

## **Samoa's Experimental Solid Waste Accounts FY2013-14 to FY2015-16**

### *Executive Summary*

Samoa's Experimental Solid Waste Account is the first for Solid Waste highlighting the **collection and management** of solid waste in Samoa. The Solid Waste Accounts closely follow the System of Environmental Economic Accounts Framework (SEEA 2012) and are useful in organizing information on solid waste collection and management of flows to landfills, recycling facilities or directly to the environment. The main aim of this report is to present the amount of solid waste collected in Samoa, who collected them and how solid wastes are managed.

Samoa's solid waste accounts mainly focused on the collection and management of solid wastes for three financial years 2013-14 to 2015-16. **The account only includes solid waste collected and disposed of at Tafaigata Landfill in Upolu Island and solid waste exports.** The landfill received solid waste collected from around Upolu Island, covering an estimated **77%** of Samoa's total population of 195,979 (Samoa Bureau of Statistics, Population and Housing Census, 2016). There is another landfill in the bigger island of Savaii but there is no data collected to account for the collection and disposition of waste. Solid waste here refers to both solid waste residuals and solid waste products collected for exports.

### *1. Accounts Highlights*

- An estimated total of **7,234.4 Tonnes** of solid waste (residuals and products) collected in FY2015-16, a decline of about **32.0%** compare to FY2013-14 (**10,697.2 Tonnes**) (Figure 1). A combination of contributing factors like suspected illegal dumping, less collection efforts and non-compliance of contractors responsible for collection have caused the decline throughout the accounting period.
- Around **67.0%** of that total collection sourced from households and the rest from other industries in FY2015-16.
- During the same period, government contracting collection system accounted for the bulk of all solid waste collected at around **70.6%** (4,789.0 MT), other industries at **17.0%** and the rest by recycling companies (**12.4%**) Figure 2.
- **79.0 %** of all solid wastes collected in FY2015-16 ended up at Tafa'igata Landfill, **2.0%** incinerated (i.e. healthcare waste), **11.0%** was exported as recyclable solid wastes and the remaining **9.0%** as accumulated solid waste at recycling facilities.
- General waste was the largest type of waste landed at the landfill estimated at **5,036.0 Tonnes** (or 87.6% of total disposal at landfill).

- Hazardous waste <sup>1</sup> (mainly hospital hazardous waste) constituted around **2.0%** (191.4 T) of total solid waste collected.
- Around **841.3 Tonnes** were exported as recyclable solid waste to overseas markets in FY2015-16, a decrease of around **53.0%** from about **1,804.1 Tonnes** in FY2013-14 (Table 4).
- Metallic waste constituted the bulk of solid waste products collected and exported in FY2015-16 at around **51.0%** and **48.0%**.

## 2. Why Solid Waste Accounts?

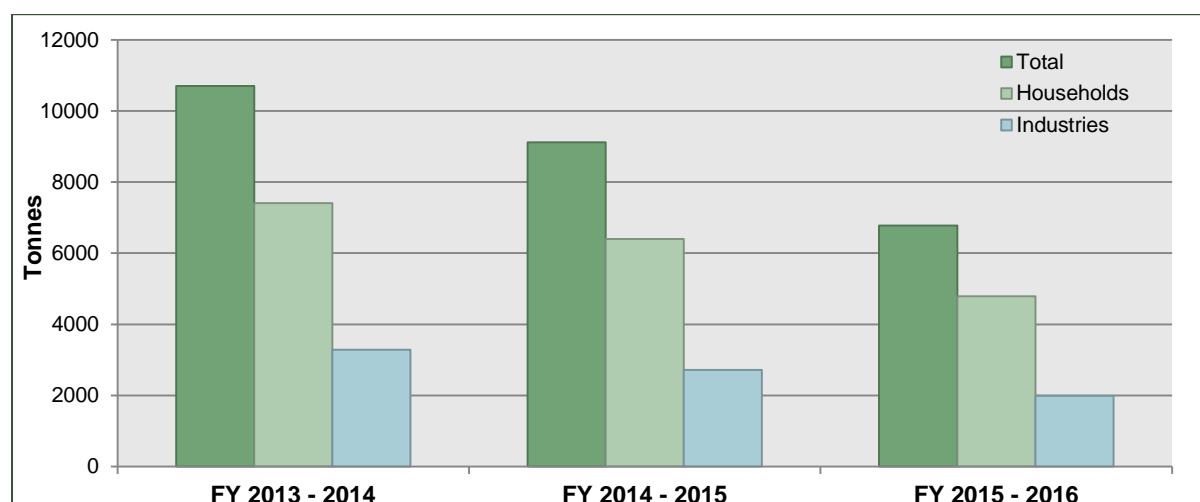
Solid waste is a major concern for Samoa's environment because of its potential to cause detrimental impacts on national development activities, health and the environment. Solid waste can also be a valuable product. Therefore a compilation of waste accounts for Samoa would address issues concerning solid wastes at any level. From environmental concerned issues to national priorities on its built environment and also the need for robust statistical information for policy issues. Waste accounts can organize information on all wastes, all sources, all methods of disposal, even if data are partial and can identify gaps to be addressed and improved in future work.

## 3. Account Results

### 3.1 Collection and Disposal at Landfill

**Figure 1** clearly highlights the decline in the total solid waste collected for FY 2013-14 to FY 2015-16 at around 32.0%. The decline in both households and industries contributed to the overall decrease in solid waste collected throughout the accounting period. The highest was recorded in FY 2013-14 with an estimated 10,697.2 tonnes where solid waste collected from households accounted for the bulk of it at around 69.3% and the remaining 30.7% by industries. The percentage split between industries and household waste supply was relatively constant throughout the accounting period. **Table 2** summarizes the estimated total solid waste collected from households and industries.

**Figure 1: Estimated Total Solid Waste Collected and Disposed of at Landfill (FY 2013-14 to FY2015-16)**



<sup>1</sup> Hazardous waste is waste that has substantial or potential threats to public health or the environment.

**Table 2: Solid Waste Collection and Management: FY2013-14 to FY2015-16**

Waste Category	Sources of Solid Waste Collected (T)				Management of Solid Waste (T)				
	All Industries	Households	Landfill	Total	Landfill	Incineration <sup>4</sup>	Exports	Accumulation	Total
<b>FY 2015-2016</b>	<b>2,315.8</b>	<b>4,879.0</b>	<b>39.7</b>	<b>7,234.4</b>	<b>5,746.8</b>	<b>191.4</b>	<b>841.3</b>	<b>455.0</b>	<b>7,234.4</b>
<b>Solid Waste Residuals</b>	<b>1,149.2</b>	<b>4,789.0</b>		<b>5,938.1</b>	<b>5,746.8</b>	<b>191.4</b>			<b>5,938.1</b>
General	839.3	4,196.7		<b>5,036.0</b>	5,036.0	-	-		<b>5,036.0</b>
Glass	59.4	296.9		<b>356.2</b>	356.2	-	-		<b>356.2</b>
Market	27.7	138.7		<b>166.4</b>	166.4	-	-		<b>166.4</b>
Bulk	14.4	72.0		<b>86.4</b>	86.4	-	-		<b>86.4</b>
Green	10.0	49.8		<b>59.8</b>	59.8	-	-		<b>59.8</b>
Recyclable <sup>1</sup>	7.0	34.9		<b>41.9</b>	41.9	-	-		<b>41.9</b>
Condemned	-	-		<b>-</b>	-	-	-		<b>-</b>
Healthcare <sup>2</sup>	191.4	-		<b>191.4</b>	-	191.4	-		<b>191.4</b>
<b>Solid Waste Products</b>	<b>1,166.6</b>	<b>90.0</b>	<b>39.7</b>	<b>1,296.3</b>	<b>-</b>	<b>-</b>	<b>841.3</b>	<b>455.0</b>	<b>1,296.3</b>
Metallic Waste	588.7	67.5	17.7	<b>673.9</b>	-	-	404.8	449.0	<b>853.8</b>
Car batteries	209.1	5.0	6.5	<b>220.6</b>	-	-	127.5	-	<b>127.5</b>
Aluminium cans	108.7	1.5	1.0	<b>111.2</b>	-	-	52.5	-	<b>52.5</b>
e-Waste	260.1	16.0	14.5	<b>290.6</b>	-	-	256.5	6.0	<b>262.5</b>
Others	-	-	-	<b>-</b>	-	-	-	-	<b>-</b>
<b>FY 2014-15</b>	<b>2,716.7</b>	<b>6,396.9</b>		<b>9,113.6</b>	<b>7,676.2</b>		<b>1,437.4</b>		<b>9,113.6</b>
<b>Solid Waste Residuals</b>	<b>1,279.3</b>	<b>6,396.9</b>		<b>7,676.2</b>	<b>7,676.2</b>		<b>-</b>		<b>7,676.2</b>
General Waste	1,222.2	6,111.4		<b>7,333.5</b>	7,333.5	...	-		<b>7,333.5</b>
Glass	15.3	76.4		<b>91.6</b>	91.6	...	-		<b>91.6</b>
Market	14.8	73.7		<b>88.5</b>	88.5	...	-		<b>88.5</b>
Bulk	6.9	34.7		<b>41.7</b>	41.7	...	-		<b>41.7</b>
Green	17.1	85.3		<b>102.4</b>	102.4	...	-		<b>102.4</b>
Recyclable	3.0	14.9		<b>17.8</b>	17.8	...	-		<b>17.8</b>
Condemned	0.1	0.6		<b>0.7</b>	0.7	...	-		<b>0.7</b>
<b>Solid Waste Products</b>	<b>1,437.4</b>			<b>1,437.4</b>			<b>1,437.4</b>		<b>1,437.4</b>
Recyclable Scrap Metals	1,437.4	...	...	<b>1,437.4</b>	...	...	1,437.4	...	<b>1,437.4</b>
- Ferrous Metals	...	...	...	...	...	...	...	...	...
- Non Ferrous Metals	...	...	...	...	...	...	...	...	...
<b>FY 2013-2014 <sup>3</sup></b>	<b>3,286.3</b>	<b>7,410.9</b>		<b>10,697.2</b>	<b>8,893.1</b>		<b>1,804.1</b>		<b>10,697.2</b>
<b>Solid Waste Residuals</b>	<b>1,482.2</b>	<b>7,410.9</b>		<b>8,893.1</b>	<b>8,893.1</b>				<b>8,893.1</b>
General Waste	1,482.2	7,410.9		<b>8,893.1</b>	8,893.1	...	...		<b>8,893.1</b>
<b>Solid Waste Products</b>	<b>1,804.1</b>			<b>1,804.1</b>			<b>1,804.1</b>		<b>1,804.1</b>
Recyclable Scrap Metals	1,804.1	...	...	<b>1,804.1</b>	...	...	1,804.1	...	<b>1,804.1</b>
- Ferrous Metals	...	...	...	...	...	...	...	...	...
- Non Ferrous Metals	...	...	...	...	...	...	...	...	...

**Note:**1.Recyclable Waste includes recyclables collected and exported by recycling companies and exporters

2.Healthcare waste considered hazardous waste as all other healthcare waste included in General waste & started estimating in FY2015-16

3.There was no waste category split for FY 2013-14

4.Healthcare waste is the only incinerated waste accounted

... Data Not Available

- Nil

### 3.2 Sources and Management of Solid Waste Collected

**Table 2** above tabulates the sources of solid waste collected and management. The solid waste disposed of at Tafaigata landfill is classified into different waste categories as stated in the table. Appendix **A1** summarizes Categories and Definitions for Solid Waste.

**Table 3: Total Est. Solid Waste Collected by Source and % Share: FY2013-14 to FY2015-16 (T) <sup>1</sup>**

Fiscal Years	Industries <sup>2</sup>		Households		Total
	MT	% Share	MT	% Share	MT
2013 - 2014	3,286.3	30.7	7,410.9	69.3	10,697.2
2014 - 2015	2,716.7	29.8	6,396.9	70.2	9,113.6
2015 - 2016	2,315.8	32.0	4,879.0	68.0	7,234.4

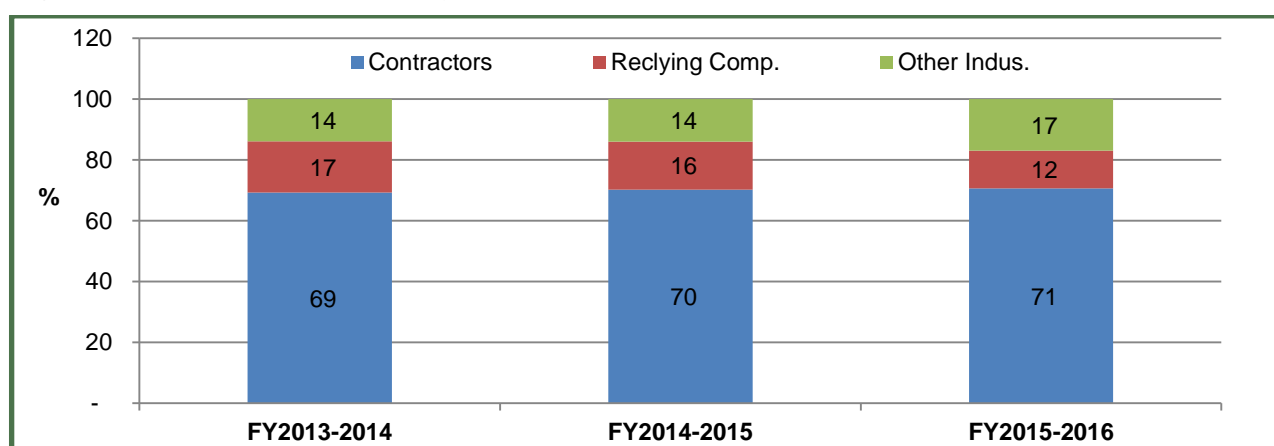
**Source:** Min. of Natural Resources and Environment (MNRE) & Central Bank of Samoa (CBS)

**Note:** <sup>1</sup> Table 3 only includes data on waste collected and disposed off at Tafaigata Landfill by MNRE (not including Savaii) and also solid waste exports by CBS

<sup>2</sup> Industries include government ministries, businesses and private companies

The Samoan government contracted companies to collect solid waste and dispose them to the Tafaigata Landfill. The contracted companies mainly covered household solid wastes while all other industries including government bodies self-delivered their own.

**Figure 3: Solid Waste Collection by Industries for FY2013-14 to FY2015-16 (%)**



Contractors consistently collected the bulk of solid waste throughout the accounting period at 69.0% to 71.0%. There is an increase in Other Industries share in solid waste collection from FY 2014-15 to FY2015-16 and the inclusion of healthcare waste collected and incinerated by Ministry of Health contributed to this increase.

### 4. Solid Waste Exports

The financial year 2015-16 recorded the least weight in tonnages of solid waste exports. Low market prices in overseas markets contributed to the decline in recycling solid waste exports. Solid waste for exports by type is summarized in **Table 4**.

Samoa generated around \$863,970 Tala from solid waste exports in FY 2015-16, a decrease of about 23.8% from the previous fiscal year 2014-15. In FY2015-16, ferrous metals dominated solid waste type for export at about 63.0% and the rest by non-ferrous metals. In exports value, nonferrous scrap metals generated more at about 73.9% as oppose to 26.1% generated by ferrous metals (Table 4).

**Table 4: Total Solid Waste Exports by Type and Value for FY2013-14 to FY2015-16**

Fiscal Years	Ferrous <sup>2</sup>		Non Ferrous <sup>3</sup>		Others <sup>4</sup>		Total	
	Tons	Val_SAT\$	Tons	Val_SAT\$	Tons	Val_SAT\$	Tons	Val_SAT\$
2013-14	670.1	350,936.0	413.0	407,744.0	721.0	339,062.0	1,804.1	1,097,742.0
2014-15	930.3	360,702.0	327.1	668,537.0	180.0	103,912.0	1,437.4	1,133,151.0
2015-16	530.0	225,114.8	311.3	638,855.5	-	-	841.3	863,970.3

Source: Central Bank of Samoa (CBS)

There are around four major companies exporting solid waste with some individual exporters. The results of a small solid waste survey conducted for these companies closely consistent with the amount provided by the Central Bank of Samoa figures on solid waste exports.

## 5. Potential Generation Scenario for Solid Waste & Census 2016

Table 5 below summarized means of solid waste disposal by households during the Population and Housing Census 2016. The census results indicated that around 71% of households disposed rubbish using the government contracted collection system and 3% directly transported waste to two landfills at Tafaigata in Upolu and Vaiaata in Savaii. The remaining 26% used other means of disposal such as burning, burying and dumped in either bush or sea. This could also be treated as uncollected or unmanaged solid waste.

**Table 5: Number of households by means of rubbish disposal, 2016**

	Means of Disposal						
	Total	Public truck rubbish collector	Burned	Buried	Public disposal sites	Dumped in the Bush	Dumped in the sea
<b>SAMOA</b>	<b>28,880</b>	<b>20,507</b>	<b>3,261</b>	<b>2,255</b>	<b>982</b>	<b>1,843</b>	<b>32</b>
Apia Urban Area	5,840	4,738	466	197	302	135	2
North West Upolu	10,105	6,360	1,426	1,180	385	748	6
Rest of Upolu	6,549	4,966	593	478	151	352	9
Savaii	6,386	4,443	776	400	144	608	15

Source: Samoa Bureau of Statistics Population and Housing Census, 2016

<sup>2</sup> Ferrous metals or steel mostly contain iron and they include offcuts from manufacturing industries and motor vehicles. They are magnetic and give little resistance to corrosion (e.g. vehicle scrap metal etc.)

<sup>3</sup> Non Ferrous metals do not contain iron, are not magnetic and are usually more resistant to corrosion than ferrous metals (e.g. copper, brass, lead, zinc, aluminum & aluminum alloys, stainless steel, electrical cable etc.)

<sup>4</sup> Others refer to unclassified waste.

Based on Table 5 above, Table 6 depicts the estimated solid waste generated, discharged and other means of solid waste disposal at the household level.

**Table 6: Estimated Volume of Solid Waste Generated, Discharged and Other Means of Disposal**

	Est Generation <sup>1</sup>	Discharged Waste <sup>2</sup>	Self-Disposed Landfill	Reached Landfill	Burned	Buried	Bush	Sea
<b>Upolu</b>	60,920.50	15,883.84	828.60	4,789.00	6,730.13	5,023.90	3,344.75	46.0411
<b>Savaii</b>	17,295.20	4,393.17	142.39	...	2,101.64	1,083.32	1,646.65	40.6245
<b>Samoa</b>	<b>78,215.70</b>	<b>20,277.01</b>	<b>970.99</b>	<b>4,789.00</b>	<b>8,831.77</b>	<b>6,107.22</b>	<b>4,991.40</b>	<b>86.67</b>

**Note:** <sup>1</sup>: Estimated by # of households \* average generation (1.06 kg/per/day) \* 7 (average household size) \* days (365)

<sup>2</sup>: Estimated by # of households \* average discharge rate (0.387 kg/per/day) \* 7 (average household size) \* days (365)

**Source: Samoa Bureau of Statistics & Min. of Natural Resources and Environment**

For Upolu, household solid waste generation is estimated around 60,000 tons a year (Table 6). Tafaigata landfill received an estimated 4,789 tons of household solid waste for the financial year 2015-16. Compare that with the estimated 16,712 tons of possible landfill waste (i.e. discharged waste + self-disposed to landfill), there is still a significant amount of about 70% of solid waste not reaching the landfill. Hence, here raises the question about illegal dumping and other related issues of concern with the collection system in place. Similar issues are also highlighted by the 2017 Waste Audit Report (Refer Appendix A2).

Assuming an average per capita generation rate of 1.06 kg per person per day (Waste Audit, MNRE 2017) and a population of 195,979 (Samoa Bureau of Statistics, Population and Housing Census, 2016), the household generation rate is therefore about 207 tons per day or more than 75,000 tons per year.

## 6. Methodology

Solid waste management is monitored and managed by the Ministry of Natural Resources and Environment under their Environment Conservation Division – Solid Waste Unit. Most of the landfill disposal data was provided by the Waste Unit but some of the data were incomplete or missing due to weighbridge technical faults in some months. Proportion of waste by category for missing months was estimated using the percentage share of the given months.

A ratio of 1 to 5 was used to split the total waste collected by source of solid waste and sent to landfill for three financial years. It was also assumed that the amount collected from other industries was self-delivered to the landfill while household wastes collected and delivered to landfill by contracted companies.

Solid Waste Survey for recycling companies used to estimate solid waste products collected by source and type of product as well as the amount exported by different product types. Solid waste export figures provided by Central Bank of Samoa only classified solid waste exports by ferrous and non-ferrous metals. The set of data were reconciled and they were not significant differences in weight and value.

Expert opinion on Healthcare waste was used to estimate the amount of hazardous waste from hospitals (national & district) excluding private clinics. See Appendix A3.

## **7. Future Work and Data Gaps**

---

There are a lot of data gaps discovered during the compilation of the accounts and it is something to address in the next account. Some of the issues to be addressed are as follows;

- Increase coverage of account to include other landfill to provide the whole of Samoa's waste generation to collection and management.
- Follow up accounts for the 2016-17 and 2017-18 to incorporate new findings of the Waste Audit 2017.
- Improve data collection to account for missing information collected by the responsible ministries as well as the recycling companies.
- Address ways to quantify missing landfill data due to weighbridge failure at times.
- Healthcare waste data could be improved if incineration data are recorded and made available for use instead of the estimates produced.
- Incorporate the amount of solid waste imports through arriving aeroplanes and ships by the Quarantine Division of Ministry of Agriculture and Fisheries

## **8. Conclusion**

---

This is the first ever Solid Waste Account for Samoa and it will provide the platform for future accounts.

Throughout the accounting period from FY2013-14 to FY2015-16, solid waste collected and disposed off at Tafaigata Landfill has declined. However, there are still questions about illegal dumping as the PUMA office recorded an increase in number of complaints regarding illegal dumping from 9 cases in FY2014-15 to 16 cases in FY2015-16 (See Appendix A4)

Compilation of these accounts revealed certain areas that needed to improve in future accounts. The accounts really tested the availability of information and the capacity of the unit in compiling the waste accounts and anticipating that the accounts will be improved over the years.

Total solid waste collected does not truly reflect the actual generation of solid waste at both the household and industry levels as both are not well recorded and documented. The waste account is basically dependent on the weigh bridge data collection with very little administration information from other stakeholders.

## **9. Acknowledgement**

---

We would like to acknowledge the following stakeholders for their collaboration and assistance in sharing their expert knowledge as well as waste data and related statistics for the construction of this first ever Experimental Solid Waste Account for Samoa.

- Waste Unit-Environment Conservation Division (Ministry of Natural Resources and Environment)
- Planning and Urban Management Agency (Ministry Natural Resources and Environment)

- Economics Division (Central Bank of Samoa)
- Waste Unit-Health Protection and Promotion Division (Min. of Health)
- Recycling Companies (namely Pacific Recycling Company, Waste Management Company, Metal Man and One Scrap Metal)
- Samoa Recycling and Waste Management Association (SRWMA).

We would also like to acknowledge the valuable and technical contribution and feedback provided by the UNESCAP SEEA experts, Mr Michael Bordt and Teerapong Praphotjanaporn.

## 11. References

---

Ministry of Natural Resources and Environment, 2018; *National Solid Waste Management Strategy 2019-2023* Draft.

Ministry of Natural Resources and Environment, 2013; *Samoa State of the Environment Outlook Report*. MNRE

Ministry of Natural Resources and Environment, 2017; *Solid Waste Audit Survey Report*, MNRE.

Sagapolutele & Rasch, MNRE, 2008; *The Domestic Solid Waste Generation and Characterization Study on Upolu and Savaii Islands*, Apia, Samoa

Samoa Bureau of Statistics, 2016; *Household and Population Census 2016*, Samoa Bureau of Statistics.

UNSD, 2014; *System of Environmental - Economic Accounting 2012 Central Framework*, New York, USA.



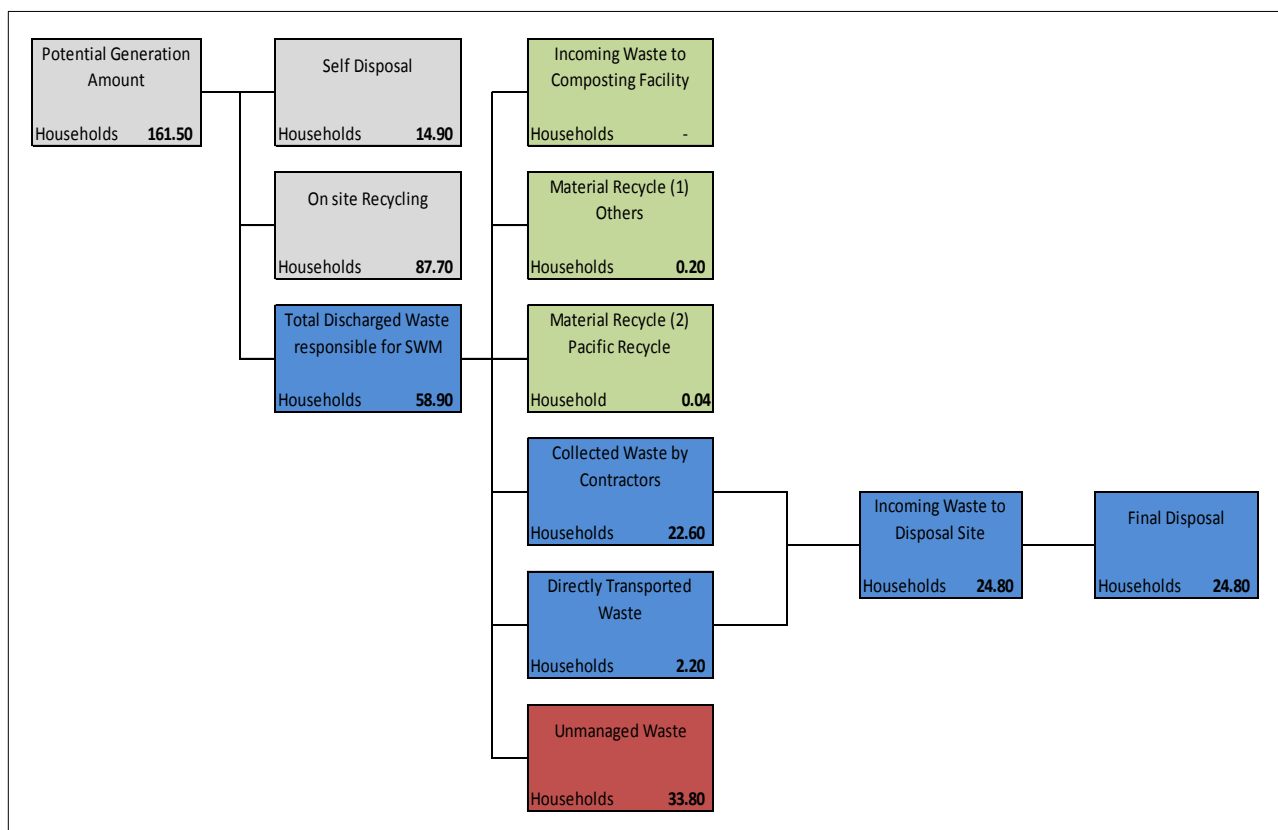
### A1: Solid Waste Categories & Definitions

#### MNRE Solid Waste Categories and Definitions

Waste Category	Definition
Bulk	Refer to heavy wastes (mostly electronic wastes e.g. white goods discarded fridges and freezers, TVs, washing machines, car bodies, computers etc.)
Condemned	These are condemned goods that are expired or contaminated and are not safe for consumption
General Waste	Usual wastes generated from daily life activities (mostly light in weight) includes paper, plastic papers, textiles, diapers, etc.
Glass	Includes all glass natured materials like beverage glass bottles and all glass bottles and louvers
Green	Organic wastes and mostly originated from plant parts e.g. plant clippings
Market	Generally wastes derived from public markets operation but in our context, it refers to plant originated wastes (e.g. plant leaves and skins, clippings from flowers etc.)
Recyclable	Wastes that can be recycled and nearly all wastes are recycled worldwide but depends on each countries e.g. plastic bottles, ferrous tins, aluminum cans, scrap metals
Healthcare	Refers to hazardous healthcare waste from hospitals and health clinics. E.g. needles, pharmaceuticals, chemicals, etc.

Source: Ministry of Natural Resources and Environment

### A2: Daily Waste Stream for Upolu (Tons)



Source: Waste Audit, Ministry of Natural Resources and Environment 2017

### A3: Healthcare Waste Estimates

#### Estimated Healthcare Waste for FY2015-16

Hospitals	#	Bin Volume (Liters)	# of Bins	Frequency	Total Litres	kg	Tonnes
Moto'otua Hospital	1	240	8	Daily	700,800	700,800	700.8
Tuasivi Hospital	1	240	1	Daily	87,600	87,600	87.6
District Hospitals Upolu	6	120	12	Twice a Week	149,760	149,760	149.76
District Hospitals Savaii	3	120	3	Weekly	18,720	18,720	18.72
<b>Total Hospital Waste</b>	<b>11</b>	<b>720</b>	<b>24</b>		<b>956,880</b>	<b>956,880</b>	<b>956.9</b>
<b>Assume 20% of total waste is HCW</b>					<b>191,376.0</b>	<b>191,376.0</b>	<b>191.4</b>

Source: Ministry of Health (MOH)

**Note:** Healthcare waste (HCW) estimates provided by MOH expert opinion and advice  
Conversion: 1liter = 1kg

### A4: Illegal Dumping Complaints

#### Number of Complaints Received and Confirmed by PUMA<sup>1</sup> on Illegal Dumping of Solid Waste

FY	All Public Complaints	Illegal Dumping	Illegal Dumping Share (%)
2013-14	176	22	12.5
2014-15	126	9	7.1
2015-16	139	16	11.5

Source: Ministry of Natural Resources and Environment (MNRE)

<sup>1</sup>PUMA – Planning and Urban Management Agency Division