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IEGULDĪJUMS TAVĀ NĀKOTNĒ

CLIENT: *MINISTRY OF ENVIRONMENTAL PROTECTION AND REGIONAL DEVELOPMENT*

CONTRACTOR: *SIA "GEO CONSULTANTS"*

CONTRACT: *ASSESSMENT OF INVESTMENT NEEDS FOR THE DEVELOPMENT OF THE NATIONAL WASTE MANAGEMENT PLAN FOR PERIOD 2021-2028*

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Final report - summary

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Geo Consultants

LASA Latvijas Atkritumu saimniecības asociācija

KONSORTS

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1 GENERAL INFORMATION ON CONTRACT

The report is prepared in accordance with Contract no. IL / 57/2020, "Assessment of Investment Needs for the Development of the National Waste Management Plan for 2021–2028", signed between the Ministry of Environmental Protection and Regional Development (Client) and SIA "Geo Consultants" (Contractor). In the fulfilment of the contract, SIA "Geo Consultants" cooperated with the experts of the Association "Latvian Waste Management Association" and SIA "Konsorts".

The aim of the contract is to prepare an investment needs assessment for the further development of the waste management system in Latvia, identifying the priority measures required to achieve the objectives set in the waste management sector.

In order to achieve the goal of the contract, the main tasks to be performed are an inventory of the current situation in the waste management sector, incl. assessment of the existing waste management infrastructure, assessment of the amount of managed waste and elaboration of forecasts regarding the amount of generated and managed waste and their future development trends in the period until 2035. Based on the results of the assessment of the current situation and forecasts on the dynamics of the amount of waste generated, and taking into account the sector targets, optimization proposals and recommendations for potentially supported investment activities in the field for improvement of the waste management system were elaborated.

2 ASSESSMENT OF THE MSW LANDFILLS

Within the framework of the research, the assessment of municipal waste landfills has been performed, incl. volumes of waste managed, assessment of existing infrastructure and its potential service life, financial and economic aspects. Based on the results of the assessment, initial proposals for re-profiling of landfills have been prepared. The collected information will be used to prepare an assessment of investment needs on national level, as well as to review the waste management regions.

2.1 ASSESSMENT OF INFRASTRUCTURE

A summary of the infrastructure in municipal landfills is provided in the tables (Table 2.1, Table 2.3, Table 2.3). By 2020, all municipal waste landfills have been established and operated waste treatment facilities in which biodegradable waste and recyclable waste are separated from the unsorted municipal waste stream. The total national wide capacity of the equipment is higher than the amount of unsorted municipal waste entering the landfills, however, when evaluating individual landfills, it has been concluded that the capacity is insufficient. At the same time, it should be noted that the equipment needs to be modernized by introducing the latest technological solutions, especially with regard to technologies for automated separation of recyclable materials.

Table 2.1. Description of the waste treatment and disposal infrastructure in municipal waste landfills in 2020

Landfill	Unsorted municipal waste sorting facilities (R12B) tpa	Waste treatment facilities C&D waste, industrial waste (R12B) tpa	Secondary resources sorting (R12B) tpa	Composting field (R3A) m2	BDW anaerobic treatment (R3D) tpa	Landfill cell remaining capacity (D1) m3

Getliņi	300 000	90 000		1 400	125 000*	1 190 000 (incl. bioreactor cell 200 000)
Brakšķi	30 000			2 600		540 000 (t.sk. energošūna 240 000)
Cinīši	30 000			1 600		164 906
Daibe	30 000		10 000	5 600		213 000
Janvāri	30 000		10 000	5 000		160 260
Pentuļi	20 000		12 000	1 700	20 000	219 307
Ķīvītes	26 000	30 000		0		160 000 (incl. bioreactor cell 160 000)
Križevņiki	20 000			4 400		334 856
Kaudzītes	20 000		10 000	3 500		490 975
Dziļā vāda	30 000			8 000		605 859
Total	**536 000**	**120 000**	**42 000**	**33 800**	**145 000**	**3 919 163**

* into operation starting from 2022

Number of landfills operate separate equipment the treatment of specific waste, like bulky waste, C&D waste etc.. As well there are dedicated sorting facilities for separately collected recyclable waste, which mainly treats recyclable waste from the separate collection system and also recyclable materials recovered from the unsorted municipal waste stream.

Available waste disposal infrastructure, incl. bioreactor cells are described (Table2.2). The total storage capacity for waste disposal is 4.0 million. m3, assuming that the volumes of waste delivered to landfills, as well as the volumes of recycling remain at the level of 2019, the service life of the existing landfill facilities, according to initial calculations, varies from 3 to 54 years.

The calculations are based on a pessimistic scenario, i.e. a situation where the demand for the recovered waste materials is low and all waste and materials except secondary resources are disposed of or stored in landfill cells. In order to determine the possible additional capacity in those landfills where remaining capacity of the storage facilities is the lowest compared to the annual amount of landfilled waste, the remaining capacity was modeled by changing the slope to 1: 2.5 and increasing the storage fill height to 25-35m. Where several separate waste disposal cells are located nearby, it was planned to combine the cells and, accordingly, to use the volume between the cells for waste disposal (such a practice has been implemented in separate landfills so far). The model results show that by using such an approach it is possible to significantly increase the remaining service life in several landfills, see table (Table2.2)

Table2.2. Remaining service life of municipal landfills and bioreactor cells

Landfill	Annual amount of waste to be landfilled/stored tpa	Remaining capacity t (existing data)	Remaining service life years (existing data)	Remaining capacity t (modeling results)	Remaining service life years (modeling results)
Getliņi	395 000	1 190 000	3,0	1 600 000	4,1
Brakšķi	38 400	540 000	14,1	n/a	n/a
Cinīši	43 500	164 906	3,8	870 000	20,0
Daibe	45 106	213 000	4,7	1 100 000	24,4
Janvāri	31 300	160 260	5,1	290 000	9,3

Pentuļi	14 000	219 307	15,7	n/a	n/a
Ķīvītes	38 100	160 000	4,2	160 000	4,2
Križevņiki	18 100	334 856	18,5	n/a	n/a
Kaudzītes	9 100	490 975	54,0	n/a	n/a
Dziļā vāda	23 900	605 859	25,3	n/a	n/a
Total	656 506	4 079 163			

The modeling results show that in four of the five landfills, by optimizing the landfill filling technology, as well as by applying the combined cell technology, it is possible to significantly increase the service life of the existing landfill cells.

In addition to the depositing infrastructure, information on landfill leachate and gas management systems was collected. Local leachate treatment plants are installed in 8 landfills, from 2 landfills leachate is exported for treatment to wastewater treatment plants. In fact, all leachate treatment plants need modernization to ensure high-quality treatment of increasing leachate volume and increasing pollution concentration.

Table2.3. Description of the additional infrastructure in municipal waste landfills in 2020

Landfill	Leachate treatment m3/h	Landfill gas collection system m3/h	CHP MWh_{el}
Getliņi	6,0	2 500,0	6,50
Brakšķi	-	500,0	0,00
Cinīši	6,0	250,0	0,00
Daibe	7,0	350,0	0,35
Janvāri	6,0	500,0	0,00
Pentuļi	-	-	0,70
Ķīvītes	5,0	500,0	1,10
Križevņiki	5,0	350,0	0,00
Kaudzītes	4,5	-	0,00
Dziļā vāda	4,0	-	0,00
Total	44,0	4 950,0	8,7

Landfill gas collection systems are installed in 7 landfills, of which three landfill gas is used for regeneration in cogeneration plants, three landfills for gas utilization have installed combustion torches without energy recovery. Development of landfill gas management systems, incl. The installation of cogeneration plants must be planned in the context of the development of BDW anaerobic fermentation plants, providing sufficient gas management and cogeneration capacity both for the recycling of BDW and for the economic use of gas collected from landfills.

2.2 WASTE QUANTITIES AND COMPOSITION

The general trend in recent years shows that the average amount of waste delivered to landfills is increasing, in 2019, the total amount of waste brought to landfills reaches 786.5 thousand. t. The largest share is formed by the unsorted municipal waste stream 501.2 thousand tons, or 63% of the total amount, see.(Table2.4).

Table2.4. Assessment of the amount of waste managed in municipal waste landfills in 2019

	Quantity received t	Waste treatment tpa	Delivered for recycling tpa (Secondary resources, RDF)	Stored in bioreactor cells (BDW from mechanical treatment, BDW)	Landfilling tpa (Wastes from mechanical treatment, industrial waste, etc.)
Unsorted municipal waste	501 189	60 892	36 367	256 039	147 834
Biodegradable waste	42 318	7 484	0	33 863	971
Secondary resources	21 963	87	11 767	451	10 175
Other	221 044	79 610	61 861	0	61 478
TOTAL	**786 514**	**148 073**	**109 995**	**290 353**	**220 458**

About 90% of the unsorted municipal waste stream delivered to landfills is treated by separation of BDW fraction and recyclable materials. The BDW fraction, depending on the available infrastructure, is placed in composting sites or bioreactor cells. After composting, i.e. technical compost is used for the daily coating of the landfilled waste layer, for the construction of temporary roads and areas inside the waste storage facility, etc. BDW placed in bioreactor cells is planned to be excavated within 10-15 years after placement, the excavated material is intended to be treated by separating the recycable materials, the unusable materials will be disposed of in the landfill. Recyclable materials separated from the unsorted waste stream are then delivered for recycling, and also RDF is produced.

The waste stream labeled 'Other waste' mainly includes industrial waste and construction waste. These waste streams are treated by recovering inert materials or recyclable materials that are delivered to recycling, while inert materials are most often used to arrange landfill technological processes - construction of internal roads and sites, construction of temporary roads in landfill cells, etc.

Approximately 19% of the total incoming waste is recycled and used on site, 14% is delivered for recycling, approximately 37% of the total amount is placed in bioreactor cells, about 2% is temporarily stored. The amount of waste landfilled accounts for up to 28% of the total amount of waste received in landfills.

2.3 FINANCIAL AND ECONOMICAL ASSESSMENT

Summary of financial and economic indicators of landfills, incl. waste disposal tariffs, main cost items expressed per ton of waste managed, description of credit liabilities and information on funds for landfill closure and recultivation are provided in the table (Table2.5).

Table2.5. Assessment of financial and economic aspects of landfills - summary

Landfill		Getliņi	Brakšķi	Cinīši	Daibe	Dziļā vāda
Opertaor	unit	SIA "Getliņi EKO"	SIA "JKP"	SIA "AADSO"	SIA "ZAAO"	SIA "Vidusdaugavas SPAAO"
WMR		Pierīgas WMR	Zemgales WMR	Dienvidlatgales WMR	Ziemeļvidzemes WMR	Vidusdaugavas WMR
UMW landfill tariff 01.01.2020.		***61,16***	***56,72***	***48,85***	***66,79***	***69,62***
Landfilling component	EUR/t	41,66	34,66	24,39	42,01	42,12
Landfill tax component	EUR/t	19,50	22,06	24,46	24,78	27,50
Landfill tax rate	EUR/t	50,00	50,00	50,00	50,00	50,00
Operational characteristics 2019						
Waste received	*tonnas*	*463 684*	*46 947*	*45 431*	*53 818*	*22 968*

Waste landfilled (According to calculation methodology of PSRB)	*%*	*18,4%*	*43,7%*	*56,4%*	*51,3%*	*88,6%*
Production costs per tonne of waste received, excl. Landfill tax and depreciation of fixed assets	EUR/t	25,88	20,84	20,95	25,81	30,31
Labor costs	EUR/t	6,98	8,38	9,87	6,60	12,60
Depreciation of fixed assets	EUR/t	8,53	3,93	7,60	9,57	33,11
Proportion of administrative costs from total landfill costs	%	7,1%	5,5%	7,8%	6,0%	3,0%
Expenditure per tonne of waste accepted	EUR/t	45,54	46,81	57,84	62,31	104,68
Revenue per tonne of waste accepted	EUR/t	54,21	53,30	50,10	62,01	76,82
Credit liabilities						
Credit balance 31.12.2019.	EUR	7 464 330	342 705	0	1 300 867	2 856 386
Credit payback due date	gads	2026	2023	-	2026	2041
Funding for landfill closure						
Funding balance 31.12.2019.	EUR	0	100 231	24 635	86 898	0

Landfill	mērv.	**Janvāri**	**Kaudzītes**	**Krīževņiki**	**Ķīvītes**	**Pentuļi**
Opertaor		SIA "AAS Piejūra"	SIA "AP Kaudzītes"	SIA "ALAAS"	SIA "Liepājas RAS"	PSIA "VLK"
WMR		Piejūras WMR	Malienas WMR	Austrumlatgales WMR	Liepājas WMR	Ventspils WMR
UMW landfill tariff 01.01.2020.		***64,01***	***63,02***	***57,73***	***54,96***	***42,93***
Landfilling component	EUR/t	40,62	38,02	32,84	35,92	42,34
Landfill tax component	EUR/t	23,39	25,00	24,89	19,04	0,59
Landfill tax rate	EUR/t	50,00	50,00	50,00	50,00	50,00
Operational characteristics 2019						
Waste received	*tonnas*	*45 500*	*9 586*	*18 460*	*41 747*	*28 943*
Waste landfilled (According to calculation methodology of PSRB)	*%*	*27,2%*	*38,5%*	*52,5%*	*28,6%*	*12,8%*
Production costs per tonne of waste received, excl. Landfill tax and depreciation of fixed assets	EUR/t	29,26	32,53	25,47	33,05	25,38
Labor costs	EUR/t	14,13	11,94	13,22	11,30	4,25
Depreciation of fixed assets	EUR/t	28,85	26,64	21,57	21,40	12,96
Proportion of administrative costs from total landfill costs	%	10,2%	6,8%	3,8%	10,5%	0,0%
Expenditure per tonne of waste accepted	EUR/t	78,16	81,64	72,92	74,71	43,84
Revenue per tonne of waste accepted	EUR/t	59,13	64,99	55,03	65,20	43,01
Credit liabilities						
Credit balance 31.12.2019.	EUR	2 424 800	152 965	402 715	295 000	689 348
Credit payback due date	gads	2030	2027	2026	2022	2026
Funding for landfill closure						
Funding balance 31.12.2019.	EUR	16 964	11 122	91 528	6 438	13 455

3 ASSESSMENT OF WASTE GENERATION AND MANAGEMENT

3.1 MUNICIPAL SOLID WASTE

In this report, the inventory of MSW quantities includes following waste classes from list of waste[1] - Group 2000 excluding 200140 - Metals and group 1501. The composition of the generated MSW is dominated by unsorted municipal waste (66%), followed by packaging (18%), biodegradable waste (9%) and other waste (6%).

Table3.1. Composition of generated MSW, tons, 2013-2019[2]

Gads	Total	Unsorted MSW (Class 200301)	Packaging (Group1501)	Biodegradable waste	Other
2013	704 387	510 109	77 350	71 668	45 260
2014	726 039	525 464	77 931	63 200	59 444
2015	798 121	560 774	95 840	92 437	49 070
2016	802 474	550 362	95 804	80 543	75 764
2017	798 060	571 445	97 754	118 096	63 383
2018	785 074	529 133	112 876	87 517	55 548
2019	800 413	530 000	147 216	71 602	51 595
% from MSW generated in 2019	n/a	66.2	18.4	8.9	6.4

During the period under review, the amount of recycled MSW has increased, reaching 40% in 2019. Approximately one third of the amount of recycled MSW is made up of recycled packaging waste - in 2019, 36.5% of recycled MSW was packaging (Group 1501), while in 2013 it was 34%.

The amount of municipal waste generated per capita in the period from 2013 to 2019 is described in Figure 3.1, in the period under review this indicator has increased by 22.6%.

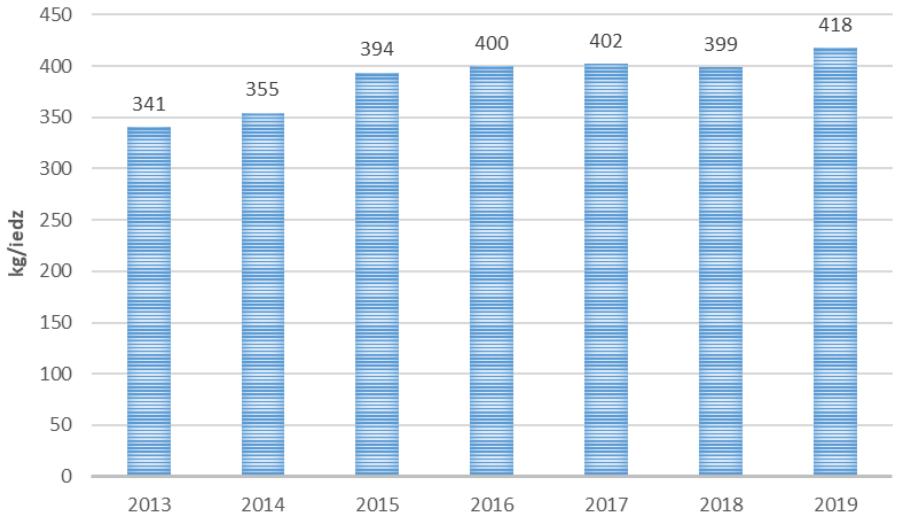

Figure 3.1 MSW produced per capita (kg per capita), 2013.-2019.[3]

[1] Cabinet Regulation No. 302 "Regulations on Waste Classification and Properties That Make Waste Hazardous".
[2] The authors' calculation, based on the data from State statistical report "3-Waste" database
[3] The authors' calculation, based on the data from State statistical report "3-Waste" database

3.2 INDUSTRIAL WASTE

Under the terms of the contract, the report on industrial waste includes waste from groups 1 to 15; Group 17 and Group 19 wastes. Data collection has been performed for the period of the previous waste management plan from 2013 to 2019, for which data are provided in public databases.

Table (Table3.2) summarizes the data on the quantities of industrial waste generated, collected, imported, exported, recovered and landfilled between 2013 and 2019. The column "Incinerated" of the table contains data on waste treatment with code R1. The column "Recycled" contains data on waste treatment operations with codes R2, R3 (R3A, R3B, R3C, R3D), R4, R5, R6, R7, R8, R9, R10, R11. The column "Prepared for recycling" contains data on waste with codes R12 (R12A, R12B) and R13. The column "Landfilled" contains data on all types of landfilled waste with codes D.

Table 3.2. Quantities of waste generated and treated (tons) 2013-2019

Year	Generated	Collected	Imported	Exported	Incinerated (R1)	Recycled (R2-R11)	Prepared for recycling (R12-)	Landfilled (D-)
2013	1 399 574	894 519	169 307	97 287	456 135	633 656	312 111	176 583
2014	1 829 256	958 242	201 209	99 397	51 2302	813 092	223 788	193 924
2015	1 671 224	812 878	291 788	99 515	236 465	1 387 206	199 505	78 217
2016	2 416 526	727 314	280 437	113 905	121 019	1 568 241	272 625	371 732
2017	2 499 971	947 588	243 471	157 600	135 426	2 209 383	292 158	53 288
2018	2 595 190	1 416 937	263 711	150 531	185 626	1 795 549	497 752	162 320
2019	2 373 104	1 122 740	357 676	232 516	66 117	721 237	333 568	172 607

Assessing the generation and management of industrial waste during the previous waste management planning period, it is concluded that the amount of waste in general is increasing, as well as the amount of sorted waste is increasing, which further indicates the possibilities not only to dispose but also to recycle waste. With the increase of waste recycling opportunities and the improvement of international market links, not only the quantities and types of imported but also exported waste are increasing.

3.3 CONSTRUCTION AND DEMOLITION WASTE

The construction and demolition waste stream consists of the manufacturing sector (professional construction and demolition) and household construction waste, while each stream includes both non-hazardous and hazardous construction waste. Information on non-hazardous industrial construction waste generated and collected in Latvia, as well as its treatment activities, is provided in the table (Table3.3).

Table3.3. Amount of non-hazardous industrial construction and demolition waste management tons, 2013-2019 [4]

Year	Generated	Collected	Imported	Exported	Recycled (R2-R11)	Incinerated (R1)	Landfilled in landfills (D1)	Other landfilling	Prepared for recycling (R12)	Stored (R13)
2013	109 805	449 861	8 595	6 960	85 583	33	58 161	3 822	175 579	972
2014	155 502	460 800	6 853	10 337	109 954	25	10 086	4 400	96 343	0
2015	168 246	329 102	92 499	9 690	192 103	269	8 980	26 380	141 631	0
2016	194 963	192 761	106 673	3 759	112 384	0	2 717	19 725	140 504	16 517
2017	52 354	189 437	75 182	16 178	125 241	0	10 210	22 373	155 573	0
2018	11 3491	385 292	57 966	13 262	179 381	0	13 855	349	191 448	2
2019	84 194	287 821	92 550	16 717	164 233	0	2 835	17 670	127 529	15

[4] The authors' calculation, based on the data from State statistical report "3-Waste" database

% in 2019	n/a	100	n/a	5,8	57,1	0,0	1,0	6,1	44,3	0,0

3.4 BIODEGRADABLE, BIOLOGICAL AND FOOD WASTE

Biodegradable waste (BDW)

The obtained data show that the amount of BDW generated in 2019 increased by 12% compared to 2013, while the amount of BDW collected - by 20% (Table3.4). The amount of recycled BDW in 2013-2019 fluctuated significantly and in 2019 returned to the level of 2013. The amount of BDW disposed of in landfills has significantly decreased, accounting for only 17.3% of the amount of BDW generated in 2019. Since 2016, 40 - 57% of generated BDWs are prepared for recycling and recovery (R12, R12A, R12B). Further operations with waste prepared for recycling and recovery are not traceable by waste stream and / or class, so it is not possible to determine exactly how much of the prepared waste has been recycled, recovered or disposed of.

Table3.4. Amount of BDW generated and collected, incl. the share of BDW in unsorted municipal waste, and treatment operations, tons, 2013-2019[5]

Year	Generated	Collected	Imported	Exported	Recycled (R2-R11)	Incinerated (R1)	Landfilled in landfills (D1)	Other landfilling (D2-D15)*	Stored (R13)**
2013	425 628	381 050	24 758	77 158	173 360	14 197	245 228	14 595	0
2014	424 630	394 191	24 411	67 319	130 681	22 012	250 800	10 980	0
2015	557 900	472 861	326	87 475	180 391	39 909	227 460	37 752	3
2016	547 595	458 019	2 934	78 303	221 665	6 763	110 484	178	318
2017	650 827	549 569	3 642	67 803	288 325	6 721	114 306	224	29
2018	557 271	505 855	12 784	84 736	208 212	6 607	88 976	0	78
2019	475 273	457 279	9 367	99 921	149 135	7 652	82 348	0	7
% of 2019	n/a	96.2	n/a	21.0	31.4	1.6	17.3	0.0	0.0

* In the the period under review, BDW were disposed of under codes D5 (62069 t) and D10 (1660 t).

** In the period under review, a total of (R13) 434 t of BDW, including 317 t - wooden packaging (class 150103) and 81 t - paper packaging (class 150101).

On average, 53% of the generated BDW is BDW from unsorted municipal waste stream that is transported to landfills and is prepared for recycling and recovery by mechanical biological treatment (R12A)

Biological waste (BioW)

Similar to BDW, the amount of BioW generated, collected, recycled and recovered has fluctuated over a wide range, reaching the highest amount in 2017. (Table3.5). It can be seen that the activities performed with BioW do not have a constant upward or downward trend, except for disposal, which gradually decreases with each passing year and in 2019 accounts for 23% of the amount of BioW generated.

Table3.5. Amount of BioW generated and collected, incl. the share of BioW in unsorted municipal waste, and treatment operations, tons, 2013-2019[6]

Year	Generated	Collected	Imported	Exported	Recycled (R2-R11)	Incinerated (R1)	Landfilled in landfills (D1)	Other landfilling (D2-D15)*	Stored (R13)**
2013	297 354	252 776	20 244	14 442	111 554	14 153	192 857	11 487	0
2014	310 340	279 901	20 236	16 455	92 545	21 954	196 699	8 961	0
2015	408 311	323 272	2	20 789	151 079	39 861	178 791	37 752	3
2016	415 575	325 999	934	14 381	197 688	6 621	95 382	177	0

[5] The authors' calculation, based on the data from State statistical report "3-Waste" database

[6] The authors' calculation, based on the data from State statistical report "3-Waste" database

2017	514 790	413 533	1 883	14 725	252 683	6 577	104 835	221	22
2018	421 596	370 208	68	13 554	153 108	6 581	80 650	0	3
2019	320 482	302 440	229	12 817	67 409	7 607	74 058	0	0
% of 2019	n/a	94.4	n/a	4.0	21.0	2.4	23.1	0.0	0.0

* During the period under review, BioA were disposed of under codes D5 (39022 t) and D10 (1599 t).

Food waste (FW)

FW account for about 35% of unsorted municipal waste. The amount of FW generated in 2013-2019 ranged from 222,000 tons to 393,000 tons (Table3.6). Although 99.9% of the generated FW was collected in 2019, only about 21% was recycled and recovered, 9.6% was disposed of in landfills, with the remaining amount being prepared for recycling and recovery related to unsorted municipal waste management activities.

Table3.6. Amount of FW generated and collected, incl. the share of FW in unsorted MSW, and treatment operations, tons, 2013-2019[7]

Year	Generated	Collected	Imported	Exported	Recycled (R2-R11)	Incinerated (R1)	Landfilled in landfills (D1)	Other landfilling (D2-D15)*	Stored (R13)**
2013	229 805	194 949	20 241	13 446	61 766	10 620	166 766	10 309	0
2014	222 989	208 278	20 236	15 683	44 710	11 809	172 266	7 470	0
2015	268 938	229 783	0	20 194	91 781	0	155 612	187	3
2016	327 180	250 127	934	13 560	134 445	42	48 262	177	0
2017	393 043	304 733	1 879	10 810	191 155	42	28 491	221	20
2018	320 925	285 992	57	7 111	126 062	29	25 500	0	3
2019	236 855	236 582	68	3 561	48 784	336	22 730	0	0
% of 2019	n/a	99.9	n/a	1.5	20.6	0.1	9.6	0.0	0.0

3.5 HAZARDOUS WASTE

The hazardousness of waste is determined by the properties of hazardous substances in the waste and their quantity. Cabinet Regulation No. 302 of 19 April 2011[8] defines hazardous waste as waste which has one or more properties that make it hazardous to human life and health, the environment and personal property, and which corresponds to the categories of hazardous waste specified in the waste classification.

When describing the collected data, it should be noted that the data on the amount of waste generated in the national report are submitted only by those organizations that have received category A and B permits for polluting activities, therefore the amount of waste collected differs significantly from the amount of waste generated.

Table3.7 Total amount of hazardous waste by waste sections, treatment operations in the period 2013 - 2019, tons

Section No	Generated	Collected	Imported	Exported	Incinerated (R1)	Recycled (R2-R11)	Stored (R13)	Landfilled in landfills (D1)	Landfilling - incineration (D10)	Other landfilling (D5; D9: D14; D15)
1	2	2	-	-	-	6	-	2	-	-
2	-	1	-	-	-	-	-	-	-	-

[7] The authors' calculation, based on the data from State statistical report "3-Waste" database

[8] Cabinet Regulation No. 302 of 19 April 2011 "Regulations Regarding Waste Classification and Properties That Make Waste Hazardous"

Section No	Generated	Collected	Imported	Exported	Incinerated (R1)	Recycled (R2-R11)	Stored (R13)	Landfilled in landfills (D1)	Landfilling - incineration (D10)	Other landfilling (D5; D9: D14; D15)
3	32	32	-	-	1	-	-	-	-	-
4	12	7	-	-	-	7	-	-	-	-
5	2 752	5 295	-	92	-	707	-	-	-	-
6	609	1 233	-	-	66	127	0,1	629	-	89
7	2 971	3 747	562	-	-	2 085	123	-	0,4	27
8	2 826	6 046	659	619	-	2 636	1 061	-	10	-
9	5	13	-	13	-	14	-	-	-	-
10	2 113	7	6 013	-	-	22	-	2	-	1
11	2 504	5 846	115	40	-	169	0,4	200	0,4	3 004
12	461	643	-	-	-	-	-	14	4	23
13	52 895	160 476	12 318	954	746	28 085	327	-	58	2
14	75	795	3	394	-	1 187	-	-	0,4	-
15	5 292	9 230	69	-	-	1 780	921	-	29	-
16	58 084	262 843	46 202	3 206	0,05	33 098	6 904	268	47	4 065
17	16 283	149 030	194	238	-	31 947	12 377	12 882	-	743
18	53 745	13 051	183	3 817	-	168	3	-	106	3 720
19	56 265	72 160	171	28 447	91 904	30 953	594	13 261	-	1 394
20	4 366	9 423	858	2 897	-	31	399	-	0,4	40
	261 292	699 880	67 348	40 717	92 718	133 023	22 710	27 258	257	13 106

4 WASTE FLOW MODELING AND FORECASTS

In accordance with the terms of reference, this chapter models the amount of municipal waste managed (separately collected, prepared for re-use, recycled, recovered and disposed of) to justify the most appropriate alternatives and solutions to achieve the objectives of Directive 2008/98 / EC and Directive 1999/31 / EC over period of time from 2021 to 2035.

Three scenarios were elaborated

a) **baseline scenario (scenario A) -** the implementation of the existing waste management policy (measures, economic and other instruments) continues; no new waste management capacities are created, except the capacity of waste recycling and recovery (with energy recovery) facilities to be established during the 2014-2020 programming period of the EU funds.

b) **Scenario with waste prevention measures (Scenario B)** - in addition to the baseline scenario, new waste prevention measures are taken and new waste streams are collected separately (bio-waste, textiles, household hazardous waste) landfills are re-profiled (the amount of landfilled waste is reduced).

c) **scenario with the introduction of circular economy measures (scenario C)** - the waste prevention measures modeled in Scenario (b) are complemented by measures included in the Circular Economy Action Plan for Latvia 2020-2028 and the EU's New Circular Economy Action Plan. Additional capacities for preparation of waste for re-use, recycling and material and energy recovery are implemented.

Parameters and assumptions used in the modeling:

- population dynamics (source: SIA "Jāņa sēta" demographic projections 2030);

- main macroeconomic indicators and forecasts until 2023 [9] (source: Ministry of Finance);
- waste composition – data form landfill incoming unsorted MSW flow composition analysis;
- In all scenarios it is planned that from 2022 the deposit system will start operating in the country in accordance with the objectives set out in Cabinet Regulation No. 519[10]

The modeling results for the baseline (A) scenario and the circular economy scenario with the investment program (C) are presented in Figures 4.1. and 4.2.

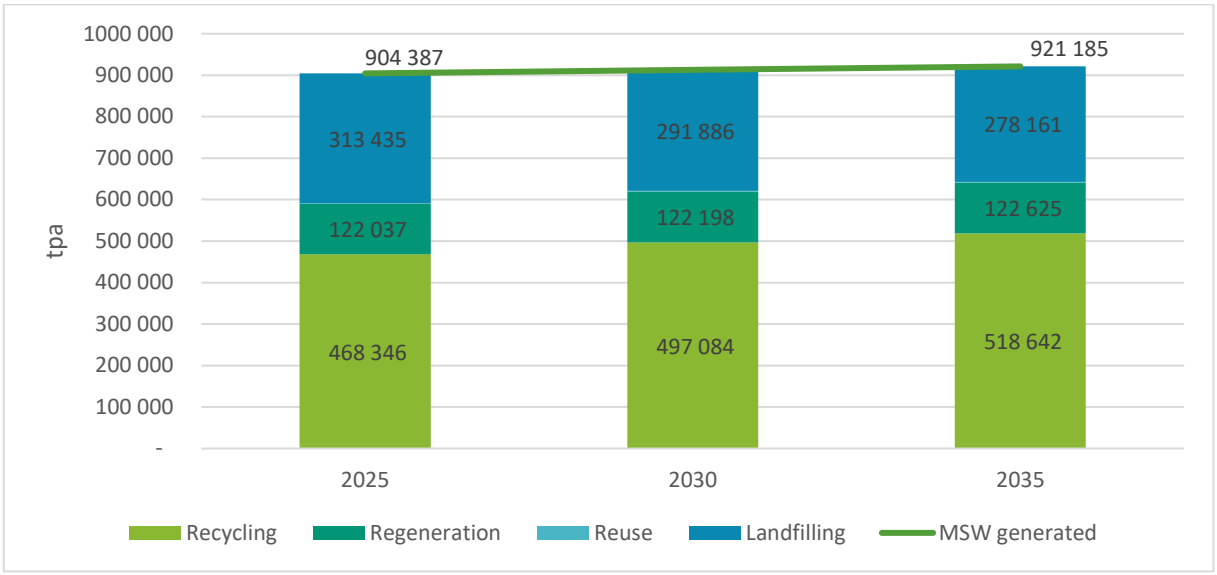

Figure 4.1 Waste management forecasts for 2020-2035 (scenario A), tons

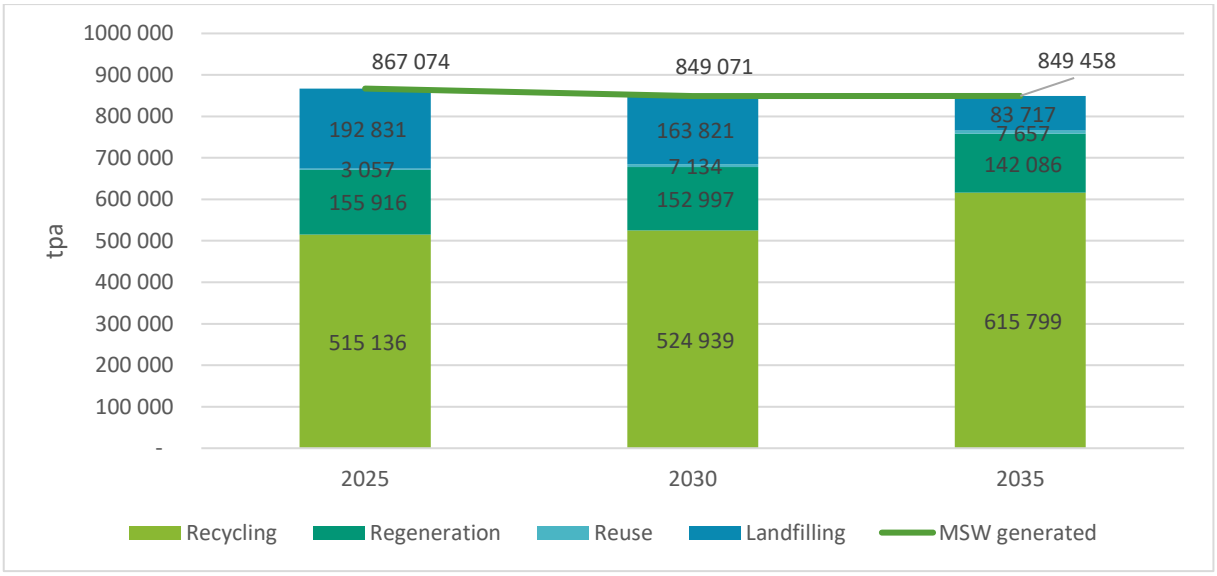

Figure 4.2 Waste management forecasts for 2020-2035 (scenario C), tons

[9] Ministry of Finance, Macroeconomic projections
https://www.fm.gov.lv/lv/sadalas/tautsaimniecibas_analize/tautsaimniecibas_analize/galvenie_makroekonomiskie_raditaji_un_prognozes/

[10] Cabinet of Ministers Regulations No. of 11 August 2020 519 "Rules of Operation of the Deposit System"

Table 4.1 Reuse and reduction of volumes of municipal waste in waste management forecasts for 2020-2035 (scenarios A; B and C), tons

Waste flow	Scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Reduction																	
Food waste	A	176 692	185 704	191 461	194 835	198 122	198 487	198 853	199 219	199 586	199 954	200 322	200 691	201 061	201 431	201 802	202 174
	B; C	172 915	173 210	174 750	173 933	172 905	164 348	165 589	161 910	158 216	156 508	143 968	153 071	153 353	153 636	153 919	142 072
Reduction %		**-2%**	**-7%**	**-9%**	**-11%**	**-13%**	**-17%**	**-17%**	**-19%**	**-21%**	**-22%**	**-28%**	**-24%**	**-24%**	**-24%**	**-24%**	**-30%**
Textile	A; B	28 800	30 268	31 207	31 757	32 292	32 352	32 412	32 471	32 531	32 591	32 651	32 711	32 771	32 832	32 892	32 953
	C	28 800	30 268	31 207	31 292	31 020	29 718	28 995	28 242	27 468	26 678	25 873	25 056	24 227	23 387	22 537	21 677
Reduction %		**0%**	**0%**	**0%**	**-1%**	**-4%**	**-8%**	**-11%**	**-13%**	**-16%**	**-18%**	**-21%**	**-23%**	**-26%**	**-29%**	**-31%**	**-34%**
Reuse																	
Glass	A; B; C	-	-	347	360	454	569	873	1 004	1 145	1 397	1 580	1 614	1 648	1 683	1 719	1 756
Textile	B	374	787	1 217	1 651	2 099	2 523	3 371	4 221	5 075	5 932	6 791	7 229	7 669	8 109	8 552	8 568
	C	374	787	1 217	1 627	2 016	2 318	3 016	3 671	4 285	4 855	5 382	5 537	5 669	5 777	5 860	5 636
WEEE	C	71	75	77	78	80	80	80	80	80	80	80	81	81	81	81	81
Furniture, bulky waste	C	8	17	35	53	72	90	90	90	91	91	91	109	128	146	165	184

5 PROPOSALS FOR THE DEVELOPMENT OF REPAIR AND REUSE SERVICES

The main policy tools proposed are legislative instruments, economic instruments, extended producer responsibility schemes, green public procurement, public information, control, regular reporting and coercive sanctions. Main proposals – summary:

1. When developing and adopting regulatory enactments, it is also necessary to provide for annual control over their implementation and making the necessary improvements. For example, when setting the requirement for the introduction of separate collection of paper, metal, glass and plastic in the municipality, the number of required points and areas per certain number of inhabitants was not initially determined. Consequently, there are municipalities, for example, in the North Vidzeme AAR, where the coverage of the separate waste collection network is significantly better both in terms of collection points and areas than required by the applicable regulatory enactments as well quantities of recyclable materials collected are exceeding state average.

2. Strong regional waste management centers (with and without a waste disposal function) need to be set up to become the supervisor of each regional waste management plan in their territory.

3. The circular economy is based on the design of new products, which includes their sustainable use, including reparability.

4. To follow the import of secondhand goods into Latvia. Inspect incoming cargo and impose penalties for covert entry of waste. Due to the fact that disposal in the country is cheaper than in most other EU countries, waste is imported under the names of secondhand goods. When dismantling bales of imported used clothes, on average half of the content is unusable waste. This possibility must be forbidden as soon as possible.

5. Eliminate the possibility for food waste producers (legal entities) - restaurants and hotels to dispose of food waste in unsorted waste containers, as before. At present, the costs of food waste collection are higher than those of unsorted waste collection, as the natural resource tax on unsorted waste disposal is not balanced with the costs of waste collection and recycling. Contracts with operators and their implementation must be monitored.

6. Establish a requirement for the subjects of the Producer Responsibility System, when selecting operators, to evaluate them according to the amount of service costs. Identify the items to be reported in the costs, including the further payment for processing. Competition between operators has resulted in such low payments to producers that it is not only difficult to collect the type of waste for them, but it is practically impossible to pay the additional amount required for their recycling..

6 PROPOSALS FOR THE REVIEW OF WASTE MANAGEMENT REGIONS

6.1 GENERAL APPROACH CHARACTERISTICS

Historically, the territory of Latvia is divided into 10 waste management regions, the unifying element of each region is the Landfill for Municipal Waste Disposal, the aim of creating the regions was to ensure economically sound waste management, from waste treatment sites to municipal waste disposal landfills, etc.. More than 10 years have passed since the establishment of the WMR and the situation in the field of waste management has changed:

- Waste disposal is not the main function of the waste management system, thus landfill becomes obsolete as a waste management system unifying element,
- there have been significant changes in the population in the regions which have led to changes in the amount of waste generated,
- The main topicality in the waste management sector is the promotion of waste reuse, recycling and recovery, the success of which is largely determined by the availability of appropriate infrastructure.

Currently, the volumes of waste managed by WMR differ significantly (from less than 10 thousand tons in Maliena WMR, to more than 450 thousand tons in Pieriga WMR), therefore an assessment of the future viability, usefulness, functions, division of duties and responsibilities of WMR is required. moreover, it should be noted that, in essence, the only unifying functional element of WMR is, in accordance with the legislation, the requirement to dispose of municipal waste in a landfill in the region in which it is generated..

Addressing this issue, the study will assess the amount of waste generated in each WMR by waste groups, the existing waste management infrastructure, the financial and economic aspects of waste management. The main criteria for revising the boundaries of the WMR and the list of municipalities within them are:

- waste production density in relation to the location of the infrastructure required for waste management,
- existing waste stream transport directions,
- infrastructure capacity and landfill optimization measures,
- financial and economic criteria, incl. possibilities to cover existing liabilities, possibilities to finance new infrastructure objects,
- the impact of the proposed changes on the solvency of waste generators.

When preparing the justification for the correspondence of municipalities to waste management regions, the administrative-territorial division according to the administrative-territorial reform will be taken into account.

6.2 PROPOSALS FOR OPTIMIZATION OF WASTE MANAGEMENT REGIONS AND INFRASTRUCTURE

For the implementation of the defined system centralization tasks, it is proposed to create a model of 5 to 7 waste management regions, which has been developed on the basis of the previously analyzed principles, incl. having regard to the ATR. The ATR is based on all the most important regional indicators, i.e. the current and projected population dynamics in the region, the existing road infrastructure and its condition, the current and projected dynamics of economic development by sectors. Therefore, it is justified to harmonize the boundaries of the AAR reorganization model with the boundaries of the new administrative territories created as a result of ATR. Otherwise, there may be administrative obstacles to the further operation of waste management regions if, for example, the boundary of the WMR divides one of the newly created municipalities.

6.2.1 Optimization of waste management regions - a seven-region model

Initially, it is proposed to create 7 WMR model in which:

- By integration of Dienvidlatgales WMR, Austrumlatgales WMR and part of Vidusdaugavas AAR, Latgale WMR is created;
- By integration of Ziemeļvidzeme, Maliena WMR, part of Vidusdaugavas WMR and part of Pierīga WMR, Vidzeme WMR is created;

- By integration of Pierīga WMR with part of Vidusdaugavas WMR, Pierīga WMR is expanded;
- Piejūra WMR, Liepāja WMR, Zemgale WMR un Ventspils WMR remains within existing borders.

Figure 6.1. WMR optimization – 7 WMR model

The technical and economic indicators of the regions are described in the table (Table 6.1.). Taking into account the location of waste streams and infrastructure, significant differences between the amount of waste potentially managed in the regions remained, however, even in the smaller waste management regions, the amount of waste managed together is increasing.

Table 6.1. Technical and economic indicators of the 7 WMR, forecast in 2020

WMR	Number of municipalities	Number of inhabitants	MSW generated, tpa	Other waste generated, tpa	Waste generated 2020 vs 2035 t	Waste generated 2020 vs 2035, %
Latgale	9	276 939	60 655	10 183	-1 686	-2%
Liepāja	3	127 651	30 221	7 555	1 689	4%
Piejūra	3	128 956	32 096	12 838	7 302	16%
Pierīga	10	910 470	293 454	93 347	137 417	36%
Ventspils	3	72 665	16 689	7 010	1 179	5%
Vidzeme	11	271 812	47 752	19 538	5 165	8%
Zemgale	3	115 494	34 302	3 773	5 951	16%

The amount of waste managed in the regions ranges from 23.7 thousand t in Ventspils region up to 386.8 thousand t in the Pieriga region. Negative dynamics of waste growth remained in one waste management regions - Latgale WMR.

6.2.1 Optimization of waste management regions - a five-region model

When developing an optimization proposal within 5 WMR, the creation of the following regions is initially proposed:

- Latgale WMR is created by integration of Dienvidlatgale WMR, Austrumlatgale WMR and part of Vidusdaugava WMR;
- Vidzeme WMR is created by integration of Ziemeļvidzeme, Maliena WMR, part of Vidusdaugava WMR and part of Pieriga WMR;
- By integration of Pieriga WMR with Zemgale WMR, the Viduslatvijas WMR is created;
- Piejūra WMR by integration with a part of Ventspils WMR creates the Ziemeļkurzeme WMR;
- Liepāja WMR integration with a part of Ventspils WMR forms Dienvidkurzeme WMR.

Figure 6.2. WMR optimization – 5 WMR model

The technical and economic indicators of the regions are described in the table (Table 6.2.). Taking into account the different situation in different regions of Latvia, it is also not possible to balance the quantities of waste managed within one region also in the 5 WMR model, however, such a model provides an opportunity to increase the volumes managed in one place.

Table 6.2. Technical and economic indicators of the 5 WMR, forecast in 2020

WMR	Number of municipalities	Number of inhabitants	MSW generated, tpa	Other waste generated, tpa	Waste generated 2020 vs 2035 t	Waste generated 2020 vs 2035, %
Dienvidkurzemes	4	155 665	35 204	9 648	2 015	4%
Latgales	10	306 444	66 237	11 411	-1 404	-2%
Viduslatvijas	12	996 459	322 174	95 892	143 086	34%
Vidzemes	11	271 812	47 752	19 538	5 165	8%
Ziemeļkurzemes	5	173 606	43 801	17 755	8 157	13%

The amount of waste managed in the regions ranges from 44.8 thousand. t in the Dienvidkurzeme region up to 418 thousand. t in the Viduslatvija region. Negative dynamics of waste growth remained in one waste management region - Latgale AAR.

6.3 FEASIBILITY OF THE INTEGRATION OF WASTE MANAGEMENT REGIONS

By implementing the optimization of waste management regions and specializing the existing landfills, different investment costs of the necessary infrastructure development measures as well as operating costs were calculated. Within the framework of the in-depth analysis financial and economic indicators valuation for the period from 2021 to 2035 was also performed. The obtained comparative results are given in the table below.

Table 6.3. Financial and economic indicators, 2021-2035..

Indicator	Unit	10 WMR scenario (baseline)	7 WMR scenario	Odds	5 WMR scenario	Odds
Amount of investment	M. EUR	301.9	284.8	-17.1	270.8	-31.1
Amount of investment per 1 tone	EUR/t min.	17.1	17.1		17.0	
	EUR/t max.	72.1	36.3		32.8	
Credits	M EUR	199.6	179.4	-20.2	169.9	-29.2
Additional finance	M EUR	8.6	6.0	-2.6	4.9	-3.7
Landfill infrastructure operating costs	M EUR	1 019.6	962.4	-57.2	927.3	-92.3
Including additional operating costs	M EUR	178.7	165.9	-12.8	158.8	-20.0
Financial efficiency of investments						
NPV, milj. EUR	min.	0.2	0.2		5.4	
	max	50.0	49.7		54.0	
IRR	min.	4.4%	4.4%		10.2%	
	max	16.8%	16.8%		14.7%	
Public expenditure on waste management services (MSW and others)	M EUR	2 000.0	1 919.1	-80.9	1 877.4	-122.6
MSW management service cost (EUR/t)	min.	166.6	162.2		160.5	
	max.	313.4	206.0		191.2	
Share of MSW management expenses in household income	min.	0.89%	0.95%		0.74%	
	max	1.30%	1.23%		1.12%	

7 ASSESSMENT OF CURRENT WASTE MANAGEMENT SYSTEM, PRIORITY DEVELOPMENT RECOMMENDATIONS

Elements of the existing waste management system and performance results have been analyzed in the previous sections of the report, incl. Landfill infrastructure assessment and waste volumes managed - Chapter 2 of the report "Assessment of the MSW landfills", total waste volumes managed, collection, treatment, recycling, recovery and disposal activities by waste streams are analyzed in Chapter 3 "Assessment of waste generation and management", future trends in Chapter 4 "Waste flow modeling and forecasts", the possibilities for waste re-use are analyzed in Chapter 5 "Proposals for the development of re-use and repair services ".

7.1 LANDFILL INFRASTRUCTURE DEVELOPMENT

To date, the infrastructure of municipal landfills provides the management of more than 80% of the collected municipal waste. Landfill infrastructure has been developed in terms of engineering solutions and environmental protection requirements, therefore it is recommended to further develop it as regional waste management centers. The implementation of the following activities is necessary for the optimization of the existing functions and the introduction of new waste treatment activities:

a) Preparation of waste for recycling / recovery - modernization / construction of existing facilities and / or new facilities for the separation of recyclable / recoverable materials from the unsorted waste stream. Equipment modernization in 10 landfills, incl. to improve the treatment of unsorted municipal waste streams, to prepare separately collected BDW for recycling, to prepare RDF for recovery. The average amount of unsorted municipal waste and separately collected BDW treated in landfills during the reporting period is 540 thousand tpa, the necessary equipment modernization costs are estimated at an average of 95-100 EUR per tonne of processing capacity. As a result of the implementation of the activity the following capacity has been ensured: preparation of BDW for processing - on average 210 thousand tpa; Preparation of RDF for regeneration - on average 130 thousand. tpa.
b) BDW processing - anaerobic fermentation equipment for mechanically separated and separately collected BDW processing - establishment of BDW processing equipment in 4 waste disposal sites, 2nd stage of Getliņi landfill BDW processing equipment development. The total amount of BDW entering landfills is estimated at an average of 210 thousand tpa, respectively, calculating the additional required processing capacity, without the Getliņi landfill BDW recycling equipment development project, the capacity shortfall is estimated at 110 thousand. tpa. The investment costs for the development of BDW recycling facilities per tonne of processing capacity are estimated at 550-650 EUR / t. As a result of the implementation of the measure, the increase of BDW processing capacity by an average of 110 thousand tpa.
c) Leachate management - Increasing the capacity of the leachate treatment system in 5 municipal waste landfills. In landfills where the waste disposal service is provided, it is necessary to modernize the leachate treatment system, which includes the installation of pre-treatment systems, increase of capacity and optimization of leachate concentrate management. The necessary investment costs are planned: at the Getliņi landfill 7.5 mln. EUR; in the other 4 landfills 1.8-2.5 mln. EUR. As a result of the implementation of the measure, the required capacity of the leachate treatment equipment has been ensured.
d) Landfill gas management - Increasing the capacity of the landfill gas management system in 5 municipal waste landfills where waste is andfilled - investments are planned for the construction of the next stages of the gas collection system and improvement of recovery equipment. Indicatively determined costs of necessary investments are: 8.5 mln. EUR at Getliņi landfill (incl. Gas purification and preparation in biomethane quality); 1.1-3.0 million EUR in other landfills. In 5 landfills, where waste disposal is suspended, investments in the range of 150-200 thousand are planned to meet the minimum landfill gas management requirements. EUR. As a result of the implementation of the measure, the efficient operation of landfill gas collection and utilization systems has been ensured.
e) Waste disposal infrastructure - Construction of new landfill cells is planned in waste management regions where waste disposal capacities are estimated to be insufficient during the reporting period. The required additional capacity is estimated at 1.5 million tons at the Getliņi landfill and 0.45 mln t landfill Ķīvītes, 0.4 mln t landfill Daibe. Investment costs for the construction of a landfill cell are estimated at an average of 400-550 thousand EUR for a waste landfilling facility with a

capacity of 100 thousand t. As a result of the implementation of the measure, the necessary waste disposal capacities have been provided until 2035 in the amount of 2350 thousand. t.

f) Recultivation of existing landfill cells - Recultivation of filled landfill cells in landfills Ķīvīte, Daibe and Getliņi, total recultivated cell area 19.4 ha, incl. 6.1 ha in Ķīvīte landfill, 3.4 ha in Daibe landfill, 9.9 ha in Getliņi landfill, the costs of recultivation works have been determined on average 200-300 thousand. EUR / ha. As a result of the implementation of the measure, recultivation works in the area of 19.4 ha have been performed.
g) Conservation of existing landfill cells – conservation of the existing landfill cells and treatment of leachate at landfills where waste disposal operations are suspended. The works include full treatment of the accumulated leachate, transfer of waste to one cell sector, construction of a delimitation wall and creation of a rainproof cover. The costs of conservation work are estimated at an average of 290 thousand. EUR / ha. As a result of the implementation of the measure, storage conservation works were performed in 5 landfills, the total area 25 ha.
h) Implementation of environmental protection measures, infrastructure extension - Landfill Getliņi and nearby area remediation works - in order to reduce historical pollution it is planned to recover the former landfill (~ 25 ha), soil / groundwater remediation, as well as to expand the landfill area ~10 ha . Reconstruction of the access road (3.7 km) is planned for the Daibe landfill. Reconstruction of the drainage system is planned for the Dziļā vāda landfill. As a result of the implementation of the measure, the impact of MSW landfills on the environment has been minimized and operational safety has been increased.

7.2 DEVELOPMENT OF SEPARATE COLLECTION SYSTEM

The development of a separate waste collection system is critical to increasing waste recycling, as, mainly with the exception of waste streams such as ferrous and non-ferrous metals, high-quality recyclable materials can be obtained by sorting waste at source.

Experience to date has shown that the involvement of waste producers in the separate collection system is influenced by both the availability of separate collection infrastructure and the development of environmental awareness among waste producers. Regarding the provision of the availability of separate collection infrastructure for municipal waste, significant progress has been observed in previous years and the average availability of the separate collection infrastructure in the country exceeds the minimum requirements specified in regulatory enactments..

At the same time, in order to further develop the system, a change of approach is recommended – i.e. given that the minimum standards for setting up separate collection infrastructure have been met in most regions, it would be advisable to develop door–to-door collection approach as fare it is economically and technically feasible.

The second direction in the development of the system is the requirements specified in regulatory enactments for the inclusion of new waste streams in the separate collection system, i.e. separate collection of biodegradable waste and separate collection of textile waste. An important aspect in assessing the possible solutions for organizing the separate collection of these waste streams is their share in the amount of waste generated on a daily basis. For BDW flows of up to 40% in total, it is recommended to use door-to-door system, while it is recommended to collect textile waste through a collection point system.

In general, within the framework of the waste collection system development program, we recommend the implementation the following activities:

a) Expansion of the coverage of the municipal waste separate collection infrastructure - improvement of the existing municipal waste separate collection points, installation of new points door-to-door collection system development. It is planned to purchase and place both mobile and underground type containers. The average cost of purchasing containers is estimated at 350 EUR per container. As a result of the implementation of the measure, ~ 6 thousand separate collection containers of different volumes have been placed;
b) Expansion of the infrastructure of sorted waste collection sites - improvement of the existing sorted waste collection sites, installation of new sites. Currently, analyzing the fulfillment of the regulations for the installation of sorted waste collection areas, it has been established that in order to meet the minimum requirements, it is necessary to install an additional 14 sorted waste collection sites. During the implementation period of the plan, taking into account that the sites are an important collection infrastructure for special waste groups, it is recommended to review the minimum requirements and impose an obligation to install separate waste collection sites in all areas of the existing counties with a population of at least 5,000. Setting such minimum threshold for the creation of sites would require the an additional 13 sites, for a total of 27 sites. Indicative costs for the installation of one collection site have been determined on average 80 thousand. EUR. As a result of the implementation of the measure, an additional 27 separate waste collection sites have been established.
c) Separate collection of biodegradable waste - the implementation of a system of separate collection for biodegradable waste requires the purchase of collection containers for installation at waste generation sites, incl. purchase of specialized containers, which allows to reduce the frequency of container emptying to two weeks. Initially, the required number of containers is estimated at ~ 25 thousand container. The average cost for the purchase and installation of one container is estimated at 250 EUR. As a result of the implementation of the measure, ~ 25 thousand BDW separate collection containers of different volumes have been placed.
d) Establishment of separate collection infrastructure for textile waste - includes installation of textile waste collection containers in existing and newly established separate waste collection sites, as well as installation of special containers in publicly accessible places - near supermarkets, municipal institutions, etc.. The implementation of the system should be gradual, with up to 500 collection points set up in the first years. Estimated purchase and installation costs of one container ~ 2.5 thousand EUR. As a result of the implementation of the measure, ~ 500 textile waste separate collection points have been placed.
e) Municipal hazardous waste management - as waste producers still have limited opportunities to dispose of municipal hazardous waste e.g. household chemicals, contaminated packaging, medicines, etc. in an environmentally sound manner, it is recommended to place storage containers for household hazardous waste in all sorted waste collection sites. The container must be equipped with the necessary bins for the storage of separate streams of household hazardous waste. The purchase and installation costs of one container are indicatively estimated at 4.0 thousand EUR. As a result of the implementation of the measure, ~ 80 additional household hazardous waste collection containers have been placed.
f) Separate collection of food waste from companies and institutions - when developing separate collection and recycling of food waste, it is recommended to purchase specialized large containers for food waste collection from food wholesale bases, logistics centers, markets, food production companies and supermarkets where large volumes of wood waste are produced. The planned purchase costs of one container is an average 6.0 thousand EUR, indicatively required number of containers ~ 100. pcs. As a result of the implementation of the measure, ~ 100 specialized large containers are purchased.

7.3 REPAIR AND REUSE OF WASTE

In order to promote the preparation of waste for re-use, it is recommended to start the development of an organized system for the circulation of second-hand goods, which includes the infrastructure for the collection and preparation of goods for re-use. As such a system does not exist in Latvia so far, it is initially recommended to start its development in the form of a pilot project, which would allow obtaining information on the quantities, types and indicators of involvement of goods to be prepared for re-use. The initial system infrastructure should include:

a) Establishment of goods collection infrastructure - support for the establishment of goods collection system, which mainly includes placement of containers intended for this purpose in sorted waste collection sites, purchase costs of one container on average 5.0 thousand. EUR, required number of containers ~ 100 pcs. In addition to collection areas, campaign-type collection activities should be organized for the collection of reusable goods directly from households..
b) Establishment of repair and preparation for re-use centers - The functions of repair and preparation for re-use centers should include the inspection of collected goods and, if necessary, repair / preparation for re-use, storage of ready-to-use goods and transfer to new users. Support for the establishment of centers should be provided for the establishment of suitable premises, as well as for the purchase of equipment necessary for the provision of the service. The possibility of purchasing road transport - collecting / delivering goods to new users should be considered. In the pilot implementation phase of the system, it is recommended to establish one such center in the territory of each waste management region. Indicative costs for the establishment of one center ~ 350 thousand. EUR. As a result of the implementation of the measure, initially 5 centers were established, one in each waste management region.

7.4 MODERNIZATION OF WASTE MATERIALS RECOVERY FACILITIES

In parallel with the landfill infrastructure, waste preparation for recycling and recovery is carried out at municipal waste sorting stations, construction and demolition waste treatment centers, waste treatment centers for electrical and electronic equipment, etc. In order to increase waste treatment volumes and recovered recyclable materials, as well as developing infrastructure for new waste streams processing for the recovery, the implementation of the following activities is recommended:

a) Improvement of the technological processes of the existing separately collected municipal waste sorting lines - improvement of the efficiency of the existing mechanical and manual waste sorting equipment, with the aim to ensure the achievement of the highest possible recycling / recovery volumes. It is recommended to support measures that increase the volume of materials sent for recycling, ensure the preparation of RDF, to prepare separately collected BDW for recycling. Indicative investment costs per tonne of pre-processing capacity is ~ EUR 250. As a result of the implementation of the measure, an increase in the capacity of preparation of separately collected waste for recycling by at least 100 thousand tpa is ensured.
b) Improvement of other technological processes of waste stream treatment - waste streams such as construction waste, electrical and electronic equipment, end-of-life vehicles, etc. improvement of technological processes of preparation for recycling / recovery with the aim to increase the amount of materials sent for recycling. The exact quantitative result to be achieved is not defined, the aim of the measure is to promote the introduction of new technological solutions. As a result of the implementation of the measure, the technological processes of preparation of certain waste streams for processing / recovery have been improved by reducing the amount of disposed waste.

c) Textile waste collection and sorting centers - The establishment of regional textile waste sorting centers or a centralized system should include the construction / fitting out of premises and the supply of equipment for sorting and preparing separately collected textile waste according to future uses by streams: 1) reusable;) for recycling, 3) for recovery and 4) for disposal. Initially, the required processing capacity is estimated at 5 to 10 thousand. tpa, indicative investment costs 175 EUR per tonne of sorting equipment capacity. As a result of the implementation of the measure, a textile waste sorting center with an operating capacity of up to 10 thousand tpa has been established.

7.5 RECYCLING FACILITIES DEVELOPMENT

In order to promote the increase of waste recycling volumes, it is recommended to provide support for the establishment of new recycling facilities and improvement of technological processes of existing ones. First of all, it is recommended to develop recycling for waste streams for which local capacity and export opportunities are currently not available (including glass, paper, bio-waste). It is assumed that the availability of recycling capacity will have a cumulative effect - it will facilitate the separation of additional waste from the waste stream. Given the requirements for the introduction of a separate collection system for textile waste, special attention should be paid to the development of recycling capacities for this type of material. Potentially supported activities:

a) Recycling of bio-waste and food waste into transport fuels - construction of separate facilities for the recycling of bio-waste and food waste collected from wholesale bases, logistics centers, markets, food businesses, including supermarkets and catering. The construction of equipment that ensures the production of high-quality energy resources, e.g. natural gas quality biomethane, bioethanol. The required equipment capacity is estimated at 20 thousand. tpa - food waste and ~ 20 thousand. tpa by-products of food production, projected investment costs ~ 625 EUR per tonne of processing capacity. As a result of the implementation of the measure, the establishment of new, high value-added processing equipment has been ensured, the expected increase of processing capacity to 40 thousand tpa.
b) Materials recycling - equipment for materials recycling (glass, plastics, paper, textiles, etc.). Priority should be given to equipment for the processing of materials with limited market and export opportunities (glass, paper). Projected investment costs per tonne of processing capacity of the plant - on average 750 EUR, expected increase of local processing capacity up to 20 thousand tpa.
c) Municipal WWTP sludge recycling - Investments in the establishment of WWTP sludge recycling infrastructure in 6-8 municipal waste landfills - adaptation of infrastructure, purchase of equipment for preparation of sewage sludge compost. The projected increase in sludge processing is estimated at ~ 50 thousand tpa. The investment costs for the establishment of one sludge processing area (incl. Deliveries of machinery and equipment) are indicatively estimated at ~ 350 thousand EUR. As a result of the implementation of the measure, the increase of WWTP sludge processing volumes by ~ 50 thousand tpa is ensured.
d) Natural gas quality biomethane preparation equipment - equipment for landfill gas, gas from BDW anaerobic digestion plants, purification and preparation for use as a fuel for road transport. Purchase of compressed biomethane-powered vehicles for waste management purposes, incl. specialized waste collection transport, transport for secondary raw materials. The equipment can be located in landfills Daibe, Cinīši, Janvāri and Ķīvītes. Projected equipment capacity 250-350 Nm3 / h. Planned investment costs for the development of one set of equipment 3.5-4.0 mln. EUR. As a result of the implementation of the measure, four facilities with an operating capacity of 250-350Nm3 / h has been established.

7.6 WASTE REGENERATION INFRASTRUCTURE

As a result of waste preparation for recycling and recovery activities, a certain amount of non-recyclable but high caloric materials (up to 200 - 220 thousand tpa) is generated, which can be prepared as an energy resource for energy production. In the current situation, due to the lack of suitable recovery facilities, this amount of energy resource is disposed of in landfills. In order to reduce the amount of landfilled waste, especially taking into account the disposal limits set in 2035, it is recommended to consider the possibility of establishing waste recovery facilities with energy recovery. It should be noted that in the development of energy recovery technologies, a prerequisite for energy efficient and economically justified operation of the technology is the efficient use of the produced heat, which can be ensured only if the produced heat is transferred to the district heating network. Evaluating the potentially available energy recovery capacities in the coming years, as well as the possibilities to transfer the produced heat energy for consumption in the district heating network, it is recommended to consider the implementation of the following activities:

a) Establishment of waste recovery facilities with energy recovery in Viduslatvijas WMR - Establishment of waste recovery with energy recovery in Viduslatvija WMR, Riga city. Installations must ensure the recovery of non-recyclable waste by producing heat with or without electricity generation. Indicative required capacity ~ 110 000 tpa, investment costs 900-1100 EUR per tonne of plant regeneration capacity.
b) Establishment of waste recovery with energy recovery equipment Latgale WMR - Establishment of waste recovery with energy recovery Latgale WMR, Daugavpils city. Installations must ensure the recovery of non-recyclable waste by producing heat with or without electricity generation. Indicative required capacity ~ 20,000 tpa, investment costs 900-1100 EUR per tonne of plant regeneration capacity.
c) Establishment of waste recovery with energy recovery facilities in Vidzeme WMR - Establishment of waste recovery with energy recovery in Vidzeme WMR, Valmiera city. Installations must ensure the recovery of non-recyclable waste by producing heat with or without electricity generation. Indicative required capacity ~ 20,000 tpa, investment costs 900-1100 EUR per tonne of plant regeneration capacity.

7.7 PUBLIC EDUCATION AND INFORMATION ACTIVITIES

The aim of public information and education measures is mainly to involve waste producers in the separate collection system, as the effectiveness of the separate collection system depends not only on the availability of the service, but also on the producer's willingness to participate in waste sorting. Taking into account the new initiatives regarding the introduction of separate collection of new waste streams, incl. the separate collection of biodegradable waste and the separate collection of textile waste, as well as the development of a system for preparing goods for re-use, the implementation of public information and education measures are an integral part of the implementation of the planned measures. Information activities should be supported not only as an informative component of infrastructure development projects, but also as separate independent activities. In parallel with infrastructure development measures, it is recommended to provide support for the following measures aimed at informing and educating the public:

a) Public information and education measures - Education and information campaigns on the development of a separate waste collection system, new elements of the system throughout the implementation of the plan (including separate collection of BDW, separate collection of textile waste, development of recycling centers, etc.). The costs are indicatively set at 0.20-0.50 EUR per

capita per year. As a result of the implementation of the measure, the necessary information provided to the public is promoted.

b) Establishment of educational competence centers in waste management regions - establishment of at least one competence center in each waste management region, which was constantly engaged in the planning and implementation of educational activities. Supported activities could include the establishment of a center, incl. construction / furnishing and equipping of premises. The cost of setting up one center is estimated at around 500 thousand. EUR. As a result of the implementation of the measure, 5 educational competence centers have been established - one center in each waste management region.

8 INVESTMENT PRIORITIES AND SOURCES OF FINANCE

The priority directions of development of the waste management sector are analyzed in Chapter 7 of the report. Based on the results of the analysis and taking into account the prepared proposals, an investment cost assessment of potentially implemented activities has been prepared, as well as a list of priority supported activities has been prepared and possible sources of financing have been analyzed..

8.1 INDICATIVE ASSESSMENT OF INVESTMENT COSTS AND RECOMMENDATIONS FOR PRIORITY ELIGIBLE ACTIVITIES

An indicative estimate of the amount of investments required for the efficient operation and development of the waste management sector in the period until 2035 is presented in table. (Table 8.1). The required amount of investment is determined based on the necessary measures, quantities and the costs of implementation. For each activity, the synergistic effects on the achievement of the objectives set out in the directives have been assessed.

Table8.1. Indicative assessment of investment costs

No	Activity	Investment costs EUR	Synergistic effects on the achievement of the objectives of the directives		
			2018/851/EC	2018/850/EC	2018/852/EC
1.	**Development of separate collection system**				
1.1.	Increase of the coverage of the municipal waste separate collection infrastructure	2 200 000,00	Direct contribution*	Direct contribution	Direct contribution
1.2.	Separate collection sites infrastructure development	2 100 000,00	Direct contribution	Direct contribution	Direct contribution
1.3.	Separate collection of BDW	6 400 000,00	Direct contribution	Direct contribution	No contribution
1.4.	Separate collection of textile waste	1 250 000,00	Direct contribution	Direct contribution	No contribution
1.5.	Hazardous household waste management	360 000,00	Partial** contribution	Partial contribution	No contribution***
1.6.	Separate collection of food waste from commerce	600 000,00	Direct contribution	Direct contribution	No contribution
1.7.	TOTAL	12 910 000,00			
2.	**Development of the system for reuse and repair of goods**				
2.1.	Goods collection system	500 000,00	Direct contribution	Direct contribution	No contribution
2.2.	Establishment of repair and preparation for re-use centers	1 750 000,00	Direct contribution	Direct contribution	No contribution
2.3.	TOTAL	2 250 000,00			

No	Activity	Investment costs EUR	Synergistic effects on the achievement of the objectives of the directives		
			2018/851/EC	2018/850/EC	2018/852/EC
3.	**Modernization of waste materials recovery facilities**				
3.1.	Capacity rising of facilities for waste treatment before recycling and recovery	52 900 000,00	Direct contribution	Direct contribution	Partial contribution
3.2.	Existing sorting and processing facilities development for MSW	25 000 000,00	Direct contribution	Partial contribution	Direct contribution
3.3.	Sorting and processing facilities development for other waste streams	10 000 000,00	Partial contribution	Direct contribution	No contribution
3.4.	Textile waste sorting facility	1 750 000,00	Direct contribution	Direct contribution	No contribution
3.5.	TOTAL	89 650 000,00			
4.	**Recycling facilities development**				
4.1.	BDW recycling (R3D)	65 600 000,00	Direct contribution	Direct contribution	No contribution
4.2.	Bioethanol production from food waste	25 000 000,00	Direct contribution	Direct contribution	No contribution
4.3.	Secondary raw materials recycling	15 000 000,00	Direct contribution	Partial contribution	Direct contribution
4.4.	Sewage sludge recycling	2 500 000,00	Partial contribution	Partial contribution	No contribution
4.5.	TOTAL	108 100 000,00			
5.	**Waste regeneration infrastructure**				
5.1.	Regeneration facility Viduslatvijas WMR	120 000 000,00	Partial contribution	Direct contribution	No contribution
5.2.	Regeneration facility Latgales WMR	20 000 000,00	Partial contribution	Direct contribution	No contribution
5.3.	Regeneration facility Vidzemes WMR	20 000 000,00	Partial contribution	Direct contribution	No contribution
5.4.	TOTAL	160 000 000,00			
6.	**Landfill infrastructure development**				
6.1.	Leachate treatment	15 400 000,00	No contribution	Direct contribution	No contribution
6.2.	Landfill gas management	15 750 000,00	No contribution	Direct contribution	No contribution
6.3.	Bio-methane production from landfill gas	15 000 000,00	Direct contribution	Partial contribution	No contribution
6.4.	Waste landfilling	10 500 000,00	No contribution	Direct contribution	No contribution
6.5.	Recultivation of landfill cells	4 825 000,00	No contribution	Direct contribution	No contribution
6.6.	Conservation of landfill cells	7 330 100,00	No contribution	Partial contribution	No contribution
6.7.	Environment protection measures, infrastructure extension	98 450 000,00	No contribution	Direct contribution	No contribution
6.8.	TOTAL	167 255 100,00			
7.	**Public education and information activities**				
7.1.	Public education and information activities	3 600 000,00	Direct contribution	Partial contribution	Direct contribution
7.2.	Establishment of educational competence centers in waste management regions	2 500 000,00	Direct contribution	Partial contribution	Direct contribution
7.3.	TOTAL	6 100 000,00			
8.	**IT solutions**				

No	Activity	Investment costs EUR	Synergistic effects on the achievement of the objectives of the directives		
			2018/851/EC	2018/850/EC	2018/852/EC
8.1.	Optimization and development of waste management accounting systems	2 500 000,00	Direct contribution	Partial contribution	Direct contribution
8.2.	TOTAL	2 500 000,00			
9.	GRAND TOTAL **(1:8)**	**548 765 100,00**			

* Direct contribution - the implementation of the measure makes a direct positive contribution to the achievement of the objectives set out in the relevant directive - for example - the development of a separate collection system increases recycling, thus promoting municipal waste recycling, packaging waste recycling and reduces waste disposal.
** Partial contribution - the measure is not directly aimed at achieving the objectives of the Directive, but has an indirect positive effect - for example - management of municipal hazardous waste – the establishment of separate collection containers is not directly aimed at increasing recycling, but it does contribute the separation of the hazardous waste stream from the municipal waste, thus avoiding hazardous substances in recyclable materials.
*** No contribution - the implementation of the measure does not affect the achievement of the objectives set out in the relevant directive - for example - the separate collection of hazardous waste does not affect the achievement of the packaging waste targets set in the Packaging Directive (2018/852 / EU)

8.2 FINANCIAL ANALYSIS OF THE IMPLEMENTATION OF THE PLANNED MEASURES

The financing of the development of the waste management system must be based on the 'polluter pays' principle. This means that the management of the system (separate collection, preparation for re-use, recycling, recovery of materials and energy) is provided by a waste management fee paid by the waste producer.

With regard to State or EU funding or donations, the actual assessment of the investment shortfall should be made on the basis of estimates of the required investments in infrastructure / equipment in the period up to 2035, incl. the amount of investment at which it would be possible to achieve a positive return on investment (taking into account the possible sources of financing with and without the support component) should be determined, while maintaining a moderate impact on the share of waste producers' expenditure on waste management.

Based on the overall financial-economic analysis of the waste management system, the financing scheme includes the maximum allowable EU funding support (35% for the private sector or 85% for the public sector).

Acquisition of basic investments is planned for 7 years (2021-2027). More financially intensive projects related to the development of landfill infrastructure are planned to be implemented within five years from 2021 to 2025. Establishment of waste recovery infrastructure is planned for 2022-2024.

The investment financing scheme is determined by:

- Sources of financial resources (European Union funds grants, state financing, local government budget funds, companies own resources, loans from credit institutions)
- Proportions of attracted support resources depending on the directions of WMS development
- Leverage costs.

In total, waste management fees are affected by 3 external variables:

- Fee for waste collection;
- Fee for waste disposal;
- Landfill tax for waste disposal.

The development of the SA management system in five AARs and in Latvia in general will affect each of the above-mentioned values, as the calculation of the service fee will additionally include:

- new capital investments in the form of depreciation deductions,
- fee for attracted financial resources (loan interest),

- relevant operating costs,
- Additional revenues from the sale of materials / substances that will arise in the technological process of waste recycling / recovery.

Determining the impact on the MSW management fee, developing the waste management system in Latvia in the period until 2035, additional operating expenses have been determined based on the actual costs in Latvia for activities performed and information provided by potential equipment suppliers / manufacturers for activities where actual costs are not determined. According to preliminary estimates, additional operating costs may reach approximately 23.8 million EUR annually. In turn, additional revenues that reduce waste management fees will amount to 17.7 million EUR.

The existing municipal waste management fee varies considerably depending on the regional waste management infrastructure, population, amount of waste generated and collected. On average in Latvia this indicator is about 120 EUR per tonne of waste

According to the assessment, waste management payments on average are 0.6% of household income in 2020. The increase of waste management fee in the calculation period is estimated at ~ 40%, thus the share of MSW management expenses in household income may increase, however, not exceeding 1% of household income (on average 0.92% in the period). Without attracting co-financing from EU funds, the maximum increase of the SA management fee in the period under review could be ~ 57%, and payments for waste management services would exceed 1%..

Table8.2. Affordability calculation

Factors	Unit	2021	2025	2030	2035
Average income per household member	EUR/month.	548,29	591,16	639,88	692,61
MSW per capita generated	tonnes	0,294	0,334	0,356	0,382
Population	Pers.	1,887,156	1,819,838	1,742,028	1,658,983
MSW collection fee	EUR/t	119,50	161,39	171,43	165,18
Payment for MSW collection monthly	EUR	3,54	5,44	6,16	6,37
VAT rate		21%	21%	21%	21%
Share of MSW management expenditure in household income		**0,65%**	**0,92%**	**0,96%**	**0,92%**

Based on the assumptions made, the total public expenditure on waste management in the period from 2021 to 2035 would reach 1.78 billion EUR..

However, in order to ensure the successful implementation of the planned waste management system development program by 2027, the support of the European Union funds of more than 170 mln. EUR, which is on average 31% of the total amount, but for individual measures varies between 0%, 35% and 85%.

Table8.3. Investment financing scheme, thousand EUR

	With EU funding	
Investments	**548 765.1**	**100%**
EU funds	170 969.4	31.1%
Loan	284 751.2	51.9%
Own funds of enterprises	93 044.5	17.0%

Summarizing the above, the amount of investment or investment insufficiency is equivalent to the required EU funding of 170 million. EUR.