



SPREP
Secretariat of the Pacific Regional
Environment Programme



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Waste Audit Report REPUBLIC OF THE MARSHALL ISLANDS

September 2021



Supported by the Australian Government
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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.

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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 the Republic of Marshall Islands. 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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Executive Summary

Summary of audit activities

- Five surveys completed in Majuro and Ebeye
 - waste collection
 - sort and weigh
 - interviews
 - landfill audits
 - stockpile assessments
- Data collected across Majuro
 - 141 household samples
 - 133 household interviews
 - 31 commercial samples
 - 33 commercial interviews
 - 30 stockpile assessments
 - 20 landfill loads audited
- Data collected across Ebeye
 - 138 household samples
 - 126 household interviews
 - 28 commercial samples
 - 22 commercial interviews
 - 16 stockpile assessments
 - 4 landfill loads audited

Waste generation rates

- Majuro - Average household generation per day is 0.7kg
- Ebeye - Average household generation per day is 1.1kg.

Household key composition trends

- Majuro - Dominated by paper and cardboard, plastics and single use items.
- Ebeye - Dominated by plastics, paper and cardboard, hygiene and metals.

Commercial composition trends

- Majuro - Dominated by paper cardboard and plastics.
- Ebeye - Dominated by paper and cardboard and plastics.

Recovery of recyclables

- Majuro -aluminium cans, glass bottle and PET bottles collected under the Marshall Islands CDL scheme.
- Ebeye - low at the time of the audit. Potential for capture of aluminium cans and PET bottles under the Marshall Islands CDL scheme, to be implemented this year in Ebeye.

Stockpiles in the Marshall Islands

- Most commonly stockpiled materials in both Majuro and Ebeye are:
 - Metals (vehicles and heavy machinery)
 - Used oils.

Majuro Landfill composition

- 21.5% paper and cardboard
- 18.9% organics
- 14.1% plastics
- 9.5% metals
- 9.4% single use items
- 8.2% hygiene
- 8.2% other
- 2.1% glass
- 0.4% batteries
- 0.2% e-waste
- 0.1% fishing

Ebeye disposal site composition

- 28.0% paper and cardboard
- 26.2% plastics
- 12.2% metals
- 11.3% single use plastics
- 11.0% hygiene
- 4.2% organics
- 3.6% hazardous
- 1.5% e-waste
- 1.8% glass
- 0.2% other waste
- 0.0% batteries

Interview outcomes

- Majuro - Households - 6.6/10 level of satisfaction with the collection service. Commercials - 7.4/10 level of satisfaction with the collection service.
- Ebeye - Households - 8.0/10 level of satisfaction with the collection service. Commercials - 8.4/10 level of satisfaction with the collection service.

Acronyms

Abbreviation	Meaning
ADB	Asian Development Bank
CDL	Container Deposit Legislation
EPA	Environment Protection Authority
HDPE	High-density polyethylene
JSA	Job Safety Analysis
KALGOV	Kwajalein Atoll Local Government
KAJUR	Kwajalein Atoll Joint Utilities Resources
KASWMP	Kwajalein Atoll Solid Waste Management Plan
MALGOV	Majuro Atoll Local Government
MAWC	Majuro Atoll Waste Company
MEC	Marshall Energy Company
OEPPC	Office of Environmental Planning and Policy Co-ordination
PET	Polyethylene terephthalate
PRIF	Pacific Regional Infrastructure Facility
SIDs	Small Island Developing States
SPREP	Secretariat of the Pacific Regional Environment Programme
T+TI	Tonkin & Taylor International Limited
UNEP	United Nations Environment Programme

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/>

Introduction

The Secretariat of the Pacific Regional Environment Programme (SPREP) engaged Tonkin & Taylor International Limited (T+TI) to undertake a waste audit in the Republic of Marshall Islands. This report presents the findings of the waste audit undertaken for the Republic of Marshall Islands. 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 Majuro audit was coordinated on behalf of the Department of Environment by the Majuro Atoll Waste Company (MAWC). On Kwajalein Atoll the audit was coordinated by the Kwajalein Atoll Local Government (KALGOV). In view of the Covid-19 pandemic, T+TI worked remotely, supporting the delivery of the waste audit by working in collaboration with other key stakeholders. The audits took place in Majuro from 9 March to 23 April and Ebeye from 22 March to 9 April 2021.

The results from the Republic of Marshall Islands waste audit are part of a Pacific-wide audit programme being implemented by the SPREP and other agencies.

This audit is funded by SPREP through the EU-funded PacWaste Plus programme and with support from the Australian-funded Pacific Ocean Litter Project. 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 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.

This audit report details how the Republic of Marshall Islands Audit was delivered. The report is structured as outlined below:

- **Section 2** sets out the context for the audit including socio-economic background, statutory framework for waste management and existing waste services.
- **Section 3** highlight the existing waste services in Majuro and presents the audit findings.
- **Section 4** highlight the existing waste services in Ebeye and presents the audit findings
- **Section 5** presents the import and export data for the Republic of Marshall Islands
- **Section 6** presents a national assessment on waste management in the Republic of Marshall Islands based on the audit findings in Majuro and Ebeye.
- **Section 7** contains the annexes to this report.

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

COVID 19

The Republic of Marshall Islands has remained Covid-19 free with borders closed early in the pandemic. While tourism is a growing industry numbers in recent years have been very low meaning the impact of the Covid-19 pandemic on tourism related waste is not significant. Enhanced cleaning protocols to manage the risk of a Covid-19 outbreak have resulted in some increases in waste generated for disposal in Majuro and Ebeye.

The impact of the Covid-19 response in the Republic of Marshall Islands 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 Republic of Marshall Islands.

Background

Socio-Economic Background

The Republic of Marshall Islands are made up of 29 atolls and five islands located in the central Pacific Ocean. The population across the Republic of Marshall Islands was last assessed in 2019, with a population of approximately 58,800 people². The languages spoken include Marshallese and English. Over 74% of the population live on the capital island Majuro and the Kwajalein atoll (also known, and referred to herein, as Ebeye) in urban clusters. Urbanisation has been steadily increasing over the last two decades. The populations living in Majuro and Ebeye in 2019 are shown in **Table 1**.

Table 1: Population living in Majuro and Ebeye

State	Population ³	Households ¹
Majuro	27,797	4,013
Ebeye	11,408	1,103

Gross domestic product (GDP) of the Republic of Marshall Islands is US\$3,788 per capita (all reference to dollars is US). The main sources of income for the Republic of Marshall Islands are services (over 70% of GDP) followed by agriculture, industry, and manufacturing.

Tourism has become a larger proportion of GDP in recent years, with the Republic of Marshall Islands attracting over 6,800 visitors per year⁴.

The Republic of Marshall Islands economy faces challenges including:

- Remoteness from trade centres.
- Small labour force.
- Limited natural resources.
- Uneven spread of wealth across urban and rural areas and across islands.
- Vulnerability to natural hazards and climate change.

At the time of conducting the waste audit Covid-19 had been declared a global pandemic by the World Health Organisation. Like many other Pacific Island nations, the Republic of Marshall Islands has avoided an outbreak by closing international borders. This has meant that the Republic of Marshall Islands have had no tourist visitors since 8 March 2020. In September 2020 the Asian Development Bank (ADB) forecast⁵ the Republic of Marshall Islands GDP growth rate to be -5.5% in 2020 and -1.4% in 2021.

² Data.worldbank.org 2019 Population, Marshall Islands

³ PRIF 2021 Republic of the Marshall Islands. <https://www.theprif.org/country-profile/republic-marshall-islands>

⁴ World Data.info 2021 Tourism on the Marshall Islands <https://www.worlddata.info/oceania/marshall-islands/tourism.php>

⁵ ADB 2021 Economic indicators for the Marshall Islands <https://www.adb.org/countries/marshall-islands/economy>

Legislation

The summary of relevant legislation provided in **Table 2** has been sourced from the *Stocktake of existing and pipeline waste legislation report*⁶.

Table 2: Legislation summary

Legislation name	Description
National Environment Protection Act 1984	Establishes the National Environment Protection Authority (EPA) and regulates the prevention of water, air, and land pollution through standards for solid waste collection, storage, and disposal.
Littering Act 1982	Littering outlined as an offence.
Office of Environmental Planning and Policy Co-ordination (OEPPC) Act 2003	Co-ordination of environmental programs.
Public Health, Safety and Welfare Act 1996	Regulates sanitation including toilets and rubbish. The legislation stated that rubbish that can attract animal and insects are prohibited.
Styrofoam Cups and Plates, and Plastic Products Prohibition and Container Deposit Act 2016	Prohibits the import, manufacture, sale or distribution of Styrofoam cups and plates, disposable plastic cups and plates, and plastic shopping bags. Establishes the container deposit program and a recycling fund.
Styrofoam Cups and Plates, and Plastic Products Prohibition and Container Deposit (Amendment) Act, 2018 (P.L. 2018-54).	Container deposit legislation (CDL) was introduced to the Marshall Islands, specifically Majuro in August 2018. MAWC is the current Recycling Program System Operator. The same CDL laws and regulations apply in Ebeye, but KALGOV has yet to implement the CDL. Establishment of the CDL has been listed as a key focus of the Kwajalein Atoll Solid Waste Management Plan (KASWMP).
Ministry of Environment Act 2018	Establishes the minister for the Environment portfolio.

There is currently no specific waste management legislation in place in the Republic of Marshall Islands. There are several national regulations and state laws and regulations relevant to waste management. A Solid Waste Management Plan exists for both Ebeye and Majuro and provides some analysis and context for waste management.

Waste Management Protocols

Pipeline legislative activities for waste management and governance in the Republic of Marshall Islands (March 2020) include:

- **National Waste Policy** – A national waste policy is currently being developed. No delivery date was publicly available.
- **Container deposit schemes** – Implementation of a container deposit scheme proposed under 2016 legislation is ongoing in Ebeye and established in Majuro as noted in Table 2.
- **Waste to energy supporting regulatory framework** – There is an investigation of a waste to energy project in the Republic of Marshall Islands and it is reported that this project will require ongoing monitoring and support.

Further information on waste legislation can be sourced in the references noted above.

⁶ Stocktake of existing and pipeline waste legislation: Republic of Marshall Islands. Prepared by the Melbourne Law School at the University of Melbourne, Australia with technical assistance from Monash University. 16th March 2020.

Stakeholders - Roles and Responsibilities

Government departments with waste responsibilities in the Republic of Marshall Islands are set out in **Table 3**.

Table 3: Key organisations with responsibility concerning waste management in the Republic of Marshall Islands

Stakeholder	Location	Responsibility
National Government		
Department of Environment of the Ministry of Natural Resources	Majuro Atoll	National level policy, regulation, and legislation.
Local Government (Atoll)		
Majuro Atoll Local Government (MALGOV)	Majuro Atoll	Collects some waste (generally garden organics and waste from public urban and park areas).
Kwajalein Atoll Local Government (KALGOV)	Kwajalein Atoll (Ebeye)	Responsible for waste collection, operation, and maintenance of the final disposal site. KALGOV through contract to EPA will be the recycling program operator which includes operating the program.
Environment Protection Agency (EPA)	Kwajalein Atoll (Ebeye) Majuro Atoll	Perform inspections of the disposal site to ensure environmental standards are met, organisation of recycling, promotion of recycling and environmental education is undertaken. Monitor and ensure the safe and secure handling of all regulated hazardous waste.
Subordinate Agencies		
Majuro Atoll Waste Company (MAWC)	Majuro Atoll	MAWC was established in 2007 under the Ministry of Public Works. MAWC is responsible for waste collection, operation, and maintenance of the final disposal location.

Waste Services

Information on waste services and facilities has been summarised from the relevant Solid Waste Management Plans including:

- Kwajalein Atoll Solid Waste Management Plan, 2019-2028, KALGOV.
- Solid Waste Management Plan for Majuro, 2019-2028, MAWC.
- Report and Recommendation of the President to the Board of Directors, Proposed grant, Republic of Marshall Islands: Ebeye Solid Waste Management Project, Asian Development Bank, November 2020.

Audit Team

Roles and Responsibilities

The audit was undertaken by a T+TI project team working closely with local agencies. An overview of the team is provided in **Table 34**.

Table 3: Project team for waste audits of Ebeye and Majuro

Role	Ebeye	Majuro
Team Leader	Chris Purchas (T+TI)	
Waste Auditor	Anna Ainsworth (T+TI)	
Country Coordinator	Scott Paul	Halston de Brum
In country Focal Point	Morine Bettere	Jacqueline Lakmis
Audit team	6 staff from KALGOV	4 staff from MAWC
Number of attendees at audit training	20	8

The T+TI project team intended to be present in the Republic of Marshall Islands for some or all of the audit period. Travel restrictions due to the Covid-19 meant that the T+TI team participated remotely. The T+TI Country Coordinator was 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.

Responsibilities

A description of the responsibilities for each role has been provided in **Table 4**.

Table 4: Responsibilities of the project team

Role	Responsibilities
Team Leader	Provide effective communication of progress for the waste audit. Provide regular reporting and updates to the SPREP Project Manager and Republic of Marshall Islands Focal Point.
Country Coordinator	Provide remote support for the duration of the waste audit. Provide daily feedback to the in country focal point and audit team.
Waste Auditor	Reporting of the waste audit for the Republic of Marshall Islands.
In country Focal Point	Supervising the physical audits in Country on the ground with remote support from the Country Coordinator and Waste Auditor.

Audit Planning

An Audit Plan⁷ for the Republic of Marshall Islands was prepared by T+TI. 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 atoll 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.

Personal protective equipment required for the audit was provided by T+TI and was shipped from New Zealand to Ebeye and Majuro.

⁷ T+TI, 22/12/2020 *Republic of Marshall Islands Audit Plan*. Prepared for SPREP. T+TI ref: 1013155.

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.
- Scales for the sort and weighing of waste samples.

Equipment unable to be shipped, but sourced in the country included:

- Vehicles required to collect waste samples and undertake stockpile assessments were hired in country.
- Petrol for use in the hire vehicles.
- Raincoats to work during wet weather.
- Bins and sorting containers.
- 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, a requirement for those team members involved in this part of the audit to receive vaccinations of Tetanus, Hepatitis A and B (where available). Due to the Hepatitis A vaccine not being available in Republic of Marshall Islands, only Hepatitis B and Tetanus were given. Proof of vaccinations for the in-country audit team is provided to T+TI.

T+TI produced a Job Safety Analysis (JSA) for waste audits undertaken in Ebeye and Majuro. This provides details on the audit methodology and describes the hazards associated with the tasks undertaken as part of the audit. Each hazard was considered individually, and mitigation measures implemented.

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

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.
- Provision for telephone or video conference delivery from a remote team.

The audit process and data collection approach were 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 fashion⁸.
- Live or end of day data submission to allow review of data collected⁹.

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 was 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.

Training of the waste audit team was undertaken on 27 February 2021 for Majuro and 13, 19 20 March 2021 for Ebeye and involved a range of guides and training materials. The training for the Marshall Islands audit teams was managed by the T+TI (Waste Auditor) remotely providing introductions with the in-country project team.

The 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.
- “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.

⁸ Data collected through Survey 123 and received by T+TI on ArcGIS Enterprise

⁹ 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 on each atoll are listed in **Table 56**.

Table 5: Key waste audit delivery partners

Ebeye	Majuro
<ul style="list-style-type: none"> • Ministry of Natural Resources – Department of Environment • Ministry of Social Services – Department of Health • Finance and Planning – Customs Department • Ministry of Infrastructure – Department of Works • Chamber of Commerce – Commercial Sector • Kwajalein Atoll Local Government (KALGOV) • Community 	<ul style="list-style-type: none"> • Ministry of Natural Resources – Department of Environment • Ministry of Social Services – Department of Health • Finance and Planning – Customs Department • Ministry of Infrastructure – Department of Works • Chamber of Commerce – Commercial Sector • Majuro Atoll Waste Company (MAWC) • Community

Several key stakeholder groups supported the delivery of the audits with details of the consultation and engagement activities included in **Table 6**.

Table 6: Stakeholder engagement undertaken

Stakeholder	Description of Audit Interface	Stakeholder Engagement
Householders	Bag collection Interviews	<ul style="list-style-type: none"> • Letter delivery providing details of audit to participating households¹⁰ • Media release through Facebook • Description on local radio in the week prior to the audit • Face to face interviews
Commercial owners	Bag collection Interviews	<ul style="list-style-type: none"> • Letter delivery-providing details of audit to participating commercials¹¹ • Media release through Facebook. • Description on local radio in the week prior to the audit • Face to face interviews
Commercial operators (collectors and disposers)	Landfill disposal operators	<ul style="list-style-type: none"> • Face to face discussions • Interviews where required

¹⁰ Delivered to households explaining audit and instructions to leave bags at entry to driveway prior to audit.

¹¹ Delivered to commercials 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 7**

The audit methodologies for each atoll are detailed in the Republic of Marshall Islands Audit Plan (Appendix A). The methodology applied has been derived from the Waste Audit Methodology – A step-by-step manual to conduct comprehensive waste audits in SIDs¹², attached as an Appendix to the audit plan. The audit plan was developed based on the most recent household and commercial statistics from the Economic Policy, Planning and Statistics Office. The target sample numbers reflected experience on similar audits and were intended to ensure adequate data to provide a statistically valid estimate of waste characteristics and quantity. The sample size 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 samples sizes determined for Ebeye and Majuro were:

- Ebeye: 80 households and 20 businesses
- Majuro: 120 households and 30 businesses

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. 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 7: 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. The location was also photographed to assist in identifying the location for Component 3. Bags of two sizes (120 litre and 240 litre) were provided for the audit, these were then put out for collection by 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 the landfill/disposal site 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 uses 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 has been collected a second team returned to complete an interview. The interview was recorded on a standard form.
4 Landfill audit	Audits were completed at Majuro and Ebeye disposal sites. 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 by KALGOV and MAWC. Stockpiles in Ebeye and Majuro were assessed during the audit. Materials characteristics and quantity were estimated. Each stockpile was recorded including photographs and estimated composition and quantity.

¹² Published by PRIF

Identification of Households and Commercial Premises

Maps showing sample locations by household and commercials were provided to the Majuro audit team and blank maps were provided to the Ebeye audit team for them to identify households and commercials. 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 in **Figure 1** and **Figure 2**.

Knowledge of collection arrangements was considered when identifying a random and representative sample.



Figure 1: Sample locations in Ebeye



Figure 2: Sample locations in Majuro

Summary of Data Collected

The total number of household and commercial samples, stockpile assessments completed, and landfill loads audited in Ebeye, and Majuro are summarised in **Table 8** which discusses the difference between sample plan targets and actual sample numbers.

Table 8: Summary of sample numbers collected in the Marshall Islands¹³

Sample type	Ebeye Actual Sample	Ebeye Sample Plan	Majuro Actual Sample	Majuro Sample Plan
Household				
Samples taken	138	80	141	120
Interviews	126	80	133	120
Commercial				
Samples	28	20	31	30
Interviews	22	20	33	30
Stockpile assessments	16	n/a	30	n/a
Landfill load audits	4	n/a	20	n/a

Several factors discussed below resulted in the difference between the sample plan, the actual audit numbers for this audit and data presented in this report. These were:

- 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 that are identified during quality assurance.
- For both Majuro and Ebeye, the teams collected additional samples for sorting and weighing and follow up interviews to account for early data discrepancies and provide additional sample points in the event of samples being excluded during quality assurance.
- Outliers in composition is also an important consideration when presenting the data.

When producing waste composition data for this project, a robust quality assurance and data review process was employed, 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.

Where data was excluded from calculations due to the confidence interval, this has been noted throughout the report. Both Majuro and Ebeye audit teams collected more samples than initially targeted in the sample plan. This ensured that a representative number of samples would be used in calculations, following the removal of data outside of the confidence intervals.

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.

¹³ Data derived from the waste audits undertaken in the Marshall Islands

Key aspects include are illustrated in **Figure 2**.

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 Waste audit specialist would then feedback findings to the country coordinator daily or more frequently as required, creating a continuous feedback loop (**Figure 2**).

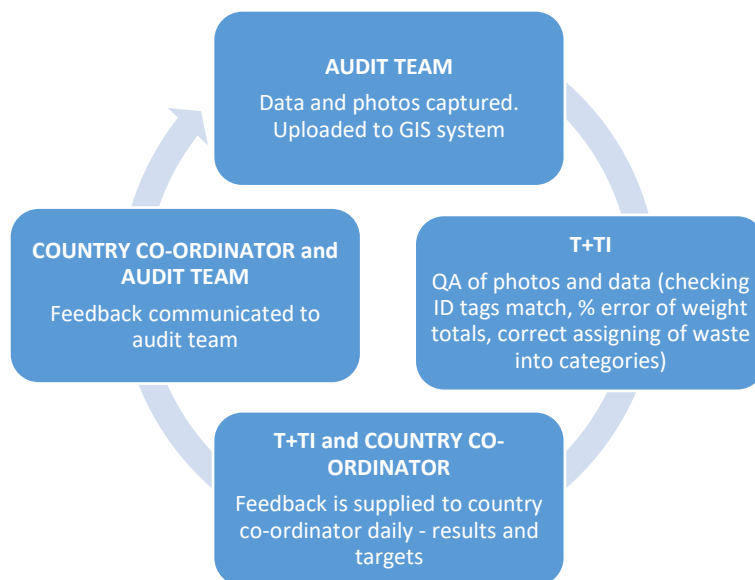


Figure 2: Continuous feedback loop in place to ensure quality of audit outputs.

Majuro Atoll

The audit was undertaken between 9 March and 23 April 2021, excluding Saturdays and Sundays.

Majuro Waste Services

Household Waste

Solid waste collection for the island of Majuro is provided by MAWC daily, six days a week (Monday to Saturday).

The roadside collection service offered across Majuro is split by area:

- The collection services from Laura to Rita is undertaken along primary roads. Household waste is collected free of charge, with the cost covered by Government. Waste is contained within 360 litre wheelie bins. It is common practice that a single bin is shared by multiple households.
- The collection area from the Airport and Laura uses the Iokwe Bag system (designed for Majuro). This system requires users to purchase a prepaid bag, which they put out for collection.

Some households opt to transport their own waste directly to Majuro Landfill. Garden organics and bulky waste is collected free of charge on Saturdays.

MAWC receive a subsidy from the Government which helps fund the household waste collection service. The subsidy does not fully cover the operational cost to deliver the service.

Household Recycling

There is no recycling collection service provided at the roadside in Majuro. There is, however, the Majuro CDL scheme, which requires users to deliver their recyclables to drop off points.

The materials currently targeted by the scheme are:

- Aluminium cans
- PET beverage containers (**Figure 3**)
- Glass beverage bottles

Those who use this scheme currently receive five cents for depositing a single container. One cent is claimed by the Recycling Program System Operator (MAWC) as a handling fee.



Figure 3: PET bottles at the Majuro Landfill

Commercial Waste

Commercial businesses in Majuro can either have their waste collected by MAWC or self-haul to the landfill. It is common practice for larger companies (such as supermarkets) to transport their own waste to the landfill.

Businesses wanting to use the roadside collection are required to pay a fee, which is dependent on container size. Typically, 96-gallon (360 litre) wheelie bins and two/four-yard skips are available for use. It is common for multiple businesses to use the same bin. As of July 2017, 109 commercial customers had a contract with MAWC for waste collection.

MAWC Charging for Commercial Waste Collection

Waste collection fees for commercials in Majuro are charged monthly, these are:

- two cubic yard bin: \$24/month.
- four cubic yard bin \$48/month (minimum two pickups).

Other Government Departments provide free of charge waste collection services in areas of Majuro where MAWC do not offer a collection service. Departments are the Majuro Atoll Local Government, Ministry of Works, Utility and Infrastructure and Office of Commerce, Investment and Tourism. Public place bins, bulky waste (e.g., vehicles), and on occasions green waste collections, are provided.

Hazardous Waste

Hazardous waste found on Majuro includes batteries, e-waste, asbestos, waste oil and medical waste.

Batteries

There is currently no separation of batteries due to space constraints at the landfill and equipment not being available to enable separation of batteries from the mixed waste stream.

Batteries have previously been collected at the landfill and stored out in the open, separately to mixed waste. MAWC used to buy batteries from the public for US \$0.30/kg and the EPA exported these batteries under the Basel convention protocol. Previously separated batteries are stored on site.

Medical Waste

A private waste company is contracted by the Ministry of Health and Human Services (Hospital operator) to collect and transport medical waste to the MediBurn 30 incinerator located in the ISI's compound.

Waste Oil

Waste oil from vessel fleets, garages, and the Marshall Energy Company (MEC) power stations is managed by the MEC. By 2019, waste oil stores had built up to 1.3 million gallons and stored between MEC's Delap Tank Farm and Kwajalein Atoll Joint Utility Resources Inc (KAJUR) Power Plant in Ebeye. In December 2018 with the help of international funding, MEC made physical improvements to the storage units to ensure the waste oil was secured safely.

From November 2019, MEC began exporting waste oil to South Korea for disposal and recycling. Through the contract, 36,000 gallons per month of waste oil was exported between November 2019 to June 2020. This increased to 60,000 gallons per month from July 2020. It is expected that all waste oil which has been stored at MEC for the past 30 years will be exported by June 2021¹⁴. Current stockpiles are expected to be 12,000 gallons (413 tonnes) remaining. See section 0 Stockpiles in Majuro for further detail.

Waste oil production is expected to decrease over time with improved fuel quality and machinery efficiency. Annual waste oil volumes collected by MEC are 37,000 gallons, with an expectation that this will reduce to 28,800 per annum by 2025 across the Republic of Marshall Islands.

There is no handling of waste oil by MAWC.

Asbestos¹⁵

In July 2014, PacWaste conducted a baseline asbestos survey and identified the following:

- Very few asbestos containing materials are present in Majuro.
- The College of the Republic of Marshall Islands is considered a moderate to high-risk area with the presence of 660m² of asbestos containing material present in the construction of the buildings.
- There are no stockpiled asbestos materials at the landfill site.

¹⁴ <https://www.mecrmi.com/index.php/reducing-the-waste-oil-stockpile/>

¹⁵ PacWaste Country Profile, Republic of Marshall Islands

Waste Facilities

There is one public landfill located at Jable Baktan, Majuro (Figure 4 and Figure 5).



Figure 4: Majuro Landfill location



Figure 5: Majuro Landfill¹⁶

Landfill Infrastructure

Majuro Landfill covers an area of 1.62 hectares and is operated by MAWC. Equipment located at the site includes two excavators (1.2m³ manufactured in 2011 and 2014) and two loaders (3.8m³ and 2.2m³, both manufactured in 2011).

An incinerator was installed in early 2017 and was only in use for approximately two years. The incinerator is rarely used for the following reasons:

- Absence of an exhaust treatment made it unsuitable to operate given the landfill location.
- The landfill area is fully utilised for filling and associated activity, leaving very little space for operations of the incinerator.
- Absence of proper shelter, the incinerator does not operate during rainy days.

¹⁶ Picture taken during the Majuro waste audit (March 2021)

Composting Infrastructure

MAWC signed a 30-year lease for land located in Laura to be used as a composting facility. The building was constructed in December 2019. A lack of equipment to enable the transportation of garden organic wastes to the composting facility from the landfill has resulted in garden organics being landfilled at Majuro Landfill.

Garden organics transported directly to the composting facility is currently chipped onsite. The volume of garden organics accepted at the site is unknown. The site is not currently composting due to a lack of other inputs used in the past (fish waste and copra cake).

Charging at the Landfill

Household waste transported directly to the disposal site does not require a payment fee. However, commercials who deliver waste directly to the facility are required to pay for tipping. The fee is collected by a representative at the landfill who controls access.

MAWC fees for commercial waste are:

- General waste (pickup truck or smaller) - \$5 during business hours (8:30-17:00).
- General waste (pickup truck or smaller) - \$8 outside of business hours (17:00-22:00).
- Bulky mixed waste (long bed truck and larger)- \$10 during business hours (8:30-17:00).
- Garden organics only (long bed truck 3 ton and smaller) - \$3 during business hours (8:30-17:00).
- Garden organics only (long bed truck 3 ton and smaller) - \$5 outside of business hours (17:00-22:00).
- All waste (all types of vehicles) delivered outside of business hours - \$10 after 22:00 and Sundays.

Inputs to Landfill

The landfill accepts all households and commercial waste from either the MAWC roadside or self-haul. The landfill does not accept waste oil, or medical waste.

Waste segregation is only undertaken at the landfill if items can be easily removed and can be sold back to the public. Some scrap metals and white goods are also separated out from the mixed waste stream. Due to a lack of viable markets this material is landfilled.

Wastes are tipped onto a concrete pad at the site and an excavator moves it onto the landfill mound. No waste compaction is undertaken on site and the waste mound was recorded at 17m above ground level in 2017.

The site is regularly closed (between one and two days per week) to commercials, due to the limited capacity of the concrete dumping pad. Only waste collected through the MAWC roadside collection services are allowed into the site after daily working hours. Commercials arriving at the site after closing hours, are required to return the next day once the concrete pad has been cleared. This is dependent on the availability of equipment and machinery; therefore, the landfill could be closed for several days per week to commercials.

Segregated garden organics delivered to the landfill has previously been transported to the compost facility when equipment has been available. All equipment used for transporting garden organics is currently under maintenance.

Table 9: Materials accepted at Majuro Landfill

Material	Storage	Further Details/Management
Glass bottles	Open, separate area to mixed waste.	Beverage bottles only are stored separately from other waste streams. There is no onward sale, but under the CDL scheme MAWC pay \$0.05/unit. The glass bottles collected under the CDL scheme are landfilled. Other glass bottles (not under the CDL scheme) are disposed to directly to landfill.
Aluminium cans	Open, separate area to mixed waste.	Aluminium can (collected under the CDL scheme) are stored separately from other waste streams. Under the CDL scheme MAWC pay \$0.05/unit. Aluminium cans collected in this way are exported.
PET beverage containers	Open, separate area to mixed waste.	Beverage containers are stored separately from other waste streams. Under the CDL scheme MAWC pay \$0.05/unit PET bottles collected under the CDL scheme are landfilled.
Tyres	Open, separate area to mixed waste.	Tyres are stockpiled in Arrak, Laura, Ajeltake near Airport. Tyres not used for community projects are landfilled.
Garden organics	Landfill	Garden organics delivered separately to general waste are currently sent to landfill. Equipment used for the transportation of green waste to the composting facility is not currently available. There is no separation of garden organics from the mixed waste stream at the landfill. Some garden waste is delivered directly to the composting facility (Refer Section 2.5.1.5.2).
Other wastes		
E-waste	Open, separate area to mixed waste when white goods are delivered separately.	White goods delivered separated to the landfill are broken down and useable parts are on sold to the public. All other e-waste is sent to landfill. There is evidence of illegal dumping of e-waste, identified through the stockpile assessment survey.
Scrap waste	Dedicated area outside at the landfill	Segregated for recycling prior to entering the landfill.
Batteries	Previously batteries have been segregated and exported.	There is currently no segregation of batteries at the landfill from the mixed waste stream. Batteries currently stored at the landfill are awaiting export.
Gas bottles	Dedicated area outside at the landfill.	No segregation of gas bottles from mixed waste stream. No export is undertaken.

Majuro Waste Audit Findings

Household Audit Findings

The household sample collection identified that a significant proportion of household waste, mainly bulky waste items is stored on individual properties.

Access to Waste Collection Services

Access for households to a waste collection service has been provided in **Table 10**, this summarises feedback on the collection service for households including a waste collection rating, recorded for Majuro (**Table 10**).

Table 10: Summary of access to collection services

Item	Comment
Total interviewed	133
% with access to collection service	82.7%
Average collection service rating	6.63/10
Comments	<ul style="list-style-type: none"> • Lower ratings were due to waste not being collected to schedule or waste being spilled during collection/transport. • 84/133 households reported that they require a bin or requested additional waste bin/s. • 54/133 households requested the collection of waste bags in addition to bins.

It is common practice for a number of options to be selected by householders and commercials for the same waste stream (**Table 11**). For example, in some household's food scraps were recorded being fed to animals or pets.

Table 11: Waste management activities adopted by households

Material	Disposal options
Waste	<ul style="list-style-type: none"> • Collected through the waste collection service • Transported to landfill • Dumped, not at the landfill
Garden organics	<ul style="list-style-type: none"> • Collected separately once per week • Transported to landfill • Dumped, not at the landfill
Sanitary	<ul style="list-style-type: none"> • Collected through the waste collection service • Transported to landfill • Dumped, not at the landfill
Bulky items	<ul style="list-style-type: none"> • Collected separately once per week • Transported to landfill • Dumped, not at the landfill
Food scraps	<ul style="list-style-type: none"> • Collected through the waste collection service • Transported to landfill • Dumped, not at the landfill • Store at household

The identified management activities adopted by householders is due to the following reasons:

- Request for containers and a waste collection to be provided.
- Collection of bulky wastes requested, even with the separate bulky waste collection currently provided.
- New waste bins requested.
- Collections timing to be on schedule.
- Additional containment for waste requested.

Participants were asked “How much are you willing to pay for waste collection per week (total cost)?” The response is presented in **Table 13**¹⁷.

Table 13: Willingness to pay

Willingness to Pay	Percentage Composition
Nothing	100%
Under \$1	0%
\$1 to \$2	0%
\$2 to \$3	0%
\$3 or more	0%

Household Waste Composition

Typical roadside waste containers and examples of waste put out for collection can be seen in **Figure 6**.



Figure 6: Typical waste collection from households in Majuro

The average composition of waste by weight from households in Majuro is shown in **Figure Error! No text of specified style in document.** 7. The graph presents the proportion of waste by category for waste from households placed for collection.

¹⁷ Participants were also asked about their willingness to pay for a 120L, 240L and 360L bags, with the same response.

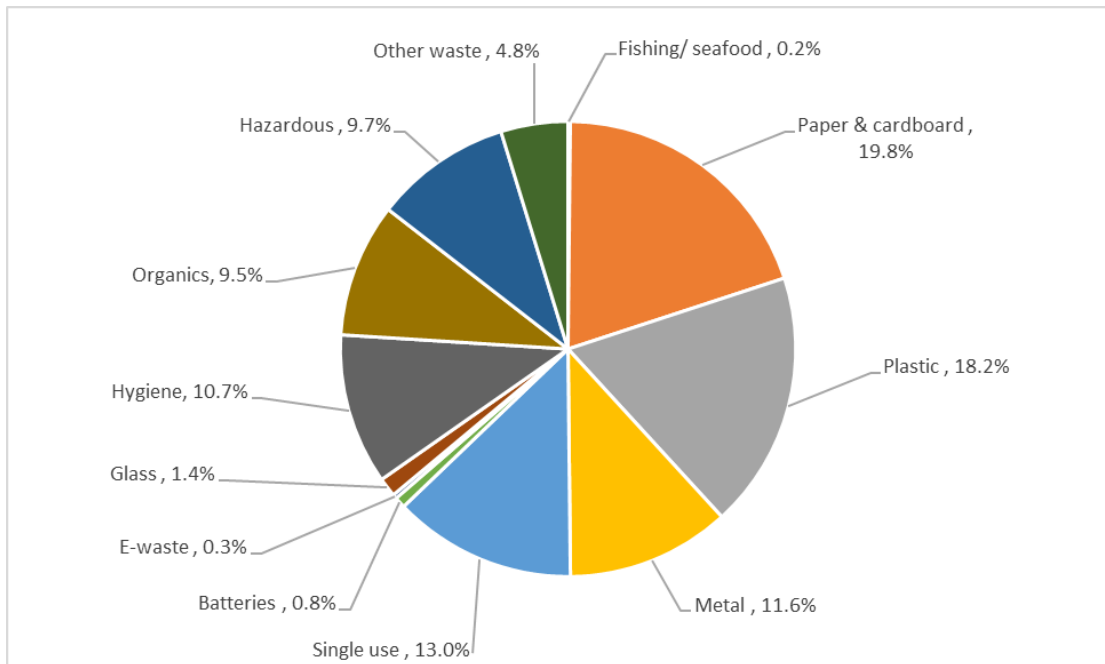





Figure Error! No text of specified style in document.7: *Majuro average household waste composition summary*

Key audit findings by category and photos have been identified in **Table14**.

Table 14: Waste material findings

Waste Material	Description	Picture
Paper and cardboard	Dominated by cardboard boxes.	
Plastics	Dominated by soft plastics. Plastic drinks containers – small (0.6 litre) water bottles (PET), 0.6 litre Coca Cola, small and larger juice bottles (various).	
Single use items	Dominated by coffee cups and paper takeaway containers.	

Waste Material	Description	Picture
Hygiene	Dominated by nappies.	No photos provided due to lower proportions in samples. Composition by weight between 9%-12%.
Metals	Dominated by food cans: small tins (coated steel) various sizes and brands.	
Hazardous	Dominated by gas canisters.	
Organics	Mostly garden organics.	
Glass	Coffee jars and sauce bottles.	

Other waste and glass were also present in the samples. There were low proportions of e-waste, batteries and fishing related items observed in the household waste.

The lower and upper range for each component of household waste have been calculated at a 95% confidence interval and are presented in **Table 14** and **Figure 8**. This provides a measure of the range of estimated proportion for each material that might be expected for repeated composition surveys for households in Majuro.

Interviews with householders has provided the data we have used to estimate the average quantity of waste (4.6kg per week) from sampled households for Majuro¹⁸.

The estimated generation of waste per household per day is 0.7kg (within a range of 0.1kg – 2.4kg per household per day).

¹⁸ The data used to calculate the composition of waste collected from households in Majuro 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 12: Waste composition for households identified as part of the sort and weigh of samples for Majuro¹⁹

	Fishing/ Seafood	Paper and Cardboard	Plastics	Metals	Single Use Items	Batteries	E-waste	Glass	Hygiene	Organics	Hazardous	Other Waste
Composition	0.2%	19.8%	18.2%	11.6%	13.0%	0.8%	0.3%	1.4%	10.7%	9.5%	9.7%	4.8%
Combined sample weights (kg)	2.2	265.4	244.5	156.0	174.4	10.5	4.1	18.1	143.7	127.5	130.5	63.8
Average weight per sample (kg)²⁰	0.03	3.1	2.9	1.8	2.1	0.1	0.0	0.2	1.7	1.5	1.5	0.8
Lower range	0.0%	18.0%	18.8%	10.1%	11.2%	0.0%	0.0%	0.0%	6.0%	6.2%	7.1%	2.1%
Upper range	0.8%	22.0%	21.7%	14.7%	14.9%	2.0%	0.9%	1.9%	12.1%	13.4%	11.2%	5.5%

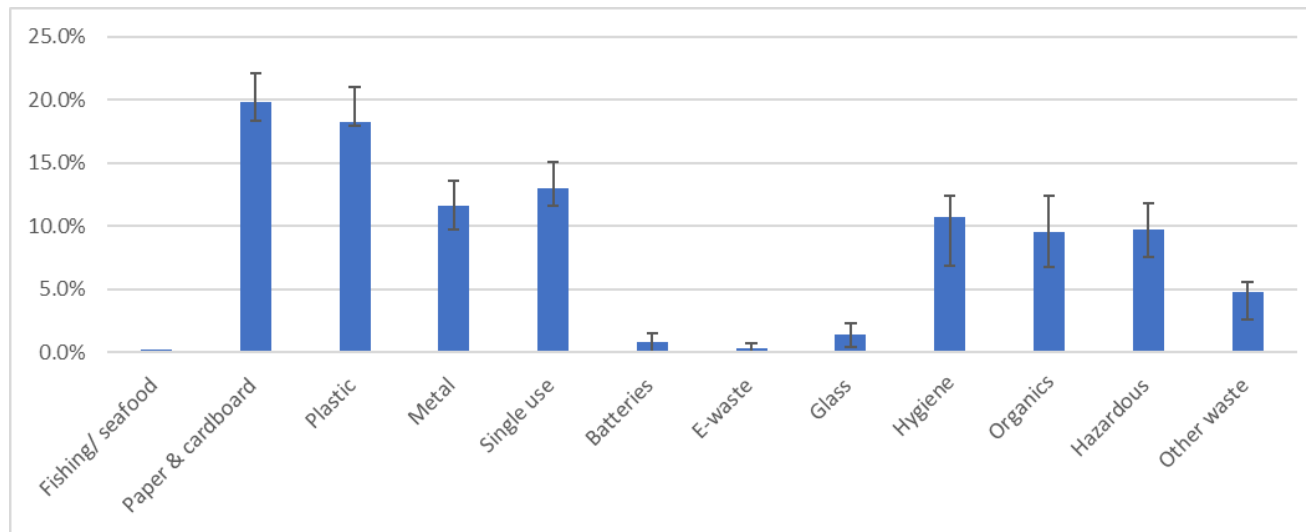


Figure 8: Waste composition for households identified as part of the sort and weigh of samples collected for Majuro

¹⁹ Confidence interval of +15% and -15% applied during data analysis. 85/141 samples were within this range and have been used to derive the composition.

²⁰ Count of all data used (85). 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 those materials identified. Paper and cardboard, plastics, metals, and single use items were present in the waste stream.

Key points to note:

- Paper and cardboard and metals and are present at a relatively high proportion of the total household waste stream (both easily recycled where markets are accessible).
- Plastics are present with a high proportion of single use items (soft plastics) suitable for recycling if markets can be secured.
- Improvement of the existing system to ensure that targeted recyclables are effectively collected.

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.

Detailed observations for potentially recyclable materials identified in the waste samples has been provided in **Table .**

Table 15: Observations by material

Material	Key Materials	Detail on Observations
Paper and cardboard	Dominated by cardboard boxes.	Other cardboard items include egg boxes, food, and non-food cardboard packaging.
Metals	Dominated by food cans: small tins (coated steel) various sizes and brands.	The data provided is the sample of households from across Majuro. Household interviews reported an average of 3.1 (3) drinks can per person, per household, per week. The range varied between 0 to 40 cans per week between samples collected. Using the average from the household interview data collected, across Majuro, this equates to 84,979 cans per week for the population (est 27,797). Over one year this is estimated to be around 4,418,905 drinks cans ²¹ per year. This is considered at the upper end of the number of drinks cans likely to be produced ²² .
Plastics	Dominated by soft plastics. Plastic drinks containers – small (0.6 litre) water bottles (PET), 0.6 litre Coca Cola, small and larger juice bottles (various).	Household interviews reported an average of 2.1 plastic water bottles per person per household per week with a range of 0 to 35 bottles per person, per week. Using the average from the household interview data collected, across Majuro this equates to 59.018 per week for the whole population (27,797). Over one year this is estimated to be around 3,068,933 plastic bottles per year. This is likely to be at the upper end of the number of water bottles produced per week.

²¹ Note the number of drinks cans and plastic bottles are based on the data collected from the audit data only.

²² 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 Audit Findings

The total number of commercials audited by type is shown in **Table 13**, 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 13: Commercial waste sample numbers

Commercial Type	Sorted and Weighed	Interview
Retail and trade	9	17
Freight and transport	1	1
Accommodation	8	11
Offices	1	1
Healthcare	1	1
Manufacturing	1	1
Trade	0	1
Total	21	33

Access to Waste Collection Services

Table 16 summarises feedback on the collection service including a waste collection rating.

Table 16: Summary of access to collection services²³

Total Interviewed	33
% of commercials who use a collection service	64%
% of commercials who do not access the collection service	36%
Average collection service rating	7.4/10 ¹
Commentary to the collection service rating	<p>Comments provided by commercials were like the responses received from households:</p> <ul style="list-style-type: none"> • Lower ratings were due to waste not being collected as per the collection schedule or waste being spilled during collection/transportation. • A number of commercials (16/33) reported that they require an additional waste bin. • A number of commercials (9/33) requested for the collection of waste bags as well as the existing bin collection.

²³ Data collected and recorded in survey 123 app, from interviews held with commercials

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 14**.

Table 14: Options for waste management adopted by commercials

Material	Disposal Options
Waste	<ul style="list-style-type: none"> Transported to the landfill Collected as part of the waste collection service
Garden organics	<ul style="list-style-type: none"> Transported to the landfill Collected as part of separate Saturday collection
Sanitary	<ul style="list-style-type: none"> Transported to the landfill Collected as part of the waste collection service
Bulky items	<ul style="list-style-type: none"> Transported to the landfill Collected as part of separate Saturday collection
Food scraps	<ul style="list-style-type: none"> Transported to the landfill Collected as part of the waste collection service

Participants were asked “How much are you willing to pay for waste collection per week (total cost)?” The response is presented in **Table 17**.

Table 15: Willingness to pay - commercials

Willingness to pay	Percentage composition
Nothing	100%
Under \$1	0%
\$1 to \$2	0%
\$2 to \$3	0%
\$3 or more	0%

Commentary and observations made through these interviews are noted below.

- Request for waste collection
- Request for waste bags and bins.
- Request for gloves.
- Bins to be provided for different types of waste.
- Collection to be on schedule.

Commercial Waste Composition

The composition of commercial waste collected, sorted, and weighed for Majuro is shown in **Figure 9**.

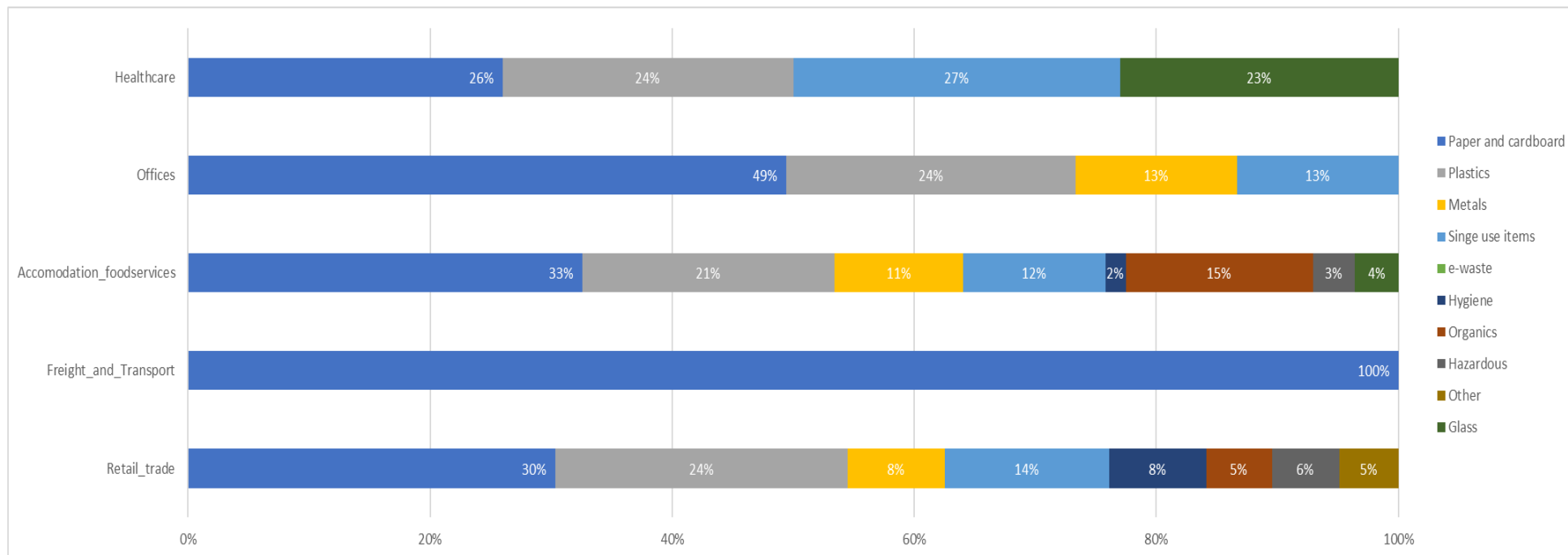



Figure 9: Composition of waste from commercials by type in Majuro

The combined data (for 21 commercial premises) provides an indicator of commercial waste composition overall. The samples sorted and weighed, provide a snapshot of the likely composition from these types of commercials.

The data collected suggests that the dominant waste categories across the commercial types surveyed were paper and cardboard and plastics.

Table 16: Waste material findings

Waste Material	Description	Pictures from the Audit
Paper and cardboard	Dominated by cardboard boxes and cardboard packaging, dominating the freight and office samples.	
Plastics	Dominated by soft plastics, food containers – sauces, non-consumable liquid containers.	
Single use items	<p>Plastic containers – mainly single use items for example: plastic takeaway food containers (PET, PP) plastic takeaway cups (PET or PP).</p> <p>Single use items included: straws, plastic drinks containers and supermarket bags.</p>	

Waste Material	Description	Pictures from the Audit
Organics	Food organics and garden organics present only in the healthcare and foodservice samples.	

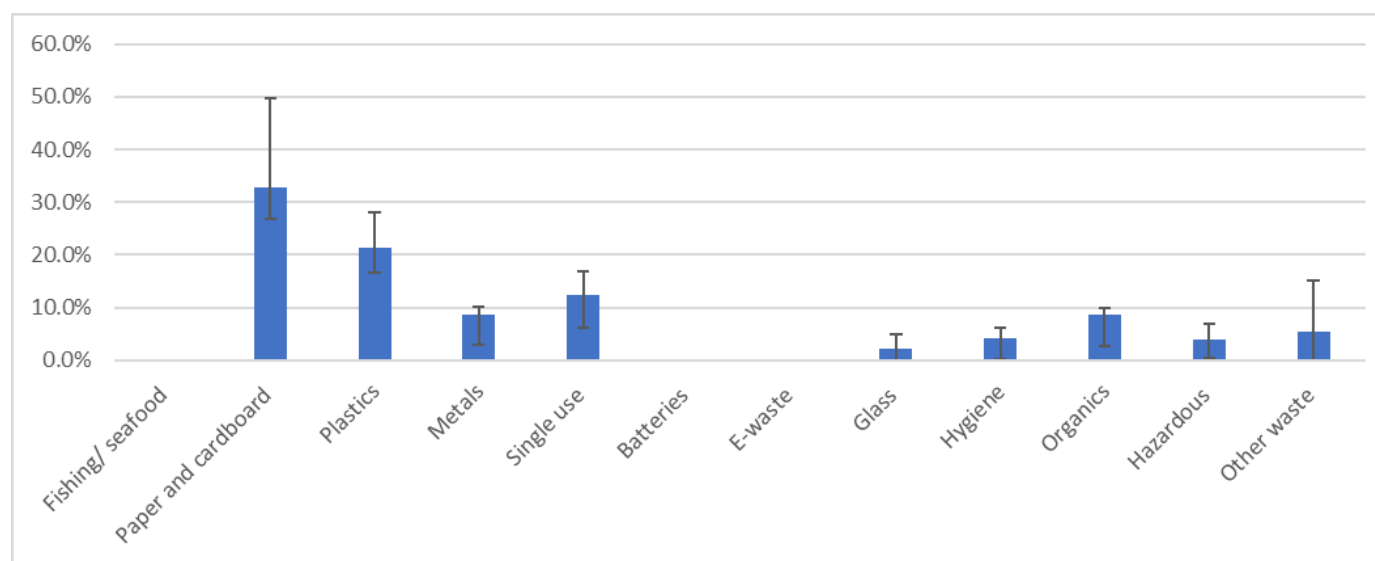
The overall waste composition for commercials is presented in **Table 17** and **Figure**. The lower and upper range have been calculated at a 95% confidence interval. This provides a measure of the range of estimated proportion for each material that might be expected for repeated composition surveys for commercial premises in Majuro.

Samples taken from commercials were sorted and weighed into categories which has provided the data to estimate the composition of waste from sampled commercials in Majuro.

Due to the low number of times fishing/seafood, batteries and e-waste were identified during the survey, the margin of error in the range has not been provided. These items were recorded once or twice for all the household samples physically sorted and weighed.

Table 17: Waste composition for commercials identified as part of the sort and weigh of samples collected for Majuro²⁴

	Fishing/ Seafood	Paper and Cardboard	Plastics	Metals	Single Use Items	Batteries	E-waste	Glass	Hygiene	Organics	Hazardous	Other Waste
Composition	0.0%	32.8%	21.5%	8.7%	12.5%	0.0%	0.0%	2.2%	4.3%	8.8%	3.9%	5.4%
Combined sample weights (kg)	0.0	104.8	68.6	27.8	39.9	0.0	0.0	7.0	13.7	28.0	12.5	17.3
Average weight per sample (kg) ²⁵	0.0	5.0	3.3	1.3	1.9	0.0	0.0	0.3	0.7	1.3	0.6	0.8
Lower range	N/A	23.1%	12.9%	1.8%	5.6%	N/A	N/A	0.0%	0.0%	2.5%	0.0%	0.0%
Upper range	N/A	54.4%	27.1%	9.6%	19.0%	N/A	N/A	7.0%	4.0%	11.2%	7.1%	20.9%



²⁴ Confidence interval of +15% and -15% applied during data analysis. 21/31 samples were within this range and used to calculate the waste composition

²⁵ Count of all data used (21). Total weight (kg) per category divided by count to provide average weight per sample

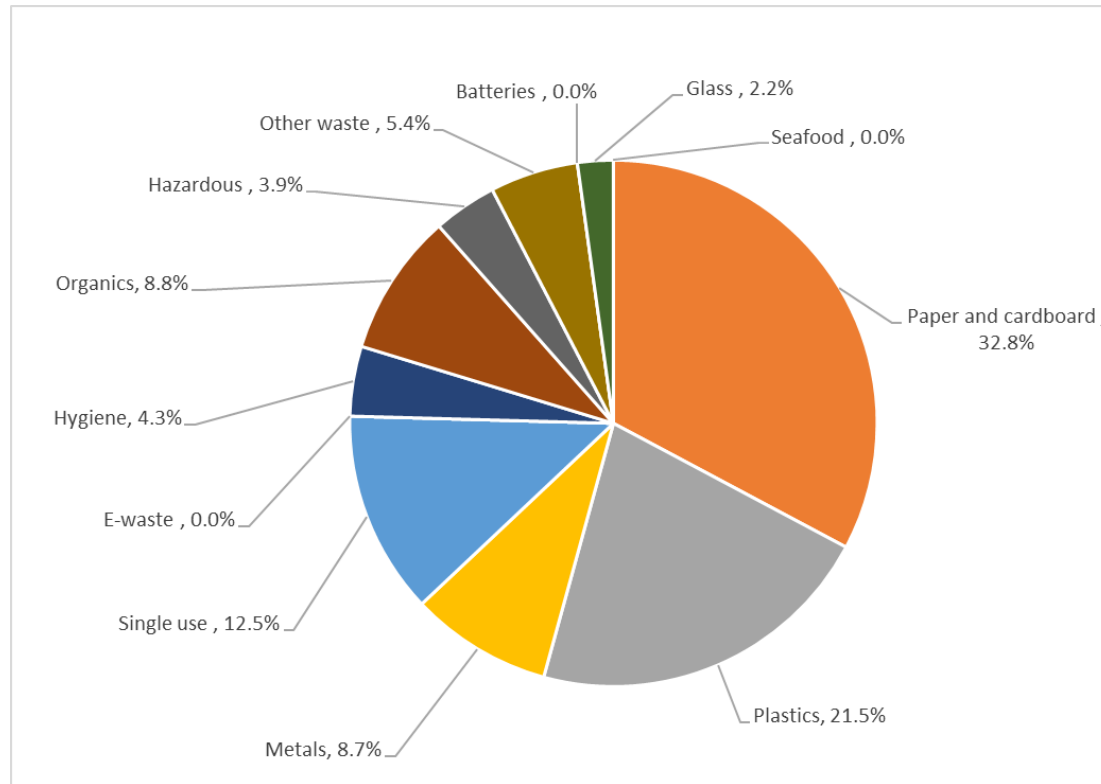


Figure 10: Waste composition for commercials identified as part of the sort and weigh of samples collected for Majuro

Landfill Audit

By 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 18** and **Figure**). 15/20 landfill audits were used to determine the commercial waste composition. Five landfill audits were household waste only. Landfill audits were not able to be undertaken continuously over one week, when the site was open.

Composition

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

MAWC collections using 2017 tonnage data from the Solid Waste Management Plan for Majuro, 2019-2028

- Household waste – 15.6 tonnes per day. Household waste sample composition from the sort and weighing has been applied to household waste.
- Public and commercial – 6.4 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 Majuro, 2019-2028

- Household waste – 2.4 tonnes per day. Household waste sample composition from the sort and weighing has been applied to household waste dropped off directly.
- Commercial waste – 10.3 tonnes per day. Commercial waste sample composition from the sort and weighing and the landfill audit visual assessment data (see Appendix D for density assumptions) has been combined and applied to the commercial waste.
- 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 Majuro Landfill is approximately 10,826 tonnes per year.

Table 18: Estimated composition of solid waste by weight at Majuro Landfill

Materials	Composition %	Tonnage per Day	Tonnage per Year
Fishing/ seafood	0.1%	0.0	9
Paper and cardboard	22.2%	7.7	2,406
Plastics	14.2%	4.9	1,533
Metal	9.6%	3.3	1,041
Single use items	9.3%	3.2	1,011
Batteries	0.4%	0.1	44
E-waste	0.2%	0.1	17
Glass	2.1%	0.7	223
Hygiene	8.9%	3.1	966
Organics	17.3% ²⁶	6.0	1,880
Hazardous	7.4%	2.6	797
Other waste	8.3%	2.9	898
Total	100%	34.7	10,826

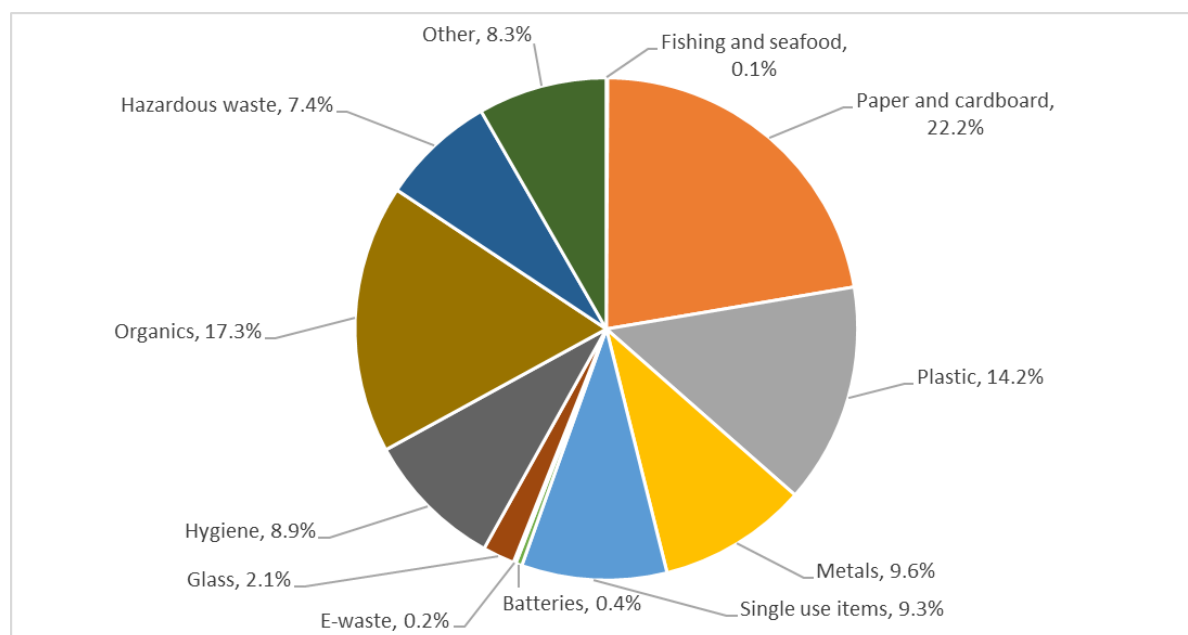


Figure 10: Percentage waste composition for Majuro Landfill

This excludes the volumes of materials which have been identified in stockpiles in **Table 21**.

Pictures from the audit indicate that a large volume of plastics and paper and cardboard are generated by households and sent to Majuro Landfill. This is representative of the samples collected which include a large volume of plastics and paper and cardboard categories.

Due to their nature, plastics, paper, and cardboard (when dry) are lighter for a given volume than hygiene and organic waste (garden and food organics). Other materials that are relatively dense (higher weight for a given volume) include metals, batteries, and glass.

²⁶ Rounded down from 17.4% to 17.3% due to rounding to reach 100.0.

Assessment of Operational Costs

MAWC provided the current cost for operating the disposal site for 2018 which was \$1,062,273 per annum. Total waste to Majuro Landfill per annum is approximately 10,826 tonnes. This equates to a cost of approximately \$98 per tonne.



As a state-owned enterprise, MAWC receive a subsidy for the residential waste collection service. The government subsidy does not cover the total cost of delivering the waste collection service. The cost to deliver the waste collection contract has not been provided.



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.



The types and estimated quantities of materials found in stockpiles across Majuro has been provided in **Table** . Assumptions associated with identifying the weight in tonnes of the stockpiles identified have been provided in **Appendix C**.



Table 21: Type and estimated quantity of materials found in stockpiles in Majuro

	Weight (tonne)	Volume/Count, (units)	Litres	Location	Photos Captured During the Audit
Truck	45.5	Count: 7		Delap	
Boats	6.5	Count: 13		Jenrok, Lomar, Utrikan	

	Weight (tonne)	Volume/Count, Litres (units)	Location	Photos Captured During the Audit
Cars	9.0	Count: 6	Batkan, Lomar, Laura	
Van	10.0	Count: 5	Lomar, Laura, Mico Uliga	

	Weight (tonne)	Volume/Count, Litres (units)	Location	Photos Captured During the Audit
Heavy machinery	80.0	Count: 8	Pll area, Mieco Uliga	
Roofing iron	2.1	Count: 107	Arrak College of the Republic of Marshall Islands, Lomar, Laura	

	Weight (tonne)	Volume/Count, Litres (units)	Location	Photos Captured During the Audit
Tank	0.2	Count: 1	Lomar, Laura	
Tyres	2.2	Count: 271	Arrak, Laura, Ajeltake near Airport	

	Weight (tonne)	Volume/Count, Litres	Location	Photos Captured During the Audit
White goods	0.7	3m ³	Lomar, Laura	
Demolition	9.0	40m ³	Pll Area	
Used oil²⁷	110	120,850 litres	Republic of Marshall Islands (not just Ebeye) 120,850 litres.	2014 estimate for the Republic of Marshall Islands. There is no separation by Ebeye or Majuro. This excludes Marshall Islands Energy Company stockpiles.

²⁷ Consultancy for Contemporary Used Oil audits in selected Pacific Island Countries. Report for Republic of Marshall Islands. 2014

Weight (tonne)	Volume/Count, Litres (units)	Location	Photos Captured During the Audit
Used oil ²⁸	454 litres (120,000 gallons) on 30 April 2021), based on MEC estimates to have all previous stockpiles exported.	Delap Tank Farm (MEC stored volumes, awaiting export).	In 2019, MEC reported 300,000 gallons at the Delap Tank Farm. 36,000 gallons are exported monthly (November 2019-June 2020). In July 2020 this increased to 60,000 gallons per month. By June 2021 MEC expects to have exported the waste oil build up from the last 30 years.
Asbestos ²⁹	660m ²	Two locations at the College of the Republic of Marshall Islands and Ace Hardware.	2014 estimate for Majuro only.

²⁸ <https://www.mecrmi.com/index.php/reducing-the-waste-oil-stockpile/>

²⁹ Survey of the Regional Distribution and Status of Asbestos Contaminated Construction Material and Waste - Best Practice Options for its Management in Pacific Island Countries. Report for the Republic of Marshall Islands. 2015

Ebeye

Introduction

The audit was undertaken between 22 March and 9 April 2021, excluding Saturday and Sundays.

Ebeye waste services

Household waste

Solid waste collection in Ebeye and areas connected via the Causeway including Jabro Island all the way to Gugeegue is provided free of charge by KALGOV. Remote areas, separated by ocean atoll water, use pit or burning methods for waste. Ennibur (northern part of Kwajalein Atoll) use a combination of small dumpsters and burning. There is no waste collection service provided in areas outside of the Ebeye mainland.

Household waste is collected in 230 litre wheelie bins and often a single bin is shared by multiple households. The waste collection vehicle collects waste from designated sites along the designated collection route. There are rare occasions when burning of waste occurs, often limited to leaves and branches. Prior to 8th February 2021, households had the option of transporting their own waste directly to Ebeye dump site (herein referred to as Ebeye disposal site). The disposal site has since restricted access to all vehicles, due to safety concerns. Access is now available for the compactor truck and bulky waste collection truck (dump truck) only.

Bulky wastes are not collected through the roadside collection services. Householders were historically required to transport these themselves or request a pickup. The pickup comes at a cost of \$75 per collection. There is regular stockpiling of household waste, rundown vehicles, and demolition waste from projects around the island.

Household Recycling

There is currently no recycling collection service in Ebeye.

Waste Collection

KALGOV undertakes household waste collection every second day from Monday to Friday. Waste collection is less frequent in remote areas such as Gugeegue, where collection is done only on Saturday. Colour coded waste collection routes on Ebeye are shown in **Figure**. Two compaction trucks are used by KALGOV to collect household waste from the roadside from Ebeye.

The cost of the roadside collection is covered by the Government.



Figure 11: Waste collection routes in Ebeye (KASWMP, 2018)

Commercial Waste

Commercials can use larger dumpster (six cubic yards, approximately 4m³). Prior to 8th February 2021, commercial businesses had the option of having their waste collected by KALGOV (for a fee) or self-hauling to the disposal site.

Accessibility to the site has been restricted by KALGOV from 8th February 2021. KALGOV is currently collecting all non-bulky commercial waste free of charge.

Bulky waste can be collected from commercial facilities at a rate of \$75 per load.

Hazardous Waste

Hazardous waste found in Ebeye includes batteries, medical waste, waste oil, e-waste, waste chemicals (mainly produced by the hospital), quarantine waste and small quantities of asbestos.

Batteries

There is a separate area at the disposal facility, where batteries are stacked and covered alongside asbestos.

Car batteries are stacked awaiting export alongside heavy equipment. Previously it was anticipated that not all of the currently stockpiled car batteries would be exported. In April 2021, KALGOV staff were provided with information on this export process but are awaiting training on this process. No export of car batteries has occurred.

Medical Waste

Segregated medical waste from Ebeye Hospital is collected by a contractor for incineration since 2019. The incinerator is located at Gugeegue. The risk and potential impact of increased infectious medical waste associated with a potential Covid-19 outbreak has been recognised and would likely overwhelm existing medical waste transport and disposal infrastructure. Medical waste management has been listed as a focus of the Ebeye Solid Waste Management Project which is funded by the Asian Development Bank.

Waste Oil

Waste oils not managed by MEC are stored within the grounds of the Kwajalein Atoll Joint Utility Resources Inc at Mon kubok weto.

Waste oil from vessel fleets, garages and the MEC power stations is managed by the Marshall Energy Company (MEC). By 2019, waste oil stores had built up to 120,000 gallons at KAJUR Power Plant. In December 2018 with the help of international funding, MEC made physical improvements to the storage units to ensure the waste oil was secured safely.

In 2019, 50,000 gallons from the KAJUR Power Plant was collected and packaged in eight bladder containers for export to South Korea.

MEC have continued to export waste oil since, it is not known how much used oil is still remaining at KAJUR Power Plant. MEC expects that all waste oil which has been stored for the past 30 years will be exported by June 2021³⁰. Waste oil production is expected to decrease over time with improved fuel quality and machinery efficiency. Annual waste oil volumes collected by MEC are 37,000 gallons, with an expectation that this will reduce to 28,800 per annum by 2025 across the Republic of Marshall Islands.

³⁰ <https://www.mecrmi.com/index.php/reducing-the-waste-oil-stockpile/>

E-waste

There are no segregation and collection service provided for e-waste in Ebeye.

Asbestos

There is a separate area at the disposal facility, where asbestos can be landfilled alongside batteries.

Quarantine Waste

There is no quarantine site on Ebeye, with no international ports on the island. Wastes produced by the US military base are disposed of within the grounds of the base itself.

Waste Disposal Site

There is one public disposal site in Ebeye, located at the north end of the island (**Figure 11** and **Figure 12**). The site covers an area of 1.6 hectares, which accounts for approximately 5% of Ebeye's area. A document³¹ by the ADB in November 2020, proposes the construction of a high-temperature incinerator and an upgrade to the existing waste disposal and recycling facilities.



Figure.10: Ebeye disposal site³²

³¹ Asian Development Bank, November 2020. *Proposed grant - Republic of the Marshall Islands: Ebeye Solid Waste Management Project*.

³² Republic of the Marshall Islands: Ebeye Solid Waste Management Project, MWUI, September 2020



Figure 11: Ebeye disposal site location



Figure 12: Aerial image of the disposal site taken by drone (with contours above sea level), June 2018 (Source: KASWMP)

Disposal Site Infrastructure

There is currently no lining or leachate treatment system in place. There has been reports on discharge of leachate into the surrounding Lagoon Environment. The disposal site has capacity for the next 25 years. The level of compaction is low, given that waste arrives in the compaction vehicle and is lightly compressed using the excavator bucket. The site requires upgrade before it can be classed as a proper sanitary landfill.

Heavy equipment is not stationed at the site permanently. There is one excavator (owned by KALGOV) which is currently operational. A bulldozer and loader (currently non-operational) have also been previously used periodically. There is an ongoing challenge for KALGOV for the timely maintenance of vehicles and equipment.

There are two bailers onsite awaiting the start-up of the CDL scheme.

Charging at the Disposal Site

No fees are collected for waste disposal. However, KALGOV is currently considering the introduction of landfill disposal fees.

Inputs to the Disposal Site

The disposal site accepts waste from the KALGOV collection and directly from commercial businesses and households.

There is limited extraction of materials at the disposal site. The excavator separates out steel from the incoming waste streams, mainly from bulky waste loads delivered by the dump truck. However, separated steel is not exported and ends up being mixed back into the mixed waste stream.

The management procedure involves waste being discharged, spread out and loosely compacted using an excavator daily.

A baseline survey undertaken in August 2017 to estimate a waste flow to the disposal site, concluded the following:

- 11.8 tonnes of waste are disposed daily at the current disposal site, this equates to approximately 4,300 tonnes per year.
- The average number of vehicles entering the site was 23 per day.
- 68% of the incoming waste are delivered by KALGOV.
- 32% of the incoming waste are delivered by commercials and households directly.

Future Changes Proposed by KALGOV

CDL Scheme

MAWC trained KALGOV staff in April 2021 on how to operate the CDL scheme. The implementation of the Marshall Islands CDL scheme in Ebeye is due to begin at the end of 2021.

The scheme will require users to deliver their recyclables to drop off points or the disposal site. Baling will occur at the disposal site.

Aluminium cans and PET bottles are the main target materials of the scheme. Those who use this scheme will receive five cents for depositing a single container.

Household Audit Findings

The household sample collection identified that a significant proportion of households store bulky waste items and general waste on individual properties.

Access to Waste Collection Services

Table Error! No text of specified style in document. summarises feedback on the collection service for households including a waste collection rating, recorded for Ebeye.

Table Error! No text of specified style in document.22: Summary of access to collection services

Item	Comment
Total interviewed	126
% with access to collection service	80.2%
Average collection service rating	7.97/10
Comments	<ul style="list-style-type: none"> • In general, there was high satisfaction with the waste collection service provided. • The service was reported as late on occasions by some households. • Several households (4/126) reported that they would like their own bin.

Alternative approaches to managing waste were highlighted through the interviews. It is common practice for several options to be selected by householders and commercials for the same waste stream. For example, in some households, food scraps were recorded being fed to animals and reported to be discarded in the ocean.

Table 19: Options for waste management adopted by households

Material	Disposal options
Waste	<ul style="list-style-type: none"> • Collected as part of the waste collection service
Garden organics	<ul style="list-style-type: none"> • Collected as part of the waste collection service • Dumped - not at the landfill site
Sanitary	<ul style="list-style-type: none"> • Collected as part of the waste collection service • N/A (meaning waste stream not relevant)
Bulky items	<ul style="list-style-type: none"> • Collected separately on a pay by collect basis • N/A (meaning waste stream not relevant)
Food scraps	<ul style="list-style-type: none"> • Collected as part of the waste collection service • Dumped – not at the landfill site (in the ocean) • Transported to the disposal site

There are several reasons which drive householders' decisions for waste management. The interviews suggest that these include:

- Increased number of waste collections.
- More time for collection i.e., more manpower on the collection vehicle.
- Requesting one bin.

Participants were asked “How much are you willing to pay for waste collection per week (total cost)?” The response is presented in **Figure 13**¹⁷.

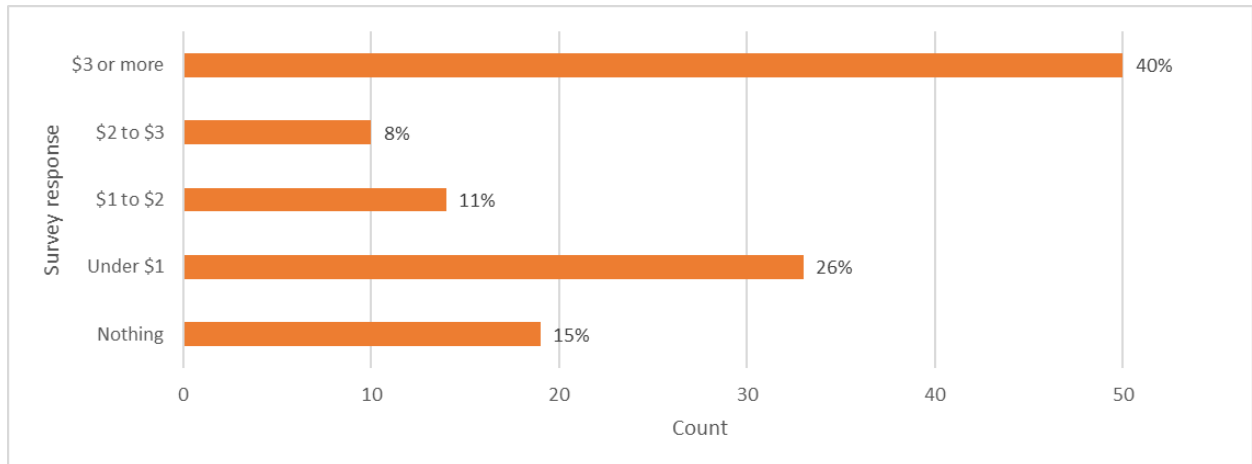


Figure 13: Willingness to pay for households’ collection of rubbish – survey outcomes for Ebeye

Access to a collection service is similar in both Majuro and Ebeye. High satisfaction with the waste collection service delivered in the Marshall Islands was higher in Ebeye (7.98/10) than Majuro (6.63/10). Reasoning for the lower rating for Majuro is detailed in **Table 10**, with a high number of requests to additional or replacement bins and more bags for waste containment.

Household Waste Composition

Typical roadside waste containers and examples of waste put out for collection in Ebeye can be seen in **Figure 16** (note: bags were provided for the audit to aid sample collection).

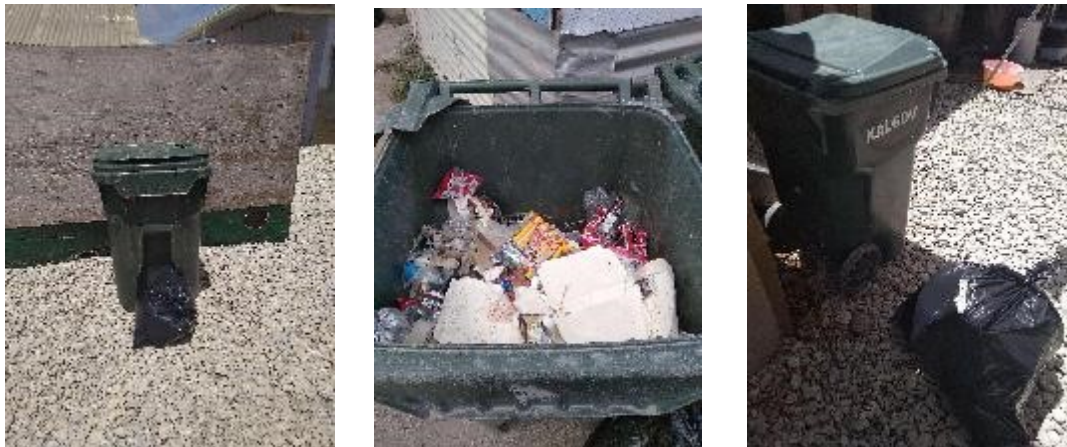


Figure 16: Typical waste collection from households in Ebeye

The average composition of waste by weight from households in Ebeye is shown in **Figure 14**.

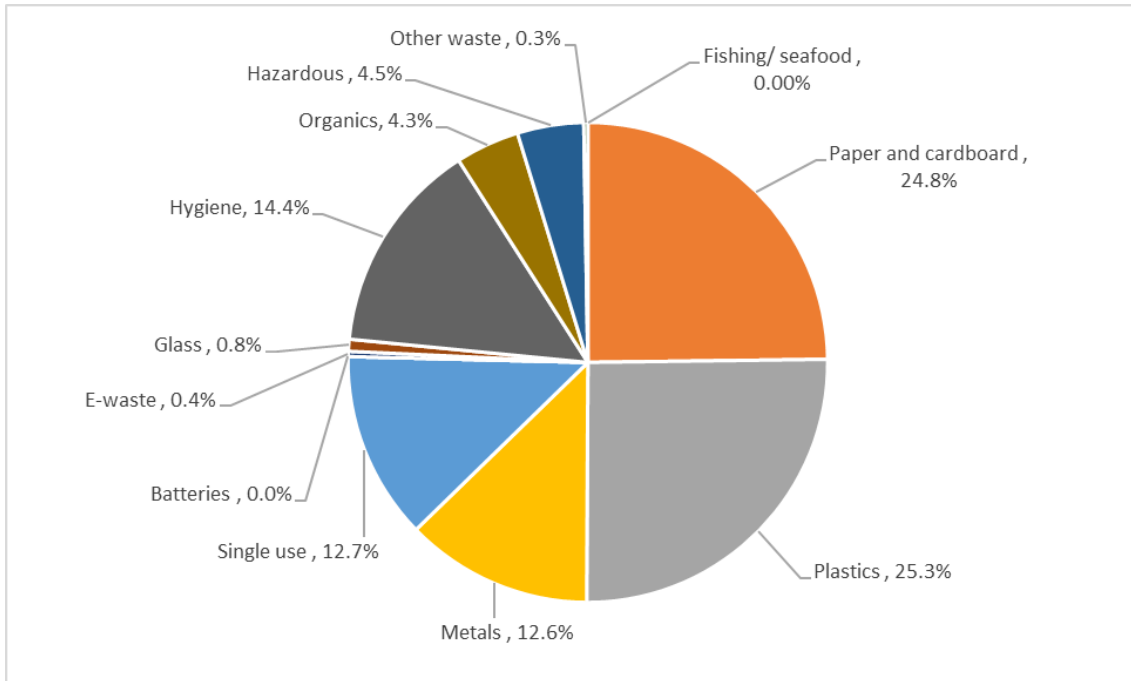






Figure 14: Ebeve average household waste composition summary

Key audit findings by category for household waste and photos have been identified in **Table 27**. Plastics, paper, and cardboard are recorded in higher proportions in Ebeve. Plastics, dominated by PET bottles, are a higher proportion for Ebeve compared to Household composition for Majuro.

This is consistent with the fact that PET bottles are being collected under the CDL scheme on Majuro. Aluminium beverage containers (drinks cans) (sorted under the metals category) and glass are similar in proportions for both Majuro and Ebeve. Aluminium cans and glass bottles are also covered by the CDL scheme in Majuro.

Table 27: Waste material findings

Waste Material	Description	Pictures from the Audit
Plastics	<p>Dominated by drinks containers of varying sizes.</p> <p>Plastic drinks containers – small (0.6 litre) water bottles, larger (1.5 litre) water bottles (PET), small juice bottles (various).</p> <p>Plastic containers – food (condiments), non-food – body wash (HDPE).</p>	

Waste Material	Description	Pictures from the Audit
Paper and cardboard	Dominated by cardboard boxes.	
Hygiene	Dominated by nappies.	
Metals	<p>Dominated by aluminium drinks containers and food cans.</p> <p>Cans – drinks (aluminium) –predominately soft drink and beer cans and food.</p> <p>Small tins (coated steel) various sizes and brands.</p>	
Single use items	Dominated by coffee cups, paper takeaway boxes and plastic cutlery.	
Organics	Dominated by food organics and garden organics.	No photos provided of the smaller waste categories.
Hazardous	Dominated by gas canisters.	

There were low proportions of organics, e-waste, batteries, hazardous waste, other waste and fishing related items observed in the household waste stream.

The lower and upper range for each component of household waste have been calculated at a 95% confidence interval and are presented in **Table 21** and **Figure 15**. This provides a measure of the range of estimated proportion for each material that might be expected for repeated composition surveys for households in Ebeye.

Interviews with householders has provided the data we have used to estimate the average quantity of waste (7.2kg per week)³³ from sampled households for Ebeye³⁴. The estimated generation of waste per household per day is 1.1kg (within a range of 0.1kg – 6.4kg **per household per day**).

The same analysis was used to calculate the waste generation rated for both Majuro and Ebeye. We have provided **Table 20** to show the differences between the sample sizes collected and audited and how this results in the generation rates presented in this report.

Table 20: Waste material findings

Location	Generation Rate Range (kg)	Average Generation Rate (kg)	Average Quantity of Waste (Average Sample Weight)
Majuro	0.1-2.4	0.7	4.6kg
Ebeye	0.1-6.4	1.1	7.2kg

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

³³ Waste collections includes waste generated over two, three and four days. The in-country team provided the number of days' worth of waste for each day samples were taken.

³⁴ The data used to calculate the composition of waste collected from households in Ebeye 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 21: Waste composition for households identified as part of the sort and weigh of samples for Ebeye³⁵

	Fishing/ Seafood	Paper and Cardboard	Plastics	Metals	Single Use Items	Batteries	E-waste	Glass	Hygiene	Organics	Hazardous	Other Waste
Composition	0.0%	24.8%	25.3%	12.6%	12.7%	0.0%	0.4%	0.8%	14.4%	4.3%	4.5%	0.3%
Combined sample weights (kg)	0.0	92.0	93.8	46.9	47.0	0.0	1.3	3.0	53.4	16.0	16.6	1.0
Average weight per sample (kg)³⁶	0.0	1.7	1.7	0.9	0.9	0.0	0.02	0.1	1.0	0.3	0.3	0.02
Lower range	N/A	21.3%	24.3%	8.4%	4.9%	N/A	0.0%	0.0%	5.9%	0.0%	1.9%	0.0%
Upper range	N/A	30.8%	37.7%	15.4%	13.4%	N/A	0.7%	2.3%	17.0%	9.9%	6.8%	0.4%

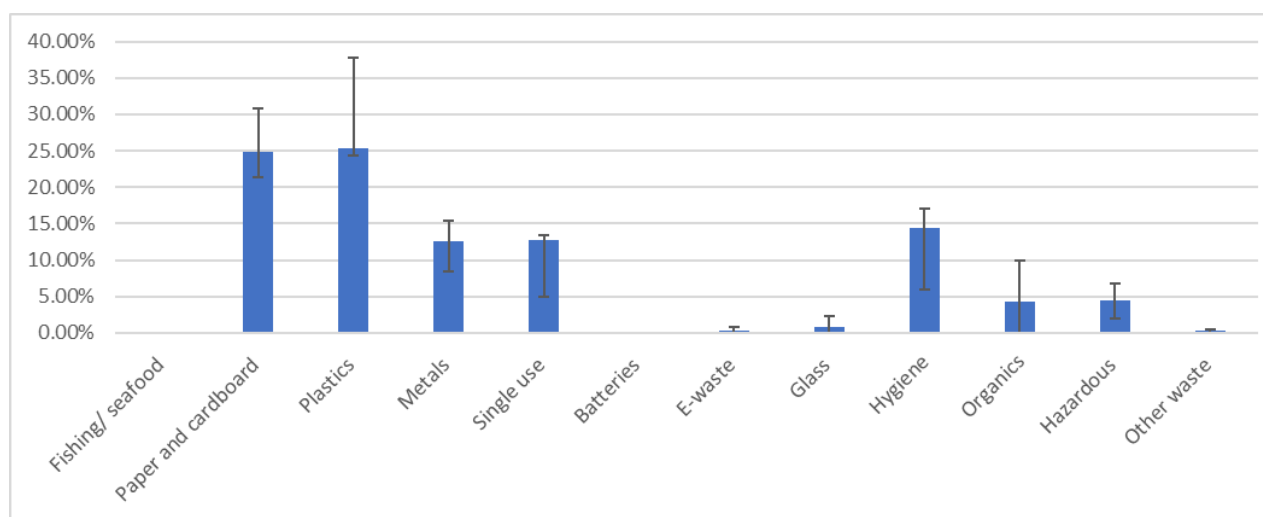


Figure 15: Waste composition for households identified as part of the sort and weigh of samples collected for Ebeye

³⁵ Confidence interval of +15% and -15% applied during data analysis. 54/138 samples were within this range and have been used to derive the composition.

³⁶ Count of all data used (55). 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.

Paper and cardboard, plastics and metals, single use and hygiene were recorded as the most dominant categories in household waste samples. Glass, organics and hazardous were also identified but were less significant.

Examples of these waste streams following separation are provided in **Table 22**

Key points to note:

- Paper and cardboard and metals are present at a relatively high proportion of the total household waste stream (both easily recycled where markets are accessible).
- Plastics are present with a high proportion of soft plastics.
- A significant proportion of the items identified have the potential to be involved in the deposit scheme beginning this year in Ebeye e.g., drinks containers.

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.

Table 22: Observations by material

Material	Key Materials	Detail on Observations
Paper and cardboard	Dominated by cardboard boxes.	Other cardboard items include paper bags, food, drink, and non-food cardboard packaging.
Plastics	Plastic drinks containers – small (0.6 litre) water bottles, larger (1.5 litre) water bottles (PET), small juice bottles (various). Plastic containers – food (condiments), non-food – body wash (HDPE).	Household interviews reported an average of 2.4 plastic water bottles per person per household per week with a range of 0 to 24 bottles per person, per week. Using the average from the household interview data collected, across Ebeye this equates to 26,992 per week for the whole population (11,408). Over one year this is estimated to be around 1,403,566 plastic bottles per year. This is likely to be at the upper end of the number of water bottles produced per week.
Metals	Cans – drinks (aluminium) predominately soft drink and beer cans and food. Small tins (coated steel) various sizes and brands.	The data provided is the sample of households from across Ebeye. Household interviews reported an average of 1.8 drinks can per person, per household, per week. The range varied between 0 to 24 cans per week between samples collected. Using the average from the household interview data collected, across Ebeye, this equates to 20,584 cans per week for the population (est 11,408). Over one year this is estimated to be around 1,070,346 drinks cans per year. This is considered at the upper end of the number of drinks cans likely to be produced ³⁷ .

³⁷ 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 Audit Findings

The total number of commercials audited by type is shown in **Table 23** provides the count, or the number of commercials which were audited. 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 23: Commercial type and count

Commercial Type	Sorted and Weighed	Interview
Retail and trade	12	13
Business and household	0	3
Accommodation and food service	0	2
Mixed small business	4	4
Total	16	22

Access to Waste Collection Services

Table 24 summarises feedback on the collection service including a waste collection rating.

Table 24: Summary of access to collection services³⁸

Item	Comment
Total interviewed	22
% of commercials who use a collection service	81.8%
Average collection service rating	8.4/10 ³⁹
Comments	<ul style="list-style-type: none"> • There was generally high satisfaction with the waste collection service provided. • The majority of the commercials surveyed opted not to provide a comment.

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 25**.

Table 25: Options for waste management adopted by commercials

Material	Disposal Options
Waste	<ul style="list-style-type: none"> • Collected as part of the waste collection service
Garden organics	<ul style="list-style-type: none"> • Collected as part of the waste collection service • Dumped
Sanitary	<ul style="list-style-type: none"> • Collected as part of the waste collection service • N/A (meaning waste stream not relevant)
Bulky items	<ul style="list-style-type: none"> • Collected separately on a pay by collect basis • N/A (meaning waste stream not relevant)
Food scraps	<ul style="list-style-type: none"> • Transported to the disposal site • Collected as part of the waste collection service • Dumped – location other than the disposal site

³⁸ Data collected and recorded in survey 123 app, from interviews held with commercials

³⁹ Sample size of 15 who responded to the question.

Participants were asked “How much are you willing to pay for waste collection per week (total cost)?” The response is presented in **Figure 19**.¹⁷

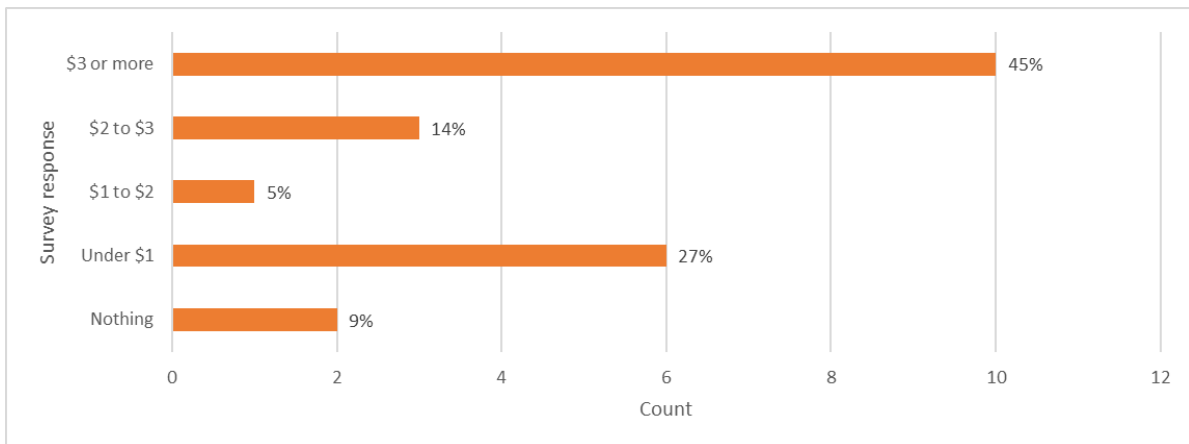


Figure 16: Willingness to pay for commercial collection of waste – survey outcomes in Ebeye

Commercial Waste Composition

The composition of commercial waste collected, sorted, and weighed for Ebeye is shown in **Figure 17**.

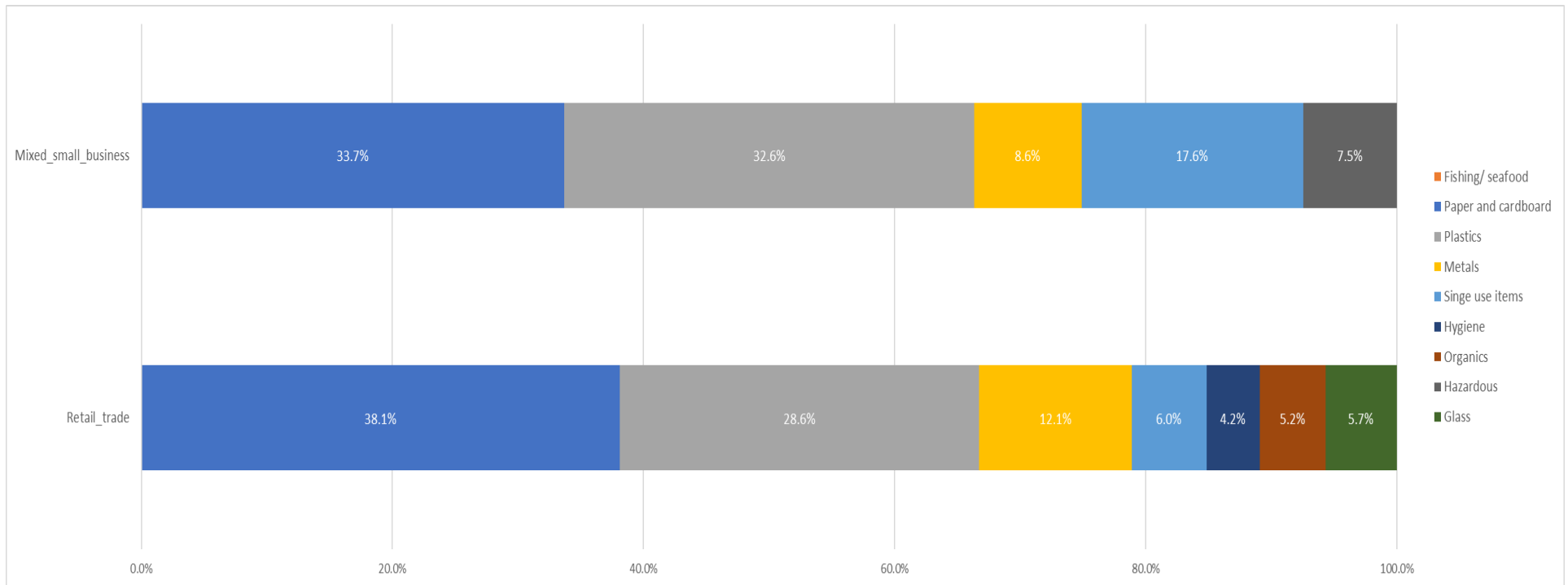


Figure 17: Composition of waste from commercials by type in Ebeye⁴⁰

⁴⁰ Two commercials sector have been presented as these data are those within the confidence interval of +15% and -15% applied during data analysis.

There were 12 samples sorted for retail and trade and four samples sorted for mixed small business. The samples sorted and weighed, provide a snapshot of the likely composition from these types of commercials. The combined data (for 16 commercial premises) provides an indicator of commercial waste composition overall.

The data collected suggests that the dominant waste categories across the commercial types surveyed were paper and cardboard and plastic. Followed by single use items and metals.

Table 26: *Commercial waste findings*

Waste Material	Description	Pictures from the Audit
Paper and cardboard	Dominated by cardboard boxes and packaging. Cardboard dominated the retail and trade and mixed small commercial samples.	
Plastics	Dominated by plastic drinks containers – small and large (water bottles).	
Metals	Dominated by aluminium and steel (food) cans.	
Single use items	Dominated by paper takeaway containers and coffee cups.	

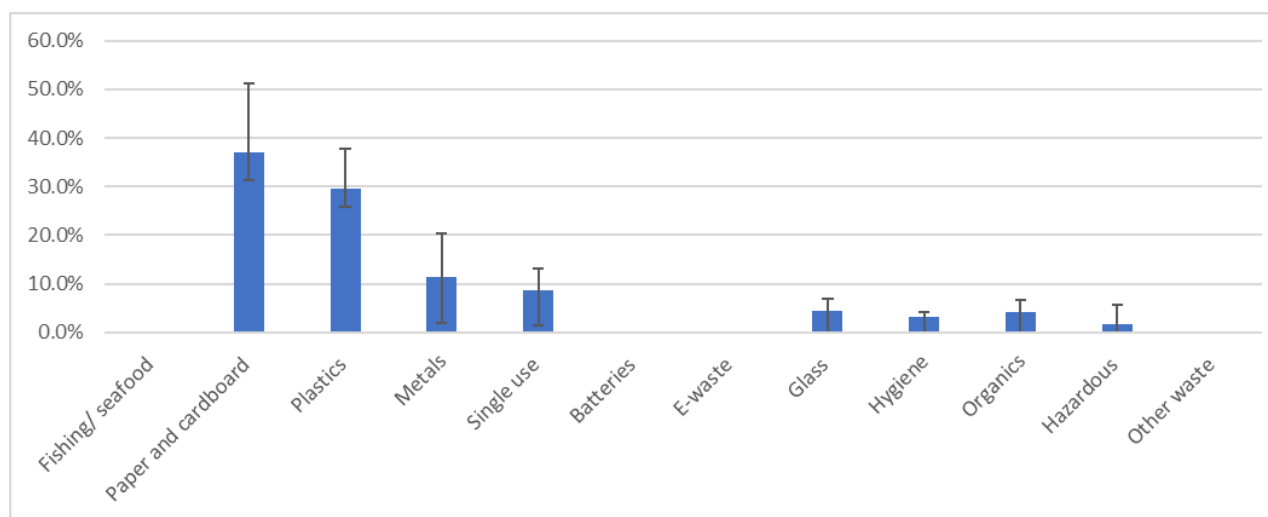
The overall waste composition for commercials has been provided combining the data from the sort and weigh survey and is presented in **Table 27** and **Figure**

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 Ebeye.

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

Table 27: Waste composition for commercials identified as part of the sort and weigh of samples collected for Ebeye⁴¹

	Fishing/ Seafood	Paper and Cardboard	Plastics	Metals	Single Use Items	Batteries	E-waste	Glass	Hygiene	Organics	Hazardous	Other Waste
Composition	0.0%	37.1%	29.5%	11.4%	8.5%	0.0%	0.0%	4.5% ⁴²	3.3%	4.1%	1.6%	0.0%
Combined sample weights (kg)	0.0	31.7	25.2	9.7	7.3	0.0	0.0	3.8	2.8	3.5	1.4	0.0
Average weight per sample (kg) ⁴³	0.0	2.0	1.6	0.6	0.5	0.0	0.0	0.2	0.2	0.2	0.1	0.0
Lower range	N/A	27.5%	23.4%	0.0%	0.0%	N/A	N/A	0.0%	N/A	0.0%	0.0%	N/A
Upper range	N/A	53.1%	40.3%	26.0%	13.0%	N/A	N/A	7.8%	N/A	9.6%	8.2%	N/A



⁴¹ Confidence interval of +15% and -15% applied during data analysis. 16/28 samples were within this range and used to calculate the waste composition

⁴² Rounded up to 4.5% from 4.4% to provide a total of 100.0%

⁴³ Count of all data used (16). Total weight (kg) per category divided by count to provide average weight per sample

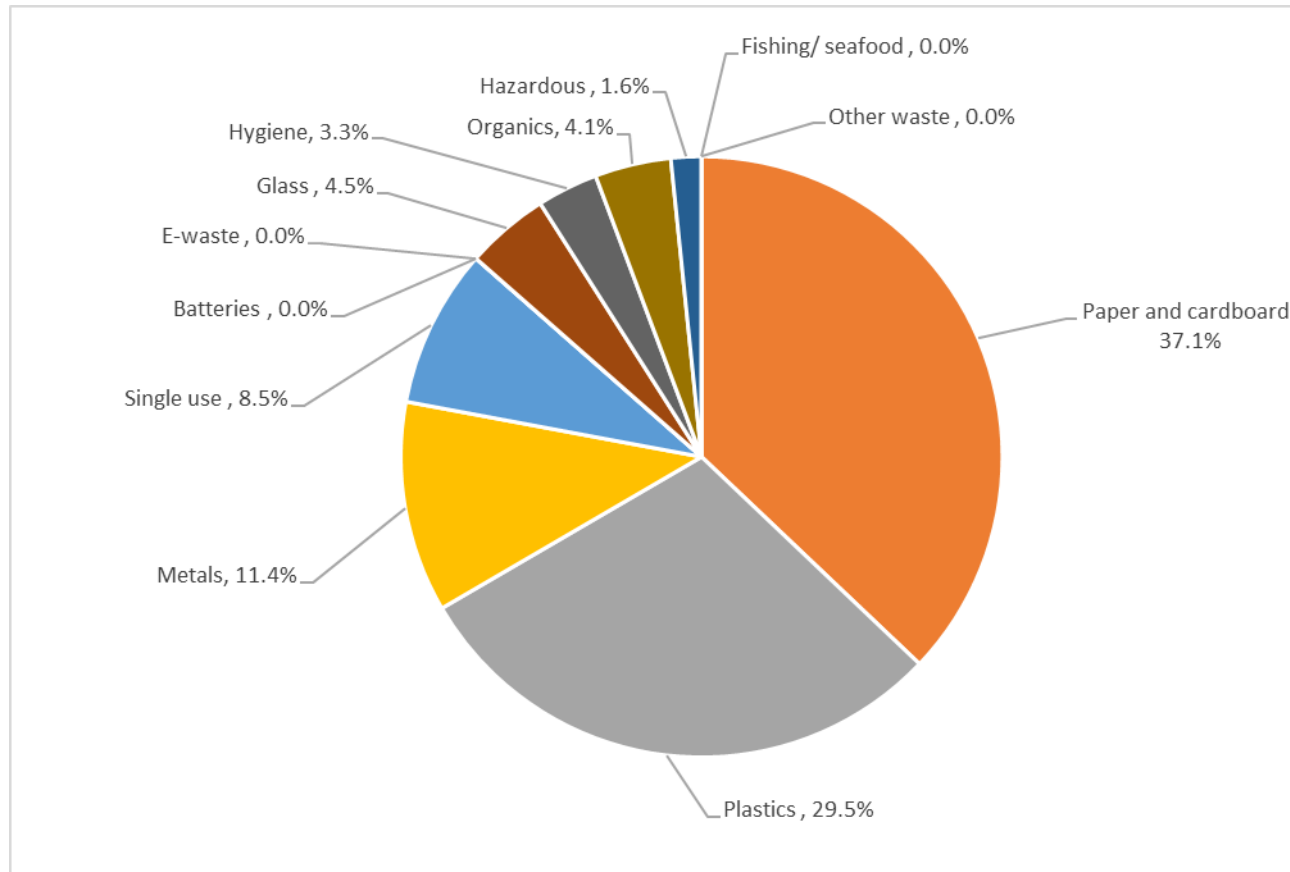


Figure 21: Waste composition for commercials identified as part of the sort and weigh of samples collected for Ebeye

Landfill Audit

Considering the source of waste and using the sort and weigh audit data for households and commercials and visual assessments from the landfill audits, an overall waste composition has been developed (**Table 29** and **Figure 18**).

Composition

In February 2021, KALGOV stopped all access to the disposal site apart from the compactor truck and dump truck. The following assumptions have been made in discussions with the KALGOV in-country audit team (**Table 28**).

Table 28: Assumptions

KALGOV Provided Information	Assumptions
The numbers of waste compactor truck loads per day (two) entering the disposal site. Six days per week, Monday to Saturday.	Household and commercial waste sample composition combined from the sort and weighing has been applied to the compactor truck composition. The proportion of household to commercial was defined as 71%, 29% respectively (as per the Kwajalein Atoll Solid Waste Management Plan (2019-2028)).
Compactor truck weight - 11.2 tonnes.	
Compactor truck composition – since 8 February 2021, both household and commercial waste has been collected together in the compactor truck.	
The number of deliveries per week by the dump truck containing bulky waste entering the disposal site. Estimated between two and three times per week.	Landfill audit visual assessments were used to determine the volume of waste delivered by the dump truck (see Appendix C for density assumptions).
No other vehicles are entering the disposal site.	No assumptions required.

This suggests that the total waste to Ebeye disposal site is approximately 7,084 tonnes per year. Comparing this figure to the estimated tonnage for Majuro suggests the per capita waste generation is significantly higher in Ebeye.

The Majuro estimates are based on 2017 landfill tonnages (no data was available for 2021) broken down into household and commercial waste. For Ebeye, 2021 data was used as outlined above. There are also differences in overall composition with Ebeye data suggesting additional plastics. This is consistent with the lack of CDL scheme in Ebeye.

The composition derived from the data collected and provided by KALGOV, provides an indicative estimation of the likely composition of waste accepted at the Ebeye disposal site, classified as the general waste stream. This excludes the volumes of materials which have been identified in stockpiles.

Table 29: Estimated composition of solid waste by weight at Ebeye disposal site

Materials	Composition %	Tonnage per Year
Fishing/ seafood	0.0%	0
Paper and cardboard	28.0%	1,984
Plastics	26.2%	1,853
Metals	12.2%	861
Single use items	11.3%	802
E-waste	1.5%	105
Hygiene	11.0%	781
Organics	4.2%	300
Hazardous	3.6%	255
Other waste	0.2%	13

Materials	Composition %	Tonnage per Year
Batteries	0.0%	0
Glass	1.8%	130
Total	100%	7,084

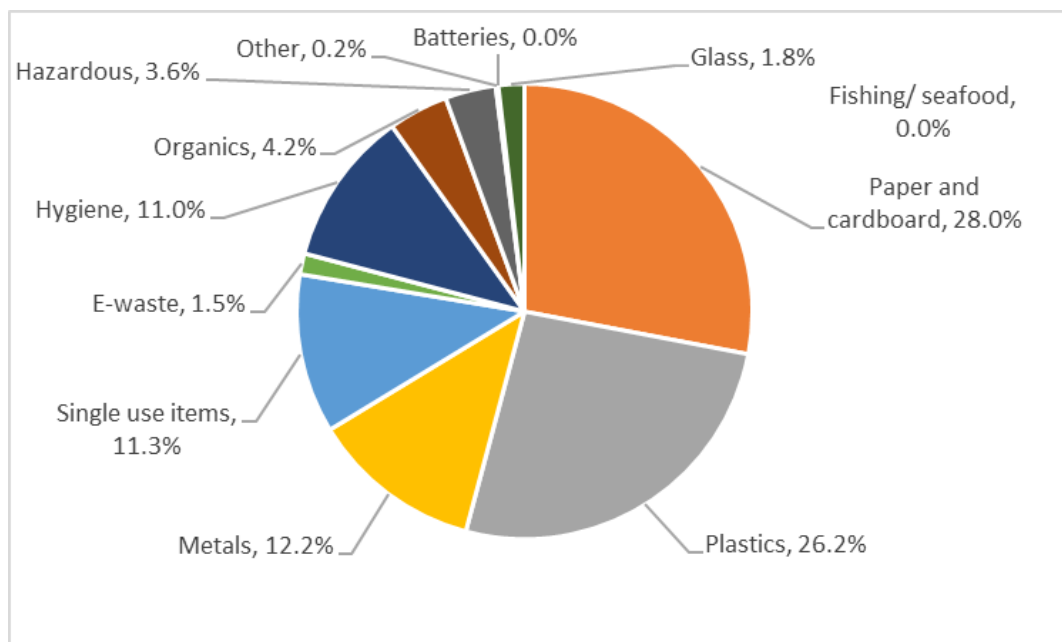


Figure 18: Percentage waste composition for Ebeye disposal site

The low organics content is reflective of the responses provided through interviews and by KALGOV. Food organics particularly are fed to animals, pets or dumped in the ocean.

Asbestos containing materials and batteries are received at the disposal site, however quantities are not recorded and thus not included in landfill or stockpile data.

Pictures from the audit indicate that a large volume of plastics, paper and cardboard are generated by households and sent to the disposal site. This is representative of the samples collected which include a large volume of plastics and paper and cardboard categories.

Due to their nature, plastics, paper, and cardboard (when dry) are lighter for a given volume than hygiene and organic waste (garden and food organics). Other materials that are relatively dense (higher weight for a given volume) include metals, batteries, and glass.

Information provided by KALGOV indicates that although Covid-19 has not reached the Republic of Marshall Islands, lockdown protocols which include cleaning areas more regularly, have increased the amount of waste produced in Ebeye. There has also been an increase in bulky item waste and renovations.

Assessment of Operational Costs

The annual budget for the operation of the Ebeye disposal site for financial year 2020-2021 is \$68,720. This was provided by KALGOV and covers operational costs including: personnel, fuel, equipment etc. A total waste tonnage disposed to Ebeye disposal site is 7,084 tonnes per year, this equates to a cost around \$9.70 per tonne.

Revenue from the bulky waste collection (dump truck) charged at \$75 per collection, equates to \$9,750 revenue for KALGOV. No other charges are collected at the disposal site.

In 2019, the annual budget, set out in the Kwajalein Atoll Solid Waste Management Plan was \$160,366. The plan suggested this funded be provided by the Republic of Marshall Islands Government, but it is not clear whether this funding has been provided. The \$160,000 for collection is in addition to the disposal site budget of \$68,720 noted above.




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.



The types and estimated quantities of materials found in stockpiles across Ebeye has been provided in **Table**



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


Table 34: Type and estimated quantity of materials found in stockpiles in Ebeye

	Weight (Tonne)	Volume/Count (Units)	Location	Photos Captured During the Audit
Trucks and buses	45.5	Count: 7	North Camp	
Boats	1.5	Count: 3	Buoj (lagoon side)	 

	Weight (Tonne)	Volume/Count (Units)	Location	Photos Captured During the Audit
Cars	6.0	Count: 4	Tobikle (ocean side)	<p>Mixed with other materials in stockpiles</p> 
Vans	2.0	Count: 1	Gugeegue	

	Weight (Tonne)	Volume/Count (Units)	Location	Photos Captured During the Audit
Heavy machinery	110.0	Count: 11	North camp	
Roofing iron	0.4	Count: 20	Gugeegue	

	Weight (Tonne)	Volume/Count (Units)	Location	Photos Captured During the Audit
Tank	0.5	Count: 1	Gugeegue	
Demolition	3.6	3.6m ³	Tobikle (ocean side)	

	Weight (Tonne)	Volume/Count (Units)	Location	Photos Captured During the Audit
Shipping containers	4.6	Count: 2	Gugeegue	
Used oil ⁴⁴	110	120,850 litres	Republic of Marshall Islands (not just Ebeye) 120,850 litres.	2014 estimate for the Republic of Marshall Islands. There is no separation by Ebeye or Majuro. This excludes Marshall Islands Energy Company stockpiles.
Used oil ⁴⁵	-	Unknown volumes awaiting export	KAJUR Power Plant	In 2019, 50,000 gallons from the KAJUR Power Plant was collected and packaged in eight bladder containers for export to South Korea. MEC have continued to export waste oil since, it is not known how much used oil is still remaining at KAJUR Power Plant.

⁴⁴ Consultancy for Contemporary Used Oil audits in selected Pacific Island Countries. Report for Republic of Marshall Islands. 2014

⁴⁵ <https://www.mecrmi.com/index.php/reducing-the-waste-oil-stockpile/>

Customs Data

Customs Republic of Marshall Islands record based on item imported/exported, quantity, value and tax. This data is recorded for all importers and exporters each time goods are imported and exported. Recording by HS Code is not currently undertaken.

Imported Goods

Container numbers for import and export was provided by Swire Shipping covering four shipping companies (Swire, Matson, Kyowa and Mariana express line) for the 2019 calendar year. Data from three companies on island, Majuro Do it Best, Joemar Development and True Value provided import data. Majuro Do it Best and True Value are hardware stores based in Majuro and Joemar Development is a local construction firm. Customs for the Republic of Marshall Islands provided car imports (units) for 2006 – 2012.

Exported Goods

A large proportion, 73% of all exports is fish (HS Code 03) and was reported by Swire Shipping. Copra is the second largest export material for the Republic of Marshall Islands.

Table 35: Breakdown of customs data for key import data

Total import Value for Marshall Islands (USD) ⁴⁶	Import HS Codes	Estimated Weights – Imported
<p>\$11,953,361,000</p> <p>Note: value has been taken directly from Trademap. Other sources may report a different import value.</p>	<ul style="list-style-type: none"> • Cement (HS Code 2523) • Aluminium roofing (HS Code 76) • Lumber (HS Code 44) • Rebar (HS Code 72) • Concrete blocks (HS Code 6810) • Vehicles (HS Code 8703) 	<p>Total import for 2019 (unless specified) - 54,195 tonnes were imported to the Republic of Marshall Islands.</p> <p>Data provided by in country companies has enabled the breakdown below, which form part of the total imported tonnage.</p> <ul style="list-style-type: none"> • Cement – 2,169 tonnes (two main importers (2019 data for Joemar Development and 2020 data for True Value)). • Aluminium roofing – 73 tonnes. • Lumber – 1,140 tonnes. • Lumbar, plywood – 27,143 units (2020) • Rebar – 143 tonnes. • Concrete blocks – 3,032 tonnes⁴⁷ (two main importers (2019 data for Joemar Development and 2020 data for True Value)). • E-waste (refrigerators, washing machines, TVs etc – 1,057 units(2020 data only from one importer). • Vehicles – 318 units, 636 tonnes⁴⁸ (2012).

Note: the HS codes have been sourced by T+TI based on the materials

⁴⁶ [Trade Map - List of supplying markets for a product imported by Marshall Islands \(Mirror\)](#)

⁴⁷ Weights based on 4 to 8 inch blocks and taken from [Concrete Block - Cash Concrete Products INC](#)

⁴⁸ Assumed 2 tonne per vehicle in absence of vehicle types.

Table 30: Breakdown of customs data for key export data

Total export value for Marshall Islands (USD) ⁴⁹	Export HS Codes	Estimated weights – exported
<p>\$1,252,396,000</p> <p>Note: value has been taken directly from Trademap.</p>	<ul style="list-style-type: none"> • Fish (HS Code 03) • Copra / copra oil (HS Code 2306) 	<p>Total export for 2019 - 27,860 tonnes from the Republic of Marshall Islands.</p> <ul style="list-style-type: none"> • Fish and fish products, 20,338 tonnes. • Copra products, 4,701 tonnes⁵⁰. • Other products, 2,821 tonnes

⁴⁹ [Trade Map - List of importing markets for a product exported by Marshall Islands \(Mirror\)](#)

⁵⁰ Data provided for the copra exports overlapped years (October 2018 – September 2019, October 2019 – September 2020), and an average was applied to estimate the copra exports for the 2019 calendar year.

National Assessment

Household

Plastic, Paper and Cardboard, single use items, and metals are the most dominant materials in the household audit for both Majuro and Ebeye. Ebeye recorded plastic as the highest at 25.3%, followed by Paper and cardboard at 24.8% and then metal at 12.6%. Majuro recorded paper and cardboard as the highest at 19.8% followed by plastic at 18.2% and metal at 11.6%. Single Use items account for 13% of the household waste composition in Majuro and 12.7% in Ebeye. Waste are either collected by local authorities, self-hauled to landfill by households or illegally dumped. 82.7% of Majuro communities have access to garbage collection services and 80.2% on Ebeye.

Commercial Facilities

Paper and Cardboard, and plastic were recorded as the most dominant materials in the commercial samples from both Majuro and Ebeye. Majuro recorded 32.8% of commercial waste comprising of paper and cardboard followed by plastic at 21.5%. Ebeye recorded 37.1% for Paper and cardboard while plastic make up 29.5%. The third dominant material for Majuro was Single use items at 12.5% while metals was the third dominant material for Ebeye at 11.4%.

Landfill

Assessment of public landfills in Majuro and Ebeye identified paper and cardboard, and plastics to be the most dominant materials. This finding is closely related to finding from the household and commercial audits. The landfill in Ebeye recorded metal as the third dominant material at 12.2% while the Majuro landfill recorded organics as the third dominant material at 14.2%. There is a separate collection service in Majuro for organic waste that transport segregated garden organics to the landfill. . Due to unavailability of equipment used for transporting garden organics, segregated organics are landfilled. This explains the disparity in the household composition result and the landfill composition result in Majuro.

Recovered Material Stockpiles

Assessment of waste streams of the two atolls highlighted that a significant proportion is made up PET bottles, aluminium cans, and glass. Improvement to the existing CDL scheme in Majuro and Ebeye have potential to recover these materials.

Appendix A: Waste sort categories

Table B1: Primary categories

Category 1	Examples
Metals	Aluminium cans, Aluminium recyclable, Steel containers, White goods, End of life vehicles, Metal other.
Paper and cardboard	Cardboard, liner paperboard (LPB - cardboard container lined with plastic or aluminium), composite, paper.
Plastics	PET containers, HDPE containers, LDPE containers, PVC containers, PP, EPS, PS, Flexibles/film, Other plastic.
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
Hygiene	Feminine Hygiene, Pharmaceutical, Medical waste, Nappies, Other sanitary waste
Organics	Food organics, Wood/timber, Garden organics, Other organics
Hazardous	Paint, Fluorescent tubes, Household chemicals, Asbestos, Clinical (medical), Gas bottles, Mercury, Containerised used oil, Hazardous (other)
Other	Textiles, EOL renewable energy equipment, Tyres, Rubble/concrete including Ceramics

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
Truck	6500	kg
Boat	500	kg
m bikes	180	kg
Cars	1500	kg
Van	2000	kg
Heavy machinery	10000	kg
Roofing iron	20	kg
Dumped general waste	200	kg/m3
Other metal	63	kg/m3
E-waste	38	kg/m3
White goods	225	
Demolition	225	kg/m3
Plastics	13	kg/m3
Tank	150	
Timber	178	kg/m3
Aluminium cans	154	kg/m3
Greenwaste	150	kg/m3
Batteries	5	kg
Tyres	8	kg
Glass	347	
Hazardous	238	kg/m3
Waste oil	1000	L/m3

Appendix C: Density Assumptions

Density assumptions applied to landfill visual assessment compositions		
Category	Conversion (kg/m ³)	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/

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