

Terms of Reference: Curbside and Multi-Residential Waste Composition Studies

December 2015

Table of Contents

Executive Summary.....	iii
1. Background	1
1.1. Purpose	1
2. Project Partners	2
2.1. General Responsibilities of the Joint Project Partners.....	2
2.2. Disclosure of Information	2
2.3. Financial Obligations of the Project Partners	3
3. Project Scope	4
3.1. Selection of Programs	4
3.2. Study Components.....	4
3.2.1. Single-Family Studies	4
3.2.2. Multi-Family Studies	4
Appendix A: Multi-Residential Waste Composition Study Protocol	5
1. Objectives.....	5
1.1. Terminology	5
2. Study Design.....	6
2.1. Seasonal Studies.....	6
2.2. Sampling Period	6
2.3. Multi-Residential Building Selection	6
3. Collection and Weighing of Recyclables and Garbage.....	7
3.1. Collection Requirements.....	8
3.2. Requirements for weighing and tipping collected loads	9
4. Sample/Sub-sample Preparation for Sorting	10
4.1. Sampling Requirements for Recycling Stream(s)	10
4.2. Sampling Requirements for Garbage Stream	10
4.3. Extracting Sub-samples from Recycling and Garbage Streams	10
5. Sorting and Characterization	12
5.1. Sorting Requirements	12
6. Reporting the Study Results.....	14
6.1. Reporting Requirements.....	14

Appendix B: Single-Family Waste Composition Study Protocol	16
1. Objectives.....	16
1.1. Terminology	16
2. Study Design.....	16
2.1. Seasonal Studies.....	16
2.2. Sampling Period	17
2.3. Single-Family Household Selection	17
3. Waste Collection Specifications	18
3.1. Collection Requirements.....	18
4. Sorting and Characterization	20
4.1. Sorting Requirements	20
5. Reporting the Study Results.....	22
5.1. Reporting Requirements.....	22

Executive Summary

Over the past few years, Stewardship Ontario (SO), the Continuous Improvement Fund (CIF) and individual municipalities have been conducting detailed waste composition studies on their own, collectively, and at different times with varying methodologies. This ad hoc process of studying programs in Ontario has been costly to all parties and has not necessarily provided the most statistically sound and detailed data.

The CIF Committee¹ and Stewardship Ontario agree that standardization of the study methodology and project coordination will benefit all stakeholders.

On September 23, 2015, the Waste Diversion Ontario (WDO) Board directed WDO staff to develop Terms of Reference (ToR) for the waste composition studies, in consultation with the CIF Committee. The Board further directed WDO staff to include the following principles in the ToR:

- Waste composition studies are to be funded by both the CIF and Stewardship Ontario, with matching funds provided by Stewardship Ontario being equal to the combined contribution of the CIF and the individual host municipal contribution.
- Waste composition studies are to be co-ordinated between the CIF and Stewardship Ontario to meet Stewardship Ontario's needs for fee-setting, in accordance with the Blue Box Program Plan.
- Information, data and results of any CIF-Stewardship Ontario studies are to be shared between the CIF and Stewardship Ontario, provided that the information and data are used for the sole purpose of operating the Blue Box Program Plan and are not shared beyond these two parties, unless authorized by the parties in writing.
- A common methodology for data collection and analysis (current methodology attached as Appendices A and B) is to be used for the waste composition studies.

The following ToR was developed in consultation with members of the CIF Committee to adhere to these principles.

Any decision or further revisions related to the ToR are at the discretion of WDO, following consultation with the CIF Committee.

¹ The CIF Committee consists of representatives from the Association of Municipalities of Ontario (AMO), the City of Toronto, Stewardship Ontario, WDO, and the CIF.

1. Background

In the approved Blue Box Program Plan (BBPP) of 2003, specific program elements were outlined as being mandatory requirements. One such element is data collection and analysis (see section 8.2, BBPP 2003) “for the purposes of identifying potential areas for program improvements, measuring program performance, and as inputs to the calculation of Stewardship Ontario (SO) fees only for each program year”.

These ToR provide the scope and methodology to move forward with an integrated plan for studies that will provide all stakeholders with up-to-date, accurate data to fulfill their obligations under the BBPP and to their constituents (the “Project”).

1.1.Purpose

The purpose of the ToR is to clearly define the roles and responsibilities of the Project partners, their respective financial obligations, and management of information collected in the course of completing the Project.

2. Project Partners

The Project will be a collaborative effort between partner municipal programs (i.e., a municipality that has agreed to participate in the waste study program), Stewardship Ontario and the CIF. The CIF Committee may seek input from WDO or the Municipal Industry Program Committee (MIPC) or other parties to further enhance the quality of the work.

2.1. General Responsibilities of the Joint Project Partners

All communications (written and oral) with stakeholders and municipalities will represent the joint nature of the project and recognize the involvement of all Project partners.

CIF and Stewardship Ontario will share project responsibilities. Both Stewardship Ontario and CIF will be jointly responsible for organizing and administration the Project including sharing of workload such as the hiring and coordination of the contractor(s).

Stewardship Ontario will be responsible for developing all required templates and working documents as needed to fulfill the requirements of the BBPP. Stewardship Ontario's templates and working documents are to be used, including worksheets required by the contractor(s) to accurately sort material categories, document findings, etc.

CIF will be responsible for reviewing and finalizing the required documents. Changes to Stewardship Ontario's templates and/or instructions to the contractor(s) proposed by one member of the CIF Committee or partner municipality will not be unreasonably denied by the CIF Committee.

Information, data and results of any studies (i.e., the raw data) will be provided by the contractor(s) to Stewardship Ontario and CIF to ensure consistency with the methodology.

Stewardship Ontario will also be responsible for analyzing the raw data and providing CIF with accompanying summary reports (e.g., a summary sheet for each municipality and the aggregated version of the seasonal study results).

CIF will post the aggregated version of the seasonal study results on their website and will provide the partner municipal program with the raw data.

2.2. Disclosure of Information

The partner municipal program may use and share the raw data at their own discretion. If the raw data is provided to an external party by the partner municipal program, the partner municipal program should inform SO and CIF.

Raw data will be provided to WDO, Stewardship Ontario, and CIF. Raw data is to be used for the sole purpose of informing the operation of the BBPP (i.e., setting Ontario steward fees). The raw data of any study may not be shared, unless authorized in writing by the CIF Committee (i.e., AMO and Stewardship Ontario agree) and the partner municipal program, with the exception of the following:

1. Additional Project funding partners will be provided with data as outlined in the funding agreement.
2. Any organization or individual who is being utilized by Stewardship Ontario, the CIF and WDO for the purpose of administering the BBPP, provided that organization or individual has signed a confidentiality agreement with Stewardship Ontario, the CIF and/or WDO, and that Stewardship Ontario, AMO, the CIF and WDO agree to enforce the terms of the confidentiality agreement.
3. As otherwise noted in this ToR.

2.3. Financial Obligations of the Project Partners

Notwithstanding the provisions of subsection 2.1, Waste composition studies are to be funded by both the CIF and Stewardship Ontario, with funds provided by Stewardship Ontario being equal to the funds provided by the CIF. Notwithstanding the foregoing, changes to Stewardship Ontario's templates and/or instructions to the contractor(s) requested by one member of the CIF Committee or the partner municipality that are not useful to all members of the CIF Committee will be paid by the requesting member's organization or the partner municipality (e.g. any incremental costs to add a new sort category requested by Stewardship Ontario to track a new type of packaging introduced by a steward would be paid for by Stewardship Ontario unless otherwise agreed by the CIF Committee). Costs incurred by the partner municipality will not be eligible for inclusion in the net cost calculation of the Blue Box Program (i.e., study add-ons that are outside the scope of the Blue Box Program Plan e.g., organics).

The WDO Board will provide direction to the CIF Committee on the amount to be included in the CIF annual operating budget. WDO will seek the advice of the CIF committee on this amount prior to providing such direction.

3. Project Scope

The scope and nature of the Project includes the completion of a minimum of five (four season) curbside waste composition studies per year over the course of the next three years. These studies will include a variety of both Single-Family (SF) and Multi-Family (MF) dwellings in five distinct municipal Blue Box programs per year.

3.1. Selection of Programs

CIF and Stewardship Ontario staff will provide a joint recommendation to the CIF Committee for approval, with the five suggested municipal curbside programs and study type (SF or MR) to be included in the Project each year. This list of programs will be determined by CIF Committee to ensure satisfaction with the statistical representativeness of the data based on the following:

- Geography and demographics (i.e., seasonality, density);
- Previous study participation (i.e., timing of last study, recent program changes, etc.);
- WDO Datacall program type (i.e., Rural Regional, Large Urban, etc.); and
- Municipal program willingness to participate.

3.2. Study Components

The studies will be undertaken by an approved contractor(s) and will follow a standardized methodology (current methodology attached as Appendices A and B). Any changes to the methodology deemed by the Project partners to enhance the Project will require the agreement of the CIF Committee and must not impede data accuracy or consistency in any way.

3.2.1. Single-Family Studies

- Each SF component will consist of 100 households grouped into 10 groups of 10 households.
- Studies will be conducted over a two-week period to account for bi-weekly collection of garbage and recycling and will represent two weeks of generation of both waste streams.
- Studies will be repeated four times a year (with a 13-week gap) to reflect differences in seasonal consumption.

3.2.2. Multi-Family Studies

- The number of multi-res buildings audited in any year may vary but a typical number for a four season study will be between 5 and 10. SO and CIF will confirm the exact number and waste categories with the selected muni partners annually.
- The number of buildings will be divided up over the two week study period; one week of generation of garbage and recycling will be sampled in each building.
- Studies will be repeated four times a year (with a 13-week gap) to reflect differences in seasonal consumption.

Appendix A: Multi-Residential Waste Composition Study Protocol

1. Objectives

The objectives of Multi-Residential Waste Composition Studies are to:

- Collect accurate multi-residential waste composition and generation data in appropriate municipalities across Ontario;
- Estimate provincial waste generation rates (kg/household/week) for multi-residential households by material category; and
- Estimate typical recovery rates for recyclable Blue Box wastes.

The results of waste composition studies are used for the following purposes:

- Assess Blue Box material generation rates, in order to set Ontario steward fees (with the stewards' reports as the cross check);
- Assess opportunities and priorities for improving cost-effective recovery;
- Determine the recovery performance of existing programs; and
- Validate possible best practice assumptions.

1.1. Terminology

Partner Municipality: A municipality that has agreed to participate in the waste study program.

Multi-Residential Complex: For this study, the term “multi-residential complex”, or “complex”, means apartment buildings, condominiums and townhouse complexes where waste and recyclable materials are collected at a central location. Townhouses receiving door-to-door curbside collection are not included. Apartment buildings with fewer than six units are not included.

Contractor: Company retained to provide services for a multi-residential waste composition study.

Hauler: The party that will collect the waste samples from the multi-residential complexes. This could be a private waste management company, or a municipal crew.

Sorting site: Location at which the waste samples are to be unloaded and sorted. Waste samples should be sorted at a waste management facility in a climate-controlled building with good ventilation and lighting, low traffic flow, and on-site washroom facilities.

Bulky items: Large or heavy items such as couches and mattresses that are not accepted or collected with the regular household garbage. The **partner municipality** will provide a definition of bulky items. This study does not include bulky items.

White goods: Large metal-based appliances such as refrigerators, freezers, clothes washers and dryers, dishwashers, ranges, stoves, air conditioners, and hot water tanks. White goods are not included in this study.

Sub-samples: Samples extracted from a load of garbage or recycling that are collected from a complex using the specified methodology. Each sub-sample weighs approximately 100 kg.

2. Study Design

This section provides an overview of the overall design of a multi-residential waste composition study.

2.1. Seasonal Studies

Four, two-week long studies will be conducted by the **contractor** in each **partner municipality**, one in each season of winter, spring, summer, and fall as follows (exact study dates to be confirmed by SO/CIF and their contractor with the host municipality):

- “Fall” – October 1 to December 7, 20XX
- “Winter” – January 10 to March 9, 20XX
- “Spring” – April 2 to June 1, 20XX
- “Summer” – June 25 to September 21, 20XX

2.2. Sampling Period

Each multi-residential seasonal study will take place over a two-week period.

The study will measure the quantity and composition of printed paper and packaging within the garbage and recycling collection streams generated during a one-week (7-day) period.

2.3. Multi-Residential Building Selection

Selection of sample buildings is the responsibility of the **partner municipality**, in collaboration with **CIF** and **Stewardship Ontario**.

- a) The sample material will come from the randomly-selected multi-residential complexes within the municipality that together represent the municipality’s multi-residential waste generation/recovery behaviour.
- b) Once the number of complexes is determined, they will be split over the two week period.
- c) The **partner municipality** will identify the complexes to be sampled, with approval by **CIF** and **Stewardship Ontario**.
- d) It is recommended that the **partner municipality** work with their planning and housing departments and possibly their regular waste hauler(s) when selecting the complexes.
- e) The **partner municipality** must visit each of the sample complexes before the study begins to confirm that the complex meets the criteria for inclusion in the waste study and to check that the information on the complex is correct (i.e. number of bins/carts, collection days, number of units, occupancy rates, etc.).
- f) The **partner municipality** is required to help the **contractor** fill out the Waste Study Description spreadsheet (see Section 8.1) which includes information on the municipality’s waste programs, a description of each of the multi-residential complexes, occupancy rates, number and type of bins/carts, etc.
- g) The **partner municipality** will provide the **contractor**, the **hauler**, **CIF** and **Stewardship Ontario** with a collection schedule and the addresses of the selected complexes.

- h) The **partner municipality** will consider collection times when selecting the complexes and will try to spread out the collection work over the two-week study period as much as possible. Storage and processing problems might arise if too much sample material arrives at the sorting site on any given day.
- i) The **partner municipality** will endeavour to keep travel times between the complexes and the sorting site to a minimum. The drive time between a complex and the sorting site should not exceed 45 minutes under normal circumstances.
- j) When selecting the complexes, the **partner municipality** will consider:
- Type of complex (condo, apartment, rent-assisted, etc.);
 - Number of floors and units (high-rise, low-rise, townhouse complex);
 - Property value or rent;
 - Occupancy rate;
 - Number of units with in-sink food disposal units (garburators);
 - Age of complex; and
 - Demographics of complex.
- k) Complexes with morning collection should be chosen. This will ensure that the **hauler** may access the sample material and deliver it first thing in the morning, giving the study team sufficient time for sorting.
- l) Avoid complexes with:
- Advanced waste diversion systems for recyclables or organics (e.g., tri-sorters or in-ground collection systems);
 - Supplementary private waste collection, in addition to municipal collection;
 - A tuck shop or commercial businesses on the premises; and
 - Known illegal dumping issues, or bins located in areas that provide opportunities for illegal dumping by non-residents.
- m) If a significant number of multi-residential complexes in the **partner municipality** do not offer recycling, this should be reflected in the sample complexes (i.e., include some complexes that do not offer recycling).
- n) If there is a choice, pick the complex that does not compact its garbage, as non-compacted waste is much easier to characterize accurately than compacted waste.
- o) The **partner municipality** will provide **CIF** and **Stewardship Ontario** with the details of the process used to select the sample complexes.
- p) It is not recommended that the **partner municipality** tell the residents in the sample complexes about the study. Questions from residents about the waste study will be directed to the **partner municipality**. If necessary, **CIF** and **Stewardship Ontario** can help the **partner municipality** draft a letter for residents who require more information.

3. Collection and Weighing of Recyclables and Garbage

This section outlines the requirements for the collection and weighing of the recycling and garbage generated in the one-week sampling period at the selected complexes.

3.1. Collection Requirements

- a) The **partner municipality** is responsible for ensuring that the regular hauler(s) empty all of the recycling and garbage containers at the complexes on the regularly scheduled collection day(s) before the study starts, regardless of their level of fullness.
- b) The **partner municipality** will ensure that the regular hauler(s) know when the study is being conducted and provide a list of dates and addresses to the regular hauler(s) to avoid their inadvertent collection of the sample material.
- c) The **partner municipality** is responsible for arranging collection and delivery to the sorting site of the sample material.
- d) The **partner municipality** will provide the **contractor, the hauler, CIF and Stewardship Ontario** with a collection schedule and a list of collection addresses.
- e) The waste samples must be collected in an empty, dedicated truck, preferably with a dedicated driver.
- f) The **hauler** must collect all recycling and garbage (does not include white goods or bulky items – these are defined in Section 1.1) generated by the complexes during the sampling period and deliver it to the sorting site. It should be noted that some complexes might have two garbage pick-ups.
- g) Waste collection cannot begin before the time specified by the partner municipality's waste collection by-laws.
- h) Recyclables are to be collected and weighed separately from garbage. The hauler must keep containers and fibres separate, if they are set out separately. **CIF and Stewardship Ontario** recommends that the hauler use a split truck to collect fibre and container materials.
- i) If the **hauler** uses a compaction vehicle to collect the garbage, they are required to turn the compaction down as much as possible. This will ensure that the waste materials are easier to separate when they are being sorted.
- j) The **hauler** is required to fill out a Collection Log (see Section 6.1) for each pick-up and provide this information to the contractor when the sample material is tipped at the sorting site. The hauler must note the type of waste collected, the weight of the sample in kilograms, the name and address of the complex where the material originated, and the time the material was picked up.
- k) The **hauler** will make a note on the Collection Log if the materials are wet (particularly paper and paper packaging), or the bins contain substantial amounts of water or snow/ice.
- l) The **contractor** is responsible for ensuring that the **hauler** fills in the Collection Log.
- m) The **hauler** and the **contractor** shall ensure that all staff do not read, copy or retain any of the materials found in the waste streams at any point during the study (i.e. both sample collection and sorting).
- n) The **contractor** will take digital photographs of the 10 complexes used for the study and provide these to **CIF and Stewardship Ontario** and the **partner municipality**. There will be two shots of each complex, including a wide-angle shot that shows the whole complex from the street, and a shot that shows the garbage and recycling bins/carts at each complex.
- o) The **hauler** must have a cellphone and will notify the **partner municipality** immediately if they encounter any problems during collection.

- p) A representative from the **partner municipality** will be available by phone to answer questions about collection.
- q) Questions from residents or other parties should be directed to the **partner municipality**.

3.2. Requirements for weighing and tipping collected loads

- a) It is vital that all of the recycling and garbage generated during the one-week period is collected and that accurate weights of the loads are obtained.
- b) The **hauler** will collect the sample material in an empty truck and weigh in and out on a properly calibrated weigh scale. The **hauler**/weigh-scale operator will not use a set tare weight for the truck for calculating the load weights.
- c) If possible, trucks will weigh in and out on the same scale.
- d) The driver will endeavour to park their truck in the same position on the scale when they weigh in and out.
- e) If the **hauler** wants to use an on-board weigh scale to weigh the sample loads, the **hauler** must first provide information to **CIF** and **Stewardship Ontario** on the accuracy of the on-board scales.
- f) The **contractor** is required to monitor the **hauler's** weighing and tipping activities.
- g) To protect against the possibility of the sample material getting lost when it is delivered to the sorting area, **CIF** and **Stewardship Ontario** recommends that the **hauler** contact the **contractor** by phone as soon as they arrive at the weigh scale. If necessary, the **contractor** should station a staff person at the weigh scale to direct the **hauler**.
- h) The **contractor** is responsible for ensuring that the weigh-scale operator is aware of the study and can direct the truck to the site where the samples are to be tipped.
- i) In order to get accurate weights, the **contractor** must ensure that sample material does not get hung up in the truck after it has tipped (on occasion, waste can hang up in the truck, particularly if it is wet or frozen).
- j) The **hauler** will be careful when weighing the samples to ensure that nothing that could affect the weight changes from the time they weigh in to the time they weigh out. For example, if there are two people in the truck when it weighs in, they both must be in the truck when it weighs out. Similarly, the driver will not fuel up between weighing in and weighing out.
- k) If the **contractor** discovers commercial waste in the load, or suspects that the load contains material from another building or illegally dumped material, they must ask the hauler about it, and they must immediately notify **CIF**, **Stewardship Ontario** and the **partner municipality**. If possible, the **contractor** will attempt to salvage the load by separating the unwanted material and weighing it.
- l) If the **contractor** has any reason to believe that the truck weight is not accurate, or a significant amount of water or snow/ice spills out of the truck when it tips, the **contractor** will make every effort to weigh the unsorted material. This will ensure that accurate weights are determined for the loads delivered.

4. Sample/Sub-sample Preparation for Sorting

This section provides an overview of requirements to prepare the collected waste materials for sorting.

4.1. Sampling Requirements for Recycling Stream(s)

- a) If a complex generates less than 200 kg of recyclables per week (single-stream programs), or at least 100 kg of fibres and at least 100 kg of containers per week (multi-stream programs), the **contractor** is required to sort the entire load(s)² delivered to the sorting site. (If this is the case, please proceed to Section 5.1.)
- b) In this scenario, all recyclables delivered to the sorting site from a multi-residential building form the sample(s) to be sorted by the **contractor**.
- c) If the complex generates more than 200 kg of recyclables per week (single-stream programs), or at least 100 kg of fibres and at least 100 kg of containers per week (multi-stream programs), the **contractor** may either:
 - Option 1 - Sort the entire load(s) delivered to the sorting site as one sample (two samples for multi-stream programs); or
 - Option 2 - Extract sub-samples from the delivered load(s) to be subsequently sorted.

If Option 1 is chosen, please proceed to Section 5.1.

4.2. Sampling Requirements for Garbage Stream

- a) If a complex generates less than 400 kg of garbage per week, the contractor is required to sort the entire load delivered to the sorting site. (If this is the case, please proceed to Section 5.1.)
- b) In this scenario, all garbage delivered to the sorting site from a multi-residential building forms the sample to be sorted by the **contractor**.
- c) If the complex generates more than 400 kg of garbage per week, the **contractor** may either:
 - Option 1 - Sort the entire load delivered to the sorting site as one sample (two samples if garbage is collected two times per week); or
 - Option 2 - Extract sub-samples to be subsequently sorted.

If Option 1 is chosen, please proceed to Section 5.1.

4.3. Extracting Sub-samples from Recycling and Garbage Streams

Please skip this section and proceed to Section 5.1 if the entire load is to be sorted for the recycling and garbage streams.

- a) Each sub-sample will be approximately 100 kg and will be sorted separately.
- b) The **contractor** will use a **variant of the cone and quartering technique** to extract sub-samples from the recycling and garbage loads collected from the multi-residential complexes.

² In multi-stream programs, fibres and container streams are to be sorted separately.

To avoid breakage, damage and compaction of the collected material, it is not recommended to thoroughly mix the load with a front-end loader, as per the cone and quartering technique. Instead, the following steps to obtain sub-samples will be followed:

- i. The hauler will unload the collected material from the complex onto the tip floor at the sorting site in one continuous pile to avoid gaps in the load, in order to facilitate the collection of the sample.
- ii. Using a front-end loader, the material will be formed into a cone-shaped pile.
- iii. The pile will be divided into two by a straight line through its centre.
- iv. The pile will be further divided by a second straight line perpendicular to the first, forming four quarters.
- v. Using a front-end loader or equivalent, sample material will be removed from each quarter and delivered to the sorting area.
- vi. The approximate weight of material required from each quarter of the pile will be one-fourth of the total quantity required to make the number of 100-kg sub-samples needed for that load. Please see point c. and d. below to determine the amount of material required, depending on the number of pick-ups per week. (For example, if four 100-kg sub-samples are required from a given load, approximately 100 kg of material will be removed from each quarter and delivered to the sorting area.)
- vii. The material will be sorted in 100-kg increments until the required number of sub-samples has been achieved.

c) Sub-sampling requirements for complexes with weekly garbage and weekly recycling collection:

Waste Stream	Sub-Samples	Sub-Sample to be Sorted (kg)
Garbage Pick-Up #1	#1	~100
	#2	~100
	#3	~100
	#4	~100
Total garbage sorted per complex →		~400
Recycling Pick-Up #1	#1	~100
	#2	~100
Total recycling sorted per complex →		~200
Total waste sorted per complex →		~600

- d) Sub-sampling requirement for programs with more than one garbage pick-up per week and one recycling collection per week:

Waste Stream	Sub-Samples	Sub-Sample to be Sorted (kg)
Garbage Pick-Up #1	#1	~100
	#2	~100
Garbage Pick-Up #2	#3	~100
	#4	~100
Total garbage sorted per complex →		~400
Recycling Pick-Up #1	#1	~100
	#2	~100
Total recycling sorted per complex →		~200
Total waste sorted per complex →		~600

5. Sorting and Characterization

This section provides an overview of the requirements for sorting collected samples.

5.1. Sorting Requirements

- a) The **contractor** will provide the following equipment:
- Heavy-duty puncture-resistant gloves, safety footwear, traffic vests, coveralls, dust masks, ear plugs, and safety glasses for the sort staff;
 - A first aid kit;
 - Work tables on which to sort the waste (one with 5-10 cm-high sides on three sides is recommended);
 - Leak-proof containers of sufficient volume and in sufficient number for sorting and weighing the waste; and
 - Any other items necessary to complete the sort (e.g., rakes, brooms, dustpans, and knives to open the bags, etc.).
- b) The **contractor** will supply a sufficient number of sorters and support staff to complete the work in a timely fashion.
- c) The **contractor** must ensure that their staff and subcontractors are familiar with **Stewardship Ontario**'s material categories and sampling and sorting methods.
- d) The **partner municipality** will provide:
- An area suitable for waste sorting, ideally in a climate-controlled building at a waste management facility with good ventilation and lighting, low traffic flow, and on-site washroom facilities.
 - Disposal bins for the sorted material and arrange for the bins to be emptied as required. (The **partner municipality** will cover all costs associated with these bins, including hauling and disposal.)
 - A container for hazardous wastes such as hypodermic needles.

- Adequate notice about the study and its importance to regular staff working at the sorting site.
 - If possible through staff at the sorting site, a loader operator to help with the sub-sample extraction activities (see Section 4.3) and transfer of the sample material from the tipping floor to the area where the materials will be sorted.
- e) **CIF and Stewardship Ontario** recommends that members of the waste sorting crew get a tetanus shot if they have not had one in the last 10 years.
 - f) If a complex generates less than 400 kg of garbage per week, the study team is required to sort all of it. (An experienced four-person study team can sort roughly 100 kg of compacted multi-residential garbage per hour.) If the complex generates more than 400 kg of garbage per week, the **contractor** may either sort it all, or sort sub-samples (see Section 4.3 for sub-sampling instructions).
 - g) If a complex generates less than 200 kg of recycling per week, the study team is required to sort all of it. If the complex generates more than 200 kg of recycling per week, the **contractor** may either sort it all, or sort sub-samples (see Section 4.3 for sub-sampling instructions). **CIF and Stewardship Ontario** would prefer to see 100% of the recycling sorted, if possible.
 - h) If the **partner municipality** operates a two-stream recycling program (i.e., fibres and containers), the **contractor** may either: 1) sort all the material (fibres and containers should be sorted separately as two samples); or 2) sort one sub-sample of container material that weighs approximately 100 kg, and one sub-sample of fibres that weighs approximately 100 kg (see Section 4.3 for sub-sampling instructions). **CIF and Stewardship Ontario** would prefer to see 100% of the recycling sorted, if possible.
 - i) If the **partner municipality** operates a single-stream recycling program (i.e., containers and fibres are mixed), the **contractor** may either: 1) sort all of the material collected; or 2) sort two sub-samples of mixed recyclables, each weighing approximately 100 kg (see Section 4.3 for sub-sampling instructions). **CIF and Stewardship Ontario** would prefer to see 100% of the recycling sorted, if possible.
 - j) The **contractor** will provide a suitable electronic weigh scale capable of measuring from 0.01 kg to at least 60 kg. This weigh scale must be of sufficient accuracy to provide weight measurements within $\pm 1\%$ of true weight.
 - k) All weight measurements will be expressed in kilograms to two decimal places and will be recorded in the *Waste Sort Log* (see Section 6.1).
 - l) The tare weights of the weigh bins will be checked periodically during the sorting process.
 - m) The **contractor** will sort the samples by complex and by stream into the material categories shown on the *Material Categories* spreadsheet (see Section 6.1).
 - n) If the **contractor** is not sure to which category an item belongs, they will either contact **CIF and Stewardship Ontario** immediately for assistance, or select the most appropriate category and include a note to identify the item and its weight, so that it can be properly allocated by **CIF and Stewardship Ontario** later on.
 - o) The **contractor** will make note of and weigh separately any item/material that significantly affects the total weight measured for a material category (e.g., an 18-litre PET bottle and a magazine collection).

- p) The **contractor** will disassemble multi-material items that are easy to separate. For example, if the paperboard insert in a plastic bubble pack is not bonded to the outer packaging, the contractor will remove it and sort the card into the "Boxboard" category and the plastic into the proper plastic category.
- q) The **contractor** will make best efforts to separate food wastes from their packaging before weighing. This can be achieved by opening all packages and shaking out the contents.
- r) Bags/containers containing hypodermic needles, lancets, other sharps or other highly hazardous wastes will be set aside, weighed, and described and recorded separately under the category "Other Materials". The **partner municipality** is responsible for providing a container for hazardous wastes such as used hypodermic needles.
- s) Garbage bags found in the recycling stream will be opened and the materials inside sorted into the material categories listed on the *Material Categories* spreadsheet (see Section 6.1).
- t) Light materials/items must be weighed directly on the scale, not in the bin.
 - The following approach will be used for managing "fines" (i.e., items <1 cm across):
 - Estimate the composition of the fines by weight (i.e., 10% kitty litter, 30% food waste, 20% mixed fine paper, 30% clear glass, and 10% coloured glass);
 - Split the mix accordingly; and
 - Add material to the appropriate bins before weighing.
- u) The **contractor** will record the weights of the separated materials in the *Waste Sort Log* (see Section 6.1) as follows:
 - Record multiple weights for one category (e.g., "25.15 + 5.25").
 - Enter a "0" if there is no material for a category.
- v) The waste samples should be sorted and disposed on the day they are collected. Material may be held over and sorted on another day if the **partner municipality** and the operators of the waste facility permit it. Waste held over should be covered to protect against moisture loss, damage by pests, etc.
- w) The **contractor** will keep the sort site in a reasonably clean state and will clean the floor, sorting tables, sort bins and other surfaces in contact with the waste at the end of each day.
- x) All waste materials handled during the study will be collected post-sort by the **municipality** or designated waste contractor and disposed of in the correct manner.
- y) Upon completion of the waste study, the **contractor** will promptly remove all of their equipment and supplies, and return the sort site to its pre-study state.

6. Reporting the Study Results

This section outlines the requirements for recording the sorting results.

6.1. Reporting Requirements

- a) Only the data collection forms and electronic spreadsheets provided by **CIF** and **Stewardship Ontario** are to be used for reporting.
- b) Reporting for each two-week study is to be completed and provided to **CIF** and **Stewardship Ontario** no later than two weeks after the final day of sorting.

- c) Data collected on the worksheets and in the logs is to be entered in the electronic spreadsheets provided by **CIF** and **Stewardship Ontario**.
- d) All of the spreadsheets for the 20XX multi-residential studies are found in an Excel file named “Multi-Residential Waste Study Worksheets 20XX”. This file contains the following six spreadsheets:
- i. **Waste Study Description:** Use this spreadsheet to record general information about the study such as sampling dates, location of sorting site, notes on the **partner municipality’s** waste programs, description of each of the multi-residential complexes, number and type of bins/carts, occupancy rates, general notes on the materials found in the waste streams, problems and issues, and other notes that might help **CIF**, **Stewardship Ontario** and the **partner municipality** interpret the results, etc. The **partner municipality** is required to help the **contractor** fill out parts of this spreadsheet. The **contractor** is required to send this spreadsheet to **CIF** and **Stewardship Ontario** at the end of each study.
 - ii. **Material Categories:** This spreadsheet lists the material categories and provides detailed descriptions and examples. The **contractor** must make this sheet available for reference during the waste sort.
 - iii. **Collection Log:** The **hauler** must use this log to record the weights of the loads they collect.
 - iv. **Waste Sort Log:** The **contractor** must use this log to track the weights of the sorted materials and to record any notes during the sort.
 - v. **Collection Results:** The **contractor** is required to enter the collection results from the *Collection Log* on this sheet and submit it to **CIF** and **Stewardship Ontario** at the end of each study.
 - vi. **Sort Results:** The **contractor** is required to enter the sort results from the *Waste Sort Log* on this sheet and submit it to **CIF** and **Stewardship Ontario** at the end of each study. Detailed data entry instructions are provided at the top of this spreadsheet.
- e) All data must be checked for accuracy and errors and approved by the **contractor’s** project supervisor before it is submitted to **CIF** and **Stewardship Ontario**. It should be noted that the **contractor** is required to enter zeros in the collection and sort results spreadsheets where applicable.
- f) The **contractor** will email the completed electronic spreadsheets to **Sherry Arcaro** at **Stewardship Ontario** (sarcaro@stewardshipontario.ca) and Mike Birett at CIF (mbirett@wdo.ca).
- g) Once **CIF** and **Stewardship Ontario** staff have verified the data and summarized it, **CIF** will forward an electronic copy of the results to the **partner municipality**.

Appendix B: Single-Family Waste Composition Study Protocol

1. Objectives

The objectives of the Single-Family Residential Composition Study are to:

- Collect accurate single-family waste composition and generation data in appropriate municipalities across Ontario;
- Estimate provincial waste generation rates (kg/household/week) for single-family households by material category; and
- Estimate typical recovery rates for recyclable Blue Box wastes.

The results of waste composition studies are used for the following purposes:

- Assess Blue Box material generation rates, in order to set fees (with the stewards' reports as the cross check);
- Assess opportunities and priorities for improving cost-effective recovery;
- Determine the recovery performance of existing programs; and
- Validate possible best practice assumptions.

1.1. Terminology

Partner Municipality: A municipality that has agreed to participate in the waste study program.

Contractor: Company retained to provide services for the single-family waste composition study.

Sorting site: Location at which the waste samples are to be unloaded and sorted. Waste samples should be sorted at a waste management facility in a climate-controlled building with good ventilation and lighting, low traffic flow, and on-site washroom facilities.

Bulky items: Large or heavy items such as couches and mattresses that are not accepted or collected with the regular household garbage. The **partner municipality** will provide a definition of bulky items. This study does not include bulky items.

White goods: Large metal-based appliances such as refrigerators, freezers, clothes washers and dryers, dishwashers, ranges, stoves, air conditioners, and hot water tanks. White goods are not included in this study.

2. Study Design

This section provides an overview of the overall design of the single-family waste composition study.

2.1. Seasonal Studies

Four, two-week long studies will be conducted by the **contractor** in each **partner municipality**, one in each season of winter, spring, summer, and fall as follows:

- “Fall” – October 1 to December 7, 20XX
- “Winter” – January 1 to March 9, 20XX

- “Spring” – April 2 to June 1, 20XX
- “Summer” – June 25 to September 21, 20XX

2.2. Sampling Period

At each **partner municipality**, a total of two weeks of generation of waste (garbage and recycling) is to be sampled during the study period.

The 100 homes sampled in the first week will be sampled again in the second week. Depending on the frequency of collection, the total number of samples collected will vary accordingly. In the case of bi-weekly alternating collection of garbage and recycling (Scenario 1 below), only one sample per material would be collected during the two-week study period. However, each sample would represent two weeks of waste generation. Other example configurations are included in the table below.

Scenario	Waste Stream	Frequency of Collection	Number of samples per household during the 2-week study
1	Garbage	Bi-weekly	1
	Recycling	Bi-weekly	1
		Total	2
2	Garbage	Weekly	2
	Recycling	Weekly	2
		Total	4
3	Garbage	Weekly	2
	Recycling	Bi-Weekly	1
		Total	3

2.3. Single-Family Household Selection

Selection of sample buildings is the responsibility of the **partner municipality**, in collaboration with **CIF** and **Stewardship Ontario**.

- The sample material will come from 100 randomly-selected single-family homes (10 homes in a row in 10 sample areas) that together represent the **partner municipality’s** single-family waste generation/recovery behaviour.
- Selected homes all receive the same level of service.
- Homes will be selected in groups of 10 in a row and are located on the same side of the street.
- Split dwellings (i.e., homes occupied by more than one party – e.g., there is a basement apartment) will be considered only if they are common. If split dwellings are included, the **partner municipality** is to advise the **contractor** of this fact.
- Triplexes, small apartment buildings, and row houses or townhouses with communal collection pads are not to be included.
- Selected homes typically receive collection services early in the morning.
- Homes right at the beginning of a collection route should be avoided.
- Homes located on busy roads should be avoided.

- i) Vacant homes, homes under construction, or homes up for sale should be avoided.
- j) The **contractor** is required to visit each of the sample areas before the audit begins to confirm that the areas and the homes in the areas meet the criteria for inclusion in the sample.
- k) The **partner municipality** is required to assist the **contractor** by providing information about the sample areas and the **partner municipality's** waste services in order to complete the required audit report.
- l) The drive time between a sample area and the sort site should not exceed 45 minutes under normal circumstances.
- m) The **contractor** will collect and sort sample material from at least 20 or 30 households per day, up to a maximum of 60 households per day, upon agreement of **CIF** and **Stewardship Ontario**.
- n) The **partner municipality** will provide the **contractor**, **CIF** and **Stewardship Ontario** with a collection schedule for the study and the addresses of the sample homes.
- o) Residents in the sample areas should not be notified in advance of the study. Questions from residents about the waste composition study should be directed to the **partner municipality**. The **contractor** will be provided with a letter from the **partner municipality** explaining the initiative and providing contact information for distribution to residents seeking information.
- p) The **contractor** will be required to take digital photographs of representative homes in each of the 10 sample areas and provide these to **CIF** and **Stewardship Ontario** and the **partner municipality**. Addresses and other owner-identifying features (e.g., vehicle licence plates) will be removed or obscured from these photographs.

3. Waste Collection Specifications

This section outlines the requirements for the collection of the recycling and garbage generated in the 100 single-family households.

3.1. Collection Requirements

- a) The Single-Family Waste Composition Study will run for two consecutive weeks.
- b) The sample material will come from homes selected by the **partner municipality** and agreed to by **CIF** and **Stewardship Ontario**.
- c) The **contractor** is responsible for collecting all recycling and garbage set out at the curb by each sample household over the two-week sampling period.
- d) Yard waste (leaves, grass, trimmings, Christmas trees, pumpkins, etc.) set out as a separate stream will not be collected and weighed. However, the **contractor** is required to collect, sort and weigh yard wastes found in the garbage stream.
- e) Bulky items such as furniture, mattresses and barbecues that are not accepted at the curb with regular household garbage should be left at the curb for the regular hauler. The **partner municipality** will give the **contractor** a definition of bulky items.
- f) White goods (large appliances such as refrigerators, freezers, clothes washers and dryers, dishwashers, ranges, stoves, air conditioners, and hot water tanks) must not be collected or considered in any way. White goods should be left at the curb for the regular hauler.
- g) The **partner municipality** is required to advise the regular hauler(s) of when the study is being conducted and provide a list of dates and addresses to avoid.

- h) The **contractor** will contact the regular hauler(s) by phone the day before collection days to confirm that the contractor will not be collecting from the sample homes.
- i) It is recommended that the **contractor** make arrangements to “guard” the sample areas to prevent the regular hauler from inadvertently picking up sample material. **CIF** and **Stewardship Ontario** will prorate payment to the **contractor** for missing data points resulting from lack of project control by the contractor.
- j) The **contractor** will collect materials only during the times specified in the **partner municipality’s** waste collection by-laws. They should not leave missed set-outs at the curb. If there is any reason to suspect that the material is not all out, the **contractor** must revisit the sample area later on to collect the late set-outs. The intent is to ensure all waste is collected and the results reflect actual waste generation and recycling levels.
- k) The **contractor** will note on the Collection Log the total number of bags/bins/carts that are set out at each house and the number of full bag/bin/cart equivalents.
- l) Weather conditions are to be documented in the Collection Log. The **contractor** will note if the material at the curb – particularly the recyclable paper – is wet, and note whether participation could have been hampered due to inclement weather.
- m) If a household does not set out material, the **contractor** will note this in the Collection Log.
- n) If a household does not set out material, or their material is inadvertently picked up by the regular hauler, the **contractor** will not collect substitute material from another home.
- o) The **contractor** and **partner municipality** are to decide how to handle waste set-outs that do not meet municipal waste set-out requirements (e.g., bag tags are required but the bag has no tag, loose garbage, oversized pieces of cardboard, etc.). The **partner municipality** must provide “material rejection” tags/stickers for the **contractor** to use if the **partner municipality** wants the **contractor** to reject certain materials.
- p) The **contractor** will provide collection staff with personal protective equipment including clean protective clothing, heavy-duty puncture-resistant gloves, safety foot wear, safety eyewear, and traffic safety vests. The **contractor’s** staff will be neat and tidy and demonstrate a level of professionalism in both appearance and conduct that is commensurate with the standards of the **partner municipality**.
- q) The **contractor** will provide an unmarked 16-foot cube van or similar vehicle for waste collection purposes. “Unmarked” is defined as the absence of logos and decals such as those typically found on U-Haul vehicles. The **partner municipality** may elect to provide the **contractor** with magnetic logos or signs to identify the van as being affiliated with the **partner municipality** to reduce concerns from residents.
- r) The **contractor** will provide bags or containers for collecting loose material, or material set out in bins, cans or carts.
- s) The **contractor** will use tags, tarpaulins, bags or bins to keep the samples from getting mixed up in the back of the truck.
- t) The **contractor** is to notify **CIF** and **Stewardship Ontario** and the **partner municipality** immediately if any problems are encountered during collection (e.g., a resident refuses to give up their garbage, the regular hauler has picked up sample material, etc.).
- u) The **contractor’s** fieldwork supervisor must have a cellphone.

- v) Questions from residents about the waste composition study will be directed to the representative from the **partner municipality**. The **contractor** will be provided with copies of a letter from the **partner municipality** explaining the initiative and providing contact information for distribution to residents seeking information.
- w) The **contractor** shall ensure that all staff do not read, copy or retain any of the materials found in the waste streams at any point during the study (i.e. both sample collection and sorting).
- x) The **contractor** will transport the sample material to the sort site.

4. Sorting and Characterization

This section provides an overview of the requirements for sorting collected samples.

4.1. Sorting Requirements

- a) The **contractor** will provide the following equipment at a minimum for the field crew:
 - Heavy-duty puncture-resistant gloves, safety footwear, traffic safety vests, protective coveralls, ear plugs, and air-filter safety masks;
 - First-aid kit;
 - Work tables on which to sort the waste (one with 5-10 cm-high sides on three sides is recommended);
 - Leak-proof containers of sufficient volume and in sufficient number for sorting and weighing the waste; and
 - Any other items necessary to complete the sort (e.g., brooms, dustpans, and knives to open the bags, etc.).
- b) **CIF, Stewardship Ontario** or the **partner municipality** is required to provide the following:
 - An area suitable for waste sorting, ideally a climate-controlled building at a waste management facility with good ventilation and lighting, low traffic flow, and on-site washroom facilities.
 - Disposal/recycling bins for the material that has been sorted. The **partner municipality** will arrange to have the bins emptied as required and will cover all costs associated with these bins, including hauling and disposal.
 - A container for hazardous materials (e.g., needles and sharps, etc.).
- c) The **contractor** will supply sufficient numbers of sorters and support staff to complete the work in a timely fashion.
- d) The **contractor** must ensure that their staff and subcontractors are familiar with **Stewardship Ontario's** material categories and sampling and sorting methods, and provide evidence thereof upon request.
- e) Each member of the audit field crew should have a tetanus shot if they have not had one in the last 10 years.
- f) The waste samples should be sorted and disposed on the day they are collected. Materials may be held over and sorted on another day if the **partner municipality** and the operators of the waste facility permit it. Waste held over should be covered to protect against moisture loss, damage by pests, etc.

- g) The **contractor** will provide a suitable electronic weigh scale capable of measuring from 0.01 kg to at least 60 kg. This weigh scale must be of sufficient accuracy to provide weight measurements within $\pm 1\%$ of true weight.
- h) All weight measurements will be expressed in kilograms to two decimal places and will be recorded in the *Waste Sort Log* (see Section 5.1).
- i) The tare weights of the weigh bins will be checked periodically during the sorting process.
- j) The **contractor** will sort and weigh all (100%) of the material that is collected from the sample homes.
- k) The **contractor** is not required to weigh the sample material before it is sorted.
- l) The sample material will be sorted by stream and by sample area into the material categories listed on the *Categories Described* spreadsheet (see Section 5.1).
- m) Garbage bags found in the recycling stream will be opened and materials inside sorted into the material categories listed on *Categories Described* spreadsheet (see Section 5.1).
- n) The **contractor** will disassemble multi-material items that are easy to separate. For example, if the paperboard insert in a plastic bubble pack is not bonded to the outer packaging, the sorters will remove it and sort the card into the Boxboard category and the plastic into the proper plastic category.
- o) The **contractor** will make best efforts to separate food wastes from their packaging before weighing. This can be achieved by opening all packaging and shaking out the contents.
- p) The following approach will be used for managing “fines” (items <1 cm across):
- Estimate the composition of the fines by weight (i.e., 10% kitty litter, 30% food waste, 20% mixed fine paper, 30% clear glass, and 10% coloured glass);
 - Split the mix accordingly; and
 - Add material to the appropriate bins before weighing.
- q) Bags/containers containing hypodermic needles, lancets, other sharps or other highly hazardous wastes will be set aside, weighed, and described and recorded separately under the category “Other HSW”. The **partner municipality** is responsible for providing a container for hazardous wastes such as used hypodermic needles.
- r) The **contractor** will record the weights of the separated materials by waste stream and by sample area in the *Waste Sort Log* (see Section 5.1) as follows:
- Record multiple weights for one category (e.g., “25.15+5.25”).
 - Enter a “0” if there is no material for a category.
- s) Light materials/items must be weighed directly on the scale, not in a bin.
- t) The **contractor** will make note of and weigh separately any item/material that significantly affects the total weight measured for a material category (e.g., an 18-litre PET bottle and a magazine collection).
- u) If the **contractor** is not sure to which category an item belongs, they will either contact **CIF and Stewardship Ontario** immediately for assistance, or select the most appropriate category and include a note to identify the item and its weight, so that it can be properly allocated by **CIF and Stewardship Ontario** later on.

- v) The **contractor** will keep the sort site in a reasonably clean state and will clean the floor, sorting tables, sort bins and other surfaces in contact with the waste at the end of each day.
- w) All waste materials handled during the study will be collected post-sort by the **municipality** or designated waste contractor and disposed of in the correct manner.
- x) Upon completion of the waste audit, the **contractor** will promptly remove all of their equipment and supplies, and return the sort site to its pre-study state.

5. Reporting the Study Results

This section outlines the requirements for recording the sorting results.

5.1. Reporting Requirements

- a) Only the data collection forms and electronic spreadsheets provided by **CIF** and **Stewardship Ontario** are to be used for reporting.
- b) Reporting for each two-week study is to be completed and provided to **CIF** and **Stewardship Ontario** no later than two weeks after the final day of sorting.
- c) Data collected on the worksheets and in logs is to be entered in the electronic spreadsheets provided by **CIF** and **Stewardship Ontario**.
- d) All of the spreadsheets for the 20XX single-family studies are found in an Excel file named “Single-Family Residential Waste Study Worksheets 20XX”. This file contains the following six spreadsheets:
 - i. **Waste Study Description:** Use this spreadsheet to record general information about the study such as sampling dates, location of sorting site, notes on the **partner municipality’s** waste programs, a description of each of the residential streets sampled, general notes on the materials found in the waste streams, problems and issues, and other notes that might help **CIF**, **Stewardship Ontario** and the **partner municipality** interpret the results, etc. The **partner municipality** is required to help the **contractor** fill out parts of this spreadsheet. The **contractor** is required to send this spreadsheet to **CIF** and **Stewardship Ontario** at the end of each study.
 - ii. **Material Categories:** This spreadsheet lists the material categories and provides detailed descriptions and examples. The **contractor** must make this sheet available for reference during the waste sort.
 - iii. **Collection Log:** The **hauler** must use this log to record the weights of the loads they collect.
 - iv. **Waste Sort Log:** The **contractor** must use this log to track the weights of the sorted materials and to record any notes during the sort.
 - v. **Collection Results:** The **contractor** is required to enter the collection results from the *Collection Log* on this sheet and submit it to **CIF** and **Stewardship Ontario** at the end of each study.
 - vi. **Sort Results:** The **contractor** is required to enter the sort results from the *Waste Sort Log* on this sheet and submit it to **CIF** and **Stewardship Ontario** at the end of each study. Detailed data entry instructions are provided at the top of this spreadsheet.

- e) All data must be checked for accuracy and errors and approved by the **contractor's** project supervisor before it is submitted to **CIF** and **Stewardship Ontario**. It should be noted that the **contractor** is required to enter zeros in the collection and sort results spreadsheets where applicable.
- f) The **contractor** will email the completed electronic spreadsheets to **Sherry Arcaro** at **Stewardship Ontario** (sarcaro@stewardshipontario.ca) and Mike Birett at **CIF** (mbirett@wdo.ca)
- g) Once **CIF** and **Stewardship Ontario** staff have verified the data and summarized it, **CIF** will forward an electronic copy of the results to the **partner municipality**.