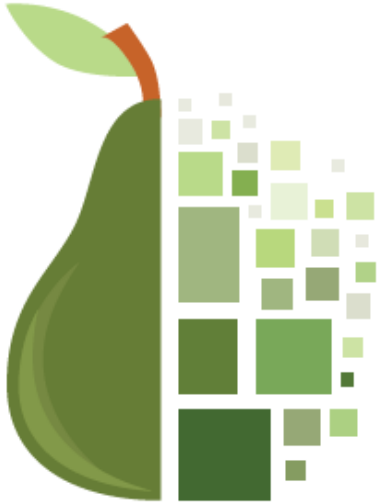


Food
Loss + Waste
PROTOCOL

Approaches for Excluding the Weight of Packaging from the Weight of Food Loss and Waste (FLW)

Published: December 17, 2019

Table of Contents

Introduction & How to Use This Document

Introduction

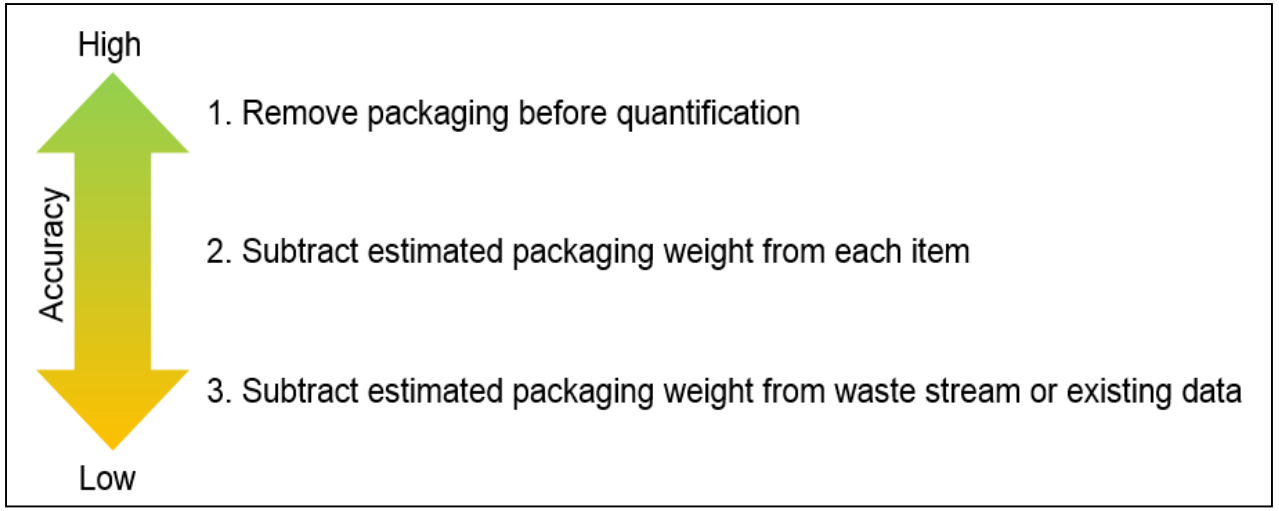
- The definition of food loss / waste (FLW) does not include packaging such as boxes, wrapping, or plastic containers.*
- Therefore the *Food Loss and Waste Accounting and Reporting Standard* (also referred to as the *FLW Standard*) requires users of the Standard to exclude the weight of any packaging from an FLW inventory.
- This document describes three approaches you could use for excluding the weight of packaging from the weight of FLW (Figure 1).
- In some cases you will be able to quantify the amount of FLW with the packaging removed (Figure 1: Approach 1). However, in many situations, the FLW that requires quantification will still be in its packaging (e.g., yogurt in its container), will be mixed with packaging (e.g., food scraps and wrapping mixed together in a collection container), or data relating to FLW will include the weight of the packaging. In these cases, you will need to make a calculation to separate the weight of the FLW from the weight of packaging (Figure 1: Approaches 2 and 3).
- This document expands upon related guidance provided by the *FLW Standard* in Sections 6.7 and 8.3.

**Edible packaging would be considered food because it is intended for human consumption*.

How to Use This Document

The document provides details about using the three approaches in Figure 1. You can use the questions on slide 4 as a guide to selecting the approach that is most relevant to your situation.

Figure 1. Summary of Approaches for Excluding the Weight of Packaging from FLW



Note: This figure corresponds to Figure 8.2 in the *FLW Standard*

Selecting the Relevant Approach

Instructions. Read the questions below and click through to the slide that is relevant to your situation.

1. Can you remove the packaging from the FLW before quantifying it?

If yes, go to slide 5 (Approach 1. Removing Packaging Before the Quantification of FLW)

If no, go to question 2

2. For individual items, or product categories, can you estimate the weight of packaging?

If yes, go to slide 7 (Approach 2. Subtracting Estimated Packaging Weight From Individual Items / Product Categories)

If no, go to question 3

3. Can you get an estimate of the packaging weight from your waste management vendor (third-party processor) or elsewhere in order to subtract it from the total weight of the waste stream, or from existing data?

If yes, see slide 9 (Approach 3. Subtracting Estimated Packaging Weight From Waste Stream / Existing Data)

If no (i.e., you have assessed the three approaches and are not able to subtract the weight of packaging), report in your FLW inventory that the weight of packaging is included along with any other relevant context

Approach 1. Removing Packaging Before the Quantification of FLW

About the Approach

You will get the most accurate estimate of FLW by quantifying it with the packaging removed (for example, de-packaging items before weighing the FLW, or using scanner data that is net of packaging weight).

Options

The following are common ways to remove the weight of packaging when using different FLW quantification methods:

- If product is de-packaged at the site of the reporting organization (e.g., at the grocery store): You should be able to report the weight of FLW net of packaging. Slide 6 provides an illustrative example of the steps a retailer might take with their waste management vendor/third-party processor in this situation.

- If using a product-based scanning (i.e., "bottom-up") method: If the content weight of items is included in your data file, you should be able to easily report on the weight of FLW net of packaging. However, if your data file only includes product weights with packaging, you will need to subtract out the estimated packaging weight. Options for doing so are described in Approach 2 (slide 7).

- If conducting a waste composition analysis (which may also be referred to as a "waste characterization study," or "waste sort"): You could require that packaging removal be part of the sorting procedure.

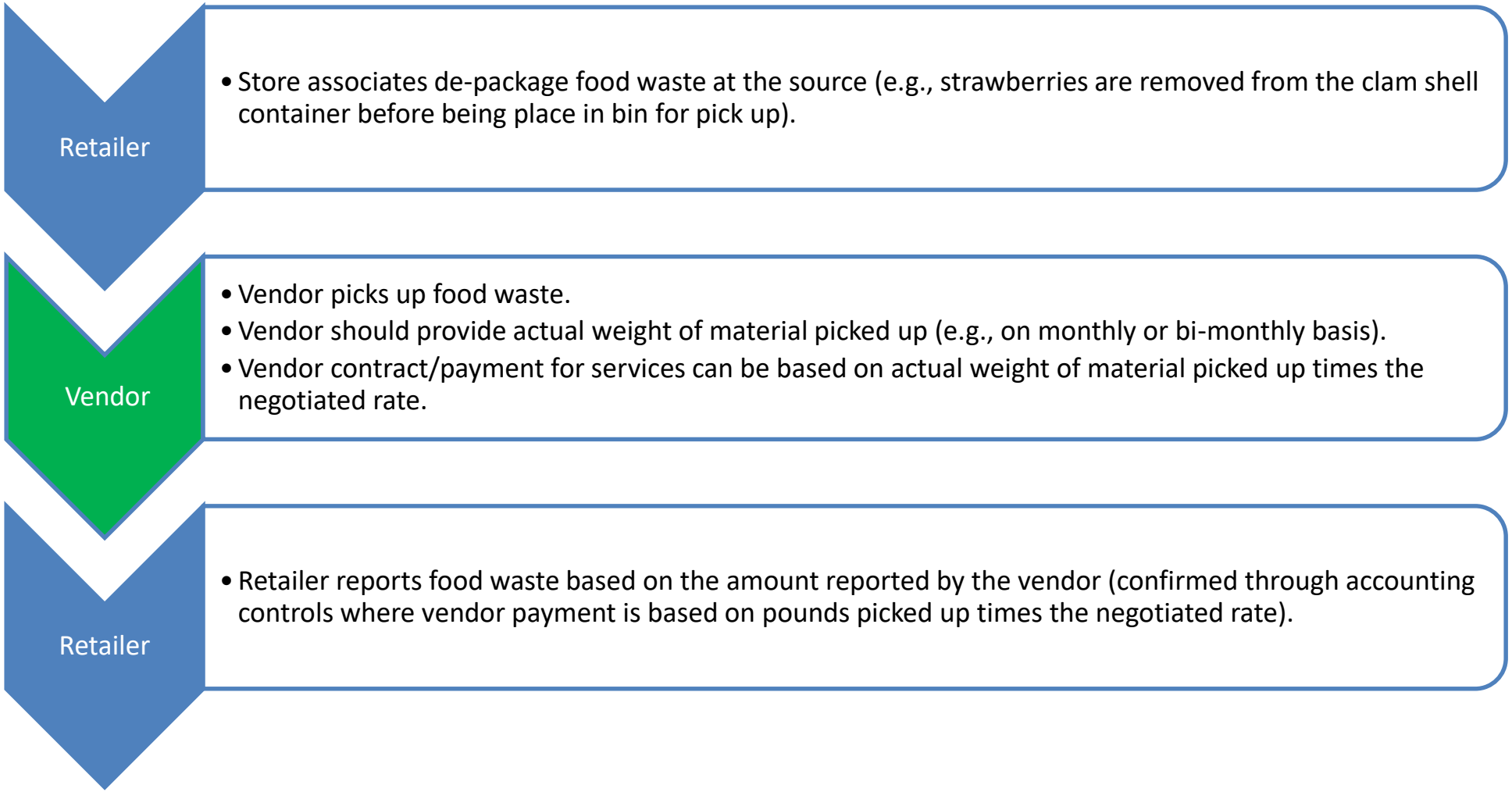
- If collecting data through diaries: You could instruct the person keeping the diary to remove the packaging. An example of this request is included in NRDC's *Estimating Quantities and Types of Food Waste at the City Level: Technical Appendices* (see Appendix P).

What to Report

When using this approach, it is helpful to make a note in your FLW inventory report that could read as follows: "Packaging weight is excluded. No separate calculation is needed to separate the weight of packaging from the weight of the FLW." It may also be helpful for the user of the inventory to add context about how the packing weight was excluded. For example, you could add to the second sentence the following: "since product weights used to calculate the total weight do not include packaging."

Where Product is De-packaged at the Store, Illustrative Steps for a Retailer to Report the Weight of FLW Net of Packaging Weight

Where product is de-packaged at the store, the weight received and reported is expected to reflect the FLW since the packaging has been removed. The following is an example of steps a retailer and its waste management vendor (third party processor) would take in this situation.



Note: Guidance on aspects to take into consideration when using data and records from vendors is included in Section 3 of WRAP's "Food surplus and waste measurement and reporting guidelines for food retail operations (September 2018)"

Source: Guidance developed based on conversations with Ahold Delhaize USA, a leading food retailer

Approach 2. Subtracting Estimated Packaging Weight *From Individual Items / Product Categories*

About the Approach

Where separation from packaging has *not* been undertaken (i.e., Approach 1), you can estimate the weight of packaging for individual items, or use averages for product categories, and thereby derive the weight of FLW net of packaging weight. This is relevant in cases where separating the FLW from its packaging is difficult (e.g., removing all the jam from a jar), or if it is not possible to include in the fieldwork (e.g., it takes additional time and effort to separate FLW from packaging in a waste composition analysis).

Options

The following are ways you can estimate the packaging weight for individual items or product categories:

- Use proxy data on the average weight of packaging by product category (see slide 8 for sample data from the United Kingdom).
- Use average package to product weight ratio factors. A set of average factors for grocery retailers will soon be available by the U.S. non profit, ReFED.
- Use average figures collected from waste audits (i.e., a waste composition analysis where packaging removal has been part of the sorting process and data has been gathered on the average package to product weight ratio).
- Subtract net printed weights on packaging for whole or unopened items. In some cases the actual weight of food may exceed the printed weight. If this is the case and is significant, you should note this as a source of uncertainty when preparing your FLW inventory report.
- Calculate the weight of a clean piece of packaging identical to the one containing the FLW and subtract it from the combined weight of the item and its packaging. This is possible where standardized packaging has been used and if you can confirm that the packaging used for subtraction matches the packaging containing the food.
- Make a visual estimate of the amount of FLW remaining and estimate its weight (e.g., where it is just a “scraping” of jam left in a jar). This is appropriate where the amount of FLW left in its packaging is relatively small and making a rough estimate is unlikely to affect the overall total greatly.

What to Report

Since estimates are involved, the *FLW Standard* requires you to describe the approach and calculation used. You should also provide any other relevant context about the associated uncertainty (see Chapter 9 of the *FLW Standard* for guidance on estimating and reporting uncertainty).

Average Weight of Primary Packaging for Select Categories

This table provides average packaging weights for select product categories based on products sold in U.K. supermarkets.

Product category	Average weight of primary packaging (grams)
Meat/Fish	11.4
Dairy – Milk	25.1
Dairy – Butter	7.9
Dairy – Cheese	11.9
Dairy - Other	16.6
Fresh Produce	7.9
Ambient/Packaged Foods	26.5
Chilled/Convenience Foods	15.5
Frozen	22.8
Soft Drinks	75.2
Bakery (bread, cakes, morning goods)	11.4

The following is how you could use the data in this table:
If 100 meat/fish items are considered FLW and you have the total weight inclusive of the packaging, subtract from that total weight 1,140 grams (i.e., 100 multiplied by 11.4 grams).

Source: Data from Valpak Ltd, a UK-wide recycling and waste management service, and correspondence with WRAP, a global UK-based organization focused on improving resource efficiency

Approach 3. Subtracting Estimated Packaging Weight *From Waste Stream / Existing Data*

About the Approach

If waste management vendor (third-party processor) records, or prior FLW studies, are being used that include the combined weight of both the FLW and packaging, then you could estimate the weight of packaging and subtract it from the total to calculate the FLW. This will produce a less accurate estimate of FLW but may be the only practical option available.

Options

The steps to take in two situations are as follows:

- Where FLW is collected for processing (e.g., anaerobic digestion) and includes packaged products, the facility doing the collection may be able to estimate the amount of packaging across its customers, ideally by sector (e.g., all food retailers). This estimate could be used by the individual reporting entity (e.g., a retailer) who would apply the "percentage of packaging weight" across its full waste stream to calculate the weight of FLW net of packaging weight.
  - Slide 10 provides an illustrative example of the related steps a retailer might take with their vendor
  - Slide 11 illustrates a sampling protocol for a vendor
  - Slide 14 includes a sampling of benchmarks for retailers to use as proxy data

- For a national or subnational FLW inventory, if a separate estimate of household packaging waste exists at the national / subnational level, this amount could be subtracted from an estimate of household FLW that includes packaging waste.

What to Report

Since estimates are involved, the *FLW Standard* requires you to describe the approach and calculation used. You should also provide any other relevant context about the associated uncertainty (see Chapter 9 of the *FLW Standard* for guidance on estimating and reporting uncertainty).

Where Product is De-packaged by a Vendor, Illustrative Steps for a Retailer to Estimate and Report the Weight of FLW Net of Packaging Weight

Where product is de-packaged by a vendor (third-party processor), the following is an example of steps a retailer and its vendor would take to estimate, subtract, and report the weight of FLW net of packaging.

Retailer

- Store associates recycle food waste with its packaging still included (e.g., produce is *not* removed from the clamshell container, packaged lettuce is *not* removed from the plastic bag).

Vendor

- Vendor picks up recycled food waste.
- Vendor provides actual weight of material picked up, which includes the weight of both food and packaging (e.g., 110,000 pounds weekly).
- Vendor estimates how much of the waste stream is packaging, by weight. Slide 11 provides an example of how a vendor may do so. In order to assess the accuracy of the estimate, the measuring entity may take an additional optional step (slide 13).
- If the vendor is *not* able to provide an estimate for the retailer's own waste stream, use proxy data (e.g., an industry average) to estimate the proportion that is packaging.
    - Slide 14 provides estimates from several third-party processors for U.S. retailers.
    - Since the amount of packaging that is included with the FLW will vary depending upon several variables – such as the nature of a company's food rescue and mark-down programs as well as the type of food collected – guidance on slide 14 helps you determine whether the estimate for your company should be on the lower or higher end of the proxy percentages.

Retailer

- Retailer applies percentage (estimated by vendor or proxy data) to total weight picked up for processing. Using the example noted here and assuming a packaging percentage of 10%, the equation would be: 110,000 pounds * 10% = 11,000 pounds.
- Retailer reports food waste, net of packaging weight (e.g., 99,000 pounds). In conformance with the *FLW Standard*, report the calculation used (see sample example below).

Sample example of calculation reported:

Food waste in pounds	
110,000	Pounds picked up by vendor for processing through anaerobic digestion
minus 11,000	Estimate of packaging by vendor = 10% packaging in feedstock received
99,000	Net food waste

Source: Guidance developed based on conversations with Ahold Delhaize USA, a leading food retailer

Example of How a Vendor May Estimate the Proportion of FLW Weight That Is Packaging

Context. Where a vendor (third-party processor) de-packages the feedstock it receives before processing it, the vendor can estimate the percentage by weight of packaging in the FLW through two steps.* Most vendors are only able to currently apply the first step, which is based on the amount of material "rejected" by the vendor. It is important to keep in mind that there is a higher degree of uncertainty in the data when only Step 1 is used.

Step 1. **Identify the proportion of the feedstock received by the vendor that is "front-end residuals"**

This step can be undertaken where the processor removes "front-end residuals" from the feedstock before it is placed in the digester or otherwise processed. These residuals include product packaging and frequently also organic fibers (e.g., corn husks and melon rinds that are not suitable for anaerobic digestion).

A vendor would:

- Weigh the feedstock received (assumed to include packaging and possibly organic fibers)
- Weigh the feedstock used for processing (or, the inverse would be to weigh just the front-end residuals removed)
- Calculate total front-end residuals as a percentage of feedstock received (i.e., "percentage total front-end residuals")

Illustrative example: If 100 tons of feedstock are received and 90 tons go into a digester then 100-90/100 = .10, meaning that the front-end residuals represent 10% of the feedstock received. A retailer with 100 tons of feedstock may therefore report 90 tons as the amount of FLW, net of packaging weight.

Notes with respect to reporting: If you use this "percentage total front-end residuals" as the presumed proportion of packaging but the waste stream includes a significant amount of organic fibers, you should note in the FLW inventory report that this is a source of uncertainty affecting your FLW data and that the true amount of FLW may be under-reported.

*Step 2 is shown on the next slide

Step 2. for “Example of How a Vendor May Estimate the Proportion of FLW Weight That Is Packaging”

Step 2. Identify the proportion of packaging in the front-end residuals, *if possible*

This step would be undertaken in order to separate the weight of organic fibers in the front-end residuals from the weight of the packaging. In the ideal scenario, a vendor could take samples of the mixed front-end residuals and dry them to remove the weight of the water intrinsic to the organic fibers. Based on the reduction in weight from drying, it can calculate a more accurate estimate of the proportion of packaging in the total feedstock received (i.e., “percentage packaging in feedstock received”).

A vendor would:

- Estimate the weight of organic fiber in the front-end residuals, using a “drying and weighing” approach.* Ideally the vendor would select a sample representative across the whole operation and evaluate this on a regular basis (Appendix A in the *FLW Standard* provides guidance to sampling and scaling up data). The following is a “low-tech” option for drying.
  1. Tare a large aluminum dish (~ 9" x 13") and record weight as "Tare Weight"
  2. Add 300 – 400 grams of mixed front-end residuals (i.e., organic fibers and packaging) to a large aluminum dish and record weight as "Wet Weight“
  3. Place sample in 103° – 105° Celsius oven for 24 hours
  4. Remove sample from oven, weigh, and record the weight as "Dry Weight"
- Calculate the “percentage packaging in feedstock received” using the following equation: “Percentage total front-end residuals”*[("Dry Weight"-"Tare Weight")/("Wet Weight"-"Tare Weight")]*(100% – “Percentage of dried sample that is organic fibers”)

Illustrative example:

- Hypothetical data points are:
  - Percentage total front-end residuals (i.e., starting proportion of Organic Fiber + Packaging) = 10% (example from step 1)
  - Tare weight = 15 grams; Wet weight = 300 grams; Dry weight = 185 grams
  - Percentage of dried sample that is organic fibers = 15%**
- Calculation: Percentage packaging = 10%*[(185-15)/(300-15)]*(100%-15%) = .05, meaning that packaging accounts for 5% of the total feedstock received. A retailer with 100 tons of feedstock would therefore report 95 tons as the amount of FLW, net of packaging weight.

*The reference standard for this method is a modification of 2540G (Total, Fixed, and Volatile Solids in Solid and Semi Solid Samples) from "Standard Methods for the Examination of Water and Wastewater“

**The proportion of the dried sample that is accounted for by organic fibers is assumed to be 15%. This is based on the assumption that after the intrinsic water weight is removed from organic fibers during drying, what remains will likely account for approximately 15 percent of the weight of the dried sample. This therefore means that 85% of the remaining material in the dried sample is packaging.

Source: Steps provided by Divert Inc., a resource recovery service provider

Optional Additional Step to Confirm Estimates of Packaging Weight From Vendors

If your vendor (third party processor) is using an anaerobic digester, there is an additional step you could take in order to assess the accuracy of the packaging estimate provided at the start of the process (i.e., before the food and packaging was processed).

This would involve:

- The vendor that picks up the residuals at the back-end of the process (i.e., the digestate) analyzing the residuals to see how much is organic matter (e.g., peach pits, corn husks) and how much is non-organic matter (assuming that most of that is packaging).
    - If the packaging cannot be separated easily, the amount of packaging could be inferred by subtracting the estimated amount of organic matter from the total weight of the back-end residuals.

- This second estimate of the weight of packaging could be compared with the estimate provided by the first vendor, assuming no packaging was removed during the processing.

- If the figures differ significantly, additional analysis could be undertaken.

Source: Guidance developed based on conversations with Ahold Delhaize USA, a leading food retailer

For U.S. Retailers: Proxy Data & Variables That Affect the Amount of Packaging

If your vendor is not able to provide an estimate of packaging weight, consider using proxy data even though this will produce a less accurate estimate of your FLW. By applying the percentage you select to the total weight of feedstock picked up by your vendor for processing, you can estimate the weight of FLW net of packaging weight. In conformance with the *FLW Standard*, report the calculation used (see sample example on slide 10).

Possible benchmarks to use as proxy data

- Based on the following estimates, the average proportion of FLW that is packaging (by weight) ranges from 5 – 11%.
- This is based on estimates from five third-party processors operating in the following U.S. states, and is assumed to be from FLW generated by food retailers:

Illinois: 8 – 11%	Maine: 10%
NJ and Massachusetts: 8%	Rhode Island: 5 – 7%
North Carolina: 10%	

Source: Information gathered by Organix, an organic residuals management company, in conversations with a sampling of other third-party processors where the level of de-packaging by the retailer and vendor may have differed

Variables that affect the proportion of packaging in FLW from a retailer

The proportion of the waste stream that is packaging will vary based on a store's donation and mark-down program as well as its product mix. Use the following guidelines to determine whether the estimate for your store is on the lower or higher end of the benchmarks provided as proxy data.

Donation / mark-down policy impact

On a per pound basis, a store will likely have more packaging in their waste stream if it has:

- Fewer donation collections per week (e.g., only twice a week versus daily)*
- Limited mark-downs

Note: Since more of the donated product from retailers typically is shelf-stable (i.e., with a higher packaging to food ratio by weight) if collection is less frequent this therefore likely results in more shelf-stable product in the waste stream.

Product mix variables

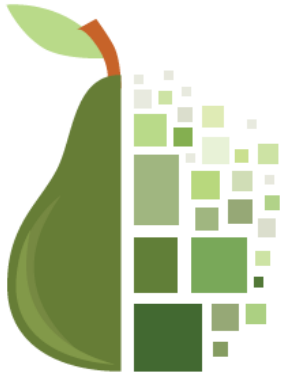
On a per pound basis, a store will likely have more packaging in their waste stream if it sells:

- More packaged produce (i.e., less produce is sold loose)
- More service deli with salad bar/cut fruit in store
- More prepared meals (e.g., meal kits)
- More packaged, refrigerated products

Source: Guidelines developed based on conversations with Divert Inc., a resource recovery service provider

Acknowledgement of Financial Support

Note: The Ministry of Foreign Affairs of the Netherlands, the Royal Danish Ministry of Foreign Affairs, the Swedish International Development Cooperation Agency (SIDA) and the Department of Foreign Affairs and Trade of Ireland (Irish Aid) provided core funding of the World Resources Institute, which made possible the development of the Food Loss and Waste Protocol. The generous financial support of the Walmart Foundation made this guidance about excluding the weight of packaging possible.



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ABOUT THE FLW PROTOCOL

The Food Loss & Waste Protocol (FLW Protocol)—a multistakeholder partnership—has developed the global *Food Loss and Waste Accounting and Reporting Standard* for quantifying food and/or associated inedible parts removed from the food supply chain—commonly referred to as "food loss and waste" (FLW). World Resources Institute (WRI) serves as the FLW Protocol's secretariat.

For questions, please contact flwprotocol@wri.org.

Published: December 2019