Consulting Services for a Waste Characterization Study in Trinidad & Tobago

Presentation of final results

Date: 12/07/2023

kwl lipor SWMCOL

SUMMARY

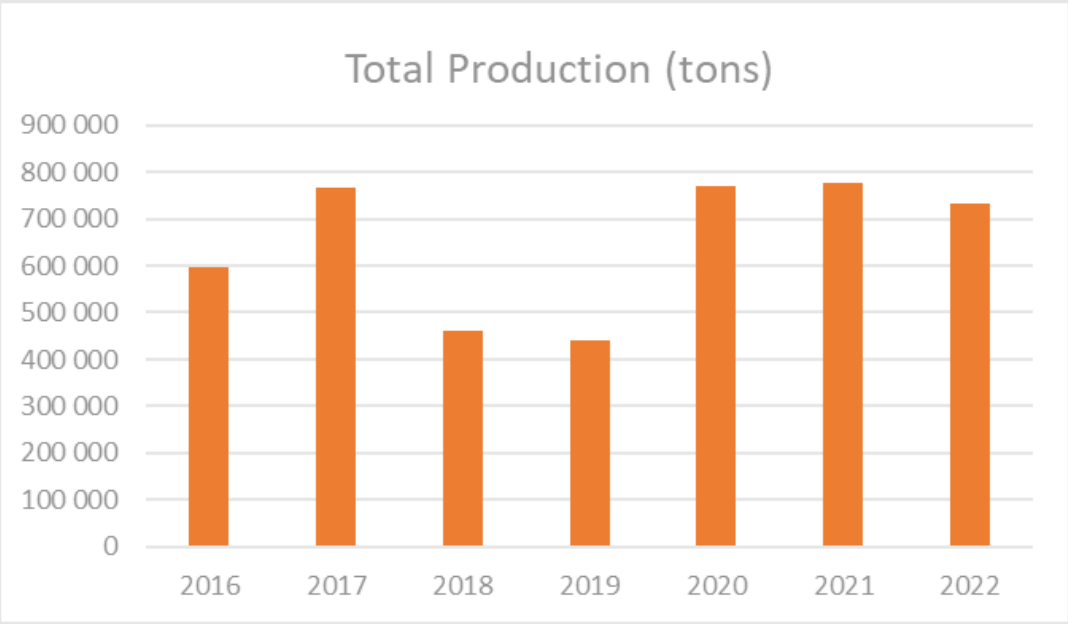
- Objectives
- Waste Characterization Methodology and Results
- Comparison of the 2010 and 2022 Characterization Results
- Population & Waste Generation Projection 2043
- Centroid Study
- Recommendations

OBJECTIVES

The waste characterization has the following main objectives:

- Determine the current characteristics of the waste
- Contribute with data to facilitate decision-making regarding the adoption of future strategies in integrated waste management system
- Make available data to evaluate the efficiency of collection methods in order to assess the percentage of contaminants in the different flows
- Capture the nuances of seasonal activities with a significant impact on the waste composition and generation (e.g. Easter, Carnival, Diwali, and Christmas)
- Make recommendations for improvement of the Waste Management in Trinidad&Tobago

WASTE PRODUCTION



In the last three years, the amount of waste has peaked at around 770 000 tons/year.

It should be noted that the absence of weighing systems and a methodology for controlling the entry into landfills could help explain the fluctuations.

The amount of recyclable waste collected is marginal.

Daily production: **2,010 tons** of municipal waste

WASTE CHARACTERIZATION METHODOLOGY

Solid waste characterization is a process that aims to identify the quantity of objects and materials resulting from the processing and use of consumer goods.

Composition is thus the term used to describe the individual components that make up a waste stream and their relative distribution within that group, usually using percentage values by weight.

The results presented are the outcomes of four characterization exercises that took place in November 2022 - called the *wet period* -, and the months of March and early April - the *dry period*. Two additional campaigns were also carried out to characterize the waste produced during festivals *Carnival* and *Diwali*.

These characterizations provided insights into nature of the municipal waste present in the unsorted waste in the 4 existing landfills in Trinidad (Beetham, Forres Park, Guanapo and Guapo).

Waste Characterization Methodology

Sorting Catalogue
Categories of the target components, in the physical characterization of waste from the multimaterial fraction

Categories	Sub/Categories
Biowaste	Organic food
	Garden Waste
Papers	Cardboard and packaging (Clean uncoated corrugated including Kraft and line board)
	Office Papers (High grade paper)
	Newspaper/ Magazines
	Mixed paper (low grade recyclable paper)
	Contaminated with fat
	Other papers (other non-recyclable mixed paper)
Beverage Containers	Clear and colored (blue, green, black, other) PET containers (sorted by size)
	Clear and colored (natural, colored) HDPE containers (sorted by size)
	Clear and colored (blue, green, brown other) Glass (sorted by size)
	Tetra Packs (sorted by size)
	Aluminum Cans
	Metal (Tin/Steel) Cans
Plastics	Non-Beverage Container Recyclables
	Mixed plastics
	Plastic packaging
Textiles	
Sanitary Textiles	

Sorting Catalogue
Categories of the target components, in the physical characterization of waste from the multimaterial fraction

Categories	Sub/Categories
Metals	Tin/steel cans (non-beverage container)
	Aluminum cans (non-beverage container)
	Ferrous metals (non-tin/ metal cans)
	White waste (not electronics)
	Reminder/composite/ bimetals (non-tin/metal cans)
	Other non-ferrous
Construction and Demolition Waste	
Composites (Waste Electrical and Electronic Equipment/ E-waste)	Large and small household appliances
	IT and Telecommunication equipment's
	Consumer Equipment and Photovoltaic Panels
	Lighting Equipment
	Electrical and Electronic Tools (non-large scale) stationary industrial tools)
	Medical Devices
	Monitoring and Control Instruments
	Automatic Dispensers
Household Hazardous Waste	Paint/Solvent/Fuel
	Batteries (both dry cell, rechargeable and lead acid) e.g., Car batteries, flashlights, small appliance, etc
	Healthcare waste
	Used Oil
	Remainder/ Composite Household Hazardous
Bulky waste	
Fine elements (<20mm)	

Waste Characterization Methodology

In the waste characterization, the flow studied was the unsorted comingled waste. The methodology used for determining the number of samples to be taken was used the Portuguese Ordinance nº 851/2009, of August 7th, which is aligned with the methodology used in the European Union.

Regarding the sample quantity, sample sizes between 100 kg and 200 kg were used, guaranteeing a confidence level of 95% and a relative precision of the average weight of the constituent samples in each characterized flow was less than 10%, values recommended in ASTM International and ERRA methodologies.

Characterization Exercice	Number of Characterizations
Diwali	10
Wet	68
Carnival	15
Dry	67

WASTE CHARACTERIZATION RESULTS

Categories	Waste produced (tons)
Biowaste	237,782
Papers	131,737
Plastic	94,168
Beverage Containers	67,325
Glass	15,003
Composites	16,022
Textiles	46,864
Sanitary Textiles	36,534
Metals	16,521
Construction and Demolition	64,515
Hazardous Waste	4,813
Bulky waste	0
Thin Elements	2,340
Total	**733,623**

Biowaste is the waste flow with the most presence in the unsorted waste, followed by Papers; Plastic and Beverage Containers;

546,015 tons of Biowaste, Papers, Plastic and Beverage Containers;

67,325 tons of Beverage Containers;

Around **168,000 tons of non-urban waste** is disposed on the landfill (mainly: Textil, Sanitary Textiles, Construction and Demolition Waste);

The presence of hazardous wastes is reduced (0.65%).

WASTE CHARACTERIZATION RESULTS

Waste Composition		% in weight	% in weight
Recycable Waste	Bio Waste	32.41%	76.63%
	Cardboard/Paper	17.96%	
	Plastics and Tetra pack	18.07%	
	Ferrous Metals	1.21%	
	Other Non Ferrous	1.52%	
	Glass	5.46%	
Non Recyclable Waste		23.32%	23.32%
		100%	100%

- 77% of the unsorted waste is recyclable waste
- Biowaste: 20.6% Organic Food and 11.8% Garden Waste
- 17.9% Cardboard, 18.07% de Plastic/Tetrapack and 5.46% Glass

Waste Characterization Results

Waste production in Diwali festivity

Waste Composition	Value
Organic Food	19.06%
Garden Waste	7.03 %
Papers	21.28%
Composites	1.11%
Plastics	11.64%
Textiles	7.05%
Sanitary Textiles	7.45%
Beverage Containers	11.77%
Construction and Demolition	5.00%
Glass	2.03%
Metals	4.98%
Hazardous Waste	0.91%
Bulky Waste	0.00%
Thin Elements	0.70%

Waste production in Carnival festivity

Waste Composition	Value
Organic Food	14.10%
Garden Waste	12.32%
Papers	17.01%
Composites	1.33%
Plastics	11.38%
Textiles	4.66%
Sanitary Textiles	3.88%
Beverage Containers	15.40%
Construction and Demolition	11.66%
Glass	2.80%
Metals	3.85%
Hazardous Waste	1.24%
Bulky Waste	0.00%
Thin Elements	0.36%

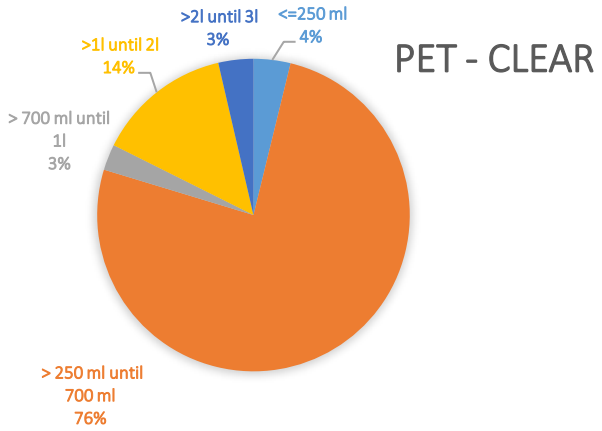
Waste production in Wet and Dry Seasons

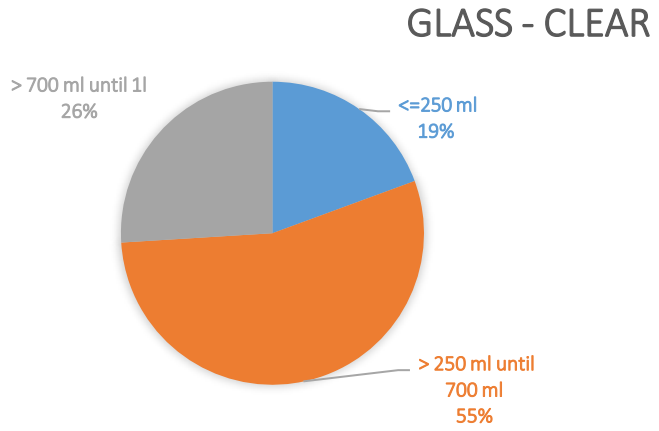
Waste Composition	Value
Organic Food	20.60%
Garden Waste	11.81%
Papers	17.96%
Composites	2.18%
Plastics	12.84%
Textiles	6.39%
Sanitary Textiles	4.98%
Beverage Containers	9.18%
Construction and Demolition	8.79%
Glass	2.05%
Metals	2.25%
Hazardous Waste	0.66%
Bulky Waste	0.00%
Thin Elements	0.32%

Waste Characterization Results

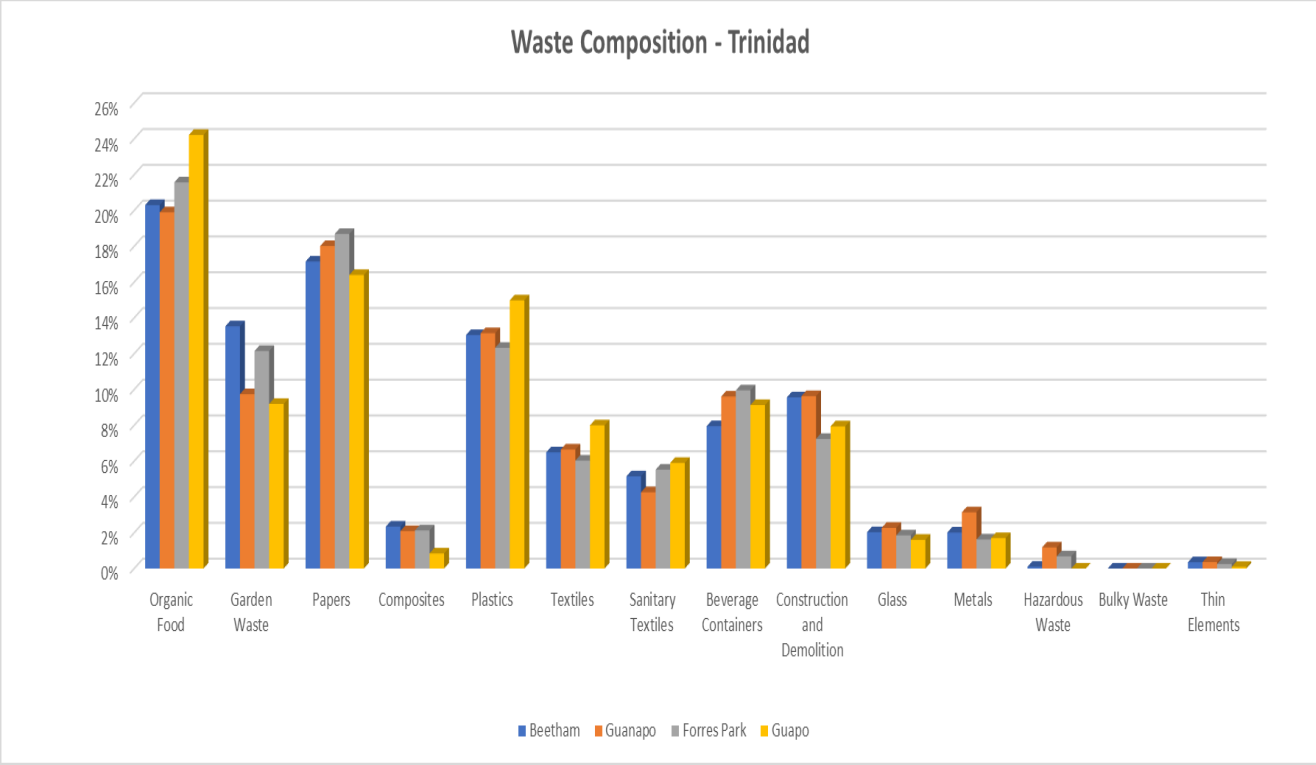
Type of Beverage Container	Total (tons)	Value
PET Clear	33,629	50.0%
GLASS - Clear	12,706	18.9%
GLASS - Green	6,280	9.3%
GLASS - Brown	5,370	8.0%
TETRA PACK	4,725	7.0%
ALUMINIUM Cans	3,690	5.5%
GLASS - Blue	675	1.0%
METAL Cans	176	0.3%
HDPE - Coloured	44	0.1%
PET Blue	15	0.0%
GLASS - Other Colors	15	0.0%
PET Green	0	0.0%
PET Black	0	0.0%
PET Other Colours	0	0.0%
HDPE - Natural	0	0.0%
Total	67,325	

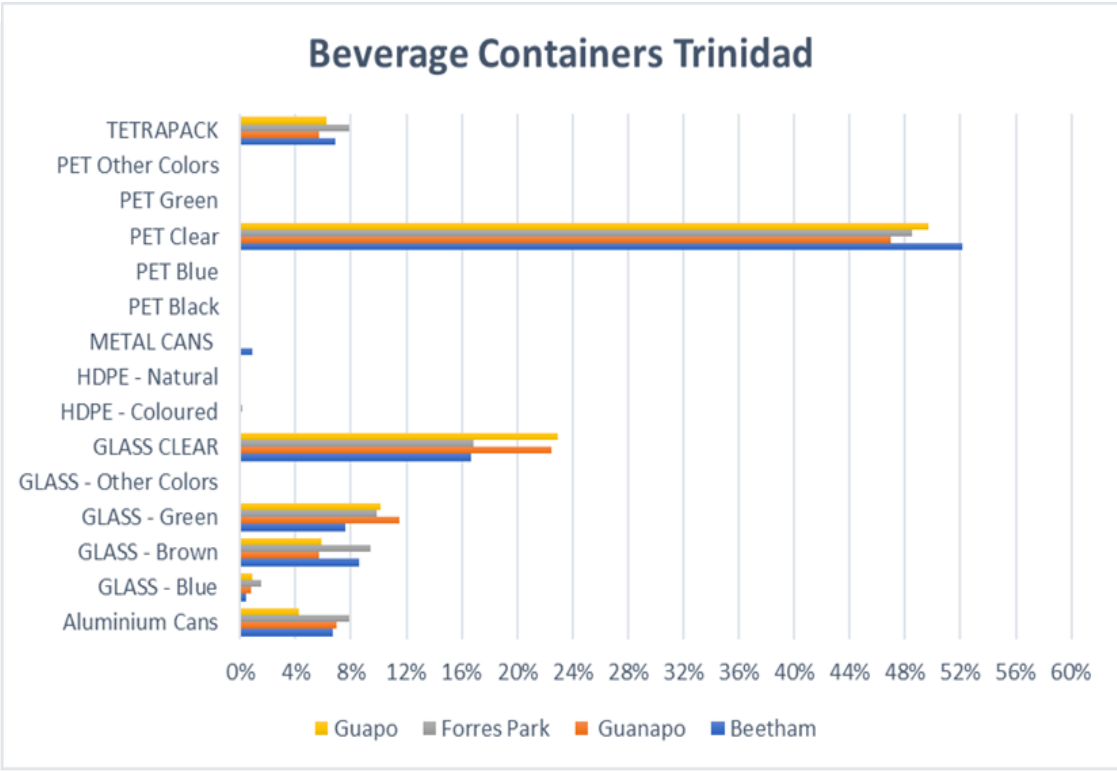
- 50% of PET Clear
- 36.2% of Glass (Clear, Green, Brown), with 50% being Glass Clear
- 7.0% Tetrapack





LANDFILL COMPARISON



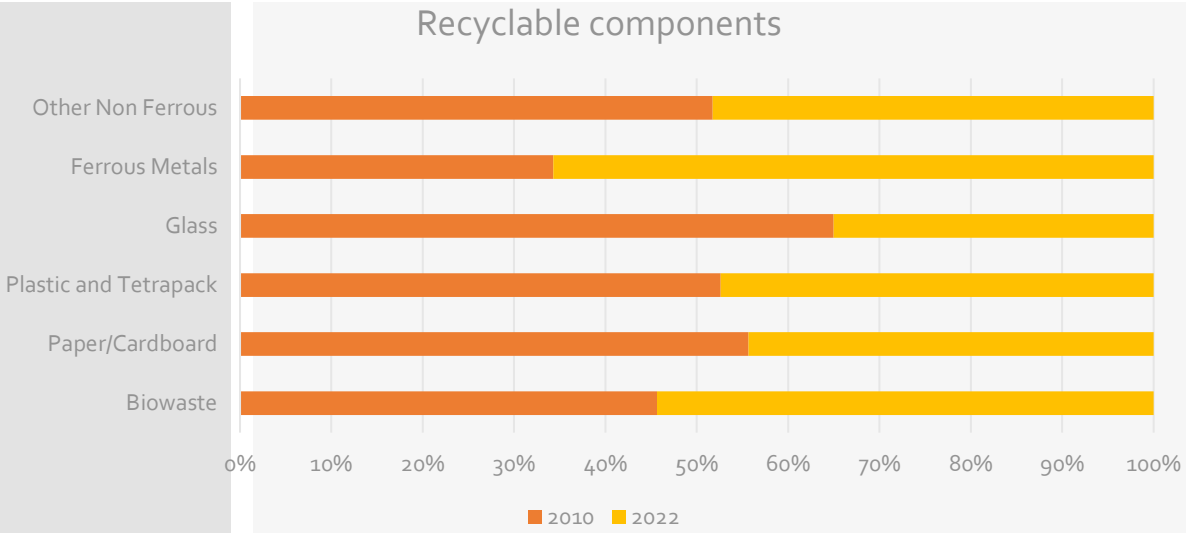


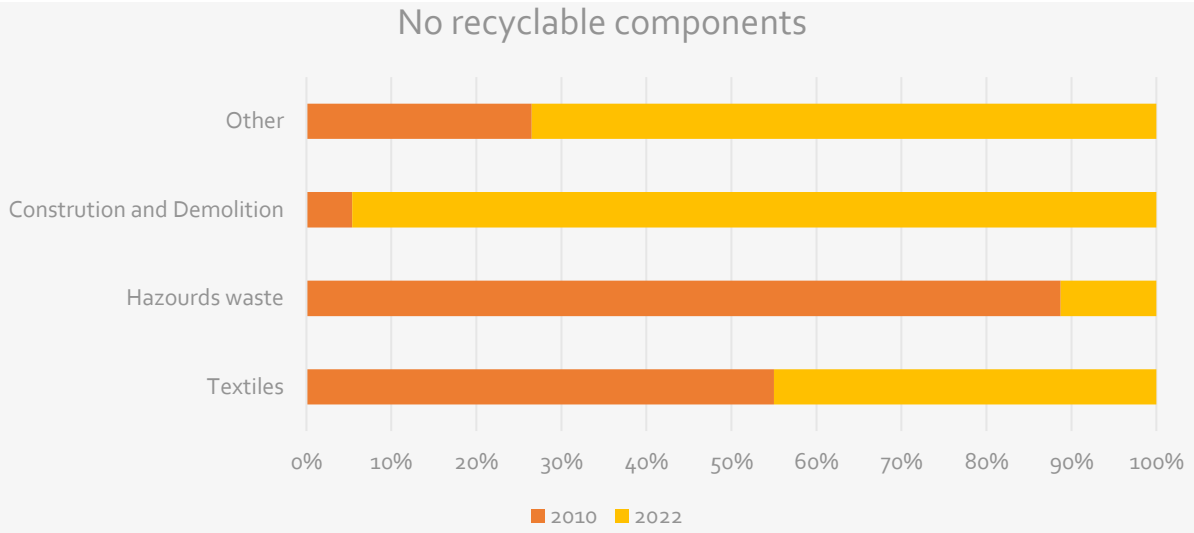
In the 4 landfills, there is a significant presence of organic food, follow by Papers and Plastics. Is important to refer the existence of a substantial quantities of non-urban waste (construction and demolition) in the 4 landfills.

COMPARISON OF THE 2010 AND 2022 CHARACTERIZATION RESULTS

2022			2010		
Waste Composition	**% in weight**	**% in weight**	**Waste Composition**	**Average Proportion**	
Recyclable			**Recyclable**		
Bio Waste	32.4%	76.6%	Organics	27.2%	83.7%
Cardboard/Paper	18.0%		Plastics	19.2%	
Plastics and Tetra pack	18.1%		Paper	18.8%	
Ferrous Metals	1.2%		Glass	10.2%	
Other Non Ferrous	1.5%		Old Corrugated Cardboard	3.8%	
Glass	5.5%		Metal Ferrous	2.3%	
Non Recyclable			Metal. Non Ferrous	1.4%	
Composites	2.18%	23.3%	Beverage Containers	0.9%	
Sanitary Textiles	4.98%		**Non Recyclable**		
Textiles	6.38%		Textiles and Clothing	7.8%	16.3%
Construction and Demolition	8.79%		Household Hazardous	5.2%	
Hazardous Waste	0.66%		Other	2.7%	
Bulky Waste	0,0%		Construction and Demolition	0.5%	
Thin Elements	0.32%				

COMPARISON OF THE 2010 AND 2022 CHARACTERIZATION RESULTS

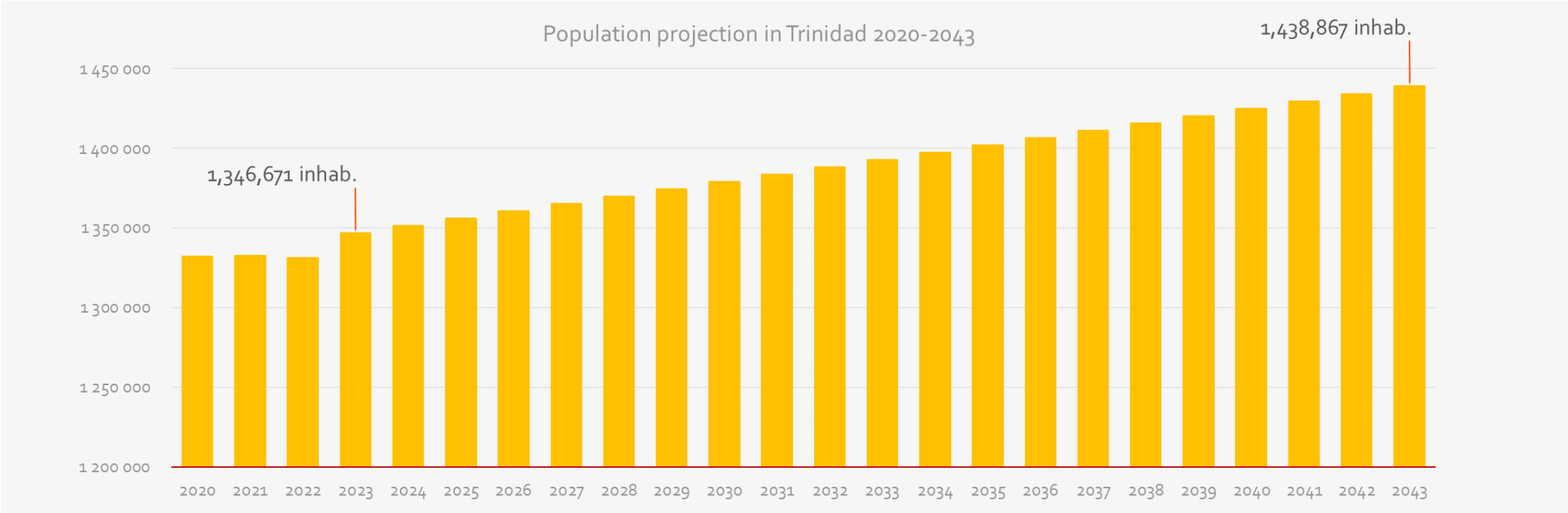




- Total stabilized waste production
- Decreasing amount of waste with recovery potential
- Significant increase of Biowaste
- Significant increase in construction and demolition waste and textile

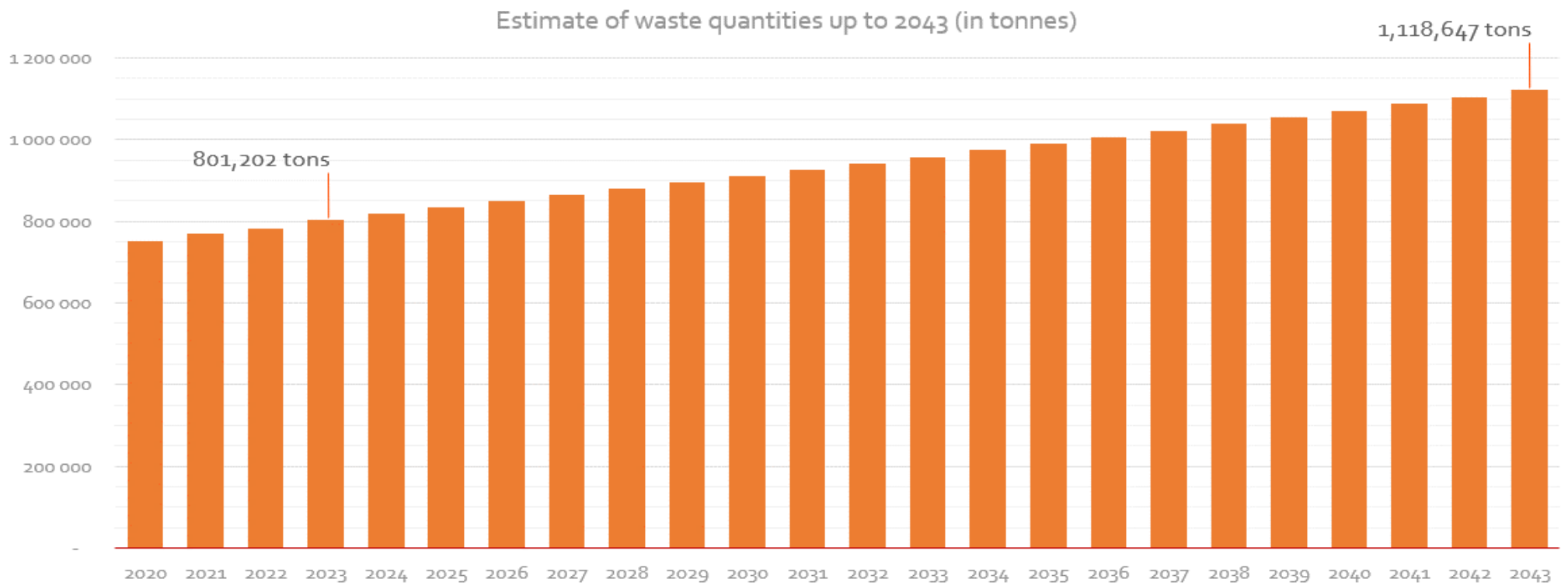
2022	2010
Recyclable	**Recyclable**
76.6%	83.7%
Non Recyclable	**Non Recyclable**
23.3%	16.3%

POPULATION WASTE GENERATION PROJECTION 2043



The population growth rates were calculated based on the official data from the "Provisional Mid-Year Estimates of Population by Age Group and Sex, 2005-2021" (CSO-TT, 2023). Growth rates were assessed for the 2005-2021 period, and the 'Trend' function (Excel) was used to calculate the evolution of the growth rate up to 2043. These growth rates were applied to the 2020 population data from WorldMap (gridded population data 100m) to estimate population growth up to 2043

POPULATION WASTE GENERATION PROJECTION 2043



Waste production rate per capita was calculated based on SWMCOL values regarding waste collection for the period 2016-2020. It was considered an estimated 2.5% annual growth rate in waste production applied for the period 2020-2043.

Centroid Study

This study aims to improve the integrated Municipal Waste Management (MSW) in Trinidad by locating Transfer Stations near the Waste Production Sources

The centroid development methodology is based on population values, per capita waste generation rates and other factors, such as road network characteristics and existing or to be built facilities.

Geospatial and demographic data is key to determining the centroid location, according to Waste Source Areas development across the country.

The main objective is to find the best (economic and logistic) solution considering all these characteristics and limitations to place transfer stations, reducing overall waste management costs

Waste Transfer Basic Principles

- Loading from the ground
- Split level transfer stations
- Integrating recycling activities
- Using current facilities (dumpsites and sorting stations), saving costs

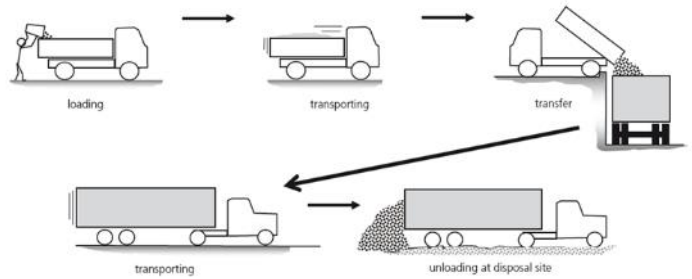
Transfer Stations in Trinidad

At its most basic, a **Transfer Station** is a flat piece of ground onto which waste is dumped by the primary collection vehicle and then loaded into the transport vehicle.

Transfer Stations provide the opportunity to storage of the waste collected during the day, so it can be transported to the disposal site at night, avoiding traffic congestion and saving time and fuel.

Different systems can be used to transfer waste from small collection vehicles to larger ones. The description of such systems is out of the scope of the present study and should be addressed carefully in a full study.

Integrating recycling activities within transfer stations is an advantage, both in economic and social terms. In this regard, the informal sector (*waste pickers, currently working at Dumpsites*) must be integrated when building transfer stations or refurbishing the facilities.



Centroid Study

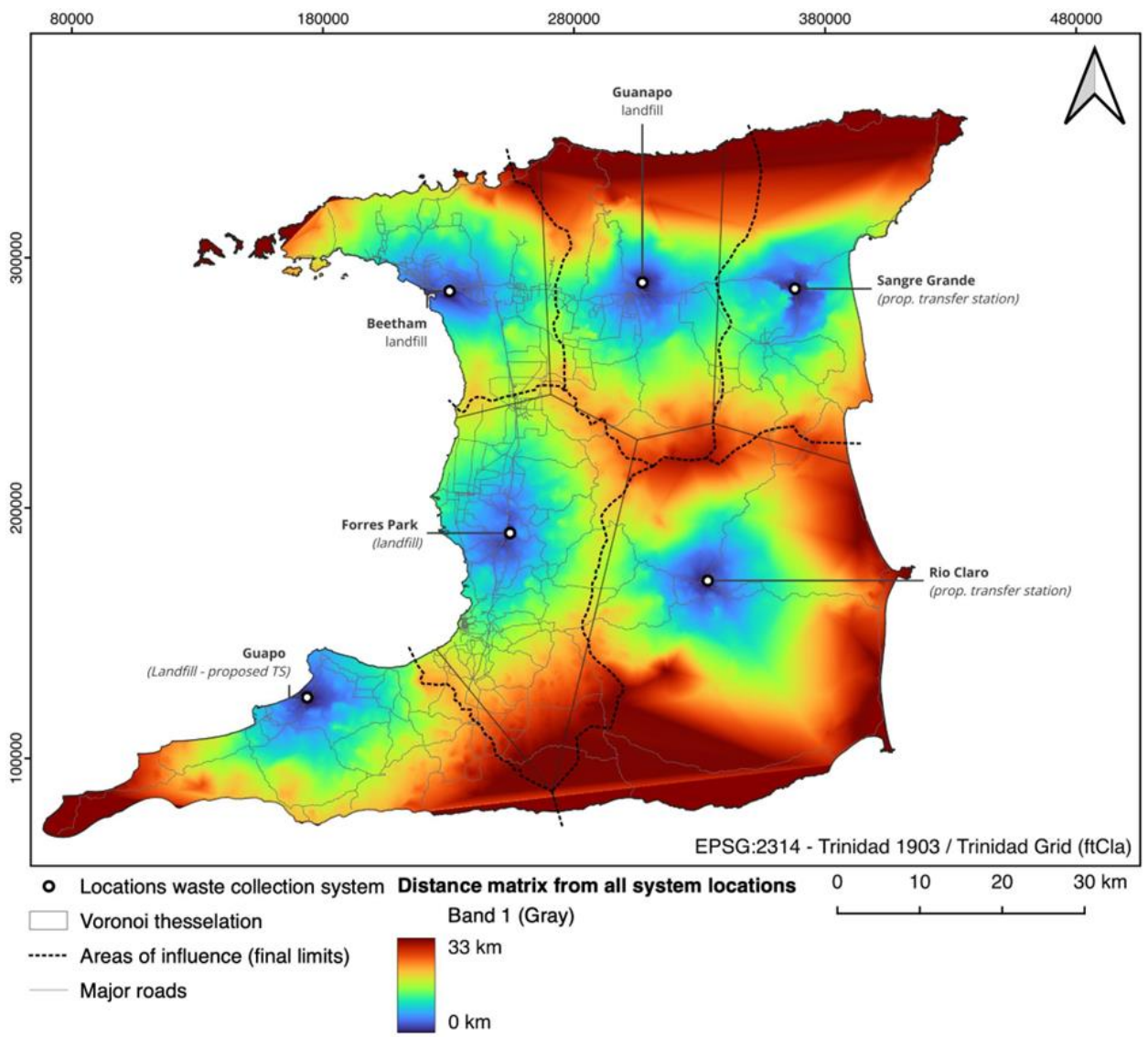
Conclusions and Recommendations

1. The waste centroid analysis shows <u>that six locations for waste disposal are required in Trinidad</u>: **(a)** a centralized Landfill in Forres Park; **(b)** a southern landfill/dumpsite in Guapo (outside SWMCOL control), **(c)** and four Transfer Stations (TS) across the Island.

2. Forres Park coverage: 31.6% of the population within 25 km of road distance.

3. All locations coverage**: 94% of the population is within 25 km of one of the TS or landfill**.

4. Two of these Transfer Stations are the current Dumpsites (Beetham and Guanapo) that must be intervened. An upgrade is needed to transform the places and improve it in order to have a layout to accommodate the waste transfer. Beetham, serving the great Port of Spain region, requires an important investment, requiring the sealing of the current Dumpsite.



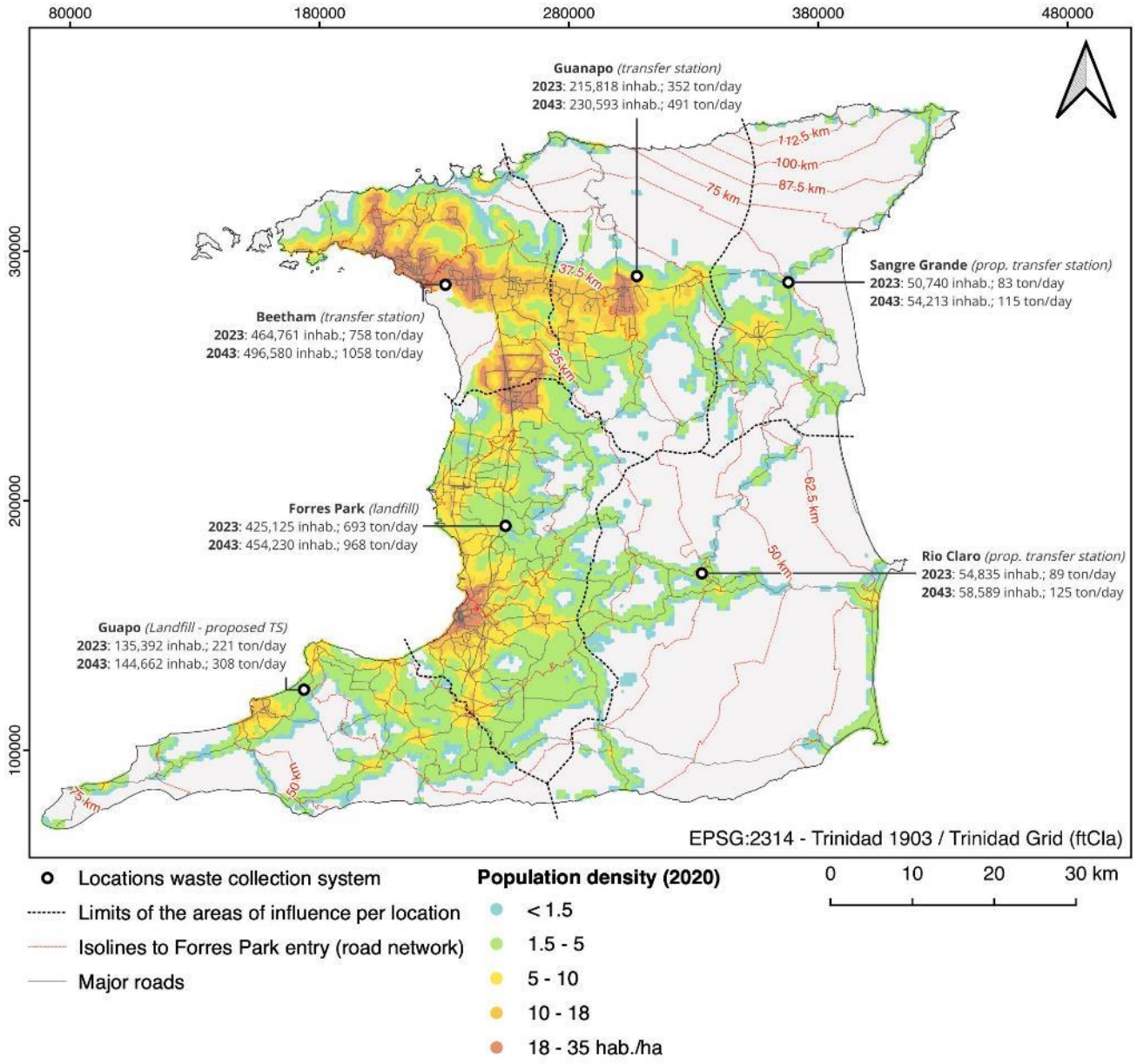
Centroid Study

Conclusions and Recommendations

5. <u>New Transfer Stations should be located in Sangre Grande and Rio Claro</u>. These TS should be modern and able to deal with the storage of bulky waste, biowaste (shredding and composting) and work as sorting centers for dry recyclables (plastic, metals, glass, paper) and finally to store Electric and Electronic Waste and other household problematic fractions.

6. <u>Waste production is expected to rise, making TS more economically feasible</u> as well as the need of more recycling centers.

7. In the area to the southeast of Bakhen, a specific small-size TS might be necessary to accommodate the waste coming from outside the 25 km line.



Transfer Stations Economic Value

Calculating the savings from having Transfer Stations is possible to show gain of 2.8 million US dollars a year, which is a net saving of circa 6 $US per ton.

These values consider the current quantities and use 4 Transfer Stations.

id	name	Type	Population (2023)	Waste (ton/day)	Costs and savings ($US/ton) Loads per day	25 km round journey	Long haul, 21 tons		Net savings
1	Forres Park	Landfill (future engineered main Landfill)	425 125	693	213	$US per day	n.a.	$US per day	$US per day
2	Beetham	Transfer station (existing Dumpsite/ upgrade to TS)	464 761	758	232	10 892	36	3 375	7 517
3	Guanapo	Transfer station (existing Dumpsite/ upgrade to TS	215 818	352	108	5 058	16	1 500	3558
4	Sangre Grande	Transfer station (proposed)	50 740	83	25	1 189	3	281	908
5	Rio Claro	Transfer station (proposed)	54 835	89	27	1 285	4	375	910
6	Guapo	Landfill/ Dumpsite (outside SWMCOL control)	135 392	221	68		n.a.		
			1 346 671	2 195 ton per day					
			Total waste	801 202 ton per year					
	Long Haul, 21 ton - cost factor, 2x		2 Empirical value						
	Savings per day		12 893 $US per day						
	Total savings		4 705 854 $US per year						
	Savings per ton		6 $US per ton						
	Transfer Stations (n=4) - total operation cost		1 866 667 $US per year						
	Net savings		2 839 187 $US per year						

INSTITUTIONAL AND INFRASTRUCTURE

RECOMMENDATIONS

KEY MESSAGES

The Waste Sector presents a significant opportunity for growing and country development

Waste as a resource (RAW MATERIAL) - Circular Economy on practice - Less dependence on the outsider

Incentives creation for recycling industry development (new industries) - Jobs creation

Reduce environmental impacts (less GHG emissions, better air quality or groundwater protection) and better quality of life

INSTITUTIONAL AND INFRASTRUCTURE

RECOMMENDATIONS

Waste Sector development (administrative organization of the waste sector)

Invest in the creation of a database with waste production by National/Municipality/Corporation, by counties (Residential, Non Residential (hotels, factories), Industries) and in periodic waste characterizations;

Develop a **National Strategic Plan for Municipal Waste Management** for the next 5/10 years;

Develop a **Plan to Reduce Food Waste**;

Develop an **Integrated Waste Management Model/Concept** (Prevention, Collection, Sorting/ Separation, Recycling/Organic Valorisation, Incineration; Landfill);

INSTITUTIONAL AND INFRASTRUCTURE

RECOMMENDATIONS

National Urban Waste Awareness Campaigns

Implementation of Deposit System of Beverage Containers

Consider creating managing entities, in which those who produce or place products on the market have to pay for the collection and final treatment

Consider the implementation of a tariff to support the costs of waste collection and treatment

3 typologies of Waste (Municipal Waste, Hazardous Waste and Hospital Waste) - adequate LEGISLATION development

Recovery and Sealing of Landfills

OPERATIONAL PROJECT TO INCREASE RECYCLABLE WASTE

RECOMMENDATIONS

Improve the management process for the **entry/exit of collection vehicles** at the facilities

Collection and treatment for **Biowaste and non-urban waste**

Transfer Stations Construction

Cooperation between SWMCOL and the Corporations/General Population

Definition of **Colour Code for Each Bin/ Container/ Waste stream**

Different strategies for residential sector and for non-residential sector

OPERATIONAL PROJECT TO INCREASE RECYCLABLE WASTE

RECOMMENDATIONS

Definition of Periodic Characterization of Waste in law/ legislation (Residential, Non-Residential or Commercial Sector)

Transform Home Composting as a solution, offering incentives to citizens in a way they want to take part of the process

Selection of the containers type, in accordance the characterization made in the previous/recommendations

Drop-off-site to Household Hazardous Waste or creation of a specific place (well identified as red area, for instance) for hazardous waste in the Drop-off-sites

Creation of a **Drop-off-site models** near the population

Thank you!