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Secretariat of the Pacific Regional Environment Programme

PacWastePlus
PACIFIC WASTE MANAGEMENT

This initiative is supported by **PacWastePlus**-a 72 month project funded by the European Union (**EU**) and implemented by the Secretariat of the Pacific Regional Environment Programme (**SPREP**) **to sustainably and cost effectively improve regional management of waste and pollution.**

Waste Audit Report

FEDERATED STATES OF MICRONESIA

June 2021

Supported by the Australian Government through the Pacific Ocean Litter Project

Australian Aid

The information and data gathered from these waste audits will be used by countries in the Pacific to support the development and monitoring of waste and resource recovery projects and recommend the infrastructure and policy interventions required. The regional dataset will also be used to identify and evaluate potential regional projects that would improve waste management in the region.

Acknowledgment: SPREP, through the PacWastePlus programme engaged Tonkin & Taylor International Limited (T+TI) to undertake a waste audit in five Pacific Island countries. This report presents the findings of the waste audit undertaken for Federated States of Micronesia. The methodology applied for this waste audit was as per the Waste Audit Methodology – a step-by-step manual to conduct comprehensive waste audits in SIDs, produced by the Pacific Regional Infrastructure Facility (PRIF).

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Our vision: A resilient Pacific environment sustaining our livelihoods and natural heritage in harmony with our cultures.

As part of SPREP's commitment to the environment, this item is printed on paper made from 100% recycled postconsumer waste.

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COVID 19

The impact of the Covid-19 response in the Federated States of Micronesia on waste generation and composition is difficult to accurately quantify without data on these aspects before and after the start of the pandemic. Waste generation typically correlates well with economic activity i.e., there are likely to be limited impacts related to Covid-19. This suggests that the data collected for this audit is relevant and reflective of waste generation and composition for the Federated States of Micronesia.

Acronyms

Abbreviation	Meaning
ADB	Asian Development Bank
CDL	Container Deposit Legislation
CSEPA	Chuuk State Environmental Protection Agency
DPW&T	Department of Public Works and Transportation
DPTW	Department of Transportation and Public Works
EOL	End of Life
EPA	Environment Protection Authority
EPS	Expanded Polystyrene
GDP	Gross Domestic Product
HDPE	High-density polyethylene
FSM	Federated States of Micronesia
JSA	Job Safety Analysis
KIRMA	Kosrae Island Resource Management Authority
KMG	Kitti Municipal Government
KTG	Kolonia Town Government
LDPE	Low-density polyethylene
LPB	Liner paperboard
NMG	Nett Municipal Government
MG	Municipal Governments
MMG	Madolenihmw Municipal Government
PE	Polyethylene
PET	Polyethylene terephthalate
POPs	Persistent Organic Pollutants
PP	Polypropylene
PRIF	Pacific Regional Infrastructure Facility
PS	Polystyrene
PSEPA	Pohnpei State Environmental Protection Agency
PVC	Polyvinyl chloride
PWMS	Pohnpei Waste Management Service
SIDs	Small Island Developing States
SMG	Sokehs Municipal Government
SPREP	Secretariat of the Pacific Regional Environment Programme
T&I	Office of Transport and Infrastructure
T+TI	Tonkin & Taylor International Limited
UNEP	United Nations Environment Programme
UMG	Uh Municipal Government
YSEPA	Yap State Environmental Protection Agency

The PacWastePlus Programme

The Pacific – European Union (EU) Waste Management Programme, PacWastePlus, is a 72-month programme funded by the EU and implemented by the Secretariat of the Pacific Regional Environment Programme (SPREP) to improve regional management of waste and pollution sustainably and cost-effectively.

About PacWastePlus

The impact of waste and pollution is taking its toll on the health of communities, degrading natural ecosystems, threatening food security, impeding resilience to climate change, and adversely impacting social and economic development of countries in the region. The PacWastePlus programme will generate improved economic, social, health, and environmental benefits by enhancing existing activities and building capacity and sustainability into waste management practices for all participating countries.

Countries participating in the PacWastePlus programme are: *Cook Islands, Democratic Republic of Timor-Leste, Federated States of Micronesia, Fiji, Kiribati, Nauru, Niue, Palau, Papua New Guinea, Republic of Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu*.

KEY OBJECTIVES

Outcomes & Key Result Areas

The overall objective of PacWastePlus is "to generate improved economic, social, health and environmental benefits arising from stronger regional economic integration and the sustainable management of natural resources and the environment".

The specific objective is "to ensure the safe and sustainable management of waste with due regard for the conservation of biodiversity, health and wellbeing of Pacific Island communities and climate change mitigation and adaptation requirements".

Key Result Areas

- **Improved** data collection, information sharing, and education awareness
- **Policy & Regulation** - Policies and regulatory frameworks developed and implemented.
- **Best Practices** - Enhanced private sector engagement and infrastructure development implemented
- **Human Capacity** - Enhanced human capacity

Learn more about the PacWastePlus programme by visiting

https://pacwasteplus.org/

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PacWastePlus
PACIFIC WASTE MANAGEMENT

Executive Summary

Summary of Audit Activities

Five surveys completed in FSM

- waste collection followed by a sort and weigh
- interviews
- landfill audits
- stockpile assessments

Data collected across Pohnpei

- 76 household samples
- 25 commercial samples and interviews
- 74 household interviews
- 10 stockpile assessments
- 52 landfill loads audited

Data collected across Chuuk

- 120 household samples
- 27 commercial samples
- 97 household interviews
- 25 commerial interviews
- 22 stockpile assessments
- 67 landfill loads audited

Data collected across Kosrae

- 92 household samples
- 90 household interviews
- 24 commercial samples and interviews
- 3 stockpile assessments
- 17 landfill audits

Data collected across Yap

- 49 household samples
- 71 household interviews
- 3 commecial samples and 7 interviews
- 5 stockpile assessments
- 7 landfill audits

Waste Generation Rates

- Pohnpei - Average household generation per day is 0.5kg
- Chuuk - Average household generation per day is 2.5kg.
- Kosrae - Average household generation per day is 1.6kg.
- Yap - Average household generation per day is 0.6kg.

Stockpiles in FSM

Most commonly stockpiled materials:

- Pohnpei - cars, trucks, heavy machinery and used oil.
- Chuuk - cars, heavy machinery and used oil.
- Kosrae - cars, trucks, heavy mahinery and used oil.
- Yap - cars, trucks, vans, heavy machinery and use oil.

Pohnpei Landfill Composition

- 24.4% paper and cardboard
- 22.6% organics
- 12.8% plastics
- 11.3% metals
- 15.2% other
- 0.3% e-waste
- 0.0% fishing
- 1.9% hygiene
- 0.3% single use items
- 2.6% glass
- 0.3% batteries

Chuuk State Landfill Composition

- 21.9% paper and cardboard
- 21.0% organics
- 16.3% plastics
- 14.3% metals
- 3.7% single use plastics
- 1.0% e-waste
- 2.4% hygeine
- 2.3% hazarodous
- 14.9% other waste
- 0.1% batteries
- 1.8% glass

Interview Outcomes

- **Pohnpei - Households** - 4.4/10 level of satisfaction with the collection service. Commercials - 6.1/10 level of satisfaction with the collection service.
- **Chuuk - Households** - 5.1/10 level of satisfaction with the collection service. Commercials - 6.0/10 level of satisfaction with the collection service.
- **Kosrae - Households** - 8.4/10 level of satisfaction with the collection service. Commercials - 8.4/10 level of satisfaction with the collection service.
- **Yap - Households** - 6.4/10 level of satisfaction with the collection service. Commercials - 10.0/10 level of satisfaction with the collection service.

Kosrae (Tofol) Landfill Composition

- 22.7% paper and cardboard
- 16.7% plastics
- 9.9% metals
- 10.6% other
- 1.5% e-waste
- 0.0% fishing
- 24.9% organics
- 2.8% hygiene
- 6.3% single use items
- 2.7% glass
- 0.0% batteries

Yap State Landfill Composition

- 16.2% paper and cardboard
- 16.2% plastics
- 21.4% metals
- 0.0% single use plastics
- 0.0% e-waste
- 20.1% hygeine
- 21.0% organics
- 4.0% hazarodous
- 0.0% other waste
- 0.0% batteries
- 1.0% glass

Commercial Composition Trends

Pohnpei - samples dominated by paper and cardboard, plastics, metals and organics.

Chuuk - Varied by sector. All sectors dominated by paper and cardboard and plastics. Organics were also recorded in high quantities in the education and training and retail/trade. With metals also dominating accommodation and food service and construction and demolition samples.

Kosrae - Dominated by paper and cardboard, plastics, metals and organics (particularly for mixed small businesses

Introduction

The Secretariat of the Pacific Regional Environment Programme (SPREP) engaged Tonkin & Taylor International Limited (T+TI) to undertake a waste audit in the Federated States of Micronesia (herein FSM). This report presents the findings of the waste audit undertaken for FSM. The methodology applied for this waste audit was as per the *Waste Audit Methodology – a step-by-step manual to conduct comprehensive waste audits in SIDs, produced by the Pacific Regional Infrastructure Facility* (PRIF)[1].

The waste audits were undertaken between several departments in close collaboration with T+TI. In view of the Covid-19 pandemic, T+TI worked remotely, supporting the delivery of the waste audit working in collaboration with other key stakeholders.

The audits were conducted on the following dates:

- Chuuk was coordinated by the Chuuk State Environmental Protection Agency (CSEPA) and began on 14 January to 31 January 2021.
- Kosrae was coordinated by the Kosrae Island Resource Management Authority (KIRMA) and began on 2 March to 30 April 2021.
- Pohnpei was coordinated by the Pohnpei State Environmental Protection Agency (PSEPA) and began on 14 January to 5 February 2021.
- Yap was coordinated by the Yap State Environmental Protection Agency (YSEPA) and began on 30 March to 7 May 2021.

The results from the FSM waste audits contribute to a Pacific wide audit programme implemented by SPREP and partner development agencies. This audit was funded by SPREP through the EU-funded PacWaste Plus programme and with support from the Australian Government-funded Pacific Ocean Litter Project (POLP). Other audits in the region are funded by the United Nations Environment Programme (UNEP), the World Bank and the Pacific Regional Infrastructure Facility (PRIF). The information and data gathered from the waste audits will be used to support the development and monitoring of waste and resource recovery projects and recommend any infrastructural, service, or policy interventions intended to continually improve waste management systems and services.

The FSM Waste Audit Report is structured as follows:

- **Section 1: Introduction –** provides background information and details on waste audit methodology.
- **Section 2: Pohnpei** - sets out the context for the audit in the state of Pohnpei including the available waste infrastructure, statutory framework for waste management, and existing waste services.
- **Section 3: Chuuk** - sets out the context for the audit in the state of Chuuk including the available waste infrastructure, statutory framework for waste management, and existing waste services.
- **Section 4: Kosrae** - sets out the context for the audit in the state of Kosrae including the available waste infrastructure, statutory framework for waste management, and existing waste services.
- **Section 5: Yap -** sets out the context for the audit in the state of Yap including the available waste infrastructure, statutory framework for waste management, and existing waste services.
- **Section 6: National Assessment** - presents a national assessment based on the audits in the four states.
- **Section 7 National Customs Data**.
- **Section 8 Appendices** - provides the Waste Sort Categories used for the audit, the assumption of Stockpile Assessment, Waste Density assumptions, and the HS Codes

[1] PRIF (2019) Waste Audit Methodology. A step -by-step manual to conduct comprehensive waste audits in SIDs.

Socio-Economic Background

FSM is made up of four states comprising 607 low coral atolls and volcanic mountainous islands, of which 65 are inhabited. There is a combined population across Micronesia of 112,640[2]. There are four main areas the islands of FSM are split into: Yap, Chuuk, Pohnpei and Kosrae.

The 2010 census reported that there were 11,183 households across these four states. The languages spoken include English, Chuukese, Pohnpeian, Kosraean and Yapese. The respective populations living in each state are shown in **Table 1.**

Table 1 Population by State

State	Population[3]	Households[4]
Chuuk	48,654	2,092
Kosrae	6,616	1,143
Yap	11,377	1,660
Pohnpei	36,196	6,288

Gross domestic product (GDP) per capita in 2018 was US$3,634[5]. The economy faces challenges including:

- Few commercially valuable mineral deposits.
- Limited tourism opportunity (isolation, lack of facilities, lack of air and water transportation)
- Geographical challenges (main states are located far apart and isolated)

Economic activity is related to subsistence farming and fishing. A large portion of employment is through the government sector[6].

At the time of conducting the audit Covid-19 had been declared a global pandemic by the World Health Organisation. Like many other Pacific Island nations, FSM has avoided an outbreak by closing their international boarder.

Audit Methodology

Audit Team

The audits were undertaken by a T+TI project team working closely with local agencies. The T+TI team comprised a Team Leader, a Country Coordinator, and a Waste Auditor. An overview of the team is provided in **Table 2**.

[2] World Bank (2018)

[3] FSM Statistics 2010

[4] 2010 Census

[5] https://countryeconomy.com/gdp/micronesia

[6] https://www.economy.com/federated-states-of-micronesia/indicators

Table 2: Project team for waste audits in FSM

	Chuuk	Kosrae	Pohnpei	Yap
Team Leader	Chris Purchas (T+TI)			
Waste Auditor / Country Coordinator	Tekao Herrmann (T+TI)	Anna Ainsworth (T+TI)	Tekao Herrmann (T+TI)	Anna Ainsworth (T+TI)
In country Focal Point	Joyce Sewell	Blair Charley	Brad Soram	Christina Fillmed
	Masahori Mori	Kiobu Luey		Jacob Falan
Audit team	5 staff from Chuuk EPA	15 staff from KIRMA	12 from Pohnpei EPA	4 staff from Yap EPA
Number of Officers Trained	24	27	20	8
Training Dates	14 January 2021 15 January 2021	3 March 2021	13 January 2021 14 January 2021	30 March 2021 31 March 2021

It was intended that the T+TI project team be present in FSM for some or all the audit periods. Travel restrictions due to the Covid-19 meant that the T+TI team participated remotely.

The T+TI Country Coordinator and T+TI Waste Auditor were present remotely for the entire waste audit period. While the in country focal point was available for the duration of the waste audit managing the waste audit activities on the ground.

A description of the responsibilities for each role has been provided in **Table 3**.

Table 3: Responsibilities of the project team

Role	Responsibilities
Country Coordinator	Provide remote support for the duration of the waste audit. Provide daily feedback to the in country focal points and audit teams.
In country Focal Point	Delivering the physical audits in country, on the ground, with remote support from the Country Coordinator and Waste Auditor.
Team Leader	Provide effective communication of progress for the waste audit. Provide regular reporting and updates to the SPREP Project Manager and FSM Focal Points.
Waste Auditor	Reporting of the waste audit for FSM.

Audit Planning

Communications with the in country focal points began in 2020 and early 2021, as defined in **Error! R eference source not found.**.

The country focal points coordinated the creation of audit teams. Audit Plans for each of the four countries in FSM where audits were planned was prepared by T+T.

The identification of individuals to take part in the audit included consideration of experience in previous waste audits, some understanding of the waste operations in each location and being able to operate a smart phone to input the raw data.

It was agreed that team members that were identified to input the raw data would use their own personal phones.

Equipment required for the audit was provided by T+TI and was shipped from New Zealand to FSM.

This included the following:

- Coveralls;
- Disposable gloves;
- Protective gloves – to go over the top of the disposable gloves;
- Face masks;
- First aid kit;
- Wheelie bin liners – 240 litre and 120 litre;
- Tongs – long and short handled;
- Dustpan and brush;
- Masking tape;
- Hand sanitiser;
- Safety glasses; and
- T+TI mobile phones (excluding Yap).

Equipment unable to be shipped, but sourced in FSM included:

- Vehicles required to collect waste samples and undertake stockpile assessments were hired in country;
- Scales for the sort and weighing of waste samples;
- Petrol for use in the hire vehicles
- Bins and sorting containers; and
- Sim cards providing data for phones to upload audit data from survey forms.

Health and Safety

The importance of ensuring that health and safety is considered integral to the delivery of the waste audit was communicated continually from the first remote meeting with the in country focal point.

Due to the nature of the physical sorting and weighing of waste, each team members involved in this part of the audit was required to receive vaccinations of Tetanus, Hepatitis A and B (where available).

Due to the Hepatitis A and Hepatitis B vaccines not being available in some of the four states, the following was provided as part of the audits (**Table 4**).

Table 4: Vaccinations given for FSM waste audits

Vaccinations	Chuuk	Kosrae	Pohnpei	Yap
Hepatitis A	Unavailable	Unavailable	Given	Unavailable
Hepatitis B	Unavailable	Given	Given	Unavailable
Tetanus	Given	Given	Given	Given

Confirmation of vaccinations for the in-country audit team was provided. T+TI produced a Job Safety Analysis (JSA) for each of the waste audits in FSM. This provides details on the audit methodology and describes the hazards associated with the tasks undertaken as part of the audit. Each hazard is considered individually, and mitigation measures outlined.

The JSA is reviewed and discussed alongside a health and safety presentation which forms part of the training. Everyone taking part in the waste audits is required to sign the JSA, which confirms that they have understood and agree to the information.

Audit Training

The training and audit delivery process was designed to allow the project team to provide support and supervision remotely.

Remote training was achieved through:

- Training material based on a mix of videos, written material and presentations;
- On-line quizzes to test understanding of key audit and safety concepts; and
- Provision for telephone or video conference delivery from a remote team.

The audit process and data collection approach were also designed to allow for remote supervision as much as possible if required. Key aspects included:

- Daily start-up meetings with the various audit teams (by telephone or video if required);
- Form based data collection on mobile phones or tablets to ensure data is collected in a consistent fashion[7];
- Live or end of day data submission to allow review of data collected[8]; and
- Periodic check in by telephone or video each day to track sample collection, data quality and challenges as they arise.

The remotely located T+TI Country Coordinator and/or T+TI Waste Auditor were available throughout the audit period to answer any questions from the audit team, provide feedback on the data and ensure that the team are comfortable with the health and safety requirements for the audit. The training involved a range of guides, training materials and remotely providing introductions with the in-country project team.

The T+TI Country Coordinator and/or T+TI Waste Auditor was on hand to answer any questions through the day by video conference. The training included:

- Working through “how to guides” for each survey component;
- An explanation of how to use the data collection software (on mobile phones), followed by an afternoon of training on the survey data input; and
- “Dummy run” for each of the surveys collecting data and familiarisation with roles.

The focus on training was supported throughout the audit activity through daily (or more frequent) contact and review of data being submitted through the data collection apps each day.

[7] Data collected through Survey 123 and received by T+TI on ArcGIS Enterprise
[8] Data stored on the T+TI secure system in project folders

Stakeholders

The key delivery partners working alongside T+TI to deliver the waste audits are detailed in **Error! Reference source not found.**.

Table 5: Key delivery partners

Chuuk	Kosrae	Pohnpei	Yap
Chuuk State EPA	KIRMA	Pohnpei State EPA	Yap State EPA
Public Works	Community	Department of Transportation and Public Works	Environmental Health & Sanitation
Department of Transportation and Public Works	Lelu Town Government	Public Works	Red Cross
Community	Tafunsak Municipal Government	Community	Office of Planning & Budget
	Department of Transportation and Infrastructure		Department of Transportation and Infrastructure
	Public Health Services		

Several key stakeholder groups supported the delivery of the audits with details of the consultation and engagement activities included below.

There is currently no specific waste management legislation in place in FSM. Waste management is covered under a number of national regulations and state laws and regulations relevant to waste management.

A Solid Waste Management Strategy exists for each of the states (Yap, Chuuk, Pohnpei and Kosrae) and provides some analysis and context for waste management noting that the dispersed and isolated municipalities make the management of solid waste a challenge.

Waste Management Protocols

Pipeline legislative activities for waste management and governance in FSM (current as of April 2021) include:

- ***National Waste Policy*** – A national waste policy is currently being developed. No delivery date was publicly available;
- ***State legislative initiatives for Chuuk –*** Littering law and solid waste regulations under the Clean Environment Act, timeframe for the introduction of these laws is yet to be determined;
- ***Container deposit schemes –*** The scheme has been proposed in Chuuk and Pohnpei and action plans are outlined in relevant solid waste strategies. Existing systems are in place in Yap and Pohnpei with a proposed expansion for Yap; and
- ***Plastic product ban*** - A national ban on the importation of single-use styrofoam containers and plastic shopping bags is due to come into force in July 2020. Pohnpei ban yet to be confirmed for the use of plastic bags.

Stakeholders – Roles and Responsibilities

Respective municipalities are responsible for and finance waste collection and transportation. Key organisations involved in solid waste management are included in **Table 6**.

Table 6: Stakeholder roles and responsibilities

Stakeholder	Responsibility
National Government	
Environmental Protection Agency	The EPA from each state: • Pohnpei State Environmental Protection Agency (PSEPA). • Chuuk State Environmental Protection Agency (CSEPA). • Yap State Environmental Protection Agency (EPA). Perform inspections at landfills to ensure environmental standards are met, organisation of recycling, promotion of recycling and environmental education. In Chuuk and Yap specifically, EPA has broad oversight of CDL through recycling policy.
Subordinate Agencies	
Pohnpei - Office of Transportation and Infrastructure (T&I)	One state government and eleven municipalities with their own governance structure and legislative functions performed by the Municipal Councils. Solid waste collection is the responsibility of each municipality. Pohnpei T&I is responsible for construction project administration, government property and infrastructure maintenance. Including operation of the waste disposal site. T&I manage the contract for waste collection and the disposal site.
Kosrae Island Resource Management Authority (KIRMA)	Agency with the Government who monitor, promote safety and security, and inform policy to protect the islands resources. KIRMA supported the delivery of the waste audit for Kosrae. There are four municipalities in Kosrae. Solid waste collection is the responsibility of each municipality.
Kosrae - Department of Public Works and Transportation (DPW&T)	DPW&T manage the contract for waste collection and management and maintenance of the landfill site in Kosrae.
Chuuk - Department of Transportation and Public Works (DPTW)	DPTW is responsible for collection and transportation of waste and operation and management of the disposal site in Chuuk.
Yap - Department of Public Works and Transportation (DPW&T)	DPTW is responsible for collection and transportation of waste and operation and management of the disposal site in Yap.

Section 2:
Pohnpei Waste Audit Findings

Legislation

The summary of relevant national and state in Pohnpei is provided in the table below that has been sourced from the *Stocktake of existing and pipeline waste legislation report* [9].

Table 7 Legislation Summary

Legislation name	Description
	National
Solid Waste Management Strategy 2010 -2015)	Identifies how FSM will establish technically sound and financially sustainable solid waste management. The strategy has 3 strategic objectives focusing on policy, implementation, and education.
Plastic products ban (2020)	Prohibits the import of single-use disposable Styrofoam, plastic food service items and plastic shopping bags from 1 July 2020.
National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (2007)	Plan detailing FSM's obligations as a party to the Stockholm POPs Convention.
	State level
Solid Waste Management Strategy 2019 – 2023	Identifies how Pohnpei State will establish technically sound and financially sustainable solid waste management.
Plastic bag ban (2011)	Ban on single use plastic bags for Pohnpei.
Container Deposit Legislation (2011)	Establish sustainable financing for solid waste management with reducing the negative impact on final landfill sites. Targeting aluminium cans only.

Waste Services

Household Waste

In each municipality (six on the main land islands and five on the outer islands), various bags such as rice and pig feed bags are used by households for waste containment. The bags are placed into drums and located on wooden platforms for collection. Black bags were provided for the audit, to empty the contents from bins put out for collection and provide double bagging of waste put out in bags). Typical roadside waste containers and examples of waste put out for collection in Pohnpei can be seen in **Figure 1** below.

Figure 1: Typical waste collection put out for collection from households in Pohnpei

In Kolonia town, Kolonia Town Government (KTG) waste collection is contracted to a private company: Kleen Cut who charges fees to residents of $10 per month. Large size containers (1.5 m^3) are provided free of charge for householders to drop off their waste into for collection.

Government and various organisations fund a free waste collection service on a quarterly basis each year. Many residents store waste until these scheduled days. Waste is often placed in heaps on the roadside and in backyards. Waste collected on these days' accounts for approximately 16% of waste generated in one year.

Waste, which is not collected, is reported improperly discharged to open spaces.

Household Recycling

Aluminium cans have previously been collected every three months, however, drop off is now the only available option, requiring households to pre-register. Aluminium cans can be delievred to either the KTG recycling centre or Madolenih Redemption Centre, where cans are counted into baskets of 500.

A press for the aluminium cans is located at the KTG recycling centre only. All cans dropped off at the Madolenih Redemption Centre are transported to the KTG recycling centre. A refund of six cents per can is paid, with an operational cost of one cent per can (consumers receive five cents per can redeemed).

Approximately 25% of household waste in food organics, which is typically reused in the following ways:

- Feeding food organics to livestock; and
- Coconut fibre and husk used as firewood.

Food organics not recovered at the house is sent to Dekehtik Landfill.

Commercial Waste

Private waste collection companies provide waste bins for waste containment as part of their collection service. These services are delivered to commercials (large scale stores, business offices and public institutions) for a fee. The biggest collection company is Pohnpei Waste Management Services (PWMS), who mainly provide services in Kolonia.

A significant portion of commercial establishments still deliver their waste directly to the landfill.

Charging

The collection service charging and regularity of collections provided by the representative municipal governments (MG's) is defined below for households and commercials.

Table 6: Charging by municipality for households and commercials

Location	Households	Commercials
Kitti Municipal Government (KMG)	$5/month	$10/month
Kolonia Town Government (KTG)	$5/month Free collection for schools, churches, and households with a member of 60 years of age.	$20/month
Madolenihmw Municipal Government (MMG) –	Free collection service, regular collection day not set.	Free collection service.

Location	Households	Commercials
Nett Municipal Government (NMG)	Twice weekly collection delivered free of charge.	Free of charge
Sokehs Municipal Government (SMG)	Weekly paid collection service ($5/month). Free collection for schools, churches, and public offices.	No details
Uh Municipal Government (UMG)	Weekly paid collection service ($5/load). Free collection for schools, churches, and public offices.	Paid collection service ($5/load).

Fee collection rates (where applicable) are low, resulting in limited income for the municipalities. The fee deficit is made up by municipalities through local revenue sharing i.e., commercial licence fees and court fees.

Hazardous Waste

Healthcare Waste

Healthcare waste management is funded by the Government and with healthcare waste incinerated on island since March 2018. Two medical incinerators are in Pohnpei, but it is unknown whether either are currently operational. The incinerator located at the hospital is used for healthcare waste, sharps and pharmaceutical waste produced by the Pohnpei State Hospital. Training of four Pohnpei State Hospital staff was undertaken for both operation and maintenance of the incinerators[10].

Asbestos

Estimated volumes of asbestos containing materials across Pohnpei is estimated to be around 3,052 m^2. Asbestos containing materials were identified at nine locations across Pohnpei.

Used Oil

Estimated volumes of used oil in Pohnpei taken from the Consultancy for Contemporary Used Oil Audits in Selected Pacific Island Countries Report for the State of Pohnpei indicated around 891,600 litres (2013-14). Used oil is reported to be used as generator fuel. Locations of stockpile locations has been identified in Section 3. No updated information was provided during the audit.

Pohnpei Waste Facilities

Landfill Infrastructure

Dekehtik Landfill is located along the main road between the Airport and city centre in the Kolonia municipality. The landfill is the main disposal site for all municipalities in mainland Pohnpei and occupies an area of approximately 4 hectares. The site is owned by the State Government and operated by PWMS (a private entity).

The landfill is a rehabilitated site to a Fukuoka landfill method, which includes a leachate collection line and treatment pond Operations and maintenance funding of the landfill is provided by the State and Federal Governments.

[10] Baseline Study for the Pacific Hazardous Waste Management Project – Healthcare Waste. 2014

Figure 0.2: Dekehtik Landfill in 2017

KTG owns two four tonne compactor trucks and a two-tonne dump truck. One of the compactor trucks is lent out to their contractors. Equipment located at the landfill includes:

- Crusher;
- Bailer;
- Two compactor trucks; and
- Boom trucks.

There is a non-governmental organisation in Pohnpei undertaking the composting of garden organics. A composting site is also located at the College of Micronesia.

Charging at the landfill

There is currently no gate fee or tipping fee charged at the landfill.

Inputs to Landfill

Waste acceptance at the landfill includes general and hazardous waste. Separation of waste onsite is limited to the separation of hazardous from general waste. Self-haul is a common method for both householders and commercials.

This is likely to be a preferred option for householders and commercials since there is no charge associated with waste drop off.

Approximately 46% of waste disposed is collected by local governments and 54% is brought direct from households and commercials.

Pohnpei Waste Audit Findings

Household Audit Findings

Access to Waste Collection Services

Table 7: Summary of access to collection services

Access for households to a waste collection service	Details
Total Households Interviewed	74
% with access to collection service	18.9%
Average collection service rating	4.4/10
Comments	The lower waste collection service rating was primarily due to the service being unreliable or the low frequency of the service (monthly for households).

Alternative approaches to managing waste were highlighted through the interviews. It is common practice for several options to be selected by householders for the same waste stream (**Table 8**).

Table 8: Waste management activities adopted by households

Material	Disposal options
Bulky items	• Collected • Transported to landfill
Food organics	• Collected • Illegally dumped • Transported to landfill • Stored
Garden organics	• Collected • Illegally dumped • Transported to landfill • Burned • Stored
Sanitary	• Collected • Transported to landfill • Burned
General Waste	• Collected • Transported to landfill • Illegally dumped

Household's reasoning behind preference for disposal options was not provided during the audit.

Participants were surveyed on their willingness to pay for collection services. 62% of those interviewed preferred a free collection service, 16% were willing to pay between $1 and $2, 11% are willing to pay $3 to more, 5.5% willing to pay between $2 to $3, and another 5.5% willing to pay under $1.

Outcomes from this survey question are presented in **Figure 3**.

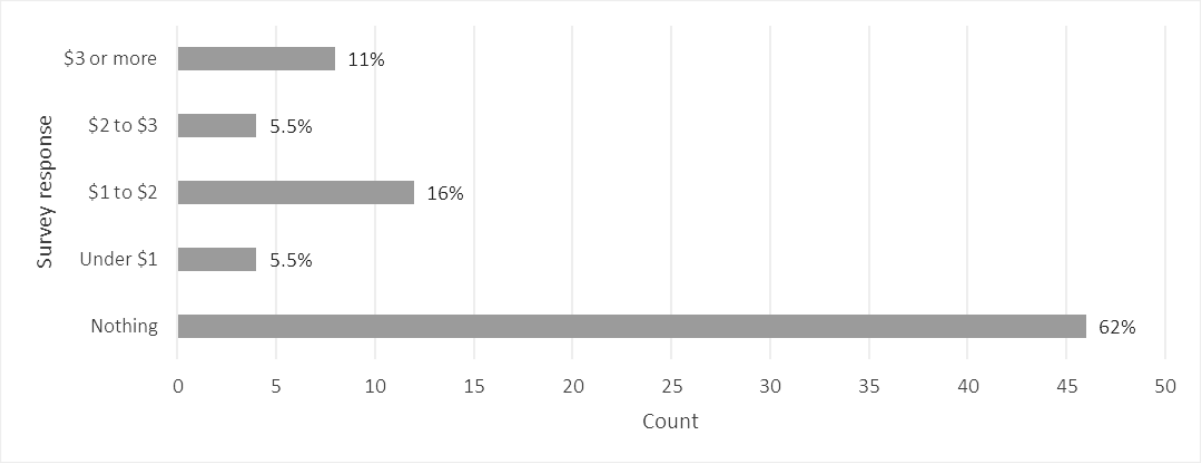


Figure 3: Willingness to pay for households' collection of waste – survey outcomes in Pohnpei

Household Waste Composition

The average composition of waste by weight from households in Pohnpei is shown in **Figure 4**.

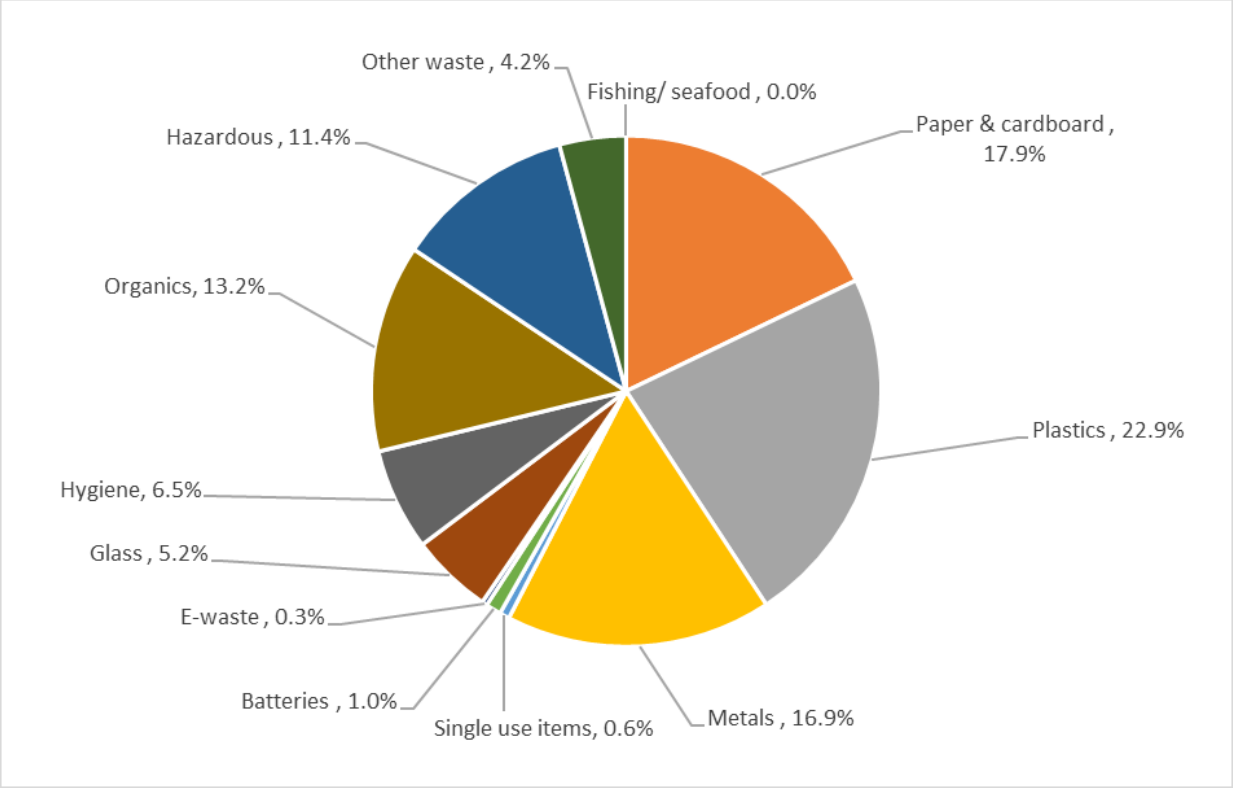
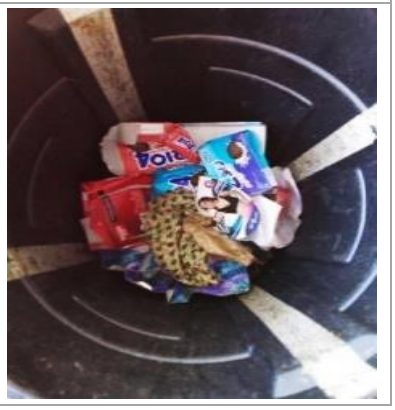


Figure 4: Pohnpei average household waste composition summary

Key audit findings by category and photos have been identified in **Table 9Error! Reference source not found.**. Plastics (22.9%), paper and cardboard (17.9%) and metals (16.9%) were the largest components of the waste stream.

Table 9: Waste material findings

Waste Material	Description	Audit Images
Hazardous Wastes	Dominated by butane cooking gas bottles.	
Metals	Dominated by food cans and foil. Aluminium drink cans are collected under the CDL scheme, however in this instance, they form part of the waste out for collection.	
Organics	A mixture of food and garden organics.	
Paper and Cardboard	Dominated by cardboard boxes (food and consumables). Samples also included egg cartons, Tetra Pak containers and office paper.	

Waste Material	Description	Audit Images
Plastics	Dominated by soft plastic food wrappers, food containers (PE and HDPE). Clear plastic bottles (oil and water) were also put out as part of the waste collection. Note: these two items are collected as part of the CDL scheme, however in this instance, they form part of the waste put out for collection.	

Hygiene, glass, and other wastes[11] were recorded in smaller quantities with details provided below.

- Glass mainly consisted of alcohol beverage bottles and food condiment bottles;
- Hygiene was dominated by nappies and sanitary items; and
- Other waste was dominated by textile waste.

Fishing and seafood, e-waste, batteries, and single use items represented less than four percent of the total composition by weight. The lower and upper range for each component of household waste have been calculated at a 95% confidence interval and are presented in **Error! Reference source not found.**and **Figure 5**.

This provides a measure of the range of estimated proportion for each material that might be expected for repeated composition surveys for households in Pohnpei. Interviews with householders provided data we have used to estimate the average quantity of waste from sampled households for Pohnpei[12].

The estimated generation of waste per household per day is 0.5 kg (within a range of 0.05 kg – 3.8 kg per household per day). Due to the absence of fishing/seafood identified during the survey, the margin of error in the range has not been provided.

[11] Other waste includes: textiles, EOL renewable energy equipment, Tyres, Rubble/concrete including Ceramics.
[12] The data used to calculate the composition of waste collected from households has been derived from samples collected from all household properties during the audit only. The total weight of samples collected was averaged using the count (total number of samples). This is the methodology as presented in the Waste Audit Methodology – A step-by-step manual to conduct comprehensive waste audits in SIDs produced by PRIF.

Table 10: Waste composition for households identified as part of the sort and weigh of samples for Pohnpei[13]

	Fishing/ seafood	Paper and cardboard	Plastics	Metals	Single use items	Batteries	E-waste	Glass	Hygiene	Organics	Hazardous	Other waste
Composition	**0.0%**	**17.9%**	**22.9%**	**16.9%**	**0.6%**	**1.0%**	**0.3%**	**5.2%**	**6.5%**	**13.2%**	**11.4%**	**4.2%**
Combined sample weight (kg)	0.0	170.1	217.8	160.6	6.0	9.3	3.2	49.5	61.5	125.2	108.7	40.2
Average weight per sample (kg)[14]	0.0	2.9	3.8	2.8	0.1	0.2	0.1	0.9	1.1	2.2	1.9	0.7
Lower range	N/A	16.2%	22.3%	15.2%	0.0 %	0.0 %	0.0 %	2.3%	2.0%	9.5%	8.8%	1.6%
Upper range	N/A	21.0%	28.2%	19.6%	1.4%	1.7%	0.5%	6.4%	7.9%	15.5%	14.3%	5.9%

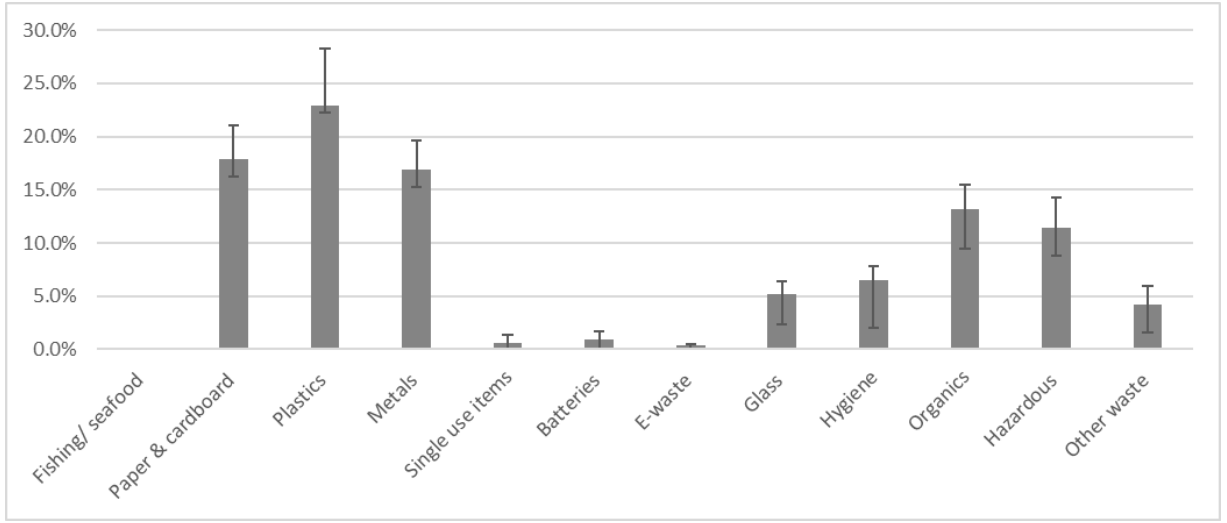


Figure 5: Waste composition for households identified as part of the sort and weigh of samples collected for Pohnpei

[13] Confidence interval of +15% and -15% applied during data analysis. 58/76 samples were within this range and have been used to derive the composition.
[14] Count of all data used (58). Total weight (kg) per category divided by count to provide average weight per sample

Potentially Recyclable Materials

A range of potentially recyclable material was identified. Plastics, paper and cardboard, and metals were recorded as the most dominant categories in the household waste samples.

Examples of these waste streams following separation are seen in **Figure 6** and **Table 11.**

Key points to note:

- Plastics are present with a high proportion of single use items suitable for recycling, if markets can be secured; and
- Metals, paper, and cardboard are both easily recycled, where markets are accessible.

Interview data suggested a wide range of household usage/generation. Average figures provide a useful indication of likely quantities of materials but should be validated for example using a large sample size for household surveys and/or considering sales data.

Figure 6: Potentially recyclable items identified through the sort and weigh of samples collected in Pohnpei

Table 11: Observations by material

Material	Key Materials	Observations
Metals	Dominated by aluminium drinks cans (Cola, Fanta, Sprite). Food tin cans (Spam and Tuna).	The data provided is the sample of households from across Pohnpei. Household interviews reported an average of 2.4 (2) drinks can per person, per household, per week. The range varied between 0 to 10 cans per week between samples collected. Using the average from the household interview data collected, across Pohnpei, this equates to approximately 85,632 cans per week for the population (est. 36,196). Over one year this is estimated to be around 4,452,846 drinks cans per year. This is considered at the upper end of the number of drinks cans likely to be produced[15].
Paper and Cardboard	Dominated by cardboard boxes	Also included egg cartons, cereal boxes, milk cartons, tissue boxes and food packaging boxes.
Plastics	Dominated by small (0.6 litre) and large (1.5 litre) water bottles (PET), soy sauce bottles (PET), cooking oil bottles (PET), small juice bottles (various). Plastic containers included food (condiments i.e., ketchup), non-food – body wash (HDPE), cleaning product (HDPE).	Household interviews reported an average of 2.2 (2) plastic water bottles per person per household per week with a range of 0 to 10 bottles per person, per week. Using the average from the household interview data collected, across Pohnpei this equates to approximately 78,182 per week for the whole population. Over one year this is estimated to be around 4,065,476 plastic bottles per year. This is likely to be at the upper end of the number of water bottles produced.

Commercial Audit Findings

The total number of commercial establishments audited by type is shown in **Table 12**, this provides the count, or the number of commercials audited during the waste audit.

Where there is a difference between the number of sort and weigh surveys completed and the interviews completed this indicates that the sort and weigh data has been excluded from the analysis through the quality assurance process.

Table 12: Commercial waste sample numbers

Commercial Type	Number Samples Sorted/Weighed	Number People Interviewed
Retail and Trade	15	20
Mixed Commercial	0	1

[15] If this data is to be used to inform potential recyclables for capture, it will be important to validate these numbers with further survey work specifically capturing a larger sample of households.

Access to Waste Collection Services

All commercials are required to arrange a private collection service or transport the waste they produce to the landfill themselves. **Table 13** summarises feedback on the collection service including a waste collection rating.

Table 13: Summary of access to collection services[16]

Access for Waste Collection Service	Details
Total interviewed	25
Percentage of commercials who access a collection service	40%[1]
Average collection service rating	6.1/10[17] - The lower waste collection service rating was primarily due to the inconsistency of the service and unreliable or low frequency of the service (monthly for some commercials).

It is common practice for several options to be selected by commercials for the same waste stream. Options undertaken by commercials are identified in **Table 14.**

Table 14: Options for waste management adopted by commercials

Material	Disposal Options
Bulky Items	• Transported to landfill (self-hauled) • Collected •
Food Organics	• Collected and disposed as general waste • Illegally dumped • Stored
Garden Organics	• Transported to landfill (self-hauled) • Burned • Illegally dumped • Collected
Sanitary	• Transported to landfill (self-hauled) • Collected
Waste	• Transported to landfill (self-hauled) • Collected

Participants were surveyed on their willingness to pay for collection services. Outcomes of the survey are presented in **Figure 7.** 60% of household interviewed preferred a free garbage collection while the remaining 40% are willing to pay for garbage collection service with 36% willing to pay between $1 and $3 or more. Only 4% of those interviewed are willing to pay below $1. No comments were provided by commercials on alternative waste management.

[16] Data collected and recorded in survey 123 app, from interviews held with commercials
[17] Sample size of 10 who responded to the question and only one commercial who uses the collection service.

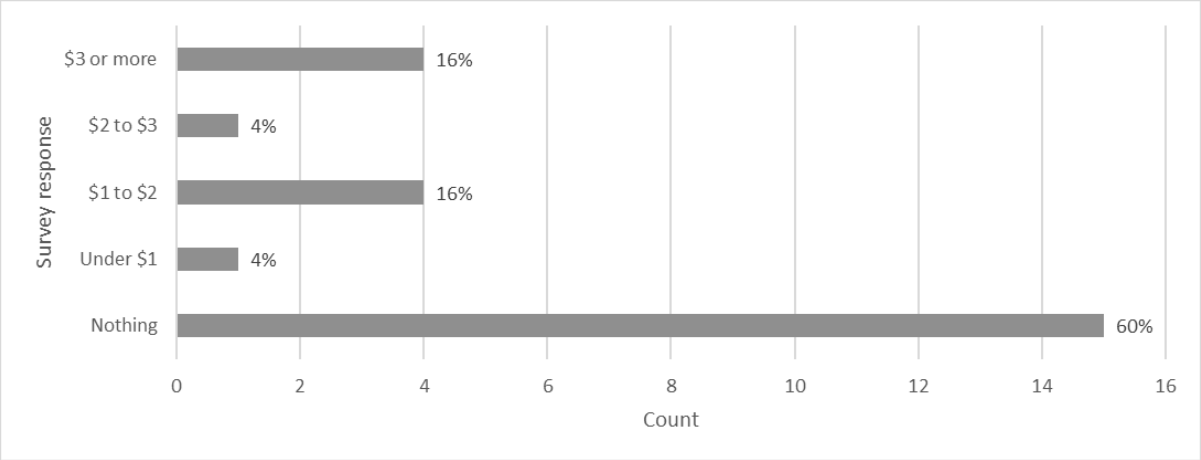


Figure 7: Willingness to pay for commercial collection of waste – survey outcomes in Pohnpei

Commercial Waste Composition

The composition of commercial waste collected, sorted, and weighed in Pohnpei is shown in **Error! Reference source not found.**

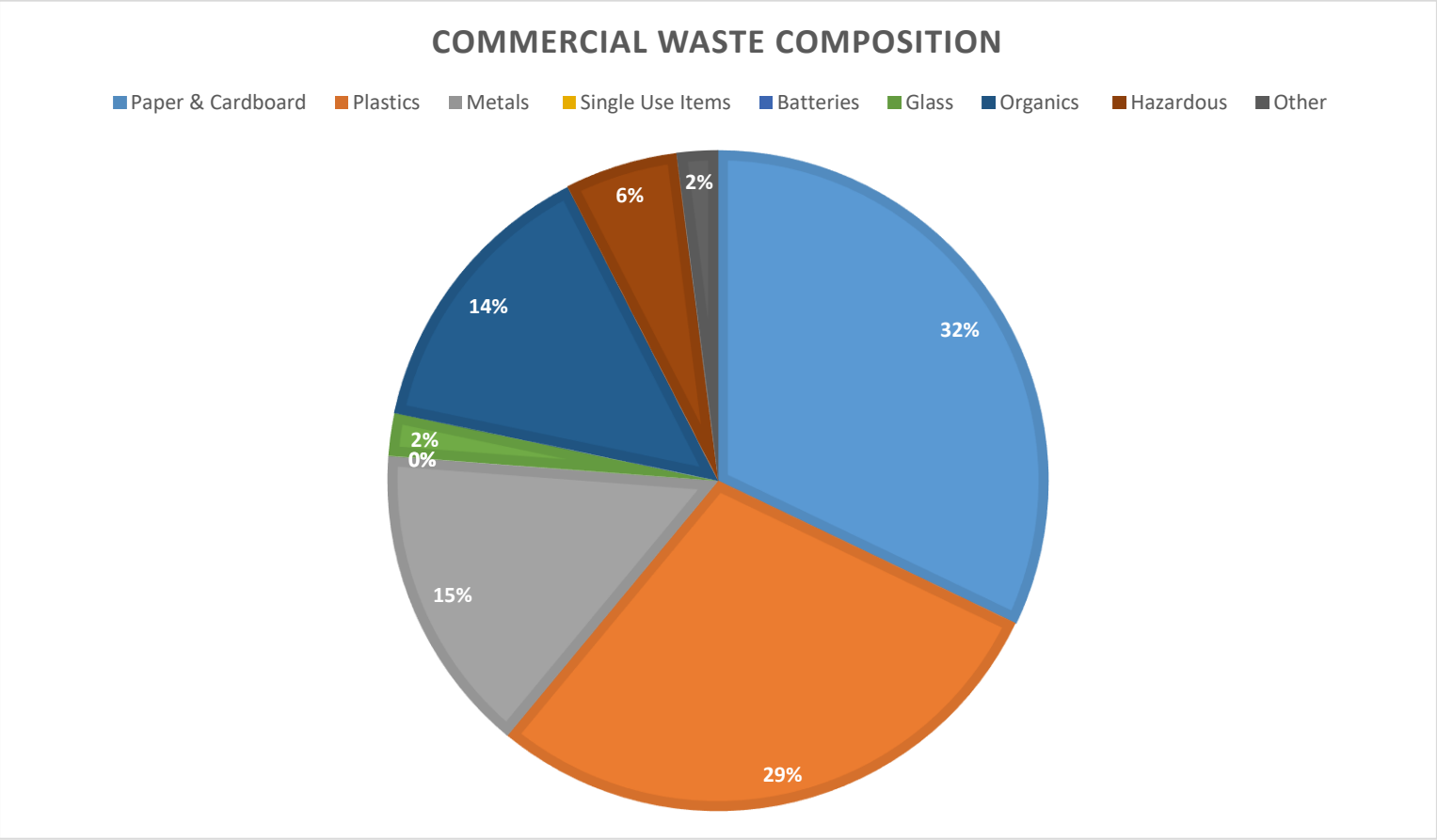


Figure 8: Composition of waste from commercials in Pohnpei

Key audit findings by category and photos have been identified in **Table 15**. The data collected suggests that the dominant waste categories for retail commercial types surveyed were paper and cardboard (33%) and plastics (29%). Other dominant waste streams included metals (14%) and organics (13%).

Table 15: Observations by material

Material	Key Materials	Audit Images
Metals	Dominated by metals: drinks (aluminium cans – beer and soda cans) food (steel cans - various brands).	
Organics	Dominated by food organics.	
Paper and Cardboard	Dominated by cardboard boxes.	

Material	Key Materials	Audit Images
Plastics	Plastic drinks containers – small and large (water bottles) (PET), other drinks containers (HDPE) and clear soft drink bottles (PET). Plastic containers – food containers (PE) and non-food containers (i.e., laundry liquid bottles).	

The overall waste composition for these retail commercials is presented in **Table 17** and **Error! Reference source not found.**

The lower and upper range have been calculated at a 95% confidence interval, providing a measure of the range of estimated proportion for each material that might be expected for repeated composition surveys for commercial premises in Pohnpei.

Due to the absence of fishing/seafood, single use, batteries, hygiene, and e-waste, the margin of error for these items has not been calculated.

Table 7: Waste composition for commercials identified as part of the sort and weigh of samples collected for Pohnpei[18]

	Fishing/ Seafood	Paper and Cardboard	Plastics	Metals	Single Use Items	Batteries	E-waste	Glass	Hygiene	Organics	Hazardous	Other Waste
Composition	**0.0%**	**32.1%**	**28.9%**	**15.2%**	**0.0%**	**0.0%**	**0.0%**	**2.1%**	**0.0%**	**14.2%**	**5.5%[19]**	**2.0%**
Combined Sample Weight (kg)	0.0	52.0	46.8	24.6	0.0	0.0	0.0	3.5	0.0	23.0	9.0	3.3
Average Weight per Sample (kg)[20]	0.0	3.5	3.1	1.6	0.0	0.0	0.0	0.2	0.0	1.5	0.6	0.2
Lower Range	N/A	26.3%	24.0%	6.8%	N/A	N/A	N/A	0.0%	N/A	4.6%	0.0%	0.0%
Upper Range	N/A	49.1%	35.7%	21.2%	N/A	N/A	N/A	3.9%	N/A	17.6%	10.0%	3.6%

[18] Confidence interval of +15% and -15% applied during data analysis. 15/25 samples were within this range and used to calculate the waste composition.
[19] Composition has been rounded down to 5.5% from 5.56%, due to rounding error and total equalling 100.0%
[20] Count of all data used (15). Total weight (kg) per category divided by count to provide average weight per sample

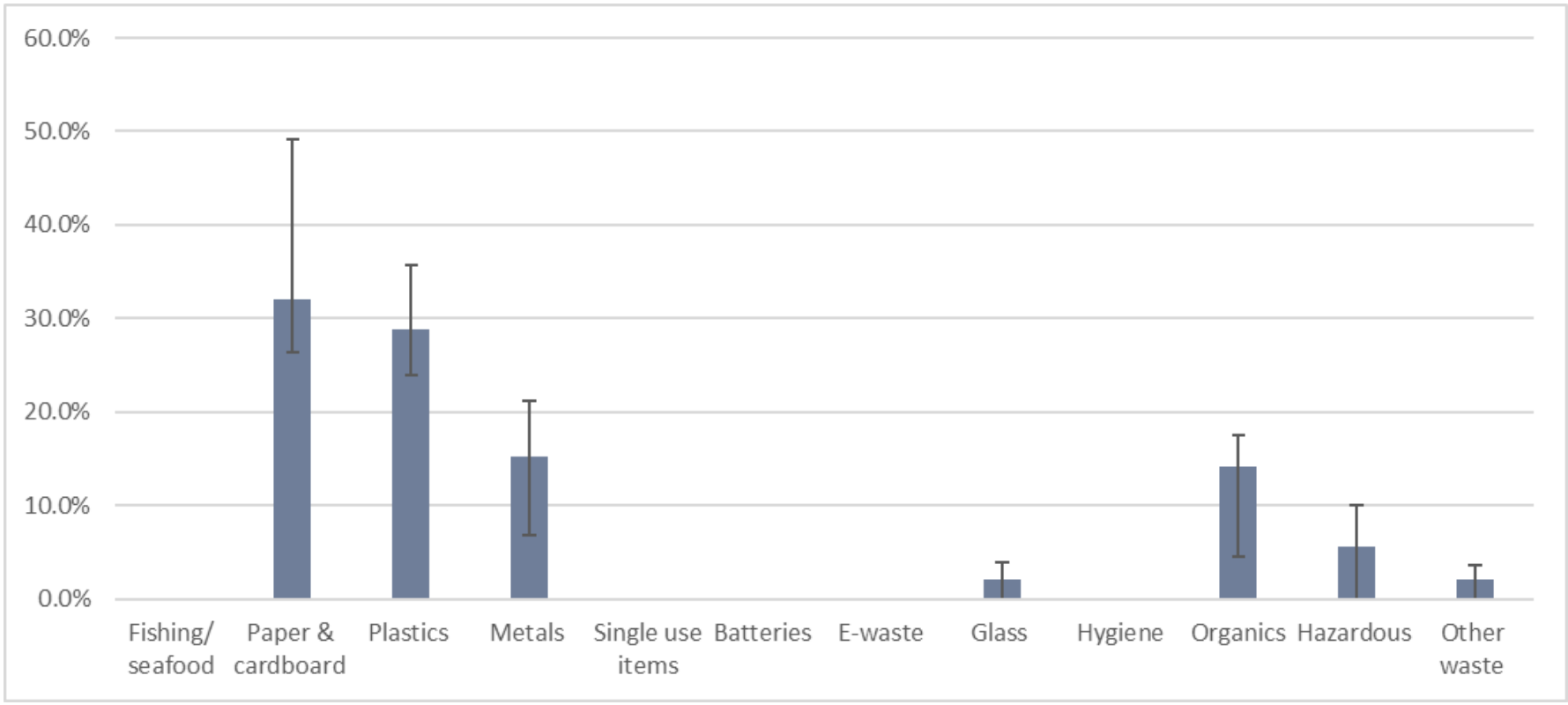


Figure 9: Waste composition for commercials identified as part of the sort and weigh of samples collected for Pohnpei

Landfill Audit

Considering the source of waste, landfill visual assessment data and using the sort and weigh audit data for households and commercials, an overall waste composition has been developed and is reflected below.

Waste collections by local governments (2017 tonnage data from the Solid Waste Management Plan for Pohnpei, 2020-2029)

- Household waste – 2.4 tonnes per day
- Household waste sample composition from the sort and weighing has been applied to household waste.
- Public and commercial waste – 3.7 tonnes per day
- Commercial waste sample composition from the sort and weighing has been applied to the public and commercial waste.

Direct transport to landfill (2017 tonnage data from the Solid Waste Management Plan for Pohnpei, 2020-2029)

- Household waste – 4.4 tonnes per day
- Household waste sample composition from the sort and weighing has been applied to household waste dropped off directly.
- Commercial waste – 8.0 tonnes per day
- Commercial waste sample composition from the landfill audit visual assessment data has been combined and applied to the commercial waste taken directly to the landfill.

Private collection company (2017 tonnage data from the Solid Waste Management Plan for Pohnpei, 2020-2029)

- Commercial waste - 4.4 tonnes per day
- Commercial waste sample composition from the landfill audit visual assessment data has been combined and applied to the commercial waste delivered directly to the landfill through the private company collection.

**Daily tonnages were factored up, given the site is open six days per week, 52 weeks a year.*

This suggests that the total waste to Pohnpei Landfill is approximately 7,000 tonnes per year.

Table 8: Estimated composition of solid waste in Pohnpei Landfill

Materials	Composition %	Tonnage per Day	Tonnage per Year
Batteries	0.3%	0.1	21
E-waste	0.3%	0.1	19
Fishing / Seafood	0.0%	0.0	0
Glass	2.6%	0.6	187
Hazardous	8.3%	1.9	597
Hygiene	1.9%	0.4	138
Metals	11.3%	2.6	807
Organics	22.6%	5.2	1616
Other Waste	15.2%	3.5	1089
Paper and Cardboard	24.4%	5.6	1744
Plastics	12.8%	2.9	918
Single Use Items	0.3%	0.1	22
Total	**100%**	**22.94**	**7157**

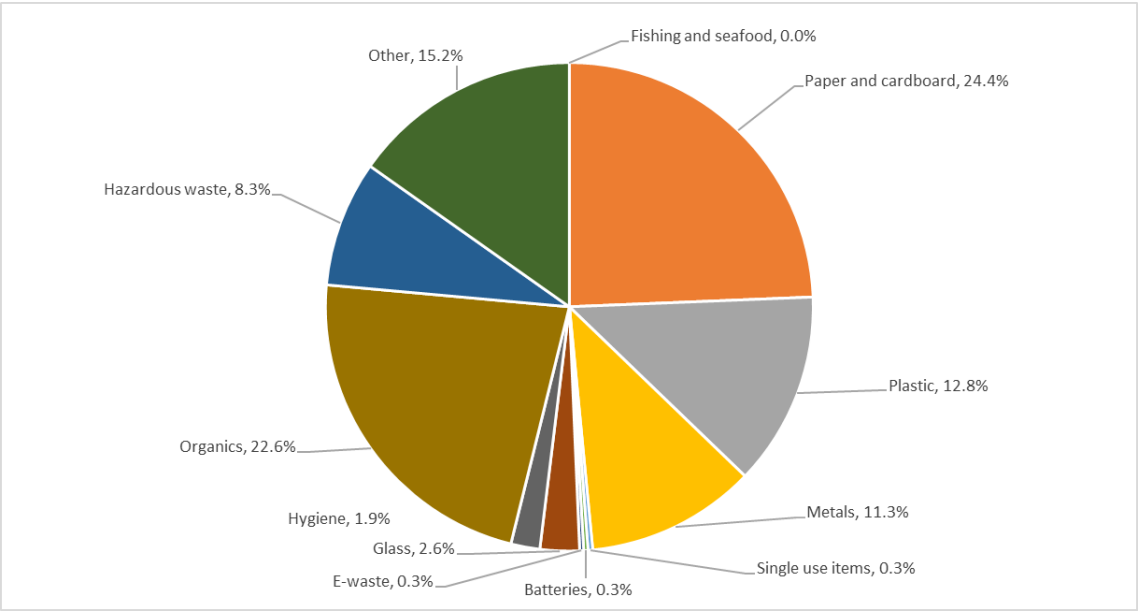


Figure 10: Percentage waste composition for Pohnpei Landfill

The information in **Table 18** and **Figure 10** excludes the volumes of materials identified in stockpiles.

The composition derived from the landfill audits indicate that a large volume of paper and cardboard, and plastics, are generated by households and sent to Pohnpei Landfill.

Assessment of Operational Costs

Current operation and contracts costs associated with waste collection and landfill has been derived from the Solid Waste Management Plan for Pohnpei, 2020-2029.

Annual operational costs for Pohnpei Landfill are reported as $114,000 per year. Total waste to Pohnpei Landfill is approximately 7,157 tonnes per year. This equates to an approximate cost of $15.9 per tonne.

The waste collection collects revenue of around $17,500. With the delivery of the waste collection costing $169,000. Where revenue and collection cost are combined, there is a total cost for waste collection and landfill operational costs estimated at $37 per tonne.

Stockpiles

Stockpiles in Pohnpei are generally located at:

- Private commercial sites;
- APSCO Quarry; and
- At a scrap metal facility.

A summary of the types and estimated quantities of materials found in stockpiles across Pohnpei has been provided in **Table 19**.

Table 9: Type and estimated quantity of materials found in stockpiles in Pohnpei.

Item	Weight (Tonne)	Volume/ Count (units)/ Litres	Location	Audit Images
Truck	1333	205	Private property, auto repair shop, scrap metal company and APSCO Quarry.	
Boat	31	2	Private property.	

Item	Weight (Tonne)	Volume/ Count (units)/ Litres	Location	Audit Images
Cars	524	349	Auto repair shop, scrap metal company, APSCO Quarry.	
Vans	260	130	Auto repair shop, scrap metal company.	

Item	Weight (Tonne)	Volume/ Count (units)/ Litres	Location	Audit Images
Heavy Machinery	1210	121	Auto repair shop, scrap metal company, APSCO Quarry.	
Roofing Iron (sheets)	2	100	Scrap metal company, Kolonia	

Item	Weight (Tonne)	Volume/ Count (units)/ Litres	Location	Audit Images
Tank	0.45	3	Yakupa, Dekehtik	
Other Metal	72.45	72,450m^3	Scrap metal company, Kolonia	

Item	Weight (Tonne)	Volume/ Count (units)/ Litres	Location	Audit Images
E-waste	6	6,042m^3	Scrap metal company, Kolonia	
Shipping Containers	2.3	1	APSCO Quarry.	

Item	Weight (Tonne)	Volume/ Count (units)/ Litres	Location	Audit Images
Used Oil	811	891,600 litres	Approximately 500, 55-gallon drums and one large (approx. 27,000 litre) tank of used oil are stored at the PUC powerplant. (viewed during the audit). We have assumed that this is part of the total as reported in the total. Other locations not defined.	Based on 2013/14 data from *Cleaner Pacific 2025 Pacific Regional Waste and Pollution Management Strategy 2016-2025*[21]. 
Asbestos	Data not available.	3,557m^2	Total across FSM	Based on 2013/14 data from Cleaner Pacific 2025 Pacific Regional Waste and Pollution Management Strategy 2016-2025. No further data was available throughout audit, as such no images are available.

[21] *Cleaner Pacific 2025 Pacific Regional Waste and Pollution Management Strategy 2016-2025*, Secretariat of the Pacific Regional Environment Programme (SREP), 2016.

Section 3:
Chuuk Waste Audit Findings

Legislation

The summary of relevant national and state legislation on waste management in Chuuk is provided in the table below and has been sourced from the *Stocktake of existing and pipeline waste legislation report* [22].

Table 20 Legislation Summary

Legislation name	Description
National	
Solid Waste Management Strategy 2010 -2015)	Identifies how FSM will establish technically sound and financially sustainable solid waste management. The strategy has 3 strategic objectives focusing on policy, implementation, and education.
Plastic products ban (2020)	Prohibits the import of single-use disposable Styrofoam, plastic food service items and plastic shopping bags from 1 July 2020.
National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (2007)	Plan detailing FSM's obligations as a party to the Stockholm POPs Convention.
State Level	
Solid Waste Management Strategy 2019-2023	Identifies how Chuuk State will establish technically sound and financially sustainable solid waste management.
Littering Act 1991	Established to control the littering in Chuuk establishing a process for designation of appropriate sanitary public dump sites and maintenance of such sites.
Clean Environment Act 2018	Details a phasing out plan for single use plastic shopping bags and the controls to manage the ban.
Not yet in legislation	Proposed Container Deposit Legislation (CDL) will include aluminium cans, PET bottles and car Batteries.

Waste Services

Household Waste

A weekly collection is provided by DPTW through the following systems:

- A 'horn collection system' operated in remote areas whereby collection truck sounds a signal that waste can be bought to the truck for collection; and
- A station collection system is operated in populated areas, where households drop off bagged waste (various sizes) at one of the 22 stationary bins installed at roadsides.

[22] Stocktake of existing and pipeline waste legislation: Federated States of Micronesia Prepared by the Melbourne Law School at the University of Melbourne, Australia with technical assistance from Monash University on behalf of the Secretariat of the Pacific Regional Environmental Programme (SPREP) 2020

Remote areas of Chuuk are not accessible by trucks and have no collection service. Collection coverage is estimated to be 48% of households across Weno[23].

The cost of the waste collection service is covered by Government.

Household Recycling

There is no roadside recycling collection service in Chuuk. Some food organics are used for feeding livestock, but food organics continue to be disposed to the public landfill. Coconut fibre and husk is used as firewood.

A CDL program was previously in place but has not operated since 2002. There is no recycling company in Chuuk undertaking waste separation and thus no export of materials occur.

Commercial Waste

A free weekly collection service is provided by DPTW. However, a significant portion of commercial facilities deliver their waste directly to the landfill.

Hazardous Waste

Healthcare Waste

Healthcare waste management is funded by the Government. There are two incinerators on island, both located at the hospital, one is operational, while the other is currently being installed[24]. The operational incinerator is used to burn healthcare waste, including sharps and pharmaceutical waste, two to three times per week. Operation of the incinerator is dependent on wind direction, as the production of smoke by the incinerator can below into the hospital buildings and patient wards. The incinerator is used to burn healthcare waste, sharps, and pharmaceutical waste[10].

Asbestos[25]

Estimated volumes of asbestos containing materials is 705m^2, identified at three locations across Chuuk. Location details can be found in Section 3 (Stockpiles).

Used Oil

Estimated volumes of used oil are 21,650 litres (2013-2014), taken from the Consultancy for Contemporary Used Oil Audits in Selected Pacific Island Countries Report for the State of Chuuk. Locations of stockpile locations has been identified in Section 3. No updated information was provided during the audit.

Other Wastes

End of Life Vehicles

In 2020, Chuuk began a “junk cars collection” project, this was stopped early due to limited available space at the landfill. End of life vehicles are used as artificial reef around the island.

[23] Chuuk Solid Waste Management Strategy 2019

[24] Experts are required in country to continue installation of the incinerator, however, there have been delays due to travel restrictions due to Covid-19.

[25] Survey of the Regional Distribution and Status of Asbestos Contaminated Construction Material and Best Practice Options for its Management in Pacific Island Countries. Report for the Federated States of Micronesia

Chuuk Waste Facilities

Landfill Infrastructure

There is one public landfill in Chuuk called Marina interim dumpsite (herein referred to as Chuuk State Landfill). The site is located next to the DT&PW workshop in the northwest of the island. This is a temporary site, while a permanent location is being finalised. Pohnpei EPA and T&I own and operate the site. The site is open 24 hours a day, seven day a week. The site occupies an area of 1,700 m^2 and has been in operation since 2016.

There is no formal method of waste management used and the site is at full capacity. Operations at the landfill are based on fuel availability and available funds.

Equipment located at the landfill includes:

- Crusher;
- Two compactor trucks;
- Boom trucks.

Error! Reference source not found. Neouo landfill (closed) was previously used for waste disposal before its closure in 2015. Rehabilitation of this landfill (subject to funding) is currently under consideration. This will provide for the storage of abandoned vehicles and scrap metals.

Inputs to Landfill

Waste acceptance is general waste only. There is no separation of waste at the landfill. Approximately 48% of waste received at the landfill is collected by DPWT and 52% is delivered directly by households and commercial facilities. Approximately 7.5 tonnes of waste are received at the landfill daily.

Approximately 23% of all waste generated is reportedly being illegally dumped around the island.

Chuuk Waste Audit Findings

Household Audit Findings

Access to Waste Collection Services

Access for households to a waste collection service has been provided in **Table 21**.

Table 10: Summary of access to collection services

Access for households to a waste collection service	Details
Total interviewed	97
Percentage of the Population with Access to a Collection Service	51.6%
Average Collection Service Rating	5.1/10[26]
Comments	• Households without a collection service currently want access to a service; and • The lower waste collection service rating was primarily due to the low frequency of the service (one day a week).

It is common practice for several options to be selected by householders for the same waste stream (**Table 22**).

Table 112: Waste management activities adopted by households

Material	Disposal Options
Bulky Items	• Collected • Transported to landfill (self-haul) • Buried
Food Organics	• Transported to landfill (self-haul) • Collected • Illegally dumped
Garden Organics	• Transported to landfill (self-haul) • Burned • Collected • Buried • Illegally dumped
Sanitary	• Collected • Transported to landfill (self-haul) • Burned
Waste	• Collected • Transported to landfill (self-haul)

With only 51.6% of Chuuk's household having access to waste collection service, those without collection services are driven towards alternative disposal methods. Many households interviewed through the audit access to a collection service. Participants were surveyed on their willingness to pay for collection services, results are presented in **Figure 11**.

[26] Results of a sample size of 56 respondents

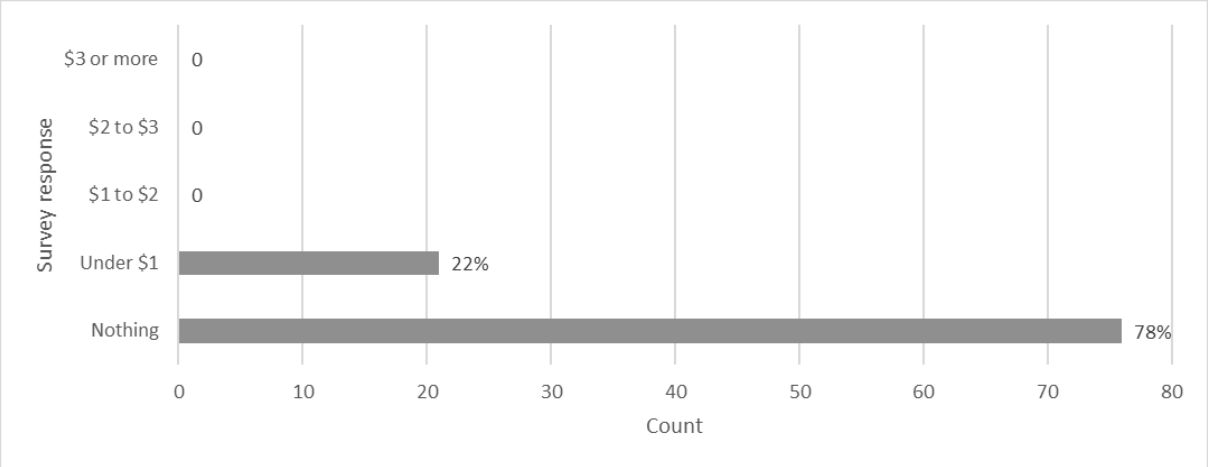


Figure 111: Willingness to pay for households' collection of waste – survey outcomes in Chuuk

Household Waste Composition

Typical roadside examples of waste put out for collection in Chuuk can be seen in **Figure 12**.

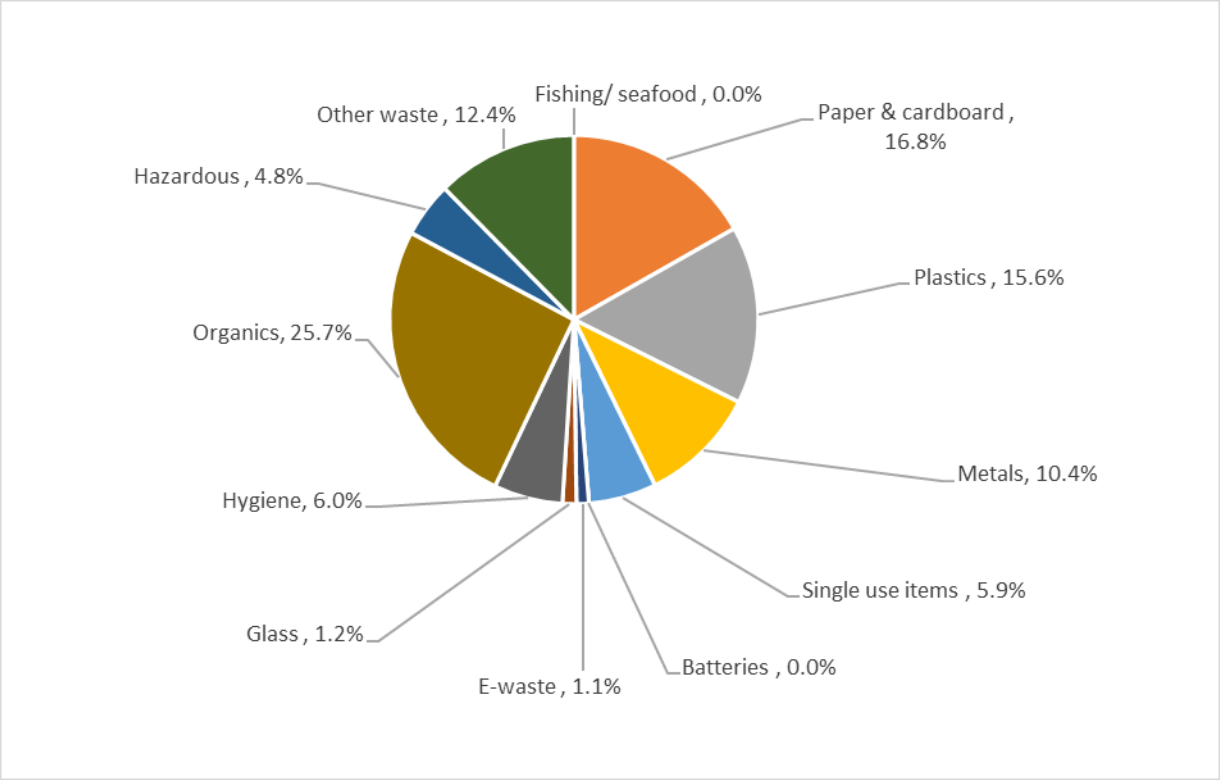


Figure 113: Chuuk average household waste composition summary

Organics (25.7%) was the largest component of the waste stream, followed by paper and cardboard (16.8 %), metals (10.4%) and other waste (12.4%). Hygiene (6%), single use items (5.9%), and hazardous wastes (4.8%) made up a smaller portion of the total waste sampled.

Key audit findings by category and photos have been identified in **Table 23.**

Table 212: Waste material findings

Waste material	Description	Audit Images
Organics	Dominated by food and garden organics	

Waste material	Description	Audit Images
Single Use items	Dominated by coffee cups, takeaway plates	
Hygiene Products	Predominately nappies.	
Paper and Cardboard	Dominated by cardboard boxes (food boxes, carry boxes), shredded cardboard and egg cartons.	
Plastics	Predominately soft plastics (food wrappers), plastic trays. Clear plastic water bottles (PE), clear cooking oil bottles,	

Waste material	Description	Audit Images
Metals	Dominated by steel food cans and aluminium drink cans.	

The lower and upper range for each component of household waste have been calculated at a 95% confidence interval and are presented in **Error! Reference source not found.** and **Figure 14**.

This provides a measure of the range of estimated proportion for each material that might be expected for repeated composition surveys for households in Chuuk. Interviews with householders has provided the data we have used to estimate the average quantity of waste from sampled households for Chuuk.[27]

The estimated generation of waste per household per day is 2.5 kg (within a range of 0.1 kg – 9.5 kg per household per day).

Due to the absence of fishing/seafood and batteries identified during the survey, the margin of error in the range has not been provided.

[27] The data used to calculate the composition of waste collected from households has been derived from samples collected from all household properties during the audit only. The total weight of samples collected was averaged using the count (total number of samples). This is the methodology as presented in the Waste Audit Methodology – A step-by-step manual to conduct comprehensive waste audits in SIDs produced by PRIF.

Table 213: Waste composition for households identified as part of the sort and weigh of samples for Chuuk[28]

	Fishing/ Seafood	Paper and Cardboard	Plastics	Metals	Single Use items	Batteries	E-waste	Glass	Hygiene	Organics	Hazardous	Other Waste
Composition	0.0%	16.8%	15.6%	10.4%	5.9%	0.0%	1.1%	1.2%	6.0%	25.7%	4.8%	12.4%
Combined Sample Weight (kg)	0.0	56.9	52.9	35.2	20.2	0.0	3.7	4.2	20.5	87.3	16.4	42.0
Average Weight per Sample (kg)[29]	0.0	0.8	0.8	0.5	0.3	0.0	0.1	0.1	0.3	1.3	0.2	0.6
Lower Range	N/A	14.8%	15.2%	8.9%	5.7%	N/A	0.0%	0.1%	0.7%	14.7%	4.5%	3.7%
Upper Range	N/A	25.1%	22.0%	15.9%	9.8%	N/A	1.2%	1.7%	9.1%	26.4%	8.8%	11.7%

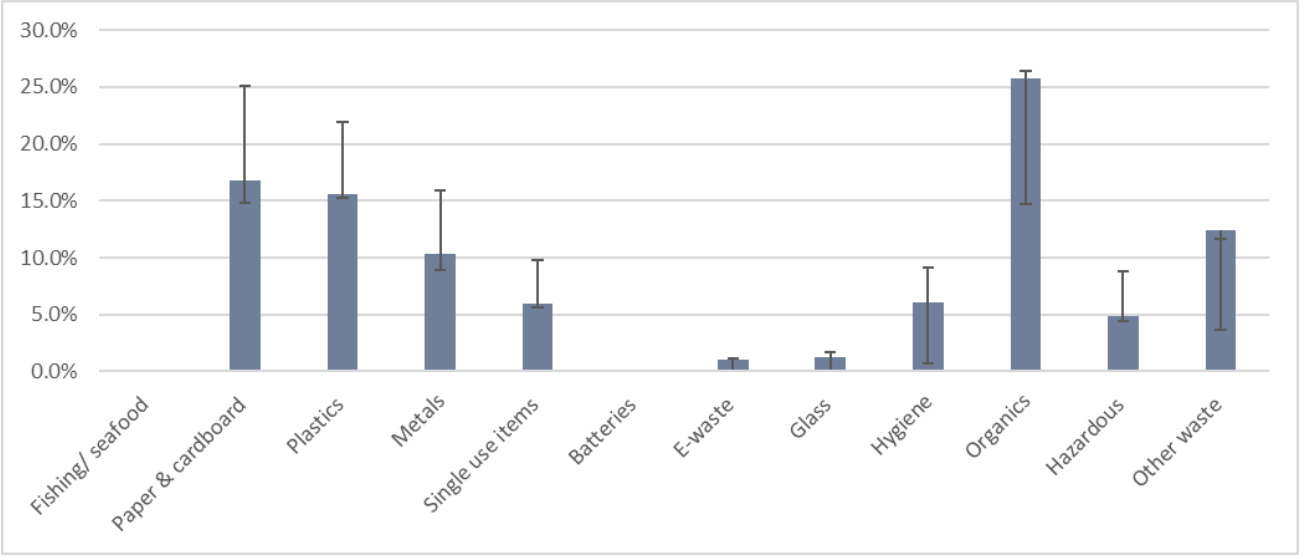


Figure 114: Waste composition for households identified as part of the sort and weigh of samples collected for Chuuk

[28] Confidence interval of +15% and -15% applied during data analysis. 67/120 samples were within this range and have been used to derive the composition.
[29] Count of all data used (67). Total weight (kg) per category divided by count to provide average weight per sample

Potentially Recyclable Materials

A range of potentially recyclable material was identified through the waste survey. This section provides commentary on materials identified as part of the audit.

Organics, paper and cardboard, plastics and other waste were recorded as the most dominant categories in household waste samples.

Examples of these waste streams following separation as part of the sort and weigh survey are seen in **Table 25**.

Key points to note:

- Paper and cardboard, and metals (aluminium drinks cans), are present and potentially recyclable where markets are accessible.
- High proportion of Plastics present which can be recycled if markets can be secured.
- Most of the potentially recyclable items identified in the audit can be recovered through a deposit or levy scheme e.g., drinks containers (PET, aluminium cans), other single use items. The Chuuk Environment Protection Agency is currently working on introducing a Container Deposit Legislation in the state.

The interview data suggested a wide range of household usage/generation.

Average figures provide a useful indication of likely quantities of materials but should be validated for example using a large sample size for household surveys and/or considering sales data.

Figure 115: Typical recyclable items identified through the sort and weigh of samples collected in Chuuk

Table 214: Observations by material

Material	Key Materials	Observations
Metals	Aluminium drink cans. Food tin cans (some are coated with steel).	The data provided is the sample of households from across Chuuk. Household interviews reported an average of 2 drinks can per person, per household, per week. The range varied between 0 to 7 cans per week between samples collected. Using the average from the household interview data collected, across Chuuk, this equates to 95,887 cans per week for the population (Est 48,654). Over one year this is estimated to be around 4.9 million drinks cans[30]per year. This is considered at the upper end of the number of drinks cans likely to be produced[31].
Organics	Garden and food organics	
Paper and Cardboard	Dominated by cardboard boxes.	Cardboard boxes, egg cartons and food packaging boxes.
Plastics	Dominated by clear plastic bottles (PET).	Household interviews reported an average of 1.7 (2) plastic water bottles per person per household per week with a range of 0 to 15 bottles per person, per week. Using the average from the household interview data collected, across Chuuk this equates to 80,983 per week for the whole population. Over one year this is estimated to be around 4.2 million plastic bottles per year. This is likely to be at the upper end of the number of water bottles produced per week.

Commercial Audit Findings

The total number of commercials audited by type is shown in **Table 26**, this provides the count, or the number of commercials which were audited during the waste audit.

Where this is a difference between the number of sort and weigh surveys completed and the interviews completed this indicates that the sort and weigh data has been excluded from the analysis through the quality assurance process.

[30] Note the number of drinks cans and plastic bottles are based on the data collected from the audit data only and is based on a population of 48,654.

[31] If this data is to be used to inform potential recyclables for capture, it will be important to validate these numbers with further survey work specifically capturing a larger sample of households.

Table 26: Commercial waste sample numbers

Commercial Type	Number Samples Sorted/Weighed	Number People Interviewed
Accommodation and Food Services	1	1
Construction and Demolition	1	1
Education and Training	1	1
Mixed Small Commercial	2	6
Other	2	5
Retail and Trade	8	8
Shopping Centre	1	1
Trade	1	1
Total	**17**	**25**

Access to Waste Collection Services

Commercials can use the local government provided collection service or transport their waste to the landfill themselves. **Table 27** summarises feedback on the collection service including a waste collection rating.

Table 27: Summary of access to collection services[32]

Access to Collection Services	Details
Total Interviewed	25
Percentage of commercials who access a collection service	24%
Average collection service rating	6/10[33] - The lower waste collection service rating was primarily due to the low frequency of the service (once a week) and the service being unreliable for one commercial.

It is common practice for several options to be selected by commercials for the same waste stream. Options undertaken by commercials identified through the audit are identified in **Table 28**.

[32] Data collected and recorded in survey 123 app, from interviews held with commercials
[33] Results of a sample size of six who answered this question.

Table 28: Options for waste management adopted by commercials

Material	Disposal Options
Bulky Items	• Transported to landfill (self-haul) • Collected
Food Organics	• Transported to landfill (self-haul) • Collected •
Garden Organics	• Transported to landfill (self-haul) • Collected • Burned • Buried •
Sanitary	• Transported to landfill (self-haul) • Collected •
Waste	• Transported to landfill (self-haul) • Collected

Participants were surveyed on their willingness to pay for collection services. Outcomes of the survey are presented in **Figure 16**.

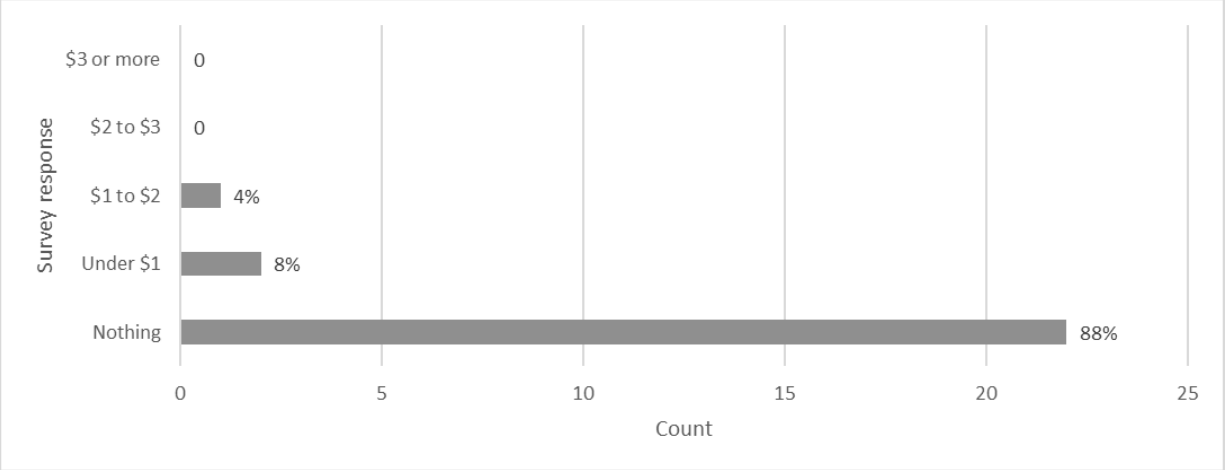


Figure 116: Willingness to pay for commercial collection of waste – survey outcomes in Chuuk

Commercial Waste Composition

The composition of commercial waste collected, sorted, and weighed for Chuuk is shown in **Error! Reference source not found.**.

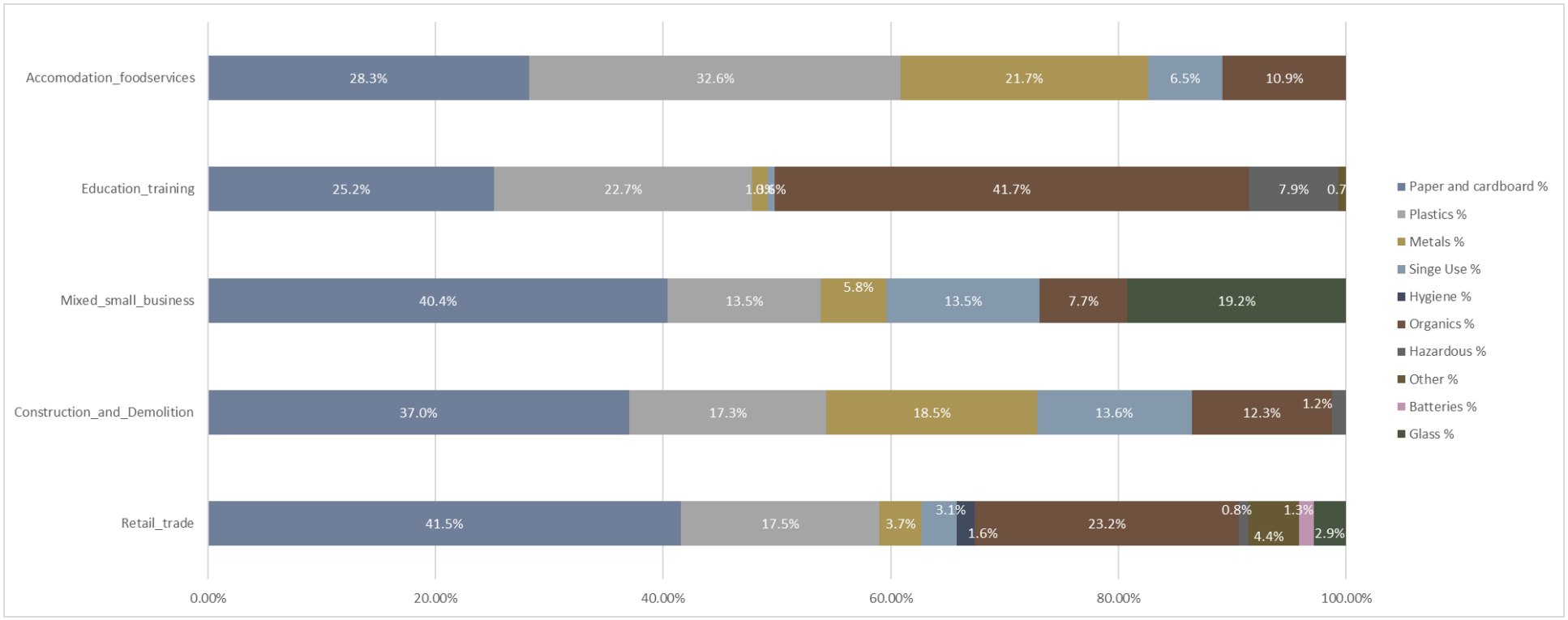


Figure 117: Composition of waste from commercials in Chuuk

The combined data (for 17 commercial premises) provides an indicator of commercial waste composition overall.

Key audit findings by category and photos are included in **Table 29**. The data collected suggests that the dominant waste categories across the commercial types surveyed were plastics, paper, and cardboard. Paper and cardboard dominated the shopping centre and retail and trade samples.

Retail samples had a higher portion of organics compared to the other commercial types. Accommodation, and construction and demolition had a larger proportion of metals compared to other commercial types.

Table 29: Observations by material

Material	Key Materials	Audit Images
Metals	Metals – drinks (aluminium – beer and soda cans, Pepsi) food (steel cans -various brands) and food cans.	
Organics	Dominated by food and garden organics.	

Material	Key Materials	Audit Images
Paper and Cardboard	Dominated by cardboard boxes (noting some photos were poor quality to confirm).	
Plastics	Plastic drinks containers – small and large (water bottles) (PET), plastic containers – food containers (PE).	
Single Use Items	Coffee cups, single use cutlery plastic (PE) takeaway containers.	

The overall waste composition for commercials is presented in **Table 30** and **Figure 18**.

The lower and upper range have been calculated at a 95% confidence interval. This provides a measure of the range of estimated proportion for each material that might be expected for repeated composition surveys for commercial premises in Chuuk. Due to the absence of fishing/seafood and e-waste identified during the survey, the margin of error in the range has not been calculated.

Table 30: Waste composition for commercials identified as part of the sort and weigh of samples collected for Chuuk[34]

	Fishing/ seafood	Paper and cardboard	Plastics	Metals	Single use items	Batteries	E-waste	Glass	Hygiene	Organics	Hazardous	Other waste
Composition	0.0%	35.8%	19.5%	6.4%	4.4%	0.6%	0.0%	2.9%	0.7%	25.6%	1.9%	2.2%
Combined sample weight (kg)	0.0	28.6	15.6	5.1	3.5	0.5	0.0	2.3	0.6	20.5	1.5	1.8
Average weight per sample (kg)[35]	0.0	1.7	0.9	0.3	0.2	0.0	0.03	0.1	0.04	1.2	0.1	0.1
Lower range	N/A	23.6%	13.4%	2.6%	2.6%	0%	N/A	0.0%	0.0%	10.5%	0.0%	0.0%
Upper range	N/A	47.2%	29.2%	8.6%	9.3%	2.2%	N/A	9.7%	4.6%	33.3%	2.1%	4.1%

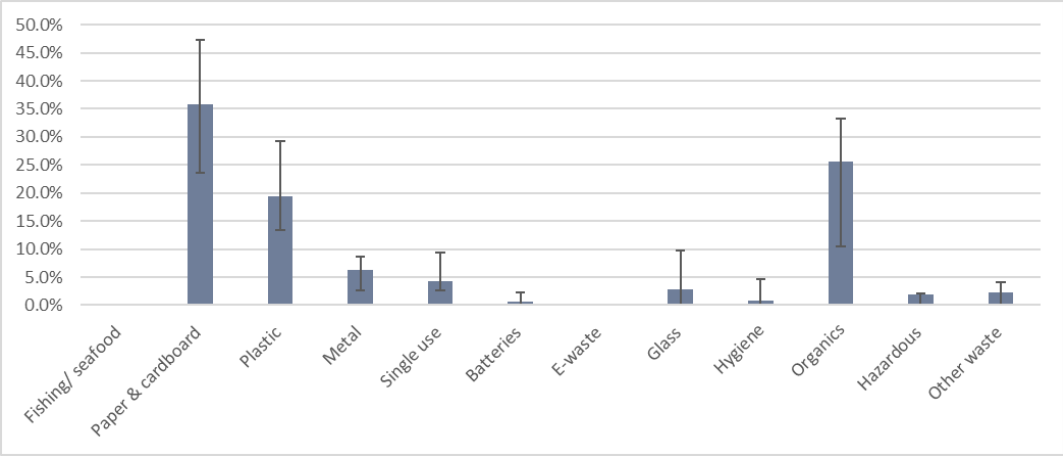


Figure 118: Waste composition for commercials identified as part of the sort and weigh of samples collected for Chuuk

[34] Confidence interval of +15% and -15% applied during data analysis. 17/27 samples were within this range and used to calculate the waste composition
[35] Count of all data used (17). Total weight (kg) per category divided by count to provide average weight per sample

Landfill Audit

Considering the source of waste, landfill visual assessment data and using the sort and weigh audit data for households and commercials, an overall waste composition has been developed.

In the absence of updated waste to landfill annual volumes, the following assumptions have been made:

Waste collections by DPTW using 2017 tonnage data from the Solid Waste Management Plan for Chuuk (2019-2029)

- Household waste – 2.8 tonnes per day
- Household waste sample composition from the sort and weighing has been applied to household waste.
- Public and commercial – 0.8 tonnes per day
- Commercial waste sample composition from the sort and weighing has been applied to the public and commercial waste.

Direct transport to landfill using 2017 tonnage data from the Solid Waste Management Plan for Chuuk (2019-2023)

- Household waste – 0 tonnes per day
- No assumptions made
- Commercial waste – 3.9 tonnes per day
- Commercial waste sample composition from the landfill audit visual assessment data has been combined and applied to the commercial waste.

The total waste to Chuuk Landfill is approximately 2,700 tonnes per year.

Table 31: Estimated composition of solid waste by weight to Chuuk Landfill

Materials	Composition %	Tonnage per day	Tonnage per year
Batteries	0.1%	0.0	1.8
E-waste	1.0%	0.1	26.6
Fishing/ seafood	0.3%	0.0	8.0
Glass	1.8%	0.1	47.6
Hazardous	2.3%	0.2	62.9
Hygiene	2.4%	0.2	66.1
Metal	14.3%	1.1	390.0
Organics	21.0%	1.6	570.5
Other Waste	14.9%	1.1	406.8
Paper and Cardboard	21.9%	1.6	597.4
Plastic	16.3%	1.2	444.6
Single Use Items	3.7%	0.3	100.5
Total	**100.0%**	**7.5**	**2,722.7**

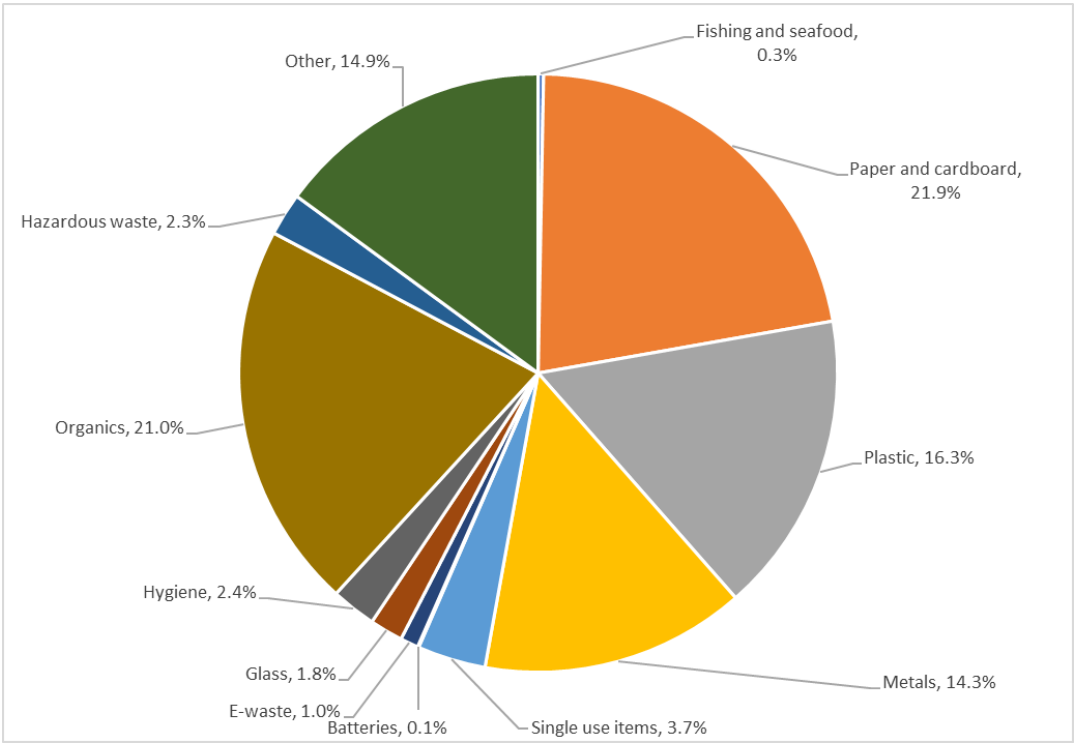


Figure 119: Percentage waste composition for Chuuk Landfill

The landfill composition data highlighted above does not include the volumes of materials stockpiled.

The audit results indicate a large volume of plastics and paper, and cardboard are generated by households and sent to Chuuk Landfill.

The high content of organics to landfill is from both household and commercial sources.

Assessment of Operational Costs

Current costs for operation and contracts associated with waste collection and the waste facilities has been derived from the Solid Waste Management Plan for Chuuk, 2019-2029.

Annual operational costs for Chuuk Landfill are reported as $20,925 per year. Total waste to Pohnpei Landfill is approximately 2,723 tonnes per year. Delivery of the waste collection costs are around $22,213 per year. When revenue and collection costs are combined, there is a total cost of waste collection and landfill operational costs estimated at $15.80 per tonne.

Stockpiles

The audit team used local knowledge to identify known stockpile locations. The audit team also identified areas of illegal dumping activity of general waste.

These have not been included in the stockpile assessment. Stockpiles in Chuuk are generally located:

- Along roads; and
- In vegetation along roadways.

Assumptions associated with identifying the weight in tonnes of the stockpiles identified have been provided in **Appendix C**.

Table 32: Type and estimated quantity of materials found in stockpiles in Chuuk.

Item	Weight (Tonne)	Volume/ Count (units)/ Litres	Location	Audit Images
Truck	19.5	3	Alongside roads.	
Cars	60	41	Alongside roads.	
Heavy Machinery	10	1	In bushes along roads.	
Other Metals	0.01	9.2m^3	Dealfair Store burn material waste.	
Used Oil	19.7	21,650 litres	Data not available.	Based on 2013/14 data from *Cleaner Pacific 2025 Pacific Regional Waste and Pollution Management Strategy 2016-2025*[36]. No further data was available throughout audit, as such no images are available.
Asbestos	Data not available.	3,557m^2	Total across FSM in 2013.	

[36] *Cleaner Pacific 2025 Pacific Regional Waste and Pollution Management Strategy 2016-2025*, Secretariat of the Pacific Regional Environment Programme (SREP), 2016.

Section 4:
Kosrae Waste Audit Findings

Legislation

The summary of relevant legislation provided in **Table 33** has been sourced from the *Stocktake of existing and pipeline waste legislation report* [37].

Table 15: Legislation Summary

Legislation name	Description
National	
Solid Waste Management Strategy 2010 -2015)	Identifies how FSM will establish technically sound and financially sustainable solid waste management. The strategy has 3 strategic objectives focusing on policy, implementation, and education.
Plastic products ban (2020)	Prohibits the import of single-use disposable Styrofoam, plastic food service items and plastic shopping bags from 1 July 2020.
National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (2007)	Plan detailing FSM's obligations as a party to the Stockholm POPs Convention.
State level	
	Yap
Solid Waste Management Strategy 2018-2022	Identifies how Yap State will establish technically sound and financially sustainable solid waste management.
Littering (Yap State Law 3-74)	Details the corrective action model in place for littering which occurs on Yap.
Yap EPA Plastic Bag Regulations	Details the restrictions of plastic bags use across Yap. Implemented as of 4 July 2014.
Container Deposit Legislation (2008)	Establish sustainable financing for solid waste management with reducing the negative impact on final landfill sites. Targeting: PET Beverage and Cooking Oil containers, Aluminium Beverage Containers, Glass Bottles, Car Battery, metals, home appliances and e-waste.
Regulations for Persistent Organic Pollutants (2014)	Details the controls in relation to the manufacture, use, store, transportation, and discard of POPs.
	Chuuk
Solid Waste Management Strategy 2019-2023	Identifies how Chuuk State will establish technically sound and financially sustainable solid waste management.
Littering Act 1991	Established to control the littering in Chuuk establishing a process for designation of appropriate sanitary public dump sites and maintenance of such sites.
Clean Environment Act 2018	Details a phasing out plan for single use plastic shopping bags and the controls to manage the ban.

[37] Stocktake of existing and pipeline waste legislation: Federated States of Micronesia Prepared by the Melbourne Law School at the University of Melbourne, Australia with technical assistance from Monash University on behalf of the Secretariat of the Pacific Regional Environmental Programme (SPREP) 2020

Legislation name	Description
Not yet in legislation	Proposed Container Deposit Legislation (CDL) will include aluminium cans, PET bottles and car Batteries.
	Pohnpei
Solid Waste Management Strategy 2019 – 2023	Identifies how Pohnpei State will establish technically sound and financially sustainable solid waste management.
Plastic bag ban (2011)	Ban on single use plastic bags for Pohnpei.
Container Deposit Legislation (2011)	Establish sustainable financing for solid waste management with reducing the negative impact on final landfill sites. Targeting aluminium cans only.
	Kosrae
Solid Waste Management Strategy (2018-2027)	Identifies how Kosrae State will establish technically sound and financially sustainable solid waste management.
Littering (Kosrae State Code, Title 13, Section 13.506)	Details the controls in place to prevent littering occurring.
Control of Plastic Wastes Act 2017	Details the ban of the use of plastic shopping bags in the sale or distribution of mechanise.
Container Deposit Legislation (2006)	Establish sustainable financing for solid waste management with reducing the negative impact on final landfill sites. Targeting PET Beverages, Glass, Aluminium, Car Batteries. Recycling deposits exist for aluminium cans only.

Waste Services

Household Waste

A weekly collection is provided by the four respective municipalities. A truck collects bins/bags/drums placed at roadside or in front of households. Limited collection services have resulted in many households opting to deliver small quantities of waste directly to the landfill. Illegal dumping occurs on vacant land in some areas.

Waste Collection coverage is unknown for the three of the state's municipalities. Around 36% of households in Lelu receive a roadside collection while there is no consistent service in the Utwe municipality.

Household Recycling

There is no roadside recycling collection service in Kosrae. There is a CDL program in place for the following materials:

- Glass bottles;
- Aluminium cans;
- PET beverage bottles; and
- Car batteries.

Refund payments to customers are five cents per beverage container and $3 per battery. One cent per container and battery is paid to the operator of the recycling system. Some food organics are used for feeding livestock while Coconut fibre and husk is used as firewood. The remaining food organics are collected as part of the waste stream and disposed to Tofol Landfill.

Commercial Waste

A paid weekly collection service for commercials is provided by respective municipalities. A significant portion of commercials deliver their waste directly to the landfill.

Charging

The collection service charging and regularity of collections provided is defined below for households. Fees are collected from householders through the local government.

Table 16: Charging for households

Location	Households
Lelu	$3/month
Malem	$2/month
Tafunsak	$2/month
Utwe municipality	No fee

Hazardous Waste

Healthcare Waste

Healthcare waste management is funded by the Government and utilises an incinerator on island. Healthcare waste, sharps and pharmaceutical waste produced by the hospital are incinerated in the onsite incinerator. Waste produced by the fishing companies is also incinerated at this facility[10].

Asbestos[25]

Estimated volumes of asbestos containing materials is estimated to be around 11m$^{2.}$ at two locations across Kosrae. Location details can be found in section 3 (Stockpiles).

Used Oil

Estimated volumes of used oil in Kosrae are 47,682 litres (2013-14), taken from the Consultancy for Contemporary Used Oil Audits in Selected Pacific Island Countries Report for the State of Kosrae. Locations of stockpile locations has been identified in Section 3. No updated information was provided during the audit.

Kosrae Waste Facilities

Landfill Infrastructure

Tofol Landfill site (which receives waste from all Kosrae) is located in the Tofol area in Lela Municipality. All community dumpsites which have been used across Kosrae in the past have been closed.

The landfill is owned by the State Government and operated by KIRMA and DT&I. The site occupies an area of 0.6 hectares and has been in operation since 2009. The site has around 11 years lifespan remaining (as of 2015).

Tofol is a semi-aerobic landfill utilises the Fukuoka method with a leachate collection system, circulation facilities and leachate collection pond. Gas pipes are also present for ventilation only.

Access to the site is through a gate, which is manned.

Equipment located at the landfill includes:

- Crusher;
- Bailer;
- Two compactor trucks;
- Boom trucks;
- Excavator (shared among divisions in DT&I);
- Bulldozer (shared among divisions in DT&I); and
- Dump truck (shared among divisions in DT&I).

Charging at the Landfill

There is no gate fee /tipping fee charged at the landfill.

Figure 20 Tofol Landfill (Kosrae)

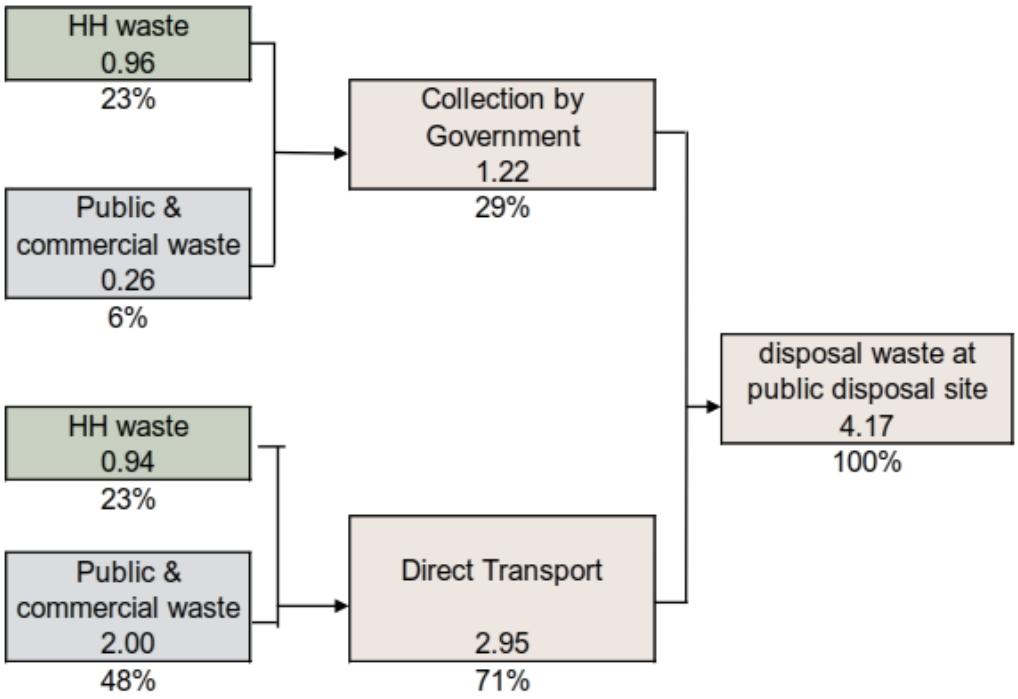


Figure 21 Disposal waste amount by source and collection/direct transportation to Tofol Landfill[38]

[38] Kosrae State Solid Waste Management Strategy 2018 – 2027. Action Plan: 2018-2022)

Kosrae Waste Audit Findings

Household Audit Findings

Access to Waste Collection Services

Access for households to a waste collection service has been provided in **Table 35**.

Table 17: Summary of access to collection services

Access to Collection Services	Details
Total interviewed	90
Percentage of Population with Access to collection service	74.4%
Average Collection Service Rating	8.4/10[39]
Comments	• Waste collection service ratings were generally positive. • Lower waste collection service ratings were due to unreliability of waste being collected. • Households were appreciative of their own time saved, by not having to transport waste to the landfill themselves. • More bins need to be provided as storing of waste for collection is becoming an issue. • Several households requested a more frequent collection service. • The transportation of waste was highlighted as an issue and households appear to be aware of a need for more waste collection trucks to increase transport capacity.

It is common practice for several options to be selected by householders for the same waste stream. For example, in some household's food organics were reported to be fed to their pigs, dogs and cats.

Table 18: Waste management activities adopted by households

Material	Disposal Options
Bulky Items	• Collected • NA (waste stream not relevant) • Transported to landfill (self-haul) • Illegally dumped • Stored
Food Organics	• Collected • Fed to animals (pigs, dogs, and cats) • Stored

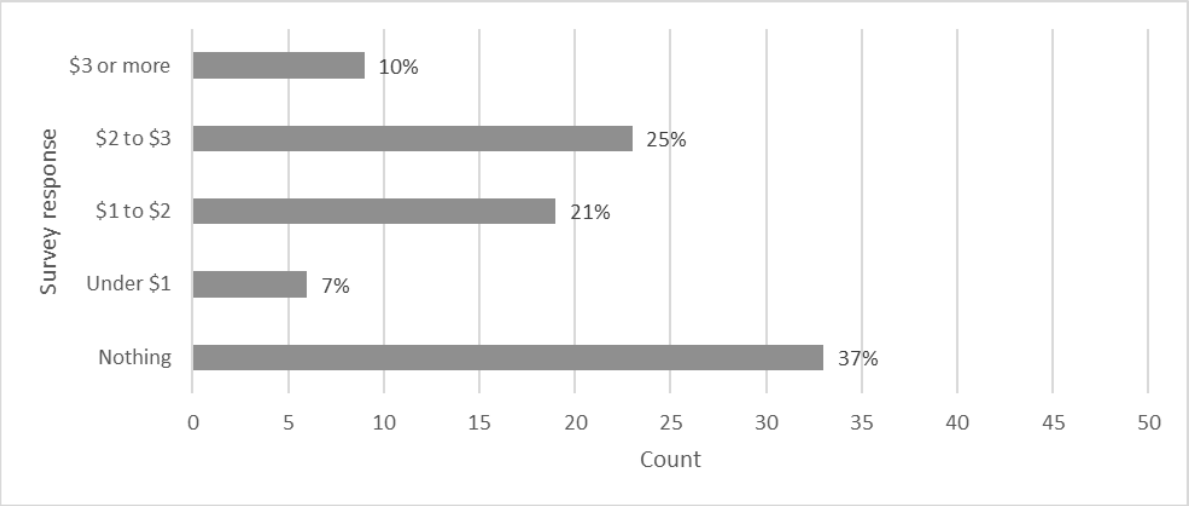
[39] Results of a sample size of 67 who answered this question.

Material	Disposal Options
Garden Organics	• Collected • Illegally dumped • Transported to landfill (self-haul) • Burned • Buried • Stored
Sanitary	• Collected • Transported to landfill (self-haul) • Illegally dumped • Buried • Stored
General Waste	• Collected • Transported to landfill (self-haul) • Illegally dumped • Buried • Stored

Identified management activities adopted by households is for the following reasons:

- Several respondents reported that they burn or dump their garden organics.
- Over half of respondents reported that they feed food organics to animals.

Participants were surveyed on their willingness to pay for collection services. 37% of those interviewed preferred free collection, 7% are willing to pay for an amount less than $1, 21% willing to pay from $1 to $2, 25% willing to pay $2 to $3, and 10% willing to pay $3 or more. Outcomes from this question are presented in **Figure 22** below.



Household Waste Composition

Typical roadside waste put out for collection in Kosrae can be seen in **Figure 23**.

Figure 203: Typical waste collection from households in Kosrae

The average composition of waste by weight from households in Kosrae is shown in **Error! Reference source not found.**

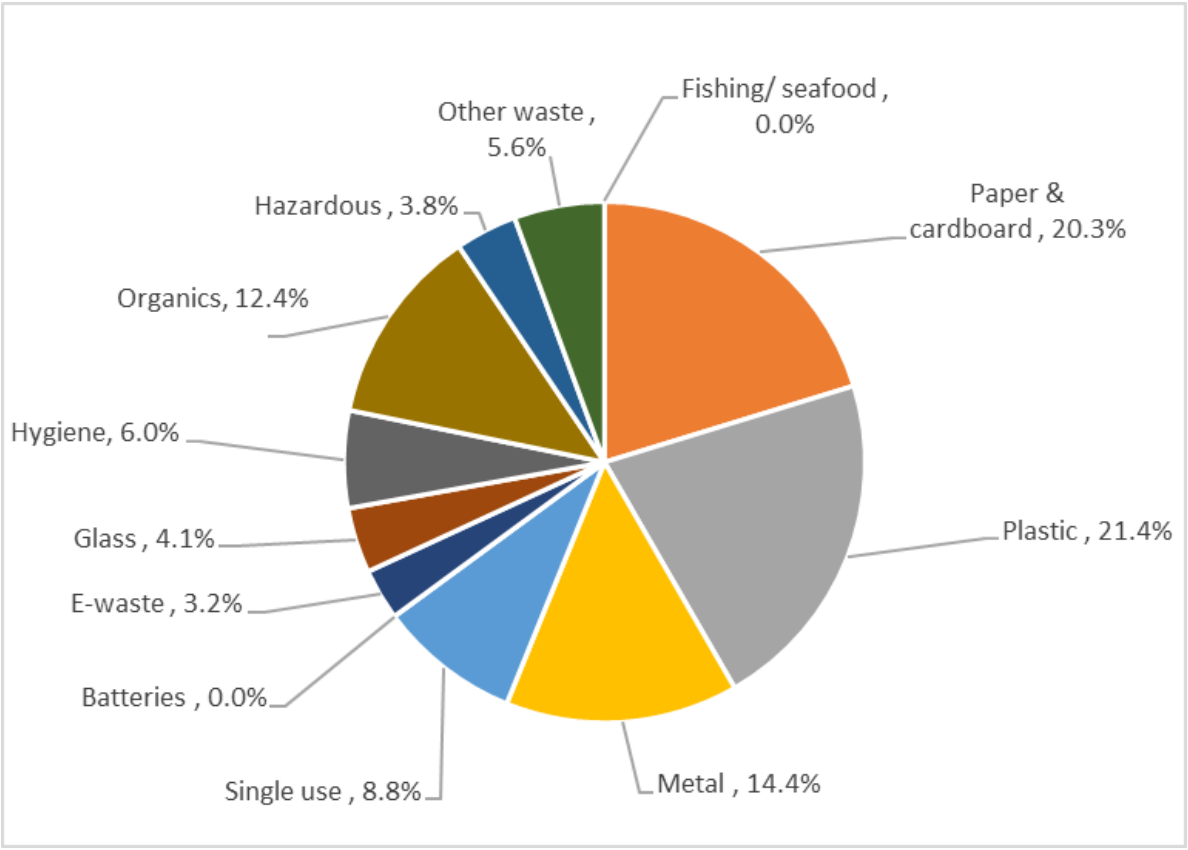


Figure 24: Kosrae average household waste composition summary

Key audit findings by category and photos have been identified in **Table 37**.

Plastics (21.4%) was the largest component of the waste stream, closely followed by paper and cardboard (20.3%), metals (14.4%), organics (12.4%), single use items (8.8%), and hygiene (6.0%).

Table 19: Waste material findings

Waste Material	Description	Audit Images
Hygiene Products	Dominated by nappies and sanitary products.	

Metals	Dominated by food cans and aluminium drink cans	
Organics	Dominated by food and garden organics.	
Paper and Cardboard	Dominated by cardboard boxes (food and consumables).	
Plastics	Primarily soft plastics (food wrappers), water bottles (clear PE), food condiment bottles: Ketchup (clear PE), cleaning product and shampoo bottles (HDPE).	
Single Use Items	Plastic takeaway containers, paper takeaway containers and coffee cups.	

E-waste, glass, hazardous and other waste were recorded in smaller quantities. The following was noted:

- Glass consisted of alcohol beverage bottles and food condiment bottles;
- Hygiene was dominated by nappies and sanitary items;
- The other category was predominately textile waste; and
- E-waste consisted of small electronics (remotes) and electrical wiring.

The lower and upper range for each component of household waste have been calculated at a 95% confidence interval and are presented in **Table 38** and **Figure 25**. This provides a measure of the range of estimated proportion for each material that might be expected for repeated composition surveys for households in Kosrae.

Interviews with householders has provided the data we have used to estimate the average quantity of waste from sampled households for Kosrae.[40] The estimated generation of waste per household per day is 1.6 kg (within a range of 0.1 kg – 8.8 kg per household per day).

Due to the absence of fishing/seafood and batteries identified during the survey, the margin of error in the range has not been calculated.

[40] The data used to calculate the composition of waste collected from households has been derived from samples collected from all household properties during the audit only. The total weight of samples collected was averaged using the count (total number of samples). This is the methodology as presented in the Waste Audit Methodology – A step-by-step manual to conduct comprehensive waste audits in SIDs produced by PRIF.

Table 20: Waste composition for households identified as part of the sort and weigh of samples for Kosrae[41]

	Fishing/ Seafood	Paper and Cardboard	Plastic	Metals	Single Use Items	Batteries	E-waste	Glass	Hygiene	Organics	Hazardous	Other Waste
Composition	**0.0%**	**20.3%**	**21.4%**	**14.4%**	**8.8%**	**0.0%**	**3.2%**	**4.1%**	**6.0%**	**12.4%**	**3.8%**	**5.6%**
Combined Sample Weights (kg)	0.0	64.4	68.1	45.9	28.0	0.0	10.1	12.9	19.2	39.3	12.2	17.8
Average Weight per Sample (kg)[42]	0.0	1.2	1.3	0.9	0.5	0.0	0.2	0.2	0.4	0.7	0.2	0.3
Lower Range	N/A	17.0%	18.4%	8.2%	2.3%	N/A	0.0%	0.0%	2.1%	5.9%	1.0%	0.3%
Upper Range	N/A	28.6%	32.8%	15.9%	6.4%	N/A	3.0%	3.2%	15.3%	25.1%	9.0%	5.7%

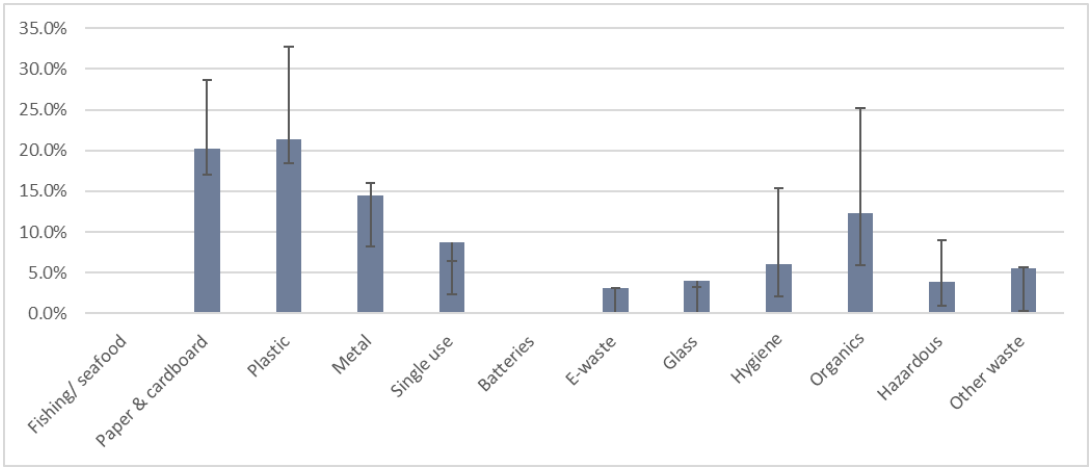


Figure 25: Waste composition for households identified as part of the sort and weigh of samples collected for Kosrae

[41] Confidence interval of +15% and -15% applied during data analysis. 54/92 samples were within this range and have been used to derive the composition.
[42] Count of all data used (54). Total weight (kg) per category divided by count to provide average weight per sample

Potentially Recyclable Materials

A range of potentially recyclable material was identified through the waste survey.

Plastics, paper and cardboard, metals, and organics were recorded as the most dominant categories in household waste as part of the waste audit. Examples of these waste streams following separation are seen in **Figure 26.**

Key issues:

- A significant proportion of the items identified (PET bottles, aluminium cans, and glass) have the potential to recovered from the waste stream. These three materials are already captured under the CDL scheme; however, deposits are only paid out for aluminium cans; and
- Metals and paper and cardboard are present at a relatively high proportion of the total household waste stream (both easily recycled where markets are accessible).

The interview data suggested a wide range of household usage/generation. Average figures provide a useful indication of likely quantities of materials but should be validated for example using a large sample size for household surveys and/or considering sales data.

Figure 26: Typical recyclable items identified through the sort and weigh of samples collected in Kosrae

Table 21: Observations by material

Material	Key Materials	Observations
Metals	Aluminium drink cans, food tin cans (some are coated with steel).	The data provided is the sample of households from across Kosrae. Household interviews reported an average of 2.2 drinks can per person, per household, per week. The range varied between 0 to 46 cans per week between samples collected. Using the average from the household interview data collected, across Kosrae, this equates to 14,728 cans per week for the population (est. 6,616).

Material	Key Materials	Observations
		Over one year this is estimated to be around 765,835 drinks cans[43] per year. This is considered at the upper end of the number of drinks cans likely to be produced[44].
Paper and Cardboard	Dominated by cardboard boxes.	Cardboard boxes, cardboard food packaging.
Plastics	Mainly comprised small (0.6 litre), larger (1.5 litre) water bottles (PET), cooking oil bottle, detergent Plastic containers – food (condiments) (PE and HDPE), non-food – shampoo (HDPE).	Household interviews reported an average of 1.5 plastic water bottles per person per household per week with a range of 0 to 12 bottles per person, per week. Using the average from the household interview data collected, across Kosrae this equates to 9,982 per week for the whole population. Over one year this is estimated to be around 519,099 plastic bottles per year. This is likely to be at the upper end of the number of water bottles produced.

Commercial Audit Findings

The total number of commercials audited by type is shown in **Table 40**, this provides the count, or the number of commercials which were audited during the waste audit.

Where there is a difference between the number of sort and weigh surveys completed and the interviews completed this indicates that the sort and weigh data has been excluded from the analysis through the quality assurance process.

Table 40: Commercial waste sample numbers

Commercial Type	Number Samples Sorted/Weighed	Number People Interviewed
Retail and Trade	11	20
Commercial and Household	1	1
Accommodation Food Services	0	1
Mixed Small Commercial	1	1
Shopping Centres	0	1
Total	**13**	**24**

[43] Note the number of drinks cans and plastic bottles are based on the data collected from the audit data only and is based on a population of 6,616.

[44] If this data is to be used to inform potential recyclables for capture, it will be important to validate these numbers with further survey work specifically capturing a larger sample of households.

Access to Waste Collection Services

Commercials are required to arrange a private collection service or transport the waste they produce to the landfill themselves.

Error! Reference source not found.below table summarises feedback on the collection service including a waste collection rating.

Table 22: Summary of access to collection services[45]

Access to collection services	Details
Total interviewed	24
Percentage of commercials who access a collection service	79.1%
Average collection service rating	8.4/10[46] • General high level of satisfaction with the collection service being provided. **A small number of commercials experienced a delay in skip collections and collection unreliability**

It is common practice for several options to be selected by commercials for the same waste stream. Options undertaken by commercials identified through the audit are identified in **Table 42**.

Table 42: Options for waste management adopted by commercials

Material	Disposal Options
Bulky Items	• Transported to landfill (self-haul) • Collected • Stored
Food Organics	• Collected • Illegally dumped • Transported to landfill (self-haul) • Stored
Garden Organics	• Transported to landfill (self-haul) • Burned • Illegally dumped • Stored • Collected • Buried
Sanitary	• Transported to landfill (self-haul) • Collected
Waste	• Transported to landfill (self-haul) • Illegally dumped • Collected

[45] Data collected and recorded in survey 123 app, from interviews held with commercials
[46] Sample size of 19 who responded to the question and only one commercial who uses the collection service.

Participants were surveyed on their willingness to pay for collection services. Outcomes of the survey are presented in **Figure 27**.

Commentary and observations made through the interviews was a general satisfaction with the service being provided.

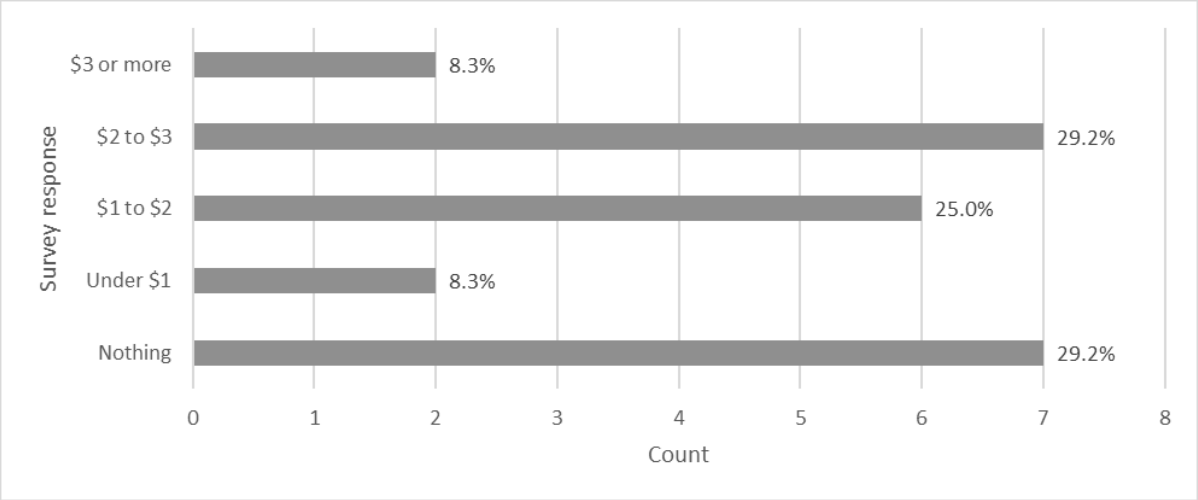


Figure 27: Willingness to pay for commercial collection of waste – survey outcomes in Kosrae

Commercial Waste Composition

The composition of commercial waste collected, sorted, and weighed for Kosrae is shown in **Figure 28.**

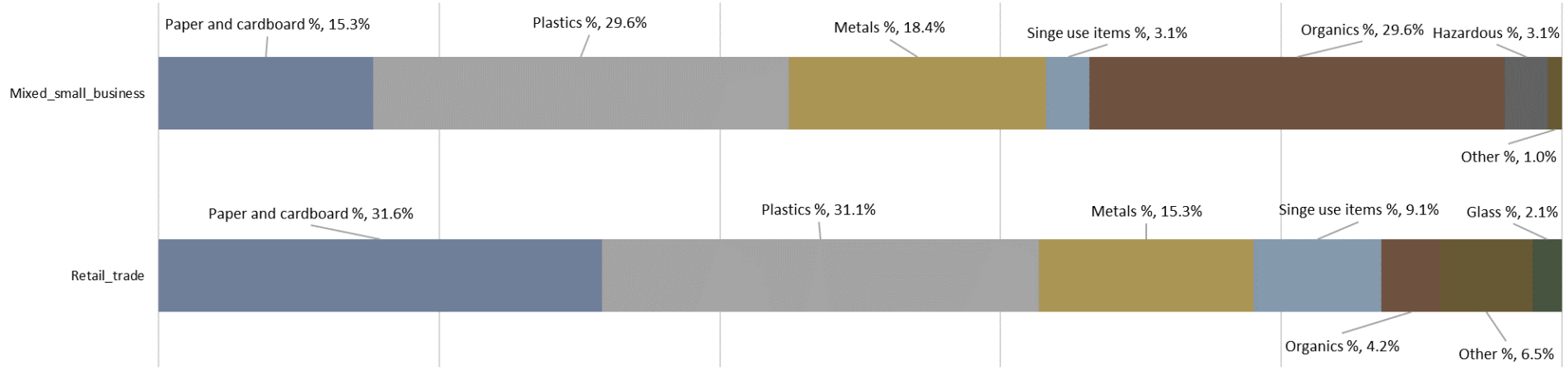


Figure 28: Composition of waste from commercials in Kosrae

The combined data (for 13 commercial premises) provides an indicator of commercial waste composition overall. Dominant waste streams for retail and trade were paper and carboard (32%), plastic (32%) followed by metal (13%) and single use items (10%). Organics made up a significant portion of the mixed small commercial sample (30%) (**Table 43**).

Table 23: Observations by material

Material	Key Materials	Audit Images
Metals	Dominated by aluminium drink cans and steel cans (food)	
Organics	Dominated by food and garden organics.	
Paper and Cardboard	Dominated by cardboard boxes.	
Plastics	Primarily soft plastics (food wrappers), water bottles (clear PET), food condiment bottles.	

The overall waste composition for commercials is presented in **Table 44** **Error! Reference source not found.** and **Figure 29.**

The lower and upper range have been calculated at a 95% confidence interval. This provides a measure of the range of estimated proportion for each material that might be expected for repeated composition surveys for commercial premises in Kosrae.

Due to the absence of fishing/seafood, batteries, e-waste, glass, and hygiene categories identified during the survey, the margin of error in the range has not been calculated.

Table 24: Waste composition for commercials identified as part of the sort and weigh of samples collected for Kosrae[47]

	Fishing/ Seafood	Paper and Cardboard	Plastics	Metals	Single use Items	Batteries	E-waste	Glass	Hygiene	Organics	Hazardous	Other Waste
Composition	**0.0%**	**30.0%**	**31.0%**	**15.6%**	**8.5%**	**0.0%**	**0.0%**	**1.9%**	**0.0%**	**6.7%**	**0.3%**	**6.0%**
Combined Sample Weight (kg)	0.0	15.0	15.5	7.8	4.3	0.0	0.0	1.0	0.0	3.4	0.2	3.0
Average Weight per Sample (kg)[48]	0.0	1.2	1.2	0.6	0.3	0.0	0.0	0.1	0.0	0.3	0.01	0.2
Lower Range	N/A	16.6%	21.0%	0.0%	3.3%	N/A	N/A	N/A	N/A	0.2%	0.0%	0.0%
Upper Range	N/A	41.6%	40.5%	32.9%	15.5%	N/A	N/A	N/A	N/A	18.7%	1.3%	12.6%

[47] Confidence interval of +15% and -15% applied during data analysis. 13/24 samples were within this range and used to calculate the waste composition
[48] Count of all data used (12). Total weight (kg) per category divided by count to provide average weight per sample

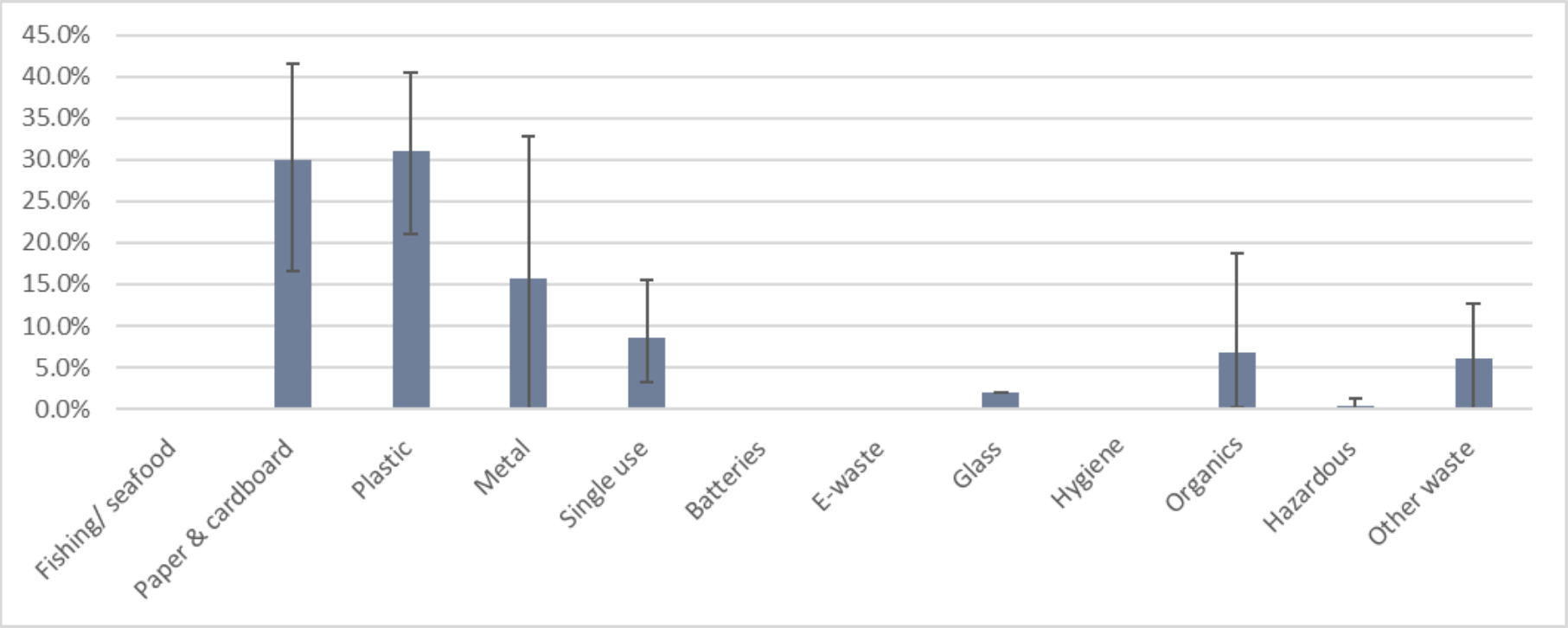


Figure 29: Waste composition for commercials identified as part of the sort and weigh of samples collected for Kosrae

Landfill Audit

Considering the source of waste, landfill visual assessment data and using the sort and weigh audit data for households and commercials, an overall waste composition has been calculated (**Table 45** and **Figure 30**). In the absence of updated waste to landfill annual volumes, the following assumptions have been made.

Waste collections by government using 2017 tonnage data from the Solid Waste Management Plan for Kosrae (2018-2027)

- Household waste – 0.96 tonnes per day
- Household waste sample composition from the sort and weighing has been applied to household waste.
- Public and commercial – 0.26 tonnes per day
- Commercial waste sample composition from the sort and weighing has been applied to the public and commercial waste.

Direct transport to landfill using 2017 tonnage data from the Solid Waste Management Plan for Kosrae (2018-2027)

- Household waste – 0.94 tonnes per day
- Household waste sample composition from the sort and weighing has been applied to household waste dropped off directly.
- Commercial waste – 2.0 tonnes per day
- Commercial waste sample composition from the landfill audit visual assessment data has been combined and applied to the commercial waste.

Daily tonnages were factored up, given the site is open 24/7 (365 days per year).

This suggests that the total waste to Tofol Landfill is approximately 1,500 tonnes per year.

Table 25: Estimated composition of solid waste in Tofol Landfill

Materials	Composition %	Tonnage per Day	Tonnage per Year
Batteries	0.0%	0.0	0
E-waste	1.5%	0.1	22
Fishing/ Seafood	0.0%	0.0	0
Glass	2.7%	0.1	42
Hazardous	1.9%	0.1	29
Hygiene	2.8%	0.1	42
Metal	9.9%	0.4	150
Organics	24.9%	1.0	378
Other Waste	10.6%	0.4	161
Paper and Cardboard	22.7%	0.9	345
Plastic	16.7%	0.7	253
Single Use Items	6.3%	0.3	96
Total	**100%**	**4.1**	**1,518**

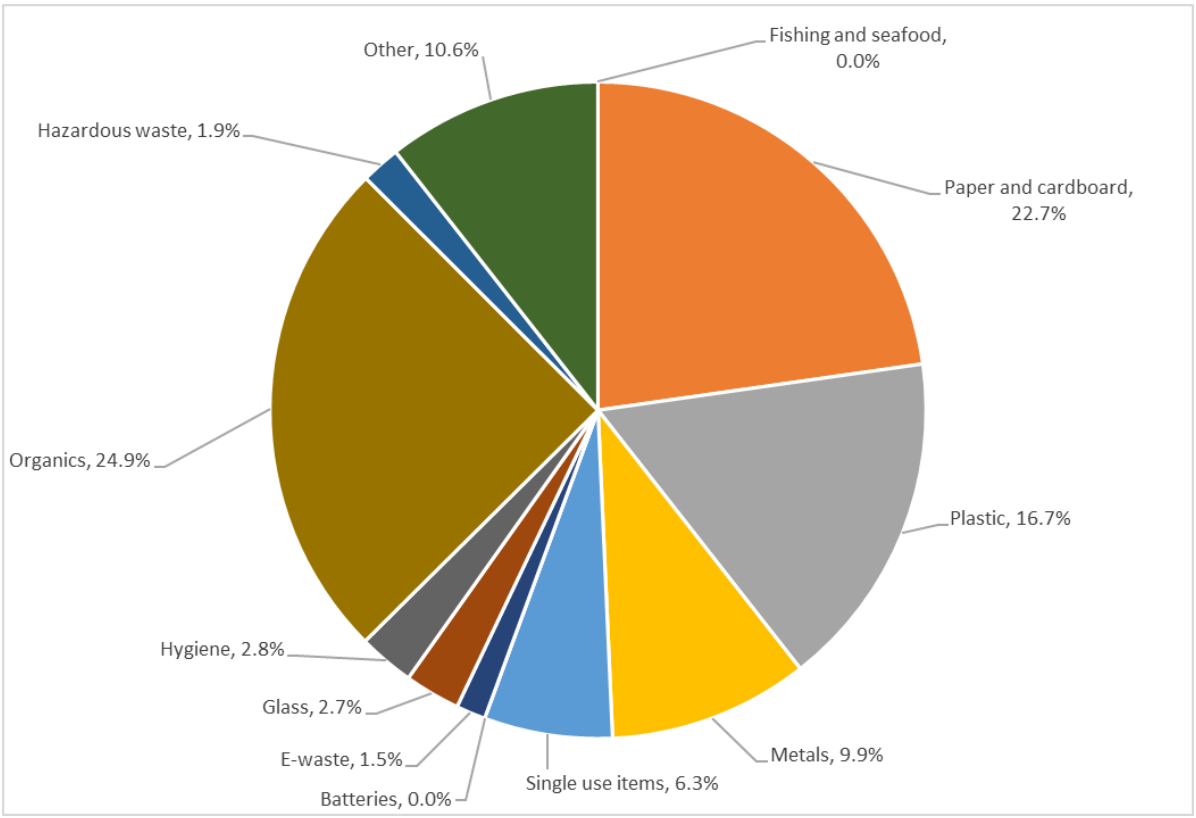


Figure 30: Percentage waste composition for Tofol Landfill

Organics made up the largest component of the landfilled material (mainly garden organics)[Error! Bookmark not defined.]. Pictures from the audit indicate that a large volume of plastics and paper and cardboard are generated by households and sent to Tofol Landfill. This is representative of the samples collected which include a large volume of plastics and paper and cardboard categories.

Assessment of Operational Costs

Current costs for operation and contracts associated with waste collection and the waste facilities has been derived from the Solid Waste Management Plan for Kosrae, 2018-2027.

Annual operational costs for Tofol Landfill were reported as $48,800 per year. Total waste to Tofol Landfill is approximately 1,518 tonnes per year. The unit cost of waste to landfill is estimated at $32.1 per tonne.

When considering total expenditure for solid waste management (waste collection, revenue from waste collection and landfill operational costs) is estimated to be $40,582, equating to a unit cost of $26.74 per tonne.

Stockpiles

The audit team used local knowledge to identify known stockpile locations. The audit team also identified areas of illegal dumping activity of general waste.

These have not been included in the stockpile assessment.

Stockpiles in Kosrae are generally located:

- Along roads;
- Vacant areas of land; and
- In vegetation along roadways.

A summary of the types and estimated quantities of materials found in stockpiles across Kosrae has been provided in **Table 46**.

Assumptions associated with identifying the weight in tonnes of the stockpiles identified have been provided in **Appendix C**.

Table 26: Type and estimated quantity of materials found in stockpiles in Kosrae

Item	Weight (Tonne)	Volume/ Count (units)/ Litres	Location	Audit Images
Trucks	156	24	Along roads to the east of the island.	Photo not available
Boats	0.5	1	Abandoned yard in Tafeyat.	
Cars	94.5	63	Along roads to the east of the island, Abandoned yard in Tafeyat and vacant land in Tofol.	
Motor Bikes	0.9	5	Abandoned yard in Tafeyat	Photo not available

Item	Weight (Tonne)	Volume/ Count (units)/ Litres	Location	Audit Images
Heavy Machinery	20	2	Abandoned yard in Tafeyat	
Roofing Iron (sheets)	1.2	60	Abandoned yard in Tafeyat	Photos not available.
Tyres	0.8	100	Abandoned yard in Tafeyat	
Aluminium Cans	1.5	10m^3	Vacant land (Tofol)	
Glass	25.7	74m^3	Abandoned yard in Tafeyat and vacant land in Tofol.	
Used Oil	43.3	47,682 litres	Data not available	Based on 2013/14 data from *Cleaner Pacific 2025 Pacific Regional Waste and Pollution Management Strategy 2016-2025*[49]. No further data was available throughout audit, as such no images are available.

[49] *Cleaner Pacific 2025 Pacific Regional Waste and Pollution Management Strategy 2016-2025*, Secretariat of the Pacific Regional Environment Programme (SREP), 2016.

Section 5:
Yap Waste Audit Findings

Legislation

The summary of relevant legislation provided in **Table 47** has been sourced from the *Stocktake of existing and pipeline waste legislation report* [50].

Table 47 Legislation Summary

Legislation name	Description
	National
Solid Waste Management Strategy 2010 -2015)	Identifies how FSM will establish technically sound and financially sustainable solid waste management. The strategy has 3 strategic objectives focusing on policy, implementation, and education.
Plastic products ban (2020)	Prohibits the import of single-use disposable Styrofoam, plastic food service items and plastic shopping bags from 1 July 2020.
National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (2007)	Plan detailing FSM's obligations as a party to the Stockholm POPs Convention.
	State level
	Yap
Solid Waste Management Strategy 2018-2022	Identifies how Yap State will establish technically sound and financially sustainable solid waste management.
Littering (Yap State Law 3-74)	Details the corrective action model in place for littering which occurs on Yap.
Yap EPA Plastic Bag Regulations	Details the restrictions of plastic bags use across Yap. Implemented as of 4 July 2014.
Container Deposit Legislation (2008)	Establish sustainable financing for solid waste management with reducing the negative impact on final landfill sites. Targeting: PET Beverage and Cooking Oil containers, Aluminium Beverage Containers, Glass Bottles, Car Battery, metals, home appliances and e-waste.
Regulations for Persistent Organic Pollutants (2014)	Details the controls in relation to the manufacture, use, store, transportation, and discard of POPs.
	Chuuk
Solid Waste Management Strategy 2019-2023	Identifies how Chuuk State will establish technically sound and financially sustainable solid waste management.
Littering Act 1991	Established to control the littering in Chuuk establishing a process for designation of appropriate sanitary public dump sites and maintenance of such sites.
Clean Environment Act 2018	Details a phasing out plan for single use plastic shopping bags and the controls to manage the ban.
Not yet in legislation	Proposed Container Deposit Legislation (CDL) will include aluminium cans, PET bottles and car Batteries.

[50] Stocktake of existing and pipeline waste legislation: Federated States of Micronesia Prepared by the Melbourne Law School at the University of Melbourne, Australia with technical assistance from Monash University on behalf of the Secretariat of the Pacific Regional Environmental Programme (SPREP) 2020

Legislation name	Description
	Pohnpei
Solid Waste Management Strategy 2019 – 2023	Identifies how Pohnpei State will establish technically sound and financially sustainable solid waste management.
Plastic bag ban (2011)	Ban on single use plastic bags for Pohnpei.
Container Deposit Legislation (2011)	Establish sustainable financing for solid waste management with reducing the negative impact on final landfill sites. Targeting aluminium cans only.
	Kosrae
Solid Waste Management Strategy (2018-2027)	Identifies how Kosrae State will establish technically sound and financially sustainable solid waste management.
Littering (Kosrae State Code, Title 13, Section 13.506)	Details the controls in place to prevent littering occurring.
Control of Plastic Wastes Act 2017	Details the ban of the use of plastic shopping bags in the sale or distribution of mechanise.
Container Deposit Legislation (2006)	Establish sustainable financing for solid waste management with reducing the negative impact on final landfill sites. Targeting PET Beverages, Glass, Aluminium, Car Batteries. Recycling deposits exist for aluminium cans only.

Waste Services

Household Waste

Waste collection service is contracted to a private company by DPW&T. Waste is collected from collection stations (financed with support from the Department of Health Services) where 55-gallon drums (equivalent to 0.2 m^3) are installed. The weekly waste collection is provided to around 16% of all households in Colonia and Tomil communities (since 2017, due to the community dump site closures). In 2017, 10 collection stations (covered areas for waste storage) were established in 10 of 11 villages in Tomil[51].

Waste from these stations is transported to Yap State Landfill. Four of the collection stations are emptied once per month by the Paradise Metal Company using a four-tonne truck with crane.

Those households not receiving a waste collection service, are required to transport their waste to the state landfill. It has been noted that households continue to transport their waste to the closed community disposal sites. These sites are not manned, and uncontrolled improper discharge is undertaken.

Household Recycling

There is no roadside recycling collection service. A CDL scheme is in place which collects approximately 1.7% of generated waste.

[51] Noted: two villages share the same collection station

Targeted items include:

- Aluminium beverage containers/cans;
- Glass beverage bottles;
- PET beverage containers; and
- Cooking oil containers.

Composting of garden organics by households is also common practice. Some garden organics are still disposed at the Yap State Landfill.

Commercial Waste

Waste from 36 public institutions, schools and general waste from the Hospital is collected by a private company contracted to DPW&T. A two-tonne dump truck and flatbed truck are used for these collections occurring one to three times per week, depending on customer requirements.

Charging

Villages of Tomil receiving the roadside collection are charged $2.50 per household per month. Fees apply for waste collection from commercials.

Hazardous Waste

Healthcare Waste

Healthcare waste management is funded by the Government and utilises an incinerator located at the Yap Memorial Hospital. The incinerator was donated to the Yap State in 2011 and is used for healthcare waste including sharps and pharmaceutical waste[10].

Asbestos

Estimated volumes of asbestos containing materials across Yap is approximately 1,108m^2 identified at seven locations. Location details are highlighted in section 3 (Stockpiles).

Used Oil

Estimated volumes of used oil in Yap are 65,750 litres (2013-14), taken from the Consultancy for Contemporary Used Oil Audits in Selected Pacific Island Countries Report for the State of Yap. Locations of stockpile locations has been identified in Section 3. No updated information was provided during the audit.

Batteries

A product stewardship programme is in place for used lead acid batteries (ULAB).

Yap Waste Facilities

Landfill Infrastructure

Yap State Landfill is a public site located in Colonia.

There are also three community disposal sites used by the local villages which surround them:

- Rumuu Fanif community dump site;
- Gachpar Gagil community dump site;
- Waayan Gagil community dump site; and

Figure 31 Yap State Landfill and community sites.

The state landfill is owned by Yap State Government and operated by Yap EPA and DPWT. The site occupies an area of 8,370 m^2. The semi-aerobic landfill has a leachate collection system, circulation facilities and leachate collection pond (regularly monitoring by YAP EPA).

Gas ventilation pipes are also present for ventilation only. Access to the site is through a gate and night security is in place. Approximately 60% of generated waste ends up at the Yap state landfill[52].

[52] Yap State Solid Waste Management Strategy 2018-2027

Equipment located at the landfill includes:

- Crusher;
- Shredder;
- Bailer;
- Two compactor trucks; and
- Boom trucks.

Charging at the landfill

There are no fees associated with the drop of waste at the landfill.

Inputs to Landfill

The landfill accepts general waste only. Separation of recyclables is undertaken at households and small amounts of recyclables are diverted at the Yap State Landfill itself[52].

A significant portion of commercials deliver waste directly to landfill. Around 23% of waste delivered to the landfill is from the collection service and 77% is delivered directly by commercials and households.

Household Audit Findings

Access to Waste Collection Services

Access for households to a waste collection service has been provided in **Table 48.**

Table 48: Summary of access to collection services

Access to collection services	Details
Total interviewed	71
Percentage of the population with access to collection service	12.7%
Average collection service rating	6.4/10
Comments	• The lower waste collection service rating was primarily due to an inconsistent service recorded by some respondents. • Other respondents commented they were satisfied with the service.

It is common practice for several options to be selected by householders for the same waste stream (**Table 49**).

For example, in some household's food organics were recorded as part of the waste stream, fed to animals.

Table 49: Waste management activities adopted by households

Material	Disposal Options
Bulky Items	• Collected • Transported to landfill (self-haul) • Illegally dumped • Stored
Food Organics	• Burned • Stored • Transported to landfill (self-haul)
Garden Organics	• Collected • Illegally dumped • Transported to landfill (self-haul) • Burned • Stored • Buried
Sanitary	• Collected • Transported to landfill (self-haul) • Bury
General Waste	• Collected • Transported to landfill (self-haul) • Stored • Buried

Identified management activities adopted by householders is for the following reasons:

- Feeding food organics to pigs.
- Collect food organics and gift them to households with pigs.

Participants were surveyed on their willingness to pay for collection services. Outcomes from this question are presented in **Figure 32.**

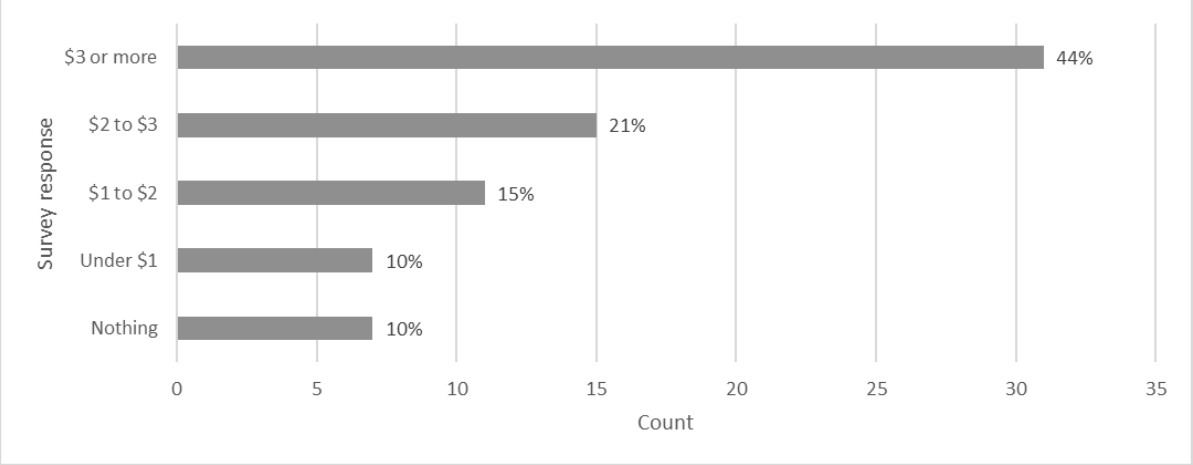


Figure 32: Willingness to pay for households' collection of waste – survey outcomes in Yap

Household Waste Composition

Typical roadside waste put out for collection in Yap can be seen in **Figure 33.**

Figure 33: Typical waste collection from households in Yap

The average composition of waste by weight from households in Yap is shown in **Figure 34**.

The available data (photos of samples in buckets for weighing) suggests some single use items are present, but it is not possible to quantify this component within plastics, metals, or paper & cardboard.

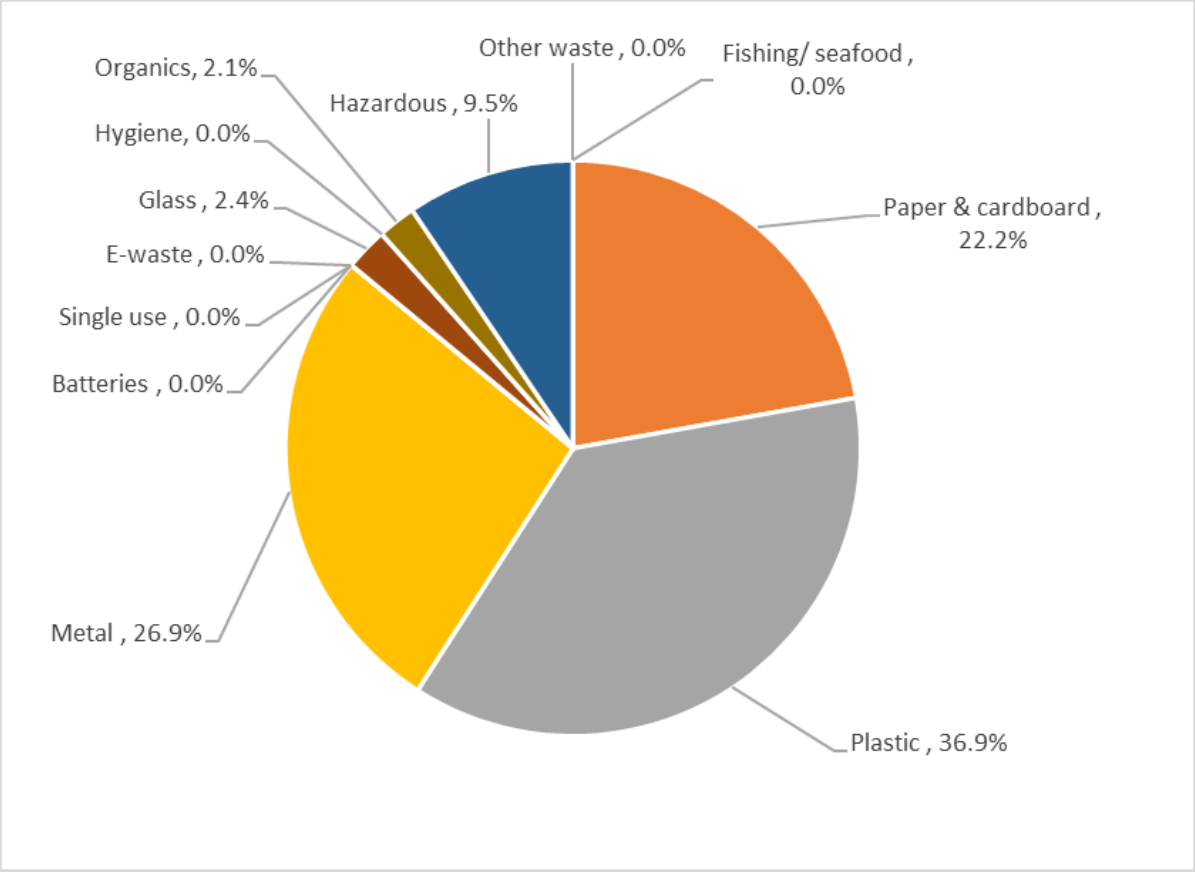


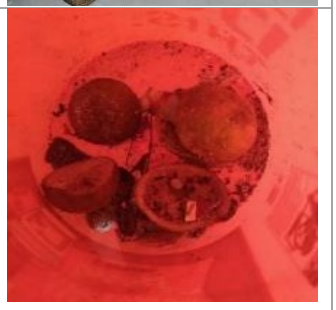
Figure 214: Yap average household waste composition summary

Plastics (36.9%) were the largest component of the waste stream, followed by metals (26.9%) and paper and cardboard (22.2%).

Hazardous waste (9.5%), organics (2.1%) and glass (2.4%) were the next largest components of the waste stream (Table 54).

Table 50: Waste material findings

Waste Material	Description	Audit Images
Glass	Dominated by glass bottles (beer).	

Waste Material	Description	Audit Images
Hazardous	Dominated by butane cooking cannisters.	
Metals	Dominated by food cans and aluminium drinks cans.	
Organics	Dominated by food and garden organics.	
Paper and Cardboard	Dominated by cardboard boxes, paper, and Tetra Pak (various) items.	
Plastics	Dominated by soft plastics and some PET and HDPE containers. Plastic drink bottles included clear PET bottles, cooking oil, water, and soy sauce. Plastic containers included (PET and HDPE items), food: yoghurt, ketchup, household cleaning.	

The lower and upper range for each component of household waste have been calculated at a 95% confidence interval and are presented in **Table 51** and **Figure 35**.

This provides a measure of the range of estimated proportion for each material that might be expected for repeated composition surveys for households in Yap.

Interviews with householders has provided the data we have used to estimate the average quantity of waste from sampled households for Yap[53].

The estimated generation of waste per household per day is 0.6 kg (within a range of 0.1 kg – 2.1 kg per household per day).

Due to the absence of fishing/seafood, single use items, batteries, e-waste, hygiene, and other waste identified during the survey, the margin of error in the range has not been calculated.

[53] The data used to calculate the composition of waste collected from households has been derived from samples collected from all household properties during the audit only. The total weight of samples collected was averaged using the count (total number of samples). This is the methodology as presented in the Waste Audit Methodology – A step-by-step manual to conduct comprehensive waste audits in SIDs produced by PRIF.

Table 27: Waste composition for households identified as part of the sort and weigh of samples for Yap[54]

	Fishing/ Seafood	Paper and Cardboard	Plastics	Metals	Single use Items	Batteries	E-waste	Glass	Hygiene	Organics	Hazardous	Other Waste
Composition	0.0%	22.2%	36.9%	26.9%	0.0%	0.0%	0.0%	2.4%	0.0%	2.1%	9.5%	0.0%
Combined Sample Weight (kg)	0.0	41.5	69.0	50.3	0.0	0.0	0.0	4.5	0.0	4.0	17.7	0.0
Average Weight per Sample (kg)[55]	0.0	1.1	1.8	1.3	0.0	0.0	0.0	0.1	0.0	0.1	0.5	0.0
Lower Range	N/A	9.3%	30.3%	20.8%	N/A	N/A	N/A	0.0%	N/A	0.0%	8.0%	N/A
Upper Range	N/A	25.2%	47.3%	34.8%	N/A	N/A	N/A	3.6%	N/A	3.5%	17.2%	N/A

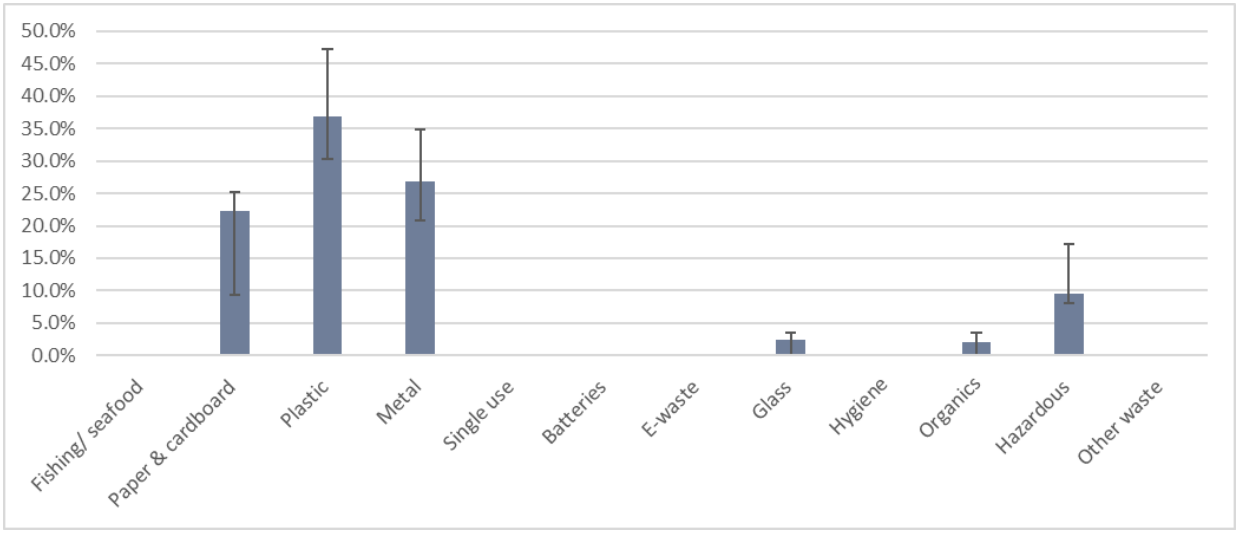


Figure 36: Waste composition for households identified as part of the sort and weigh of samples collected for Yap

[54] Confidence interval of +15% and -15% applied during data analysis. 38/49 samples were within this range and have been used to derive the composition.
[55] Count of all data used (38). Total weight (kg) per category divided by count to provide average weight per sample

Potentially Recyclable Materials

A range of potentially recyclable material was identified through the waste audit.

Plastics, metals, and paper and cardboard were recorded as the most dominant categories in household waste. Hazardous, glass and organics were also identified but were less significant.

Examples of these waste streams following separation as part of the audit are seen in **Figure 37.**

Key points to note:

- Plastics are present with a high proportion of single use items suitable for recycling if markets can be secured; and
- Metals, and paper and cardboard are present at a relatively high proportion of the total household waste stream (both easily recycled where markets are accessible).

The interview data suggested a wide range of household usage/generation. Average figures provide a useful indication of likely quantities of materials but should be validated for example using a large sample size for household surveys and/or considering sales data.

Figure 37: Typical recyclable items identified through the sort and weigh of samples collected in Yap

Table 52: Observations by material

Material	Key Materials	Observations
Metals	Dominated by aluminium drink cans. Food tin cans (some are coated with steel)	The data provided is the sample of households from across Yap. Household interviews reported an average of 3.7 (4) drinks can per person, per household, per week. The range varied between 0 to 28 cans per week between samples collected. Using the average from the household interview data collected, across Yap, this equates to 42,598 cans per week for the population (est. 11,377). Over one year this is estimated to be around 2,215,102 million drinks cans[56] per year. This is considered at the upper end of the number of drinks cans likely to be produced[57].
Paper and Cardboard	Dominated by cardboard boxes.	Dominated by cardboard boxes, paper, and Tetra Pak (various) items.
Plastics	Small clear water bottles (PE), household cleaning (HDPE), food condiment bottles (ketchup, soy sauce), large clear cooking oil (PE).	Household interviews reported an average of 1.7 (2) plastic water bottles per person per household per week with a range of 0 to 8 bottles per person, per week. Using the average from the household interview data collected, across Yap this equates to 19,744 per week for the whole population. Over one year this is estimated to be around 1,026,726 plastic bottles per year. This is likely to be at the upper end of the number of water bottles produced per week.

Commercial Audit Findings

The total number of commercials audited by type is shown in **Table 53**, this provides the count, or the number of commercials which were audited during the waste audit.

Where there is a difference between the number of sort and weigh surveys completed and the interviews completed this indicates that the sort and weigh data has been excluded from the analysis through the quality assurance process.

Table 528: Commercial waste sample numbers

[56] Note the number of drinks cans and plastic bottles are based on the data collected from the audit data only and is based on a population of 11,377.

[57] If this data is to be used to inform potential recyclables for capture, it will be important to validate these numbers with further survey work specifically capturing a larger sample of households.

Commercial Type	Number Samples Sorted/Weighed	Number People Interviewed
Commercial	0	1
Mixture	0	1
Offices	1	1
Retail and trade	2	4
Total	**3**	**7**

Access to Waste Collection Services

Commercials are required to arrange a private collection service or transport the waste they produce to the landfill themselves.

Table 54 below table summarises feedback on the collection service including a waste collection rating.

Table 54: Summary of access to collection services[58]

Access to collection services	Details
Total interviewed	7
Percentagee of commercials who access a collection service	14.3%
Average collection service rating	10/10[59] - For the one commercial using the waste collection service, the service is reported to be satisfactory.

It is common practice for several options to be selected by commercials for the same waste stream. Options undertaken by commercials identified through the audit are identified in **Table 56**.

Table 29: Options for waste management adopted by commercials

Material	Disposal options
Bulky items	• Transported to landfill (self-haul) Collected
Food organics	• Collected • Stored
Garden organics	• Illegally dumped • Stored • Burned
Sanitary	• Collected • Transported to landfill (self-haul)
Waste	• Transported to landfill (self-haul) • Collected

[58] Data collected and recorded in survey 123 app, from interviews held with commercials.
[59] Only one commercial uses the waste collection service so the service rating was based on their feedback.

Participants were surveyed on their willingness to pay for collection services. Outcomes of the survey are presented in **Figure 38**. Commentary and observations made through these interviews noted that some commercials feed their food organics to pigs.

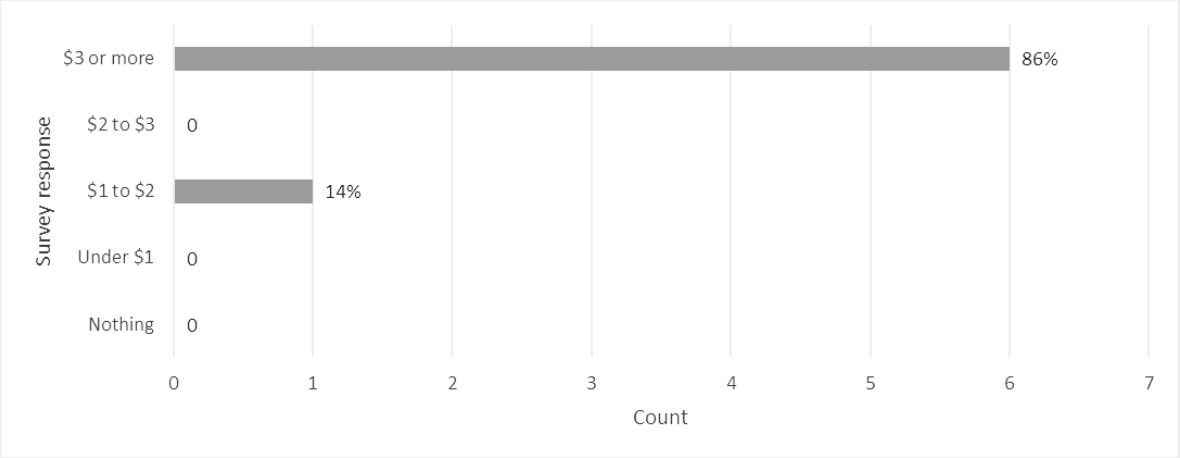


Figure 38: Willingness to pay for commercial collection of waste – survey outcomes in Yap

Commercial Waste Composition

Three commercial waste samples were collected as part of the waste audit in Yap.

Two of these samples recorded a variance of more than 15%, between the weight of separate waste categories recorded and the total sample weight. For the purposes of waste composition calculations these are not presented in the report. One of the three commercial waste samples was within the error range (85%-115%). In this case, we have not provided this data in the report, but have provided the raw data separately.

Landfill Audit

Considering the source of waste, landfill visual assessment data and using the sort and weigh audit data for households and commercials, an overall waste composition has been developed (**Table 57** and **Figure 39**). In the absence of updated waste to landfill annual volumes, the following assumptions have been made.

Table 57: Assumptions

Information	Assumptions
Waste collections by government using 2017 tonnage data from the Solid Waste Management Plan for Yap (2018-2027)	
Household waste – 0.02 tonnes per day	Household waste sample composition from the sort and weighing has been applied to household waste.

Information	Assumptions
Direct transport to landfill using 2017 tonnage data from the Solid Waste Management Plan for Kosrae (2018-2027)	
Household waste – 1.87 tonnes per day	Household waste sample composition from the sort and weighing has been applied to household waste dropped off directly.

Commercial waste – 2.49 tonnes per day	Commercial waste sample composition from the landfill audit visual assessment data has been combined and applied to the commercial waste.

Information	Assumptions
Contractor collected waste using 2017 tonnage data from the Solid Waste Management Plan for Kosrae (2018-2027)	
Household waste – 0.5 tonnes per day	Household waste sample composition from the sort and weighing has been applied to household waste.
Commercial waste – 0.77 tonnes per day	Commercial waste sample composition from the landfill audit visual assessment data has been combined and applied to the commercial waste.

*Daily tonnages were factored up, given the site is open 6 days per week, 52 weeks per year.

This suggests that the total waste to Yap State Landfill is approximately 1,763 tonnes per year.

Table 30: Estimated composition of solid waste in Yap State Landfill

Materials	Composition %	Tonnage per Day	Tonnage per Year
Batteries	0.0%	0.0	0
E-waste	0.0%	0.0	0
Fishing/ Seafood	0.0%	0.0	0
Glass	1.0%	0.1	18
Hazardous	4.0%	0.2	71
Hygiene	20.1%	1.1	355
Metals	21.4%	1.2	377
Organics	21.0%	1.2	371
Other Waste	0.0%	0.0	0
Paper and Cardboard	16.2%	0.9	286
Plastics	16.2%	0.9	285
Single Use Items	0.0%	0.0	0
Total	100.0%	5.7	1,763

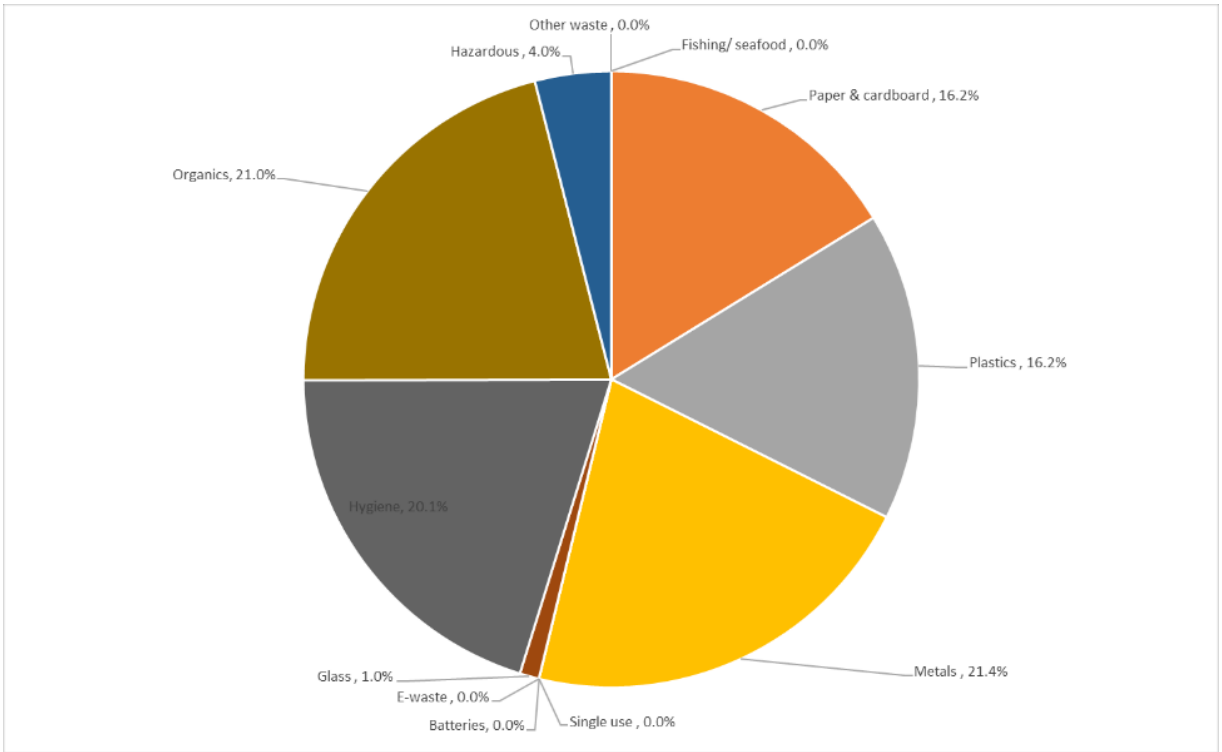


Figure 39: Percentage waste composition for Yap State Landfill[60]

Metals, organics, and hygiene occupied the largest components of the landfill). Two landfill audits for commercial waste have been used to provide the composition for the drop off commercial waste.

Assessment of Operational Costs

Current costs for operation and contracts associated with waste collection and the waste facilities has been derived from the Solid Waste Management Plan for Yap, 2018-2027.

Total waste to Yap State Landfill is approximately 1,763 tonnes per year. When considering total expenditure for solid waste management (waste collection, revenue from waste collection and landfill operational costs) is estimated to be $70,655 equating to a unit cost of $40.1 per tonne.

Stockpiles

The audit team used local knowledge to identify known stockpile locations. The audit team also identified areas of illegal dumping activity of general waste. These have not been included in the stockpile assessment.

Stockpiles in Yap are generally located:

- Along roads; and
- Vacant areas of land.

A summary of the types and estimated quantities of materials found in stockpiles across Yap has been provided in **Error! Reference source not found.**

Assumptions associated with identifying the weight in tonnes of the stockpiles identified have been provided in **Appendix C**.

[60] Note: only two landfill audits were collected for commercial waste.

Table 59: Type and estimated quantity of materials found in stockpiles in Yap

Item	Weight (Tonne)	Volume/ Count (units)/ Litres	Location	Audit Images
Trucks	253.5	39	Talguw, Rull, Public Transportation System Junkyard, Ngof, Rull, Thol, Tamil, Nungoch, Weloy	
Cars	192	128		
Vans	80	40		
Heavy Machinery	20	2	Thol, Tamil, Nungoch, Weloy	
Other Metals	1	10	Nungoch, Weloy	
Used Oil	60	65,750 litres	Data not available	Based on 2013/14 data from *Cleaner Pacific 2025 Pacific Regional Waste and Pollution Management Strategy 2016-2025*[61]. No further data was available throughout audit, as such no images are available.
Asbestos	Data not available.	3,557m^2	Total across FSM in 2013.	

[61] *Cleaner Pacific 2025 Pacific Regional Waste and Pollution Management Strategy 2016-2025*, Secretariat of the Pacific Regional Environment Programme (SREP), 2016.

Table 60: Stakeholder engagement

Stakeholder	Description of audit interface	Stakeholder engagement			
		Chuuk	**Kosrae**	**Pohnpei**	**Yap**
Householders	• Bag collection • Interviews	• Letter delivery providing details of audit to participating households[62] • Word of mouth • Face to face interviews	• Letter delivery providing details of audit to participating households • Description on local radio in the week prior to the audit • Face to face interviews	• Letter delivery providing details of audit to participating households • Description on local radio in the week prior to the audit • Face to face interviews	• Letter delivery providing details of audit to participating households • Face to face interviews
Commercial owners	• Bag collection • Interviews	• Letter delivery-providing details of audit to participating commercials • Word of mouth • Face to face interviews	• Letter delivery-providing details of audit to participating commercials • Description on local radio in the week prior to the audit • Face to face interviews	• Letter delivery-providing details of audit to participating commercials • Description on local radio in the week prior to the audit • Face to face interviews	• Letter delivery-providing details of audit to participating commercials • Face to face interviews
Commercial operators (collectors and disposers)	• Landfill disposal operators	• Face to face discussions • Interviews where required	• Face to face discussions • Interviews where required	• Face to face discussions • Interviews where required	• Face to face discussions • Interviews where required

[62] Delivered to households explaining audit and instructions to leave bags at entry to driveway prior to audit.

Sampling Methodology

Samples were collected in accordance with the sampling procedures summarised in the sampling guides. A summary of audit components and methodology is provided in **Table 31**

The audit methodology is detailed in the Federated States of Micronesia Audit Plans (Appendix A). The methodology applied has been derived from the Waste Audit Methodology – A step-by-step manual to conduct comprehensive waste audits in SIDs[63], this is attached as an Appendix to the audit plan.

The audit plan was developed based on the most recent household and commercial statistics from FSM Statistics. The target sample numbers also reflect experience on similar audits and are intended to ensure that there is adequate data to provide a statistically valid estimate of waste characteristics and quantity.

A target sample size for households and commercials in each country was determined to provide a balance between the level of precision achieved and the time required to sample, sort, and weigh the samples obtained.

The target numbers allow for some reduction in sample numbers in the event of operational issues during sample collection. They also account for the potential for some sample results to be excluded from analysis during quality assurance.

[63] Published by PRIF

Table 61: Summary of sample numbers collected in FSM[64]

Sample type	Chuuk actual sample	Chuuk sample plan	Kosrae actual sample	Kosrae sample plan	Pohnpei actual sample	Pohnpei sample plan	Yap actual sample	Yap sample plan
Household								
Samples sorted	120	120	92	120	76	120	49	100
Interviews	97	120	90	120	74	120	71	100
Commercial								
Samples sorted	27	30	24	30	25	30	3	25
Interviews	25	30	24	30	25	30	7	25
Stockpile assessments	22	N/A	3	N/A	10	N/A	5	N/A
Landfill load audits	67	N/A	17	N/A	52	N/A	7	N/A

[64] Data derived from the waste audits undertaken in Micronesia

A sample is the entire contents of a bin or bag/s put out for collection. The sample represents the waste produced by that household over the period of one week.

Table 31: Audit methodology

Audit component	Description
1. Sample collection from households and commercials	Rubbish bags/waste collected from bins collected from commercials/ households identified on audit maps. Samples taken were photographed and bags labelled with unique ID numbers, with a corresponding tag placed on a nearby tree/fence/sticker on a door. The location was also photographed to assist in identifying the location for the follow up interview (Component 3). Sample locations are presented in Section 3. Bags of two sizes (120 litre and 240 litre) were provided to householders for the audit, these were then put out for collection by these households and commercials on collection day. The entire contents of the bin for the one household were emptied into the bag/s depending on the quantity of waste. A waste sample is the entire contents of the bin put out for collection.
2. Sort and weigh of household/commercial bags	Samples transported to a location for waste sorting. Waste was sorted into primary categories and defined secondary categories. A list of these categories and their included materials is included in Appendix B. Waste in each category was weighed with data and photographs recorded in the sample collection application. The audit methodology used weight to determine composition rather than volume. The methodology does not include the identification of moisture content across different waste materials.
3. Household and commercial interviews	For each household or commercial where a waste sample was collected, a second team returned to complete an interview. The interview was recorded on a standard form.
4. Landfill audit	Audits were completed at the following locations: • Chuuk – Chuuk State Landfill • Kosrae – Tofol Landfill • Pohnpei – Dekehtik Landfill • Yap – Yap State Landfill Waste composition and quantity was estimated, and all loads recorded for the audit period. Each load was recorded including photographs and estimated composition and quantity.
5. Stockpile assessment	Stockpile audits were completed based on information provided for each state. Stockpiles were assessed during the audit. Materials characteristics and quantity were estimated. Each stockpile was recorded including photographs and estimated composition and quantity.

Identification of Households and Commercial Premises

Maps showing sample locations by household and commercial were provided to the audit team. Where locations were unsuitable for sampling, the team would move onto the next household or commercial premise of the same category. The locations of those households and commercial premises sampled are shown below. Knowledge of collection arrangements was considered when identifying a random and representative sample.

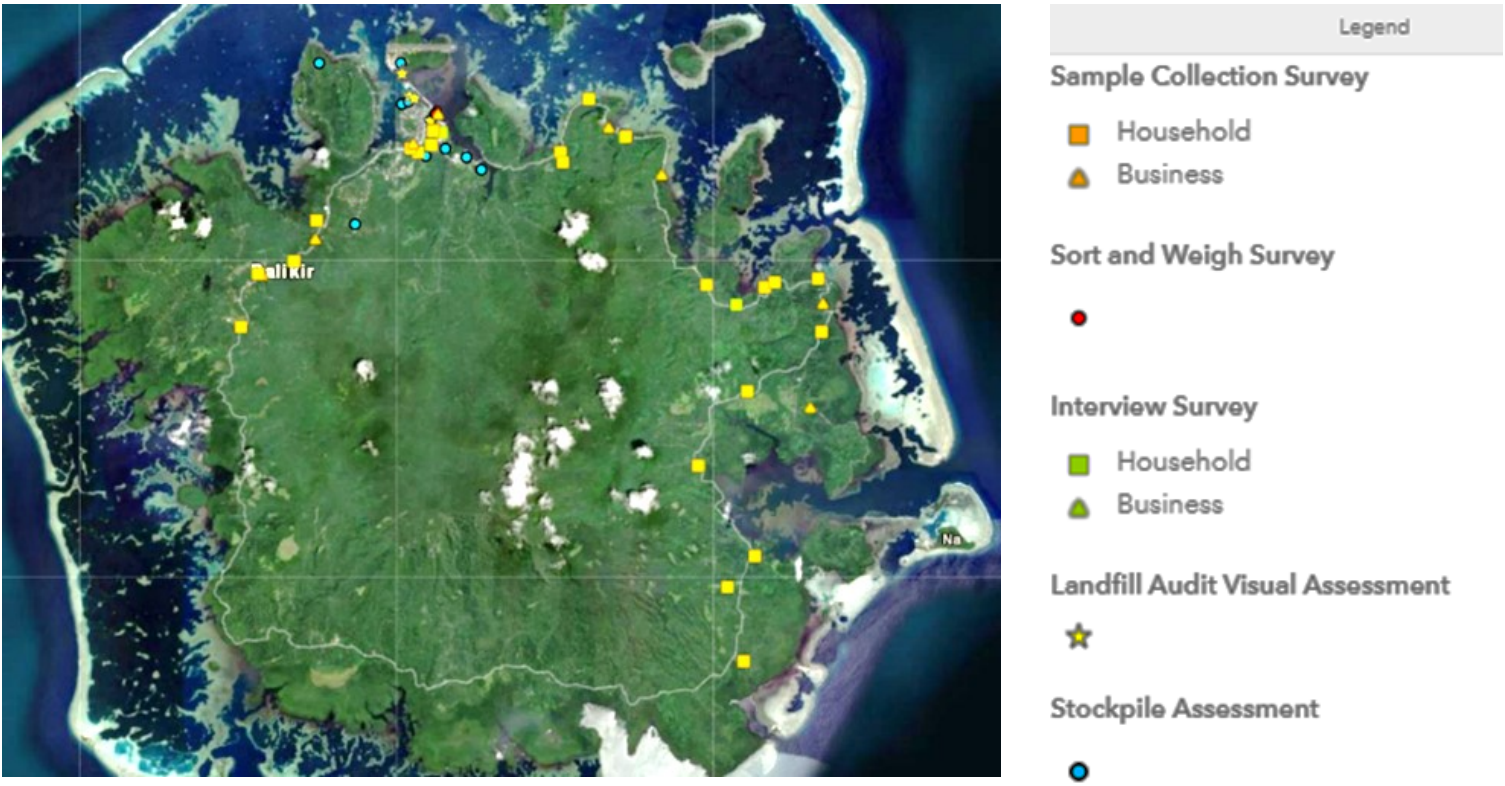


Figure 40: Sample locations in Pohnpei

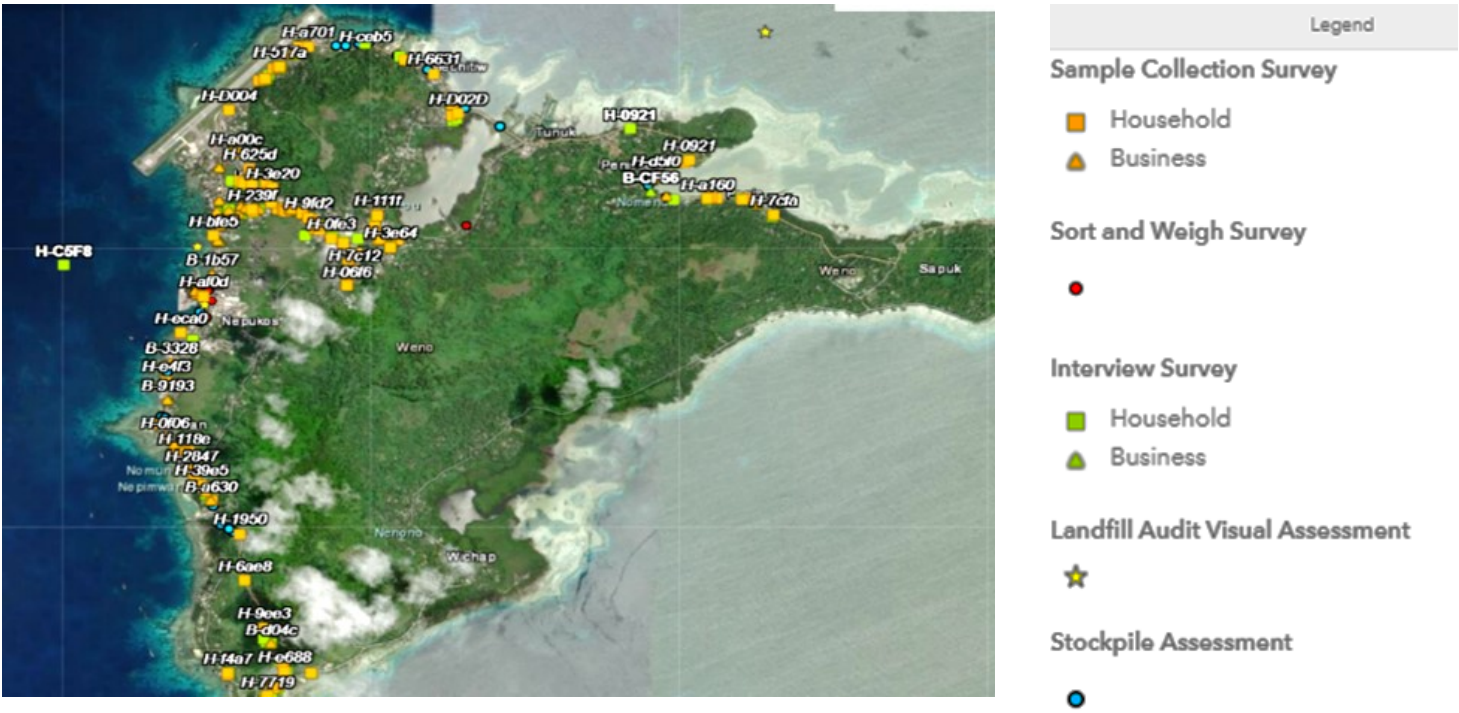


Figure 41: Sample locations in Chuuk

Figure 42: Sample locations in Kosrae

Figure 43: Sample locations in Yap

Summary of Data Collected

The total number of household and commercial samples, stockpile assessments completed, and landfill loads audited in FSM are summarised in **Table** , discusses the difference between sample plan targets and actual sample numbers. Several factors resulted in the difference between the Sample Plan and the actual audit numbers for FSM audits.

These were:

- Weather disruptions impacting on the ability of the audit team to collect samples;
- Productivity of the team sorting the waste into categories, weighing and recording this data;
  - In the first few days of the audit, it typically takes time for the team to familiarise themselves with the process of physically sorting the waste, ensuring the right waste is captured in the right category and the subsequent input of data into the phone. This reduces the productivity of the team during the first few days;
- The potential for individual samples to be unsuitable for inclusion in some of the data analysis (specifically the composition of the waste stream). This is due to data discrepancies, for example a decimal point is inserted in the wrong place;
- Outliers in composition is also an important consideration when presenting the data;
  - When producing waste composition data, for this project we complete a robust quality assurance and data review process, which accounts for the different in total start weight (total sample weight) and the total weight of the individual waste categories combined. The difference between these two numbers is calculated as a % difference. If the confidence interval or difference is more than +15% or -15% different, then we do not use this data for determining the composition of waste presented in this report. A margin of difference outside of this range (+15% to -15%), reduces our confidence in the data submitted; and
- Availability of in country audit teams to deliver the waste audits within the contract period, due to other work commitments.

Where data has been excluded from calculations when the confidence interval is applied, this has been noted throughout the report.

Validation Procedure

The audit process and data collection approach were designed to allow for remote supervision, data checking and ongoing feedback to the audit team throughout the audit process.

Key aspects included are illustrated in

Figure .

Each audit component had a standard digital form. All information was recorded on smart phones and submitted to the ArcGIS platform as it was collected.

Allowing for real time quality checking of data by the consultant team remotely. The T+TI Country Coordinator and/or T+TI Waste Auditor would then feedback findings to the Country Coordinator daily or more frequently as required, creating a continuous feedback loop.

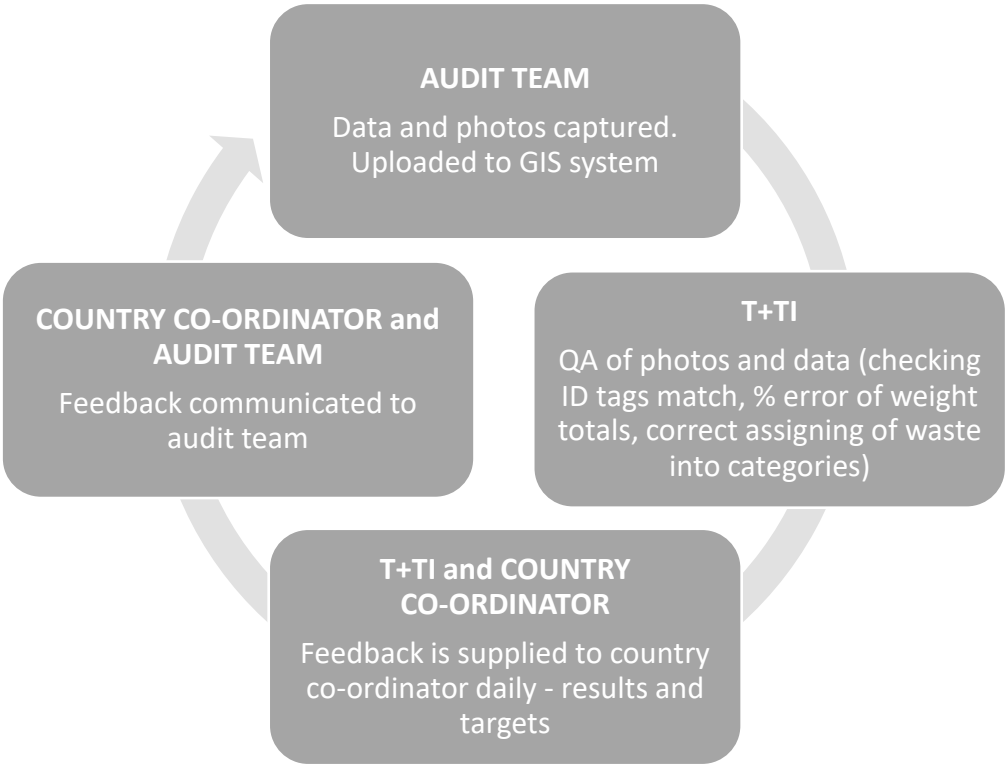


Figure 44: Continuous feedback loop in place to ensure quality of audit outputs.

National Assessment

Household

Kosrae and Pohnpei recorded paper and cardboard as the second highest while metal was recorded as the second highest in Yap. Chuuk recorded Organics as the highest proportion of household waste followed by Paper and Cardboard. The state of Kosrae reported the highest in terms of local population having access to garbage collection services with 74.4% receiving garbage collection services. Chuuk recorded the second highest with 51.6%, Pohnpei with 18.9% and Yap recorded the lowest collection service coverage at 12.7%. Households in communities without garbage collection services either self-haul to the landfill, burn or bury waste.

Commercial Facilities

Commercial samples from the four states were dominated by paper, cardboard, plastics, metals, and organics. States seemed to have similar arrangement when it comes to garbage collection services for commercial facilities. Commercial facilities can either utilise government service, arrange a private collection service or transport the waste they produce to the landfill themselves. Kosrae reported the highest percentage of commercial facilities accessing garbage collection service at 79.1%, followed by Pohnpei state at 40%, Chuuk at 24% and then Yap with 14.3%.

Landfill

Assessment of all public landfills for the four states identified paper and cardboard, plastics, organics and metals to be dominant. This findings corollate with the findings of the household and commercial audits.

Recovered Material Stockpiles

Assessment of waste streams for the four states in the Federated States of Micronesia highlighted that a significant proportion is made up PET bottles, aluminium cans, and glass. All these items have the potential to be recovered from the waste stream through the introduction of a deposit and refund scheme. These three materials are already captured under the CDL scheme that exists in some states; however, deposits are only paid out for aluminium cans. Metals and paper and cardboard are also present at a relatively high proportion of the total household waste stream and these items can be easily recycled if markets are identified and accessible. Once suitable recycling programmes and infrastructure are in place, 86% of items currently going into Yap's landfill can be diverted, 68.5% fir Chuuk and Kosrae, and 57.7% for Pohnpei.

Customs Data

An assessment of the customs data for imported goods has been undertaken and presented in **Table 633**. The value of imported goods for 2018 has been presented. The HS codes identified as high and medium importance have been defined in *Appendix E.*

Figure 45 shows import values of the high and medium importance HS codes as a proportion of the total value.

Table 63: Breakdown of customs data for key import same comments

Total import value (CIF value) + 50% for FSM	Total import value (CIF value) + 50% – for HS codes identified as medium and high importance	Estimated number of units – imported - for HS codes identified as medium and high importance
US $233,397,641	US $218,759,588 (93.7% of total imported value)	3,1947,925
	Plastic products (HS code 39 only) – US $6,249,397	Total plastic product units – 964,192
	Single use plastic items – US $103,159 (HS codes 3920, 3921 - Plastics; plates, sheets, film, foil, and strip)	Single use plastic items: 324094 units.
	Bottled water (full) (HS codes 2201, 2202) – US $4,770,642	Bottled water (including flavoured) empty units: 2,384,957.

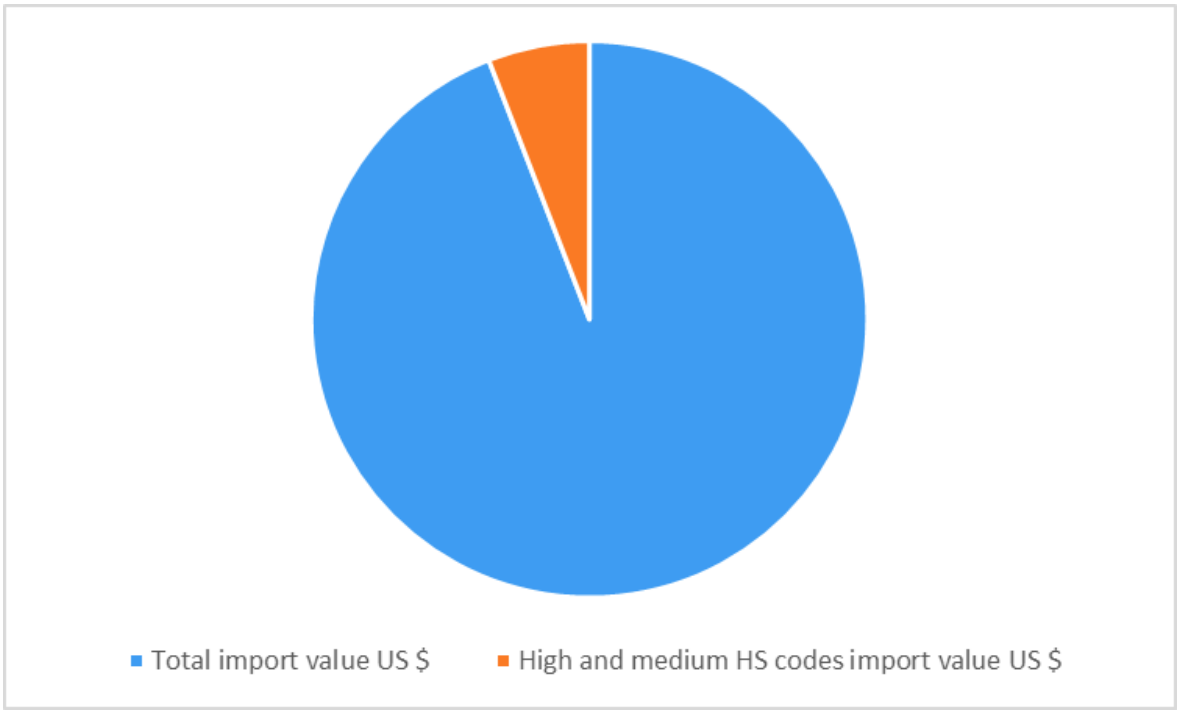


Figure 45 Total import value and proportion of high and medium defined HS codes

Appendix A: Waste Sort Categories

Table B1: Primary categories

Category 1	Examples
Batteries	Non-rechargeable, Rechargeable, Lead acid batteries, Mobile phone, Power tool batteries, Lithium Batteries, Lithium-ion batteries, Other batteries
E-waste	TVs, Mobile phones, Electrical Items & Toner Cartridges
Glass	Glass bottles, Glass jars, Glass fines, Glass other
Hazardous	Paint, Fluorescent tubes, Household chemicals, Asbestos, Clinical (medical), Gas bottles, Mercury, Containerised used oil, Hazardous (other)
Hygiene	Feminine Hygiene, Pharmaceutical, Medical waste, Nappies, Other sanitary waste
Metal	Aluminium cans, Aluminium recyclable, Steel containers, White goods, End of life vehicles, Metal other
Organics	Food organics, Wood/timber, Garden organics, Other organics
Other	Textiles, EOL renewable energy equipment, Tyres, Rubble/concrete including Ceramics
Paper and Cardboard	Cardboard, liner paperboard (LPB - cardboard container lined with plastic or aluminium), composite, paper
Plastic	PET containers, HDPE containers, LDPE containers, PVC containers, PP, EPS, PS, Flexibles/film, Other plastic

Table B2: Specific materials type categories

Category 1	Examples
Fishing/Seafood	Metal, Plastic, wood
Single Use Items	Beverage containers, Cigarette butts, Cigarette packets, Straws, Coffee cups, Bags - heavy glossy typically branded carry bags, - supermarket type light weight carry bags, Takeaway containers - plastic, other EPS/Styrofoam, paper Bottle lids

Appendix B: Assumptions for Stockpile Assessment Quantities

Item	Quantity	Unit
Aluminium Cans	154	kg/m3
Batteries	5	kg
Boats	500	kg
Cars	1500	kg
Demolition	225	kg/m3
Dumped General Waste	200	kg/m3
E-waste	38	kg/m3
Fence Wiring		
Garden Organics	150	kg/m3
Glass	347	
Hazardous	238	kg/m3
Heavy Machinery	10000	kg
motor bikes	180	kg
Other Metal	63	kg/m3
Plastics	13	kg/m3
Roofing Iron	20	kg
Tank	150	
Timber	178	kg/m3
Trucks	6500	kg
Tyres	8	kg
Used Oil	1000	L/m3
Vans	2000	kg
White Goods	225	

Appendix C: Density Assumptions

Density assumptions applied to landfill visual assessment compositions		
Category	**Conversion (kg/m3)**	**Source**
Metal	63	https://www.branz.co.nz/sustainable-building/reducing-building-waste/assessing-waste/volume-weight/
Fishing and Seafood	63	https://www.branz.co.nz/sustainable-building/reducing-building-waste/assessing-waste/volume-weight/
Paper and Cardboard	38	https://www.branz.co.nz/sustainable-building/reducing-building-waste/assessing-waste/volume-weight/
Plastic	13	www.resourcesmart.vic.gov.au/documents/Volume_to_Weight_Calculator.xls
Single Use Items	13	www.resourcesmart.vic.gov.au/documents/Volume_to_Weight_Calculator.xls
E-waste	240	www.resourcesmart.vic.gov.au/documents/Volume_to_Weight_Calculator.xls
Glass	174	www.resourcesmart.vic.gov.au/documents/Volume_to_Weight_Calculator.xls
Hygiene	225	https://www.branz.co.nz/sustainable-building/reducing-building-waste/assessing-waste/volume-weight/
Organics	225	https://www.branz.co.nz/sustainable-building/reducing-building-waste/assessing-waste/volume-weight/
Hazardous	225	https://www.branz.co.nz/sustainable-building/reducing-building-waste/assessing-waste/volume-weight/
Other	225	https://www.branz.co.nz/sustainable-building/reducing-building-waste/assessing-waste/volume-weight/

Appendix D: HS Codes

Category	Priority	HS Codes
Aluminium packaging	M	7611,7612,7613
Asbestos	M	2524,6811.40,6812
Bottle lids	M	3923.50
Ceramics	H	6901,6902,6903,6904,6905,6906,6907,6908,6909,6910,6911,6912,6913
Cigarette packets	H	2402,4813
Composite	H	4807
Computer equipment	M	8471,8443,8528.42,8528.52,8528.62,
Construction	M	9406,2523,6810
Containerised used oil	H	2709,2710.91,2710.99,3811
Cosmetics	M	3304,3305,3401
Drink Containers Alcoholic	H	2203,2204,2205,2206,2207,2208
Drink containers - milk and vinegar	H	0401,2209
Drink containers - soft drink	H	2202
Drink containers - water	H	2201
Electrical items and peripherals	M	8525,8526,8527,8528,8508,8509,8510,8513,9504,8523,4417,8471,8518 ,8543,8544,9001,9405
End of life Vehicles	H	8427,8428,8429,8430,8701,8702,8703,8704,8705,8706,8707,8708,8709 ,8710,8711,8712,8714,8715,8716
End of life vehicles air	H	88
EOL vehicles ocean	H	8407.21,8409,8901,8902,8903,8904,8905,8906,8907,8908,9506
EPS containers	H	0402,0404,3903.11
Feminine hygiene	M	9619.00.10,9619.00.20
Flexibles/Film	H	3919,3920
Flexibles/Film packaging	H	1905
Fluorescent tubes	M	8539.31
Footwear	M	64
Fuel	M	2710.12,2710.19,2710.20,2711.12,2711.13
Gas bottles	M	7311,7613
Glass fines	M	7002,7018
Glass jars	M	7010,2007,2103,2005,7013,2001,2001.10,2001.90,2002,2003,2008
Glass other	M	7001,7003,7004,7005,7006,7007,7008,7009,7011,712,7013,7014,7015, 7016,7017,7019,7020,9001,9002,9617
HDPE containers	H	0403.90,0404,1517,3901.20,3915.10,3901.20,3923.21.25
Household chemicals	M	3402,3404,3405
LDPE containers	H	3901.10,3904.10,3904.21,3904.22,3916.10,3920.10
Lead acid batteries	H	8507.10
Lithium-ion batteries	H	8507.60
LPB	H	4804.42,4804.52,4811,3912.12
Medical waste	M	3002,3003,3004,3005,3006.70,8419.20,3822,9021
Metal not Al, Fe	H	74,75,78,79,80,81
Metal other	M	8309,2710.12.6,2710.19.6
Misc. machinery	M	8474
Mobile phones	M	8517.12
Mobile phones	H	8517
Nappies	H	9619.00.30,9619.00.40

Category	Priority	HS Codes
Non-rechargeable batteries	M	8506
Other plastic	M	3915.90,3926,3307,9404.21,9404.29,9612,3905,3906,3907,3908,3909,0910,3918.90,3917.31,3917.32,3917.33,3917.39,3917.40,3916.90,3921.13,3921.14,3921.19,3921.90,3922,3923.29,3923.30,3923.40,3923.50,3923.90,3925.20,3925.30,3925.90,3926
Other sanitary waste	M	4818
Paint	M	3207,3208,3209,3210,3212,3213
Paper	M	4707,4801,4802,4803,4804,4805,4806,4808,4809,4810,4812,4814,4815,4816,4817,4820,4821,4822,4823,49
PET containers	H	3917.21,3907.60,3920.62
Pharmaceutical	M	3006
Plastic Kitchenware	H	3924
Plastic Water Tanks	H	3925.10.90
PP containers	H	3902.10,3917.22,3920.20
PS containers	H	3903.19,3903.20,3903.30,3903.90,3915.20,3920.30,3921.11
Pumps and filters	M	8413,8421.21
PVC containers	H	3917.23,3904,3918.10,3915.30,3920.43,3920.49,3916.20,3920.43,3920.49
Rechargeable Batteries NiMH NiCD	M	8507.30,8507.40,8507.50
Plastic Bags	H	3923.21,6305
Rubber - not tyres	M	4001,4002,4003,4004,4005,4006,4007,4008,4009,4010,4014,4015,4016,4017
Scrap aluminium	H	76
Scrap iron	H	72,73
Steel containers	M	7310,7311,1602.10.50,2008.99.18,1902.30,3208,3209,3210,3211
Textiles	M	50,51,52,53,54,55,56,57,58,59,60,61,62,63
Toner cartridges	M	8443.99
Toys	M	9503,9504
TVs	M	8528.7
Tyres	H	4011,4012,4013
White goods	H	8516,8422.11,8421.12,8450,8418,7321,8415
Wood/timber	M	44,9401.50,9401.60,9403.30,9403.40,9403.50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