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# Waste Audit Methodology: A Common Approach

A step-by-step manual for conducting comprehensive country waste audits in SIDs

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*Prepared in cooperation with:*



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## Executive Summary

The Pacific Region Infrastructure Facility (PRIF) is a multi-agency coordination mechanism aimed at improving the delivery of development assistance from donors and development partners to the infrastructure sector in the Pacific region.

As part of its applied research activities, PRIF has been researching the benefits and challenges of establishing a regional recycling network for the Pacific. Among the benefits considered are a gradual evolution of Pacific Island countries (PICs) from linear economies to more sustainable circular economies.

In 2017–18, PRIF commissioned a research study to identify and quantify the opportunity to improve the resource recovery of 15 primary recyclable commodities present in the solid waste stream in 15 PICs and territories. The recommendations of the project were a pre-feasibility study to determine the viability of establishing a regional network to allow for recovery, consolidation, processing and shipment of recyclables from a network of surrounding islands.

Whereas the 2018 PRIF study focused mostly on the export and import material flows of PICs, more information is required on standardised country data regarding solid waste production, collection, treatment and disposal, including more detailed analysis of institutional readiness and the infrastructure required within individual countries to ensure a viable recycling network. Over the course of 2018–19, it has also become apparent that there are a number of organisations currently working in this space with very similar requirements for waste data.

Therefore, based on waste audits commissioned by PRIF in Tuvalu, a waste audit methodology has been developed that incorporates the materials required for national baseline data collection for the following projects as a minimum:

- SPREP – PacWaste Plus
- PRIF – Regional Recycling Network
- EU – EDF11
- CCOA – Commonwealth Clean Oceans Alliance
- World Bank – Regional Recycling Network
- UNEP – GEF

This report presents a comprehensive data collection methodology that makes provision for the data collection requirements for the above projects.



## Acronyms

APWC	Asia Pacific Waste Consultants
CDS	container deposit scheme
DMP	Department of Marine and Ports
DOE	Department of the Environment
DoW	Department of Works
DWM	Department of Waste Management
EU	European Union
EEZ	Exclusive Economic Zone
J-PRISM	Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management
JICA	Japan International Cooperation Agency
Kaupule	Executive arm of island assembly of elders, similar to a local council
MHARD	Ministry of Home Affairs and Rural Development
MSW	Municipal Solid Waste
NGO	non-governmental organisation
NZ	New Zealand
PET	polyethylene terephthalate
PICs	Pacific Island countries
PRIF	Pacific Region Infrastructure Facility
PV	photo-voltaic
SAMOA	Small Islands Developing States Accelerated Modalities of Action Pathway
SIDS	Small island developing states
SPREP	Secretariat of the Pacific Regional Environment Programme
SPC	Secretariat of the Pacific Community
SWAT	Solid Waste Agency of Tuvalu
SWM	solid waste management
TIWPAP 2017–2026	The Tuvalu Integration Waste Policy and Action Plan: Towards Cleaner and Healthier Islands 2017–2026
TLD	top-level domain
UNEP	United Nations Environment Program
uPOPs	unintentional persistent organic pollutants
WMPC	waste management and pollution control



## 1 Introduction

In 2017–18, the Pacific Region Infrastructure Facility (PRIF) commissioned a research study to identify and quantify inadequate solid waste management, and the resulting marine pollution, in Pacific Island countries (PICs). The aim was to develop sustainable solutions and improved resource recovery of 15 primary recyclable commodities present in the solid waste stream in 15 PICs and territories.

The recommendations of the project were a pre-feasibility study to determine the viability of establishing a regional network (or hubs) to allow for recovery, consolidation, processing and shipment of recyclables from a network of surrounding islands. Based on the initial assessment of port facilities, capacity, shipping networks and other economic aspects, the study recommended recycling hubs in two sub-regions:

1. Western Pacific Islands, servicing Solomon Islands, Papua New Guinea and Timor-Leste.
2. Eastern Pacific Islands, servicing Cook Islands, Fiji, Kiribati, Niue, Samoa, Tonga, Tuvalu and Vanuatu.

(Further consideration of Northern Pacific countries was deferred, given existing recycling regimes established in those countries.)

The network/hub would involve construction of a processing and trans-shipment facility to receive, process and ship recyclable materials recovered from the eight countries in the Eastern Pacific sub-region.

Following these results, PRIF's Urban Development Sector Working Group recommended a 'Scoping Study' to investigate a potential pilot regional recycling network in the Eastern Pacific sub-region, with Suva presenting as an obvious hub location. Other cities would also be considered for potential hub locations given recoverable materials and shipping routes. Whereas the PRIF (2018) study focused mostly on export and import material flows of PICs, more information on standardised country data for solid waste production, collection, treatment and disposal is required, along with more detailed analysis of institutional readiness and the infrastructure required in each country to make the recycling network viable. This data is to be collected through detailed waste audits to inform the viability of the broader PRIF 'Scoping Study for the Regional Recycling Network for the Eastern Pacific Region'.

There are compelling reasons for PRIF, World Bank, SPREP and governments in PICs to have access to accurate, reliable and consistent data in order to plan future waste-reduction strategies. The key message is, 'what cannot be measured cannot be managed'.

The purpose of this manual is to provide a standard methodology for aid organisations funding the scoping study, and others, to undertake audits that cover the following:

- Household kerbside waste
- Commercial premises
- Landfills
- Assessment of the current collection systems
- Assessment of current infrastructure



- Assessment of the current legislation and policy framework
- Assessment of the current range of financial mechanisms available in the country

Importantly, by adhering to the set methodology, performance comparisons can be made with other countries when undertaking the feasibility analysis for movement and processing of material at a network hub location. Also, all future data collected using this methodology can be used to determine the impact of any programs or projects implemented in the region that aim to improve participating countries' waste management and recycling performance.

The main purpose of the data collection program is to be able to determine the:

- material composition of the domestic and commercial waste stream
- current total diversion of materials from landfill
- availability of materials for diversion and the supporting legislative and policy mechanisms
- types and quantities of materials that are currently being recovered, recycled or stockpiled.

This will then guide the development of programs to improve current levels of performance in maximising diversion of waste from landfill and the recovery of valuable resources for potential processing at the recycling hub. To achieve this, it is paramount that accurate data is collected.

The manual is structured as follows:

- Section 2 provides a checklist for the audit process
- Section 3 summarises the auditors' responsibilities
- Section 4 provides an outline of the OHS aspects of the audit program
- Section 5 discusses audit sample size criteria
- Section 6 outlines the specific methodology for sample collections
- Section 7 summarises the actual audit procedures
- Section 8 and 9 list the other datasets that are required to be collected
- Section 10 summarises the analysis to be undertaken
- Section 11 lists the criteria used to assess readiness for a country to be a part of the recycling hub
- Appendices provide pro-forma documents and other essential information
- All pro-formas have been provided as attachments

## 1.1 The benefits of a standard methodology

Data collection in the field of waste management has become complicated and disjointed in recent times, with a range of agencies collecting information to inform specific projects. The data collected is often very specific, employing variable waste stream definitions and classifications. As such, a fit-for-purpose dataset that can be used for a range of situations is not currently available. This standard methodology is designed to simplify that process by providing all involved agencies with a common collection data methodology. All data will be stored in the INFORM database curated by SPREP and made available to the project partners.





## 1.2 Confidentiality

Audit reports should not contain individual tenement information. Residents should have adequate notice about the audit in order to enable them to notify the local government should they choose not to participate. It is important to provide such notification with sufficient time allowed before conducting the audit. It is also important to ascertain that the data collected represents a 'typical week' in terms of 'waste generation' outcomes. Therefore, specifically avoiding holiday periods.

## 2 Checklist for Audit Methodology

The following provides a list of requirements to address in preparing for, conducting and analysing data for the audit program.

### 2.1 Project scope and information

- Finalise scope of the audit program
- Plan requirements
- Determine additional scope requirements
- Finalise timing for audit program
- Determine waste collection systems and schedules
- Collect available data on weights (including weighbridge weights for landfill)
- Obtain demographic data for the local government area (LGA)
- Contact customs departments for data

### 2.2 Audit competency

- Contract qualified auditors
- Develop a training/briefing program for all auditors
- Sign confidentiality agreements
- Implement a quality assurance program
- Use data forms – controlled distribution, use and recovery
- Design data input protocols to minimise and highlight errors
- Implement a data verification process
- Develop procedures to report any adverse findings (e.g., illegal disposal of waste materials)



## 2.3 Insurance

- Provide public liability details to local government
- Provide professional indemnity insurance details to local government
- Implement appropriate workers' compensation insurance
- Implement an occupational health and safety program
- Conduct a full risk assessment for the audit
- Develop and submit an OHS plan prior to commencing auditing
- Contain information in the OHS plan including, but not limited to:
  - sample collection procedures – kerbside collections
  - waste handling and sorting procedures
  - waste storage and collection
  - specific responsibilities
  - medical monitoring program
  - required vaccinations identified (minimum Hepatitis A and B, and tetanus)
  - first-aid provision
  - training
  - specific audit site issues
  - audit site evacuation procedures
  - personal protective equipment (PPE) – requirements, use and maintenance
  - risk matrix with hazard identification and risk-management program
  - developing a program to monitor ambient conditions.

## 2.4 Sample methodology

The sample methodology should be based on the following:

- The plan requirements
- Timeframes
- Streets and houses nominated for sampling
- Communicating the process to sample collectors to account for households that do not place waste/recycling containers out for collection, as well as households without a collection system in place
- Adopting procedures to ensure confidentiality of the origin of materials (i.e., household street and number)
- Issuing a public notification a minimum of six weeks prior to audit
- Providing a letter to sample collectors authorising collection
- Consulting landfill staff on the logistics of landfill auditing
- Briefing collection staff on the litter audits, if required



## 2.5 Waste audit site

The waste audit site will need to have the following attributes:

- Adequate space for segregation of pre- and post-audited waste, staff and equipment
- Protection from environmental conditions, such as weather/wind
- Protection of stormwater drains and other environmentally sensitive areas
- Adequate ventilation
- The provision of power and water
- Be secure enough to ensure audited materials are not tampered with

## 2.6 Auditing methodology

The methodology should maintain the integrity of the sample size so that the following takes place:

- Samples are not removed prior to being analysed
- Materials and/or streams are not mixed
- Efficient workflow is planned and that audited and non-audited materials are not mixed
- Sufficient equipment is available, including first-aid equipment
- Processes ensure the correct disposal of audited materials
- Timing is adequate for estimated quantity of waste sample
- Sorters are instructed on the process and categories
- Materials are sorted according to audit requirements
- Material data is recorded in weight (to 0.01 k) and volume (this is conducted by estimating the litres for each type of material)

## 2.7 Validation procedures

The procedures should do the following:

- Compare the quantity audited against historical data, with variations explained
- Indicate the participation rate
- Ensure that data is collected in accordance with plan protocols

## 2.8 Reporting structure

The structure needs to do the following:

- Be provided in the specified manner
- Provide validation data and analysis



- Provide comments in the report for any identified issues
- Provide a draft report to local government
- Integrate comments into a final report

### 3 Waste Auditor Responsibilities

The funding organisations are relying on the waste auditors' expertise, not only for the efficient delivery of the audit process and for the expected outcomes, but also for their experience and ability to identify what information is required and request it in a timely manner.

To ensure that the selected audit meets all projected outcomes in a safe and efficient manner, all parties have clear responsibilities and separate roles. However, to meet these responsibilities fully, the cooperation of all parties in supplying data and information is vital.

The waste audit team/the auditing firm is responsible for the following:

- Requesting in writing all relevant information and providing advice as to where the information may be available.
- Agreeing on the audit objectives and outcomes.
- Performing the audit in an efficient manner so as to achieve the stated objectives.
- Advising the client if timeframes cannot be met and providing a rationale as to why they cannot be met, as well as when they can be met.
- Ensuring that all audit samples are collected in accordance with the developed methodology and in a safe manner.
- Ensuring that waste is transported to the audit site in a safe and environmentally responsible manner.
- Conducting the audit in a safe manner and coordinating with the supervising waste auditor to ensure good practice at the audit location. The supervising waste auditor is responsible for ensuring the safety of waste auditors, the environment surrounding the audit area, and site personnel who may come into contact with the audit process. The audit area should be secure at all times and waste must be securely contained at all times.
- Ensuring the audit team is familiar with the site, taking note of any environmental issues that may need to be considered during the audit (e.g., close proximity of stormwater drain; close proximity of public places). Also, the availability of necessary utilities such as power, water and amenities.
- Estimating how much waste will be collected for sorting and ensuring adequate resources are available to effectively process this quantity. This will relate back to the audit scope.
- Ensuring all necessary equipment and resources are available as required and are in good order. Scales used for measuring should be calibrated, and any electrical equipment used onsite must be compliant.



- Ensuring that staff employed on the waste audit have the necessary competencies and skills to effectively complete their assigned tasks.
- Ensuring the audit site manager/local government has agreed in advance to the use of any onsite facilities or resources. This will include the actual sorting area, access to power and water.
- Advising the client immediately of any potential environmental issues that come to light as a result of the audit, even if this is outside of the scope of the audit.
- Ensuring all post-sorted waste is deposited into appropriate containers for final disposal/recycling in line with legislative and regulatory requirements and/or site licensing conditions.
- Maintaining confidentiality.
- Preparing all reports as required.

## 4 Occupational Health and Safety

### 4.1 Potential hazards

The sample collection and physical audit processes pose risks to personnel involved in these activities. The following are some possible hazards that may occur during the physical sorting of solid waste.

Consultants should ensure that a full risk assessment is conducted for each audit. This assessment should be signed off by the waste audit supervisor and used as the basis of the OHS plan.

#### 4.1.1 Sample collection process

Example risks include:

- effects of exposure to hazardous materials
- back injury
- slipping and falling
- heat stress and fatigue
- traffic
- heavy equipment movement.

#### 4.1.2 Physical audit process

Physical hazards include:

- cuts and punctures from sharp items in the sample (e.g., hypodermic needles, broken glass, razor blades)



- effects of exposure to hazardous materials, such as medical waste, aerosol cans, chemicals (powder and liquid), bottles of unknown/unlabelled substances, plastic bottles containing used syringes, and other hazardous materials
- back injury
- slipping and falling
- heat stress and fatigue
- traffic or heavy equipment movement
- noise exposure from operation of heavy equipment
- animal and/or insect bites
- airborne contaminants
- dust from solid waste
- fire.

Chemical hazards include:

- liquid spills from containers
- household and hazardous chemicals.

Biological hazards include:

- household hazardous wastes
- medical wastes and sharps
- blood-stained rags or objects
- hypodermic needles.

## 4.2 Health and safety guidelines for undertaking waste audits

Due to the potentially hazardous nature of waste auditing, preparing a site-specific OHS plan is considered an essential component of the process. These protocols for health and safety have been developed with reference to previous audits undertaken.

A waste-auditing exercise involves a number of activities that can potentially be hazardous to the participating personnel. It is therefore critically important that local governments and other relevant organisations prepare a site-specific OHS plan to address these risks before starting an audit. Such a plan should at least address the following:

- OHS policy
- Sample collection procedures
- Specific responsibilities – Safety Officer and waste auditors
- Medical monitoring
- Vaccinations required (minimum Hepatitis A and B, and tetanus)



- First-aid provision
- Training
- Specific audit site issues
- Audit site evacuation procedures
- PPE – requirements, use and maintenance
- Risk identification management program
- Monitoring of ambient conditions

To assist in preparation of this plan, **Appendix A** contains a risk-management matrix as well as forms that can be used for the development of the risk-management strategy.

**Appendix B** and **Appendix C** summarise the more common hazards that may arise during both the audit sample collection process and the physical audit. These appendices also include management strategies as a guide.

Essentially, a risk assessment should be conducted that allows for identifying all hazards and aspects of the program, as well as implementing acceptable management strategies.

All auditors should have available the following information, which will assist in the timely resolution of any issues that may arise during the sample collection and/or waste audit process.

#### 4.2.1 OHS plan

Onsite contact and information, including:

- main point of contact and telephone number
- facility manager and telephone number(s)
- location of site resources
- site map
- toilet facilities
- drinking water
- telephone
- emergency assembly area
- first-aid facility
- designated smoking area (if required)
- water and soap for washing.

Medical information, such as:

- location of local emergency medical facility
- telephone number for medical facility.



Important telephone numbers, such as for:

- fire department
- police department
- local ambulance
- local medical practitioner.

**Appendix G** and **Appendix H** contain the safety induction checklists to use for the audit process. **Appendix I** contains a pro-forma statement that should be signed by audit project staff when receiving the project OHS plan.

#### 4.2.2 Responsible personnel

The following section lists some of the duties and responsibilities of personnel who are supervising and conducting a physical sort of solid waste.

Supervising waste auditors'/project managers' duties and responsibilities include:

- delegating health and safety responsibilities to the Site Safety Officer
- ensuring that qualified personnel implement proper procedures in a safe manner
- making available proper PPE
- making available adequate time and budget
- ensuring all field personnel have read, understood and signed the master copy of the OHS plan
- checking the auditors have received training on waste characterisation methods, recognising hazardous wastes, potential risks from handling hazardous materials, managing site traffic, controlling dust/airborne contaminants, and back injury prevention
- ensuring staff have a good understanding of incident/emergency procedures and assembly areas.

Site safety officers' duties and responsibilities (may be the same person as above) include:

- preparing a site-specific OHS plan (including evacuation and assembly area procedures) prior to the start of any onsite activity
- ensuring that the plan is approved by the local government officer responsible for managing the audit
- having the duty and authority to stop unsafe operations, supervising the delivery of appropriate first-aid, and deciding when to contact emergency services
- ensuring the guidelines, rules and procedures in this document are followed for all site work
- being familiar with local emergency services, maintaining a list of emergency phone numbers, as well as providing a map with the quickest route to a medical facility
- conducting health and safety meetings before each shift, and a summary meeting at the end of each shift, to discuss safety issues, possible solutions and to notify personnel of all changes associated with health, safety and related protocols





- maintaining and inspecting PPE, as well as ensuring the proper use of PPE by all employees
- monitoring onsite hazards and the early health warning signs of auditors (e.g., heat stress/stroke, dehydration or fatigue); it is recommended that in hot weather, outdoor sampling is done during the cooler hours of the day
- completing appropriate OHS training (including an appropriate waste-auditing course, and having a current Level II First Aid Certificate).

### 4.3 General safety procedures

**Appendix D** contains a summary of the general procedures to follow to ensure a safe audit program.

It is essential to have undertaken a risk-management process and the preparation of an OHS plan for all separate audits, so as to identify specific issues and implement appropriate strategies.

### 4.4 Personal protective equipment (PPE)

**Appendix E** contains a list of the recommended PPE, which is essential for the safe conduct of the audit program.

It is important that those conducting the audit recognise that the use of PPE does not replace the need to observe other aspects of safe-handling procedures. PPE should be seen as an essential part of an overall safety plan.

### 4.5 Medical monitoring

All staff must ensure they are medically fit to perform the requested duties and that these duties will not aggravate any existing conditions. If any issues are identified that may impact on the physical well-being of a staff member, the Safety Officer should discuss these with the staff member.

Provide contact numbers of local medical practitioners, the hospital and ambulance service to all auditors and site supervisors. The Safety Officer must also be contactable by all site supervisors in order to provide prompt responses to any incident.

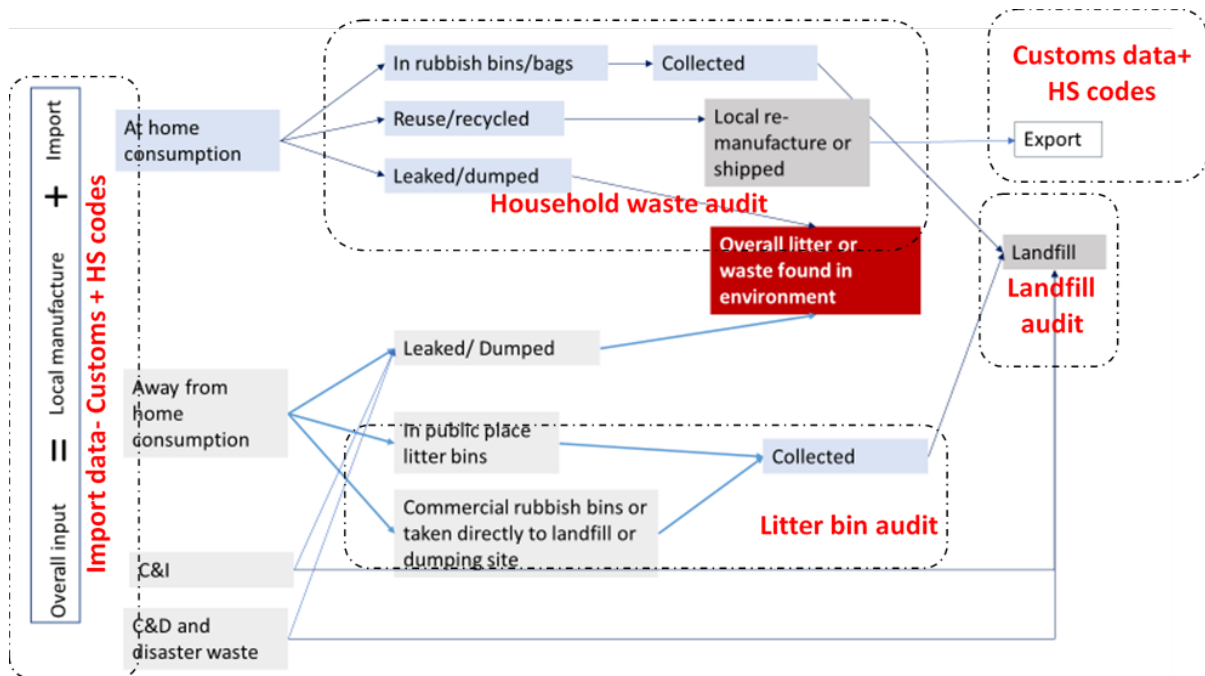
## 5 Audit Sample

The following section provides an overview of the sampling criteria to follow for conducting household, commercial waste-stream, and landfill audits. This section also provides a checklist of all other audit variables to consider to generate a comprehensive assessment of the waste management situation in each country.

It is essential that the indicated sample selection process is followed so that the audits are valid and data can be used as required.

As an overview, there are a number of methods and points where waste can be intercepted in the waste cycle, based on its disposal route. The diagram below shows some of the pathways that the generated waste can follow. Waste data can be gained from intercepting the waste after generation and at the point of disposal.

**Figure 1: Waste flows**



Based on Figure 1, it is necessary to collect the following data points in order to fully understand the waste-management system in a country. However, a study might require to only partially collect the requested data. Data points required include the following:

- Customs data for the amount of materials imported and exported
- Household audits and interviews
- Commercial audits and interviews
- Litter bin audits (if litter bins exist)
- Current data on recycling
- Current data on reuse
- Current data on local manufacturing/re-manufacturing
- Landfill audit



This section provides an audit methodology by type of audit, including:

- household collection
- commercial auditing
- litter auditing
- landfill auditing
- stockpiling.

**It is essential that this methodology is followed precisely for the accurate extrapolation of data collected through the audits.**

## 5.1 Audit timing

Avoid the following periods for auditing of residual waste and recyclables:

1. 1 December to 1 February (to minimise the impact of Christmas holidays)
2. Easter
3. Public holidays and long weekends
4. Major local events or festivals
5. Extreme weather conditions

Multiple kerbside audits have demonstrated that the types and quantities of materials generated during these periods can be significantly different from what is 'normally' generated. Therefore, to conduct the audits during these times and then extrapolate the data could lead to incorrect assumptions regarding issues such as potential diversion rates.

If possible, green organics should be audited during the cooler months of the year. If this is not possible, request data for collected green waste over the course of the year. The seasonal data should be taken into account. The standard methodology allows for the audits to be conducted consistently between countries as well as over time within the same country.

## 5.2 Sample selection

### 5.2.1 Households

To gain information on household generation, a bin/bag audit will provide valuable data about both consumption and disposal behaviour. The following details provide the methodology to follow in determining your sample and ensuring a safe audit. Undertake waste collection and sorting from households to determine the following:

- Per capita waste generation by urban and rural communities and by income level
- Per household waste generation by urban and rural households and income level



- Composition of disposed waste
- Weights and volumes of waste generated by material

To ascertain the above, the following steps must be taken:

### **Step 1: Sample location – where to collect the sample from?**

Determine the different sociodemographic regions within each local government collection area. Ascertain this using the following criteria as a guide:

- The number and size of islands within the PIC
- The type of service being provided to the communities on each island (if there are different types of collection services within each island, e.g., door-to-door and collection point, samples must cover both types of service provision)
- A minimum of two islands is recommended to be sampled for each country

Consider the following criteria for each island when undertaking sampling:

- Income levels of various communities
- Tenement size and structure (e.g., average number of people living in houses)
- Home ownership
- Type of dwelling
- Tenement income
- Block size and vegetation cover (pertinent for the green organics audit)
- Rates valuation
- Feedback from the local government

You can usually access this information from areas within the local government, department of environment or bureau of statistics. The waste collection manager (or operations manager or waste truck drivers) will be able to provide some input into this process because they will be aware of areas where the households use collection services appropriately and the areas that need improvement. Develop the detailed sampling plan with support from the local government.

### **Step 2: Sample size – how many samples should be collected?**

Domestic waste samples are collected by premises to determine the waste generation and disposal rate per household/commercial premises. Modify waste collection methods based on the area being assessed and whether a collection service is available. Then, statistically select the number of samples to be collected based on the following:

- Household numbers
- Population distribution
- Regional split
- The variability found in any previous waste audits



The methodology is designed to ensure that the variance within the samples is taken into account. We aim for minimum variance in national waste generation estimates. This might mean that our estimates for individual sites are not as precise as possible.

Population	Per household generation rate
Rural (<1000)	0.6
10,000	1.7
100,000	2.6
1,000,000	3.5

We also use the following values to estimate variance in samples:

Population	Within town variance	Between town variance
Rural	0.4	0.05
10,000	1.5	0.05
100,000	3.7	0.01
1,000,000	3.7	0.01

Total variance from rural areas, for example, is equal to:

$$\text{Var}(\text{Rural}) = W \left( \frac{0.4}{\text{number of people per town} \times \text{number of towns}} + \frac{0.05}{\text{number of towns}} \right)$$

where  $W$  is the estimated proportion of national waste coming from rural areas.

As a general rule, a sample size of 200, distributed as per population distribution, is recommended.

### 5.2.2 Commercial samples

Expectations for commercial samples have not been studied to the same extent as household samples and change quite substantially between countries. For this reason, we adopt a uniform sampling strategy, assuming no manufacturing for the places in question.

The strategy recommends gathering as many supermarket, hotel and resort samples as possible because these premises often generate the largest amount of waste. Therefore, samples from these establishments serve to reduce error as much as possible. The following sampling split is recommended as a minimum.



If 50 samples can be taken:

<b>Admin/office</b>	10
<b>Food outlet</b>	10
<b>Retail</b>	10
<b>Hotel</b>	10
<b>Supermarket</b>	10

This would yield a (very crude) estimated error of 1.0 kg/business/day or 17% at 80% CI.

If 70 samples can be taken, the following sample split is recommended:

<b>Admin/office</b>	14
<b>Food outlet</b>	14
<b>Retail</b>	14
<b>Hotel</b>	14
<b>Supermarket</b>	14

This would yield a (very crude) estimated error of 0.87 kg/business/day or 15% at 80% CI.

If a higher sample can be achieved, we recommend taking as many samples as possible and spreading them evenly among the provided categories.

A sample size calculation calculator is provided as an attachment.

## 6 Sample collection

### 6.1 Areas with a collection service

Prior to the finalisation of the audit plan, a sampling plan must be prepared, providing the number of samples to be collected by area and the resulting confidence in the data. Typically, random streets are selected from each area where the samples will be collected. The following are procedures for a sample collection:

1. The audit team typically works alongside the collection service provider to determine the best method of collecting samples prior to the normal collection. It is important that premises are unaware that their waste will be sampled because both households and premises can change their behaviour. Methods of sample collection vary based on the number of samples, days over which the samples are to be collected, number of collectors and equipment available.



2. It is imperative to have a local staff member accompany any sample collection. Local knowledge ensures smooth running of the operation, subject to the level of support provided by the client or local authority and the method of collection and sample size as to the number of staff required. Normally, a team of at least three undertake the collection.
3. Collect samples from every third to fifth house in each street from a street corner, with no more than five samples from the same street. This is not always possible and local conditions need to inform sampling protocols.
4. Collect the following data for each sampled house (a sample run sheet is provided at **Appendix K**):
  - a. GPS location
  - b. Address, if known
  - c. Number of bags sampled per household
  - d. Interview tag provided
  - e. Photograph
5. Instruct the collection supervisor to bypass any resident who raises an objection to the process.
6. Provide the collection supervisor with a letter authorising them to undertake the process, to provide to residents as required.
7. Instruct the collection supervisor to contact the audit supervisor immediately if any issues arise in relation to sample collection.

The major challenge when collecting waste that has been placed outside premises for collection is ensuring that the household or commercial premises can be identified readily by the interviewers later that day or week. To help with this, as well as recording a GPS coordinate and taking a photo, the premises where the samples are collected from could be tagged using a coloured thread or ribbon. Any similar method that allows for the correct identification of the household to be interviewed can be adopted.

We recommend at least three members be part of the collection team, with duties as follows:

- A collection supervisor and recorder *marks the location of a sample using the GPS coordinates, and at the same time take photos of the premises* for follow-up interviews. They should *insert notes on the nature of the collected samples* (e.g., on bin fullness, how much waste was collected for sampling, how much was left, types of waste, etc.).
- The second team member(s) *identifies the nature of the waste and provides information to the recorder*. In addition, they *collect samples by emptying the contents of the bins into the trash bags and placing them in the truck* for transportation to the sorting area at the landfill.
- The third team member *marks the households or commercial premises using ribbons (as tags) tied to a nearby tree, property fence or gate*, for easier identification later during follow-up interviews.

The team work together to ensure that the household numbers recorded by the recorder are the same as the numbers written on the trash bags and the ribbons (tags).



## 6.2 Collections from areas with a collection point

Some PICs have areas where an entire locality has a collection point for locals to bring their waste to prior to collection day. In this instance, the collection crew should arrive at the village the night before the collection service and approach each household for their bag. Where the household still has the bag, it is collected and the house tagged for a future interview.

However, in some cases, the samples can be collected from the collection point and a number of households can be interviewed based on the samples.

## 6.3 Collections from areas with no collection service

In this situation, three separate visits are required to ensure that the collection can take place. For example:

- On day one, staff approach the community chief and seek permission to undertake waste data collection in the village, providing the community chief/administrator with a briefing on the requested involvement.
- Staff return the next day and provide each household with a bag to use to dispose of their waste from that day onwards. Distribute 20% more than required bags, and provide information on what waste is acceptable and what is not. It is expressly forbidden to dispose of any bulky waste or problem waste into the bags.
- The team return after day one to retrieve the bags from each household. Waste in the bags from day one is discarded, as experience shows that most people use the provided bags to dispose of items that they often cannot find other ways to dispose of. Provide another bag to each household to accumulate waste for the rest of the week.
- The team return on day three or four or seven (depending on available time), and collect bags from the households they were provided to on day two. As each household brings out their waste bag, the bag is labelled and provided to the sorting team. Conduct an interview with the member of the household depositing the bag. Provide refreshments to all members of the village/community during the interview stage.
- Sort the tagged bags at the community centre in the village rather than bringing them back to the sorting site.

## 6.4 Litter

Where litter bins are provided, collect and sort the contents for a maximum of ten litter bins, and in the same manner as for the household sector above.





## 6.5 Landfill

Although the household waste generation audit covers the waste generated through the everyday consumption of products, a landfill audit will need to be undertaken to generate data around materials that are not usually found in the household bins, such as batteries and renewable energy equipment. Use the following steps for the landfill audit methodology:

- 1. Number of days of assessment:** The consultant team will determine the minimum number of loads to be audited to ensure that the results are statistically relevant. In order to do this, all landfill vehicle movement data will be collected as per landfill records and provided to the statistician to ensure that the minimum number of vehicles to be audited can be determined and provided to the auditors. In terms of the total loads to be assessed, it is important to ensure that all the different kinds of vehicles that are incoming to the landfill are audited over the course of the assessment.
- 2. Assessment protocols:** Each day, the auditors should aim to assess as many loads as possible delivered during opening hours, within safe and practical limitations. Ideally, it is important to cover a whole week of incoming landfill waste. Peak days at landfill tend to be mid-week, whereas peak loads at the transfer stations are weekends. The consultant team should seek guidance from the site partner and can vary staffing to cover this if needed. The landfill assessment protocol is provided below:
  - Auditors will need to work with each site to fully comply with their site rules. Any load directed to other designated areas, e.g., recycling drop-off, garden waste, nappy disposal, should be assessed and recorded accordingly. A landfill assessment sheet is provided at **Appendix N**.
  - The consulting team will need to ensure that the staff are in attendance from opening to closing time each audit day at each site. Based on the advised opening hours information, allow a maximum of 9.5 hours per day at each site. Our experience in Australia is that no loads could be assessed before 7 am in winter.
  - Make every effort to record every load; however, it must be acknowledged that this will be subject to the timing of the deliveries, the number of loads at any one time, and it is not always possible to record all loads and worker requirements, e.g., staff amenity breaks.
  - Staff safety is paramount at all times.
  - Staff should endeavour to take breaks at appropriate times when the number of vehicles is expected to be low.
  - If multiple vehicles arrive at one time, the assessor should obtain as much information as is safe and practical for each load.
  - If at any time the site manager believes the site conditions are unsafe, consulting staff must follow their advice and direction. This could occur in prolonged wet weather, storm or fire events.
  - The team may have two to three staff at the landfill tip-face at all times, due to the anticipated number of loads, size of the loads, time to assess and also to minimise the movement of staff at the tip-face between truck movements and deliveries.



**3. Data recording:** Provide all staff with a clear set of instructions in relation to consistent data recording. To assist, provide a vehicle and load type identifier to ensure consistency between assessors. Ensure the following:

- Equip auditors with mobile phones, high-visibility safety vests, sunscreen, wet weather gear and safety boots (with steel bases to prevent any penetration).
- Contain datasheets within specially designed all-weather clipboards. Equip staff with printers and scanners.
- Consult **Appendix N** for the number of categories to be recorded as well as the information required to be recorded.
- Record all data in a consistent manner (as litres of the load) on a standard datasheet.
- Provide space on the form so that should any other items be found in significant quantities, they can also be recorded as appropriate.
- Pre-number all sheets to ensure they are accounted for after the audit.
- Each auditor using any pre-numbered sheet should enter their name at the top of the sheet.
- Keep all completed hardcopy visual audit recording sheets in a secure location prior to data entry.
- Use online systems, where available, to collect data in the field.
- All auditors will record the following information:
  - i. Date and time of the vehicle arrival
  - ii. Registration number
  - iii. Vehicle type
  - iv. Vehicle volume
  - v. Composition of the load
  - vi. Degree of compaction
  - vii. Photographs of specific loads of interest

The following table summarises some common industry sectors based on experience. The categories should be updated based on the types of load coming into a landfill for each site. Dedicate a person to the weighbridge to record specific information in relation to source and origin of the load by ANZSIC codes. Industry sectors to be used are listed below. This list should be agreed upon during project planning for each country.



Industry sector	Examples of business types within the division
<b>Manufacturing</b>	Food products, beverage and tobacco products, textile, leather, clothing and footwear, wood products, pulp, paper and converted paper products, printing, petroleum and coal products, chemical and chemical products, polymer products, non-metallic mineral products, metal and metal products, machinery and equipment and furniture
	Meat and meat products, seafood processing, dairy products, fruit and vegetable processing, oils and fats, grain mill and cereal products, bakery products, sugar and confectionery, other food product manufacturing
<b>Retail trade</b>	Food, store and non-store, fuel, motor vehicle and motor vehicle parts
	Supermarket and grocery stores, specialised food, liquor
	Furniture, floor coverings, housewares, textile goods, electrical and electronic goods, hardware, building and garden supplies, recreational goods, clothing, footwear, personal accessories, department stores, pharmaceutical, and other store-based retailing
<b>Accommodation and food services</b>	Accommodation, hotels, hostels, bed & breakfast, restaurants, cafés, takeaway food services, pubs, taverns, bars and clubs (hospitality)
<b>Education and training</b>	Pre-school, school and tertiary education. Adult, community and other education and associated support services
<b>Charity</b>	Not-for-profit organisations – Vinnies, Mission Australia
<b>Trade</b>	Electrician, builder, plumber, carpenter
<b>Landscape</b>	Gardener
<b>Mixed small businesses</b>	Any other small business that does not fit above categories
<b>Shopping centres</b>	Centrally managed groups of shops
<b>Offices</b>	Office-based activities
<b>Unknown</b>	
<b>Other</b>	Known but not any of the above

### 6.5.1 Plastic bag audit

Experience indicates that up to 30 to 60% of commercial loads, and up to 85% of kerbside collection loads, delivered to landfills are bagged. A visual-only assessment of loads in these cases does not present a value-for-money proposition because significant unknowns result as to the nature of the bags' contents.

Based on the NSW EPA (Australia) methodology, where loads contain plastic bags in excess of 20% of the load, the assessor will randomly select two to ten bags per load, where it is safe to do so, for auditing. Frequently, at the landfill, bags are sighted on discharge; however, other loose material is then discharged on top and the bags are not redeemable. Where the bags are not accessible due to other waste being in the way, request the support of the plant operator (if available).



For domestic self-haul deliveries, retrieve samples of bags proportional to the amount delivered to determine the content of the bags. Record the number of bags selected for auditing. On collection of the sample bags, the samples are transported for sorting. If a household audit is being undertaken at the same time as the landfill audit, a plastic bag audit of the domestic stream is not necessary.

The composition of the bags is then applied to the bagged material noted during the entire audit.

It is assumed that a suitable area will be available at the landfill for sorting of contents of plastic bags.

The consulting team – with help from local staff – will sort and record as many plastic bags each day as can be physically achieved within the time allowed and with experienced staff in 7.5 hours per day. Weigh the bags of waste on electronic floor scales, and record the weight prior to placing on sorting tables. Open bags and separate the contents into the specified categories, then place into sorting bins or trays. Weigh each bin/tray and contents on a set of electronic scales. Enter the weight for each material into the appropriate space on the data recording sheet. Use the same categories for the bags as for visual, for seamless integration of the data.

Negotiate disposal of the sorted waste with each site.

## 6.6 Stockpile assessment

One of the major challenges facing PICs is their inability to move material, which leads to stockpiling. Therefore, undertake a simple assessment of stockpiles using the:

- GPS location of the stockpile
- material stockpiled
- volume or count of material
- a photograph of the stockpile.

**Appendix O** contains a stockpile assessment sheet.

## 6.7 Interviews

It is necessary to conduct interviews with sampled households to ascertain behaviours towards waste, such as the percentage of landfill waste, waste dumped on land or in water and/or burnt, composted or upcycled. This data can also be used to model waste generation for the whole country, including islands, to determine the amount or type of material that will potentially be available for shipping.

The interviews should cover the following information:

- Demographics
- Income levels
- Disposal behaviour by material type



- Willingness to pay for collection/disposal systems
- Current recycling behaviours including further source separation
- Level of awareness about the current waste service
- Type of premises
- Access to amenities (electricity, sanitation, stormwater infrastructure, etc.)
- Consumption habits

Points regarding the interviews:

- Design the questionnaires specifically for each country based on the local conditions, language and culture, and that they cover the above criteria.
- A decision should be made, with feedback from the local council, as to whether it is better to have the questionnaire in English, or another language, and undertake the interviews with the help of interpreters. In cases where the questionnaire is translated, it is important to ensure the language is not too academic, and that the questions can be answered easily by households from all walks of life.
- Conduct the interviews in pairs with at least one team member being a local and able to speak the language, accompanied by a member of the consulting staff.
- As per this methodology, during collection, record a GPS location for each household that the sample is collected from, as well as a photograph of the location. Use a piece of ribbon or string to mark the house.
- The interview team should use the GPS location to locate the house.
- Locate the piece of ribbon or string, and ensure the sample number from the string matches the one on the collection sheet. Then remove the ribbon from the premises.
- It is important to ensure that the interviewers take their time undertaking the interview.
- Interviews are the most time-consuming part of the process.

## 7 Waste sorting

An audit supervisor leads the audit, and typically a team of at least three staff are required. The in-country coordinator will arrive prior to the sorting team, undertake stakeholder engagement, obtain permits from local governments, find an appropriate sorting site, engage translators, engage three local staff who will undertake the household interviews under our direction, and will seek to employ additional council staff who will be trained to undertake waste sorting and data entry in the field.

### 7.1 Audit site set-up

Undertake sorting in a dedicated shed or marquee. The sorting area should be dry, ventilated and well protected from natural elements. Place traffic cones or high-visibility warning tape around the active sorting area.



Include waste storage areas for pre-sorted waste and post-sorted waste, which should be kept separate and away from main traffic areas and the sorting table.

Place plastic sheeting or tarp over the surface where the solid waste is to be sorted. Tape the edges of the cover down with duct tape or safely weigh it down. The cover will protect the surface from stains.

Each site supervisor is responsible for the monitoring of ambient conditions (e.g., air quality, temperature, humidity) before starting the working day and at regular times during the day. If the ambient conditions are found to be causing discomfort to the auditors, then the site supervisor should direct appropriate changes to auditing and sample collection procedures to ensure the health and safety of all personnel.

## 7.2 Sorting procedure

Weigh bags from individual households separately. Sort contents of individual bags separately into the sorting categories provided (see **Appendix L**). Place separated materials in appropriate containers, weigh on a set of electronic scales and record the weight.

The consulting team must have multiple pairs of electronic scales onsite at any one time to ensure the project can continue if a set of scales malfunctions. Store all scales in Pelican hard cases to provide protection. Calibrate all scales regularly and keep supporting documentation on record and available to be provided to the contract manager, if requested.

All staff must sign a confidentiality agreement, which prohibits them from removing anything from the material they sort or from revealing any information they obtain while sorting or auditing.

Use trays, baskets or cardboard boxes to sort the material by category.

Develop a waste data sorting sheet in close collaboration with the project manager and committee, to ensure that the project objectives are being met. The sorting sheet should comply with the following criteria:

- Comply with previous audits conducted in the region to ensure comparability
- Comply with the Tangaroa Blue marine litter database to ensure comparability to sites around the world
- Ensure that it encompasses the entire waste stream and is comprehensive
- Ensure that the waste streams of importance to different projects are covered

## 7.3 Data recording

### 7.3.1 Units

Conduct all waste quantity measurements in weight (mass) units (to 100 g) using standard metric units. All waste volume estimates should be recorded in litres (to 100 mL).



### 7.3.2 Data collection sheet

Data collection sheets are designed to be photocopied and used to record weights and volumes during the auditing process. **Appendix K** provides a blank data collection sheet. Make copies of this sheet to allow for recording of data during the audit.

Some extra lines are provided to allow you to enter items that are not covered in the list but are particularly relevant for your sample.

Use the comments section of the report form to assist in further describing the type and condition of materials that are not otherwise listed in the datasheet.

### 7.3.3 Audit validation

You may wish to check your data against previous audit reports (if available) and other state and national waste indicators. You may also wish to extrapolate the audit data and compare it to the information on total tonnages provided through the landfill and customs.

## 8 Customs data

Collect the import/export data by directly contacting the customs departments as well as relevant energy companies and distributors of whitegoods and other materials, depending on the country. **Appendix L** provides a list of materials that should be used for requesting customs data.

The data from customs is one of the most crucial elements of this survey. However, experience dictates that it can take a significant amount of time to collect this information. It is therefore advisable that you contact the customs department as the first port of call when the data collection study is commissioned.

## 9 Currently available waste data

The methodology provided here provides an estimate of waste generation as a snapshot in time. Therefore, gaining an understanding of waste generation behaviour over time provides for a cross-reference for ensuring seasonal trends are taken into account. Request the following data from each council/municipality and landfill so as to understand how the generation rate of waste might change over time:

1. Amount of total household waste collected daily (period = one year).
2. Amount of green waste collected daily (period = one year).
3. Any source separation that is being carried out (period = one year)/include waste data for the source separated material.



Collect data on current recycling and reuse of materials directly from the recyclers. This should cover the following:

- Different types of materials being recycled.
- The amount per annum of each material recycled.
- The source of the materials being recycled.
- The destination of the recycled materials.
- The processing being done within the recycling facility (i.e., compaction, shredding, washing).
- The current challenges the facility faces.

## 10 Analysis to be undertaken

The collected waste data above can be used to undertake a number of analyses. However, a basic list of analyses to be performed are listed below and the analysis methodology defined.

The aim of the feasibility study is to determine the total amount of material being generated in various parts of each country, so that the quantities to be collected, compacted and moved can be projected as accurately as possible. Based on the household and commercial as well as disposal data collected, a model of waste generation rates can be constructed to find out what the data may tell us about how waste generation varies with characteristics of households or the commercial sector.

Investigate the following features as predictors of household waste generation:

1. Household-level predictors, such as:
  - total monthly household income (from all employed members of the household)
  - monthly household spending on groceries
  - number of people in the house
  - number of children in the house
  - household rating of collection service.
2. Town-level predictors, such as:
  - whether or not there is a collection service in the household area
  - how often waste is collected if there is a service
  - average household income for the town the house is in
  - average grocery spending for the town the house is in
  - population of the town the house is in.





In a previous study, after comparing the variability in the data with the above variables, the best results were obtained using only a single predictor: *the town population*. The log-linear model trained on the whole dataset was given by:

$$\text{Generation Rate} \left( \frac{\text{kg}}{\text{hh} \cdot \text{day}} \right) = 0.4 \times \ln(\text{Town population})$$

The models that best fit the generation data are different based on the variability of waste generated versus the characteristics measured. Therefore, the model that fits the data will be different for each country but can be easily determined by modelling the data collected versus potential predictors of generation. The generation rates thus generated are then checked against actual disposal rate data made available through the landfill/dumpsite audits, as well as the incoming material data using the information provided by customs.

The landfill audit results are used to determine the following:

- The type and quantity of material being dumped at the landfill from various sectors.
- The composition of waste (weight and volume) being brought into the landfill from each sector.
- The amount of recyclable material available from the various waste streams.
- The potential recovery of material possible based on the available recyclable materials.

Further analysis can be performed to answer the following questions:

- What is the potential of recovery of materials based on new/proposed legislation, such as levies and deposit schemes?
- What is the actual recovery available after substitution and going through the consumer cycle?

Finally, the impact of all recycling and recovery options on the landfill life for each country should be modelled.

## 11 Readiness Matrix

Further to the availability of materials for recycling, the ability of a country to participate in a regional recycling network is dependent on the following:

- Its current legislative and policy regime
- Staff capacity and resourcing
- Infrastructure availability



Based on the above criteria, a readiness matrix has been created (listed in the table below). A detailed matrix will be developed and refined based on the country-specific information collected by the in-country coordinator.

Theme	Gaps
<b>Policy/legislation</b>	<ul style="list-style-type: none"> <li>• Signatory to international treaties allowing movement of waste</li> <li>• In-country deposit legislation and the extent</li> <li>• Ability to legislate swiftly, if required</li> <li>• Local by-laws and implementation</li> <li>• Responsibilities and power of implementation and compliance</li> <li>• EPR schemes</li> </ul>
<b>Data collection and decision-making</b>	<ul style="list-style-type: none"> <li>• Responsible entities for ongoing data collection</li> <li>• Responsible entities for decision-making</li> <li>• Responsible entities for implementation and compliance</li> </ul>
<b>Economic instruments</b>	<ul style="list-style-type: none"> <li>• Financial instruments for collection of different materials</li> <li>• Local laws supporting/inhibiting import/export of materials</li> <li>• Bans or phase-outs in place</li> </ul>
<b>Collection services</b>	<ul style="list-style-type: none"> <li>• Current availability and effectiveness of waste collection service</li> <li>• Ability to diversify to multiple collection types</li> <li>• Ability to expand</li> <li>• Recyclers and small-scale players for possible future collections</li> </ul>
<b>Equipment and maintenance</b>	<ul style="list-style-type: none"> <li>• Number, type and quality of equipment available for collection, compaction, cleaning and re-manufacture of different material types</li> <li>• Ability to acquire such equipment in future</li> <li>• Ability to successfully use (including available ongoing funds) and maintain such equipment</li> </ul>
<b>Private sector readiness</b>	<ul style="list-style-type: none"> <li>• Current recycling capacity of the recycling sector</li> <li>• Current collection/recycling contracts in place</li> <li>• Equipment available or capacity to deploy</li> </ul>
<b>Education and engagement</b>	<ul style="list-style-type: none"> <li>• Education and engagement requirements for the potential hub concept to work</li> <li>• Stakeholders to be engaged</li> <li>• Champions in relevant departments</li> <li>• Gaps in capacity</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>• Capacity for ongoing monitoring and evaluation: staff, technical capability</li> </ul>
<b>Training</b>	<ul style="list-style-type: none"> <li>• Technical capacity of both the private and public sector to undertake the activities required for the successful movement of material to be accepted at a hub</li> <li>• Potential areas of training and skill gaps</li> </ul>



## Appendix A – Risk management form

The following form is an example of a risk-management process. There are many variations of this form.

### 1. IDENTIFY THE HAZARD (s)

(a) Describe the hazard (s):

	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	High	High	Very high	Very high	Very high
Likely	Moderate	Moderate	High	Very high	Very high
Possible	Low	Moderate	High	High	Very high
Unlikely	Low	Low	Moderate	Moderate	High
Rare	Low	Low	Low	Low	Moderate

### 2. ASSESS THE RISK

Risk assessment calculator indicates:

\_\_\_\_\_

Identify the risk:

\_\_\_\_\_

### 3. DETERMINE WHAT CONTROL MEASURES TO TAKE

(a) Short-term/Immediate control measures:

(b) Long-term control measures:

### 4. REVIEW, APPLY AND MONITOR CONTROL MEASURES

(a) Review the possible control measure:

(i) Will the control measure introduce a new hazard?	<b>YES/NO</b> If no, continue; if yes, undertake the risk-management procedure again
(ii) Is the revised control measure effective?	<b>YES/NO</b> If yes, continue; if no, re-do step 3



(b) Control measure finally applied:

\_\_\_\_\_

(c) Monitor the control measure:

(i) Does the control measure continue to be effective?

**YES/NO**

If yes, continue to monitor; if no, re-do the risk-management procedure again

**ORGANISATION DETAILS**

(a) Audit project: \_\_\_\_\_

(b) Prepared by: \_\_\_\_\_

(c) Signature: \_\_\_\_\_

(d) Date: \_\_\_\_\_



## Appendix B – Risk-management strategies (sample collection)

Risk	Management strategy
<b>Vehicle accident while in transit</b>	<ul style="list-style-type: none"> <li>Advise all employees of this risk and remind them of the requirement to observe all traffic rules, especially speed restraints when travelling to and from sites.</li> <li>Only permit fully licensed personnel to drive vehicles.</li> </ul>
<b>Skin puncture due to contact with sharp object</b>	<ul style="list-style-type: none"> <li>Advise employees that no physical handling of waste is to occur.</li> <li>Employees will wear covered safety shoes, long-sleeve shirts and long pants to minimise any accidental contact.</li> <li>Provide first-aid kits in case of accident.</li> </ul>
<b>Odorous materials</b>	<ul style="list-style-type: none"> <li>Issue employees with facemasks.</li> <li>The site supervisor will monitor reactions during the audit when odorous samples are present to determine whether any employee requires a break.</li> </ul>
<b>Injury from slipping/fall</b>	<ul style="list-style-type: none"> <li>Discuss with employees sample collection procedures.</li> <li>All employees will wear sturdy boots and be advised to exercise due care when moving in/through any location.</li> </ul>
<b>Knocked down/run over by vehicle</b>	<ul style="list-style-type: none"> <li>Brief all employees on this risk.</li> <li>Restrict the use of mobile phones to breaks when the employee is not in a traffic area.</li> <li>Get other trucks out of the path of auditors.</li> <li>Train employees to ensure visual contact is made with any vehicle in the vicinity prior to moving off the kerbside or traversing driveways.</li> <li>Prior to moving around any corners, the employee will make a visual and auditory inspection to determine if any vehicles are approaching. If yes, then the employee will position themselves to ensure they will not be knocked down.</li> <li>Employees will wear high-visibility safety vests.</li> </ul>
<b>Muscle injury from lifting waste</b>	<ul style="list-style-type: none"> <li>Train all employees in safe lifting techniques.</li> <li>Require all employees to ‘test’ each load prior to lifting, to determine whether assistance is required.</li> </ul>
<b>Skin burn due to contact with chemicals</b>	<ul style="list-style-type: none"> <li>Advise employees not to handle any waste or container without wearing gloves and other PPE.</li> <li>Make first-aid kit and water available on each site.</li> </ul>
<b>Eye injury due to dust/chemical</b>	<ul style="list-style-type: none"> <li>Employees will wear safety glasses at all times.</li> <li>The first-aid kit should contain sterile eye wash liquid.</li> </ul>
<b>Breathing difficulties due to dust</b>	<ul style="list-style-type: none"> <li>Provide employees with facemasks.</li> </ul>



<b>Risk</b>	<b>Management strategy</b>
<b>Dehydration</b>	<ul style="list-style-type: none"><li>• All employees are expected to have their own water bottle that must be filled and taken onsite each day.</li><li>• Make drinking water available throughout the day.</li><li>• Make employees aware of the risks and early warning signs of dehydration.</li></ul>
<b>Fatigue from collection procedures</b>	<ul style="list-style-type: none"><li>• Schedule regular breaks during the collection process.</li><li>• Encourage staff to report to the site supervisor if they are feeling fatigued, and allow them to take breaks.</li><li>• Provide adequate food and water for employees to consume during breaks.</li></ul>
<b>Waste spill – water or land contamination</b>	<ul style="list-style-type: none"><li>• The employee will work on a paved area or roadway wherever possible where waste is being bagged.</li><li>• Each truck will carry a clean-up kit. Immediately clean up any spills.</li><li>• Do not bag waste near to or over a stormwater drain or other sensitive areas.</li></ul>
<b>Sun/wind burn due to exposure to elements</b>	<ul style="list-style-type: none"><li>• Require employees to wear broad-brimmed hats if working outdoors.</li><li>• Provide sunscreen. This is required to be worn and reapplied regularly during the day if working outdoors.</li><li>• Make employees aware of the risks and advise them to monitor safe conditions.</li></ul>



## Appendix C – Risk-management strategies (waste audit)

Please note that the risk-assessment matrix provided below is for guidance only. The waste audit supervisor is responsible for taking stock of the audit and site requirements, and for updating the risk-assessment matrix based on the country and site.

Risk	Management strategy
<b>Skin puncture due to contact with sharp object</b>	<ul style="list-style-type: none"> <li>• Employees will wear covered safety shoes, gloves, long-sleeve shirts and long pants to minimise any accidental contact.</li> <li>• Advise collection and site supervisor staff of correct handling procedures for waste and bags to avoid contact with body.</li> <li>• Advise employees that no physical handling of waste is to occur. Tongs are to be used where appropriate.</li> <li>• Provide first-aid kits in case of accident.</li> </ul>
<b>Odorous materials</b>	<ul style="list-style-type: none"> <li>• Locate audit sites in areas where there is adequate ventilation.</li> <li>• Issue employees with facemasks.</li> <li>• The site supervisor will monitor staff reactions during the audit when odorous samples are present to determine if any employee requires a break.</li> </ul>
<b>Illness due to contact with bacterial/infectious substances</b>	<ul style="list-style-type: none"> <li>• Employees will wear a facemask and gloves.</li> <li>• Advise employees of correct hygiene – provide water and soap for washing.</li> <li>• Advise employees to wash their hands at each break and at the end of the day.</li> <li>• Employees will wear coveralls. Also advise them to wash their clothes separately.</li> </ul>
<b>Muscle injury from lifting waste</b>	<ul style="list-style-type: none"> <li>• Train all employees in safe lifting techniques.</li> <li>• Require all employees to ‘test’ each load prior to lifting to determine if assistance is required.</li> <li>• Rotate tasks so that lifting tasks are shared throughout the day.</li> </ul>
<b>Skin burn due to contact with chemicals</b>	<ul style="list-style-type: none"> <li>• Employees are not to handle any waste or container brought onto the waste audit site.</li> <li>• Provide a first-aid kit and water at each site.</li> <li>• Advise employees to stand clear of any vehicle or person emptying a waste/recyclables container, due to risk of splashes.</li> </ul>
<b>Eye injury due to dust/chemical contact</b>	<ul style="list-style-type: none"> <li>• Employees will wear safety glasses onsite at all times.</li> <li>• The first-aid kit should contain sterile eye wash liquid.</li> </ul>
<b>Breathing difficulties due to dust</b>	<ul style="list-style-type: none"> <li>• Provide employees with facemasks.</li> </ul>



Risk	Management strategy
<b>Dehydration</b>	<ul style="list-style-type: none"> <li>• All employees are expected to have their own water bottle that must be filled and taken onsite each day.</li> <li>• Make drinking water available throughout the day.</li> <li>• Make employees aware of the risks and the early warning signs of dehydration.</li> </ul>
<b>Fatigue from auditing</b>	<ul style="list-style-type: none"> <li>• Schedule regular breaks during the auditing process.</li> <li>• Encourage staff to report to the site supervisor if they are feeling fatigued, and allow them to take breaks.</li> <li>• Provide adequate food and water for employees to consume during breaks.</li> </ul>
<b>Sun/wind burn due to exposure to elements</b>	<ul style="list-style-type: none"> <li>• Require employees to wear broad-brimmed hats if working outdoors.</li> <li>• Provide sunscreen. This is required to be worn and reapplied regularly during the day if working outdoors.</li> <li>• Make employees aware of the risks and advise them to monitor safe conditions.</li> </ul>
<b>Knocked down/run over by vehicle</b>	<ul style="list-style-type: none"> <li>• Clearly define the audit site.</li> <li>• Give employees a site-specific induction advising of the presence of traffic and hazards.</li> <li>• Define no-go areas.</li> <li>• The supervisor will be aware of the risk.</li> </ul>





## Appendix D – General safety procedures

This section lists some of the recommended general safety procedures for a physical sort of solid waste.

- All waste sorting personnel should be in good physical condition, have had a recent medical examination, maintain a current tetanus booster, and Hepatitis A and B shots, not be sensitive to odours and dust, and be able to read warning signs/labels on waste containers.
- There should be absolutely no eating, smoking or drinking during sorting activities. Keep food and liquids away from the sorting area. Plenty of fluids (e.g., water, sports drinks) and single-use, disposable cups must be available at all times. Wash hands and faces before eating, drinking or smoking. Consume drinks and take frequent rests during hot days. Any smoking is to be done at a safe, approved location away from the main auditing area.
- Group the sorters into pairs. Each member should periodically assess the physical condition of their partner.
- Always wear the following before beginning the sorting procedure: both pairs of gloves (outer rubber and inner latex), chemical goggles or safety glasses with splash shields, a dust mask, and disposable overalls.
- Do not attempt to identify unknown chemical substances present in the waste stream: vials of chemicals, unlabelled pesticide/herbicide containers, and substances (e.g., chemicals or needles) in unlabelled plastic/glass bottles/jugs.
- Household hazardous wastes are those resulting from products purchased by the public for household use, which, because of their quantity, concentration, physical or infectious characteristics, may pose a substantial known or potential hazard to human or environmental health when improperly disposed of.
- Empty containers of household hazardous wastes are generally not considered to be a hazardous waste. If hazardous wastes are detected, notify the Site Safety Officer.
- Hazardous materials and hazardous wastes should not be present in residential sources of municipal solid waste. If hazardous wastes are present in the municipal waste stream, from a commercial or industrial source, the material is not a household hazardous waste, it is a hazardous waste, and the Site Safety Officer must be notified. Sorting activities are to cease immediately until the hazard has been removed.
- A potential hazard that can arise in waste sampling is the presence of medical wastes. Sorters must be on alert for the indicators of medical wastes: hypodermic needles, needle covers, medical tubing, articles contaminated with red (blood)-coloured substances, and medical device packaging. If medical wastes are detected, the sort will be halted and the Site Safety Officer notified.
- When sorting glass, remove the large pieces first, and then remove the clear glass. Never use your hands to dig down through the waste. Use a rake or small shovel to pull/push the material to the side and continue sorting.
- At the end of each shift, remove all disposable clothing into a plastic garbage bag, and place the bag into a solid waste receptacle. All sorters must shower at the end of each shift.



## Appendix E – Recommended personal safety/ protective equipment

Use the recommended personal safety/protective equipment to prevent injuries, exposure or contact with hazardous substances or objects. The following section lists some of the recommended equipment for a visual and physical sort of solid waste.

### **Body protection:**

- Sunscreen
- Broad-brimmed hats
- Disposable coveralls
- Chemical-resistant coveralls, if appropriate
- Hard-bottomed, non-slip, steel-capped boots
- A supply of outer rubber (cut and puncture resistant) gloves
- Chemical goggles or safety glasses with splash shields
- Dust masks
- A supply of inner (latex) gloves
- Insect repellent
- Hearing protection (e.g., ear plugs or earmuffs) if site has equipment or activities that generate loud noises

### **Other safety equipment:**

- Supply of water and soap for washing/flushing
- Industrial first-aid kit
- Field blanket
- Eyewash kit
- Moist, disposable towels/wipes (e.g., baby wipes)
- Mobile telephone
- Liquids to replenish fluids (water and cups for hydration)
- Trolley

### **The personnel required to collect the audit sample should be issued with (and required to wear):**

- High-visibility safety vests
- Overalls
- Safety footwear
- Gloves
- Masks
- Safety glasses
- Broad-brimmed hats if collecting during daylight hours



## Appendix F – Medical monitoring

### Medical monitoring

All employees will be required to provide information to the Safety Officer of any conditions and/or medication programs that may be compromised during any phase of the project. For example, if an employee is prone to asthma attacks as a result of exposure to dust, then this should be brought to the attention of the Safety Officer.

### Confidentiality

The confidentiality of all records and reports provided as a requirement of the medical monitoring program and/or medical treatment will be maintained by the Safety Officer. At no time should these records/reports be provided to any other person except with the express permission, in writing, of the person to whom the records/reports refer.

### Vaccinations

All employees undertaking physical auditing will be required to show evidence that their immunity is at sufficient levels for Hepatitis A and B, and that tetanus immunisation is current. Contract staff will be requested to show similar evidence.

### First-aid precautions

First-aid kits will be present at all waste audit sites and within all waste/recyclables sample collection vehicles. Provide all staff with appropriate training during the initial orientation to manage minor incidents.

The following basic first aid items should be available in the first-aid kit:

- |   |  |
|---|--|
| <input type="checkbox"/> Adhesive bandages                    | <input type="checkbox"/> Scissors                                      |
| <input type="checkbox"/> Antibacterial ointment packets       | <input type="checkbox"/> First-aid guide                               |
| <input type="checkbox"/> Alcohol prep pads                    | <input type="checkbox"/> CPR face shield                               |
| <input type="checkbox"/> Butterfly closures                   | <input type="checkbox"/> Eye pad                                       |
| <input type="checkbox"/> Wound closure strips                 | <input type="checkbox"/> Metal tweezer                                 |
| <input type="checkbox"/> Povidone iodine prep pads            | <input type="checkbox"/> Examination gloves                            |
| <input type="checkbox"/> Elastic wrap                         | <input type="checkbox"/> Sterile sponge dressings                      |
| <input type="checkbox"/> Reusable hot and cold gel pack       | <input type="checkbox"/> Sterile trauma pad                            |
| <input type="checkbox"/> Adhesive tape rolls                  | <input type="checkbox"/> Cold pack                                     |
| <input type="checkbox"/> Ice bags                             | <input type="checkbox"/> Gauze rolls                                   |
| <input type="checkbox"/> Knuckle bandages                     | <input type="checkbox"/> Sterile examination gloves                    |
| <input type="checkbox"/> Sting relief pads (for insect bites) | <input type="checkbox"/> Conforming bandages                           |
| <input type="checkbox"/> Triangular bandage                   | <input type="checkbox"/> Note pad and pencils                          |
| <input type="checkbox"/> Arm splint                           | <input type="checkbox"/> Safety pins                                   |
| <input type="checkbox"/> Finger splints                       | <input type="checkbox"/> Splinter probe                                |
| <input type="checkbox"/> Insect repellent packets             | <input type="checkbox"/> Cotton swabs                                  |
| <input type="checkbox"/> Eye wash                             | <input type="checkbox"/> Cotton tip applicators                        |
| <input type="checkbox"/> Antiseptic towelettes                | <input type="checkbox"/> Acid burn – neutralising solution/aerosol can |



## Appendix G – Safety induction checklist (sample collection)

The collection of waste containers from the kerbside is inherently hazardous. You are responsible for ensuring that you conduct all activities in a safe manner and immediately alert your supervisor of any practice or situation you consider to be unsafe – for you or any other person. You must not undertake any activity that you consider to be unsafe.

Follow these safety procedures at all times:

- Correctly wear personal protective equipment (PPE) at all times whenever working. This includes safety vests, safety glasses, covered shoes, gloves, facemasks and coveralls.
- Ensure back braces and trolleys are supplied if moving of heavy waste loads is required.
- Never carry containers and/or individual bags of waste near the body.
- Never support bags by placing hands under the bag – bags must be held from the top.
- Always test the weight of the bag prior to lifting. Always ask for assistance if the bag is beyond your ability to lift it. Whenever lifting, bend the knees and lift from the legs – not the back.
- Always be aware of other traffic. Pay attention to other waste collectors and whether they are placing themselves in any danger from the traffic. Be aware of traffic coming from driveways.
- Never enter or exit a vehicle that is moving – always wait until it has stopped and look for any traffic.
- Be aware of other hazards, such as slippery surfaces, overhanging branches and other materials near the kerbside.
- Always ensure that all containers are physically secured prior to moving the vehicle.
- If a waste spill occurs, take immediate action to prevent the spill from spreading, use safe clean-up practices and *immediately inform* your supervisor.
- Always confirm with your supervisor as to where waste should be deposited upon arriving at the waste audit site.
- *Immediately* wash hands with disinfectant before having a break. Do not eat, drink, smoke or touch your face until you have thoroughly washed your hands.
- Leave all personal items in the designated secure area and do not touch them until you have thoroughly cleaned your hands.
- Smoking, eating or drinking is not permitted in the immediate vicinity of any area where waste is located.
- Upon completion of the day, deposit all PPE, including overalls, into the specific bags/containers provided. After depositing this equipment, *immediately* wash hands with disinfectant.
- Stop for breaks as you feel necessary. Ensure you have an adequate intake of fluids and nourishment.
- If you feel unwell, report to the supervisor immediately.
- Immediately report to your supervisor any injuries you sustain.
- If the waste collection is conducted in sunny weather, wear a sunhat and apply sunscreen on a regular basis.

I have read the procedures described above and been given a verbal occupational health and safety briefing on the hazards associated with the collection of the waste and my responsibilities.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_



## Appendix H – Safety induction checklist (audit personnel)

The waste audit process is inherently hazardous. You are responsible for ensuring that you conduct all activities in a safe manner, and that you immediately alert your supervisor of any practice or situation you consider to be unsafe – for you or any other person. You must not undertake any activity that you consider to be unsafe.

Follow these safety procedures at all times:

- Correctly wear personal protective equipment (PPE) at all times whenever working. This includes safety glasses, covered shoes, gloves, facemasks and overalls.
- Never place hands blindly into piles of waste. Spread all waste on the table and ensure it is fully visible prior to sorting. Where this is not possible, instruments such as tongs should be used to spread waste.
- Never carry bags of waste (sorted and unsorted) near the body.
- Never support bags by placing hands under the bag – hold from the top.
- Always test the weight of the bag prior to lifting. Always ask for assistance if the bag is beyond your ability to lift it. Whenever lifting, bend the knees and lift from the legs – not the back.
- If a needle or any sharp item is identified in the waste, *immediately* cease sorting and alert all auditors and the supervisor. *Do not* attempt to pick up the sharp item under any circumstance.
- Do not place hands near your face while sorting.
- *Immediately* wash hands with disinfectant before having a break. Do not eat, drink, smoke or touch your face until you have thoroughly washed your hands.
- Leave all personal items in the designated secure area and do not touch them until you have thoroughly cleaned your hands.
- Smoking, eating or drinking is not permitted in the immediate vicinity of any area where waste is located.
- Upon completion of the day, deposit all PPE, including overalls, into the specific bags/containers provided. After depositing this equipment, *immediately* wash hands with disinfectant.
- Stop for breaks as you feel necessary. Ensure you have an adequate intake of fluids and nourishment.
- If you feel unwell, report to the supervisor immediately.
- Immediately report to your supervisor any injuries you sustain.
- If the audit is conducted in the open, wear a sunhat and apply sunscreen on a regular basis.

I have read the procedures described above and been given a verbal occupational health and safety briefing on the hazards associated with the conduct of the audit and my responsibilities.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_



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## Appendix I – Declaration

All site personnel (including auditors, visitors and observers) should be handed a copy of the OHS plan. The following declaration should be signed and a copy maintained by the Safety Officer.

I \_\_\_\_\_ (print name) have read and understand the occupational health and safety plan. I will follow the procedures and protocols detailed in the plan for waste auditing at all designated sites.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_



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## Appendix J – Recommended auditing equipment

- Stanley knife (with retractable blade)
- Small bins or buckets of known volume for weighing/containing sorted materials
- Sorting table
- A scale that is accurate to 100 grams (depending upon the waste stream, if required to measure below 100 grams (i.e., for materials in small quantities such as syringes), a small but accurate set of kitchen scales would be a good alternative)
- Tongs
- Permanent markers
- Clipboard and datasheets
- Calculator
- Garbage bags
- Rake with a long handle
- Small rake with a short handle
- Shovel with a long handle
- Broom
- Camera
- Duct tape
- Plastic sheeting (minimum of 10 mm thick)



## Appendix K – Collection sheet

Please note that the consultant team used an online tool but collected the below information.

	Date:	Auditor:		Weather:			
	Sample number	GPS location recorded?	Photo?	Interview sheet provided?	Interview sheet returned?	Bags provided?	Comments
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							





## Appendix L – Sorting categories

### Material categories, definition and source of data

	Category	Description	EOL Source	Incoming
Metal	Aluminium cans	Alcoholic sodas and spirit-based mixers, beer and soft drink, Food cans, pet food cans, aerosols, industrial cans	H, C, L	Cu, D
	Aluminium recyclable	Steel packaging	H, C, L	Cu, D
	Steel containers	Alcoholic sodas and spirit-based mixers, beer, soft drink, food cans, pet food cans, aerosols, industrial cans, clean/empty paint cans	H, C, L	Cu, D
	Metal other	100% ferrous items that are not cans/tins/packaging materials, any other steel, beer bottle tops, jar lids, composite ferrous items for which the weight of the ferrous metal is estimated to be greater than the other material items, foils, 100% aluminium items that are not cans/tins/or packaging materials, any other aluminium	H, C, L	Cu, D
Fishing	Fishing/seafood metal		H, C, L	
	Fishing/seafood plastic		H, C, L	
	Fishing/seafood wood		H, C, L	
Paper and cardboard	Cardboard	Cardboard without corrugation (glossy and non-glossy), cereal boxes, business cards	H, C, L	
	LPB	Soy milk cartons, some fruit juice cartons, UHT/long-life milk	H, C, L	
	Composite	Composite paper items for which the weight of the paper is estimated to be greater than the weight of the other materials	H, C, L	
	Paper	Office paper, writing pads, letters, envelopes, books, newspapers, newspaper-like pamphlets, papers, magazines, brochures, wrapping paper, labels, paper packaging (no plastic or wax coating)	H, C, L	



	Category	Description	EOL Source	Incoming
Plastic	Polyethylene (PET) containers	Soft drink, flavoured water, fruit juice, sports drinks, plain water (carbonated/non-carbonated), food containers, mouthwash containers, detergent bottles	H, C, L	Cu, D
	High-density polyethylene (HDPE) containers	Milk and flavoured milk bottles, bleach bottles, oil containers, food containers	H, C, L	Cu, D
	Low-density polyethylene (LDPE) containers	Squeezy bottles	H, C, L	Cu, D
	Polyvinyl chloride (PVC) containers	Clear cordial and juice bottles, detergent bottles	H, C, L	Cu, D
	PP	Bottles and containers	H, C, L	Cu, D
	EPS	Yoghurt and dairy containers, vending cups, clam shells	H, C, L	Cu, D
	PS	Meat and poultry trays, vending cups, fragile-item packaging	H, C, L	Cu, D
	PP	Bottles and containers	H, C, L	Cu, D
	Flexibles/film	No shopping bags. Chip packets and other MLM packaging	H, C, L	Cu, D
	Other plastic		H, C, L	CU, D
Single-use plastic items	Beverage containers	The total count from the beverage container sort	H, C, L	Cu, D
	Cigarette butts		H, C, L	Cu, D
	Cigarette packets		H, C, L	CU, D
	Straws		H, C, L	Cu, D
	Coffee cups		H, C, L	Cu, D
	Bags – heavy, glossy, typically branded carry bags		H, C, L	Cu, D
	Bags – supermarket-type lightweight carry bags		H, C, L	Cu, D
	Takeaway containers, plastic other than EPS		H, C, L	Cu, D
	Takeaway containers, Styrofoam		H, C, L	Cu, D
	Takeaway containers, paper		H, C, L	Cu, D
	Takeaway container lids		H, C, L	Cu, D
	Bottle lids		H, C, L	



	Category	Description	EOL Source	Incoming
Batteries	Non-rechargeable batteries	Common batteries, AAA, AA etc., single-use	H, C, L	
	Rechargeable batteries	Common batteries (rechargeable), AAA, AA etc.	H, C, L	
	Lead acid batteries	Large batteries used in vehicles or other machinery	H, C, L	Cu, D
	Mobile phone batteries	Batteries used in mobile phones	H, C, L	Cu, D
	Power tool batteries	Batteries used in power tools	H,C,L	
	Lithium batteries	Small lithium batteries	H, C, L	
	Lithium-ion batteries	Batteries used in electric cars	H, C, L	Cu, D
	Other batteries	All other battery types	H, C, L	Cu, D
E-Waste	Computer equipment	Keyboard, monitor, hard drives, printers, etc.	H, C, L	Cu, D
	TVs	TVs	H, C, L	Cu, D
	Mobile phones	Mobile phones, phones, tablets, chargers, car kits, bluetooth	H, C, L	Cu, D
	Electrical items & peripherals	Radio, iPod, Gameboys, stereos, speakers, VCR, DVD players, power tools, wiring and cables, small electrical items (toaster, blender, etc.), computer discs, cassettes, DVDs, CDs	H, C, L	Cu, D
	Toner cartridges	Printer and toner cartridges	H, C, L	Cu, D
Glass	Glass bottles	Recyclable (all colours) – beer bottles, wine bottles, spirit cider/ fruit-based, flavoured water, fruit juice, sports drinks, plain water	H, C, L	Cu, D
	Glass jars	Non-beverage containers (all colours) – sauce bottles, jam jars, vegetable oils, other food containers	H, C, L	Cu, D
	Glass fines	Mixed glass or glass fines < 4.75 mm	H, C, L	Cu, D
	Glass other	Plate glass (window and windscreen), Pyrex, mirror glass, Corning Ware, light globes, laboratory and medical glass, white opaque glass (e.g., Malibu alcohol bottles)	H, C, L	Cu, D
Hygiene	Feminine hygiene	Used disposable feminine hygiene products	H, C, L	
	Pharmaceutical		H, C, L	
	Nappies	Used disposable nappies/diapers	H, C, L	
	Medical waste	Sharps, human tissue, bulk bodily fluids and blood, any blood-stained disposable material or equipment	H, C, L	
	Other sanitary waste		H, C, L	
Organics	Food	Vegetable/fruit/meat scraps	H, C, L	
	Wood/timber		H, C, L	
	Garden organics	Grass clippings, tree trimmings/prunings, flowers, tree wood (<20 mm diameter)	H, C, L	
	Other organics	Animal excrement, mixed compostable items, cellophane, kitty litter	H, C, L	



	Category	Description	EOL Source	Incoming
Hazardous	Paint	Containers containing paint (dry or wet)	H, C, L	
	Fluorescent tubes	Fluorescent tubes; compact fluorescent lamps (CFLs)	H, C, L	
	Household chemicals	Containers containing bleach, cleaning products, unused medical pills	H, C, L	
	Asbestos	Asbestos and asbestos-containing products or building materials	H, C, L	
	Clinical (medical)	Sharps, human tissue, bulk bodily fluids and blood, any blood-stained disposable material or equipment	H, C, L	
	Gas bottles	Gas bottles	H, C, L	
	Mercury	Mercury used in medical applications	H, C, L	Ministry of health, hospitals
	Hazardous other	Any other hazardous material	H, C, L	
	Textiles	Wool, cotton and natural-fibre materials	H, C, L	
	White goods		H, C, L	Cu, D
	Ceramics		H, C, L	
	Containerised used oil		H, C, L	Cu, Retail
	EOL renewable energy equipment	Includes EOL solar panels	H, C, L	Cu, Power company, installers
	End-of-life vehicles		H, C, L	Cu
	Tyres		H, C, L	Cu
	Other: please describe			

**Codes used:**

H = Household audit

C = Commercial audit

L = Landfill audit

Cu = Customs

D = Distributors



## Appendix M – Detailed list of container categories

Beverage container only for further sorting			
	<500	500–1500	>1500
<b>Aluminium</b>			
Alcoholic sodas & spirit-based mixers Beer/cider Water			
Flav. water/soft drink (carbonated) Flav. water/soft drink (non-carbonated)			
Food (human) Food (dog & cat)			
Other			
<b>Steel</b>			
Alcoholic sodas & spirit-based mixers			
Beer Cider/fruit-based etc.			
Flav. water/soft drink (carbonated) Flav. water/soft drink (non-carbonated)			
Other			
<b>LPB</b>			
Milk			
Flavoured milk Fruit juice (>90% fruit &/or veg juice)			
Fruit drink Flav. water/sports drink, non-carbonated			
Beauty & personal care Home care (inc. cleaning)			
Other			
<b>PET</b>			
Milk			
Drink pouches Flav. milk			
Flav. water/sports drink etc (non-carbonated) Flav. water/soft drink (carbonated)			
Plain water (carbonated or non-carbonated)			
Fruit juice (>90% fruit &/or veg juice) Fruit drink			
Beauty & personal care Home care (inc. cleaning)			
Other			



<b>Beverage container only for further sorting</b>			
<b>HDPE</b>			
Milk Drink pouches Flav. milk			
Flav. water/sports drink etc (non-carbonated) Flav. water/soft drink (carbonated)			
Plain water (carbonated or non-carbonated) Fruit juice (>90% fruit &/or veg juice)			
Fruit drink			
Beauty & personal care Home care (inc. cleaning)			
Other			
<b>Other plastic</b>			
Milk Drink pouches			
Flav. milk Flav. water/sports drink etc. (non-carbonated)			
Flav. water/soft drink (carbonated)			
Plain water (carbonated or non-carbonated) Fruit juice (>90% fruit &/or veg juice)			
Fruit drink Wine bladders			
Beauty & personal care Home care (inc. cleaning)			
Other			
<b>Glass</b>			
Alcoholic sodas/spirit-based mixers			
Beer Cider/fruit based, etc.			
Flav. water/soft drink (carbonated) Plain water (carbonated or non-carbonated)			
Fruit juice (>90% fruit &/or veg juice)			
Fruit drink Wine (glass only)			
Wine cooler Spirit			
Beauty & personal care Home care (inc. cleaning)			
Other			



## Appendix N – Landfill audit sheet

<b>Location:</b> _____		<b>Auditor:</b> _____			<b>Date:</b> _____		
Sample number							
Entry time							
Vehicle registration number							
Type of vehicle							
Maximum capacity (m <sup>3</sup> )							
Compaction (circle)		H	M	L	H	M	L
Tipping point							
Source (C&I / C&D / Council / SH / MSW)							
Sector (M S H O X C T L E U G)							
<b>Bagged waste</b>	<b>Bagged waste</b>						
Metals	Aluminium cans						
	Aluminium recyclable						
	Steel containers						
	Metal other						
Fishing	Fishing/seafood metal						
	Fishing/seafood plastic						
	Fishing/seafood wood						
Paper/ cardboard	Cardboard						
	LPB						
	Composite						
	Paper						
Plastic	PET containers						
	HDPE containers						
	LDPE containers						
	PVC containers						
	PP						
	EPS						
	PS						
	PP						
	Flexibles/film						
	Other plastic						



Single-use plastic items	Beverage containers			
	Cigarette butts			
	Cigarette packets			
	Straws			
	Coffee cups			
	Bags – heavy, glossy, branded carry bags			
	Bags – supermarket lightweight carry bags			
	Takeaway containers, plastic not EPS			
	Takeaway containers, Styrofoam			
	Takeaway containers, paper			
	Takeaway container lids			
	Bottle lids			
	Batteries	Non-rechargeable batteries		
Rechargeable batteries				
Lead acid batteries				
Mobile phone batteries				
Power tool batteries				
Lithium batteries				
Lithium-ion batteries				
Other batteries				
E-Waste	Computer equipment			
	TVs			
	Mobile phones			
	Electrical items & peripherals			
	Toner cartridges			
Glass	Bottles			
	Jars			
	Fines			
	Other			





Hygiene	Feminine hygiene			
	Pharmaceutical			
	Nappies			
	Medical waste			
	Other sanitary waste			
Organics	Food			
	Wood/timber			
	Garden organics			
	Other organics			
Hazardous	Paint			
	Fluorescent tubes			
	Household chemicals			
	Asbestos			
	Clinical (medical)			
	Gas bottles			
	Mercury			
	Hazardous other			
Other	Textiles			
	White goods (vol./count)	/	/	/
	Ceramics			
	Containerised used oil (vol./weight)	/	/	/
	EOL renewable energy equipment (vol./count)	/	/	/
	End-of-life vehicles (vol./count)	/	/	/
	Tyres (vol./count)	/	/	/
	Others: _____			



## Appendix O – Stockpile assessment sheet

### Stockpile assessment sheet

Date: \_\_\_\_\_

Location of stockpile: \_\_\_\_\_

#### Photo taken

Material type	<input type="checkbox"/> Cars <input type="checkbox"/> Heavy machinery <input type="checkbox"/> Solar panels <input type="checkbox"/> Boats <input type="checkbox"/> Gas bottles – acetylene <input type="checkbox"/> Gas bottles – oxygen <input type="checkbox"/> Gas bottles – cooking <input type="checkbox"/> 44-gallon drums <input type="checkbox"/> Containers (20 ft) <input type="checkbox"/> Containers (40 ft) <input type="checkbox"/> Used oil <input type="checkbox"/> Iron roofing material <input type="checkbox"/> Aluminium cans <input type="checkbox"/> Plastic water tanks
Volume of stockpile	
Number of items in stockpile	
Weight of one item (if possible)	
Comments	