METHODOLOGY FOR ESTABLISHMENT OF AN INTEGRATED AND FINANCIALLY SELF SUSTAINABLE WASTE MANAGEMENT SYSTEM - THE CASE STUDY OF PELAGONIJA, SOUTHWEST, VARDAR AND SKOPJE REGIONS

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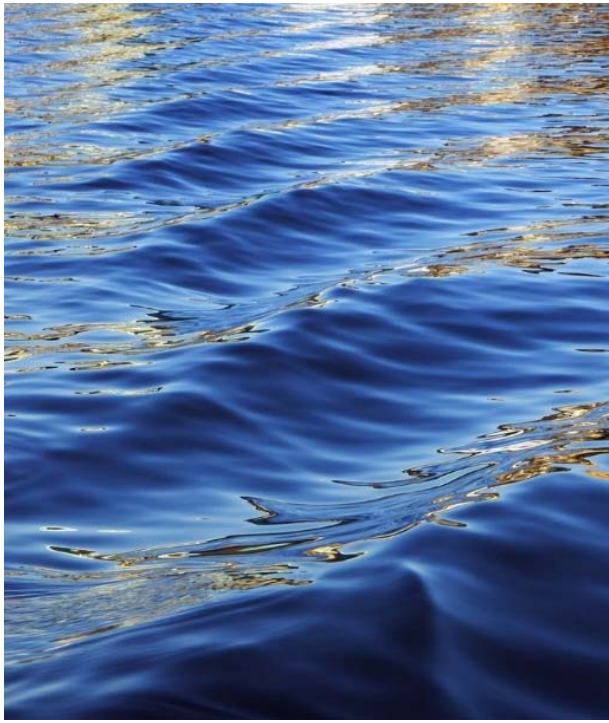

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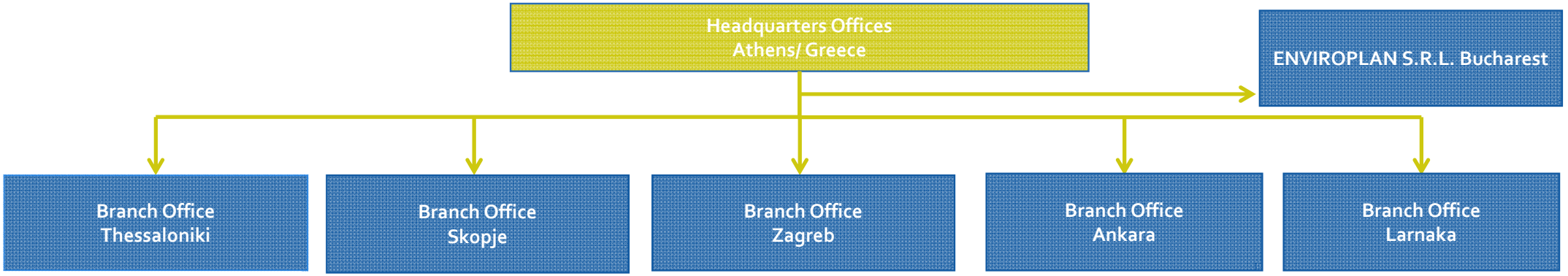

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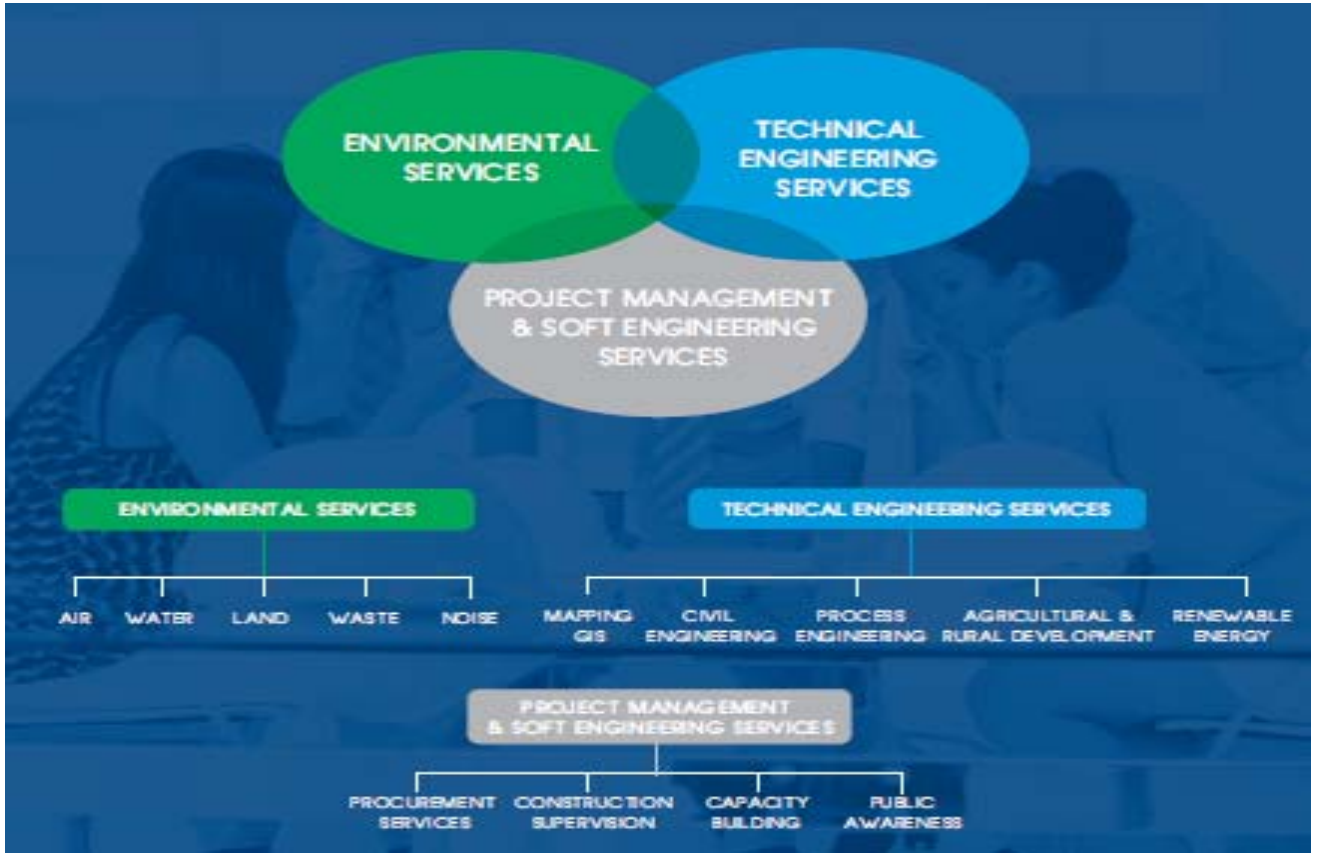

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  - ✓ World Bank (W.B.)
  - ✓ Local authorities/Ministries
  - ✓ Waste Management Organizations-Public Utility Companies
  - ✓ Private sector

Project Background

"Preparation of necessary documents for establishing of an Integrated and Financially Self-sustainable Waste Management System in Pelagonija, Southwest, Vardar and Skopje Regions"

Financing	EU
Contracting Authority	Central Financing and Contracting Department (CFCD) within the Ministry of Finance
Target groups-Beneficiaries	▪ MoEPP ▪ Intermunicipal Waste Management Board of the Pelagonija, Southwest, Vardar and Skopje regions ▪ 43 municipalities in the 4 regions
Project duration	24 months (12.2015 – 12.2017)
Project activities	Elaboration of: ▪ Regional Waste Management Plans ▪ Strategic Environmental Assessments ▪ Feasibility Studies & Cost-benefit Analyses ▪ Environmental Impact Assessment Studies ▪ Detailed Designs ▪ Needs Assessments-Market Analyses-Technical Specifications ▪ Tender Dossiers

Project Background

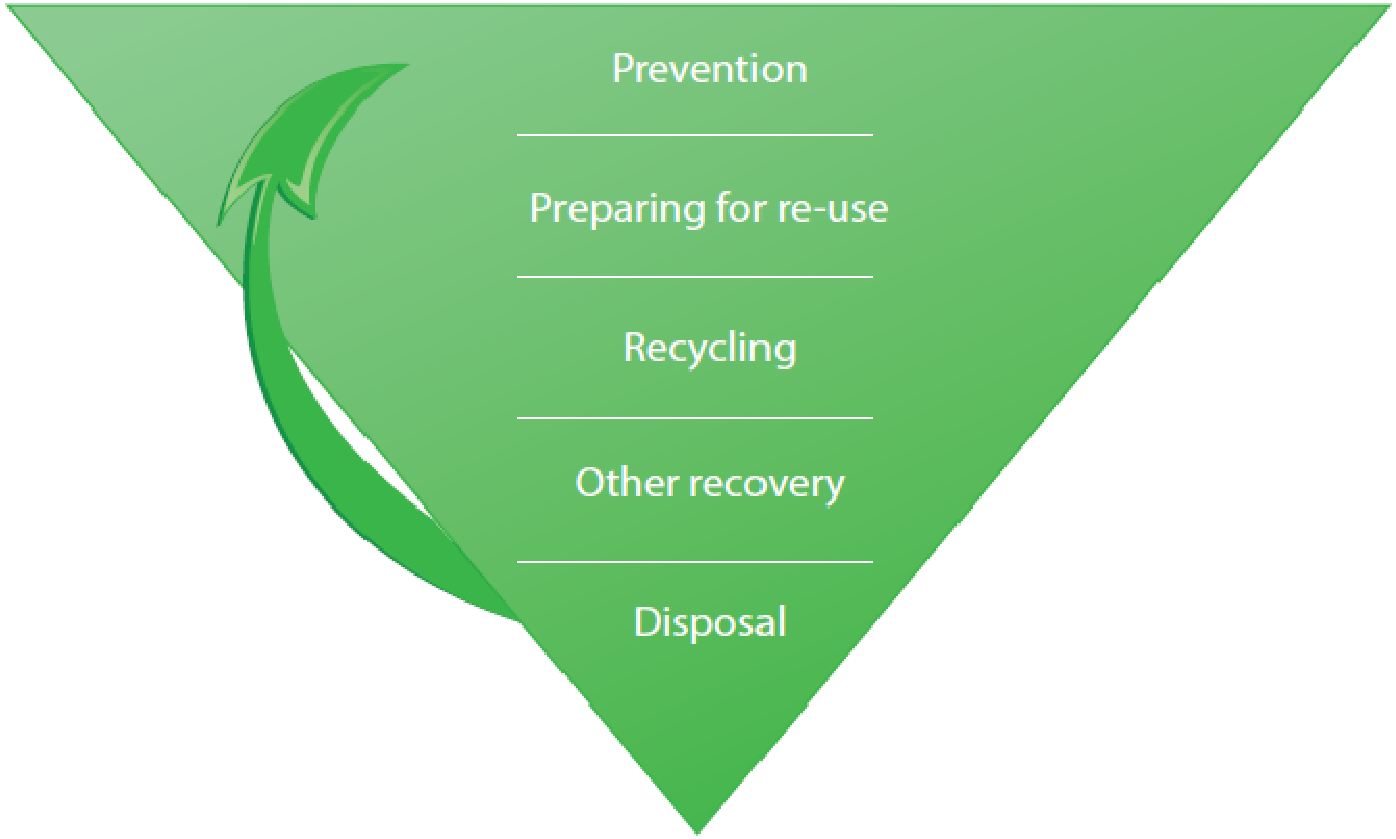
Republic of Macedonia, the 4 regions

VARDAR REGION	PELAGONIJA REGION	SKOPJE REGION	SOUTHWEST REGION
135,224 inhabitants or 6.5 % of the total population	231,137 inhabitants or 11.2% of the total population	619,279 inhabitants or 29.9% of the total population	219,981 inhabitants or 10.6% of the total population
population density 37.9 inhabitants/km^2	population density 49.0 inhabitants/km^2	population density 341.6 inhabitants/km^2	population density 65.8 inhabitants/km^2
8 municipalities (Sv. Nicole Municipality is included in Regional Planning of East Region)	9 municipalities	17 municipalities	9 municipalities
covers 16.2% of the total area	covers 18.9% of the total area	covers 7.3% of the total area	covers 13.4% of the total area

ESTABLISHMENT OF AN INTEGRATED WASTE MANAGEMENT SYSTEM (IWMS)

Legal and regulatory framework

Waste management hierarchy



ESTABLISHMENT OF AN INTEGRATED WASTE MANAGEMENT SYSTEM (IWMS)

National Legislation

Law on waste management

- Settles the framework and provides general rules for all types of waste and provides the legal basis for the secondary legislation.
- Has important links to other Laws related to tasks and responsibilities regarding administrative, organizational and operational issues in waste management, in particular to the Law on the Environment, which includes basic provisions on environmental permitting, EIA procedure and greenhouse gas emissions.
- Introduces the following documents:

National Strategy for Solid Waste Management

National Plan for Solid Waste Management

Regional Plans for SWM

Municipal Plans for SWM

Municipal Programs for SWM

Law on packaging and packaging waste

According article 35 (National aims for treatment of packaging waste), paragraphs (1) b, (1) c & (1) d of Law on management of Packaging and Packaging waste the following should be fulfilled

- ❖ By the end of the year 2020, a minimum of 55% and a maximum of 80% of the weight of packaging waste created on the territory of the Republic of Macedonia needs to be recycled
- ❖ By the end of the year 2020, the following percentages of materials where from the packaging waste is produced need to be recycled
- ✓ 60% glass
- ✓ 60% paper and cardboard
- ✓ 50% metals
- ✓ 15% wood
- ❖ By the end of the year 2018 22,5% plastic, considering only the recyclable materials in the plastic

Targets for biodegradable municipal waste landfilled (Article 87 LoWM)

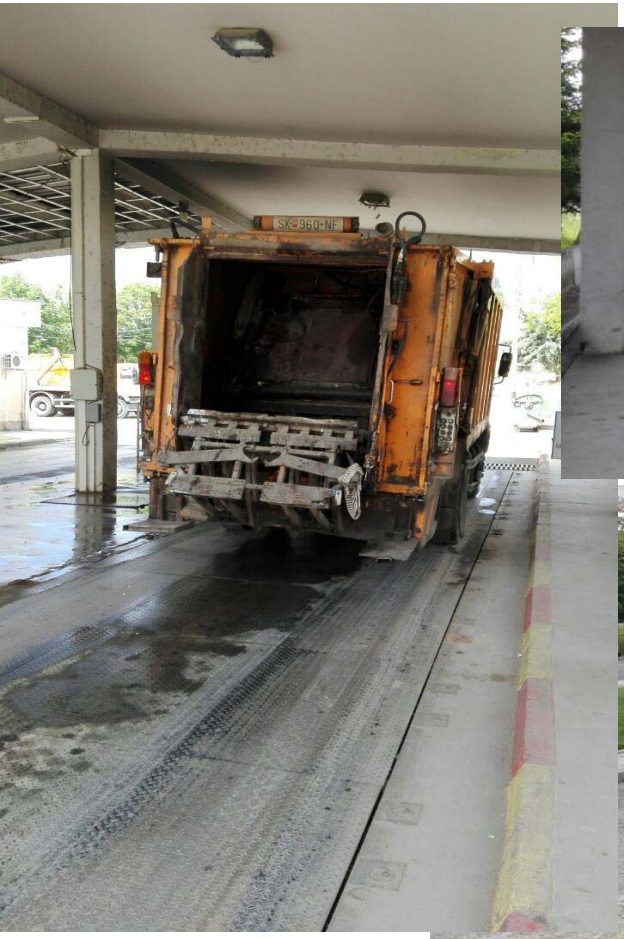
Year	Quantity of BMW landfilled, expressed as a mass percentage of MSW generated in 1995	Reduction of the quantity of BMW landfilled, expressed as a percentage reduction of the BMW generated in 1995
Reference year 1995	62%	
2017	47%	25%
2020	31%	50%
2027	22%	65%

ESTABLISHMENT OF AN INTEGRATED WASTE MANAGEMENT SYSTEM (IWMS)

Current situation identification

- The first task necessary to be covered, for the successful implementation of IWM was the analysis of the current situation
- Questionnaires were distributed
- Quantitative determination was elaborated
- Qualitative analysis was carried out
- Existing non compliant municipal landfills and dumpsites survey was executed
- Many sources were analyzed
- An assessment report was prepared for each one of the 4 regions

QUANTITATIVE DETERMINATION



QUANTITATIVE DETERMINATION

ESTABLISHMENT OF AN INTEGRATED WASTE MANAGEMENT SYSTEM (IWMS)

Quantitative Determination/Summarized results

Data derived from waste measurements in combination with information from questionnaires					
	Population 2016 (Permanent and seasonal population)	Annual waste collection (t)	Annual waste production (t)	Collection coverage %	Weighted Waste Generation (kg/ca/yr)
Skopje Region	621,518	150,065	162,883	92%	262
Southwest Region	224,371	46,826	56,224	83%	251
Pelagonija Region	231,688	62,255	70,604	88%	305
Vardar Region	135,317	35,654	37,853	94%	280

Countries *(Source: EUROSTAT)*	**Waste generation rate (kg/ca/y), 2014**
European Union (28 countries)	474
Bosnia and Herzegovina	349
Croatia	387
Serbia	302
Bulgaria	442
Slovenia	432
Slovakia	321
Hungary	385
Estonia	357
Italy	488
Spain	435
Portugal	453
Turkey	405
Cyprus	617
Czech Republic	310
Poland	272
Latvia	325
Lithuania	433
Belgium	435
Denmark	758
Germany	618
Greece	509
France	509
Luxembourg	616
Netherlands	527
Austria	566
Finland	482

PRODUCED MUNICIPAL WASTE

- Permanent and seasonal population forecasting
- Forecasting of waste generation rate regarding permanent and seasonal population
- Calculation of total generated municipal waste

Year	2016	2021	2026	2031	2036	2041	2046
Total Produced Waste (t) in Vardar Region	37,853	41,510	42,010	42,304	42,038	41,577	40,960

Year	2016	2021	2026	2031	2036	2041	2046
Total Produced Waste(t) in Pelagonija Region	70,604	77,342	78,793	79,697	79,515	78,942	78,052

Year	2016	2021	2026	2031	2036	2041	2046
Total Produced Waste (t) in Southwest Region	56,224	61,815	63,125	64,103	63,457	62,553	61,450

Year	2016	2021	2026	2031	2036	2041	2046
Total Produced Waste (t) in Skopje Region	162,883	179,729	183,834	187,627	188,892	189,113	188,456

ESTABLISHMENT OF AN INTEGRATED WASTE MANAGEMENT SYSTEM (IWMS)
Qualitative Analysis

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Qualitative Analysis

ESTABLISHMENT OF AN INTEGRATED WASTE MANAGEMENT SYSTEM (IWMS)
Summarized Results

Fractions/Regions	Pelagonija	Southwest	Vardar	Skopje
Garden waste	18.22%	14,3%	13.8%	14.1%
Other biodegradable waste	33.04%	30,9%	36.8%	28.2%
Paper	8.51%	7,0%	9.3%	7.8%
Cardboard	3.18%	5,5%	5.0%	5.8%
Glass	5.76%	5,0%	3.5%	4.6%
Metals (ferrous)	0.84%	1,6%	0.8%	1.1%
Aluminum (non-ferrous)	0.62%	1,0%	0.5%	0.7%
Composite Materials	1.40%	1,5%	2.0%	1.6%
Plastic packaging waste	1.32%	1,6%	1.6%	4.3%
Plastic bags	4.63%	6,3%	6.1%	7.8%
PET bottles	2.27%	3,0%	2.1%	3.5%
Other plastic	1.39%	2,2%	0.8%	2.3%
Textile	4.04%	6,7%	2.8%	5.4%
Leather	0.65%	1,2%	1.3%	1.0%
Diapers	5.21%	6,6%	6.3%	6.1%
Wood	0.56%	1,0%	0.8%	0.6%
Construction and demolition material	1.43%	1,2%	3.2%	1.7%
WEEE	0.35%	0,7%	0.3%	0.4%
Hazardous materials (Medical waste)	0.09%	0,7%	0.1%	0.2%
Other special waste streams (Elastic - tyres etc)	1.13%	0,3%	0.4%	0.5%
Fine fraction (<10 mm)	5.36%	1,7%	2.6%	2.2%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Fractions	Pelagonija	Southwest	Vardar	Skopje
Organic Waste	51.3%	45.2%	50.6%	42.3%
Recyclables	29.9%	34.7%	31.6%	39.5%
Textile-Leather-Wood-Elastic/Tires	6.4%	9.2%	5.3%	7.6%
Diapers	5.2%	6.6%	6.3%	6.1%
C &D material	1.4%	1.2%	3.2%	1.7%
Other waste streams (WEEE, Medical)	0.4%	1.4%	0.4%	0.6%
Fine fraction (<10 mm)	5.4%	1.7%	2.6%	2.2%
Total	100.0%	100.0%	100.0%	100.0%

ESTABLISHMENT OF AN INTEGRATED WASTE MANAGEMENT SYSTEM (IWMS)

Photos from non compliant landfills and dumpsites in the 4 regions

ESTABLISHMENT OF AN INTEGRATED WASTE MANAGEMENT SYSTEM (IWMS)

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Photos from non compliant landfills and dumpsites in the 4 regions

ESTABLISHMENT OF AN INTEGRATED WASTE MANAGEMENT SYSTEM (IWMS)
Existing municipal non compliant landfills and dumpsites

Regions	Pelagonija	Southwest	Vardar	Skopje	Total
Identified municipal non compliant landfills and dumpsites					
Municipal non compliant landfills (Includes also closed landfills)	9	12	9	3	**33**
Dumpsites	109	85	28	57	**279**
Total	118	97	37	60	**312**
Risk evaluation					
Percentage of high risk	5%	5%	5%	10%	**6%**
Percentage of medium risk	94%	95%	95%	85%	**93%**
Percentage of low risk	1%			5%	**1%**

Region	Pelagonija	Southwest	Vardar	Skopje	Total	
Type of rehabilitation						
Waste Removal (cleaning/ sanitation)	112	87	28	51	**278**	**90%**
In situ rehabilitation	6	10	9	9	**34**	**10%**

Alternative examined scenarios for IWMS

Overview of proposed scenarios for the regions

	1a (AC)	1b (AD)	1c (Inc.)	2	3a (MRF+ AC)	3b (MRF+ AD)	3c (MRF + MBS)	4 (MBT)
Waste Collection	1 bin			2 bins Mixed + Biowaste	2 bins Mixed + Recyclables			3 bins Mixed + Recyclables + Biowaste
Green Points	√	√	√	√	√	√	√	√
Home Composting	√	√	√	-	√	√	√	-
Mixed Bin Treatment	MBT with AC	MBT with AD	Inc.	MRF	MBT with AC	MBT with AD	MBS	Disposal to Landfill
Recyclable waste bin treatment	-	-	-	-	MRF	MRF	MRF	MRF
Organic waste bin treatment	-	-	-	AC	-	-	-	AC
Green waste treatment	AC	AC	Inc.	AC	AC	AC	AC	AC
Landfill	√	√	√	√	√	√	√	√

MBT: Mechanical Biological Treatment; MBS: Mechanical Biological Stabilization; AC: Aerobic Composting; AD: Anaerobic Digestion; Inc: incineration

Multi Criteria Analysis (MCA)

PROMETHEE MCA method used in order to evaluate the different waste management scenarios. The analysis involves three main phases (a) the setting of criteria, (b) the weighting of criteria, (c) the ranking of alternative schemes
The groups of criteria and individual criteria that was examined are presenting in the following table

Financial	Technical	Environmental	Social-Institutional
(F1) Investment cost	(T1) Flexibility regarding waste quantity	(E1) Air pollution	(S1) Application of priority of legislation
(F2) Net operational cost	(T2) Flexibility regarding waste quality	(E2) Generation of waste water	(S2) Possibility of creation of new jobs
(F3) Levelized Unit Cost	(T3) Simplicity	(E3) Generation of solid waste residues	(S3) Degree of fulfillment of targets
	(T4) Energetic exploitation	(E4) Toxicity of residues	(S4) Public acceptance
	(T5) Recovery of materials		(S5) Transition to future conditions

The weights of each sub-criterion have been determined

Financial Criteria	Weights %
F1	25%
F2	40%
F3	35%

Technical Criteria	Weights %
T1	25%
T2	25%
T3	20%
T4	15%
T5	15%

Environmental Criteria	Weights %
E1	30%
E2	30%
E3	20%
E4	20%

Social-Institutional Criteria	Weights %
S1	20%
S2	10%
S3	30%
S4	25%
S5	15%

Multi Criteria Analysis (MCA)

Three scenarios regarding criteria weight have been used

Criteria	Group weights % *(Scenario weight A)*
Financial	25%
Technical	25%
Environmental	25%
Social-Institutional	25%

Criteria	Group weights % *(Scenario weight B)*
Financial	35%
Technical	30%
Environmental	25%
Social-Institutional	10%

Criteria	Group weights % *(Scenario weight C)*
Financial	30%
Technical	25%
Environmental	35%
Social-Institutional	10%

Each alternative scenario has been rating according each alternative criterion. All the criteria are benefit criteria, the higher the score the better the performance is.

Recommended options for IWMS

Overview of the recommended waste management scenarios

Overview of recommended scenarios

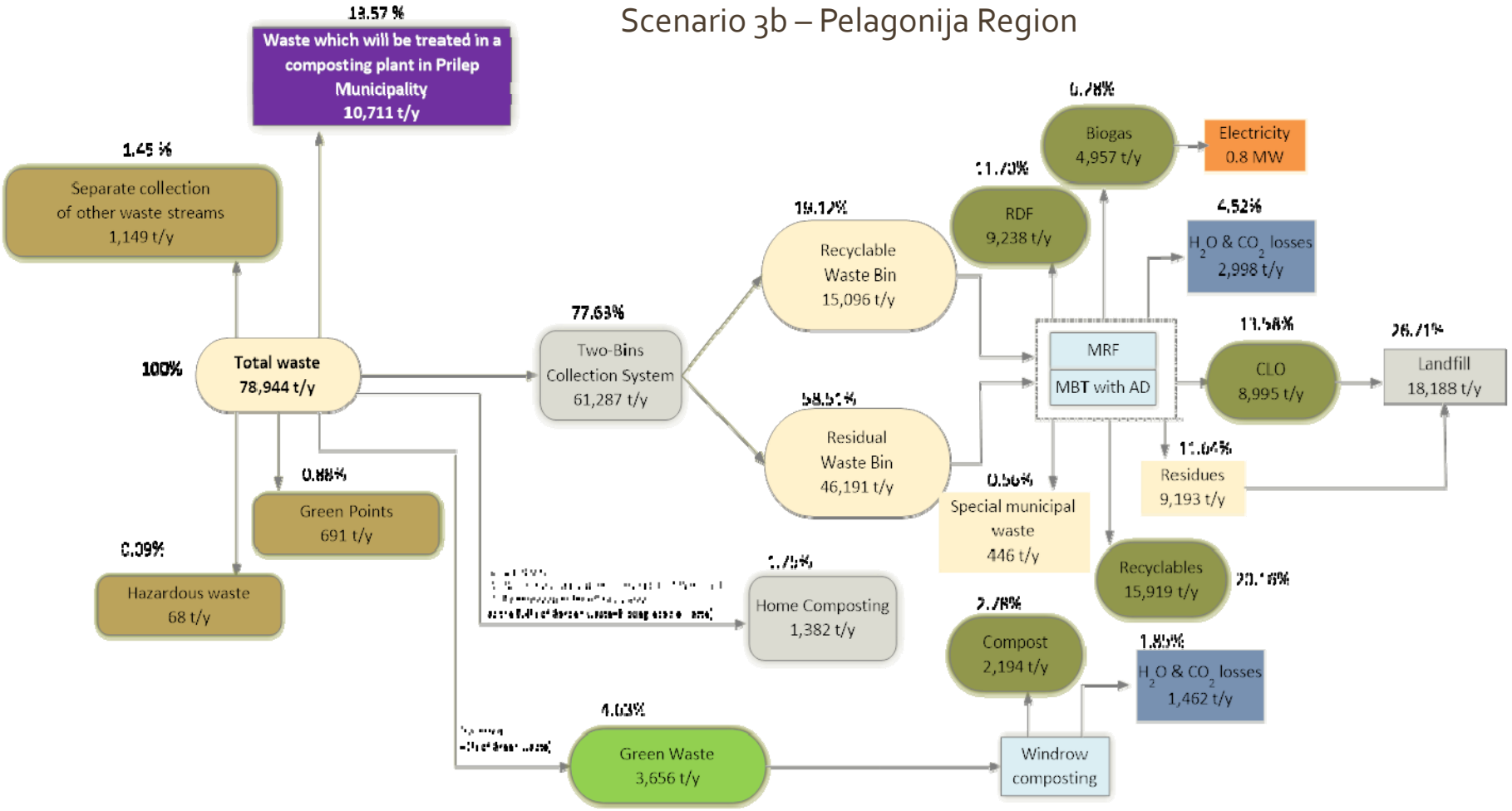
	Scenario 3b – Pelagonija Region	*Scenario 3b – Southwest Region*	*Scenario 3c – Vardar Region*	*Scenario 2 – Skopje Region*
Collection	✓ Two bins collection system (Recyclable Waste Bin and Residual Waste Bin) ✓ Green Points ✓ Separate Collection of Green Waste	✓ Two bins collection system (Recyclable Waste Bin and Residual Waste Bin) ✓ Green Points ✓ Separate Collection of Green Waste	✓ Two bins collection system (Recyclable Waste Bin and Residual Waste Bin) ✓ Green Points ✓ Separate Collection of Green Waste	✓ Two bins collection system (Recyclable Waste Bin and Residual Waste Bin) ✓ Green Points ✓ Separate Collection of Green Waste
Treatment of Recyclable Waste Bin	MRF	MRF	MRF	MRF
Treatment of Residual Waste Bin	MBT with AD and AC of digestate	MBT with AD and AC of digestate	MBS	MBT with biodrying
Treatment of Green Waste	AC	AC	AC	AC
Treatment at the Source	Home composting	Home composting	Home composting	Home composting
Products	✓ Compost ✓ Recyclables ✓ Biogas	✓ Compost ✓ Recyclables ✓ Biogas	✓ Compost ✓ Recyclables	✓ Compost ✓ Recyclables
Landfill	Residues from MRF Facility and MBT	Residues from MRF Facility and MBT	Residues from MRF Facility and Biostabilization Process	Residues from MRF Facility and Biostabilization Process

MBT: Mechanical Biological Treatment; MBS: Mechanical Biological Stabilization; AC: Aerobic Composting; AD: Anaerobic Digestion

Recommended options for IWMS

Overview of the recommended waste management scenarios

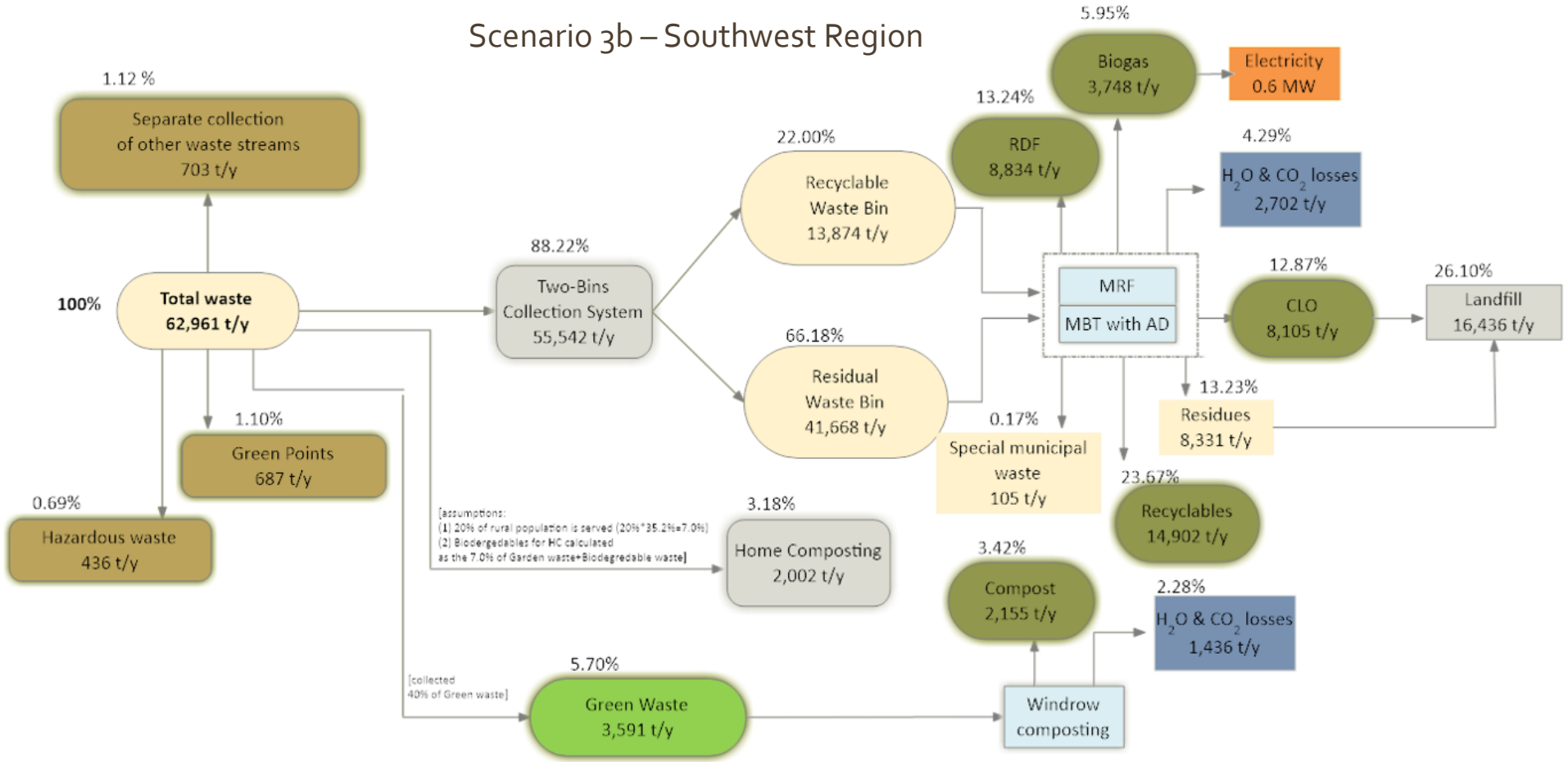
Scenario 3b – Pelagonija Region



Recommended options for IWMS

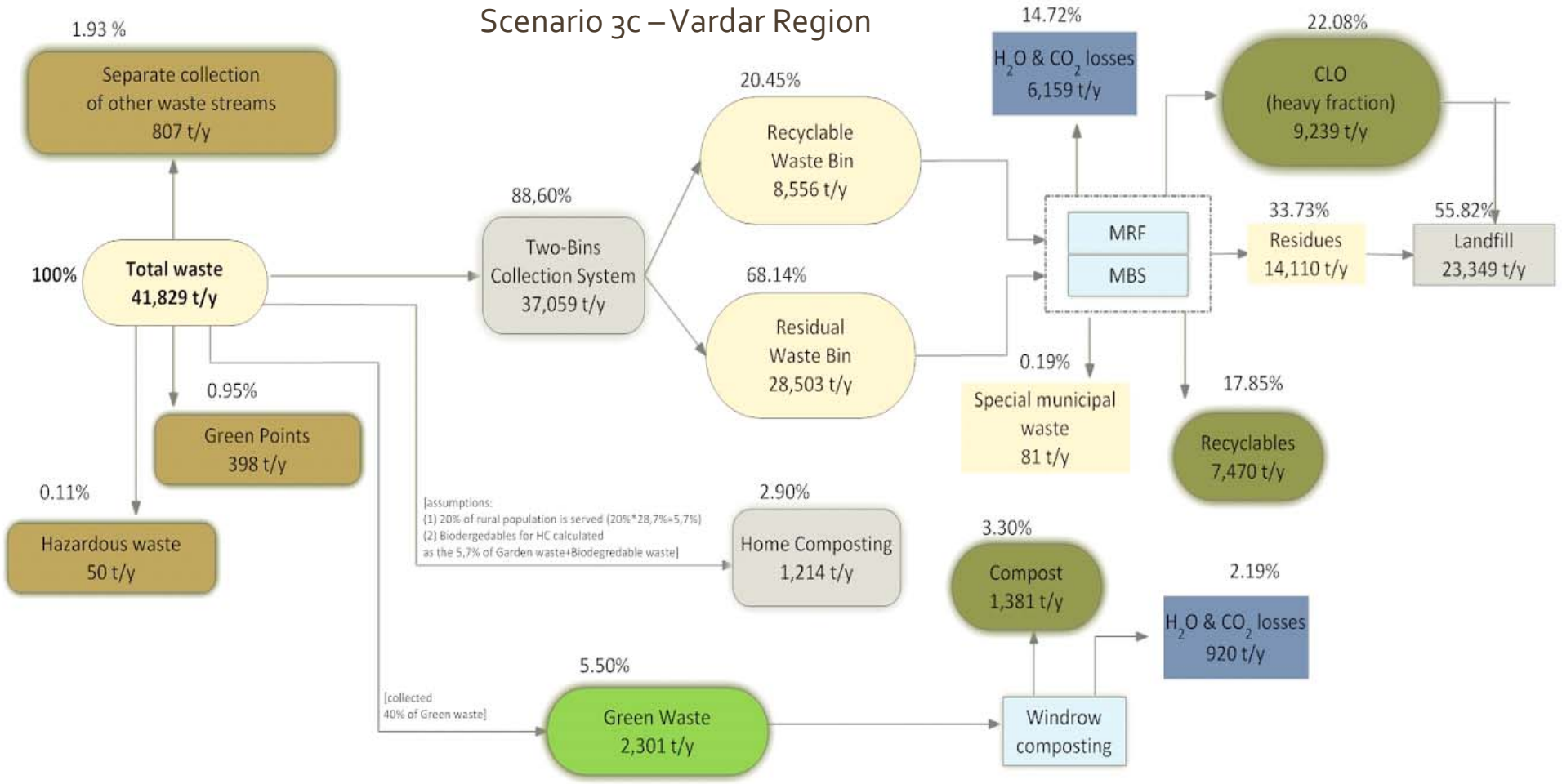
Overview of the recommended waste management scenarios

Scenario 3b – Southwest Region



Recommended options for IWMS

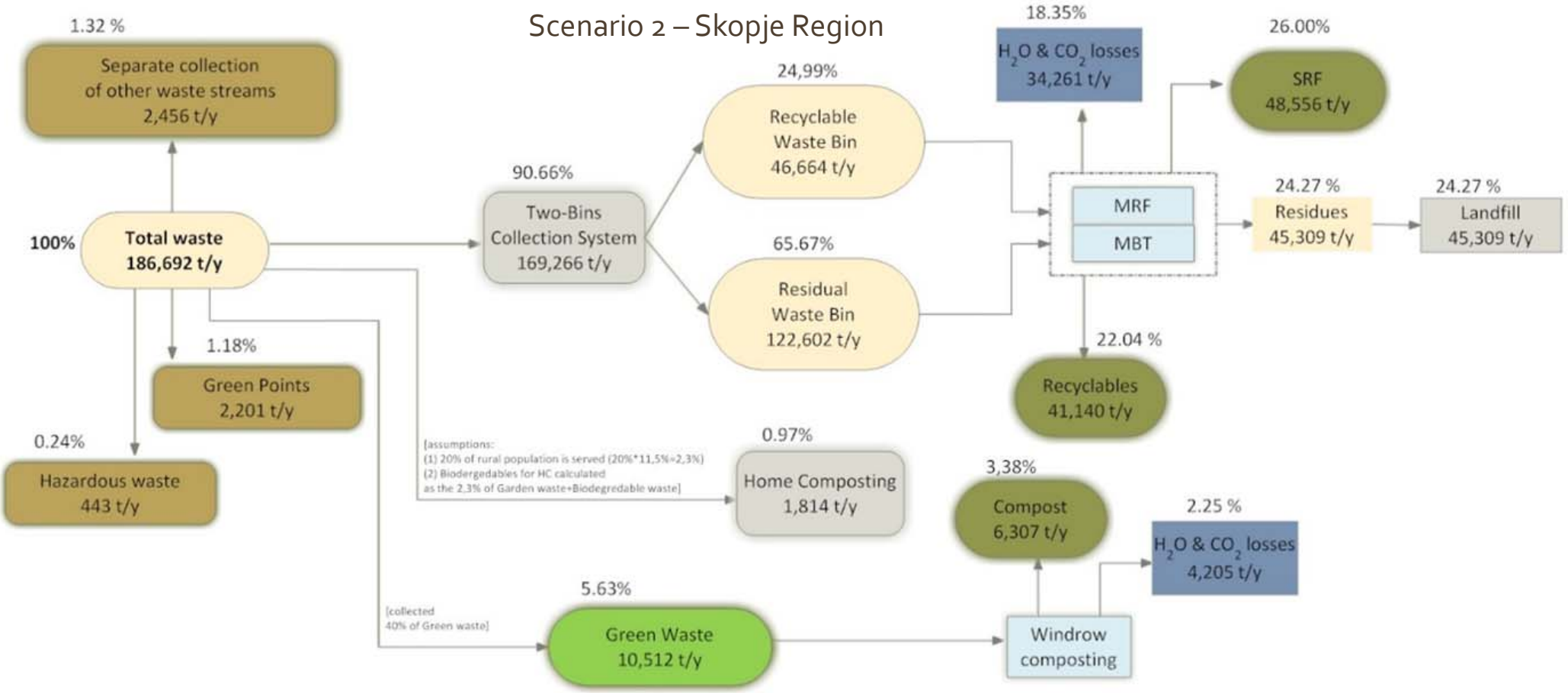
Overview of the recommended waste management scenarios



Recommended options for IWMS

Overview of the recommended waste management scenarios

Scenario 2 – Skopje Region



Site Selection Methodology for the Establishment of Central Waste Management Facilities

- The procedure for the selection of a suitable location for the waste management facilities in the 3 regions was carried out in the following stages:
- Data collection
- Determination of exclusion criteria (Settlements, Nature protected areas, archaeological sites)
- Determination of selection criteria (Capacity, distance from settlements, topography, cover material, geology, hydrogeology, hydrology, ownership, cost)
- Determination, classification and calibration of the evaluation criteria
- Estimation of the criteria weigh factors
- Site visit – Application of exclusion – selection criteria for the site under investigation – Setting of alternative sites
- Determination of sites for further evaluation
- Grading the criteria for each alternative potential sites
- Using of a multi-criteria software tool
- Ranking alternative potential sites

Site Selection Methodology for the Establishment of Central Waste Management Facilities/Groups of criteria

Criteria-Groups	Sub-Criteria
A. Geological - Hydrogeological	A1: Permeability of the underground layer
	A2: Tectonic structure of the area
	A3: Existence of hydrant points
	A4: Existence and use of underground water
	A5: Ground erosion-Stability of the slope
	A6: Seismicity and seismic risk of the area-
	A7a: Surface water recipient-Type and use of the main recipient
	A7b: Surface water recipient-Distance between Central Waste Management Facilities, recipient
	A8a: Protection of underground water due to infiltration
	A8b: Protection of underground water due to the supply via surface water
	A9a: Geomorphology of the area-Hydrological characteristics
	A9b: Geomorphology of the area-Surface formulation and slope protection
	A10: Borrow pits for clay sealing methods
B. Environmental	B1a: Land cover, ecological characteristics, landscape-Occupation
	B1b: Land cover, ecological characteristics, landscape-Proximity
	B2: Optical isolation
	B3a: Nuisance by odour and air pollution-Distance recipient
	B3b: Nuisance by odour and air pollution-Winds
	B4a: Nuisance from the circulation of the transported vehicles in inhabited areas-Annoyance from traffic
	B4b: Nuisance from the circulation of the transported vehicles in inhabited areas-Annoyance settlements

Site Selection Methodology for the Establishment of Central Waste Management Facilities/Groups of criteria

Criteria -Groups	Sub-Criteria
C. Land-Planning	C1: Distance of settlements
	C2a: Distance from agricultural activities-Land Occupation
	C2b: Distance from agricultural activities-Proximity
	C3: Distance from stock-raising activities
	C4: Distance from industrial activities
	C5a: Proximity to incompatible uses-Protected areas
	C5b: Proximity to incompatible uses-Landscape protection area
	C5c: Proximity to incompatible uses-Touristic zones
	C5d: Proximity to incompatible uses-Archaeological sites
	C6a: Final access road-Type of network
	C6b: Final access road-Necessary works
D. Operational	D1a: Impacts on operation of Central Waste Management Facilities from the climatic conditions in the area-Altitude
	D1b: Impacts on operation of Central Waste Management Facilities from the climatic conditions in the area-Winds
	D2: Adequacy of the available area-Expansion Capabilities
	D3: Adequacy of covering material
E. Financial	E1: Demands for infrastructure works
	E2: Land value
	E3: Availability of public utilities
	E4: Cost for waste transportation to the site

Methodology for determination of TSs

- In order to identify the municipalities where TSs should be established in each Region, the maximum possible number of TSs was determined taking into consideration the quantity of waste to be transported through those facilities in correlation with the distance to CWMF.

- Maps which illustrate (i) the location of the central waste management facility, (ii) the possible TSs, (iii) the municipalities which will be served for each TS and (iv) the Municipalities which will transport their waste directly in CWMF, were created.

- Relevant national regulations were taken into consideration.

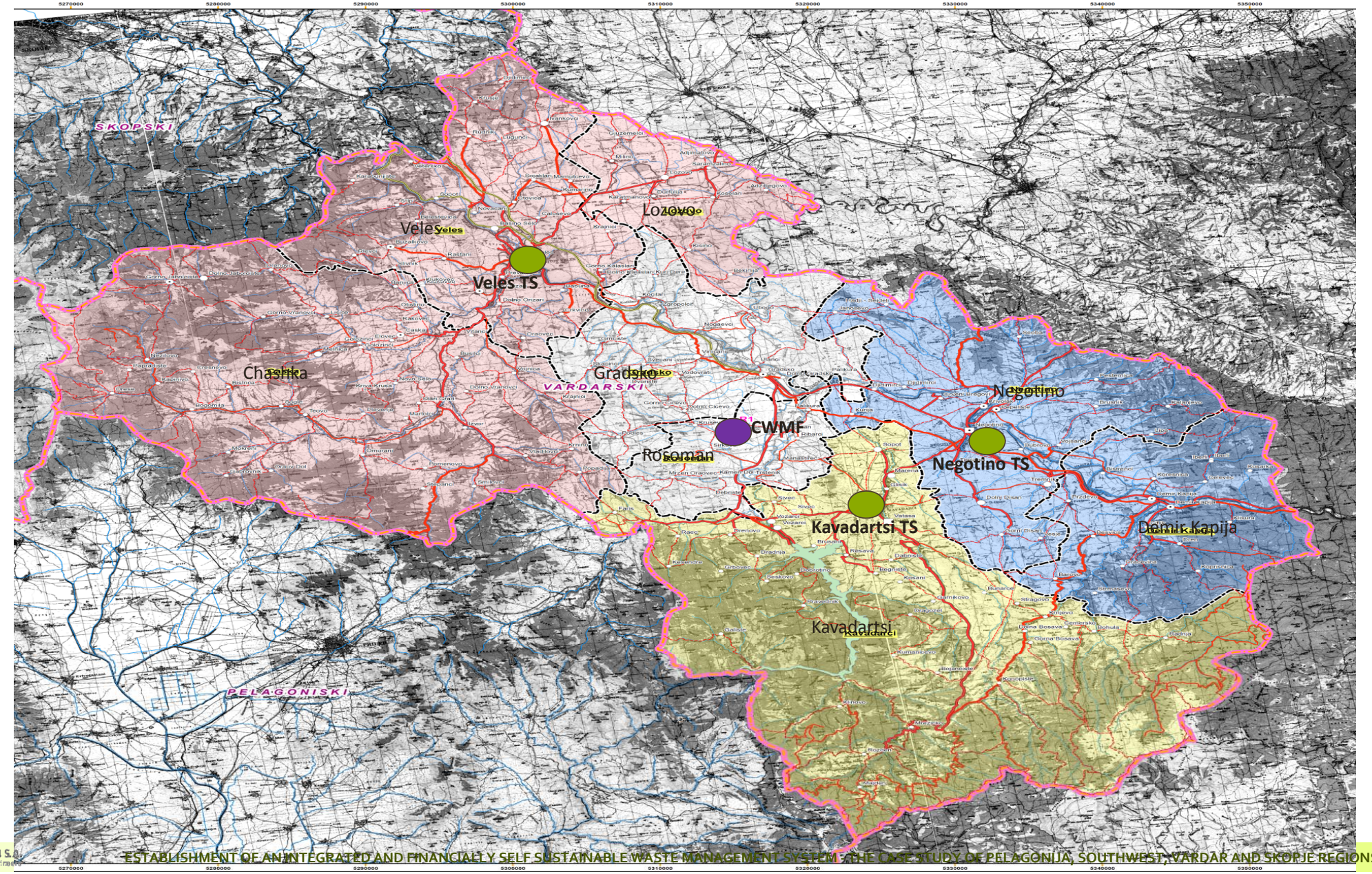
- For each TS of each region Break Even Points were calculated.

- Letter of request from the project office was sent to the selected municipalities in order to propose sites for the establishment of the TS.

Recommended options for IWMS
Transfer stations

The primary reason for construction of transfer stations (TS) is to reduce the cost of transporting waste to the CWMF.

Region	No. of TS	Location of TS	Transfer capacity t/year.
Pelagonija Region	2	• Resen • Krushevo	11.566
Southwest Region	4	• Debar • Kichevo • Ohrid • Struga	58.429
Vardar Region	3	• Kavadraci • Negotino • Veles	36.150
Skopje Region	2	• Shuto Orizari • Vardarishte	94.631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VARDARSKI
PELAGONISKI
Veles
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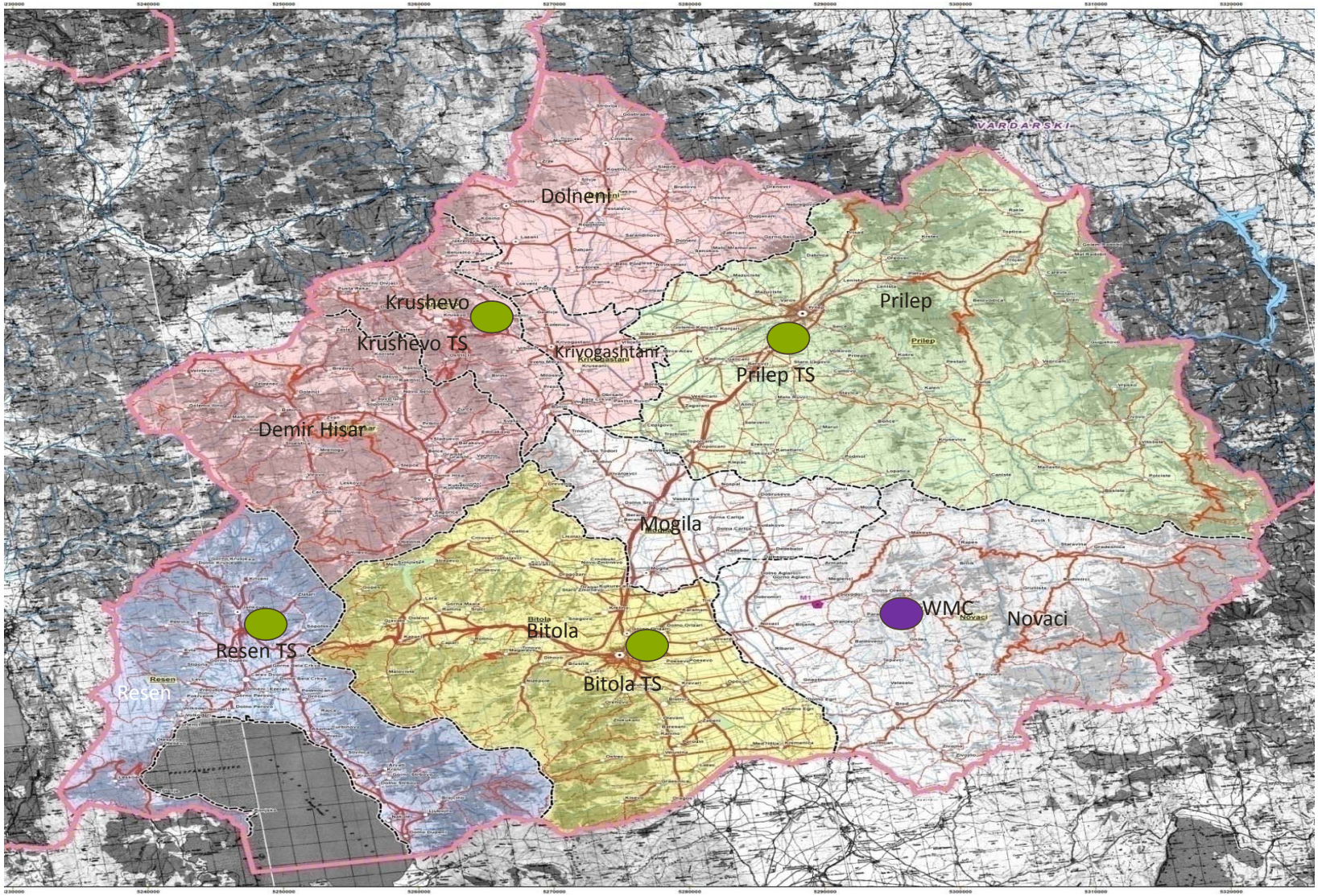
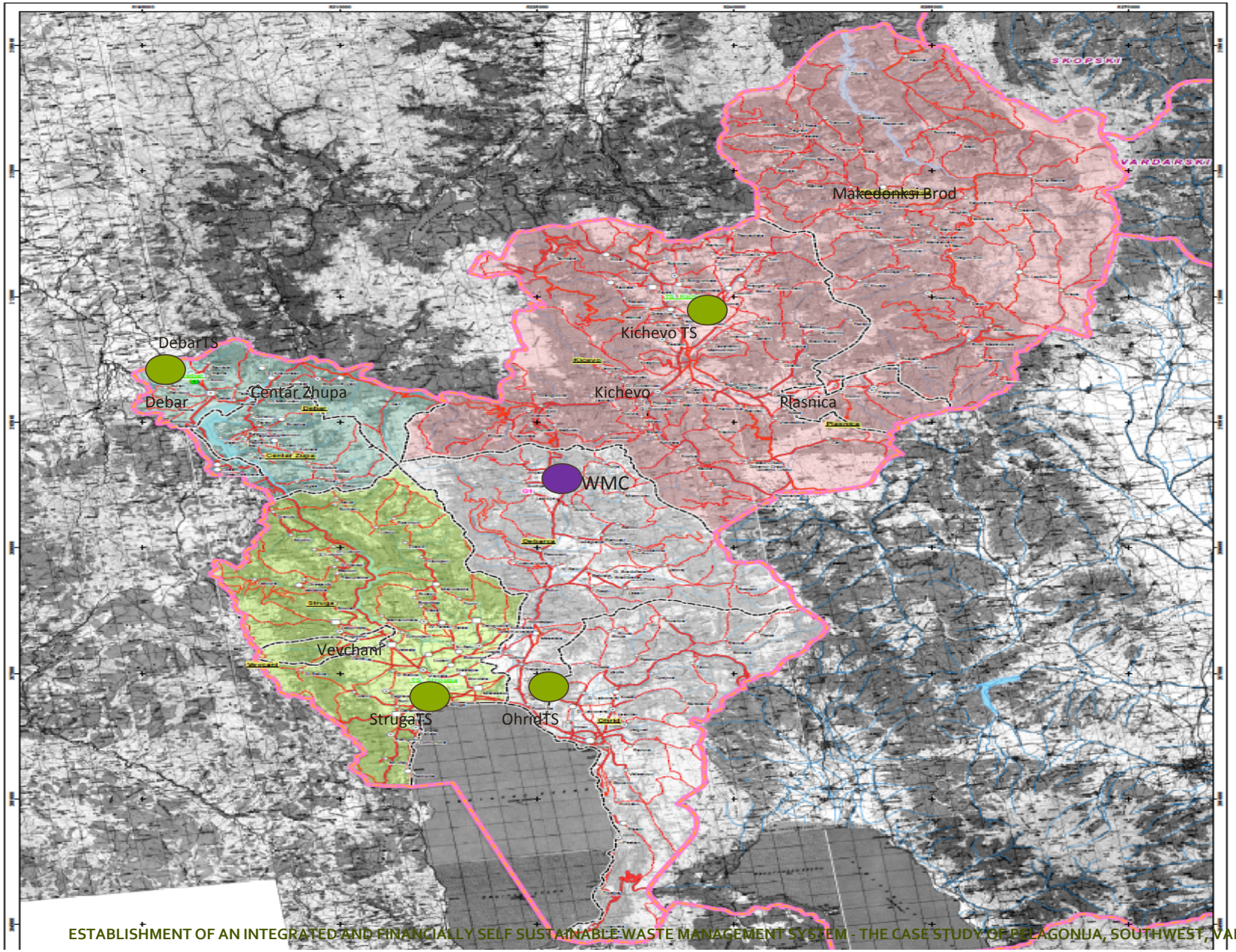
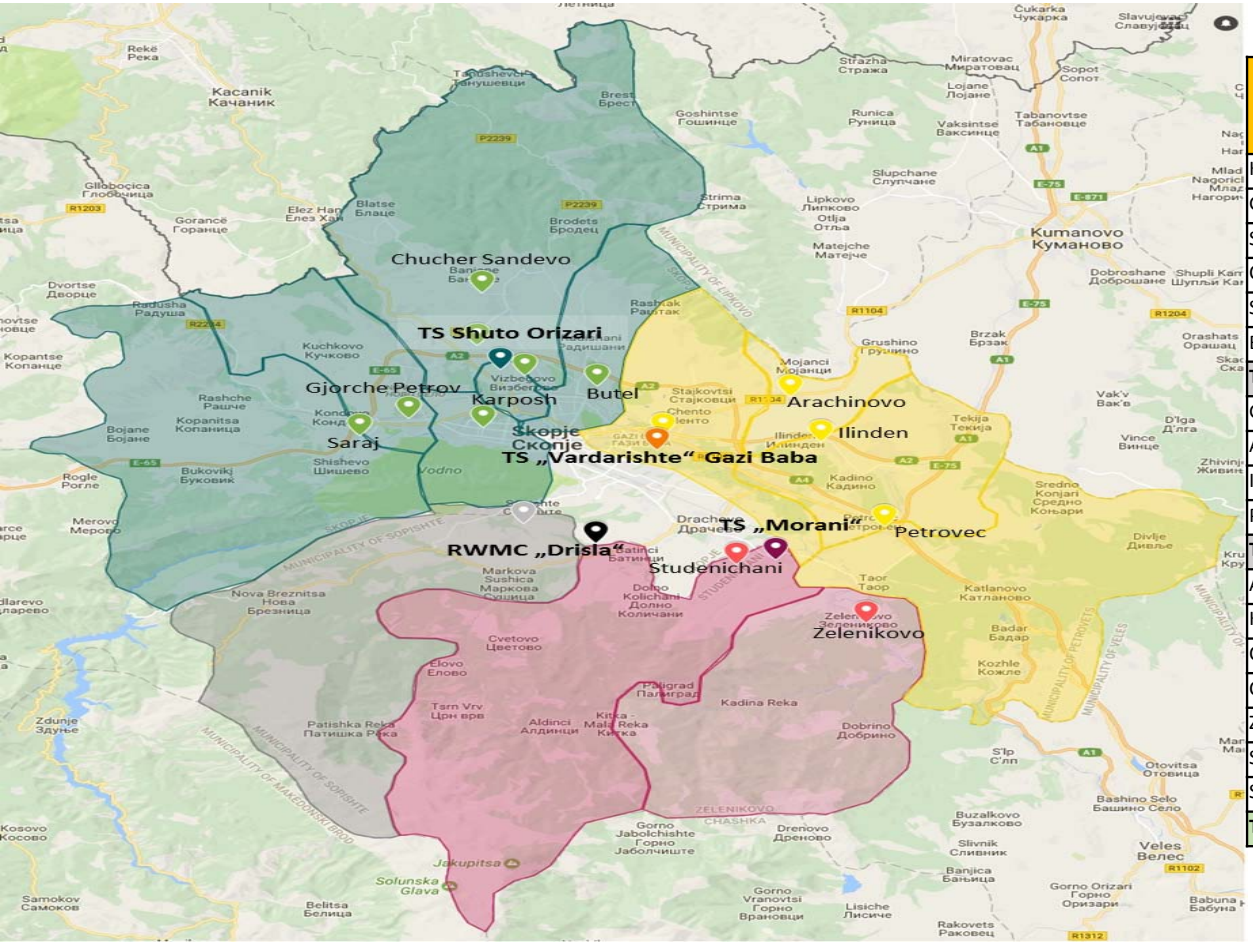
Lozovo
Chashka
Gradsko
CWMF
Rosoman
Negotino
Negotino TS
Kavadartsi TS
Kavadartsi
Demir Kapija


Dolneni
Krushevo
Krushevo TS
Krivogashtani
Prilep
Prilep TS
Demir Hisar
Mogila
WMC
Novaci
Bitola
Bitola TS
Resen TS
Resen


SKOPSKI
VARDARSKI
Makedonksi Brod
Kichevo TS
Kichevo
Rlasnica
Debar TS
Debar
Centar Zhupa
WMC
Vevchani
Struga TS
Ohrid TS



Municipality	Population (estimation 2015)	Generated waste amount, annual	Transportation
Karposh	60.924	18.685	TS Shuto Orizari
Gjorche Petrov	42.463	12.838	
Saraj	40.375	10.889	
Chucher-Sandevo	9.873	1.812	
Shuto Orizari	23.503	7.185	
Butel	38.595	11.785	
TOTAL:	**215.733**	**63.193**	
Gazi Baba	76.924	23.005	TS Gazi Baba - Vardarište
Arachinovo	13.419	3.576	
Ilinden	16.872	2.821	
Petrovets	9.021	2.035	
TOTAL:	**116.236**	**31.438**	
Aerodrom	76.871	23.666	Directly to "Drisla " landfill
Kisela Voda	61.101	18.761	
Centar	48.479	15.195	
Chair	69.147	21.335	
Zelenikovo	4.728	1.142	
Studenichani	20.946	3.804	
Sopishte	6.038	1.243	
TOTAL:	**287.310**	**85.147**	

Recommended options for IWMS

CBA of the recommended waste management scenarios

A cost-benefit analysis was prepared in order to estimate the cost of alternative scenarios for comparative evaluation purposes. The investment cost of each scenario was calculated and the operating costs and revenues of each scenario were projected.

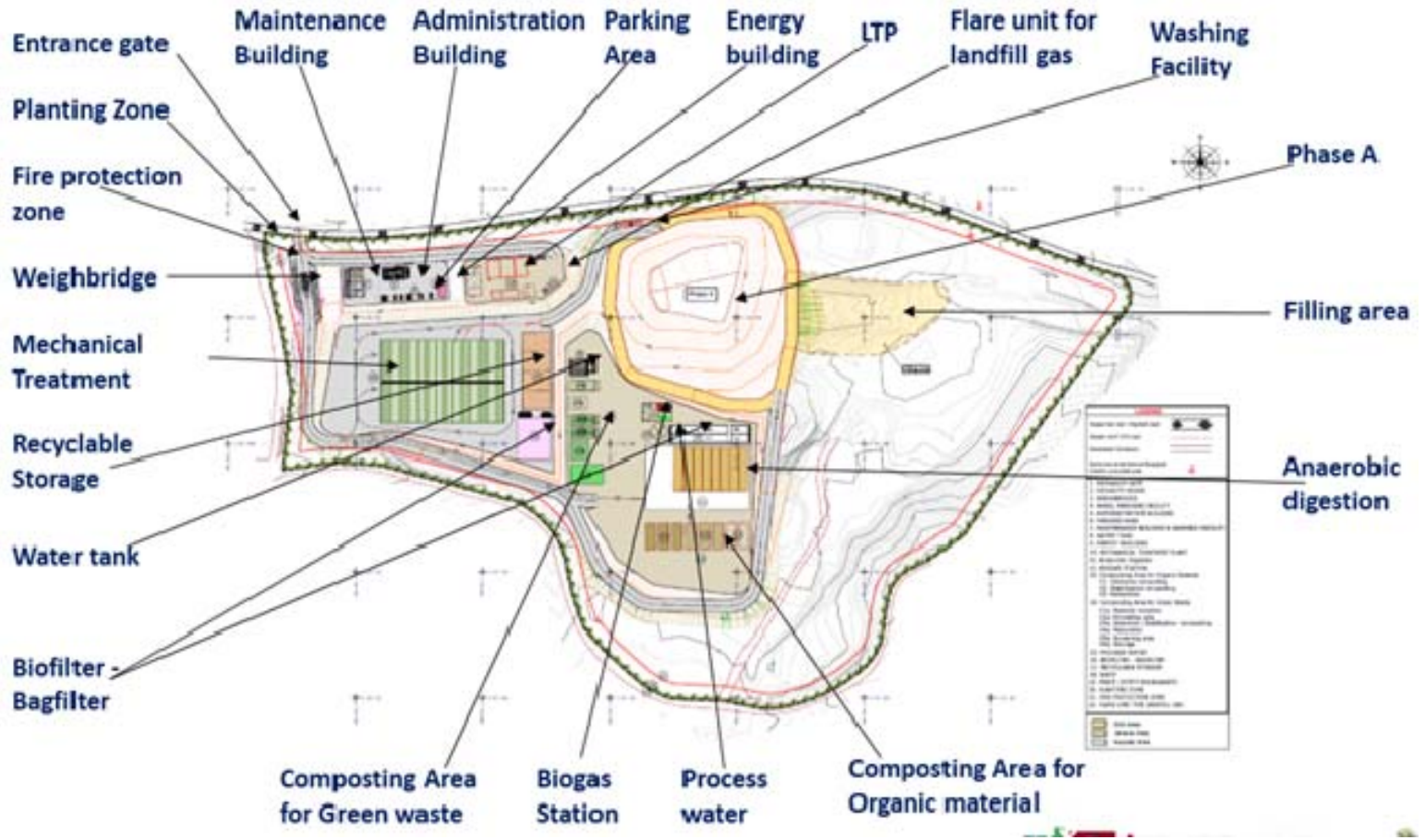
Levelized unit cost for the recommended scenario in each Region (2021-2046)

LEVELIZED UNIT COST (LUC)	Unit	NPV			
		Vardar Region	Pelagonija Region	Southwest Region	Skopje Region
Discount rate	%			4.0	
Investment cost Total (reinvestments included)	€	26.066.708	38.163.147	39.411.341	17.779.960
Operating cost	€	50.118.662	96.710.682	85.618.592	252.953.266
Revenues	€	9.419.303	28.276.152	28.210.099	-
Total cost	€	66.766.067	106.597.676	96.819.835	270.733.227
Total waste input into the system	t	559.390	929.491	840.000	2.542.503
LUC, Investment	€/t	47	41	47	7
LUC, OM&A	€/t	90	104	102	99
LUC, net OM&A	€/t	73	74	68	99
LUC, Total	€/t	**119**	**114**	**115**	**106**

Recommended options for IWMS
Central Waste Management Facility (CWMF)

The new CWMF in Pelagonija Region is going to be located in Municipality of Novaci.

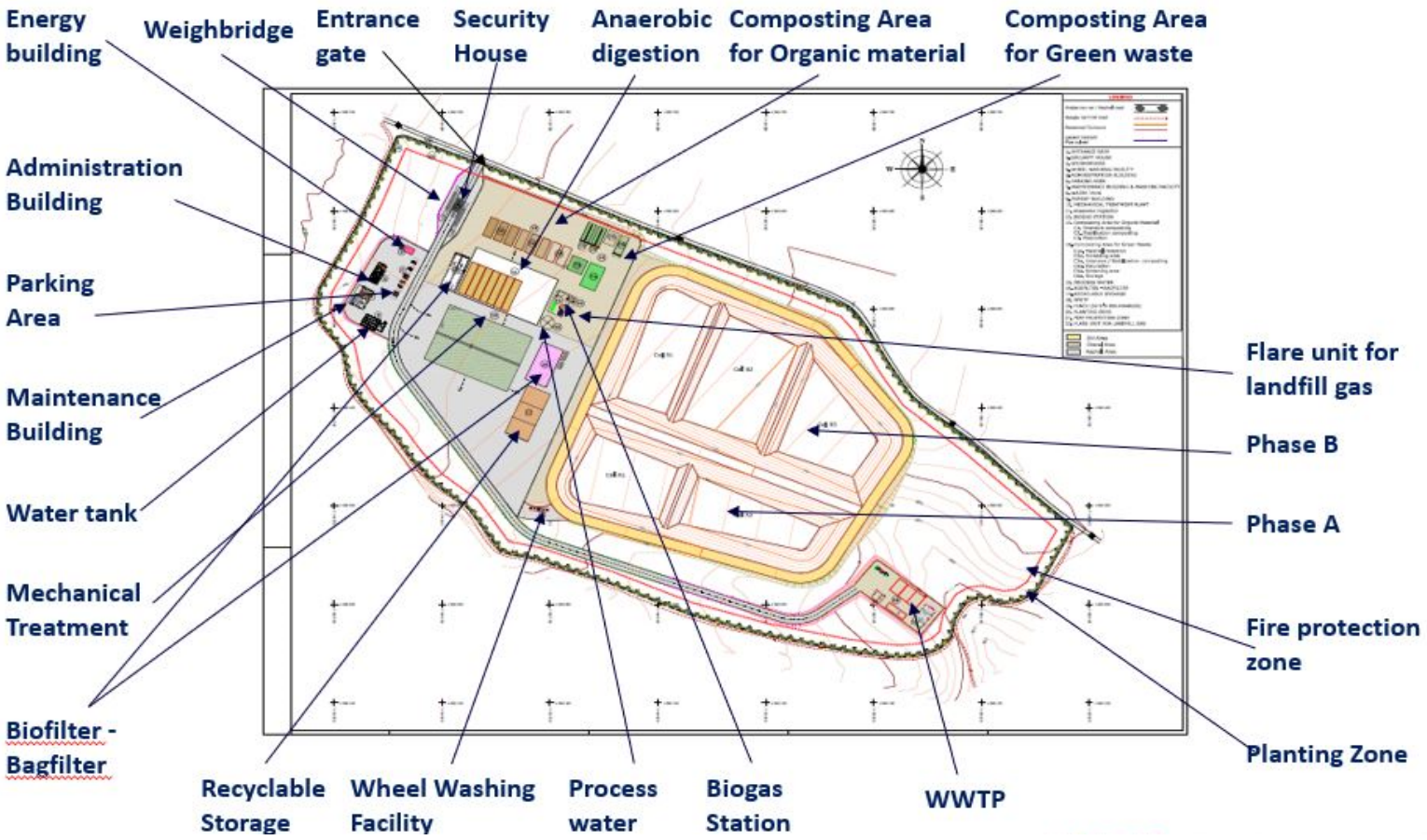
General layout of CWMF in Pelagonija Region



Recommended options for IWMS
Central Waste Management Facility (CWMF)

The new CWMF in Southwest Region is going to be located in Municipality of Debrca.

General layout of CWMF in Southwest Region

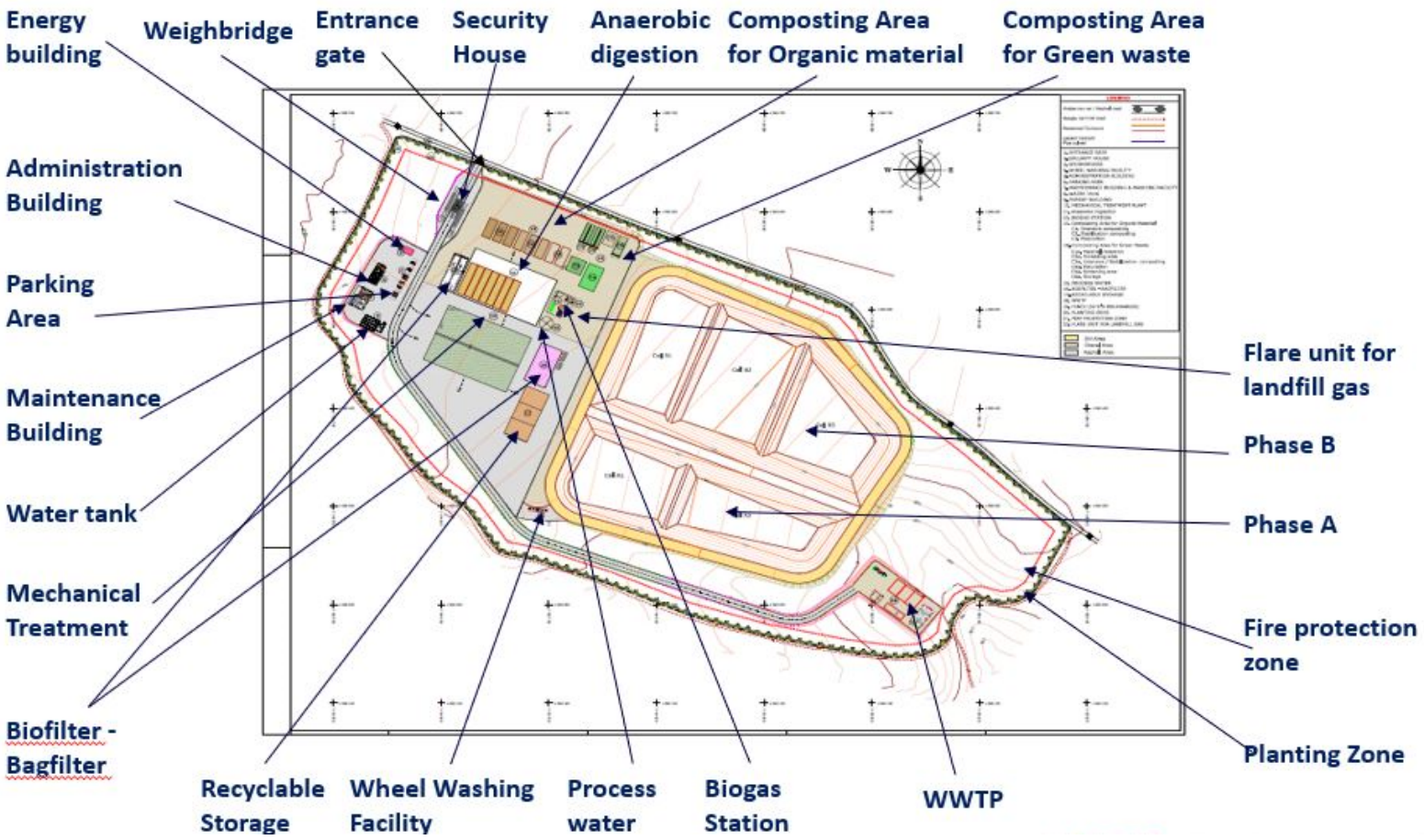


Recommended options for IWMS
Central Waste Management Facility (CWMF)

The new CWMF in Vardar Region is going to be located in Municipality of Rosoman.

In Skopje Region the landfill Drisla in Studenichani Municipality is already operating under a concession agreement with a private company (Public-Private Partnership – AD DRISLA).

General layout of CWMF in Vardar Region

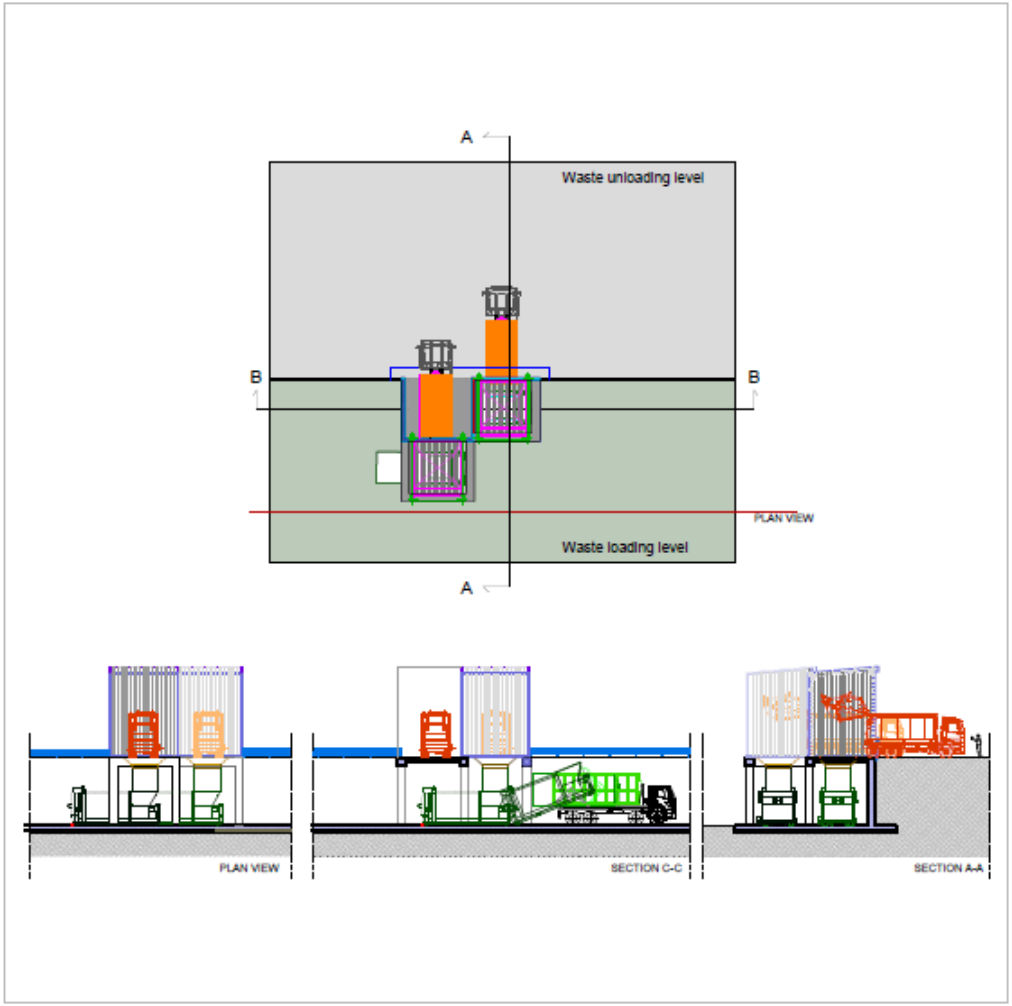


Recommended options for IWMS
Transfer stations

- The unloading system that will be applied in Transfer stations is based on a system with hopper in different levels
- For the compaction system due to low/medium size of TSs the stationary press was not selected and press containers were selected
- Two main options of press containers were examined and the most economical solution was selected

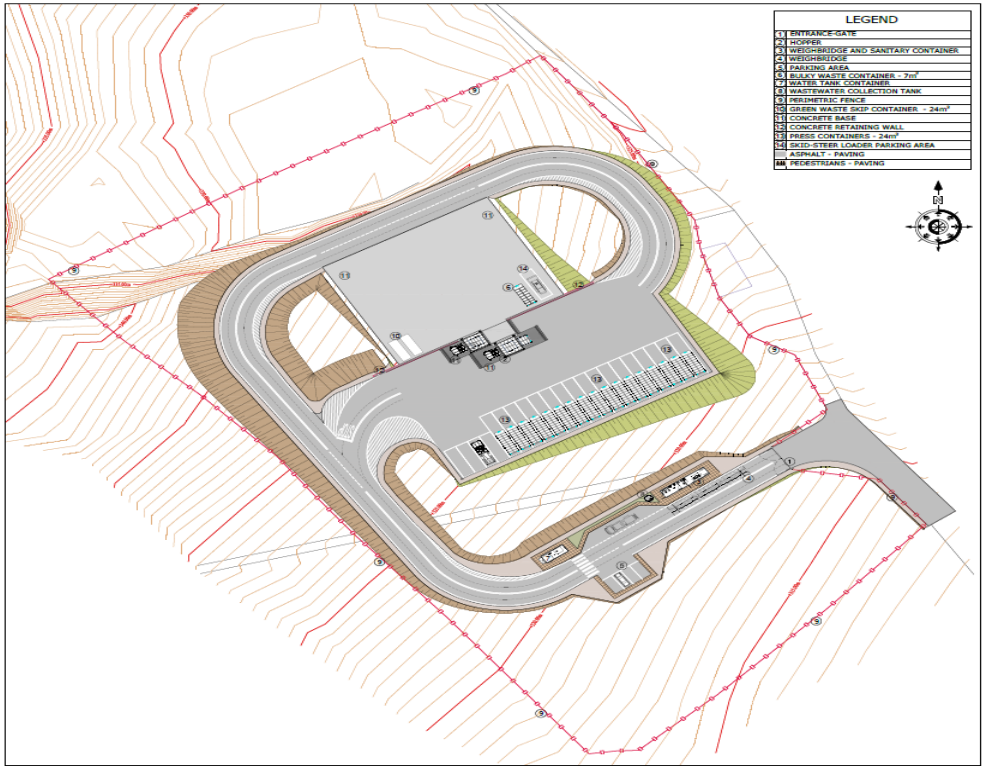
Alternative options for transportation equipment	Option 1 Wheeled press container	Option 2 Roll on/off press container
Wheeled press containers 55 m³ for mixed waste	V	
Press containers 24 m³ for mixed waste		V
Press containers 24 m³ for recyclable waste	V	V
Open Containers 24 m³ for green waste	V	V
Trucks for wheeled press containers	V	
Trucks for containers/press containers	V	V

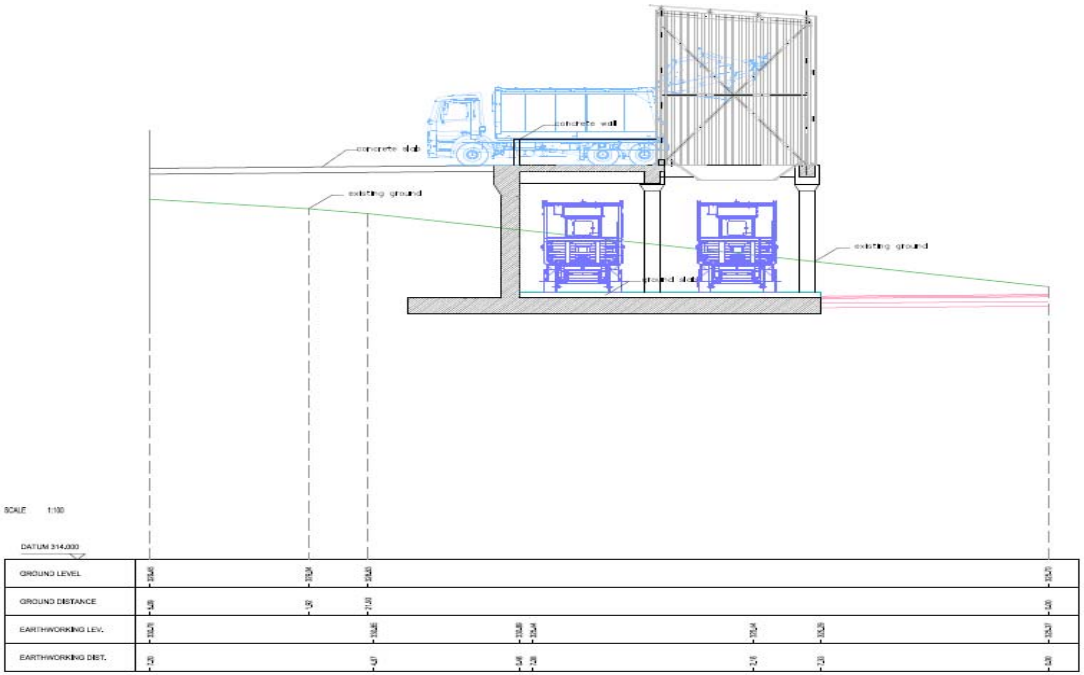
Transfer stations/Press containers



Recommended options for IWMS
Transfer stations

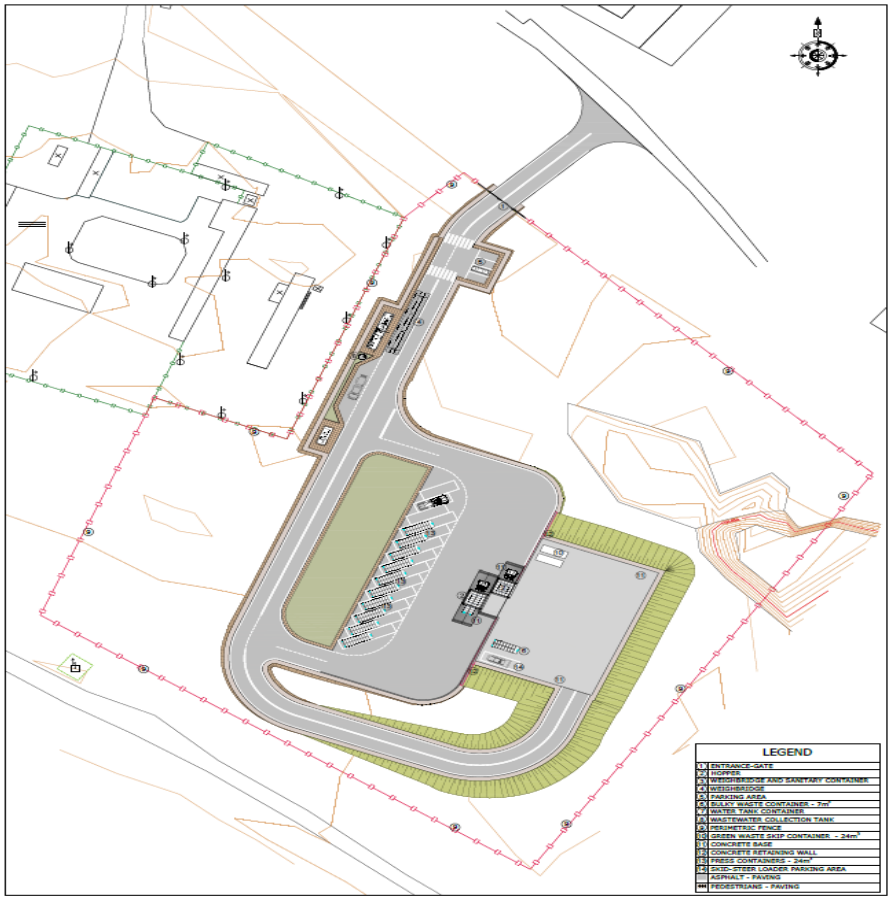
General Layout of Works – Shuto Orizari (Indicative)

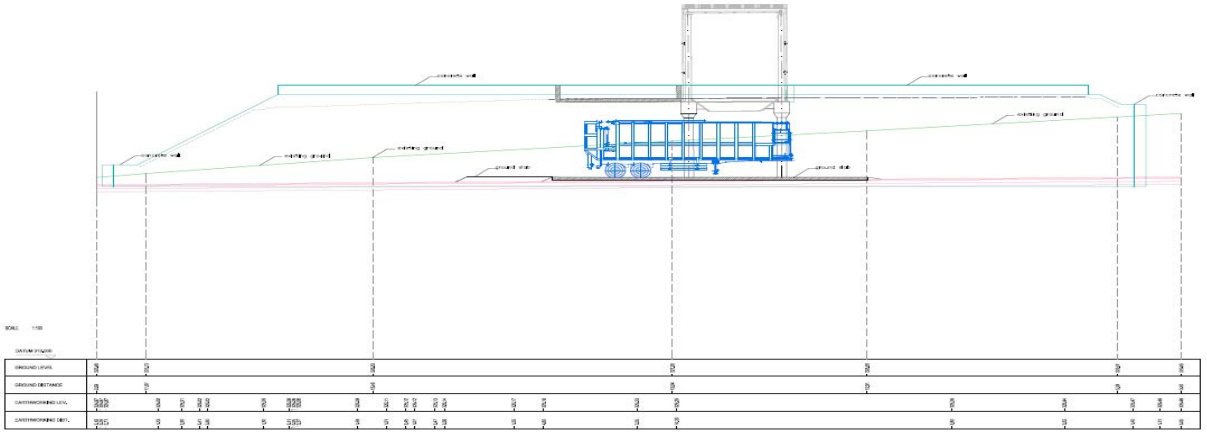




Recommended options for IWMS
Transfer stations

General Layout of Works – Vardarishte (Indicative)





CLOSURE AND REHABILITATION OF NON-REGULATED LANDFILLS AND DUMPSITES

Closure and rehabilitation models

Closure & Rehabilitation approach ID	Type	Application	Description
CR model A – Site cleaning	Ex-Situ	For small landfills and dumpsites <5,000 m^3 ranked as a low, medium and high risk	Excavation and re-deposition of the waste and contaminated soils on the municipality landfill of the territory they belong to
CR model B – capping without gas collection	In situ	For landfills marked as low and medium risks and volume up to 100,000 m^3, ranked as medium and high risk	Construction of capping layer, soil cover, leachate collection systems, and surface water control systems (diversion channels)
CR model C – capping with gas collection	In situ	High risk landfills with volume above >100,000 m^3 and medium and high risk and volume above >500,000 m^3.	Construction of capping layer, soil cover, gas and leachate collection systems and water systems (diversion channels)

Recommended options for IWMS
Collection and transport equipment

Metal bins of **1.1 m³** for mixed waste

Plastic bins of **1.1 m³** for recyclables

Plastic bins of **120 lt** for mixed waste

Plastic bins for home composting
(≥ 240 lt)

LOT 1 – Bins for collection of waste

Recommended options for IWMS
Collection and transport equipment

RCV, Collection trucks 14 m³

RCV, Collection trucks 6 m³

Green waste collection tipping trucks 6 m³

LOT 2 – Trucks for collection of waste

Recommended options for IWMS
Collection and transport equipment

Press Containers 24 m³

Open Containers 24 m³

Hook lift trucks

Open Containers 7 m³

LOT 3 – Transfer Stations Equipment

Recommended options for IWMS
Stakeholder involvement

As sources of information dissemination and raising awareness, the following were created:

- Contact database
- Cloud storage system
- Project website: http://4regionalwaste.mk/
- Facebook page: @4regionalwaste
- Street & Online Surveys

The project promoted its visibility through the following:

- Production of visibility materials (branded pens, notebooks, business folders, leaflets, etc.)
- Organization of study tours, conferences, public consultations, workshops & meetings
- Regular coverage of public events by the local and national media

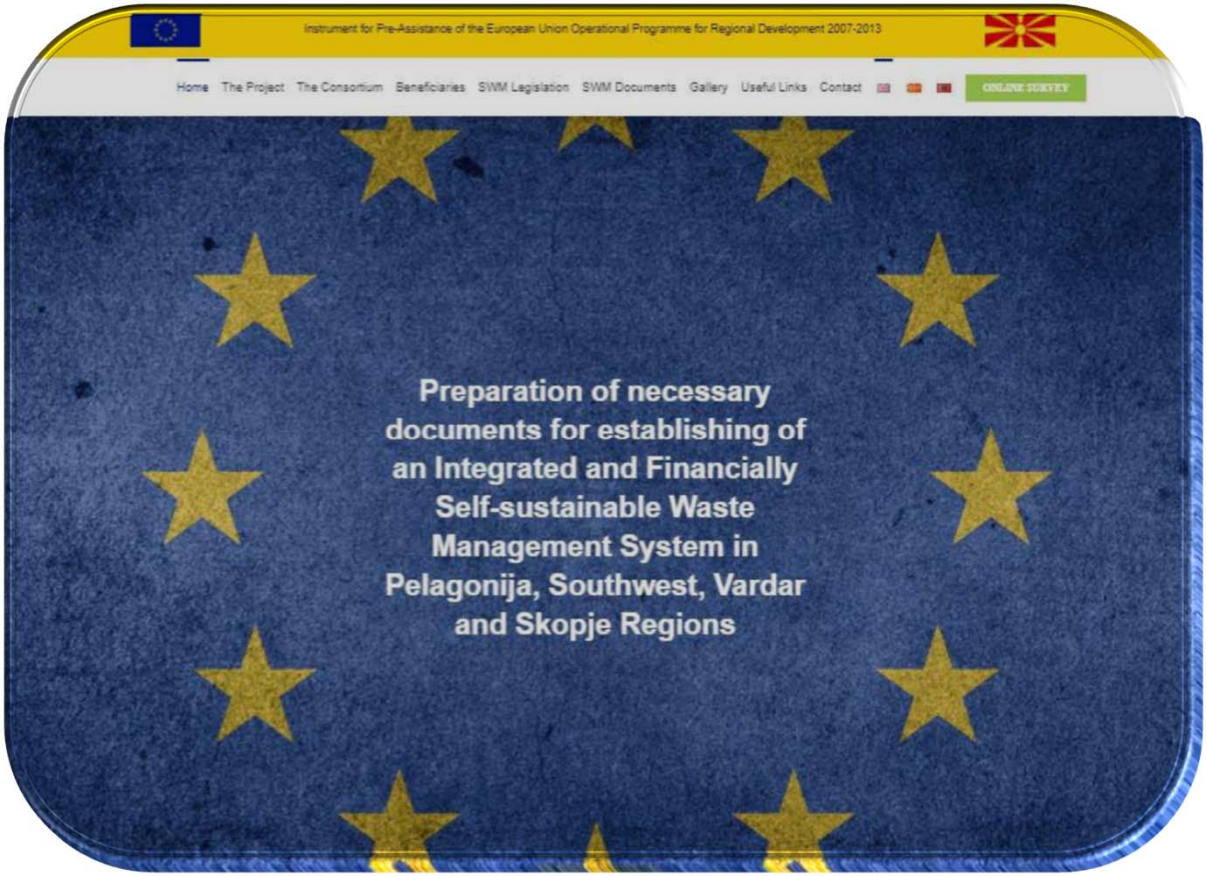
Recommended options for IWMS
Stakeholder involvement

Visibility materials

Recommended options for IWMS

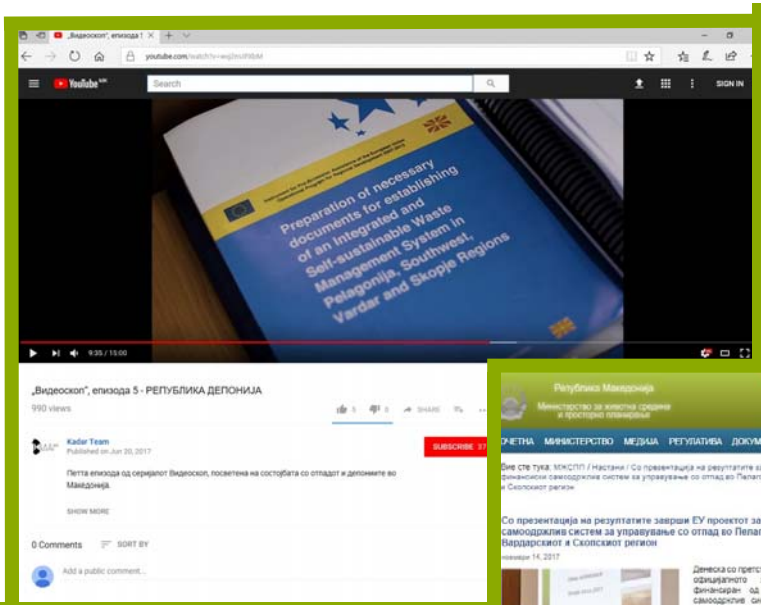
Stakeholder involvement

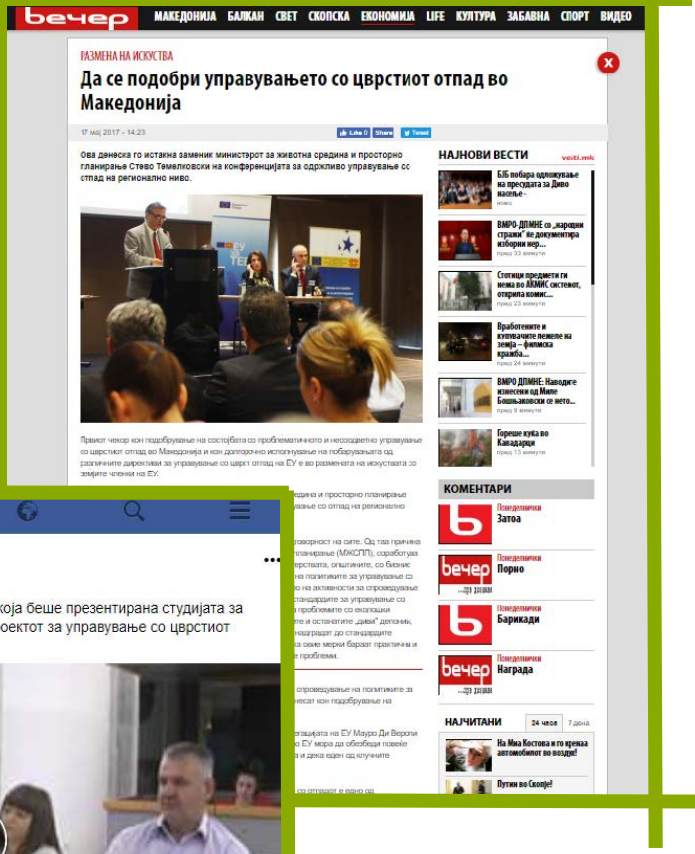
Official Project Website & Facebook Page

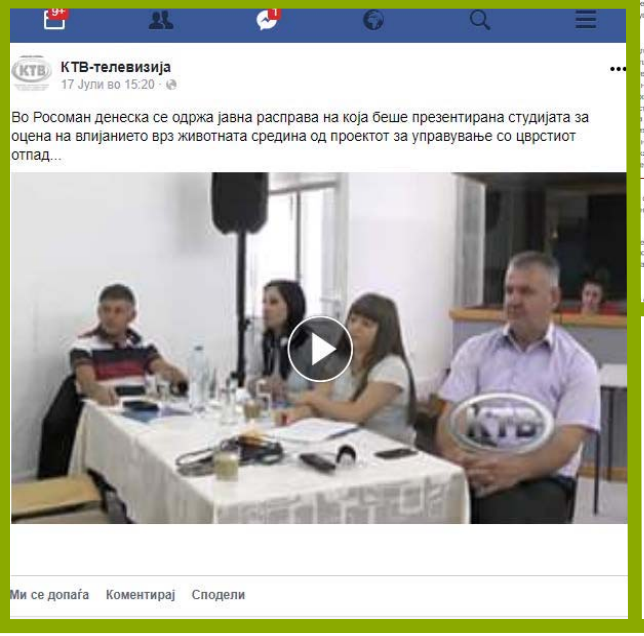


Recommended options for IWMS
Stakeholder involvement

Media coverage







Recommended options for IWMS
Stakeholder involvement

SEA - Public Consultations

EIA - Public Consultations

Recommended options for IWMS
Stakeholder involvement

Street Survey 2016 – Phase I

Street Survey 2017 – Phase II

Recommended options for IWMS
Stakeholder involvement

Events organized by the project

28 Mar – 01 Apr 2016
Initial Workshops in all 4 regions

01 Nov 2016 - 01 Feb 2017
Regional Workshops for presentation of RWMP

01 Jul 2016
1st National Workshop

13-16 Dec 2016
Study Tour I - Greece

Recommended options for IWMS
Stakeholder involvement

17 – 26 Jul 2017
Presentation of Feasibility Studies in all 4 regions

21 Dec 2016 – 24 Jan 2017
Ad Hoc Workshop with Mayors

01 – 04 Nov 2017
Study Tour II - Croatia

17 May 2017
Conference Sustainable Waste Management at Regional Level

14 Nov 2017
Final Workshop

RESULTS AND DISCUSSION

The perspective of the Project for establishment of an integrated regional waste management system was that it should be a sustainable system which is economically affordable, socially acceptable and environmentally effective. Along with the overall need for sustainable waste management, it is clear that no single treatment method can manage all municipal solid waste in an environmentally effective way.

Fundamental to implementing the system is the recognition and acceptance by all target groups of society, as producers of waste, of their responsibility to support and adopt more sustainable waste management practices.

CONCLUSIONS

The proposed integrated solid waste management systems for Pelagonija, Southwest, Vardar and Skopje Regions provide a regional planning framework for the sustainable waste management and recovery of resources aiming to achieve:

- Conformity with the legislative requirements, targets, principles and policies set by the European and national legal and regulatory framework.
- Minimisation of negative impacts on the environment and human health caused by the generation and management of waste.
- Minimisation of negative social and economic impacts and maximisation of social and economic opportunities.

Thank you for your attention!

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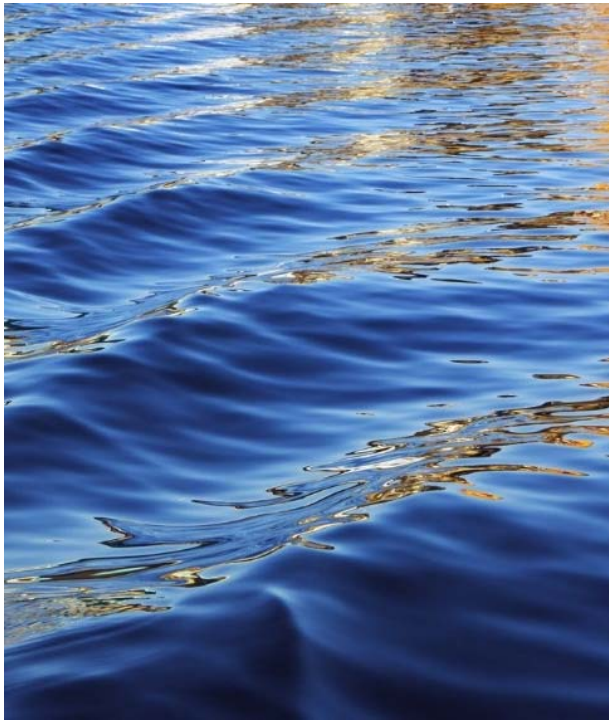
ENVIROPLAN S.A.
Consultants & Engineers