038	-13.259.964	54.429.368	-40.173.386	14.255.982	996.018	673.044	7.771.000	1.915.837	9.686.837	
2039	-10.858.859	54.429.368	-43.012.689	11.416.679	557.820	638.612	6.757.874	1.277.225	8.035.099	
2040	-8.129.692	54.429.368	-45.700.743	8.728.625	598.934	638.612	5.744.747	638.612	6.383.360	
2041	-5.463.461	54.846.488	-48.363.240	6.483.248	1.019.787	638.612	4.873.418	0	4.873.418	
2042	2.281.297	51.053.194	-51.053.194	0	2.281.297	0	4.798.144	0	4.798.144	

Equities	Equities	Equities	Equities	Equities	Liab.+Equities
Profits (-Loss) For Period	Accumulated Profits (- Losses)	IDC Financing By Municipalities	Administrative Cost Financing By Municipalities	Total Equities	Total Short/Long- term Liab.+ Equities
EUR	EUR	EUR	EUR	EUR	EUR
-81.984	0	55.584	26.400	0	997.920
-291.103	-81.984	270.787	102.300	0	22.332.159
-3.113.991	-373.087	270.787	102.300	-3.113.991	18.633.625
-2.674.075	-3.487.078	270.787	102.300	-5.788.066	14.556.445
-2.232.960	-6.161.153	270.787	102.300	-8.021.027	11.487.148
-1.797.797	-8.394.114	270.787	102.300	-9.818.824	8.271.013
-1.400.534	-10.191.911	270.787	102.300	-11.219.358	5.729.798
-712.265	-11.592.445	270.787	102.300	-11.931.624	5.587.262
-508.009	-12.304.711	270.787	102.300	-12.439.632	5.037.197
-401.585	-12.812.719	270.787	102.300	-12.841.218	2.949.393
-257.694	-13.214.305	270.787	102.300	-13.098.911	1.076.379
33.007	-13.471.998	270.787	102.300	-13.065.905	6.360.860
425.064	-13.438.992	270.787	102.300	-12.640.841	7.289.234
253.482	-13.013.928	270.787	102.300	-12.387.359	5.095.449
497.965	-12.760.446	270.787	102.300	-11.889.395	3.287.945
707.729	-12.262.482	270.787	102.300	-11.181.665	1.540.946
1.029.339	-11.554.753	270.787	102.300	-10.152.327	1.702.184
788.463	-10.525.414	270.787	102.300	-9.363.863	996.018
1.247.972	-9.736.951	270.787	102.300	-8.115.891	557.820
1.692.852	-8.488.978	270.787	102.300	-6.423.039	598.934
1.930.795	-6.796.126	270.787	102.300	-4.492.244	1.019.787
1.975.397	-4.865.331	270.787	102.300	-2.516.847	2.281.297

IMPROVEMENT OF THE SWM SERVICES IN POLOG REGION, NORTH MACEDONIA
ALTERNATIVE SCENARIO (GRANT RATE: 52.35%)
PROJECT BALANCE SHEETS (AS % OF TOTAL ASSETS / LIABILITIES)

Grant Rate	52,35%							
	Current Assets	Long-term Assets				Current Liab.	Long-term Liab.	Long-term Liab.
	Cash and Cash Equivalents	Gross Fixed Assets	Accumulated Depreciation (-)	Net Fixed Assets	Total Assets	Current Maturity of Long-term Loans	Investment Grants	Long-term Bank Loans
Year	% of Total Assets	% of Total Assets	% of Total Assets	% of Total Assets	% of Total Assets	% of Total Liab.	% of Total Liab.	% of Total Liab.
2021	0,00	100,00	0,00	100,00	100,00	0,00	52,35	47,65
2022	0,00	100,00	0,00	100,00	100,00	0,00	52,35	47,65
2023	-8,93	119,85	-10,92	108,93	100,00	4,39	59,60	52,72
2024	-25,46	153,42	-27,95	125,46	100,00	5,62	72,28	61,86
2025	-46,34	199,48	-53,14	146,34	100,00	7,13	89,03	73,67
2026	-77,98	277,04	-99,06	177,98	100,00	9,90	116,39	92,42
2027	-125,42	404,89	-179,47	225,42	100,00	14,89	160,02	120,90
2028	-168,73	493,22	-224,49	268,73	100,00	15,27	171,79	126,49
2029	-178,39	577,10	-298,71	278,39	100,00	19,55	192,34	135,06
2030	-293,92	994,29	-600,37	393,92	100,00	33,39	304,72	197,28
2031	-743,08	2.737,69	-1.894,62	843,08	100,00	91,49	776,38	449,07
2032	-130,05	593,10	-363,05	230,05	100,00	15,48	176,02	113,90
2033	-234,31	685,60	-351,29	334,31	100,00	20,46	158,05	94,91
2034	-321,74	980,78	-559,04	421,74	100,00	29,27	207,33	106,50
2035	-482,71	1.536,66	-953,95	582,71	100,00	45,37	296,56	119,68
2036	-956,36	3.278,79	-2.222,44	1.056,36	100,00	43,68	570,28	211,68
2037	-793,26	3.074,45	-2.181,19	893,26	100,00	39,54	504,80	152,09
2038	-1.331,30	5.464,70	-4.033,40	1.431,30	100,00	67,57	780,21	192,35
2039	-1.946,66	9.757,52	-7.710,86	2.046,66	100,00	114,48	1.211,48	228,97
2040	-1.357,36	9.087,71	-7.630,35	1.457,36	100,00	106,62	959,16	106,62
2041	-535,75	5.378,23	-4.742,49	635,75	100,00	62,62	477,89	0,00
2042	100,00	2.237,90	-2.237,90	0,00	100,00	0,00	210,33	0,00

Long-term Liab.	Equities	Equities	Equities	Equities	Equities	Liab.+Equities
Total Long-term Liabilities	Profits (-Loss) For Period	Accumulated Profits (-Losses)	IDC Financing By Municipalities	Administrative Cost Financing By Municipalities	Total Equities	Total Short/Long-term Liab.+ Equities
% of Total Liab.	% of Total Liab.	% of Total Liab.	% of Total Liab.	% of Total Liab.	% of Total Liab.	% of Total Liab.
100,00	-8,22	0,00	5,57	2,65	0,00	100,00
100,00	-1,30	-0,37	1,21	0,46	0,00	100,00
112,32	-16,71	-2,00	1,45	0,55	-16,71	100,00
134,14	-18,37	-23,96	1,86	0,70	-39,76	100,00
162,70	-19,44	-53,64	2,36	0,89	-69,83	100,00
208,82	-21,74	-101,49	3,27	1,24	-118,71	100,00
280,92	-24,44	-177,88	4,73	1,79	-195,81	100,00
298,28	-12,75	-207,48	4,85	1,83	-213,55	100,00
327,40	-10,09	-244,28	5,38	2,03	-246,96	100,00
501,99	-13,62	-434,42	9,18	3,47	-435,39	100,00
1.225,45	-23,94	-1.227,66	25,16	9,50	-1.216,94	100,00
289,93	0,52	-211,80	4,26	1,61	-205,41	100,00
252,95	5,83	-184,37	3,71	1,40	-173,42	100,00
313,83	4,97	-255,40	5,31	2,01	-243,11	100,00
416,24	15,15	-388,10	8,24	3,11	-361,61	100,00
781,96	45,93	-795,78	17,57	6,64	-725,64	100,00
656,89	60,47	-678,82	15,91	6,01	-596,43	100,00
972,56	79,16	-1.056,75	27,19	10,27	-940,13	100,00
1.440,45	223,72	-1.745,54	48,54	18,34	-1.454,93	100,00
1.065,79	282,64	-1.417,35	45,21	17,08	-1.072,41	100,00
477,89	189,33	-666,43	26,55	10,03	-440,51	100,00
210,33	86,59	-213,27	11,87	4,48	-110,33	100,00