Project: "*Promotion of BAT and BEP to reduce uPOPs releases from waste open burning in the participating African countries of SADC sub-region*"

SOLID WASTE MANAGEMENT PLAN

Municipality of TALATAMATY

(Draft version)

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General information about Municipality of Talatamaty

As a tropical climatic zone of altitude. It has the characteristics of the highlands of Madagascar, with an alternating "dry and cool season" and "wet and hot season". The average rainfall of the year is about 1,200 mm and does not exceed 1,400 mm and the average annual temperature is 19°C.

The "dry and cool season", known as "winter", begins in May and usually ends around mid-September. The minimum temperature, on average 10°C, is recorded around mid-July. Towards the end of this period, more precisely in August and early September, the temperature rises rapidly and reaches an average of 18°C and the precipitation remains low.

The "wet and hot season" or " Austral summer " is the rainy season; it generally begins in November and ends in April. During this period, the months of December, January, and February have the highest rainfall (e.g. in 2001 they were 211 mm, 344 mm, and 168 mm respectively). This abundance of precipitation is caused by the fluctuation of the inter-tropical convergence zone (ITCZ) and the occurrence of low-pressure cells in the Indian Ocean. In the month of December; ANTANANARIVO experiences the highest number of rainy days between 15 and 20 days per month from November to January.

In addition, during the period of major climate disturbance the rains are light but persist for a long time during the day. It is during this period of the year that flooding occurs in the low zones of Antananarivo. On average 30% of tropical disturbances passing through Madagascar have impacts on the climate of the highlands.

The Rural Commune of Talatamaty is located in the ANALAMANGA Region. It is part of the District of AMBOHIDRATRIMO. It is located 8 km from Antananarivo city and 4 km from Ivato International Airport, crossed by the national road n° 4 to Mahajanga.

It is limited by the neighboring communes:

- To the north: Rural Commune IvatoAeroport,
- To the South: Rural Commune Ambohitrimanjaka
- To the West: Rural Commune Ambohidratrimo
- To the East: Rural Commune Ivato Firaisana and Rural Commune Antehiroka

- Postal Code: 105
- Telephone number: 22 485 32
- Surface area: 12,19 km²
- Number of Fokontany: 12 Fokontany (Villages)

The following table summarizes the surface area of each fokontany constituting the rural commune of Talatamaty as well as the distance of each fokontany from the commune's central place.

Name of Fokontany	Surface in Km²	Distance/Chief Location Municipality (Km)
1. Talatamaty	0.14	1.17
2.Ambohitravao	0.25	1.38
3.Ambohibao	0.95	1.92
4.Ankadivory	1.60	1.95
5.Faralaza	0.80	1.90
6.Fitroafana	1.78	3.60
7.Maibahoaka	0.75	2.70
8.Mamory Antoby	1.54	5.66
9.Mandriambero	0.63	1.8
10.Tanjondava	1.33	1.34
11.Amboropotsy	1.74	0
12.Imeronafoavoany	0.68	2.56
TOTAL	12,19	

1 INTITIAL CONSIDERATIONS

1.1 Pre-planning decisions

Table 1: Decisions taken during the initial meeting with stakeholders about the planning process of the solid waste management plan

Results of initial pre-planning meeting with stakeholders on [insert date]						
List of stakeholders to take an active role in the planning process (make note of which ones attended the meeting with an *)		Number and purpose of each working group	Stakeholders and their assigned working group	Timeline for the planning process	Meeting frequency of working groups	Other significant planning deadlines
Waste managers: - Mayor, technical - service, - WHIF association - Fandio	Waste generators: Households, company, market, school, hotel,	WG1: Waste collection is timely matter WG2: Setting up waste treatment site	*WG1:* Mayor, Technical service, chief of fokontany, Fandio. WG2: Mayor and technical service: chronology, Equipment,	(*)	(*)	Waste generation rate and waste collection rate updated by WG1 by 1st quarter 2023 Scheme, design of facility (RCC) defined and approved by WG2 by 1st quarter 2023

(*) Note that this plan was prepared in several steps:
1- Preparation of the plan by a small group composed of the Technical Service with the support of the Technical Consultant;
2- Presentation of the draft plan to the Mayor;
3- Organization of a workshop with the stakeholders;
4- Presentation of the draft Plan by the Mayor to the Communal Council for validation

2 BACKGROUND

2.1 Waste problematic in the local context

Table 2: List of reasons why waste is problematic in TALATAMATY

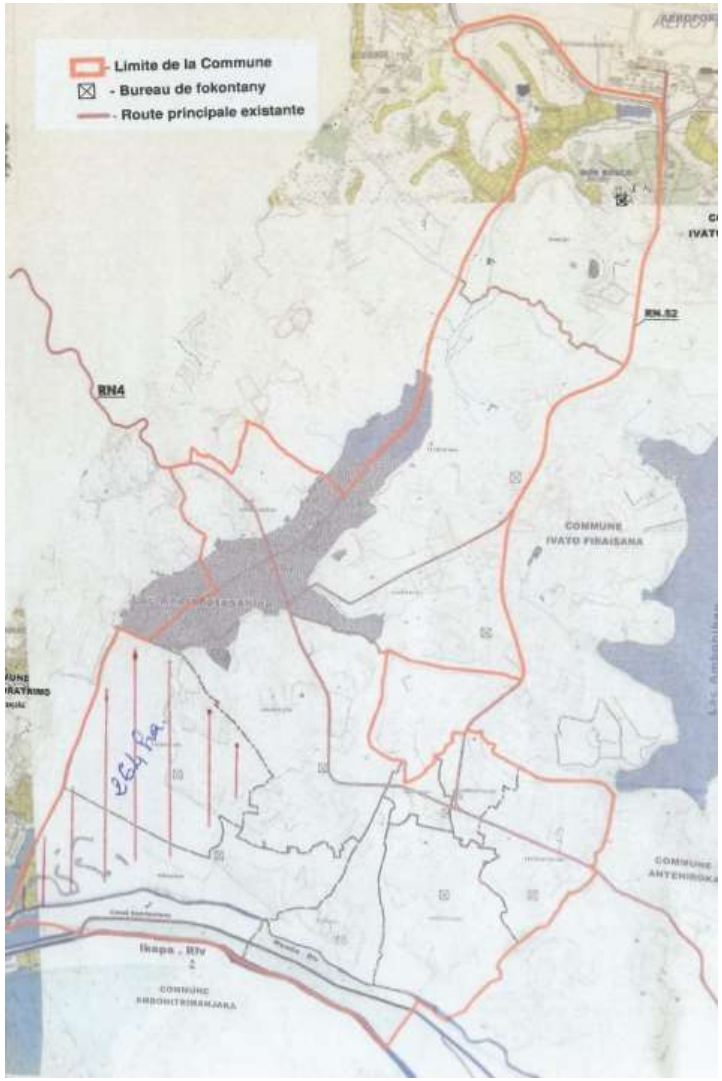
Problems waste is causing in TALATAMATY	
Health-related:	- Due to the lack of order to remove the garbage from house to house, the garbage is scattered on the streets - The waste spread causes a bad smell causing ill health in the community - The smell and smoke cause respiratory diseases - Rats, mosquitoes and flies carry various diseases such as plague and fever etc
Environmental:	- No pre-treatment of wet organic waste to landfill. thus producing methane - F ailure to treat wet waste which leads methane causes self-combustion - The smoke produced by the burning causes respiratory diseases in people living around the waste disposal site.
Aesthetic:	- Community collection bins are overflowing near major points of commercial activity in town; businesses are moving to other areas

2.2 Initial scope of the plan

Table 3: Initial scope of the solid waste management plan

Solid Waste Management Plan Scope		
Geographic	Types of Waste	Timeline (e.g., overall5-10years; 1-2 action plans resp.)
Included: - All 16 839 households of 12 Fokontany - Farmers markets Excluded: - 256 hectares of agricultural fields - All industries facilities	Included: 1. Municipal solid waste (MSW) 2. Householdswaste Excluded: 3. Industrial waste 4. healthcare waste 5. agricultural waste	5 years

Map of geographic area where waste management plan applies



3 STATUS QUO ASSESSMENT

3.1 Default data collection

3.1.1 Population and municipal data

Table 4: Required population and municipal data for the SWMP

TALATAMATY 's Population and Municipal Data			
Population size	Size of WM area	Population density	GNI/capita
(No. of people)	(km^2) or (No. of households)	(ppl/km^2) or (ppl/household)	(USD/person)
114 033 people	16 839 households	7 people/household	521 USD/person

3.1.2 Waste quantity and composition data

Table 5: Required waste quantity and composition data for the SWMP

<table>
<tr><th colspan="3">TALATAMATY's Waste Quantity and Composition Data</th></tr>
<tr><td>Determined average waste generation rate per person</td><td>(kg/pers/day)</td><td>0,3 kg/day</td></tr>
<tr><td>Population</td><td>(no. of ppl)</td><td>114 033 people</td></tr>
<tr><td>Total waste generated per day (tones/day)</td><td>(tones/day)</td><td>34.20tonnes/day</td></tr>
<tr><td>Total waste generated per year (tones/year)</td><td>(tones/year)</td><td>12 486.61tonnes/year</td></tr>
<tr><td>Determined average waste composition</td><td>(%)</td><td>
<table>
<tr><th>Waste Material</th><th>Average Percent in Waste</th></tr>
<tr><td>Organic</td><td>60%</td></tr>
<tr><td>Paper & Cardboard</td><td>6.9%</td></tr>
<tr><td>Plastics</td><td>8.49%</td></tr>
<tr><td>Metals</td><td>2.18%</td></tr>
<tr><td>Glass</td><td>2%</td></tr>
<tr><td>Rubber, Leather, and Synthetics</td><td>0.2%</td></tr>
<tr><td>Textiles</td><td>3%</td></tr>
<tr><td>Wood</td><td>3%</td></tr>
<tr><td>Inert Material</td><td>0.16%</td></tr>
<tr><td>Other</td><td>14,07%</td></tr>
</table>
</td></tr>
<tr><td>Determined average waste density (kg/m^3)</td><td>(kg/m^3)</td><td>300 *kg/m^3*</td></tr>
</table>

3.1.3 Waste policies and legislation

Table 6: Policies and legislation relevant to solid waste management

Area of Waste Management	Laws and Acts	Regulations and Standards	Economic Instruments	Enforcement
Overall (General)	- Law No. 90-033 of 21 December 1990 on the Malagasy Environment Charter - Law n° 98-029 du 20 /01/99 relating to Water Code (applies to waters dependent on the public domain, surface water, groundwater) - Law N° 99-021 du 19/08/ 99 on Industrial pollution management policy (wastewater management, solid waste management) - Decree N ° 2004-167 modifying some provisions of decree n ° 99-954 of December 15, 1999 relating to the compatibility of investments with the environment (MECIE)	Municipal Code of Hygiene		
Source Reduction (Production & Consumption)	- Decree N° 2017-010 prohibiting the production, import, marketing, stockpiling and use of plastic bags in the national territory			

Area of Waste Management	Laws and Acts	Regulations and Standards	Economic Instruments	Enforcement
	- Decree N° 2015-930 on Classification and environmentally sound management of waste electrical and electronic equipment in Madagascar			
Segregation of Waste (at source)				
Primary Storage & Collection				
Transportation & Transfer Stations				
Treatment				
Landfills				
Incinerators				

Area of Waste Management	Laws and Acts	Regulations and Standards	Economic Instruments	Enforcement
Recycling				
Resource Recovery				
(Healthcare Waste)				

3.1.4 Institutions in place

Table 7: Institutions involved in solid waste management

Type of Service	Regulator	Service Provider			
		National Government	Local Government	Private Sector	Informal
Municipal Solid Waste Management					
1. Collection			municipality		
2. Transportation			municipality		
3. Treatment					
4. Disposal			municipality		
5. Recycling / Resource Recovery					
(Healthcare Waste Management)					

3.1.5 Technologies in use

Table 8: Technologies available for solid waste management;

Type of Service	Technology				
	Type	**Quantity**	**Year of Purchase / Years in Operation**	**Condition (old, new, well maintained, overused, worn, out of operation)**	**Important Features**
Municipal Solid Waste Management					
1. Collection/2. Transportation	Truck 5 m^3	1	2021	Well maintained	
	Drawn cart	1	2021	overused	
	Wheelbarrow	1	2020	overused	
	Small truck	1	2021	overused	
3. Treatment					
4. Disposal					
5. Recycling / Resource Recovery					

3.1.5.1 Waste collection rate

Table 9: Waste collection rate as determined by quantity and load capacity of entire waste collection fleet

Waste Collection Register					
Collection vehicle type and its load capacity	**Average waste density of waste type (e.g., MSW)**	**Calculated mass of waste delivered per truck load**	**Average number of trips to disposal site per vehicle per day**	**Number of active collection vehicles of this type per day**	**Total waste collected (tonnes/day)**
(m^3)	(kg/m^3)	(kg/vehicle load)	(No.)	(No.)	(tonnes/day)
Truck 5m 3	300 kg/m^3	1,500 kg/load = 1.50tones/load	5	1	**7.5tonnes / day**
Drawn cart (1.5 m^3)	300 kg/m^3	450 kg /load =0.450tones/load	2		**0.9tonnes / day**
			Total Waste Collected per Day		**8.4tones/day**

3.1.5.2 Percentage of the population serviced

Table 10: Percentage of the population served by waste collection services, according to surveys or other data

Waste Collection Coverage Rate	
Total number of households that participated in survey	30
No. households that participated from impoverished areas	10
No. households that participated from affluent areas	20
Collection rate for impoverished households	65%
Collection rate for affluent households	20%

Waste Collection Coverage Rate	
No. people living in impoverished areas	74 121
No. people living in affluent areas	39 911
Calculated waste collection coverage rate (see in Example 3.4 in SWMP toolkit)	**24.6%**

3.1.5.3 Waste recycling, recovery, and organic waste valorization rate

Table 11: Waste valorization rate of Talatamaty

2022 Waste Recycling, Recovery, and Organic Waste Valorization Rate		
Recovery activity description	**Quantity of waste (tonnes per year)**	**Percentage of total waste generated (%)**
Organic waste converted to compost or applied directly to soil as an organic fertilizer in agriculture	0	0
Combustible waste used as a fuel or for energy generation in an incineration plant (unrecyclable paper and plastics, rubber, wood, textiles, etc.)	0	0
Waste materials separated for recycling purposes (metals, plastics, paper)	0	0
Waste materials recovered for direct reuse or repurposing (e.g., plastic bottles)	0	0
	Total Percent Waste Valorized	**0**

3.1.6 Costs and financing of the WMS

3.1.6.1 Total costs

Operating costs

Labor costs

Table 12: Register of total labor costs, based on all workers formally and informally employed by the WMS

Waste Management Stage	Job Title/ Description	Number of Workers	Employer/ Employed by	Primary Source of Payments	Annual Salary + Other Costs per Worker	Annual total
Waste Collection/ Waste Transportation	Collection truck driver	01	Municipality	budget of municipality	3 600 000	**3 600 000**
	Collection truck loader	08	Municipality	budget of municipality	3 000 000	**24 000 000**
	Garbage collector	26	Municipality	budget of municipality	3 600 000	**93 600 000**
	Responsible	02	Municipality	budget of municipality	7 200 000	**14 400 000**
		01	Municipality	budget of municipality	1 680 000	**1 680 000**
Waste Treatment						
Recycling / Resource Recovery						
Waste Disposal						
Informal Solid Waste Management***						
***Record but DO NOT include in the overall annual labor costs					**Total Labor Costs per Year**	**137 280 000**

Energy costs

Table 13: Register of total energy costs, based on all of the vehicles, equipment, and facilities in operation in the WMS

Type of Service	**Fuel/Energy-consuming vehicle, equipment, or facility**	**Quantity**	**Fuel/Energy consumption rate**	**Hours per year in operation**	**Total fuel/energy consumed per year**	**Average fuel price of the last 12 months**	**Annual total**
		(No.)	**(liters/hr; kWh)**	**(hrs/yr)**	**(liters or kWh)**	**(Ar/liter)**	**(Ar/yr)**
Municipal Solid Waste Management							
1. Collection and transportation	Truck 05 m^3	01	1.75 liters/hr	2 504 hours/year	4 382 liters of petrol/year	4 900Ar per liter petrol	**21 471 800**
3. Treatment							
4. Disposal	Gear	01	12 liters/hr	48 hours/year	576 liters of petrol/year	4 900Ar per liter petrol	**2 822 400**
5. Recycling / Resource Recovery							
					Total Energy Costs per Year		**24 294 200**

Maintenance costs

Table 14: Register of total maintenance costs, based on all of the technologies and equipment in use in the WMS

Type of Service	**Type of technology, vehicle, or equipment**	**Quantity**	**Years in operation**	**Condition**	**Original cost / Price at time of purchase**	**Estimated maintenance cost percentage**	**Annual total**
		(No.)	**(No.)**	**(old, new, overused,out of operation)**	**Ariary**	**(~5-10%)**	**(Ariary/year)**
Municipal Solid Waste Management							
1 Collection And transportation	Truck	01	2 years	**overused**	280 000 000	5% → 0.05	**14 000 000**
3. Treatment							
4. Disposal							
5. Recycling / Resource Recovery							
					Total Maintenance Costs per Year		**14 000 000**

Financial Costs

Depreciation

Table 15: Register of total deprecation costs, based on all financial assets included in the WMS

Area of waste management	**Type of financial asset**	**Quantity**	**Original price of asset**	**Typical economic life**	**Inflation rate**	**Annual total**
		(No.)	**(Ariary)**	**(No. years)**	**(%)**	**(Ariary/year)**
Municipal Solid Waste Management						
1. Collection/ 2. Transportation	Truck 05 m^3	1	280 000 000	7	0	**40 000 000**
3. Treatment						
4. Disposal						
5. Recycling / Resource Recovery						
				Total Depreciation Costs per Year		**40 000 000**

Interest rates

Fill in the table below using the information provided in Section 3.3.6 in the SWMP toolkit.

Table 16: Register of total financial costs associated with borrowing money for larger purchases in the WMS

Purpose of loan (for purchase of which asset/s)	**Amount of money borrowed**	**Interest rate on loan**	**Duration of loan**	**Annual payment (A) due to lender (annual financial cost of the loan)**
	("P" = principal in USD)	**("r" in %)**	**("n" in years)**	**(USD/year)**
		Total Financial Costs of Loans per Year		

TOTAL COSTS PER YEAR: **215 574 200Ariary/year**

3.1.6.2 Total available funding

Table 17: Financing methods used to fund the solid waste management system

Type of Service	**Organization**	**Financing Mode**		
		Direct Revenue	**Local or Natl. Govt. / Intl. Cooperation**	**Private Sector**
Municipal Solid Waste Management				
1. Collection/2. Transportation	Various taxes and fees		200 000 000	

Type of Service	Organization	Financing Mode		
		Direct Revenue	Local or Natl. Govt. / Intl. Cooperation	Private Sector
3. Treatment				
4. Disposal				
5. Recycling / Resource Recovery				

TOTAL AVAILABLE FUNDING PER YEAR: **200 000 000Ariary** /year

3.1.6.3 Total cost per tonne of waste managed

Table 18: Total cost per tonne of waste managed

Total costs for WM services	(Ariary/year)	**215 574 200Ariary/year**
Total waste collected annually (MSW/day) x (365 days)	(tonnes/year)	**2 629 tonnes MSW/year**
Total cost per tonne MSW managed	(Ariary/tonne)	**81 992 Ariary/tonne MSW**

3.1.6.4 Financial summary

Table 19: Financial summary based on all salient economic factors involved in waste management in the municipality

Financial Summary for TALATAMATY		
TOTAL AVAILABLE FUNDING	(Ariary/year)	**200 000 000 Ariary/year**
TOTAL COSTS PER YEAR	(Ariary/year)	**215 574 200Ariary/year**
FINANCIAL BOTTOM LINE (Funds minus Costs)	(Ariary/year)	**-15 574 200/year**
ECONOMICALLY SUSTAINABLE (YES or NO)	(YES or NO)	**NO**
COST RECOVERY PERCENTAGE (Funds divided by Costs)	(%)	**0.92→92%**
COST PER CAPITA	(Ariary/person)	**1891 Ariary/person**
COST PER TONNE OF WASTE MANAGED	(Ariary/tonne MSW)	**81992 Ariary/tonne MSW**

3.1.7 Stakeholder participation

Table 20: Stakeholder participation in solid waste management

Type of Service	Major Stakeholders	Level of Stakeholder Participation	Measures to Improve Stakeholder Participation
Municipal Solid Waste Management	Municipality	Extensive : collection, transportation, landfilling; Direct collection by the municipality (high charge) compared to the resources (financial, personal, material resources)	Delegationof service Increase of resources
	Fandio	Limited to pre-collection: low coverage rate - Routing to municipal bins - Materials and equipment (maintenance and renewal)	Increase of the coverage rate Renewal of materials Recoverable waste to RCC by FANDIO
	Fokontany	Limited to pre-collection: low coverage rate	- Awareness and monitoring of waste management - Enforcement of internal regulations

3.2 Future projections

3.2.1 Projected municipal solid waste quantity

Current Population:	**114 033**
Population Growth Rate:	**3.96%**
Duration of SWM plan:	**5**
Current per Capita Waste Generation Rate:	**0.3 kg / pers //day**

Projected Population:	**131 138**
Projected per Capita Waste Generation Rate:	**0.3**
Projected Total Waste Generation Rate:	**39.34 Tonne/ day**

3.2.2 Projected municipal solid waste composition

Current Gross National Income per Capita: **521 USD**
Current Income Category: **Low**
Municipal GNI per Capita Growth Rate: **3.96%**
Duration of SWM plan: **5**

Projected Gross National Income per Capita: **599 USD**
Projected Income Category (if different): **Low**
Projected Waste Composition (if new income)[1]:

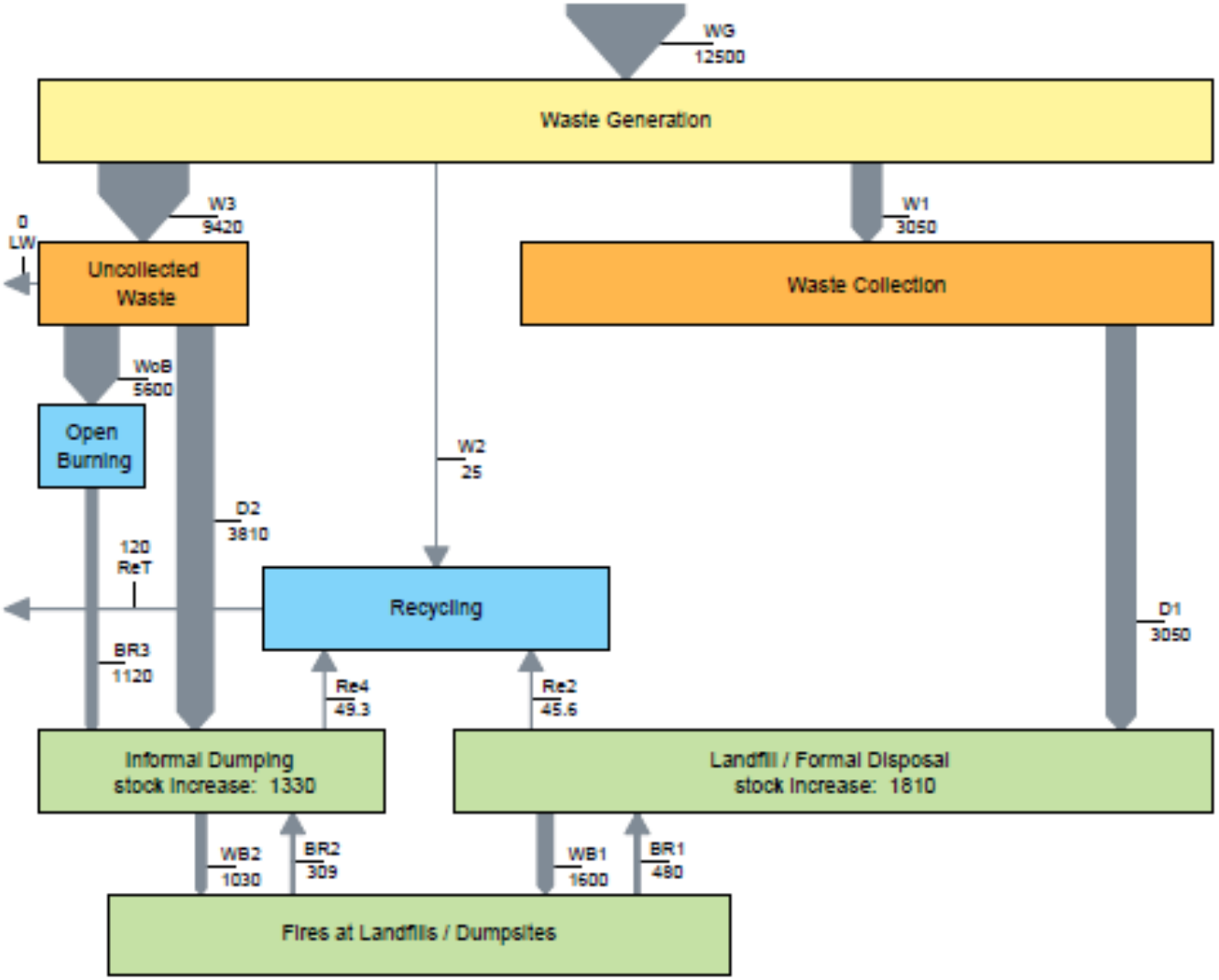
Waste Material	Average Percent in Waste
Organic	60%
Paper & Cardboard	6.9%
Plastics	8.49%
Metals	2.18%
Glass	2%
<Rubber, Leather, and Synthetics>	0.2%
<Textiles>	3%
<Wood>	3%
<Inert Material>	0.16%
<Other>	14/07%

If the same income category is maintained during the course of the SWMP, then either conduct waste samples periodically to update the composition or maintain the same composition as before for planning purposes.

[1]Take values from Box 13 in the SWMP toolkit under Section 3.4.2 in the absence of more precise projection values.

3.3 Deficit analysis

3.3.1 Material flow analysis diagram of municipal waste management system


WG
12500
Waste Generation
W3
9420
0
LW
Uncollected
Waste
W1
3050
Waste Collection
WoB
5600
Open
Burning
W2
25
D2
3810
120
ReT
Recycling
D1
3050
BR3
1120
Re4
49.3
Re2
45.6
Informal Dumping
stock increase: 1330
Landfill / Formal Disposal
stock increase: 1810
WB2
1030
BR2
309
WB1
1600
BR1
480
Fires at Landfills / Dumpsites

3.3.2 Waste management system deficiencies based on material flow analysis and other data collection

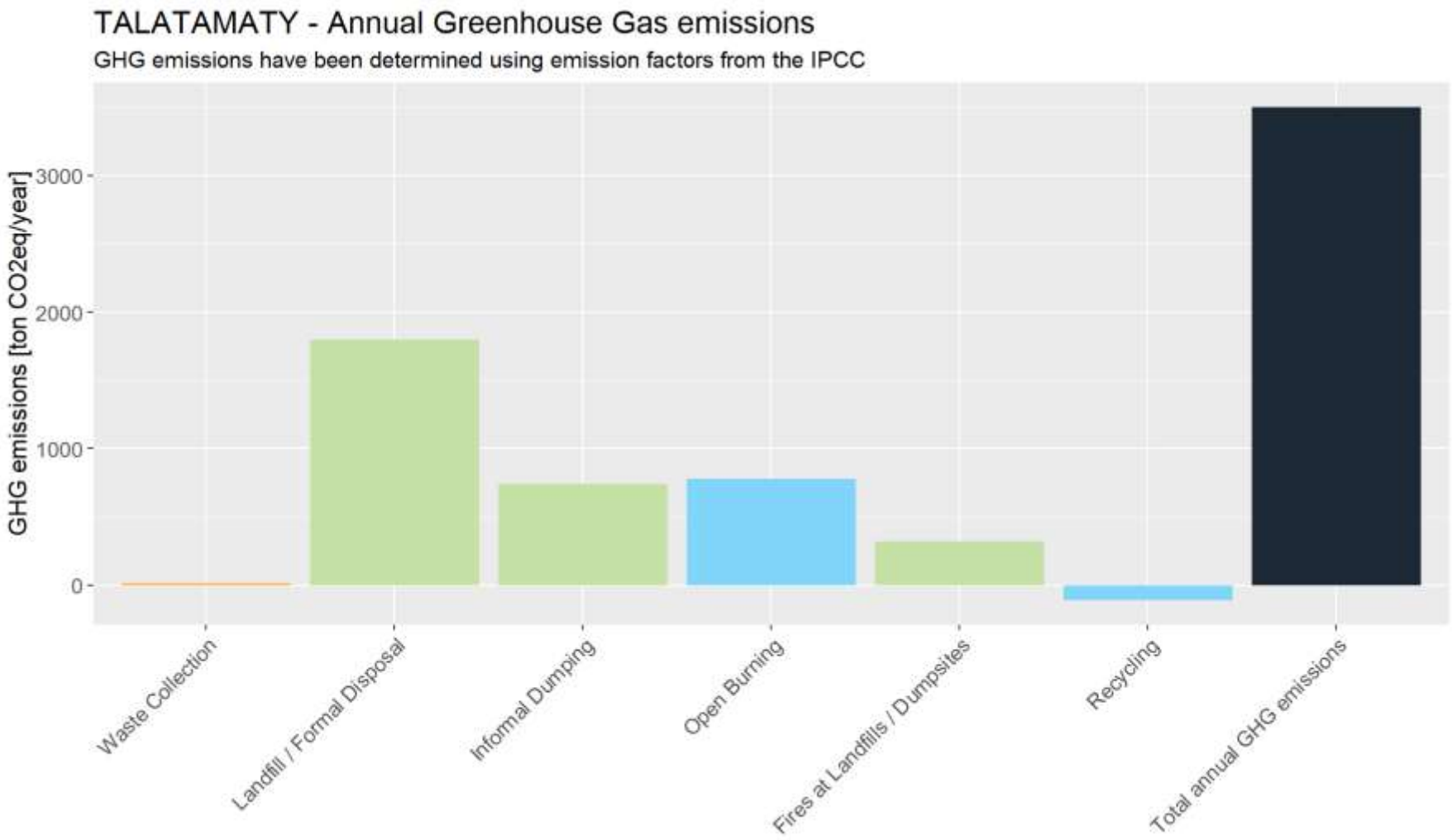
- Current per Capita Waste Generation Rate is an estimate but not based on study/surveys
- Average waste density is estimated but is not based on household studies or surveys;
- Data on uncollected waste were estimated but are not based on household studies or surveys:
  - % of waste sent by households to informal dumping;
  - % of waste sent to water;
  - % of waste burned
  - % of waste to recycling process

- The budget allocated for waste management is not clearly defined;
- Funding availability is not well established;
- % of fires at landfill and dumpsite are estimates but not based on study/survey

3.3.3 Emissions estimates based on waste composition and quantities

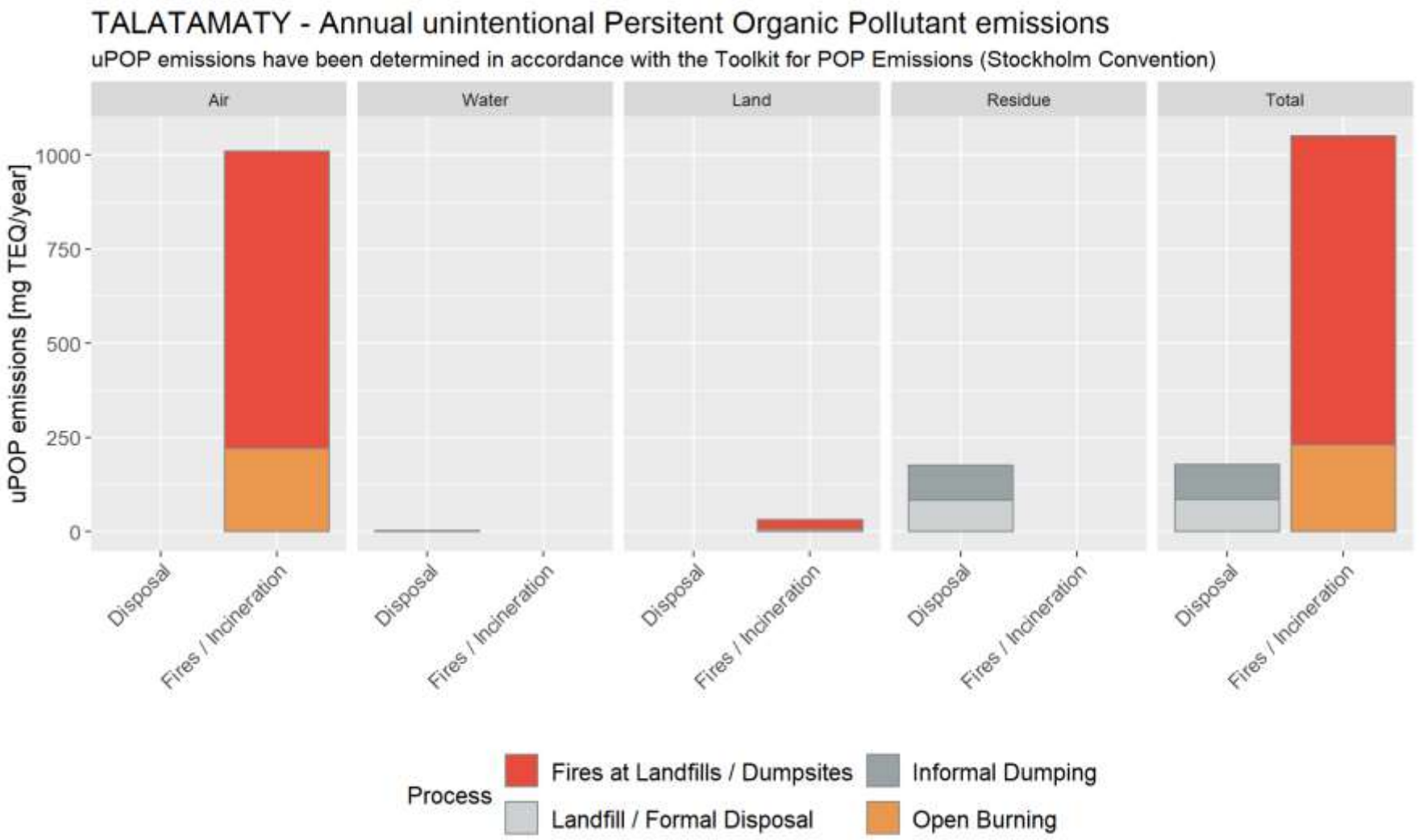
3.3.3.1 Greenhouse gas emissions

PROCESS	EMISSION (Tonnes CO2 eq/Year
Waste Collection	13
Landfill / Formal Disposal	1800
Informal Dumping	740
Open Burning	780
Fires at Landfills / Dumpsites	320
Recycling	-110
Composting	0
TOTAL	3500


TALATAMATY - Annual Greenhouse Gas emissions
GHG emissions have been determined using emission factors from the IPCC
GHG emissions [ton CO2eq/year]
3000
2000
1000
0
Waste Collection
Landfill / Formal Disposal
Informal Dumping
Open Burning
Fires at Landfills / Dumpsites
Recycling
Total annual GHG emissions

3.3.3.2 Unintentional persistent organic pollutants (uPOPs) emissions

PROCESS	EMISSION (microGTEQ/year)
Landfill / Formal Disposal	85
Informal Dumping	92
Open Burning	230
Fires at Landfills / Dumpsites	820
TOTAL	1227


TALATAMATY - Annual unintentional Persitent Organic Pollutant emissions
uPOP emissions have been determined in accordance with the Toolkit for POP Emissions (Stockholm Convention)
Air
Water
Land
Residue
Total
uPOP emissions [mg TEQ/year]
1000
750
500
250
0
Disposal
Fires / Incineration
Process
Fires at Landfills / Dumpsites
Landfill / Formal Disposal
Informal Dumping
Open Burning

3.4 Status report

Table 21: Benchmark indicators in TALATAMATY

Overall Status Report of [insert municipality name]					
	Analytical criteria	*No.*	*Indicator*	*Unit*	*Value or Description*
Drivers for solid waste management	Public Health	1	Percentage collection coverage	(%)	**24.6**
	Environmental control	2A	Percentage controlled treatment or disposal	(%)	**0**
	Environmental control	2B	Quantity of uPOPs emitted from open burning	(µg TEQ/year)	**230**
	Environmental control	2C	Quantity of greenhouse gas emissions from WMS	(tonnes CO_2-eq/year)	**3500**
	Resource management	3	Percentage materials recycled or recovered (valorized)	(%)	**0**
Governance strategies	User inclusivity	4A	Degree of user-inclusivity (HIGH – MEDIUM/HIGH – MEDIUM – LOW)	Qualitative	**Low**
	Provider inclusivity	4B	Degree of provider-inclusivity (HIGH – MEDIUM/HIGH – MEDIUM – LOW)	Qualitative	**Low**
	Financial sustainability	5A	Population using and paying for collection as percentage of total population	(%)	**72**
	Financial sustainability	5B	Overall cost recovery percentage	(%)	**92**

4 PLANNING PHASE

4.1 Setting objectives and targets

Table 22: Complete list of objectives and targets with their descriptions for the SWMP

Objective	Target and its quantifiable value to be reached (if applicable)	Target Inputs (necessary resources)	Target Outputs (expected results)	Responsible Party and/or Stakeholder	Milestones and applicable Deadlines	Priority (High, Medium, or Low)
Increase of cost recovery percentage to sustainable the waste management	Increase the cost recovery percentage to 90%	• Dedicated collection agents to collect fees • Communication and awareness materials	• Collected fees increased • Population informed and aware of the need to pay the fee	- Municipality - Communication - WHIF	1st et 2nd year of the Plan	High
Increase of waste collection rate	Increase the collection to 45%	• Rolling equipment: - Maintenance of existing equipment - Acquisition of new equipment • Staffing • Financial resources	• Number of households participating in waste collection • Well-maintained equipment • Number of operational/available materials increases • Fund available for waste collection increases	Municipality : 6. Technical service	5th year	High

Objective	Target and its quantifiable value to be reached (if applicable)	Target Inputs (necessary resources)	Target Outputs (expected results)	Responsible Party and/or Stakeholder	Milestones and applicable Deadlines	Priority (High, Medium, or Low)
Put in place recycling and recovery process in the waste management	Composting: 20% of collected waste composted	• Materials: infrastructure, machinery • Human resources: -Municipal employees • Financial resources • Communication	• Composting platform operational	Municipality: Technical service Waste pickers	2rd year	Medium
	Material recovery facility	• Material equipment for FANDIO: Charettes, wheelbarrows • Sorting bins for households • Materials: infrastructure, machines • Human resources: - Municipal employees - FANDIO • Financial resources • Communication	• RCC built and operational (in cooperation with Antehiroka)	Municipality : - Technical Service - Fokontany - FANDIO	2nd semester of the 1st year	Medium

4.2 Stakeholder feedback on targets and objectives

Table 23: Results of stakeholder consultation target feasibility questionnaire

Target Number with Brief Description	Stakeholders Associated with the Target	Average/Most Relevant Response to Question 1	Average/Most Relevant Response to Question 2	Average/Most Relevant Response to Question 3	Average/Most Relevant Response to Question 4

As mentioned in the pre-planning phase, consultation with waste management stakeholders will take place after the preparation phase by a restricted team. The stakeholder feedback table will be completed at this stage.

4.3 Scenario creation

4.3.1 Description of scenarios

Scenario 01

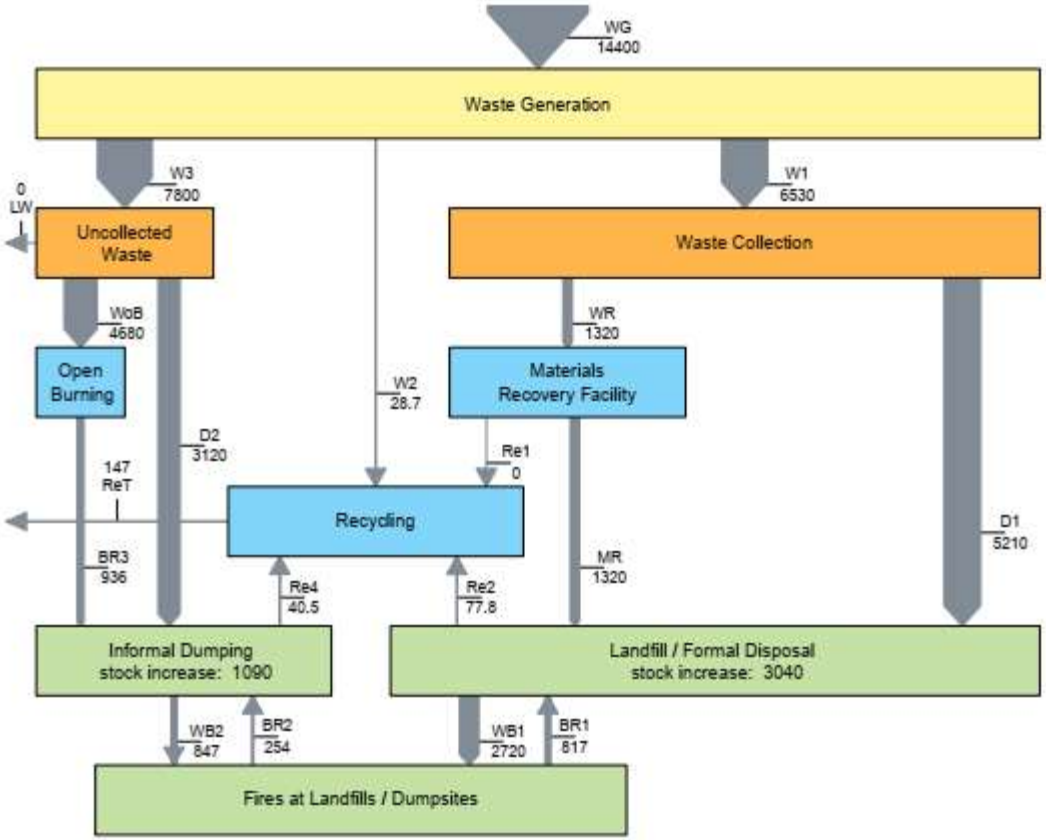
- Amount of waste generated 14360 tons/year (projection)
- Increase of current collection rate to 45 (%)
- Implementation of the RCC
- 20% of collected recyclable waste (paper, plastic, glass, metals) processed at the RCC

Scenario 02

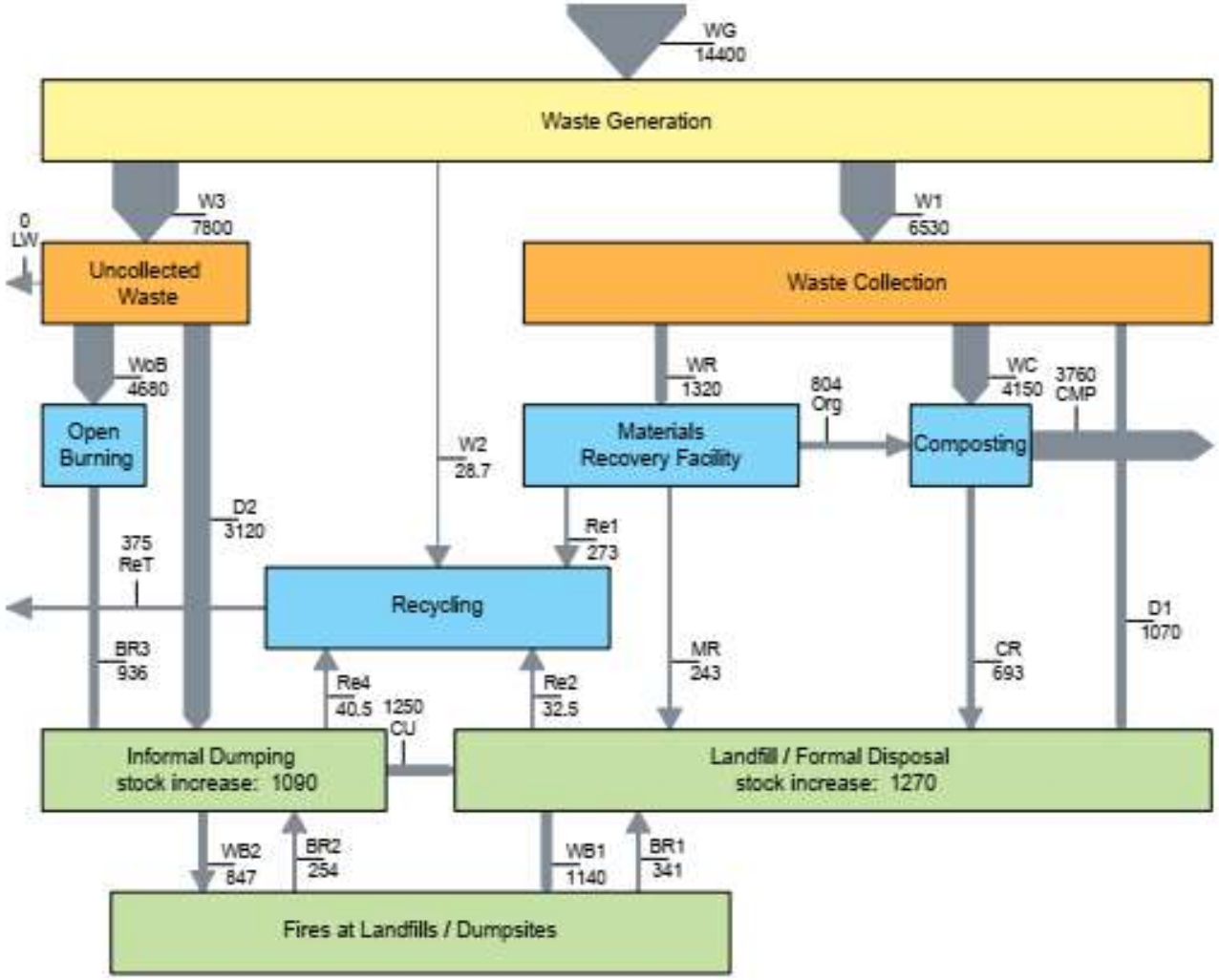
- Amount of waste generated 14360 tons/year (projection)
- Increase of current collection rate to 45 (%)
- Implementation of the RCC
- 20% of collected recyclable waste (paper, plastic, glass, metals) processed at the RCC
- 20% of compostable waste transformed into compost

4.3.2 MFA diagrams for each scenario

- Scenario 1



- Scenario 2


WG
14400
Waste Generation
W3
7800
0
LW
Uncollected
Waste
W1
6530
Waste Collection
WoB
4680
Open
Burning
WR
1320
804
Org
WC
4150
3760
CMP
Materials
Recovery Facility
Composting
W2
28.7
D2
3120
Re1
273
375
ReT
Recycling
D1
1070
BR3
936
MR
243
CR
693
Re4
40.5
1250
CU
Re2
32.5
Informal Dumping
stock increase: 1090
Landfill / Formal Disposal
stock increase: 1270
WB2
847
BR2
254
WB1
1140
BR1
341
Fires at Landfills / Dumpsites

4.3.3 Comparison of scenarios and scenario selection

Analytical criteria	*Indicator*	*Unit*	*Value or Description*	
			Scenario 1	**Scenario 2**
Public Health	Percentage collection coverage	(%)	45	45
Environmental control	Quantity of uPOPs emitted from all process	(µg TEQ/year)	1670	1107
Environmental control	Quantity of greenhouse gas emissions from WMS	(tonnes CO_2-eq/year)	4600	3700
Resource management	Quantity materials recycled or recovered (valorized)	Tonnes/year	1320	5470
Financial sustainability	Population using and paying for collection as percentage of total population	(%)	90	90
Financial sustainability	Total annual cost	Ariary	500 000 000	170 000 000

Taking into account the emissions of UPOPs and GHG as well as the quantity of recovered materials, scenario 2 is taken for this plan.

4.4 Action plan

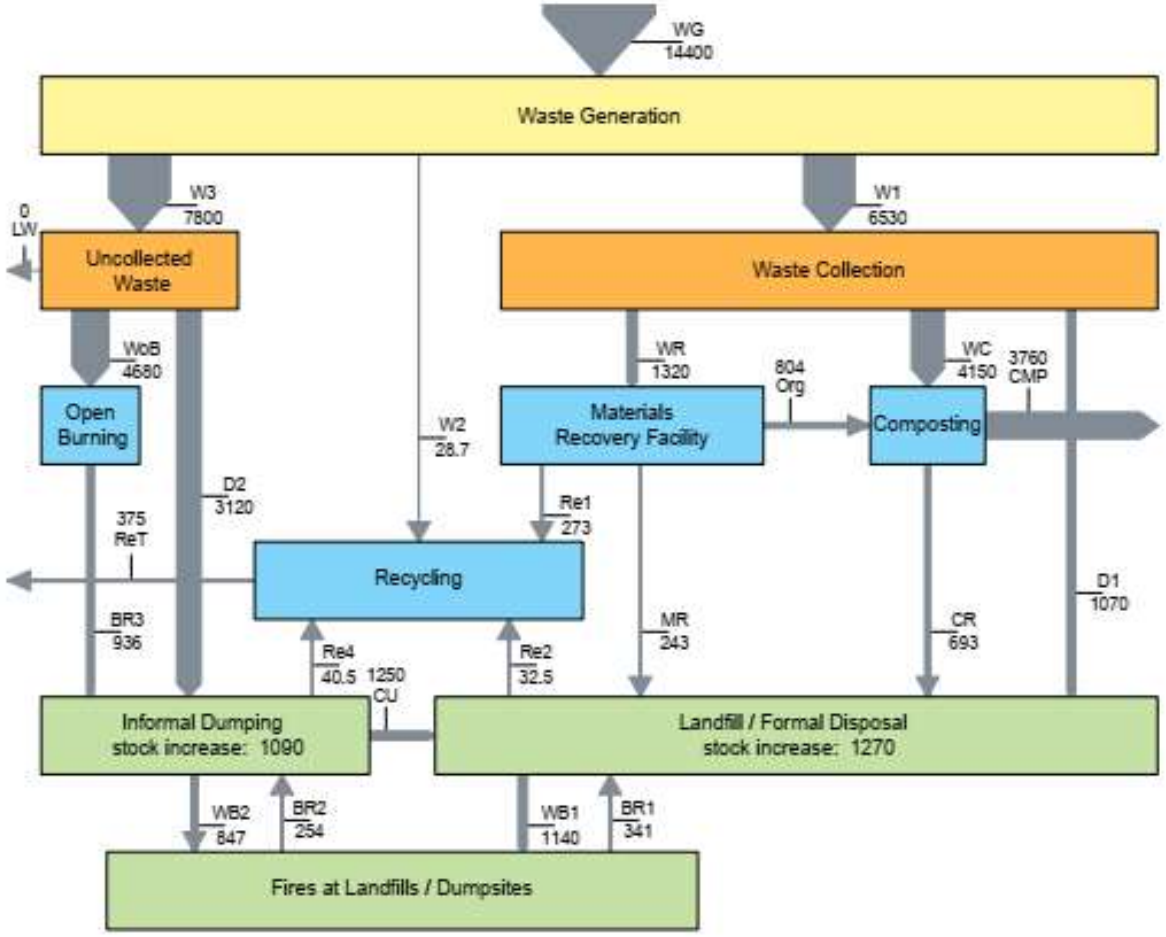
Table 24: Action plan for reaching determined targets of the overall SWMP

Action Plan for Period: **2023 - 2028**						
Waste Type	**Objective**	**Target Number with Brief Description**	**Responsible Party and/or Stakeholder**	**Actions to be Taken**		
				Short-term (2023)	**Mid-term (2024-2026)**	**Long-term (2027-2028)**
Municipal Solid Waste	1.Increase of cost recovery percentage to sustainable the waste management	1.1Increase the cost recovery percentage to 90% *The current recovery rate is around 60 %*	- Municipality	1.1.1Redeployment of agents of the commune 1.1.2 Awareness campaign of the population in fokontany 1.1.3Implementation of a system of proximity collection 1.1.4 Recovery	1.1.2 Awareness campaign of the population in fokontany 1.1.4 Recovery 1.1.5MonitoringEvaluation	1.1.4 Recovery
	2.Increase of waste collection rate	2.1. Increase the collection rate to 45% *(The current collection rate of 27,5% should be improved)*	- Municipality (Technical servive) - Fokontany - WHIF	2.1.1 Periodic maintenance and commissioning of existing equipment 2.1.2. Improvement of the collection program (pre-collection...) 2.1.3. Raising the awareness of the population (Munipal code of hygiene…) 2.1.5 Strengthening the governance system of the municipality	2.1.1 Periodic maintenance of materials and equipment 2.1.4. Acquisition of new materials 2.1.2. Improvement of the collection program (pre-collection...)	2.1.1 Periodic maintenance of materials and equipment 2.1.2. Improvement of the collection program (pre-collection)

Action Plan for Period: **2023 - 2028**						
Waste Type	**Objective**	**Target Number with Brief Description**	**Responsible Party and/or Stakeholder**	**Actions to be Taken**		
				Short-term (2023)	**Mid-term (2024-2026)**	**Long-term (2027-2028)**
		2.2.Find a Private and Public partnership for the collection of waste *(the resources available to the municipality should be strengthened to achieve the collection objectives)*	Municipality : - Decentralized Cooperation and Partnership Development Unit	2.2.1. Contact and mobilization of public and private partners 2.2.2. Presentation of the Waste Management Plan	2.2.3. Establishment of a partnership agreement	
	3.Put in place recycling and recovery process in the waste management	3.1. 20% of collected waste is composted *(To recover the compostable materials that are currently disposed of in landfills the installation of a composting site is planned)*	• Municipality Technical service • Garbage pickers • Company	3.1.1. Setting up the waste system 3.1.2 Sensitization of the community (farmers, users)	3.1.3. Construction of the platform 3.1.4. Acquisition of materials and equipment 3.1.5. Recruitment of agents 3.1.6 Training of agents 3.1.7. Start-up of the site	3.1.8 Compost production and sale 3.1.9. Setting up an agricultural demonstration

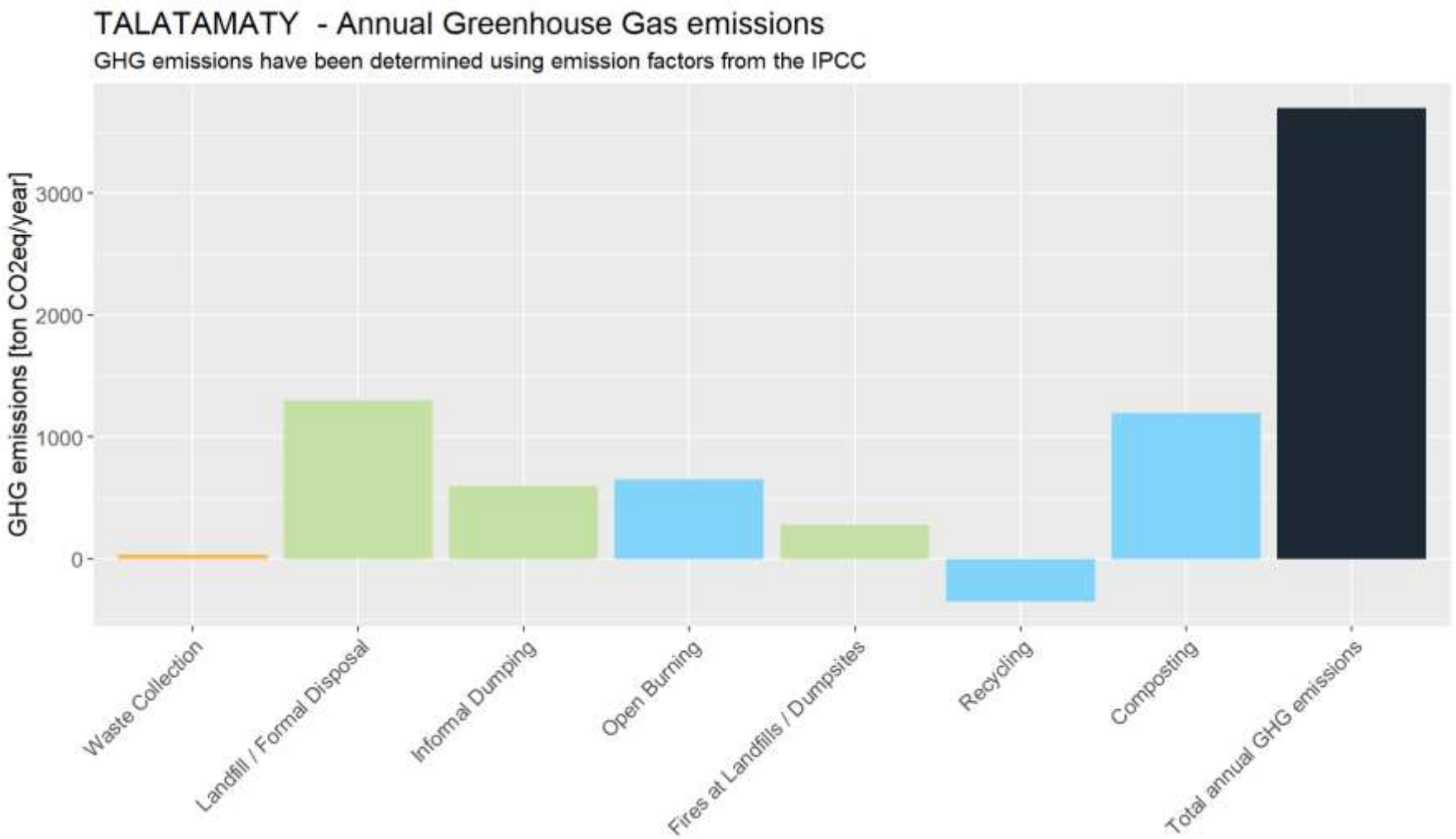
Action Plan for Period: **2023 - 2028**						
Waste Type	**Objective**	**Target Number with Brief Description**	**Responsible Party and/or Stakeholder**	**Actions to be Taken**		
				Short-term (2023)	**Mid-term (2024-2026)**	**Long-term (2027-2028)**
		3.2 RCC (*) *(To recover recoverable materials and reduce emissions, the installation of a CCR is planned)*	• Municipality: Technical direction • FAMAFA • Garbage pickers • Company	3.2.1. Construction of the facility 3.2.2. Setting up the waste system at the pre-collection level (bin, sorting...) 3.2.3. Acquisition of materials and equipment 3.2.4. Recruitment of agents (FANDIO) 3.2.5 Training of agents 3.2.6 Identification and setting up of pilot sites 3.2.7. Start-up of the site 3.2.8. Community awareness (generators, buyers/sellers) 3.2.9 Contact and contracting with recyclers	3.2.10 Operationalization of the RCC 3.2.11. Awareness campaign 3.2.12. Extension of pilot sites	3.2.10 Operationalizing the RCC

4.4.1 Predicted MFA diagram based on WMS improvements



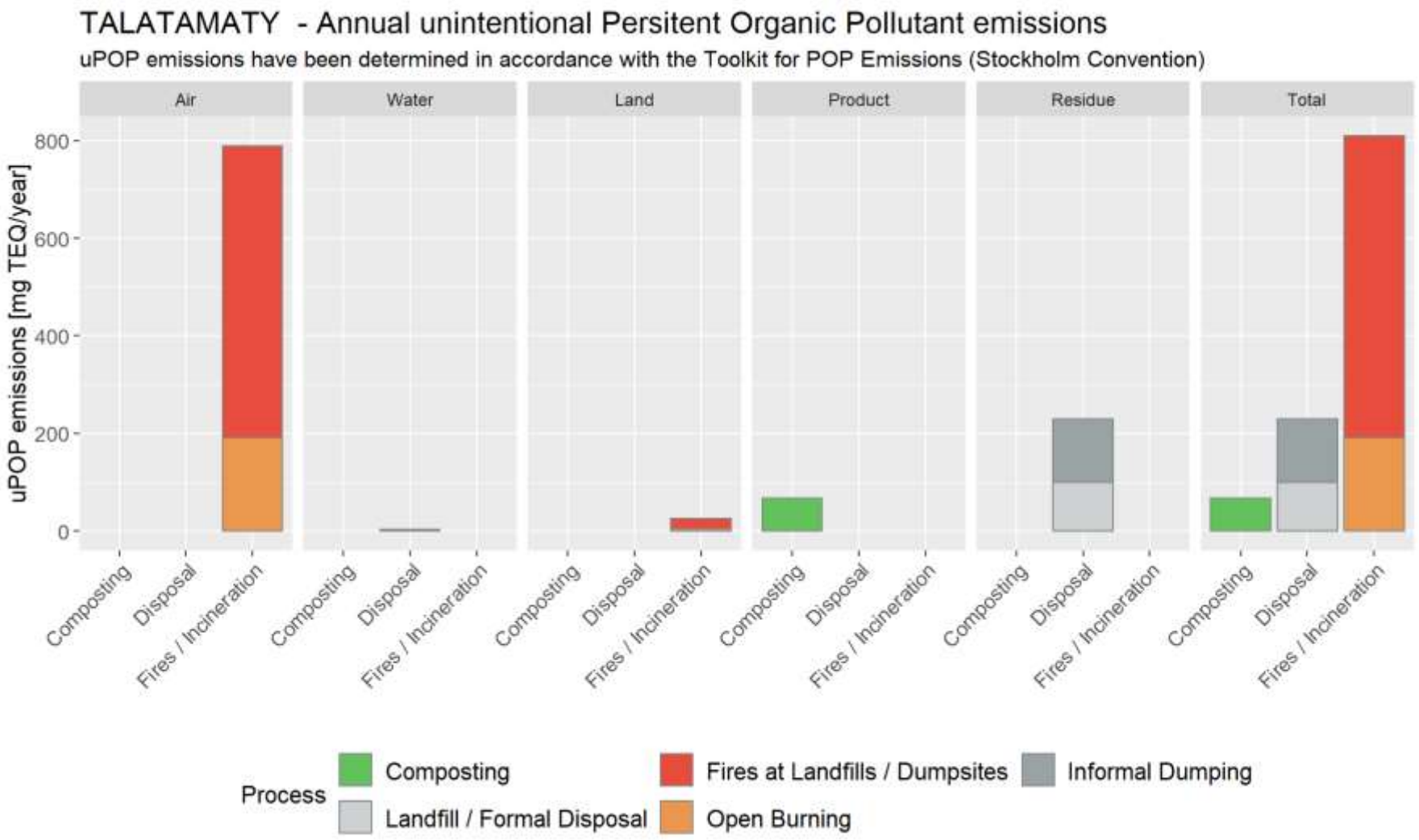
4.4.2 Expected reduction of uPOP and GHG emissions based on WMS improvements

PROCESS	EMISSION (Tonnes CO2 eq/Year
Waste Collection	32
Landfill / Formal Disposal	1300
Informal Dumping	600
Open Burning	650
Fires at Landfills / Dumpsites	280
Recycling	- 350
Composting	1200
TOTAL	3700



Determine improved values for unintentional POP emissions using the UNIDO WaPla Tool and the information provided in Section 4.5.2 in the SWMP toolkit. Insert the diagram and table with derived values below.

PROCESS	EMISSION (µg TEQ/year)
Landfill / Formal Disposal	100
Informal Dumping	130
Open Burning	190
Fires at Landfills / Dumpsites	620
Composting	67
TOTAL	1107


TALATAMATY - Annual unintentional Persitent Organic Pollutant emissions
uPOP emissions have been determined in accordance with the Toolkit for POP Emissions (Stockholm Convention)
Air
Water
Land
Product
Residue
Total
uPOP emissions [mg TEQ/year]
800
600
400
200
0
Composting
Disposal
Fires / Incineration
Process
Composting
Landfill / Formal Disposal
Fires at Landfills / Dumpsites
Open Burning
Informal Dumping

5 IMPLEMENTATION

5.1 Implementation program

Fill in the table below using the information provided in Sections5.1 and 5.2 in the SWMP toolkit.

Table 25: Planned implementation program to ensure effective execution of the plan's actions to be taken

Implementation Program						
Waste Type	**Actions to be taken**	**Costs of actions (Ariary)**	**Economic Instruments to cover costs of each action**	**Relevant Policy and Legal Instruments**	**Relevant Partnerships and Environmental Agreements to be forged**	**Relevant Stakeholder Participation and Public Awareness efforts**
Municipal Solid Waste	**1.Increase of cost recovery percentage to sustainable the waste management**					
	1.1Increase the cost recovery percentage to 70%					
	1.1.1 Redeployment of municipal staff			Municipal note		
	1.1.2 Awareness campaign for the population in fokontany	12 000 000	- Own resources (PR) of municipality: Taxes - Contributions from persons and companies		- MEDD - NGO - Medias	
	1.1.3 Setting up a neighborhood recovery system	26 000 000	- Own resources of municipality	Deliberation of the City Council	-	

Implementation Program						
Waste Type	**Actions to be taken**	**Costs of actions (Ariary)**	**Economic Instruments to cover costs of each action**	**Relevant Policy and Legal Instruments**	**Relevant Partnerships and Environmental Agreements to be forged**	**Relevant Stakeholder Participation and Public Awareness efforts**
	1.1.4Recovery				- Trésor Principal Inter Communal (TPIC)	
	- 2.Increase of waste collection rate					
	- 2.1. Increase the collection to 45%					
	2.1.1 Periodic maintenance and commissioning of existing equipment	25 000 000	Own resources of municipality		-	
	2.1.2. Improvement of the collection program (pre-collection...)		Own resources of municipality WHIF Fokontany	Municipal Code of Hygiene	-	
	2.1.3. Raising the awareness of the population	12 000 000		Municipal Code of Hygiene	- MEDD - NGO - Medias	
	2.1.4. Acquisition of new materials	80 000 000	Own resources (PR) fo municipality: Taxes	Deliberation of the City Council	- - Donors - Private sector - NGO	

Implementation Program						
Waste Type	**Actions to be taken**	**Costs of actions (Ariary)**	**Economic Instruments to cover costs of each action**	**Relevant Policy and Legal Instruments**	**Relevant Partnerships and Environmental Agreements to be forged**	**Relevant Stakeholder Participation and Public Awareness efforts**
	2.1.5. Strengthening the governance system of the municipality	30 000 000	Own resources of municipality: Taxes Grants (State, Donors, Private sectors,...) Private sector		- Private sector - Donors - NGO	
	- 2.2.Find a Private and Public partnership for the collection of waste					
	2.2.1. Contact and mobilization of public and private partners	2 000 000	Own resources of municipality: Taxes Own resources of municipality: Taxes		- Public partners - National and international partners	
	2.2.2 Presentation of the Waste Management Plan	5 000 000				
	2.2.3. Establishment of a partnership agreement			Deliberation of the City Council		
	- 3.Put in place recycling and recovery process in the waste management					
	- 3.1. 20% des déchets collectés sont compostés					
	3.1.1. Setting up the waste system	5 000 000	Own resources of municipality: Taxes Financial and technical partners		-	
	3.1.2. Sensitization of the community (farmers, users	6 000 000	Own resources of municipality: Taxes Financial and technical partners NGO		- NGO - Medias - …	

Implementation Program						
Waste Type	**Actions to be taken**	**Costs of actions (Ariary)**	**Economic Instruments to cover costs of each action**	**Relevant Policy and Legal Instruments**	**Relevant Partnerships and Environmental Agreements to be forged**	**Relevant Stakeholder Participation and Public Awareness efforts**
	3.1.3. Construction of the platform	150 000 000	Own resources of municipality: Taxes Financial and technical partners		- National/International companies	
	3.1.4. Acquisition of materials and equipment	30 000 000	Own resources of municipality: Taxes Financial and technical partners		- Government - Donors - Private sector	
	3.1.5. Recruitment of agents	10 000 000	Own resources of municipality: Taxes Financial and technical partners		-	
	3.1.6 Training of agents				- Ministries - Municipality - Consultants/ Trainers	
	3.1.7. Start-up of the site	30 000 000	Own resources of municipality:		- Private sector	
	3.1.8 Compost production and sale					
	3.1.9. Setting up an agricultural demonstration					
	- 3.2 RCC (*)					
	3.2.1. Construction of the facility (*)	-	Municipality Financial and technical partners		- National/International companies	
	3.2.2. Setting up the waste system at the pre-collection level (bin, sorting...)	See 3.1.1	Own resources of municipality: Taxes Financial and technical partners		-	

Implementation Program						
Waste Type	**Actions to be taken**	**Costs of actions (Ariary)**	**Economic Instruments to cover costs of each action**	**Relevant Policy and Legal Instruments**	**Relevant Partnerships and Environmental Agreements to be forged**	**Relevant Stakeholder Participation and Public Awareness efforts**
	3.2.3. Acquisition of materials and equipment (*)		Municipality Financial and technical partners		- Government - Donors - Private sector	
	3.2.4. Recruitment of agents (FANDIO)	7 000 000	FANDIO		-	
	3.2.5 Training of agents				- Ministries - Municipality - Consultants/ Trainers	
	3.2.6. Identification and setting up of pilot sites	30 000 000			-	
	3.2.7. Start-up of the site				-	
	3.2.8. Community awareness (generators, buyers/sellers)	10 000 000		ONG Medias …	-	
	3.2.9 Contact and contracting with recyclers	2 000 000			- Private sector - Companies (Recyclers)	
	3.2.10 Operationalization of the RCC	30 000 000	Municipality		- Private secteor - NGO	
	3.2.11. Awareness campaign	10 000 000			- NGO	
	3.2.12. Extension of pilot sites	50 000 000	Municipality		- Donors	

Implementation Program						
Waste Type	**Actions to be taken**	**Costs of actions (Ariary)**	**Economic Instruments to cover costs of each action**	**Relevant Policy and Legal Instruments**	**Relevant Partnerships and Environmental Agreements to be forged**	**Relevant Stakeholder Participation and Public Awareness efforts**
			Financial and technical partners			

5.2 Actions to be monitored

Table 26: Actions to be continually monitored as part of the new waste management system

Area of waste management	Actions to be monitored	Responsible party or stakeholder
General	Mobilizing municipal resources	• Financial Affairs Department • Financial partners • Treasurer FANDIO
	Definition of annual financing needs	
	ROM recovery	
	Collection of revenues generated by the provision of collection services	
	Acquisition of materials and equipment	
	Carrying out regular analyses and summaries of the budget consumed in relation to the planned budget	
	Reinforcement/ recruitment of agents for waste management	• FANDIO • Communal Hygiene Commission • Technical Service
	Construction of facilities	
	Implementation of a communication and awareness plan	
	Conducting a citizen satisfaction survey	
	Regular analysis and synthesis of the results obtained in relation to the objectives set	
	Effective enforcement of the Municipal Hygiene Code	
Collection and Transportation	Management of rolling stock and equipment	• Technical service • Financial service
	Organization of the collection system	
	Evaluation of the financial impact of the cost of collection/transportation on the municipality's budget	
	Evaluation of fuel quantities and costs	

Area of waste management	Actions to be monitored	Responsible party or stakeholder
Recycling and Recovery	Formalization of the activities of informal waste pickers at the sources of waste generation	• WHIF • Technical Service • FANDIO
	Collection of revenues generated by informal and formal recycling activities respectively	
	Evaluation of the quantity of each material recycled in a formal or informal way	
Treatment	Waste characterization	
	Monitoring of the increase in the amount of waste treated compared to the waste collected (%)	• WHIF • Technical Service • FANDIO
	Monitoring of the quantities of "outputs" of the treatment processes: - compost produced - separated and sorted recyclables	
	Collection of revenue from compost sold and/or recycled materials	
	Evaluation of the costs and expenses of operating the RCC	
Disposal	Monitoring of open burning rate reduction at landfill sites	• WHIF • Technical Service
	Reduction of emissions from untreated organic waste going to landfill, as well as from open burning	
	Reducing the amount of waste going to landfills	

5.3 Performance indicators

Frequency at which a performance report will be published and a review of the system will occur 1 in (1-5) years

Table 27: Performance indicators for assessing performance outputs of the new WMS based on implementation of the SWMP

Area of waste management	**Performance Indicator (PI)[1]**	**Targets linked to PI**	**Necessary data collection[2]**	**Responsible party for data collection**
General	Individual waste production.	0,3kg/day	- Waste characterization (type, quantity..)	- Municipality - Technical service - WHIF - Controller general
	Municipal Resource Recovery Rate	90%	- Number of collection agents - % of population aware of the use of the tax dedicated to household waste	
	Recovery rate of household waste fees	70%		
	Number of complaints received by the Municipality	0	- Number of complaints received by the municipality about the collection of waste in the bins - Number of complaints received about unsanitary conditions in neighbourhoods	
-				
Collection and Transportation	Waste collectionl rate	45%	- Number of agents dedicated to the collection - Equipment and materials and equipment dedicated to collection - Number of partnerships established with local actors	- Municipality - Technical service - FANDIO - Fokontany

[1]Performance indicators have the purpose of quantifying the performance outputs of the overall system. As such, the performance indicators selected to assess the plan will be closely linked to the targets determined to meet plan objectives.
[2]Should be closely related to the actions to be monitored.

Area of waste management	Performance Indicator (PI)[1]	Targets linked to PI	Necessary data collection[2]	Responsible party for data collection
	Increased revenue from the provision of collection services	90%	- Number of fokontany where the waste management system: pre-collection, composting site, sorting center is in place - % of population adhering to the system (survey)	- Municipality - FANDIO - Fokontany
	User and citizen satisfaction rate	90%	- % Satisfied users (survey)	- - FANDIO - Medias - Munipality - Technical service
-				
Recycling and Recovery	Increase in annual production of recycled waste	50%	- Amount of recoverable waste processed at the RCC level	- FANDIO - Munipality - Technical service
	Increased revenue from recycled products	60%	- Quantities of recyclable waste sold	
	Annual reduction in the volume of waste going to landfill	-30%	- Annual quantity of waste sent to landfill	
	Annual reduction in the amount of untreated waste disposed of	-50%		
-				
Treatment	Quantity of waste treated compared to waste collected	20%	- Annual production of the composting site	- Munipality - Technical service

Area of waste management	Performance Indicator (PI)[1]	Targets linked to PI	Necessary data collection[2]	Responsible party for data collection
	Annual reduction in open burning and open waste disposal levels	-20%	- Annual amount of waste burned in the open - uPOPs emissions	- Munipality - Technical service