



CIF Final Report #1117

## Blue Box Litter Auditing and Lid Testing - Durham Region

September 2021

Prepared for:  
Resource Productivity and Recovery Authority  
Continuous Improvement Fund

## Acknowledgement

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## Executive Summary

In 2020, Durham requested financial support under the CIF 2020 REOI to undertake the measuring and monitoring portion of a phase 2 pilot involving distribution of a blue box lid (which helps prevent litter) to 1,000 households and evaluation over an 8-month period to determine if the lid:

- effectively reduces litter and thereby increasing capture and associated marketed revenue;
- has an impact on collection and processing costs;
- has an impact on material processability; and
- is utilized and accepted by residents.

The measuring and monitoring plan included data tracking, visual observation logging, activity based costing, and other assessments.

On average, litter generated over the two seasons was 0.008kg per household per week which translates to 0.416 tonnes per 1,000 HH's per year. Areas with denser populations, young families, and more rural areas tended to be less likely to use the lids. The results indicated that with over 9% of households utilizing a lid an average of 36.89% reduction in litter was seen. Further, those areas that received 2 lids during the project had higher uptake in utilizing the lids which resulted in lower litter generated.

The time-and-motion studies for collection calculated an increase of 24.6% in stop time or 2.58 seconds when comparing open boxes to lidded ones. The moisture calculations showed that the average weighed difference/change between the moisture for lidded fibre materials versus open box was 4.95% and 4.70% difference was seen in containers. When comparing processing of dry materials versus wet materials both streams are impacted by moisture. A conservative 4% change in processing speed could equate to a savings per tonne for each stream. Increased capture of tonnage also increased processing costs.

Finally, surveys showed that 81% of respondents found the lid easy to use and 88% of respondents noticed that the lid prevented litter from the blue box on windy days. Overall, 75% of respondents would recommend the lid to other residents of Durham (likely or very likely).

Based on the results of this study, a lid, placed on an open top blue box in a dual stream recycling program, can decrease litter on streets once a certain level of participation is achieved and especially on windy days. Additionally, a lid can decrease moisture which directly impacts processing at the MRF and the quality of the marketed material. Durham Council recommended that the lid be made available to residents on a full cost-recovery basis.

# 1. Introduction

Durham Region is a 2-tier municipality made up of 8 lower-tier municipalities. It is the largest geographical jurisdiction in the Greater Toronto Area stretching from Lake Simcoe in the north to Lake Ontario in the south, and from as far west as Pickering to Newtonville in the east. The Region encompasses an area of approximately 2,532 square kilometers and is home to approximately 673,500 residents.

Durham Region has operated a dual-stream Blue Box program for over 25 years, currently servicing approximately 215,000 residential curbside recycling stops, 25,064 multi-residential units in 398 buildings, and three Waste Management Facilities (WMF) that accept residential recyclables.



Figure 1: Map of Durham Region, Ontario, Canada

Roughly 46,000 MT of Blue Box materials are collected for processing annually with a residue rate of approximately 11% in 2020. The Region owns the Material Recovery Facility (MRF) and contracts out blue box collection to Miller Waste Systems Inc. and GFL Environmental Inc.

## 2. Background

The province of Ontario identified that a top area for action was to “prevent and reduce litter in our neighbourhoods and parks” in the 2019 discussion paper “Reducing Litter and Waste in our Communities”.

Municipalities with open top blue boxes routinely receive complaints from residents regarding litter associated with recycling services. Many municipalities have reviewed various box litter-abatement tools such as nets, plastic lids, flexible flaps, and levered tops over the years without identifying one that meets the requirements of the program. Other municipalities with “box” recycling programs are estimated at ~75% of province. Looking at WDO municipal groups 1 and 2 (representing 68% of Ontario’s blue box tonnages) there are 10 municipalities that offer “boxed” programs, 8 of which are dual stream including Durham Region.

### 2.1 Project Goals and Objectives

In 2019, the Region of Durham prototyped an innovative new recycled crumb rubber blue box lid. Given its geographic location, Durham services a variety of housing including urban, suburban, rural, waterfront, and seasonal as well as newer developments to older established residential areas. This project aimed to study the effectiveness of this litter abatement tool in a municipality that is representative of much of the province’s housing stock and, the implications on both collection and processing.

In 2020, Durham requested financial support under the CIF 2020 REOI to undertake the measuring and monitoring portion of a phase 2 pilot involving lid utilization in 1,000 households and evaluation over an 8-month period to determine if the lid:

- effectively reduces litter, thereby increasing capture and associated marketed revenue;
- has an impact on collection and processing costs;
- is utilized and accepted by residents; and
- has an impact on material processability.

Durham designed two sizes of lids to accommodate the many unique types of boxes utilized throughout the Region. The lids are made from recycled tires and the 2019 pilot study reported improvements in resident’s assessment of litter levels and suggested that collection workers supported its use. For small batch production of the lid (<1,500 lids) cost for 2 lids, p&e, and delivery are estimated at \$23.19 per household.



Concern over litter arising from “boxed” programs has some municipalities considering a shift to bags or carts, which would require significant modifications in capital costs and operating

systems. The results of this project may provide a viable option to resolve litter related concerns with box-based collection.

Research completed in July 2016 in Portland Maine estimated that 2.25 tonnes of recyclable materials per 1,000 households “leaked” from their open box single stream system in the form of curbside litter each year. No equivalent studies have been completed in Ontario. Most of the litter studies across North America have focused on “litter” in general with no emphasis on the composition and total generation of blue box materials. Thus, this project studied blue box litter generation in 10 sample areas, for 6 weeks, over two seasons.

### 3. Approach

The measuring and monitoring plan included data tracking, visual observation logging, activity based costing, and other assessments that addressed:

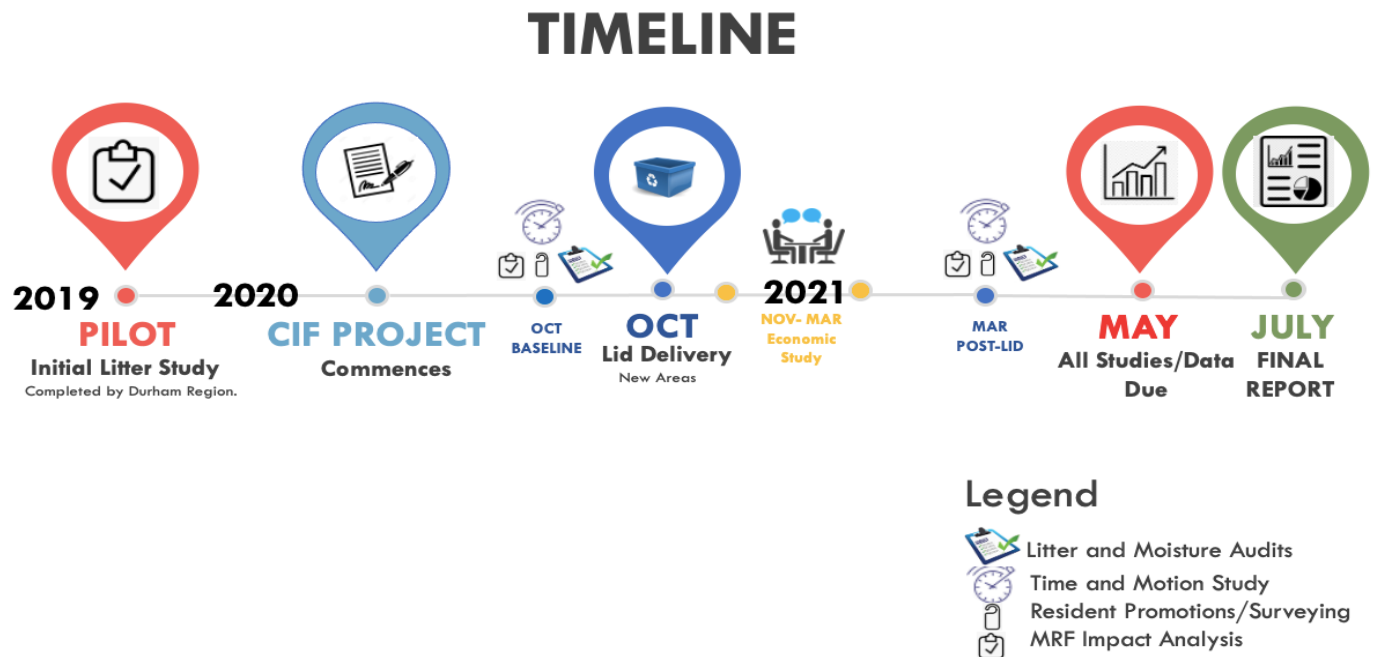
1. Total generation and composition of litter per household per week pre and post lid implementation (previous “pilot” areas included to determine longevity of lid utilization)
2. The measure by which this lid impacts litter generation and material moisture
3. The impact of set-out influencers including overflowing bins, windy days, weather conditions, public works events, and other, to be identified, unknowns
4. Economic costs associated with litter cleanup
5. Collection timing considerations – time and cost with and without lids on route
6. Public acceptance and utilization of abatement tool

Specific monitoring and measuring tasks included:

- 6-weeks of litter audits following an approved methodology:
  - o Prior to lid implementation in October 2020
  - o Post lid implementation in April 2021
- Audits completed in sample areas representative of Ontario municipality housing types (10 areas) for a total of ~ 1,000 households
- Measuring moisture levels of primarily fibres comparing “open” and “lidded” boxes
- Tracking total number of litter complaints received by the Region over time
- Tracking total staff time associated with the procurement and delivery of the lids
- Estimating time associated with litter collection by lower-tier municipalities (per km of residential road)
- Activity based monitoring and observations of collection pre and post implementation
- Surveying of residents pre and post lid implementation regarding acceptance, overall impressions, utilization, and pricing parameters.

### 3.1 Project Timeline, Implementation, and Methodology

The project timeline was as follows:



### 3.2 Litter Audit

The Blue Box litter audit included collecting of all litter from 996 households in 6 municipalities (Scugog, Oshawa, Pickering, Whitby, Clarington and Ajax – see Table 1) and 10 locations over 4 collection days (Tuesday-Friday), for 4 weeks in the fall (starting end of September) and again 4 weeks in the spring (April).

The purpose of the first week of each audit period is to “clean or clear” the sample areas. The remaining 3 weeks were to collect and measure the litter generated from each specific sampling location. There were two parts to the litter audit: prior to collection and after collection.

#### *Prior to collection data requirements*

In order to collect accurate data, researchers visited the sample areas ahead of the collection trucks. The Region requires residents to set out garbage and recycling by 7:00 am on the collection day.

For each collection day (once per week for each sample area – 8 weeks total), the following details were noted for each sample area:

- Date of collection
- Wind and weather conditions (wind velocity, temperature, and weather notes from last 12 hours)
- Names of data collectors
- Start time of data collection and end time for data collection
- Address of household with/without recycling containers
- Visual assessment details for every recycling container
  - o Number of containers (box and/or bag), stream of recyclables (paper, containers, or mixed), presence of lids/no lid, note the size or type of container, the volume (fullness of boxes/bags) of recyclable materials as to the degree to which they overflow or materials have been placed adjacent to the set-out (where the volume of recyclable materials exceeded the capacity of the container, volumes are to be reported as a percentage of the capacity of the container).

#### *After collection data requirements*

After the “clean and clear” week of each area for each season (fall/spring), litter collection for three weeks (3) occurred. After recyclables were collected by the contractor, litter within 20 feet/6 metres of the sidewalk (or set-out location) of each container was collected (10ft/3m into the street and 10ft/3m toward the dwelling).

All litter equal to or larger than 1 in<sup>2</sup> /2.5 cm<sup>2</sup> and attributable to a recycling container was collected. Litter not likely to have been in the recycling bin (such as bagged pet waste, cigarette butts, weatherworn litter, food waste, and broken bottles) was also collected and categorized as “other waste – suspected non-blue box” subcategory. Other spaces, outside of 20 ft/6 m setting but located within the sample areas with obvious litter accumulation was noted and photographed.

For each collection area the following general information was taken:

- Date of litter collection
- Area of litter collection
- Wind and weather conditions (wind velocity, temperature, and weather notes from previous 12 hours)
- Names of litter collectors
- Start time of litter collection and end time for litter collection
- Any spaces with accumulated litter outside of “sampling” parameters.

Following collection (3 weeks per season), all litter from each sample area was labelled separately (by area) and taken to a sort location and segregated and characterized by size, weight (kg), and material type. The litter was sorted into the following categories and subcategories:

- |   |                         |   |
|---|-------------------------|---|
| – Mixed Paper<br>(magazine/office)                    | – Plastic #1 - PETE     | – Aluminum/Steel<br>containers            |
| – Newspaper   | – Plastic #2 – HDPE     | – Other metal                             |
| – Boxboard  | – Mixed Plastic, #3–#7  | – Glass                                   |
| – Cardboard   | – Straws/PS Coffee Lids | – Other waste (blue box)                  |
| – Polycoats   | – Other plastic         | – Other waste (suspected<br>non-blue box) |
| – Paper Beverage cups                                 |                         |   |
| – Unrecyclable Paper<br>Packaging (wrappers,<br>etc.) |                         |   |

Within each category, litter was counted, weighed (by verified calibrated scale), and sorted by size: small (1–3 in./2.5-7.5cm), medium (3–6 in./7.5-15cm), and large (6+ in./15+cm).

#### *Final Report (see Appendix A)*

Based on the data collected pre and post collection, the final report summarized:

- a. Litter collection date/sample area with weather highlights
- b. Total staff time associated with litter collection (per sample area per km)
- c. Total generation rate kg/hh/wk and composition of litter per sample area (based primarily on housing type)

### **3.3 Collection Time-and-Motion Study**

A team was dispatched efficiently, meeting the collection operator(s) at the sampling area on their predetermined route. The time-and-motion assessment was completed for a total of four (4) weeks. The team followed the collection trucks in a separate vehicle, recording pertinent data. Collection operators were instructed to collect all materials, bagged/boxed/and box with lid and provide enforcement of materials as/if needed. Collection contractor was not instructed to do anything different than their regular routine.

#### *Data Recording*

The following data was recorded:

- Number of containers (bag, box, box with lid) by street address
- Time spent by collection operators when handling recycling
- Any time spent by collection operators completing recycling enforcement policies (tagging etc.)
- Noted “litter” issues generated during collection (blown from truck, dropped during collection etc.)

Time spent driving between stops, adjusting truck doors were disregarded and not recorded. Only “hands on time” was recorded, that is time spent with recycling material or recycling container being touched by the collection operator. For the recyclable material in box, the time recorded starts when the hand touches the first container and ends with the last recycling bin returning to the curb. This is to be repeated for every stop until the sample area is complete.

To record time, a software application “Timestudy Stopwatch”, was utilized allowing for timestamps to be recorded, saved, and uploaded while in the field. The software application allowed for “laps” and outputs in several industry standard time forms exportable in .csv format. For the purpose of this assessment, auditors used Decimal Minutes as the unit of time measurement due to its ease in comparing and analyzing. Decimal Minutes are represented by one minute divided by 100. For the results section Decimal Minutes were translated into seconds.

For further redundancy, a GoPro camera was mounted to allow for an extra angle and a source in the event of lost data.

Based on the data collected for the time-and-motion assessment, the final report summarized:

- a. Total staff time associated with data collection (per sample area)
- b. Average time (seconds) per housing sample area
  - a. To collect recycling open boxes
  - b. To collect recycling lidded boxes (set-outs with have a lidded box)
  - c. To collect recycling and where enforcement occurred
  - d. Other observations, photographs, and videos

### 3.4 Moisture Analysis

During the litter audit (October and March), a team was dispatched, ahead of the collection operator in order to collect, move to the sort-location, and weigh ~200 households’ materials. Keeping the streams separated (fibres and containers), auditors collected and ultimately weigh 100 households of open boxed recycling and 100 households of lidded boxed recycling per season. This was called the “wet weight”. After the initial weighing, materials were set laid out to dry for 7 days and weighed again. This was called the “dry weight”.

The following calculation for moisture content was completed for each pile i.e.: “lidded” materials and “unlidded” materials.

$$\text{Moisture content (\%)} = \frac{W1 - W2}{W2} \times 100$$

where, W1 = total wet weight; and W2 = total dry weight

Based on the data collected for the moisture audit, the final report summarized:

1. Total staff time by activity associated with moisture audit per week (including dates)

2. Sample size (i.e. standardized numbers of blue boxes/households' weights) and average moisture content of:
  - a. Open fibre blue boxes
  - b. Open container blue boxes
  - c. Lidded fibre blue boxes
  - d. Lidded container blue boxes
  - e. Comparison and estimate of average percentage moisture difference between open versus lidded blue boxes
  - f. Other observations, photographs, and videos

### 3.5 Local Economic Study

For the local economic study, a consultant was hired in partnership with Durham Region and the CIF to survey all eight lower tier municipalities in the Region of Durham to develop confidential data sets, with information including (but not limited to):

- Total households in municipality and municipal features (rural, urban, suburban, etc.)
- Total kilometers associated with residential areas
- Total estimated kg/tonnes of litter collected annually - focus on residential areas (kg/km<sup>2</sup>)
- Type and details of local litter collection systems (municipal staff, adopt-a-road, other)
- Total direct costs associated with litter collection
- Total estimated indirect costs associated with litter (i.e. road sweeping / gutter cleaning)
- Number of complaints received by municipality re: litter and estimated average time per complaint – from reporting to resolution. FYI: Region of Durham also provided reports on litter complaints received at all call centres from September 2020 until April 2021
- Other insights

#### *Final Report – Economic Analysis (Appendix B)*

Based on the data collected from each lower-tier municipality and the Region of Durham, the final report summarized (where available):

- d. Average estimated annual tonnage of collected litter (per hh and per road km)
- e. Average municipal direct staff time associated with litter collection (street sweeping and pick-up per km)
- f. Total indirect staff time associated with litter collection
  - i. Handling complaints
  - ii. Organizing voluntary collections
  - iii. Other indirect litter collection information not noted above

### 3.6 MRF Impact

Most Ontario recycling facilities (MRFs) process materials on a cost per tonne basis. One of the measurements associated with this project in regard to the impact of the blue box lid is moisture, especially to fibres. Therefore, to study the potential impact of shifts in material moisture at the MRF, several interviews were conducted with operators and data was reviewed from the Durham MRF.

During the interviews MRF productivity was discussed with respect to moisture. Moisture can be a challenge in the truck (especially unloading from dual stream collection vehicles), and it is also a challenge in the processing facility, as higher moisture drives additional costs associated with:

- speed adjustments to lines, increases downtime mainly because of stopping more frequently to clean screens,
- potential increases to electricity costs for fans and heaters (to promote material drying and ease handling), and
- potential increased contamination and cross-contamination rates because materials slide or fall instead of ride and fly.

Ultimately moisture also influences the ability to compact and load as well as facility liquid management to sewer systems. Other reports suggest that higher levels of moisture reduce the marketability of paper and other materials. One respondent noted that loads may be rejected if the moisture content is over 12 percent<sup>1</sup>.

“Processors agree that it is essential to maintain productivity at their facility. Slowing everything down and processing fewer tons per hour has an “exponential cost impact” and it is not possible from a capacity perspective”<sup>2</sup>.

On a wet day, one processor suggested that the fibres line throughput may adjust from 25 tonnes per hour to 17.5 tonnes per hour, a 24.3% difference<sup>3</sup>. A recommendation with respect to moisture in recycling suggested that methods be sought to “prevent moisture from accumulating in curbside collection bins during transport and transfer to market”<sup>4</sup>.

To further evaluate the impact of moisture, the following data was requested from the Durham MRF for wet days and dry days:

- Inbound tonnage
- Belt Speeds
- Throughput
- Total downtime

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<sup>1</sup> [https://www.kingcounty.gov/~media/depts/dnrp/solid-waste/about/documents/MRF\\_assessment-2020.ashx?la=en](https://www.kingcounty.gov/~media/depts/dnrp/solid-waste/about/documents/MRF_assessment-2020.ashx?la=en)

<sup>2</sup> [https://www.kingcounty.gov/~media/depts/dnrp/solid-waste/about/documents/MRF\\_assessment-2020.ashx?la=en](https://www.kingcounty.gov/~media/depts/dnrp/solid-waste/about/documents/MRF_assessment-2020.ashx?la=en)

<sup>3</sup> Interview Rodney Libby, Durham MRF Operator, Miller Waste March 2021

<sup>4</sup> [https://www.kingcounty.gov/~media/depts/dnrp/solid-waste/about/documents/MRF\\_assessment-2020.ashx?la=en](https://www.kingcounty.gov/~media/depts/dnrp/solid-waste/about/documents/MRF_assessment-2020.ashx?la=en)

### 3.7 Residential Survey

A total of 996 households were notified of online surveys through street signage and direct mail letters and postcards. These surveys were conducted pre and post lid implementation. The households were located in 10 locations across the Region of Durham. Households are divided by housing type as well as tool provided.

Surveying Required	Tool Provided	Total Number of Households
Pre and Post Survey	2 new lids (lids distributed last week of October 2020)	487
Pre and Post Survey	1 new lid (lids distributed last week of October 2020)	104
Utility Survey	Lids and boxes provided in 2019	405

Previous survey results from “old lid areas” were analyzed regarding “utility”.

Final Report – Residential Surveying (see Appendix D)

From the survey data provided to the consultant, analysis was completed to compare<sup>5</sup> results from each sample area:

- a. Overview of baseline (pre-lid) information on litter/project awareness and current blue box activities
  - Relate to Region of Durham and lower tier “complaints” data
  - Top suggestions provided for program improvements
  - Compare results from housing “types”
- b. Highlights of follow-up (post-lid) responses:
  - Impact on litter/project awareness and blue box activities
  - Resident insight into lid utility, marketability, and P&E provided
  - Top suggestions provided for program improvements
  - Compare results from housing “types”
  - Provide comparisons of the results from areas with 2 new lids versus 1 new lid
- c. Summary notes, recommendations, and observations of surveying

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<sup>5</sup> For areas where lid was already provided in 2019, previous survey data shall be utilized for the baseline analysis  
CIF Final Report Project #1117 (Blue Box Litter Auditing and Lid Testing, September 2021)

### 3.8 Sample Areas

Table 1: Sample Pilot Areas

Pilot Area	Municipality	Sample Type	Description	Lid Option	Total HH
1	Scugog	Rural – Single Detached	Low density, outside CMAs <sup>6</sup> cottage country, rural	1 New Lid	49
2	Clarington	Rural – Agricultural	Low density, outside CMAs, Agricultural	1 New Lid	55
3	Oshawa	Suburban – Single Detached Pre 1960s (Old)	Medium density, within CMA	2 New Lids	121
4	Oshawa	Suburban – Single Detached 1961 – 2000 (Middle)	Medium density, within CMA	2 New Lids	145
5	Ajax	Suburban – Single Detached 2001+ (New)	Medium density, within CMA	Old Lid Area	191
6	Whitby	Urban – Single Detached Pre 1960s (Old)	High density, within CMA	2 New Lids	115
7	Pickering	Urban – Single Detached 1961 – 2000 (Middle)	High density, within CMA	2 New Lids	106
8	Whitby	Urban – Single Detached 2001+ (New)	High density, within CMA	Old Lid Area	122
9	Ajax	Urban – Semi Detached/Condo	High density, within CMA	Old Lid Area	61
10	Whitby	Suburban/Urban – Row Houses/ Multi Residential	Row of houses joined by common sidewalk and a continuous grouping on multi-levels	Old Lid Area	31

<sup>6</sup> [Census Metropolitan Area, Statistics Canada](#)

### 3.9 Project Challenges and Solutions

Table 2: Summary of Set Up and Implementation Challenges

<b>Key Set Up Problems and Implementation Challenges</b>	<b>Solution Implemented</b>
Submitted consultant costs exceeded budget	<ul style="list-style-type: none"><li>• Revised audits and studies from 5 weeks to 4 to meet financial limits</li></ul>
Initial P&E consultant approach was not deemed effective during COVID restrictions	<ul style="list-style-type: none"><li>• Regional staff created and implemented the communication and education program then shared all data and feedback with consultant for independent analysis</li></ul>
Non compatible “point in time” survey questions that weren’t duplicated in subsequent surveying	<ul style="list-style-type: none"><li>• Questions pre and post implementation – comparisons were made where applicable</li></ul>
Post implementation survey questions removed	<ul style="list-style-type: none"><li>• Region of Durham removed questions associated with residential insights into costing of lids based on Council Decision to provide lids on a cost-recovery basis prior to project completion</li></ul>
Limited information available from Lower-Tiers for economic study	<ul style="list-style-type: none"><li>• Staff utilized various external sources of data and estimated information to generate calculations and compare them to other sources of data in order to validate the findings.</li></ul>

## 4. Project Results

### 4.1 Litter Generation, Composition, Street Collection Costing

In order to determine the lost opportunity for recycling revenue, litter was gathered, sorted, weighed, and counted into 18 categories for each of the 10 areas over three weeks for two seasons. The generation of litter analysis focused on the average weight collected per household per week from rural, suburban, and urban areas.

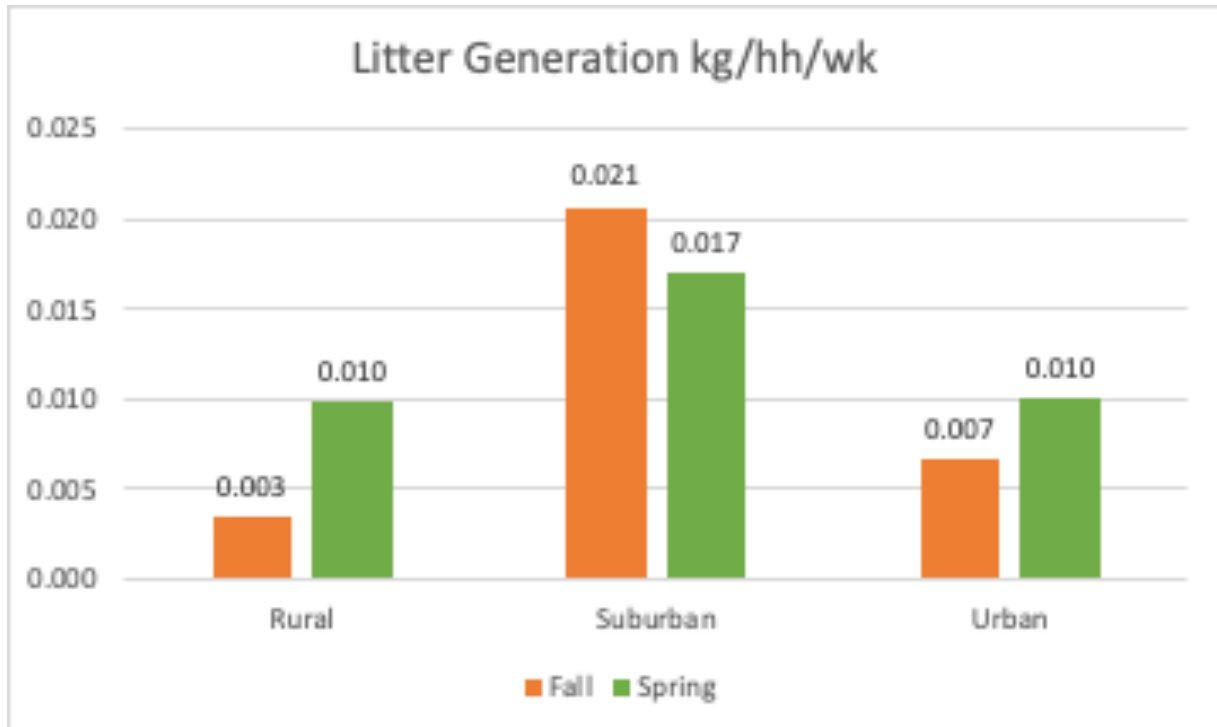


Figure 2: Average Litter Generation kg/hh/wk by area characteristic

As seen in Figure 2, Suburban and Urban areas generate more litter than rural households and more litter was collected in the spring season for both rural and urban areas. This is despite the implementation and increase utilization of the blue box lid. On average, litter generated over the two seasons was 0.008kg per household per week which translates to 0.416 tonnes per 1,000 HHs per year.

The two graphs below represent the composition of litter from all ten areas included in the study for the fall 2020 and spring 2021 audits.

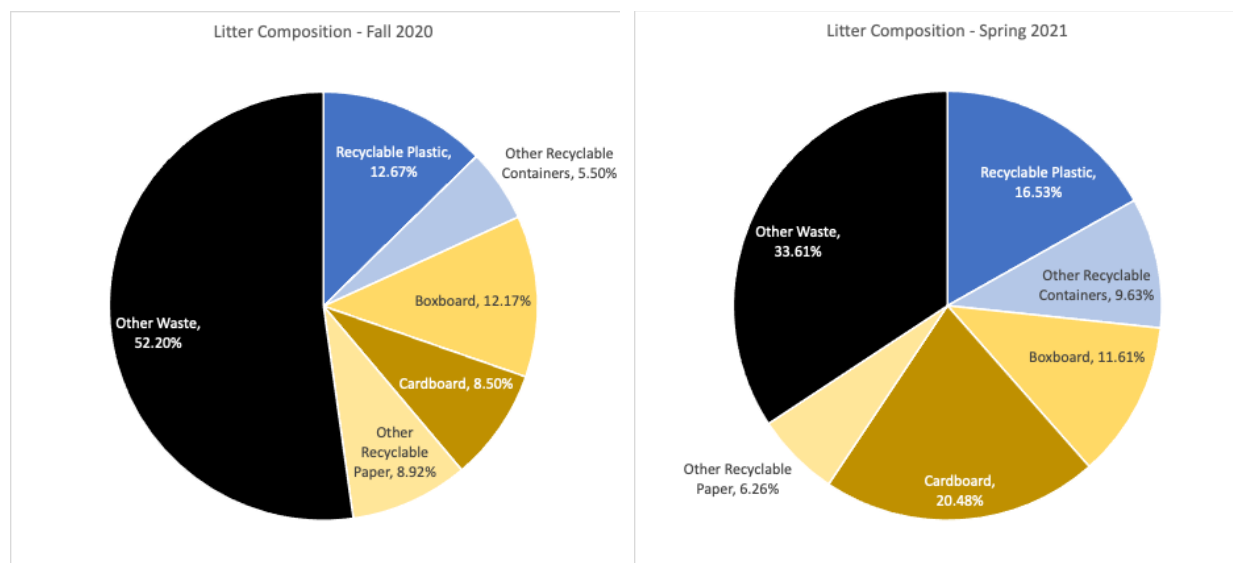


Figure 3: Litter Composition Fall 2020 and Spring 2021

As can be noted, in the composition charts above, there are some differences in the composition of litter materials collected. In the spring more recyclable materials were seen (66.39% vs. 47.80%). More plastics and cardboard were noted in the 2021 audit with less other waste. It is important to comment that some littered items, for example coffee cups, although not accepted in Durham recycling, may have originated from a blue box.

It must also be noted that the litter found in the various sample areas were not necessarily generated from the blue box. While the blue box may be a source of litter generation, it is important to consider other factors such as other waste streams (garbage & organics), pests disturbing waste set-outs, wind-blown litter, litter generated from vehicular traffic, and litter generated by pedestrians.

To provide a more fulsome understanding of the total cost of litter, staff time associated with residential street cleaning was collected. AET staff travelled a total of 72.66 km of streets in ten areas over six weeks. It took an average of 20 staff minutes per residential area kilometer to sweep up litter. With a fully burdened labour cost approximation of \$27.40 per hour this equals \$9.11 per km in labour costs to clean the streets.

#### 4.2 Blue Box Set-outs and Lid Participation Rates

Based on both seasons, an average of 71.25% of households participated each week in fibres stream recycling and 66.68% in containers stream recycling. During set-out data collection it was noted if the household utilized a blue box lid, and on which stream.

For the households with lids in the Fall Season (only 4 areas), a total of 5.30% of households used at least one lid on their blue box. A total of 13.53% of households used at least one lid on their blue box in the Spring.

Use of the lid varied by sample area. The greatest usage was witnessed in Area 4 of the Spring season (31.90%) and the lowest levels were observed in Area 1 in the Spring season (5.10%). Area 4 is a suburban, post-war neighbourhood with a large elderly population. This demographic seemed to take care to reduce their litter and abide by the recommended recycling guidelines. Other areas with denser populations, young families, and more rural areas tended to be less likely to use the lids. For more details see Appendix A.

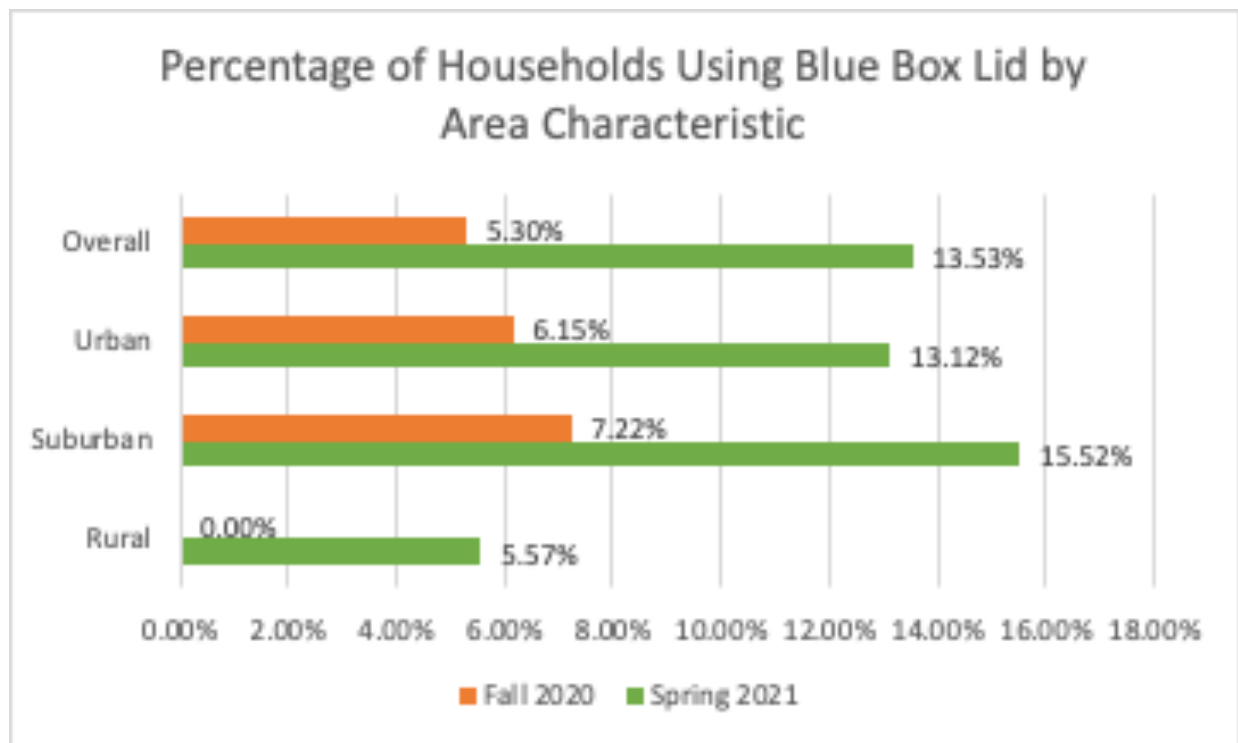


Figure 4: Percentage of Households Using a Blue Box Lid

In 2019 Areas (Area 5, 8-10) residents were provided one blue box lid. In 2020 Areas, 2 sample neighbourhoods received 1 lid (Area 1 and 2) and 4 others received two lids (Areas 3 and 4, and Areas 6 and 7). On average residents put the lid on the fibres bin (7.75%) more often than the containers bin (4.59%). Figure 5 shows that in all the sample areas, the lid is utilized primarily on the fibres blue box (3.09% to 14.33% of set-outs). That said, in the areas where 2 lids were provided, set-outs with lids increased for both fibres and containers.

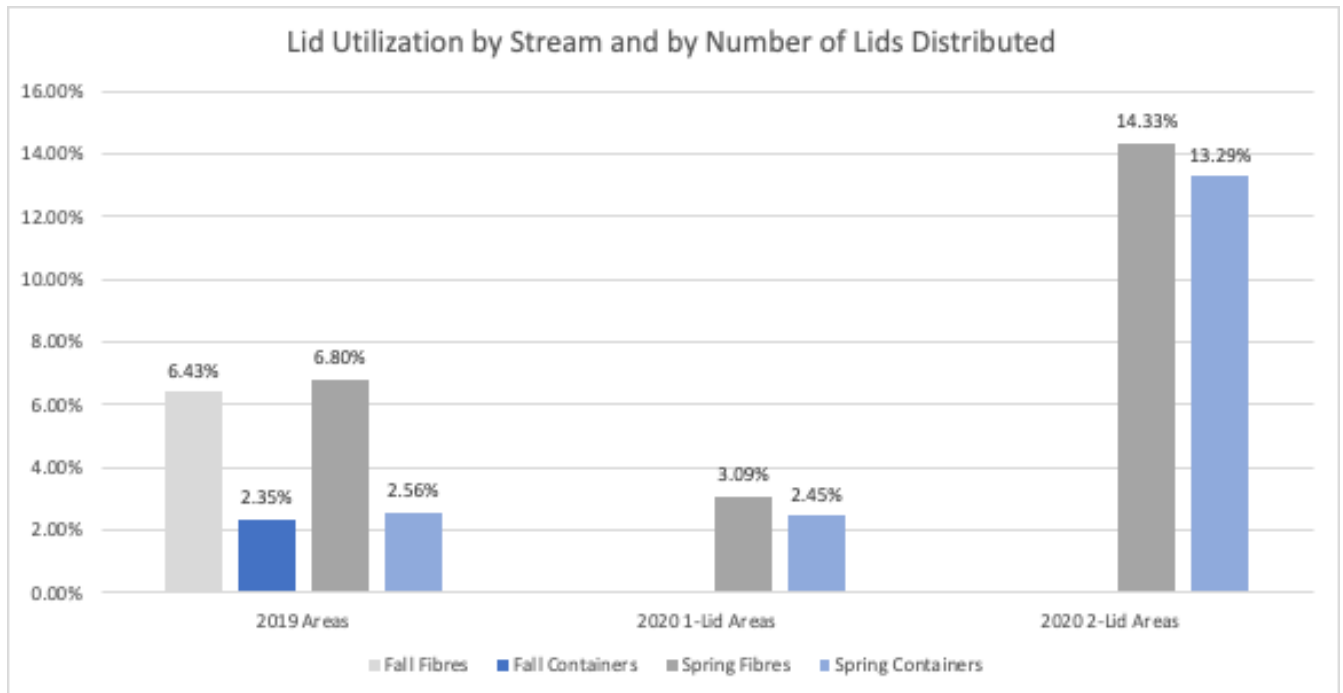


Figure 5: Lid Utilization by Stream and by Number of Lids Distributed

To measure other variables associated with blue box litter, auditors provided the average wind velocity per sample area for each sampling event as well as noted fullness of blue box bins. In order to evaluate the impact of wind and overflowing bins on litter generation, statistical calculations were completed, namely correlation equations.

Correlation measures the relationship between two independent variables in coordination with one-another. The closer the equation is towards positive 1 (one), the greater the significance of a relationship between the two variables. The following figures show that there is a relationship between increased wind velocity and litter collected from the sample areas (Figure 6 and Figure 7). However, they also show that there is no relationship between the percentage of overflowing bins and the amount of litter collected from the sample areas (Figure 8).

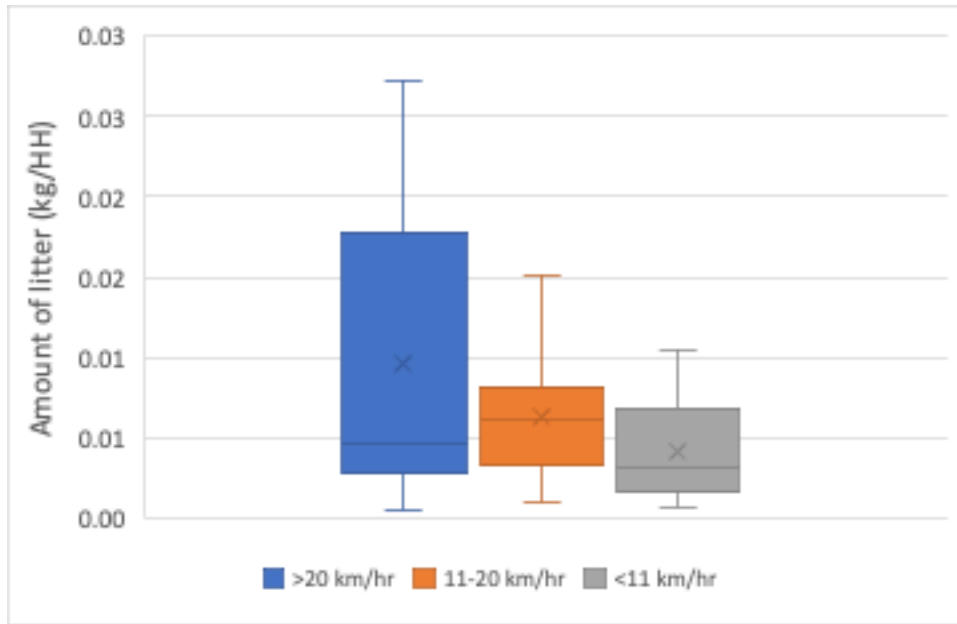


Figure 6: Wind Velocity Groupings and Amount of Litter Collected kg/hh

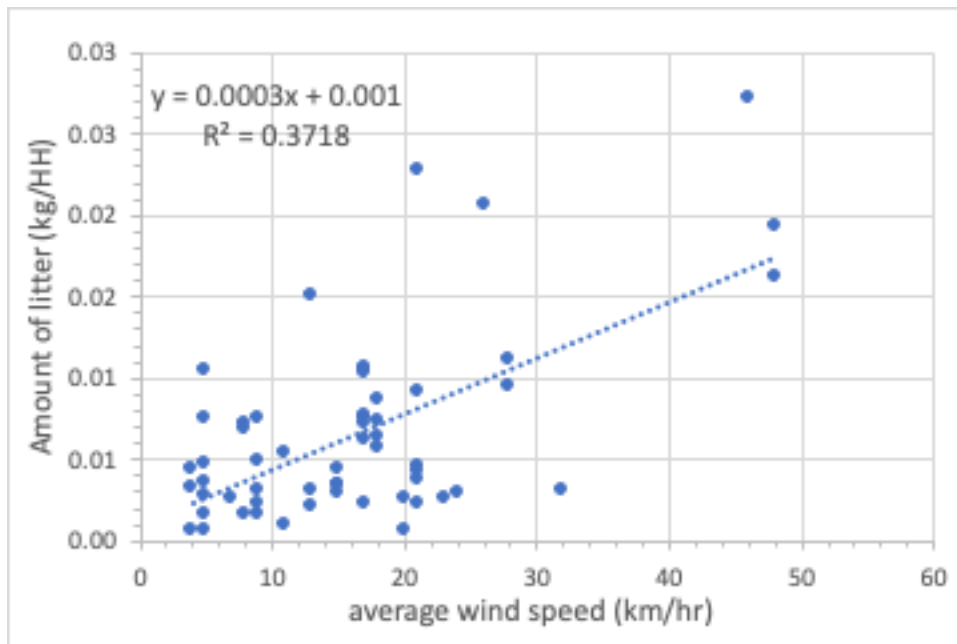


Figure 7: Correlation of Amount of Litter Collected (kg/hh) and Average Wind Speed (km/h)

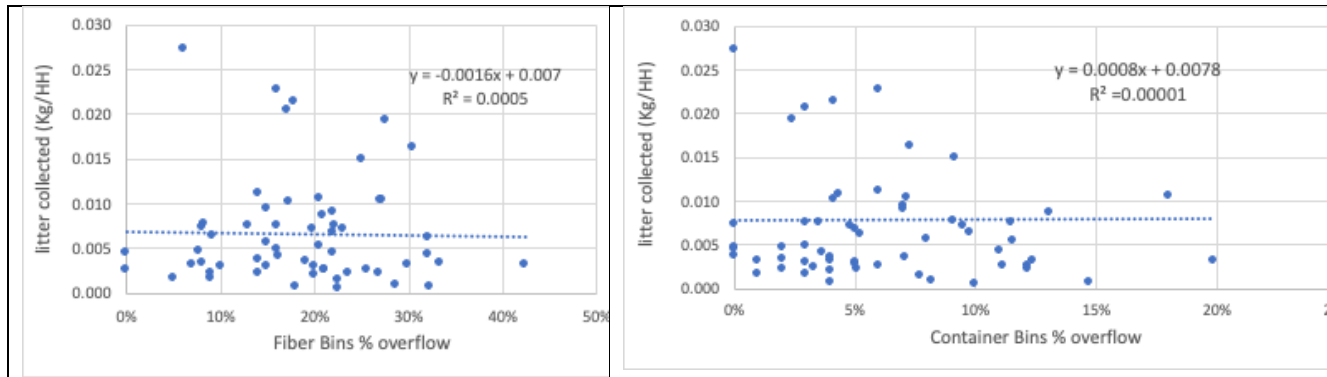


Figure 8: Correlation between % of overflowing bins and litter collected (kg/hh)

### 4.3 Pre and Post Implementation Litter Generation

In order to determine a change in litter generation per sample area, total percentage of litter generated per household change and percentage of households utilizing the lid was reviewed. Table 3 shows that with lid utilization of greater than 9% of households, a reduction of collected litter per household was seen.

Table 3: Pre and Post Implementation Litter Generated Per Household

Sample Area	Litter Generation Change	Lid Utilization (Average)
Area 1 – Rural	95.02%	5.10%
Area 2 – Rural	219.25%	5.99%
Area 3 – Suburban (x)	0.60%	10.95%
Area 4 – Suburban (x)	-46.73%	31.90%
Area 5 – Suburban	58.03%	6.47%
Area 6 – Urban (x)	-13.55%	19.57%
Area 7 – Urban (x)	-58.63%	15.09%
Area 8 – Urban	-74.11%	9.31%
Area 9 – Urban MR	1958.67%	5.94%
Area 10 – Suburban MR	-28.95%	12.10%

(x) – Area provided with 2 lids

Between 0% and 74% change in percentage of litter generated was seen in areas with between 9.31% and 31.90% of households utilizing the lid. On average, with over 9% of households utilizing a lid a 36.89% reduction in litter was seen. Further, those areas that received 2 lids during the project had higher uptake in utilizing the lids which resulted in lower litter generated.

#### 4.4 Moisture Results

Some municipal collection contracts and most processing facilities charge a cost per tonne for picking-up materials either curbside or depot and/or processing them. With open blue boxes, carts, or bins, exposure of recycling materials to the elements can add moisture, which in turn adds unnecessary weight, upwards of 22%<sup>7</sup>. This added weight, in contracts with costing by heaviness, can have an obvious impact on overall program costs.

In the moisture audit conducted (see Figure 9), AET consulting took samples of open top and lidded blue box materials, from both fibre and container streams. The materials were weighed (*wet weight*), spread on tarps and left to dry for seven days, then weighed again (*dry weight*). Moisture content percentage was calculated using the equation  $(\text{wet weight} - \text{dry weight}) / \text{dry weight} \times 100$ .

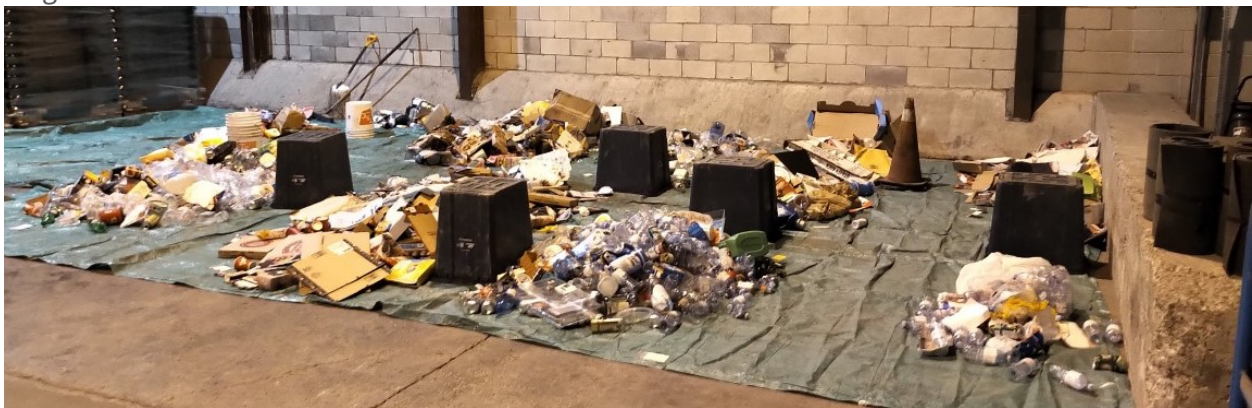


Figure 9: Moisture Audit “drying” area

Auditors collected 380 samples of “open boxed” materials (212 fibres and 168 containers) and 173 samples of “lidded” materials (173 fibres and 106 containers). The hypothesis was that if materials were kept dry at the curb with the use of a lid, then the moisture content percentage change would be lower when compared to the open box. Figure 10 shows that this hypothesis was true with the exception of the containers stream in Fall 2020.

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<sup>7</sup> [https://thecif.ca/wp-content/uploads/2020/05/1065-Algonquin\\_Highlands\\_Final\\_Report.pdf](https://thecif.ca/wp-content/uploads/2020/05/1065-Algonquin_Highlands_Final_Report.pdf)  
CIF Final Report Project #1117 (Blue Box Litter Auditing and Lid Testing, September 2021)

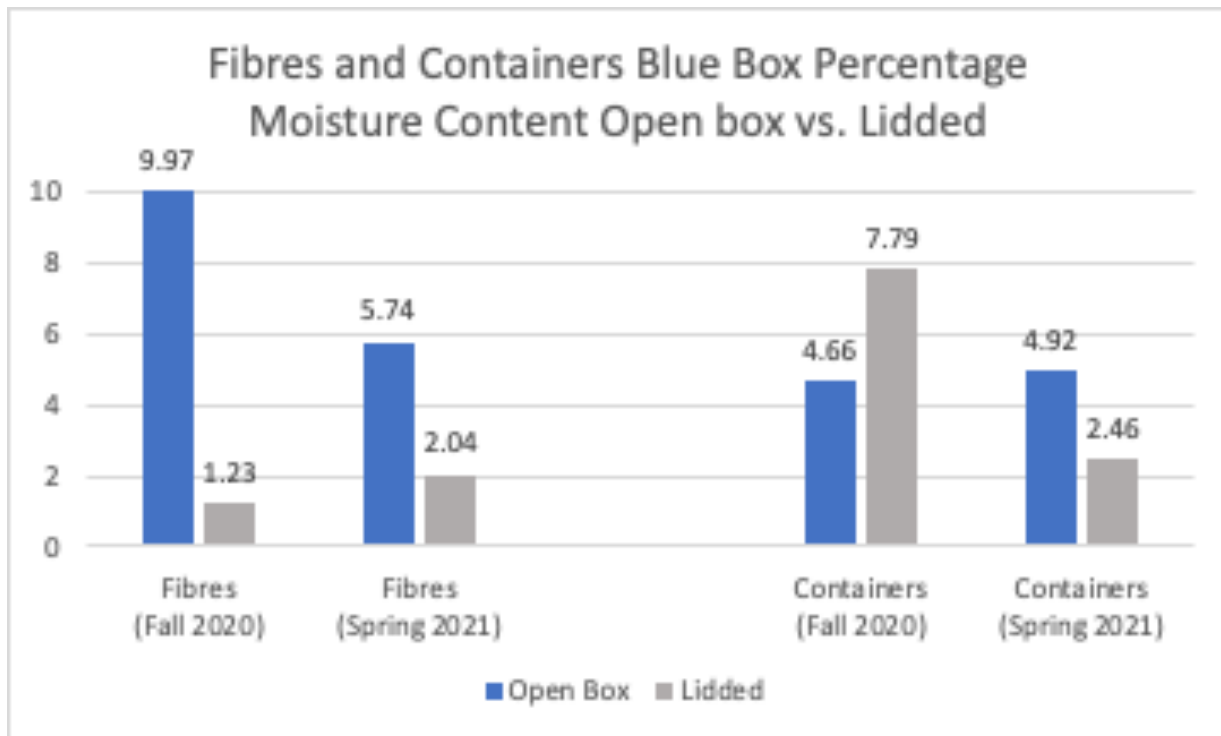


Figure 10: Moisture Content Percentage Open Box vs. Lidded

In Figure 11, the moisture calculations showed that the average weighed difference/change between the moisture for lidded fibre materials versus open box was 4.95%. Although containers generally maintained their moisture in the fall 2020 results, the weighted average showed a 4.70% difference between the lidded and open box with the spring and fall audits combined.

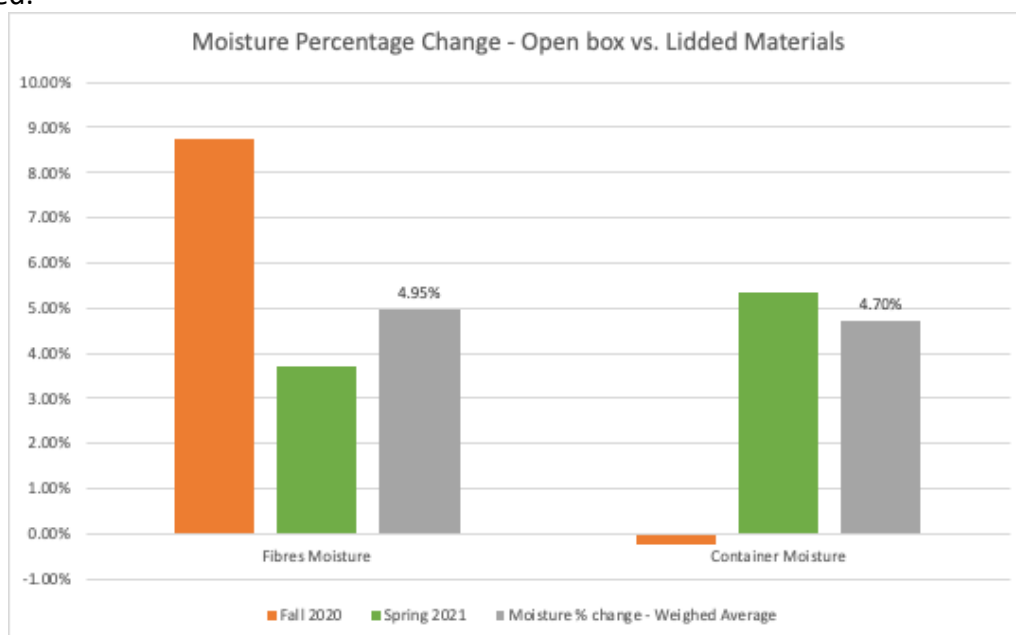


Figure 11: Percentage Difference in Moisture Open Box vs. Lidded

The moisture content results are likely associated to the weather conditions around a 12-hour period prior to collection and how much the blue box is exposed to weather while on the street or throughout the generation period (7 days). Factors to consider are the time material is set-out for collection (the night before versus the morning of collection) and the materials ability to absorb moisture (fibres versus containers).

#### **4.5 Collection Time and Motion Results**

To determine the impact of the lid on collection, AET consulting was hired to complete a time-and-motion study. The time spent emptying blue boxes was tracked for 996 households over a four-week period in the fall of 2020 and spring of 2021. During the fall period, only a small percentage of the total sample households were utilizing the lid.

There are several factors, outside of whether the boxes have lids or not, that affect collection timing in Durham Region, including:

- two different recycling collection contractors;
- diverse collection trucks (rear load, side load, over-the-top);
- unique number of operators depending on the truck type (e.g., rear loader requires 2 operators);
- area of collection (mainly impacts travel time between houses); and
- number of items set-out for recycling collection.

The analysis completed focused on the time-and-motion to collect two blue boxes (no bundles or bags) from rural, suburban, and urban areas. This was based on the fact that the majority (~70%) of households in the sample areas set out two blue boxes per week.

As shown in Figure 12, the weighted average time to collect two open blue boxes ranged from 10.21 to 11.13 seconds per stop, whereas the presence of at least one lid at a household changed the stop time weighted average to between 6.57 and 12.68 seconds per stop. No lidded boxes were collected from rural areas in the fall of 2020 and only 16 lidded stops were included in the data. Interestingly, more time was seen spent collecting boxes in urban areas.

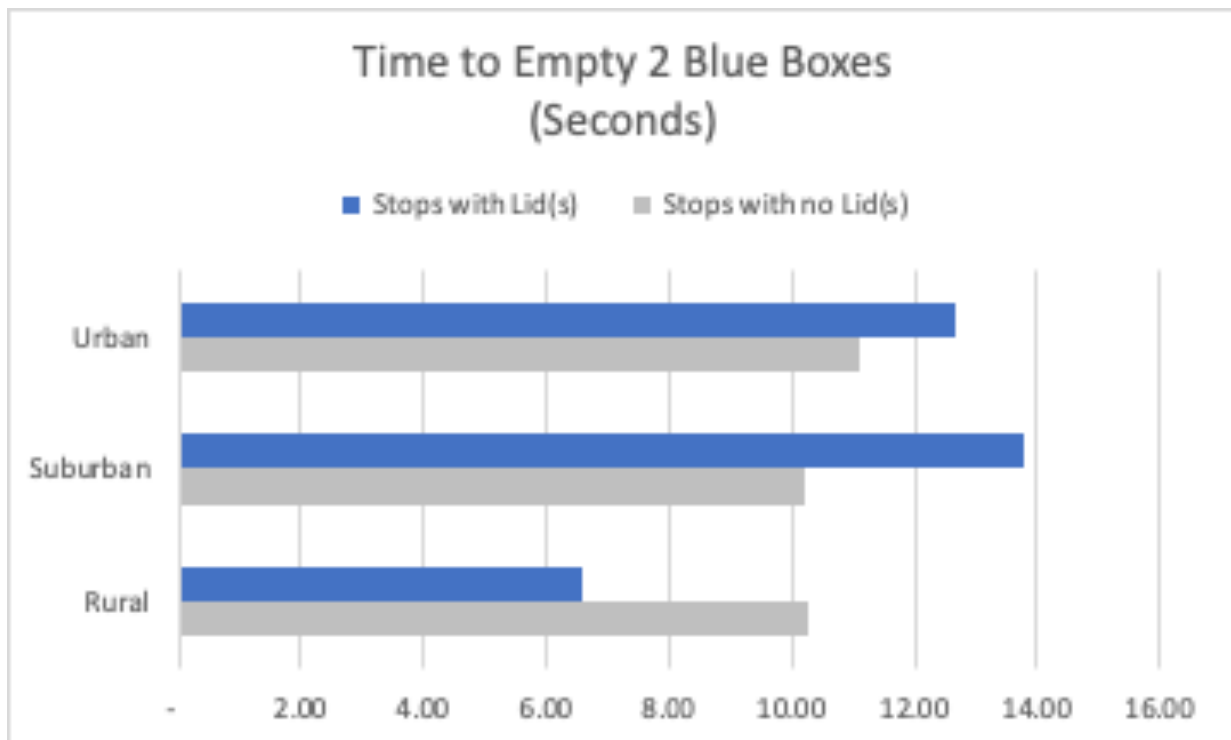


Figure 12: Weighted Stop Time with and without lids by area characteristic

These findings are based on data collected from 1,849 open box stops versus 236 lidded blue box stops tracked over four weeks in two seasons. Generally, as seen in a video with an AET auditor<sup>8</sup>, the lid is quickly removed and barely interferes with collection time. Furthermore, using a lid will save drivers time picking up materials blown from open or tipped over blue boxes. This time savings may outweigh the extra time to unhook lids, especially on windy days.

Given the limited data collected from lidded boxes in rural areas and the fact that open box collection in rural areas shows similarities to suburban collection time, a comparison between stop times for urban and suburban areas was considered. The stops times showed an increase of between 1.56 and 3.60 seconds (14% to 35% respectively). Overall, this works out to an average increase of 24.6% in stop time or 2.58 seconds when comparing open boxes to lidded ones.

#### 4.6 Local Economic Results

The local economic analysis was completed to recognize the impact of litter on the lower tier municipalities in the Region of Durham, which encompasses the Town of Ajax, City of Oshawa, City of Pickering, Townships of Scugog, Uxbridge, and Brock, Town of Whitby, and Regional Municipality of Clarington.

<sup>8</sup> <https://thecif.ca/part-iii-put-a-lid-on-it-collection-costs/>

As seen in the municipal specific summary (Table 4), there was limited success in gathering litter specific information. Ultimately, the common theme amongst all municipal representatives is that this information is just not tracked.

Table 4: Economic Summary by Lower-Tier Municipality

Summary by Municipality (2019 unless otherwise noted)								
	Ajax	Oshawa	Pickering	Scugog	Uxbridge	Whitby	Brock	Clarington
<b>Households</b>	38,105	68,613	31,469	8,707	4,447	45,241	5,035	33,384
<b>Total Kms</b>	400	861	439	412	100	492	100*	400*
<b>Population Density (persons/km<sup>2</sup>)</b>	1,974	1,998	434.6	45.9	765.8	961.1	30.2	166.4
<b>Tonnes of litter collected annually</b>		480	69.44 (800 bags) <sup>9</sup>	-	-	-		3.93 <sup>10</sup>
<b>Complaints received</b>	155	505	134	783	52	294	0	5
<b>Annual kg of collected litter per hh</b>		7	2.21					0.12
<b>Annual tonnage of collected litter per km</b>		1.2	0.16					0.01
<b>Staff time associated with litter collection (hours)</b>	2,800	8,736	4,472	2,184	520	-	-	-
<b>Staff Details</b>	2 PT (70% of 1 FTE)	20 FTE (20% of time)	2 FTE & 1 PT	21 FTE (5% of time)	1 FTE (25% of time)	-	-	-
<b>All Costs associated with litter collection (staff, complaints, and other)</b>	\$32,142	\$291,044	\$92,071	\$52,338	\$50,048	\$79,135	\$21,100	-
<b>Cost per HH</b>	\$0.84	\$4.24	\$2.93	\$6.01	\$11.25	\$1.75	\$4.19	n/a
<b>Cost per KM</b>	\$80.36	\$338.03	\$209.73	\$127.03	\$500.48	\$160.84	\$211.00	n/a

**Important Note:** Where fields are blank information was not provided by the municipality and a verified source of the same information could not be readily found through web searches. Staff time and cost information provided by staff were estimated numbers.

\*Estimated based on population (similar to other reports)

<sup>9</sup> Great Canadian Shoreline average bag weight of 8.69kg/bag

<sup>10</sup> 2015 Pitch-In Week Website posting <https://www.clarington.net/en/news/clarington-proud-participant-of-the-49th-annual-pitchin-week.asp>

While in some cases, bits and pieces of financial information was provided, no municipality kept track of the volume or weight of litter collected by them or by local volunteer programs. As a result, the litter tonnage collected per household and per kilometer was a challenge to calculate (Table 5).

With a total household count of 235,000<sup>11</sup> and estimated total residential roads at 3,204kms, utilizing the limited information provided, the following was calculated:

Table 5: Lower Tier Economic Survey Summary

Economic Summary		
	Per Household	Per Residential Kilometer
Estimated Annual Cost of litter complaints (lower-tier and Region)	\$0.14	\$9.50
Municipal annual staff time associated with litter collection	\$2.16	\$132.58
Estimated annual known costs associated with litter collection	\$2.28	\$100.72
<b>Total Estimated Annual Cost for Litter Management</b>	<b>\$4.46</b>	<b>\$232.50</b>
Annual estimated weight of collected litter	3.11kg	241.83kg

#### 4.7 MRF Results

To analyze the impact of processing wet materials versus dry materials, dates for comparison were sought. 2020 dates were selected based on “weather” conditions posted on Environment Canada historical precipitation amounts from the Oshawa Navcan station. Five wet dates and four dry dates were selected. See Appendix C for details.

Comparisons were made between the dry and wet days for inbound tonnage, production of bales and loose materials, as well as processing belt speeds, downtime, and throughput. Table 6 shows that with 3.53% more “dry” tonnage, on “dry” days, 19% less containers bales were produced and 24% more fibres bales were processed. However, moisture may not have been the only factor affecting this change in productivity.

Table 6: Inbound Tonnage and Production Comparison

Condition	Inbound Tonnage	Container Bales	Fibre Bales	Loose News Loads
<b>Wet</b>	169.80	50	35	4
<b>Dry</b>	176.02	42	46	4
<b>Difference Dry to Wet</b>	3.53%	-19%	24%	0.0%

<sup>11</sup> Statistics Canada, 2016 <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?B1=All&Code1=3518005&Code2=35&Data=Count&Geo1=CSD&Geo2=PR&Lang=E&SearchPR=01&SearchText=Ajax&SearchType=Begin&TABID=1>

Table 7 shows that belt speeds are at least 4% slower on “wet” days when compared to “dry” days and downtime is higher for both streams. As expected, throughput is higher for “dry” days for containers and higher for fibres on “wet” days. This is likely due to the extra weight of the materials being processed at higher moisture levels.

Table 7: Processing Data Comparison

Condition	Container Belt Speed	Fibre Belt Speed	Container Downtime (minutes)	Fibre Downtime (minutes)	Containers Throughput (Tonnes per Hour)	Fibres Throughput (Tonnes per Hour)
<b>Wet</b>	78%	76%	26.60	33.50	11.06	24.62
<b>Dry</b>	82%	80%	48.75	37.00	11.83	22.26
<b>Difference Dry to Wet</b>	4.79%	4.40%	45.44%	9.46%	6.47%	-10.58%

Ultimately, the above tables show, that when comparing processing of dry materials versus wet materials both streams are impacted by moisture. Based on an average gross processing cost of \$187.53/tonne<sup>12</sup> a conservative 4% reduction in processing speed could equate to a savings of \$7.50 per tonne for each stream.

#### 4.8 Residential Survey Results

Surveys for the 2020/21 CIF project were aimed at households in the 10 sample areas. The goal of the surveying was to analyze the responses from the residents from each of the sample areas pre- and post-lid implementation. See Appendix D for the detailed report.

<sup>12</sup> Based on cost per tonne from 2019 datacall for all Ontario municipal programs <https://rpra.ca/programs/about-the-datacall/>  
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Residents chosen for the pilot were sent flyers informing them about the study and the survey was promoted to residents using roadside signage and through mailed cards with survey web links.

During the Region of Durham's 2019 pilot, an initial survey was conducted which received 79 responses. For the 2020 project, a survey was completed in October 2020 which received 96 responses. Finally, a follow-up survey was conducted in April 2021 which received 188 responses.

From the initial surveys conducted in May 2019 and Oct 2020, responses showed that the residents were aware of litter being a problem in the residential areas and do their best to reduce materials blowing out of blue boxes. Awareness of the Blue Box litter study rose from 82% in October 2020 to 94% in April 2021. While single detached rural residents stated that they do not

observe any litter on their streets, in all other housing types 24% of responses (51 out 215 responses) mentioned having greater than average or lots of litter in their neighbourhoods.

In the follow-up survey of April 2021, 81% of respondents found the lid easy to use and 88% of respondents noticed that the lid prevented litter from the blue box on windy days. Overall, 75% of respondents would recommend the lid to other residents of Durham (likely or very likely).

Although respondents found the lid easy to use, some respondent found it difficult due to it being too hard to put on (35% - 14 out of 40 responses), lid not fit the box (15% - 6 out of 40 responses) and an overflowing blue box (15% - 6 out of 40 responses). Respondents in urban environments reported using the lid more often than those in suburban or rural housing categories.

The three distinct surveys all managed to draw some very interesting and useful information that can be used to help inform future decisions on lid implementation including the perception of litter, lid utility, and the lid's acceptance by residents.

## 5. Analysis

### 5.1 Cost Benefit Detailed Description

In order to evaluate the cost benefit of the blue box lid numerous calculations were made. It should be noted that these are based on averages and estimates from all the reports associated with this project. With the cost of 2 lids being \$23.19 inclusive of lids, p&e, and delivery a total cost for the Region of Durham with 10% participation is estimated at \$486,753.62.

As reported, the overall average of 0.008 kg per household per week of litter is generated. Therefore, it is estimated that, in Durham Region, approximately 1.75 tonnes of recyclable materials are lost annually into the environment from 10% of households. Based on the November 2020 CIF Price Sheet, this would represent an annual loss of approximately \$135.81 in revenue. Further \$418.89 in improved collection capture of recycling would be experienced in the Region. Improved collection capture would only be applicable for municipalities that pay a flat fee per stop. This calculates to a total “capture” savings of \$554.70 per year.

Reducing litter on streets can have other financial savings benefits including reduced complaints handling and costs associated with litter collection either directly by staff or indirectly by street maintenance activities such as street sweeping and gutter cleaning. For the lower-tiers combined in the Region of Durham an estimated 35% reduction in \$4.46/hh of litter costs for 10% of households will calculate an annual savings of \$32,781.

Through time and motion studies completed, it was observed that utilizing a lid increased the time to collect two blue boxes by 24.6% (or 2.5 seconds per house) when comparing non-lid household stops. Assuming a scenario with 10% lid participation, two blue boxes per stop, this would add approximately 15 hours per week to collection. With an estimated collection cost of \$100 per operating hour this would increase collection costs by \$75,833 per year. Further, improved capture would increase processing costs per tonne to the Region estimated at \$15,618.43.

Keeping in mind that moisture levels can vary a lot throughout the year, and assuming a processing cost of around \$115 a tonne, a 4% reduction in moisture for a municipality that collects 46,000 tonnes annually, could see a potential savings of \$21,160 processing costs with a 10% participation rate on the lids.

## 5.2 Cost Benefit Analysis

Based on the information detailed above, the following table summarizes the estimated payback period for implementing the lid to 10% of the population.

Table 8: Project Cost Benefit Analysis

	Estimated Cost/Savings
Cost of Lid (includes production, delivery, and p&e) – total estimate for 10% of Durham Region residents, 2 lids/hh at \$23.19 per HH	\$486,753.62
Total annual costs (collection and processing)	\$91,451.76
<b>TOTAL COSTS</b>	<b>\$578,205.38</b>
Total estimated annual revenue	\$554.70
Total avoided costs (complaints, MRF)	\$53,941.00
<b>TOTAL SAVINGS</b>	<b>\$54,495.70</b>
<b>Payback</b>	<b>10.61 years</b>

## 5.3 Lessons Learned and Future Study Suggestions

The Durham blue box litter project was multi-dimensional and offered tremendous insights into litter generation, blue box moisture, impacts to collection time, MRF processing, and lower-tier economics as well as participant response. As with any complex study, many lessons were learned, and future study suggestions formed. The following is a summary list of the top items to consider for further studies.



**Litter tracking.** To differentiate between wind-blown blue box litter and other litter influencers, further analysis on litter generated, accidentally, by collection driver as well as blown from truck operations may be beneficial.

**Comprehensive waste audits.** A more comprehensive waste audit of blue box material composition to compare litter composition would assist in further identification of sources of litter.



**Windy day time-and-motion studies.** A time-and-motion study associated with driver collection on windy days to determine if using a lid will save drivers time picking up materials blown from open or tipped over blue boxes. This time savings may outweigh the extra time to unhook lids, especially on windy days.



**Economic tracking.** Prior to study, complete a comprehensive understanding of current economics of litter tracking. Establish baseline data tracking requirements and agreements for all municipal levels to insure data consistency for litter collection.



**Improved resident communications.** Communication to residents is often challenging and requires multi-faceted approaches. Social media could not be utilized for this project but was significant in the initial roll-out of the lid in April 2019.

## 6. Project Budget

The following tables outline the total project costs for the CIF and the Region of Durham.

Table 9: CIF Project Costs

	Budget	Cost
Litter and Moisture Audits	\$65,000	\$70,060.00
Residential Surveying	\$15,000	\$15,972.45
Local Economic Study – Litter Collection Costs	\$10,000	\$9,161.95
Time and Motion Study	\$20,000	\$22,714.13
Total Project Cost	\$110,000	-
<b>Total Including HST</b>	<b>\$124,300</b>	<b>\$117,908.53</b>

Table 10: Durham Project Costs

	Budget	Cost
Lids	\$11,000	\$10,354
Residential Surveying and P&E	\$4,000	\$4,000
<b>Total</b>	<b>\$15,000</b>	<b>\$14,354*</b>

\* Does not include staff time, artwork development and design; delivery of lids; mapping of sample areas and liaising with collection staff; GIS/IT set up for online trace/tracking for pilot areas; and meetings/emails/calls.

## 7. Conclusion

Based on the results of this study, a lid, placed on an open top blue box in a dual stream recycling program, can decrease litter on streets once a certain level of participation is achieved and especially on windy days. Additionally, a lid can decrease moisture which directly impacts processing at the MRF and the quality of the marketed material. The overall cost-benefit analysis suggested a greater than 10-year payback period.

Region of Durham is responsible for curbside waste collection and, the results show that some lower tier municipalities don't track litter, the costs related to any programs related to litter clean up as it is part of their ongoing operational costs to keep parks and streets clean. Ultimately residents clean up their neighbourhood during high wind occurrences when litter blows out of blue boxes. If material is left or accumulates in catchment basins or in ditches, the clean-up is completed and not tracked in a manner that is easily quantified.

Durham Region's waste management operations staff worked directly with the contractors, consultants and CIF staff throughout the study period. Durham's Regional Council directed staff to make a recommendation regarding lid implementation. Staff recommended that lids be sold by the Region on a full cost recovery basis beginning in late 2021 as a regular program offer. In June 2021, the Works Committee and Regional Council approved the recommendation.

## Appendix A – AET Group Inc. Report CON\_WAC2021\_006



## **The Continuous Improvement Fund**

### **Blue Box Litter/Moisture Audit & Collection and Time-and-Motion Assessment**

Prepared for

The Continuous Improvement Fund

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July 9, 2021

AET File No. CON\_WAC2021\_006



# The Continuous Improvement Fund

Blue Box Litter/Moisture Audit & Collection and Time-and-Motion Assessment  
July 2021

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July 2021

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## APPENDICES

### **APPENDIX A:** Litter Audit Category Descriptions

## EXECUTIVE SUMMARY

The Continuous Improvement Fund (CIF) contracted AET Group Inc. (AET) to conduct a series of audits that focused on blue box litter, moisture and collection times. CIF partnered with AET and Durham Region to complete this study. Durham Region introduced a crumb-rubber blue box lid to mitigate the total amount of blue box litter. The lid was distributed to pilot areas and was originally shown to have positive effects when utilized to combat weather conditions. The audit focused on 10 pilot areas across Durham Region that encompassed approximately 1,000 households. Four areas had already received lids for the initial audit in the Fall and the remaining six areas received lids prior to the second audit in the spring. A total of 5.30% of households used at least 1 blue box lid in the Fall of 2020. Similarly, a total of 13.53% of households used at least 1 blue box lid in the Spring of 2021.

The highest rates of use were witnessed in a suburban Oshawa neighborhood and are easily compared to the previous season without lids. In the second season, 33.79% of households in the area deployed at least one crumb-rubber lid resulting in an estimated litter reduction of 47.97% and reduction in the staff time for litter collection of 17.48%. These decreases were witnessed despite an increase in average windspeed of 53.06%.

Additionally, the lids proved effective in protecting the blue-box material sheltered from atmospheric moisture, more so in the fibres stream. In the Fall, a lidded recycling bin had an average of 1.23% moisture content where an open boxed recycling bin had an average of 10.05% moisture content. In the Spring, a lidded recycling bin had an average of 2.04% moisture content where an open boxed recycling bin had an average of 5.74% moisture content.

However, the crumb-rubber lids are not without faults. The use of the lids added an average of 5.33 seconds to the typical recycling collection stop of 8.17 seconds in the Spring, representing a 65% increase. Residents and hauler collection staff expressed mixed opinions on using the crumb-rubber lids.

The lids overall prove to be effective, especially during heavy rain and wind but only if utilized by residents. Therefore, the maximum value of the lids may be realized by providing to only the households that desire to use them or in areas prone to high winds.

## 1.0 INTRODUCTION

The Continuous Improvement Fund (CIF) contracted AET Group Inc. (AET) to conduct a series of audits that included assessments on Blue Box litter, Moisture Audit and Time-and-Motion Assessment. The CIF partnered with Durham Region and AET to complete two rounds of audits.

In 2019, Durham Region introduced a crumb-rubber blue box lid as a part of an overall litter mitigation study. Durham initially distributed lids to 800 households. The first audit took place in the Fall of 2020. A total of 10 areas (1,000 households total) across the Region were selected to assess the blue box set-outs, litter, moisture content and time-and-motion of blue box recycling collection. For the first audit, a total of 4 areas had the crumb rubber blue box lids. Following the first audit, Durham Region distributed the crumb-rubber blue box lid to the remaining 6 areas included in the study. The second round of audits took place in the Spring of 2021.

### 1.1 Background

Table 1.1 outlines the ten areas selected for the study. The audit took place for a 4-week period in the Fall of 2020 and a 4-week period in the Spring of 2021. A total of four areas (Areas 5, 8, 9 & 10) had the crumb-rubber blue box lid during the first round of audits in the Fall of 2020. The remaining six areas (Areas 1, 2, 3, 4, 6 & 7) received the lids after the Fall audit in November 2020. Table 1.1 details the areas and Figure 1.1 illustrates the crumb-rubber blue box lid.

*Table 1.1 Study Areas*

Municipality	Area	Lid Option	Sample Type	Description	Area	Collection Day	Actual House Count
Scugog	1	New - 1 lid	Rural – Single Detached	Low density, outside CMAs cottage country, rural	Scugog (Port Perry)	Tuesday	49
Clarington	2	New - 1 lid	Rural – Agricultural	Low density, outside CMAs, Agricultural	Old Scugog Rd	Friday	55
Oshawa	3	New - 2 lids	Suburban - Single Detached – Pre 1960s (Old)	Medium density, within CMA	Oshawa	Tuesday	121
Oshawa	4	New - 2 lids	Suburban - Single Detached – 1961-2000 (Middle)	"	Oshawa	Tuesday	145
Ajax	5	Old Lid Area	Suburban - Single Detached - 2001+ (New)	"	OLD Pilot AREAS – Ajax-harwood	Tuesday	191
Whitby	6	New - 2 lids	Urban - Single Detached – Pre 1960s (Old)	High density, within CMA	Downtown Whitby east of/Henry St.	Thursday	115
Pickering	7	New - 2 lids	Urban - Single Detached – 1961-2000 (Middle)	"	Pickering (south towards Liverpool)	Wednesday	106
Whitby	8	Old Lid Area	Urban – Single Detached – 2001+ (New)	"	Old Pilot AREA - Whitby (minus townhouses)	Wednesday	122
Ajax	9	Lid Provided	Urban – Semi-Detached/Condo	"	Lid already delivered – Ajax	Friday	61
Whitby	10	Old Lid Area	Row Houses/Multi-Residential Dwellings – Urban or Suburban	Row of houses joined by common side-walk and a continuous grouping on multi-levels	Old Pilot AREAS – camwith Whitby	Wednesday	31

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Figure 1.1 Set-out with Crumb-Rubber Blue Box Lid

## 1.2 Audit Events

The study was conducted over a 4-week period each season (Fall 2020 and Spring 2021). The details of the audit week are detailed below. More information is provided in Section 2.0 regarding the methodology for the different components of the project.

Week 1:

- Record set-out information on blue box recycling stream
- Litter cleanout after recycling hauler has been through area
- Moisture audit collection of 100 open box and 100 lidded box, weigh wet material

Week 2:

- Record set-out information on blue box recycling stream
- Litter collection after recycling hauler has been through area, sort, count and weigh
- Moisture audit weigh dried material
- Time-and-Motion study

Week 3:

- Record set-out information on blue box recycling stream
- Litter collection after recycling hauler has been through area, sort, count and weigh
- Moisture audit collection of 100 open box and 100 lidded box, weigh wet material

Week 4:

- Record set-out information on blue box recycling stream
- Litter collection after recycling hauler has been through area, sort, count and weigh
- Moisture audit weigh dried material

- Time-and-Motion study

## 2.0 APPROACH AND METHODOLOGY

### 2.1 Blue Box Litter Audit

The Blue Box litter audit included the collection of all litter from all 1,000 households in the 10 different areas outlined in Table 1.1. There were two parts to the litter audit: prior to collection and after collection.

#### 2.1.1 Prior to Collection

Prior to collection, AET staff visited the sample areas ahead of the collection trucks to record the following details:

- Date of collection
- Wind and weather conditions (wind velocity, temperature, and weather notes from the last 12 hours)
- Names of data collectors
- Start and end time of data collection
- Blue Box set-out information including: number of containers (box, bag and/or bundle), stream of recyclables (paper, containers, or mixed), presence of lids/no lid, note the size or type of container, the volume (fullness of boxes/bags) of recyclable materials as to the degree to which they overflow or materials have been placed adjacent to the set-out (where the volume of recyclable materials exceeded the capacity of the container, volumes are to be reported as a percentage of the capacity of the container).

#### 2.1.2 After Collection

During the first week of the study, AET staff cleaned all litter from surrounding the 1,000 households in the 10 different areas outlined in Table 1.1. Litter collection was completed during the remaining three weeks of the study. This was done after the contracted recycling hauler had completed collection of all blue box materials. AET staff collected litter within 20 feet/6 metres of the sidewalk (or set-out location) and 10 feet/3 metres into the street. All litter equal to or larger than 1 in<sup>2</sup>/2.5 cm<sup>2</sup> was collected. For each collection area, the following information was recorded:

- Date of litter collection
- Area of litter collection
- Wind and weather conditions (wind velocity, temperature, and weather notes from previous 12 hours)
- Names of litter collectors
- Start and end time of litter collection
- Any spaces with accumulated litter outside the “sampling” parameters

All litter from each area was sorted and characterized by size, weight (kg) and material type. The litter was sorted into the following categories. A full list of the litter audit categories and descriptions can be found in Appendix A.

- Mixed Paper (magazine/office)
- Newspaper
- Boxboard
- Cardboard
- Polycoats
- Paper Beverage Cups

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- Unrecyclable Paper (wrappers, etc.)
- Plastic #1 – PETE
- Plastic #2 – HDPE
- Mixed Plastic - #3-#7
- Straws/PS Coffee Lids
- Other Plastic
- Aluminum/Steel Containers
- Other Metal
- Glass
- Other Waste (blue box)
- Other Waste (suspected non-blue box)
- Other Recyclable Material (suspected non-blue box)

Litter was counted, weighed and sorted by size for each material category. The sizes included:

- Small (1-3 in./2.5-7.5cm)
- Medium (3-6 in./7.5-15cm), and
- Large (6+ in./15+cm)

## 2.2 Moisture Auditing

During the first and third week of each audit, AET aimed to collect 100 open box blue boxes and 100 lidded blue boxes for the moisture audit. The purpose was to assess the overall moisture content of the blue box material with a lid versus without a lid. AET collected material, weighed material by stream and open versus lidded box and spread the material out on a tarp to dry for a one week (7 day period). After the drying period, the material was weighed again. The moisture content for each material stream and box type was calculated by using the formula below.

$$\text{Moisture Content (\%)} = \frac{\text{Total Wet Weight} - \text{Total Dry Weight}}{\text{Total Dry Weight}}$$

## 2.3 Time-and-Motion Collection Truck

During the second and fourth week of each audit, AET completed the time-and-motion portion of the study where they assessed the collection time for the blue box collection contractor. This was done by following the collection vehicles and timing the "hands on time" handling blue box materials. AET utilized the mobile software application "Timestudy Stopwatch" to complete the timing. Timing measurements were represented as Decimal Minutes, which is one minute divided by 100. The time laps were identified with a number, which was recorded for each appropriate household. All timing data was converted into excel spreadsheets where AET matched the identifier number to the timing data. In addition to timing, AET noted when the hauler completing enforcement on recycling set-outs. Go-Pro cameras also recorded video footage of the collection contractor for further detail and review, if necessary.

The overall purpose of the time-and-motion study was to assess the time to collect recycling open boxes, time to collect lidded boxes, time to enforce recycling and provide other observations.

## 2.4 Limitations

It must be noted that the litter found in the various sample areas are not necessarily generated from the blue box. While the blue box may be a source of litter generation, it is important to consider other factors such as other waste

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streams (garbage & organics), pests disturbing waste set-outs, wind blown litter, litter generated from vehicular traffic, litter generated by pedestrians, etc.

The moisture content results are directly related to the weather conditions for the previous 12 hour period and how much water gets into the blue box. Factors to consider are the time material is set-out for collection (the night before versus the morning of collection) and the materials ability to absorb moisture (fibres versus containers).

The time-and-motion timing is completed from the time the collection contractor touches the first bin/bag/bundle to the time their hand leaves the bin/bag/bundle. It should be noted that the timing is directly related to how many items a household has set-out. For example, if there is one blue box, the collection time will be quicker than more than one blue box. Similarly, the collection time was noted separately when a crumb-rubber blue box lid was used. In many situations, there were several blue boxes set-out, but only one bin with a lid. Caution should be used when assessing the time-and-motion timing data for lidded set-outs. In addition, auditors were not able to time enforcement separately, as it occurred in different manners, at the same time as the recycling collection activities.

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## 3.0 RESULTS AND DISCUSSION

### 3.1 Participation Rates

Based on both seasons, an average of 71.25% of households participated each week in fibres stream recycling and 66.68% in containers stream recycling. Participation is considered if a house has at least one bin of that type on the curb by the time of observation. Occasionally bins were comingled with both streams and were marked in the column that best suited the material.

Table 3.1 Recycling Participation Rates by Week and Stream

Recycling Participation Rates by Week and Stream									
Time Period	Sample Size	Fibres Stream				Containers Stream			
		# of Items	Full Container Equivalent	HHs with ≥1 Setout(s)	Participation Rate	# of Items	Full Container Equivalent	HHs with ≥1 Setout(s)	Participation Rate
Fall Week 1	929	771	702.5	630	67.81%	683	527.25	610	65.66%
Fall Week 2	997	925	810.5	742	74.42%	785	596.25	703	70.51%
Fall Week 3	997	850	785.85	695	69.71%	755	607.75	657	65.90%
Fall Week 4	997	847	732.5	710	71.21%	718	516.25	655	65.70%
Spring Week 1	993	914	818.25	706	71.10%	766	602.75	671	67.57%
Spring Week 2	904	800	721	643	71.13%	680	522.5	615	68.03%
Spring Week 3	996	884	749	707	70.98%	706	565	634	63.65%
Spring Week 4	996	945	852.5	731	73.39%	754	580.83	662	66.47%
<b>Fall Total</b>	<b>3920</b>	<b>3393</b>	<b>3031.35</b>	<b>2777</b>	<b>70.84%</b>	<b>2941</b>	<b>2247.5</b>	<b>2625</b>	<b>66.96%</b>
<b>Spring Total</b>	<b>3889</b>	<b>3543</b>	<b>3140.75</b>	<b>2787</b>	<b>71.66%</b>	<b>2906</b>	<b>2271.08</b>	<b>2582</b>	<b>66.39%</b>
<b>Overall Total</b>	<b>7809</b>	<b>6936</b>	<b>6172.1</b>	<b>5564</b>	<b>71.25%</b>	<b>5847</b>	<b>4518.58</b>	<b>5207</b>	<b>66.68%</b>

Table 3.2 and Figure 3.1 illustrate the presence of blue box lids recorded during the participation survey. For the households with lids in the Fall season, a total of 5.30% of households used at least one lid on their blue box. A total of 13.53% of households used at least one lid on their blue box in the Spring season.

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Table 3.2 Blue Box Lid Set-Out Summary

Area	Week	Fall 2020					Spring 2021				
		Sample Size	Fibres Stream - # of lids	Containers Stream - # of lids	Households with at least 1 lid	% of Households using a lid	Sample Size	Fibres Stream - # of lids	Containers Stream - # of lids	Households with at least 1 lid	% of Households using a lid
Area 1	Wk 1	49	N/A	N/A	N/A	0.00%	49	1	1	2	4.08%
	Wk 2	49	N/A	N/A	N/A	0.00%	49	1	2	3	6.12%
	Wk 3	49	N/A	N/A	N/A	0.00%	49	1	1	2	4.08%
	Wk 4	49	N/A	N/A	N/A	0.00%	49	1	2	3	6.12%
	<b>Total</b>	<b>196</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.00%</b>	<b>196</b>	<b>4</b>	<b>6</b>	<b>10</b>	<b>5.10%</b>
Area 2	Wk 1	56	N/A	N/A	N/A	0.00%	52	1	0	1	1.92%
	Wk 2	56	N/A	N/A	N/A	0.00%	55	3	1	4	7.27%
	Wk 3	56	N/A	N/A	N/A	0.00%	55	1	1	2	3.64%
	Wk 4	56	N/A	N/A	N/A	0.00%	55	4	2	6	10.91%
	<b>Total</b>	<b>224</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.00%</b>	<b>217</b>	<b>9</b>	<b>4</b>	<b>13</b>	<b>5.99%</b>
Area 3	Wk 1	116	N/A	N/A	N/A	0.00%	121	13	12	16	13.22%
	Wk 2	121	N/A	N/A	N/A	0.00%	121	8	6	10	8.26%
	Wk 3	121	N/A	N/A	N/A	0.00%	121	14	13	17	14.05%
	Wk 4	121	N/A	N/A	N/A	0.00%	121	8	5	10	8.26%
	<b>Total</b>	<b>479</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.00%</b>	<b>484</b>	<b>43</b>	<b>36</b>	<b>53</b>	<b>10.95%</b>
Area 4	Wk 1	145	N/A	N/A	N/A	0.00%	145	29	35	43	29.66%
	Wk 2	145	N/A	N/A	N/A	0.00%	145	32	28	44	30.34%
	Wk 3	145	N/A	N/A	N/A	0.00%	145	37	32	49	33.79%
	Wk 4	145	N/A	N/A	N/A	0.00%	145	36	35	49	33.79%
	<b>Total</b>	<b>580</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.00%</b>	<b>580</b>	<b>134</b>	<b>130</b>	<b>185</b>	<b>31.90%</b>
Area 5	Wk 1	162	6	2	8	4.94%	191	7	1	8	4.19%
	Wk 2	191	6	2	8	4.19%	191	15	3	17	8.90%
	Wk 3	191	14	2	15	7.85%	191	9	2	10	5.24%
	Wk 4	191	16	1	16	8.38%	191	15	1	15	7.85%
	<b>Total</b>	<b>735</b>	<b>42</b>	<b>7</b>	<b>47</b>	<b>6.39%</b>	<b>764</b>	<b>46</b>	<b>7</b>	<b>50</b>	<b>6.54%</b>
Area 6	Wk 1	115	N/A	N/A	N/A	0.00%	115	14	13	17	14.78%
	Wk 2	115	N/A	N/A	N/A	0.00%	23	4	2	5	21.74%
	Wk 3	115	N/A	N/A	N/A	0.00%	115	16	16	22	19.13%
	Wk 4	115	N/A	N/A	N/A	0.00%	115	21	20	28	24.35%
	<b>Total</b>	<b>460</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.00%</b>	<b>368</b>	<b>55</b>	<b>51</b>	<b>72</b>	<b>19.57%</b>
Area 7	Wk 1	106	N/A	N/A	N/A	0.00%	106	10	11	16	15.09%
	Wk 2	106	N/A	N/A	N/A	0.00%	106	10	10	14	13.21%
	Wk 3	106	N/A	N/A	N/A	0.00%	106	12	10	18	16.98%
	Wk 4	106	N/A	N/A	N/A	0.00%	106	12	9	16	15.09%
	<b>Total</b>	<b>424</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.00%</b>	<b>424</b>	<b>44</b>	<b>40</b>	<b>64</b>	<b>15.09%</b>
Area 8	Wk 1	88	6	1	7	7.95%	122	12	2	14	11.48%
	Wk 2	122	10	2	11	9.02%	122	13	1	13	10.66%
	Wk 3	122	9	1	10	8.20%	122	11	4	14	11.48%
	Wk 4	122	7	3	10	8.20%	122	8	1	9	7.38%
	<b>Total</b>	<b>454</b>	<b>32</b>	<b>7</b>	<b>38</b>	<b>8.37%</b>	<b>488</b>	<b>44</b>	<b>8</b>	<b>50</b>	<b>10.25%</b>
Area 9	Wk 1	61	3	1	4	6.56%	61	1	0	1	1.64%
	Wk 2	61	1	2	3	4.92%	61	3	2	4	6.56%
	Wk 3	61	3	1	4	6.56%	61	2	0	2	3.28%
	Wk 4	61	3	1	4	6.56%	61	4	3	7	11.48%
	<b>Total</b>	<b>244</b>	<b>10</b>	<b>5</b>	<b>15</b>	<b>6.15%</b>	<b>244</b>	<b>10</b>	<b>5</b>	<b>14</b>	<b>5.74%</b>
Area 10	Wk 1	31	1	0	1	3.23%	31	4	1	5	16.13%
	Wk 2	31	4	1	4	12.90%	31	1	2	3	9.68%
	Wk 3	31	1	2	3	9.68%	31	4	2	5	16.13%
	Wk 4	31	5	3	7	22.58%	31	1	2	2	6.45%
	<b>Total</b>	<b>124</b>	<b>11</b>	<b>6</b>	<b>15</b>	<b>12.10%</b>	<b>124</b>	<b>10</b>	<b>7</b>	<b>15</b>	<b>12.10%</b>
<b>Overall</b>	<b>Total</b>	<b>1282</b>	<b>53</b>	<b>18</b>	<b>68</b>	<b>5.30%</b>	<b>3889</b>	<b>399</b>	<b>294</b>	<b>526</b>	<b>13.53%</b>

Note: Only 4 areas were provided lids during the first Fall 2020 audit.

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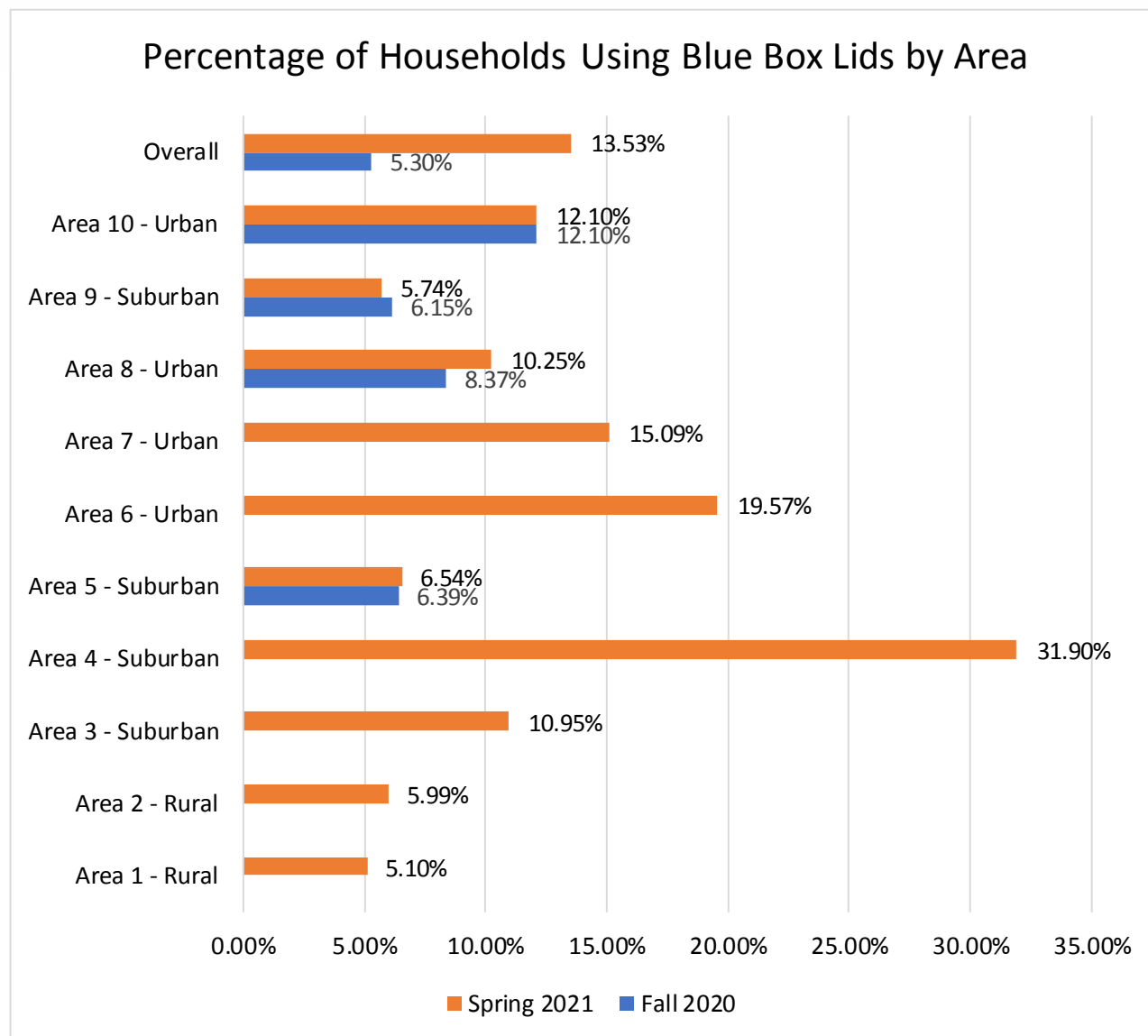


Figure 3.1 Percentage of Households Using Blue Box Lids by Area

It is important to note the lid use percentage is based on the entire sample area, including households without any recycling setouts. Use of the lids varied by area quite substantially. The greatest usage was witnessed in Area 4 of the Spring season (31.90%) and the lowest levels were observed in Area 1 of the Spring season (5.10%). Area 4 is a suburban, post-war neighborhood with a large elderly population. This demographic seemed to take care to reduce their litter and abide by the recommended recycling guidelines. Other areas with denser populations, young families, and more rural areas tended to have more material and were less likely to use the lids.

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## 3.2 Blue Box Litter Audit

### 3.2.1 Litter Generation

Table 3.3 below shows the number of pieces and weight of litter collected per household after the recycling hauler had cleared each area and the time taken by AET staff to collect observed litter. The litter was sorted into predetermined categories, photographed and weighed.

Table 3.3 Litter amounts and staff time in relation to windspeed by date and area

Area	Fall 2020					Spring 2021				
	Date	Wind Velocity km/h	Staff Minutes per km	# of Litter Pieces	Kilograms of Litter / Household	Date	Wind Velocity km/h	Staff Minutes per km	# of Litter Pieces	Kilograms of Litter / Household
Area 1 - Rural	06/10/2020	20	17	0.29	0.001	13/04/2021	15	29	0.24	0.003
	13/10/2020	23	14	0.31	0.003	20/04/2021	20	29	0.24	0.003
	20/10/2020	7	17	0.18	0.003	27/04/2021	18	20	0.53	0.006
Area 2 - Rural	09/10/2020	11	6	0.16	0.001	16/04/2021	28	4	0.40	0.011
	16/10/2020	17	3	0.82	0.008	23/04/2021	28	5	0.51	0.009
	23/10/2020	18	4	0.25	0.006	30/04/2021	46	6	1.22	0.027
Area 3 - Suburban	06/10/2020	18	34	0.86	0.009	13/04/2021	5	16	0.45	0.007
	14/10/2020	9	17	0.30	0.002	20/04/2021	21	15	0.70	0.009
	20/10/2020	17	22	0.73	0.007	27/04/2021	13	21	0.57	0.002
Area 4 - Suburban	06/10/2020	8	26	0.33	0.007	13/04/2021	9	21	0.67	0.005
	14/10/2020	9	18	0.67	0.008	20/04/2021	32	16	0.51	0.003
	20/10/2020	5	18	0.52	0.005	27/04/2021	21	14	0.33	0.002
Area 5 - Suburban	06/10/2020	9	19	0.31	0.003	13/04/2021	5	28	1.02	0.010
	13/10/2020	15	11	0.43	0.003	20/04/2021	26	22	0.85	0.021
	20/10/2020	13	20	0.60	0.015	27/04/2021	13	22	0.32	0.003
Area 6 - Urban	08/10/2020	4	18	0.43	0.003	15/04/2021	15	19	0.53	0.004
	16/10/2020	11	23	0.57	0.005	22/04/2021	15	22	0.43	0.003
	22/10/2020	0	18	0.35	0.002	29/04/2021	5	9	0.30	0.002
Area 7 - Urban	07/10/2020	48	30	0.73	0.019	14/04/2021	8	20	0.62	0.007
	14/10/2020	17	17	0.63	0.006	21/04/2021	21	19	0.33	0.004
	21/10/2020	21	14	0.28	0.004	28/04/2021	9	16	0.08	0.002
Area 8 - Urban	07/10/2020	48	27	0.90	0.016	14/04/2021	5	19	0.54	0.004
	15/10/2020	17	20	0.45	0.011	21/04/2021	21	13	0.35	0.005
	21/10/2020	17	20	0.68	0.007	28/04/2021	4	12	0.16	0.001
Area 9 - Suburban	09/10/2020	5	20	0.15	0.001	16/04/2021	24	20	0.18	0.003
	16/10/2020	17	24	0.39	0.002	23/04/2021	18	24	0.41	0.007
	23/10/2020	8	24	0.21	0.002	30/04/2021	33	48	2.95	0.079
Area 10 - Urban	07/10/2020	43	41	1.29	0.021	14/04/2021	5	18	0.52	0.003
	15/10/2020	17	23	0.48	0.010	21/04/2021	21	55	0.55	0.023
	21/10/2020	17	32	1.00	0.010	28/04/2021	4	18	0.26	0.004

Figures 3.2 and 3.3 illustrate the total amount of litter generation (kg/hh/wk) and associated wind speed for the Fall and Spring seasons. It is important to note that the weight of litter can be directly affected by the weather and moisture content. For example, if it rained, the litter is wet and will hold more moisture. This was largely seen with paper items such as tissue/towelling (classified as other waste – suspected non blue box) and other recyclable paper items such as corrugated cardboard, boxboard and mixed paper. For this reason, the litter generation values are also presented by the total number of pieces per household per week. Figures 3.4 and 3.5 illustrate the total amount of litter generation (pieces/hh/wk) and associated wind speed for the Fall and Spring seasons.

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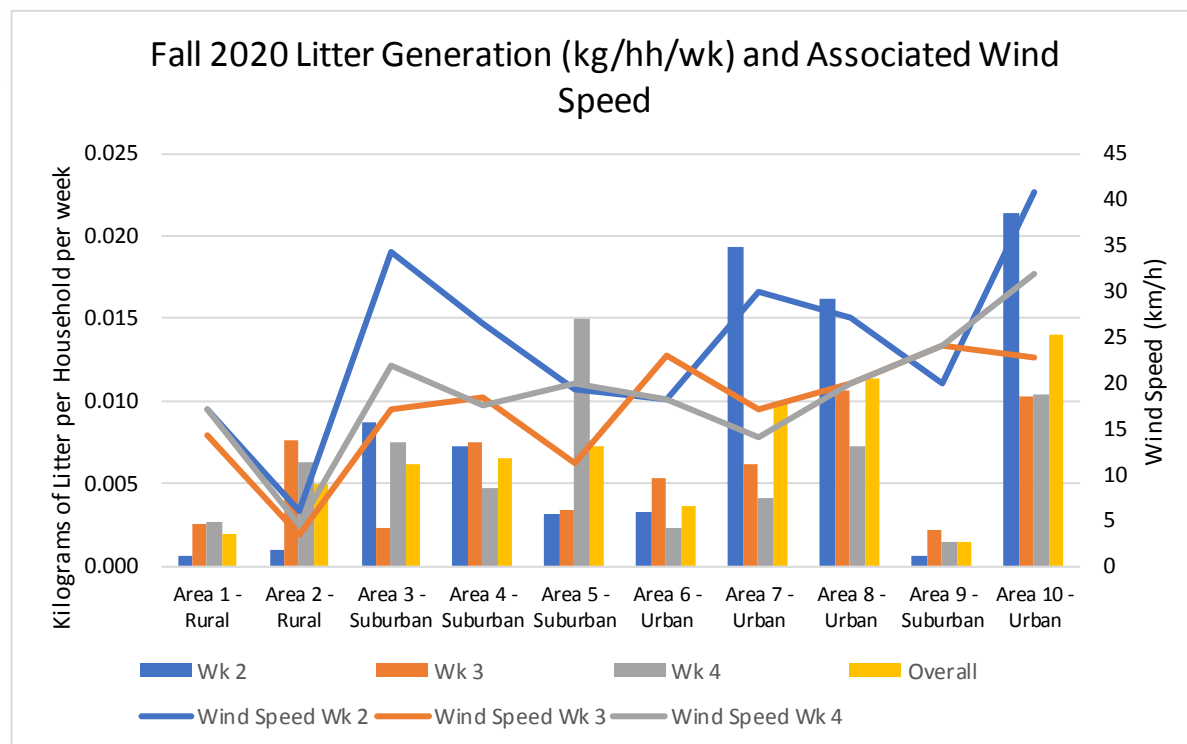


Figure 3.2 Fall 2020 Litter Generation (kg/hh/wk) and Associated Wind Speed (km/h)

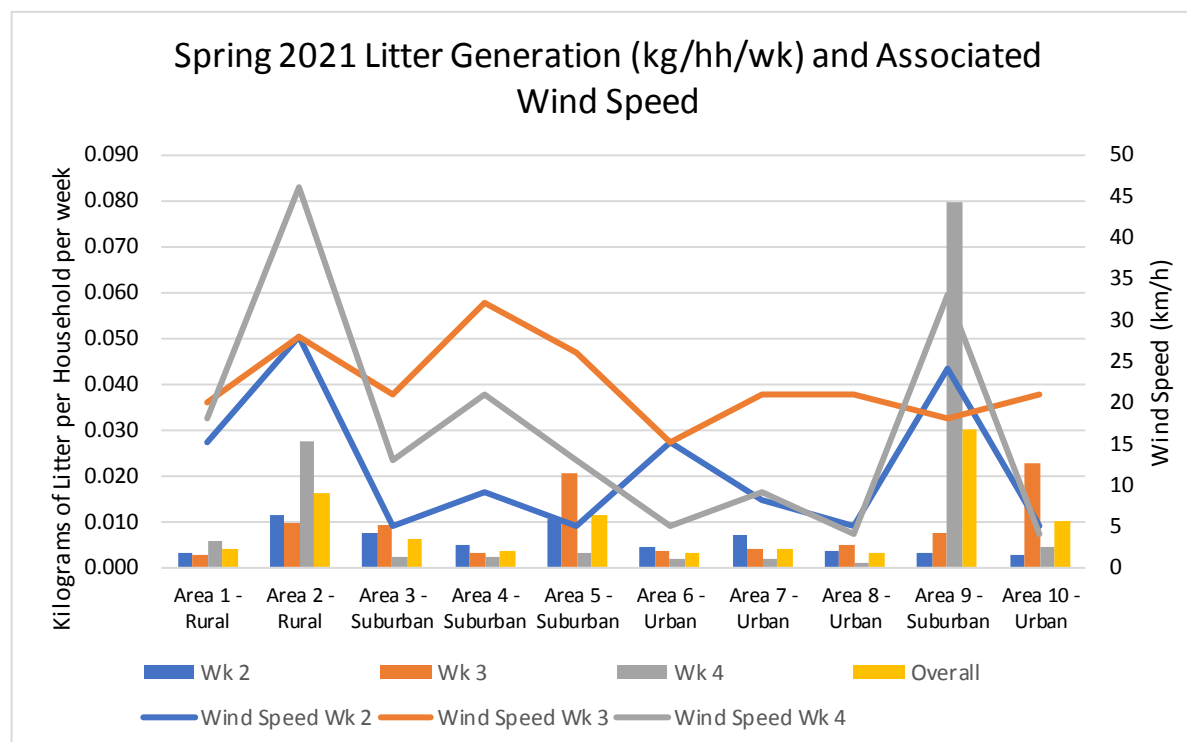


Figure 3.3 Spring 2021 Litter Generation and Associated Wind Speed (km/h)

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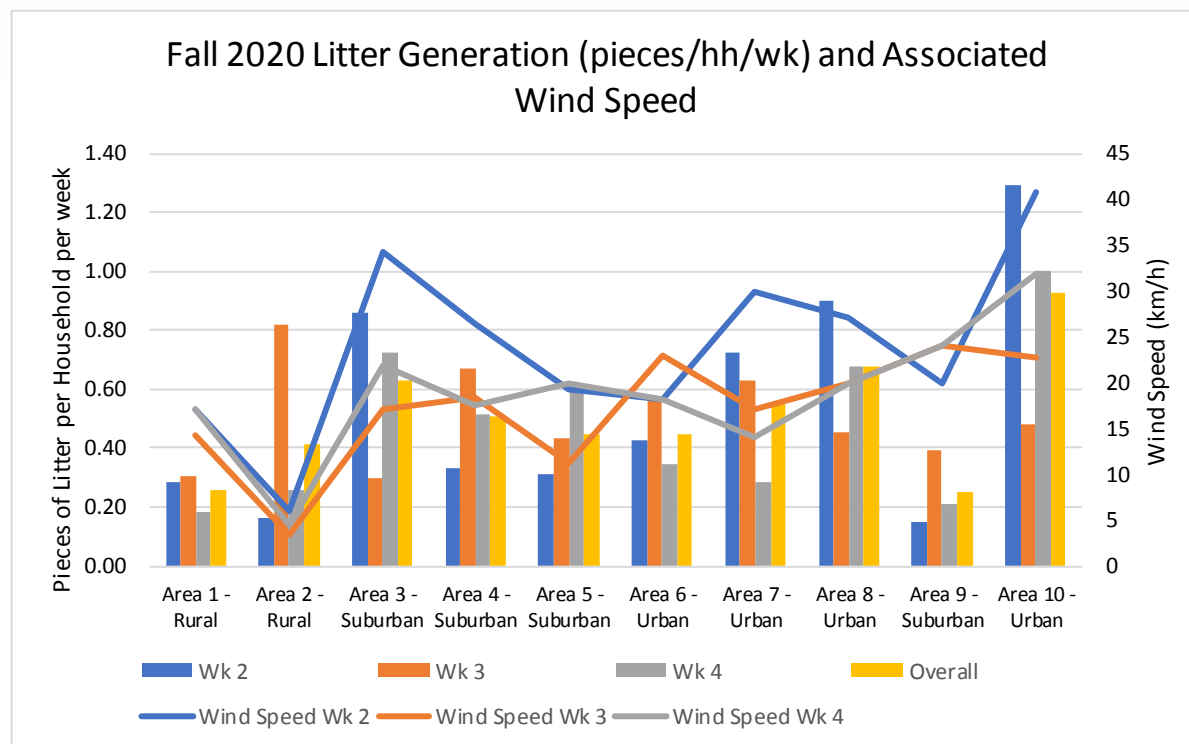


Figure 3.4 Fall 2020 Litter Generation (pieces/hh/wk) and Associated Wind Speed (km/h)

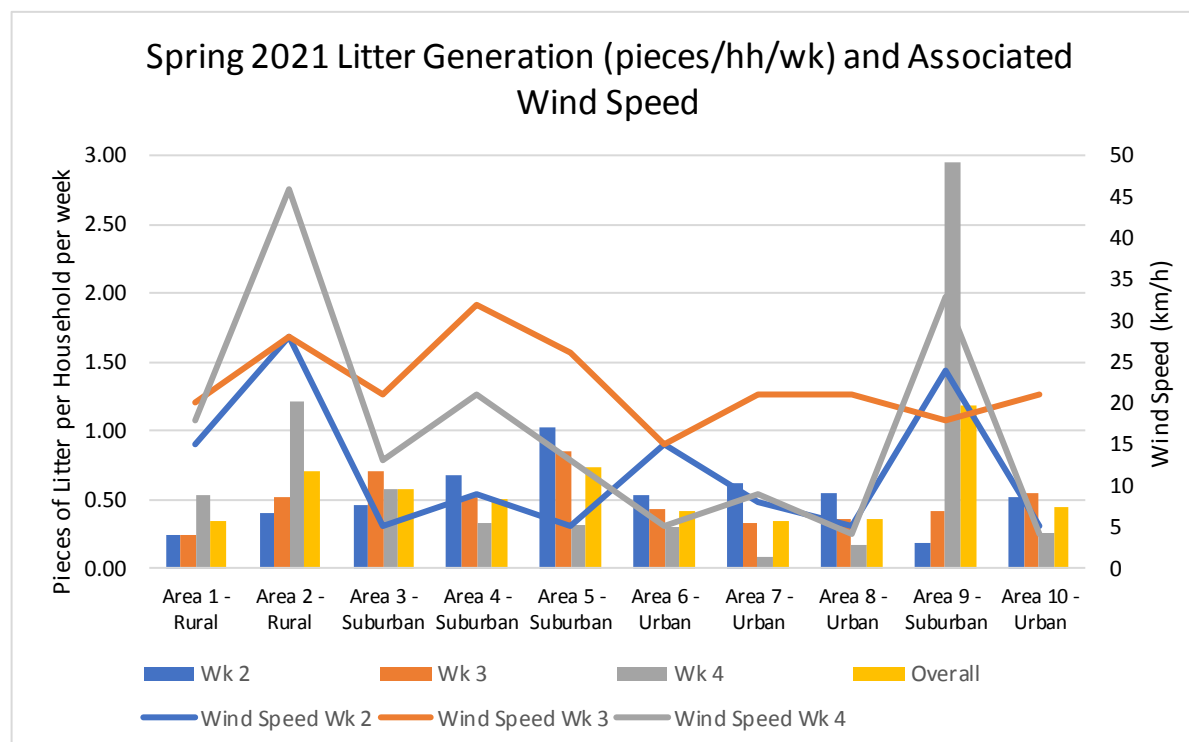


Figure 3.5 Spring 2021 Litter Generation (pieces/hh/wk) and Associated Wind Speed (km/h)

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One particularly telling observation was noted in Area 4 where two lids were distributed to each household before the Spring season began. Here, more than 30% of households were observed using at least one lid. With a large retirement aged population, the households in this area generally responded well to the program. The embracing of the blue box lids shows a notable impact in our results. When comparing the Fall season to the Spring, despite an increase of windspeed each comparable week, there was a significant reduction in both staff time and weight of litter observed. Table 3.4 expresses the notable decrease of staff time of 17.48% and litter weight of 47.07%, despite an average windspeed increase of 53.06%.

Table 3.4 Area 4 After Lids Distributed

Area 4 After Lids Distributed			
	Wind Speed	Staff Time	Litter Weight
Week 2	+ 11.11%	- 21.21%	- 31.45%
Week 3	+ 71.88%	- 13.04%	- 58.43%
Week 4	+76.19%	- 18.18%	- 51.34%
Average	+ 53.06%	- 17.48%	- 47.07%



Figure 3.6 April 30, 2021; Area 2 (left) and Area 9 (right); wind strewn blue boxes

The final day of the spring study (April 30, 2021) saw the two highest weights of litter per household. Litter collected in Area 2 and Area 9 corresponded to 0.027 kg/hh/wk and 0.079 kg/hh/wk respectively. Similarly, the total amount of pieces of litter was substantially high, with 1.22 pieces/hh/wk collected in Area 2 and 2.95 pieces/hh/wk collected in Area 9. Weather was recorded as light rain, cloudy and approximately 9 degrees Celsius. Average windspeeds exceeded 40km/hr with gusts up to 71km/hr. The wind was so impactful that bins were pushed into the streets and knocked over. In the more urban area material accumulated near garages and along fences. Some residents were observed recovering material before and after the hauler collected.

Two seasons of four weeks each were undertaken, with the first week in each season treated as a “clear-out” litter collection. Employee collection time was calculated for three weeks each season correlating to the expected litter sourced from blue box collection during the sample dates. Three weeks of ten areas accounts for thirty instances of

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litter collection each season. For nine of the ten areas, collection was undertaken by foot, while one areas (Area 2) was rural and the distance between homes was great enough to warrant collection by vehicle.

During the Spring season; a total of 1,021 working minutes (17.02 hours) were required to collect in the ten areas over the three weeks. This accounts for an average of 19.9 minutes per kilometer. The Fall season saw a similar 1,058 working minutes (17.63 hours) and a nearly identical 20.0 minutes per kilometer.

The recorded time only considers the physical time on the streets collecting and does not account for travel time to and from the location, acquiring and preparation of gear, disposal of material, route planning, or waiting for the hauler vehicles to clear the area.

## 3.2.2 Litter Composition

Table 3.5 and 3.6 display the detailed litter composition values for the Fall and Spring seasonal audits. Figures 3.7 and 3.8 illustrate the average litter composition rolled up into simplified categories. During the Fall, the total amount of other waste, that was likely not attributable to the blue box, totalled 52.20%. The same other waste category only accounted for a total of 33.61% in the Spring. This means that there was more recyclable blue box litter during the Spring. Most notably, the total amount of cardboard experienced an increase, from 8.50% in the fall to 20.48% in the spring.

Table 3.5 Litter Composition by Area – Fall 2021

Material Category	Area 1 - Rural	Area 2 - Rural	Area 3 - Urban	Area 4 - Urban	Area 5 - Urban	Area 6 - Urban	Area 7 - Urban	Area 8 - Urban	Area 9 - Suburban	Area 10 - Urban	Average
Mixed Paper (magazine/office)	6.48%	4.18%	3.07%	4.44%	5.70%	11.02%	7.08%	9.62%	7.07%	16.74%	7.54%
Newspaper	5.55%	1.48%	0.01%	1.30%	1.82%	0.67%	1.11%	1.28%	0.00%	0.61%	1.38%
Boxboard	1.64%	15.69%	1.95%	5.88%	23.58%	8.64%	13.05%	28.28%	5.90%	17.12%	12.17%
Cardboard	0.00%	5.36%	3.86%	1.59%	11.28%	20.35%	25.16%	4.03%	1.92%	11.41%	8.50%
Polycoats	0.00%	0.00%	0.00%	0.00%	6.83%	1.20%	0.00%	0.00%	0.00%	1.81%	0.98%
Paper Beverage Cups	0.00%	1.42%	3.97%	7.64%	4.98%	2.30%	3.74%	0.00%	0.00%	0.00%	2.41%
Unrecyclable Paper Packaging (wrappers, etc.)	1.53%	0.11%	0.55%	0.82%	0.23%	0.82%	0.64%	3.44%	0.08%	0.05%	0.83%
Plastic #1 - PETE	0.00%	11.78%	0.59%	9.26%	9.72%	4.22%	21.08%	3.96%	11.85%	13.97%	8.64%
Plastic #2 - HDPE	0.00%	2.72%	0.00%	0.74%	0.00%	0.00%	0.21%	2.26%	6.09%	0.00%	1.20%
Mixed Plastic, #3-#7	6.37%	0.75%	0.43%	5.08%	1.91%	0.92%	3.81%	2.49%	1.43%	4.99%	2.82%
Straws/PS Coffee Lids	0.78%	0.17%	0.61%	0.51%	0.38%	0.74%	0.14%	0.63%	0.98%	0.28%	0.52%
Other plastic	11.71%	28.31%	1.28%	6.47%	3.51%	10.03%	5.39%	1.62%	23.99%	1.41%	9.37%
Aluminum/Steel containers	4.77%	8.82%	0.46%	3.14%	3.47%	4.11%	10.50%	5.43%	0.00%	4.45%	4.51%
Other metal	0.00%	0.00%	0.00%	0.10%	2.10%	1.76%	0.10%	5.69%	0.00%	0.00%	0.97%
Glass	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other waste (blue box)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.49%	0.05%
Other waste (suspected non-blue box)	61.17%	19.20%	75.47%	53.03%	24.50%	33.21%	7.99%	23.93%	40.69%	26.67%	36.59%
Other recyclable material (suspected non-blue box)	0.00%	0.00%	7.75%	0.00%	0.00%	0.00%	0.00%	7.34%	0.00%	0.00%	1.51%
<b>Total</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>

Table 3.6 Litter Composition by Area – Spring 2021

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Material Category	Area 1 - Rural	Area 2 - Rural	Area 3 - Suburban	Area 4 - Suburban	Area 5 - Suburban	Area 6 - Urban	Area 7 - Urban	Area 8 - Urban	Area 9 - Suburban	Area 10 - Urban	Average
Mixed Paper (magazine/office)	2.37%	1.79%	3.73%	3.53%	4.08%	10.36%	6.76%	11.79%	3.25%	9.19%	5.69%
Newspaper	2.92%	0.00%	0.31%	0.00%	0.00%	1.57%	0.00%	0.00%	0.91%	0.00%	0.57%
Boxboard	0.82%	6.02%	8.04%	16.90%	8.27%	12.12%	18.05%	8.73%	20.70%	16.43%	11.61%
Cardboard	34.67%	24.07%	34.07%	2.59%	35.73%	9.53%	3.00%	4.74%	26.65%	29.73%	20.48%
Polycoats	0.00%	3.24%	3.38%	0.00%	0.37%	0.00%	0.00%	0.00%	7.86%	11.57%	2.64%
Paper Beverage Cups	0.00%	2.09%	5.33%	5.19%	2.64%	2.68%	6.22%	0.00%	1.28%	0.00%	2.54%
Unrecyclable Paper Packaging (wrappers, etc.)	0.18%	1.10%	0.98%	2.20%	0.32%	9.16%	1.31%	1.67%	0.15%	0.22%	1.73%
Plastic #1 - PETE	4.93%	30.32%	5.95%	10.11%	10.12%	0.93%	15.28%	6.13%	18.78%	2.81%	10.54%
Plastic #2 - HDPE	0.00%	5.18%	0.00%	2.93%	2.36%	0.00%	0.00%	0.00%	5.30%	0.00%	1.58%
Mixed Plastic, #3-#7	0.09%	4.84%	4.44%	5.46%	6.81%	1.76%	5.53%	11.42%	3.78%	0.00%	4.41%
Straws/PS Coffee Lids	1.82%	0.00%	1.40%	2.40%	0.97%	2.13%	1.61%	2.51%	0.20%	0.43%	1.35%
Other plastic	13.14%	3.68%	7.57%	8.25%	5.81%	14.06%	9.37%	0.74%	4.20%	1.51%	6.83%
Aluminum/Steel containers	3.10%	16.87%	7.64%	3.26%	3.22%	4.63%	1.46%	15.32%	3.40%	7.89%	6.68%
Other metal	1.19%	0.00%	0.00%	3.46%	0.21%	0.00%	0.00%	3.71%	0.00%	0.00%	0.86%
Glass	0.00%	0.00%	0.00%	0.00%	3.14%	0.00%	0.00%	0.00%	0.00%	0.00%	0.31%
Other waste (blue box)	0.27%	0.00%	0.00%	0.00%	0.00%	0.93%	17.67%	0.00%	0.00%	0.00%	1.89%
Other waste (suspected non-blue box)	34.49%	0.80%	17.15%	33.73%	15.93%	30.16%	13.75%	33.24%	3.54%	20.22%	20.30%
Other recyclable material (suspected non-blue box)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
<b>Total</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>

Fall 2020 Average Litter Composition

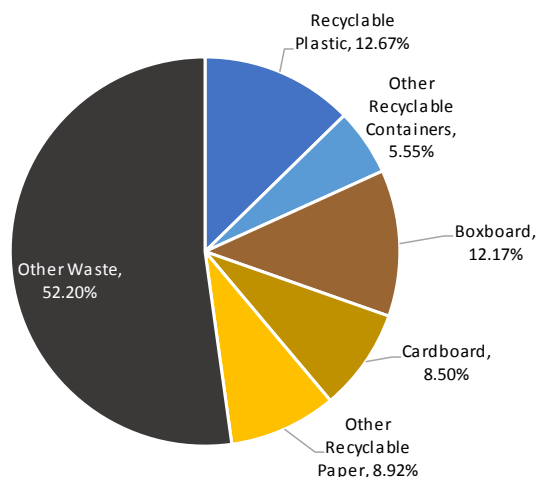


Figure 3.7 Fall 2020 Average Litter Composition

Spring 2021 Average Litter Composition

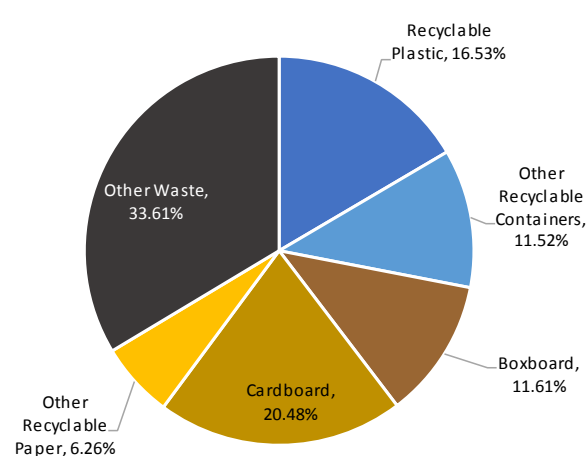


Figure 3.8 Spring 2021 Average Litter Composition

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## 3.3 Moisture Auditing

The methodology outlined to collect 200 covered and 200 uncovered blue boxes each season to compare. During the first season, with only 40% of the sample areas having lids, 200 total lids we're not encountered throughout the 2 weeks of sampling. AET collected all lidded material encountered in the Fall. This was combated by collecting an equivalent or increased number of open box (unlidded) blue box material.

The Spring season provided ample lidded material to sample, however, not distributed in all areas evenly. Some areas had less lid usage than others.

Another unexpected encounter was the presence of comingled blue boxes. Although Durham Region's recycling program runs on a two-stream system, some households comeingle their recycling and set-out as one (i.e. containers and fibres placed in the same bin). AET collected comingled recycling as a separate entry, in addition to the regular containers and fibres samples.

Table 3.7 summarizes the average moisture content of the fibres recycling, containers recycling, and comingled recycling placed in lidded blue boxes and open boxed (unlidded) blue boxes. On average, the moisture content of open boxed fibres was higher than lidded fibres. The difference in moisture was higher in the Fall, where more rain took place.

Table 3.7 Average Moisture Content for Lidded vs. Open Boxed Recycling

Season	Fibres		Containers		Comingled	
	Lidded	Open Boxed	Lidded	Open Boxed	Lidded	Open Boxed
Fall Average Moisture Content	1.23%	10.05%	4.92%	4.90%	8.23%	2.45%
Spring Average Moisture Content	2.04%	5.74%	2.29%	7.79%	2.84%	5.83%

Lids were primarily used to cover fibres but were also observed on containers and comingled materials. Fibres were observed to see a greater percent decrease in moisture weight when comparing lidded to open box. This was expected due to fibres ability to retain moisture from the atmosphere including rain and dew. Notably, containers had a larger decrease in the lidded boxes. Containers are presumably more likely to contain moisture sourced from non atmospheric conditions. For example, bottles, jars, and tubs could contain traces of food and beverages that they were initially used for and are more likely to be rinsed by the resident.

Weather encountered had a marked impact on the amount of moisture observed in the sample. The two studies took place in the Fall and Spring with temperatures above freezing and rarely hot. It is expected during summer or winter seasons, factors such as snow or dew might show different results. On days without precipitation, minimal, and sometimes no moisture weight reduction was observed. It is expected during the typical collection by the haulers the material could shed or accumulate moisture differently during their transportation.

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## 3.4 Time-and-Motion Collection Truck Assessment

Table 3.8 summarizes the average collection time of blue box recyclables for rural, suburban and urban households. In all cases in the Fall and Spring seasons, the average time to collect lidded was higher than open box. It should be noted that a stop was classified as lidded if it had at least one lid present.

Table 3.8 Average Collection Time Per Stop by Housing Type

Time and Motion Metrics	Decimal Minutes	Seconds	# of Stops
<b>Fall 2020</b>			
Rural - Average Time to Collect Open Box Stop	0.19	11.59	153
Rural - Average Time to Collect Lidded Box Stop	0.00	0.00	0
Rural - Average Time for Set-outs with Enforcement	0.28	16.98	8
Suburban Open Box Collection Time	0.18	10.75	738
Suburban Lidded Box Collection Time	0.30	18.24	31
Suburban Average Time for Set-outs with Enforcement	0.37	21.95	33
Urban Open Box Collection Time	0.21	12.36	606
Urban Lidded Box Collection Time	0.26	15.71	36
Urban Average Time for Set-outs with Enforcement	0.38	22.87	18
<b>Spring 2021</b>			
Rural - Average Time to Collect Open Box Stop	0.15	9.21	194
Rural - Average Time to Collect Lidded Box Stop	0.24	14.31	16
Rural - Average Time for Set-outs with Enforcement	0.30	17.74	1
Suburban Open Box Collection Time	0.14	8.14	880
Suburban Lidded Box Collection Time	0.24	14.24	156
Suburban Average Time for Set-outs with Enforcement	0.41	24.68	14
Urban Open Box Collection Time	0.13	7.92	751
Urban Lidded Box Collection Time	0.21	12.31	112
Urban Average Time for Set-outs with Enforcement	0.41	24.50	1

Table 3.9 summarizes the overall average collection time of blue box recyclables for all households sampled. The average time to collect lidded boxes in the Fall was 16.88 seconds compared to 11.48 seconds to collect open boxes. The average time to collect lidded boxes in the Spring was 13.50 seconds compared to 8.17 seconds to collect open boxes. It is important to note that other factors could affect collection times, such as weather, total amount of material set-out. In addition, the overall sample size of lidded stops was higher in the Spring, after the remaining six areas received blue box lids.

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Table 3.9 Average Collection Time Per Stop Overall

Time and Motion Metrics	Decimal Minutes	Seconds	# of Stops
<b>Fall 2020</b>			
Average Time to Collect Open Box Stop	0.19	11.48	1497
Average Time to Collect Lidded Box Stop	0.28	16.88	67
Average Time for Set-outs with Enforcement	0.36	21.55	59
<b>Spring 2021</b>			
Average Time to Collect Open Box Stop	0.14	8.17	1825
Average Time to Collect Lidded Box Stop	0.22	13.50	284
Average Time for Set-outs with Enforcement	0.40	24.23	16

It is expected that as the collection personnel becomes more comfortable with the lids, the time would come down a bit. Some collection staff would remove the lid, hold it in one hand while dumping the bin in the truck, and then place the lid in the empty bin. Other collection staff would use two hands, pull the two closest corners up and over, allowing the lid to fall on the lawn behind.

Throughout the study, the collection contractor did reject items during collection. The enforcement took place in several different manners. Sometimes this was done by pulling out specific non-acceptable items and placing it back in the empty bin or on the lawn beside. Sometimes the non-acceptable items were visible prior to lifting the bin and other times they were pulled out after being dumped into the collection vehicle. An enforcement sticker was only used once during the entire study. During this instance, the collection contractor on a rear loading vehicle retrieved stickers from the cab to tag four clear blue recycling bags. While the employee was placing the stickers, the resident emerged to inquire why their material was not being collected. The whole interaction took 29 seconds. There were a total of 59 stops that took place with enforcement in the Fall and 16 stops that took place with enforcement in the Spring. The average time to collect a set-out with enforcement ranged from 21.55 seconds in the Fall to 24.23 seconds in the Spring.

## 3.5 Other Observations

The benefits of the lid are greatest when covering loose paper and other fibres that are more susceptible to blowing winds and a higher capacity for absorbing moisture. However, with larger cardboard boxes, particularly shipping boxes, it is very likely to encounter fibres bins with overflow. In other words, the folded and bundled boxes extend beyond the rim of the box, inhibiting the use of a lid.

While conducting the study, residents would often inquire about what AET staff were doing and freely provided feedback on the lid program. Responses and commentary from residents varied when it came to their satisfaction of the blue box lid. Sentiment varied in the public; some people loved the lids and used them every week. Others complained that they were too heavy or floppy and difficult to store in the garage. Another issue broached was that the lids didn't fit some bins that were released by Durham Region at a previous time.

Many people used them sporadically, based on the weather or the type/amount of material they had in their bins. It was noticed that clusters of lid-use existed in certain areas, suggesting people watch and match their neighbors. A few people fastened their lids to the blue boxes, resulting in an awkward container for the hauler to empty and handle.

## 4.0 CONCLUSIONS

### 4.1 Participation Rates

Based on both seasons, an average of 71.25% of households participated each week in fibres stream recycling and 66.68% in containers stream recycling.

Fall lid participation rates saw 5.30% of the sampled households with a lid (only 4 areas) across the four week study period. A total of 13.53% of households used at least one lid on their blue box in the Spring season.

### 4.2 Litter Audit

During the Spring season; a total of 1,021 working minutes (17.02 hours) were required to collect in the ten areas over the three weeks. This equated to an average of 19.9 minutes per kilometer. The Fall season saw a similar 1,058 working minutes (17.63 hours) and a nearly identical 20.0 minutes per kilometer.

The composition of litter varied from the Fall to the Spring season. The litter collected in the Fall season comprised of 52.20% of other waste (non blue box material). The litter collected in the Spring season comprised of 33.61% of other waste (non blue box material). The total amount of corrugated cardboard increased from 8.50% in the Fall season to 20.48% in the Spring season.

### 4.3 Moisture Audit

The average moisture content of lidded versus open boxed recycling experienced the biggest difference between the fibres stream material. On average, the moisture content of open boxed fibres was higher than lidded fibres in the Fall, where more rain took place. During the Fall season, the moisture content for lidded fibres was 1.23% compared to open boxed, at 10.05%. During the Spring season, the moisture content for lidded fibres was 2.04% compared to open boxed, at 5.74%. The other waste streams saw smaller changes in moisture content.

### 4.4 Collection Time

The average time for a recycling operator to collect an open box stop in the Fall was 11.48 seconds and 8.17 seconds in the Spring;

The average time for a recycling operator to collect a lidded box stop in the Fall was 16.88 seconds and 13.5 seconds in the Spring;

The average time for a recycling operator to collect a set-out requiring enforcement in the Fall was 21.55 seconds and 24.23 seconds in the Spring.

## 5.0 RECOMMENDATIONS

The use of the blue box lids displays benefits in reduction of litter and moisture contamination. The benefits are highly dependent on the weather conditions during and before collection. It is recommended that residents are encouraged to use the lids during episodes of precipitation and/or high winds speeds. Many of the benefits of the lids could be duplicated by placing a second blue box, often the containers, on top of the fibres. Neither of these methods are possible when the fibres extend beyond the walls of the blue box.

To best enable the use of the lids, it is recommended the lid size corresponds to the bins belonging to the resident.

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Overall, based on the limited use and varying responses towards the lids, it is recommended that the lid be available to residents to opt for. If a need or desire for a cover, lids should be provided. The lids could be a valuable component in the waste collection arsenal and a realistic counterargument to the covered carts.

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July 2021

## **Disclaimer**

AET Group Inc. makes no warranty and assumes no liability for the information contained in this report outlining the study results. These results reflect measurements made over the four-week study period per season as described in the methodology. As such, waste collection measurements should be considered snapshots and may not reflect accurately conditions across Durham Region over time.

APPENDIX A  
LITTER AUDIT CATEGORY  
DESCRIPTIONS



Material Category	Description and Examples
<b>Mixed Paper</b>	Magazines, office paper, receipts, mail.
<b>Newspaper</b>	Newspapers, flyers and ads resembling newspaper material.
<b>Boxboard</b>	Cereal boxes, single layer cardboard packaging.
<b>Cardboard</b>	Corrugated cardboard, delivery boxes, packaging, coffee cup sleeves, moving boxes.
<b>Polycoats</b>	Aseptic containers, polycoat containers, gable top beverage and food containers, juice boxes.
<b>Paper Beverage Cups</b>	Fast food beverage cups, single use coffee cups.
<b>Unrecyclable Paper Packaging (wrappers, etc.)</b>	Laminated paper and non recyclable paper packaging, foil or plastic lined paper. Burger wrappers, paper food pouches.
<b>Plastic #1 - PETE</b>	Clamshell containers, pop bottles, coloured and clear packaging.
<b>Plastic #2 - HDPE</b>	Bottles, lids and buckets. Coloured, or natural. Shampoo bottles, windshield wiper fluid bottles.
<b>Mixed Plastic, #3-#7</b>	PVC, LDPE, PP, PS, 'Compostable' plastic, Other plastics. Bottles and containers, Styrofoam, margarine tubs.
<b>Straws/PS Coffee Lids</b>	Plastic & paper straws, coffee lids.
<b>Other plastic</b>	Non-recyclable plastics, durables, unmarked. Toys, single use cutlery, CDs, film overwrap and packaging.
<b>Aluminum/Steel containers</b>	Aluminum/steel beverage and food containers, metal aerosol containers. Soup cans, pop cans, etc.
<b>Other metal</b>	Non-recyclable metals. Coat hangers, bottle caps, etc.
<b>Glass</b>	Glass containers, broken glass, decorations.
<b>Other waste (blue box)</b>	Materials not included in above categories and suspected to have originated in a blue box.
<b>Other waste (suspected non-blue box)</b>	Materials not included in above categories and suspected to have not originated from a blue box. Perhaps from the garbage/organic/yard waste streams, passing vehicles, pedestrians, or carried from another area. Pet waste, cigarettes, lawn care signs, food wastes.
<b>Other recyclable material (suspected non-blue box)</b>	Material that may be included in the categories above but suspected to have originated from outside of a blue box. Newspapers in bags, fibres from green bin, parking tickets.

## Appendix B – Local Economic Survey Report

This report is not available due to the confidential financial nature of the document.

Please contact CIF staff for further information.

## Appendix C – Durham Material Recycling Facility (MRF) Data

Weather Conditions as noted on [www.climate.weather.gc.ca](http://www.climate.weather.gc.ca)

“wet” with rain/snow events noted on selected dates and “dry” on same collection day for comparison in production and processing of materials.

**OSHAWA, ONTARIO, Current Station Operator: NAVCAN**

**Latitude:**43°55'22.000" N, **Longitude:**78°53'00.041" W, **Elevation:**139.90 m

PRODUCTION #'S > # OF BALES BALED PER DAY											
	Conditions	INBOUND TONNAGE	ALUMINUM	STEEL	PETE	HDPE	RIGID MIXED PLASTIC	GABLE TOP	RMP (MIXED FIBER)	OCC	LOOSE NEWS (LOADS SHIPPED/ DAY)
13-Mar-20	Wet	166.34	2	4	19	3	1	8	1	24	4
27-Mar-20	Dry	207.47	4	2	24	6	0	9	6	36	4
30-Apr-20	Wet	242.34	3	4	26	3	2	9	0	46	3
07-May-20	Dry	200.58	5	4	20	4	1	7	2	47	4
20-Oct-20	Wet	253.14	5	3	18	7	2	9	1	33	3
03-Nov-20	Dry	214.07	4	2	19	6	0	11	2	42	3
23-Nov-20	Wet, snow	83.81	6	7	32	9	1	18	1	25	4
30-Nov-20	Wet, rain	103.39	4	4	23	3	2	12	2	41	4
07-Dec-20	dry	81.95	2	4	21	3	1	8	2	46	4
Average Wet		169.80	4	4	24	5	2	11	1	34	4
Average Dry		176.02	4	3	21	5	1	9	3	43	4
Difference Dry to Wet		3.53%	-6.67%	-46.67%	-12.38%	-5.26%	-220.00%	-28.00%	66.67%	20.94%	4.00%

PROCESSING								
	Conditions	Belt Speed C	Belt Speed F	Downtime C (minutes)	Downtime F (minutes)	*Residue (tonnes)	Throughput C TPH	Throughput F TPH
13-Mar-20	Wet	70%	80%	5	12	17.06	8.5	28.34
27-Mar-20	Dry	75%	82%	59	17	15.85	11.7	21.98
30-Apr-20	Wet	73%	80%	27	35	17.57	10.8	24.06
07-May-20	Dry	83%	83%	15	53	14.58	10.9	20.4
20-Oct-20	Wet	81%	80%	30	14	17.19	14.7	25.15
03-Nov-20	Dry	84%	83%	39	14	16.96	12.4	19.37
23-Nov-20	Wet, snow	82%	70%	32	188	16.36	11	21.62
30-Nov-20	Wet, rain	82%	70%	39	73	21.69	10.3	23.91
07-Dec-20	dry	84%	70%	82	64	21.87	12.3	27.29
Average Wet		78%	76%	26.60	33.50	17.97	11.06	24.62
Average Dry		82%	80%	48.75	37.00	17.32	11.83	22.26
Difference Dry to Wet		4.79%	4.40%	45.44%	9.46%	-3.81%	6.47%	-10.58%

## Appendix D – Residential Survey Report

# CIF and Region of Durham

## *Project 1117 - Residential Survey Final Report*



**Put a lid on litter!**

**Welcome to durham's litter pilot**

Your neighbourhood has been chosen to test this new prototype lid.

Made of recycled tires it will keep recyclable material from blowing out of your blue box.

Durham Region has a two stream recycling program. Use one blue box for containers (glass, metal and plastics) and another blue box for paper, cardboard and cardboard.

Step one	Step two	Step three
Use the lid on either your "Containers" or your "Papers" blue box.	Secure the corners of the lid to hold the material in place before setting it to the curb.	On windy days stack your bins putting the lidded bin on the top.

**Thank you for your participation.**

Questions? • 1-800-667-5671 • [waste@durham.ca](mailto:waste@durham.ca)

If you require this information in an accessible format, please contact the number above.

Date: June 2021



With initial data analysis and sections of report completed by:



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## EXECUTIVE SUMMARY

The Continuous Improvement Fund (CIF), in collaboration with the Region of Durham, conducted a litter mitigation study with the aim of reducing litter from open-top blue boxes in Ontario. The Region of Durham developed a newly patented crumb-rubber blue box lid that was prototyped and tested initially in 2019 as part of their overall litter mitigation program. The CIF program moved forward on this initial work and undertook additional research broadening the scope and understanding the impact of the lid to the blue box program. Surveys for the 2020/21 CIF project were aimed at 1,000 households in the 10 sample areas as follows:

- 449 households that were previously provided lids (old lid areas)
- 432 households that would receive 2 new lids in Oct 2020 (new lid areas)
- 108 households that would receive 1 new lid in Oct 2020 (new lid areas)

The ten sample areas chosen in the Region of Durham are representative of most Ontario municipalities. The aim of the project was to analyze the responses from the residents from each of the sample areas pre- and post-lid implementation. Residents chosen for the pilot were sent flyers informing them about the study and the survey was promoted to residents using roadside signage and through mailed cards with survey web links.

During the Region of Durham's 2019 pilot, an initial survey was conducted which received 79 responses. For the 2020 project, a survey was completed in October 2020 which received 96 responses. Finally, a follow-up survey was conducted in April 2021 which received 188 responses.

From the initial surveys conducted in May 2019 and Oct 2020, responses showed that the residents were aware of litter being a problem in the residential areas and do their best to reduce materials blowing out of blue boxes. Awareness of the Blue Box litter study rose from 82% in October 2020 to 94% in April 2021. While single detached rural residents stated that they do not observe any litter on their streets, in all other housing types 24% of responses (51 out of 215 responses) mentioned having greater than average or lots of litter in their neighbourhoods. In the follow-up survey of April 2021, 81% of residents surveyed found the lid easy to use and 88% of residents noticed that the lid prevented litter from the blue box on windy days. Overall, 75% of residents would recommend the lid to other residents of Durham (likely or very likely). Although residents found the lid easy to use, some residents found it difficult due to it being too hard to put on (35% - 14 out of 40 responses), lid not fitting the box (15% - 6 out of 40 responses) and an overflowing blue box (15% - 6 out of 40 responses). Residents in urban environments used the lid more often than those in suburban or rural housing categories.

Based on the survey results and feedback from residents, the following recommendations can be made:

- Make lids available to all residents who choose to use them. This may also mean replacing old style boxes as the lids do not fit all shapes; and providing more than one for those with 2 or more boxes set out per week. An opt-in plan for the lids may be the most cost-effective approach so as not to be delivering lids to residents who will not participate.
- Provide education and awareness to residents on the lid program and "tips and tricks" on how to use them, but also provide information on alternatives to reduce windblown litter for those who choose not to opt-in to the lid program, such as: putting boxes out the morning of collection, stacking boxes, placing paper under heavier items etc.
- To further reduce potential litter and to ensure success for any residents using lids, an education program with on-going reminders is needed for the recycling drivers/contractor. This would include reminders

about box placement after emptying, picking up materials that spill, not driving distances with material in hoppers etc.

Should the Region of Durham wish to expand this blue box lid program, it would be beneficial to also review the following comments to garner a higher participation rate, reduce capital costs, and/or lower labour impact for collection. These comments include:

- The lid is heavy and hard to put on
- The lid is difficult to stretch onto the box in the winter
- The lid doesn't work when the box is full or has tall items in it
- Can't it be just like our green cart? That works great
- Can't we just have a cart with a lid like they do in Toronto?
- The driver dumped my lid into the truck and now I don't have one
- My lid went missing after collection
- It takes the driver longer to remove the lid to collect my box, so I don't use it
- The driver throws my lid in the mud after removing, so I don't like handling it again
- The lid didn't fit my old generation blue box, so I couldn't use it

With the majority of the survey feedback stating that they felt lids made a difference in the amount of litter, and the solution to most of the negative comments being an attached lid, maybe there is the potential to research an alternative that can be attached to current boxes (retrofit kit) or a new style box that can be purchased at a subsidized rate by residents.

The three distinct surveys all managed to draw some very interesting and useful information that can be used to help inform future decisions on rolling out a project like this, as well as the impact the actual lid has had on litter reduction and acceptance by residents. Some questions only provided a "point in time" response as they were not duplicated in subsequent surveying. In future pilot projects that include multiple surveys it is suggested that there be two sets of questions. One set would be the core questions and would be consistent and repeated through-out the pilot timeline to ensure an accurate depiction of how the pilot is received. The second set of questions could be specific to that point in the project timeline and used to garner more information on seasonal impacts, usefulness, acceptability, and impact.

## BACKGROUND

The Continuous Improvement Fund (CIF), in collaboration with the Region of Durham, is conducting a litter mitigation study with the aim of reducing litter from open-top blue boxes in Ontario. Initiated in 2018/2019, the Region of Durham investigated and tested ways to mitigate litter and successfully developed a newly patented crumb-rubber blue box lid (Figure 1). At that time, the Region of Durham suggested that the lid was effective at keeping material in the Blue Box. As a follow-up, in 2020, the CIF commenced additional research to evaluate the economic impact of the lid in terms of litter clean-up resources, moisture and marketability of materials in the Blue Box, and Blue Box leakage/loss into the environment. Surveying residents regarding litter awareness and recycling practices was included as a key component in the project monitoring and measurement ([Appendix A](#)).



*Figure 1: Blue box lid for litter study*

The sample areas chosen in the Region of Durham are representative of most Ontario municipalities as they include a variety of housing types such as urban, suburban, rural, waterfront/cottage/seasonal, agricultural, newer developments, and older established residential areas. The aim of the project is to analyze and understand the responses from the residents from each of the 10 sample areas pre- and post-lid implementation (Table 1). Residents chosen for the pilot were sent flyers informing them about the study taking place (Figure 2).

A description of the sample areas<sup>1</sup> can be seen in the table below.

---

<sup>1</sup> [National Housing Survey 2011](#)  
[ibid Census Profile, 2016 Census Canada](#)

**Table 1: Sample Pilot Areas**

Pilot Area	Municipality	Sample Type	Description	Lid Option
1	Scugog	Rural – Single Detached	Low density, outside CMAs <sup>2</sup> cottage country, rural	1 New Lid
2	Clarington	Rural – Agricultural	Low density, outside CMAs, Agricultural	1 New Lid
3	Oshawa	Suburban – Single Detached Pre 1960s (Old)	Medium density, within CMA	2 New Lids
4	Oshawa	Suburban – Single Detached 1961 – 2000 (Middle)	Medium density, within CMA	2 New Lids
5	Ajax	Suburban – Single Detached 2001+ (New)	Medium density, within CMA	Old Lid Area
6	Whitby	Urban – Single Detached Pre 1960s (Old)	High density, within CMA	2 New Lids
7	Pickering	Urban – Single Detached 1961 – 2000 (Middle)	High density, within CMA	2 New Lids
8	Whitby	Urban – Single Detached 2001+ (New)	High density, within CMA	Old Lid Area
9	Ajax	Urban – Semi Detached/Condo	High density, within CMA	Old Lid Area
10	Whitby	Suburban/Urban – Row Houses/ Multi Residential	Row of houses joined by common sidewalk and a continuous grouping on multi-levels	Old Lid Area

<sup>2</sup> [Census Metropolitan Area, Statistics Canada](#)



Figure 2: Flyers used to inform residents about litter pilot study

The survey was promoted to residents in the Region using roadside signage (Figure 3) and by mailing residents survey cards (Figure 4) informing them about the litter reduction study and encouraging them to participate.



Figure 3: Roadside survey promotion



Figure 4: Litter Pilot Survey Card

## LITTER COMPLAINTS RECEIVED BY THE REGION – 2019-2021

Prior to 2019, the Region did not monitor calls specifically related to litter. Since starting implementation of litter mitigation activities in 2019, the Region has directed the call centre to track litter complaints received. The following table provides an overview of the number of calls.

Year/Overall Resident Issue	Collector/Truck	Wind	Other	Total
2019	58 (84%)	4 (6%)	7 (10%)	<b>69 (100%)</b>
2020	33 (80%)	2 (5%)	6 (15%)	<b>41 (100%)</b>
2021 (Jan-March)	10 (91%)	0 (0%)	1 (9%)	<b>11 (100%)</b>

Over time, the majority of the complaints are from residents regarding drivers dropping materials as recycling is collected. Some calls received are about litter being blown onto the streets from their Blue boxes as well as collection trucks on windy days. These complaints show that residents are aware of litter from blue boxes being a problem. As the litter project has built awareness throughout the community through direct mailings, promotion, and abundant media, residents have become more engaged in notifying the Region of litter concerns.

## PROJECT AWARENESS, PROMOTION AND EDUCATION, AND PERCEIVED IMPACT

In order to evaluate the project, several survey questions probed into contributors to litter (i.e. blue box set-out timing, overflowing boxes, litter avoidance activities), project awareness, promotion and education, lid utility and perceived overall impact. A comparison of the compiled results over time are provided below.

---

***When do you usually put out your recycling boxes?***

---

Interestingly, survey responses showed that overall residents are generally split on whether or not they set-out their recycling on the night before or the day of collection. Time of set-out would influence moisture (if rain/snow event occurs prior to collection) and possible wind-blown materials.

Year	Night before Collection	Day of Collection
2019	36 (46%)	43 (54%)
2020	36 (43%)	48 (57%)
2021	75 (51%)	73 (49%)

---

***(2019/2020) When you put out your recycling boxes for collection, are they usually full and overflowing?******(2021) Do your recycling boxes tip over and spill on Windy days?***

---

In 2019/2020 residents reported putting out full and overflowing blue boxes for collection (between 76% - 86% chose yes/sometimes). In 2021 there was an obvious split in residents noticing if blue boxes tipped and spilled on windy days (53% vs. 47%).

Year	Yes/Sometimes	No
2019	68 (86%)	11 (14%)
2020	64 (76%)	20 (24%)
2021	79 (53%)	69 (47%)

---

***Durham Region supplies residents with two recycling Blue Boxes: one for containers and the other for paper/cardboard. Do you find one box more likely to cause litter versus the other?***

---

Over time, residents of Durham did not identify which blue box, containers or paper/cardboard, contributed to litter.

Year	Containers	Papers/Cardboard	Both	Unknown/Neither
2019	15 (33%)	30 (67%)	0 (0%)	0 (0%)
2020	25 (30%)	19 (23%)	18 (21%)	22 (26%)
2021	25 (31%)	13 (16%)	42 (53%)	0 (0%)
<b>Average</b>	<b>65 (31%)</b>	<b>62 (30%)</b>	<b>60 (29%)</b>	<b>22 (11%)</b>

---

**Were you aware that a Blue Box Litter Study was being undertaken in your neighbourhood?**

---

From October 2020 to April 2021, resident awareness of the blue box litter study grew from 82% to 94%.

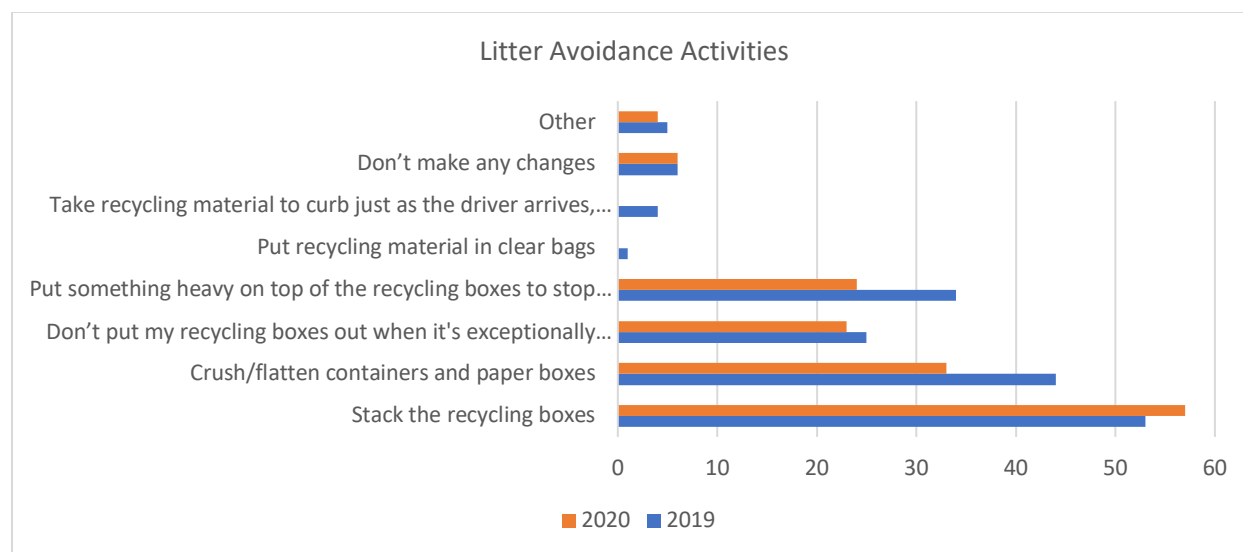
October 2020		April 2021	
Yes	No	Yes	No
67 (82%)	15 (18%)	139 (94%)	9 (6%)

---

**What do you do to reduce blue box litter?**

---

In order to understand mitigation efforts made by residents (level of effort), this survey question asked what respondents did to manage their blue boxes in order to avoid contributing to litter. Averaged over both years (162 responses overall), the top four activities were 1. Stacking recycling boxes (34%) 2. Crush/flatten containers and paper boxes (24%) 3. Don't put out blue boxes when it's exceptionally windy (15%) and 4. Put something heavy on top of recycling boxes (18%). This shows that those that completed the survey actively participated in litter avoidance activities with only 4% stating that they "don't make any changes".



---

***Please provide feedback on the following education tools supplied by Durham Region to assist you with managing your Blue Box set out to avoid litter on windy days.***

---

The following list ranks the most helpful promotion and education tools provided by Durham based on the responses received:

1. Calendar (55 – 47%)
2. Durham Region Waste App (27- 23%)
3. Website (22 – 17%)
4. Social Media (14 -12%)

---

***Is the lid easy to use?***

---

Overall the majority (82%) of those surveyed agreed that the blue box lid was easy to use.

Year	Yes	No
2021	115 (82%)	26 (18%)

If No, why was the lid not easy to use? (39 choices from 29 surveys)

- Too hard to put on (14 – 36%)
- Doesn't fit on the box/Overflowing Blue Box (11 – 28%)
- It's too heavy (7 – 18%)
- I don't like it (7 – 18%)

Other responses included:

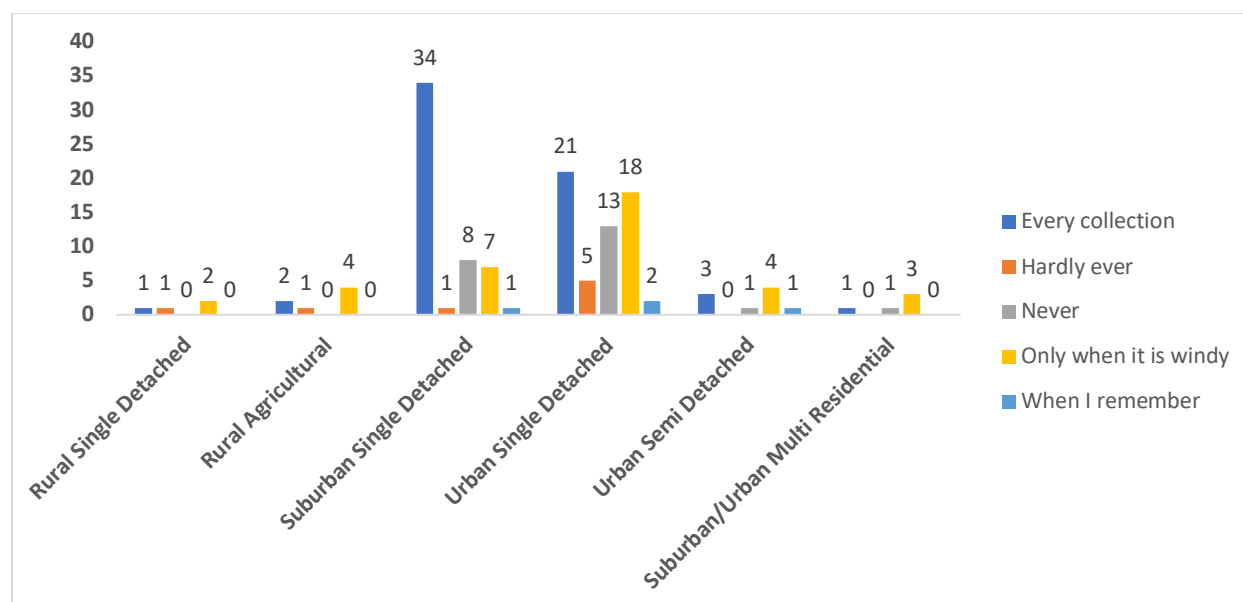
- Doesn't work/fit (x3)
- Not flexible in cold weather
- Makes more work for garbage collectors (x2)

---

### How often do you use the Blue Box Lid(s)?

---

When asked how often the blue box lid was used by respondents, of the 135 that answered, 46% (mostly in suburban and urban single detached homes) stated “every collection”. The second highest response was “windy days” with 28% of responses. “Never” and “Hardly ever” were chosen by 17% and 6% of those surveyed respectively.




---

### (2020) Would you recommend that the Region make Blue Box lids available to residents of Durham? (2021) Would you to recommend the lid to others?

---

Of the 140 responses received in both years of surveying, 74% were likely to recommend the or support the idea of Durham making the lids available to residents.

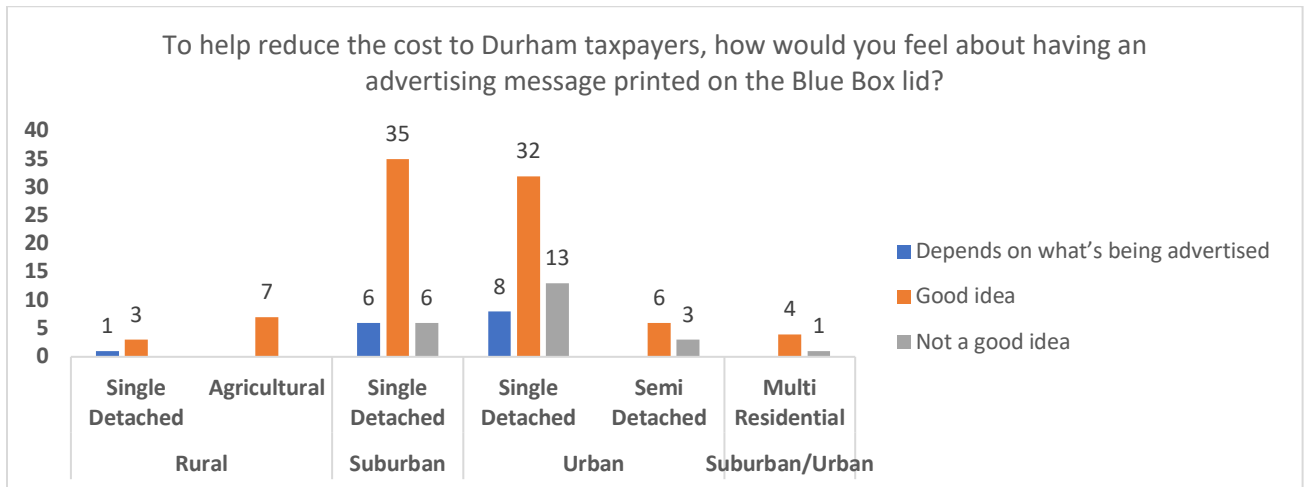
Year	Yes (likely & very likely)	No (very unlikely & unlikely & undecided)
2020	11	4
2021	93	32
<b>Total</b>	<b>104 (74%)</b>	<b>36 (26%)</b>

---

***To help reduce the cost to Durham taxpayers, how would you feel about having an advertising message printed on the Blue box lid?***

---

Of the 125 responses, 70% supported the idea of having an advertising message printed on the blue box lid. Only 18% suggested that advertising was a bad idea.



## SAMPLE AREA SPECIFIC SURVEY RESULTS

To determine the impact of the lid on specific housing types, specific survey questions were developed to compare before and after lid delivery. The following sections provide details on each of the sample areas and the results pre and post lid implementation for each area for the questions listed below.

- On a scale of 1 to 5, please rate your street with respect to litter. 5 = lots of litter (more than 5 pieces seen daily); 1 = no litter (rarely see litter)
- When do you usually put out your Blue Box for recycling? (Night before or Day of)
- On Windy days, do you make any changes to how you set out your Blue Boxes to stop material from flying away?
- If you only received one lid, which box did you put it on?
- How often do you use the blue box lid?
- Does the lid stop Blue Box Litter?
- How often do you use the Blue Box lid(s)?
- Would you recommend the lid to others?

### AREA 1 – SCUGOG (RURAL - LOW DENSITY, SEASONAL/COTTAGE)

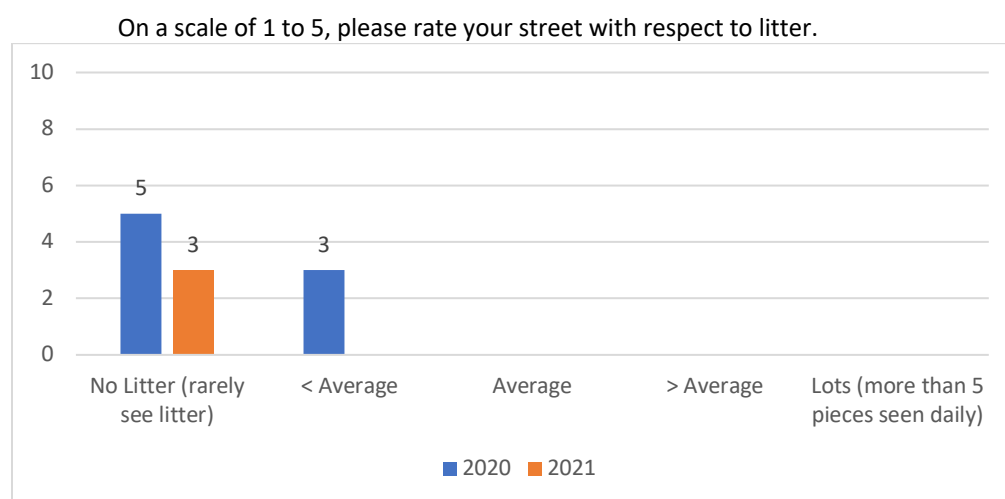
Located along a lake, these houses represent low density, rural, cottage country (some seasonal) single detached homes (Figure 5). Residents in this area are of mixed demographics.



*Figure 5: Area 1 - Scugog (Rural Seasonal/Cottage Housing)*

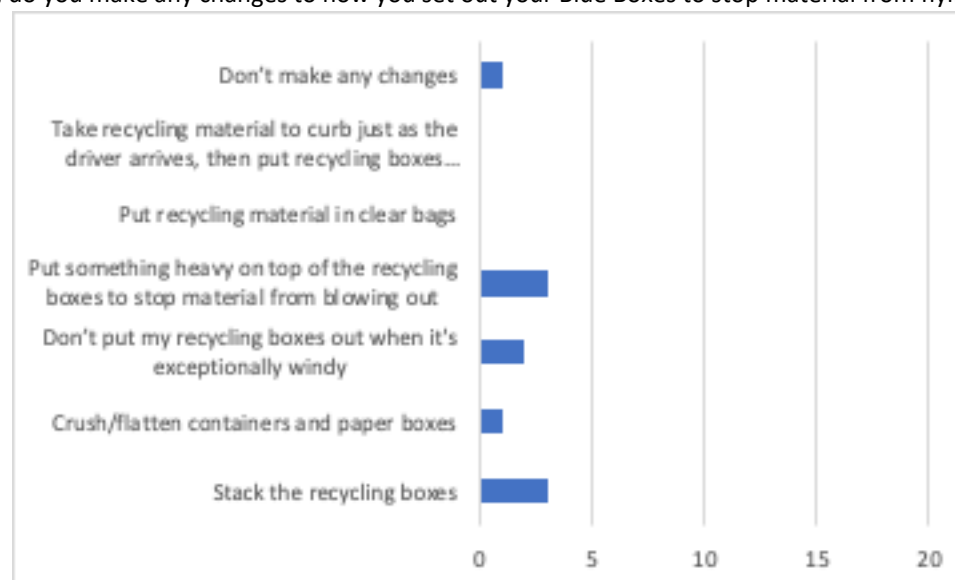
A total of 49 houses were provided with 1 new lid in late October 2020. The results of specific survey questions are provided below. Most residents put out blue boxes on the day of collection and take actions such as stacking boxes and putting something heavy on the recycling to prevent blue box litter.

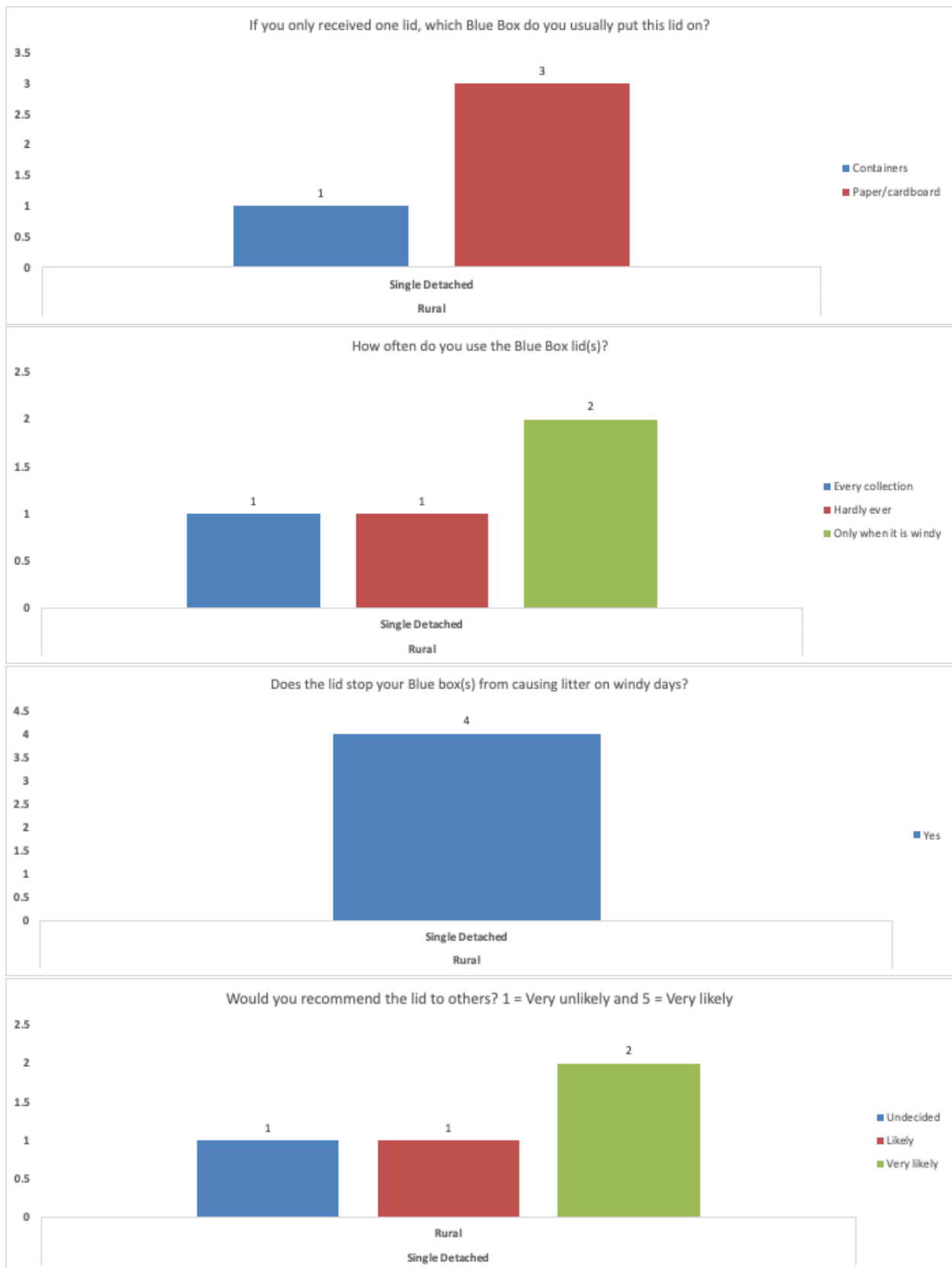
Out of 11 surveys (8 in 2020), most residents suggested that the area had less than average or no litter. In 2020, 25% of residents noticed recyclables blowing out of blue boxes and 38% reported that their blue boxes had tipped over on windy days. The 2021 survey suggested that they use the lid on the paper/cardboard box, generally on windy days, believe that the lid stops litter, and would recommend the lid to others.



When do you usually put out your recycling boxes for collection?		
Year	Night Before	Day of
2020	2 (25%)	6 (75%)
2021	2 (50%)	2 (50%)

On Windy days, do you make any changes to how you set out your Blue Boxes to stop material from flying away?





## AREA 2 – CLARINGTON (RURAL - LOW DENSITY - AGRICULTURAL)

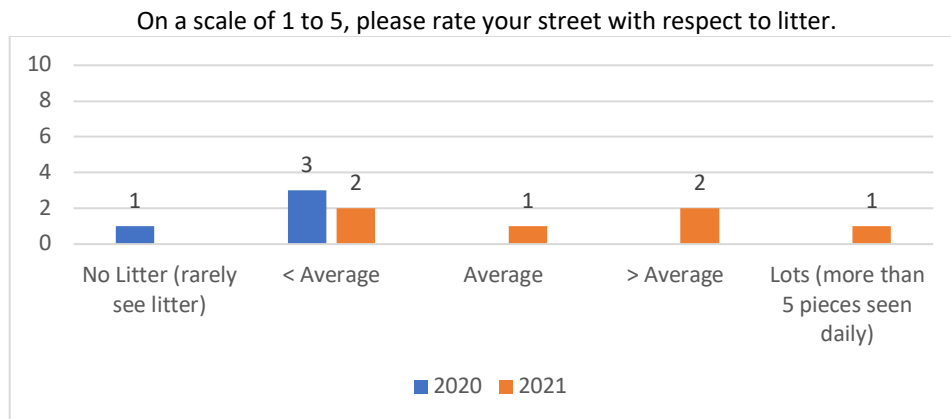
Located in a rural community with farms and large properties, these houses represented low density outside CMAs in agricultural areas with single family detached homes (*Figure 6*).



*Figure 6: Area 2 – Clarington (Low Density, Agricultural Houses)*

A total of 59 houses were provided with 1 new lid in late October 2020. The results of specific survey questions are provided below. Most residents put out blue boxes the night before collection and take actions such as stacking boxes or not putting out recycling on windy days to prevent blue box litter.

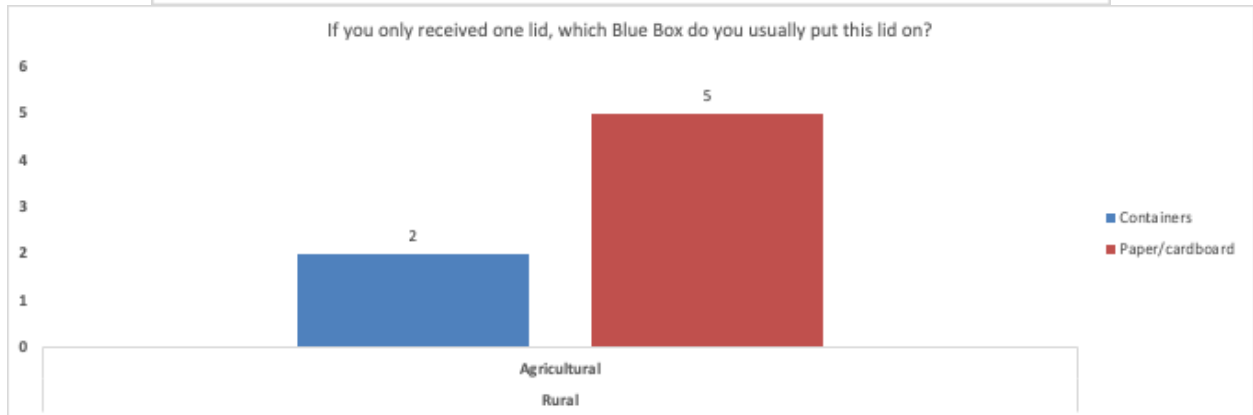
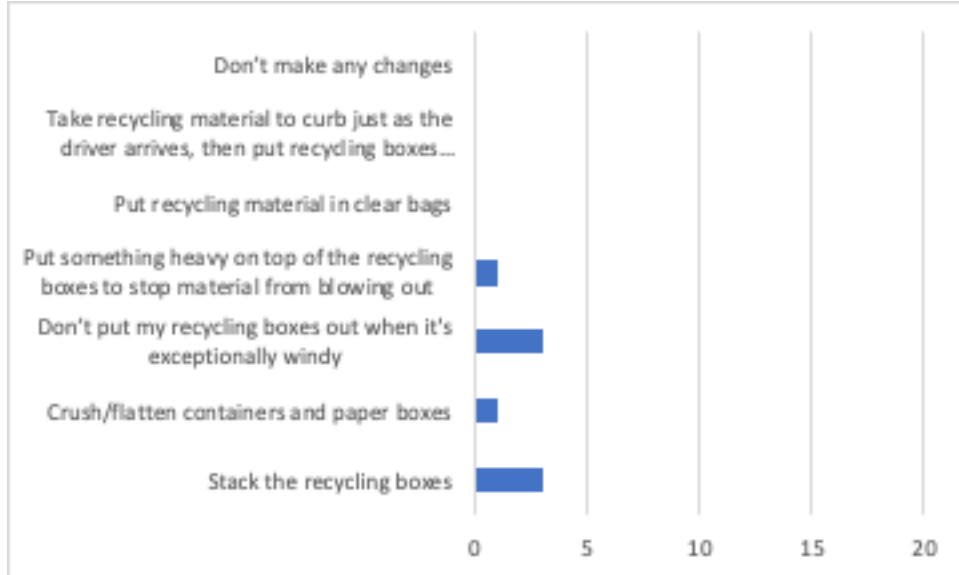
As seen in the results below, out of 10 surveys (4 in 2020), in 2020 most residents suggested less than average to no litter but more in 2021. In 2020, 75% of residents had noticed recyclables blowing out of blue boxes and 75% reported that their blue boxes had tipped over on windy days. The 2021 survey suggested that they put the lid on the paper/cardboard box, generally on windy days, believe that the lid stops litter, and would very likely recommend the lid to others.

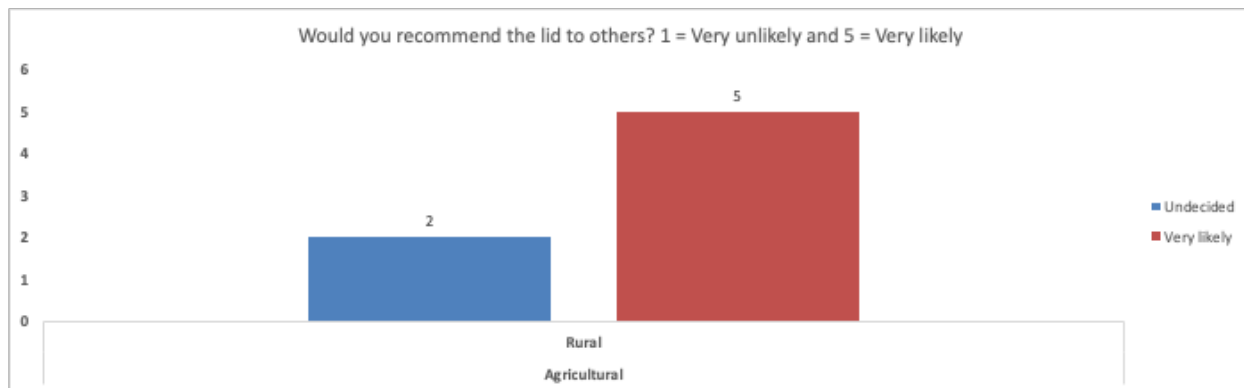
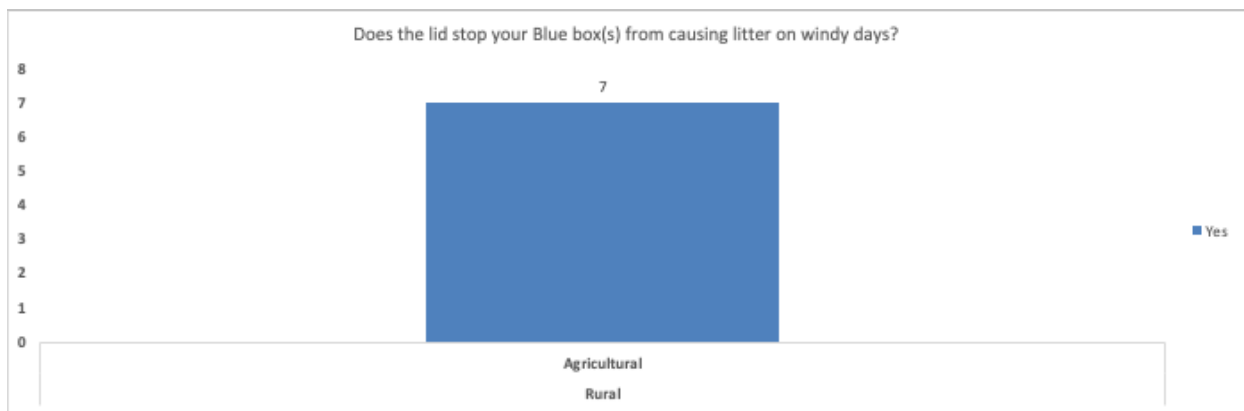
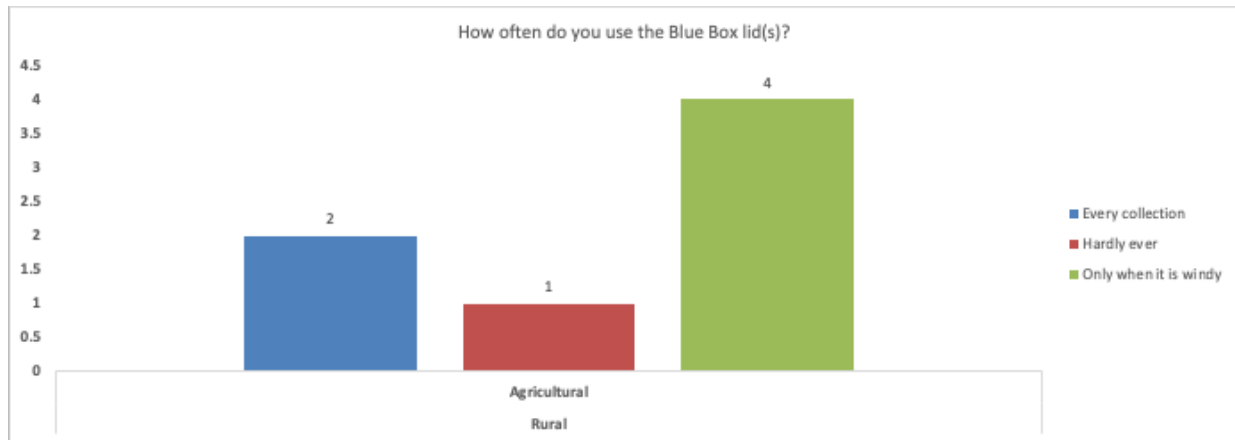


When do you usually put out your recycling boxes for collection?

Year	Night Before	Day of
2020	3 (75%)	1 (25%)
2021	5 (71%)	2 (29%)

On Windy days, do you make any changes to how you set out your Blue Boxes to stop material from flying away?





### AREA 3 – OSHAWA (SUBURBAN - MEDIUM DENSITY – PRE-1960S SINGLE DETACHED)

Located in Oshawa, these houses represented medium density, suburban detached homes build before the 1960s (Figure 7).

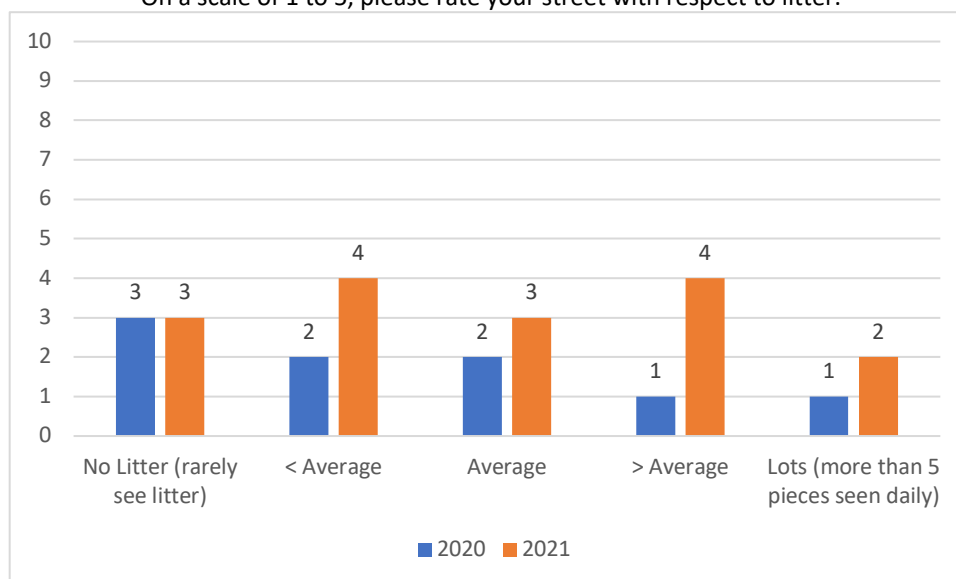


Figure 7: Area 3 – Oshawa (Medium Density, Suburban 1960s Homes)

A total of 119 houses were provided with 2 new lids in late October 2020. The results of specific survey questions are provided below. Most residents put out blue boxes the night before collection and take actions such as stacking boxes and crushing/flattening recycling to prevent blue box litter.

As seen in the results below, out of 25 surveys (9 in 2020), in 2020 most residents suggested less than average to no litter but more in 2021. In 2020, 78% of residents had noticed recyclables blowing out of blue boxes and 75% reported that their blue boxes had tipped over on windy days. The 2021 survey suggested that they put the lid on the containers box, for every collection, believe that the lid stops litter, and would very likely recommend the lid to others.

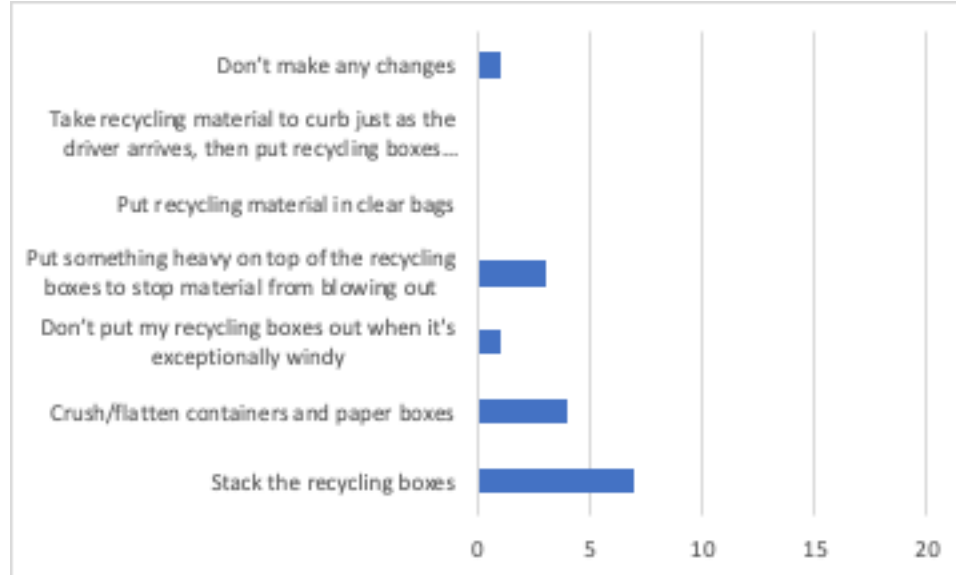
On a scale of 1 to 5, please rate your street with respect to litter.

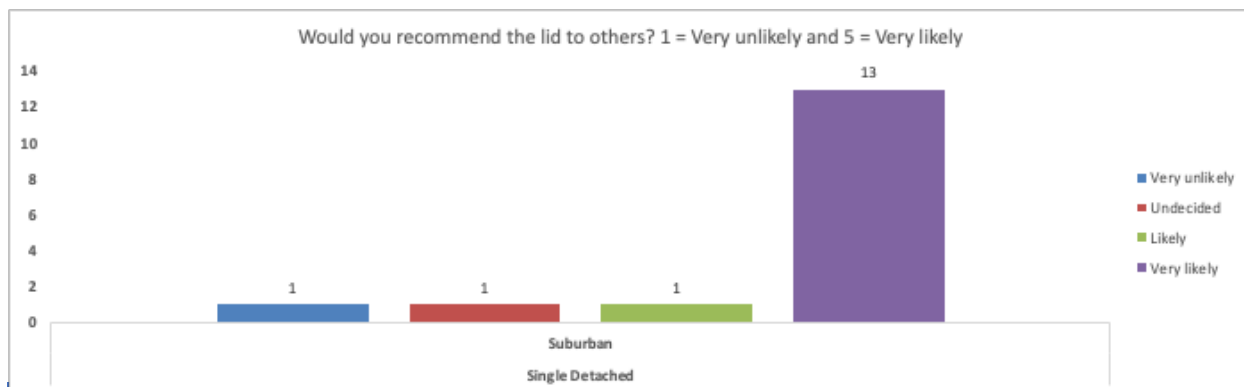
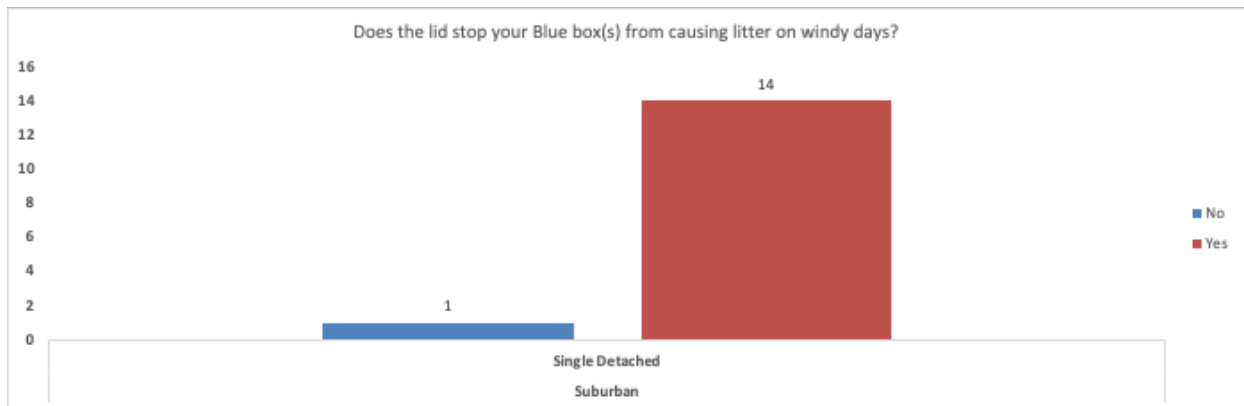
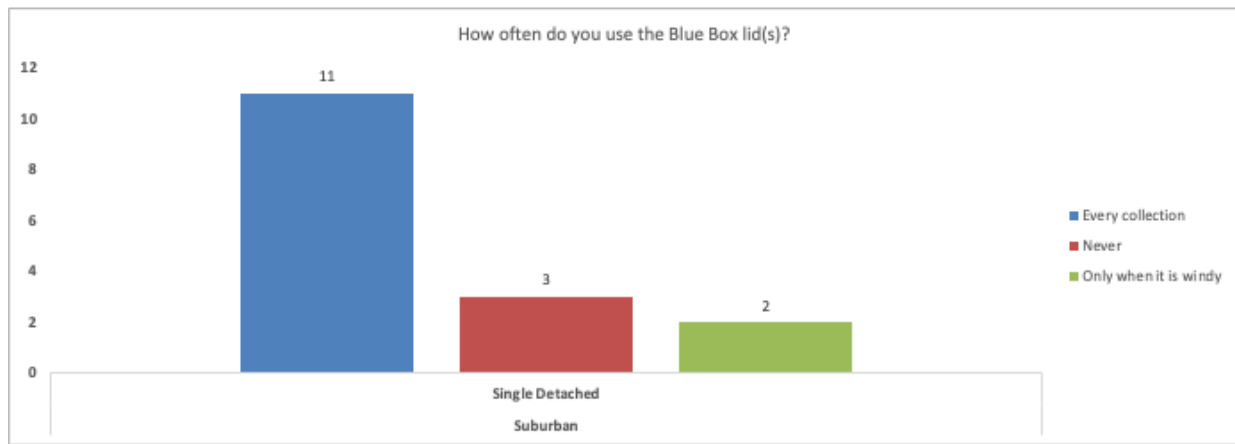
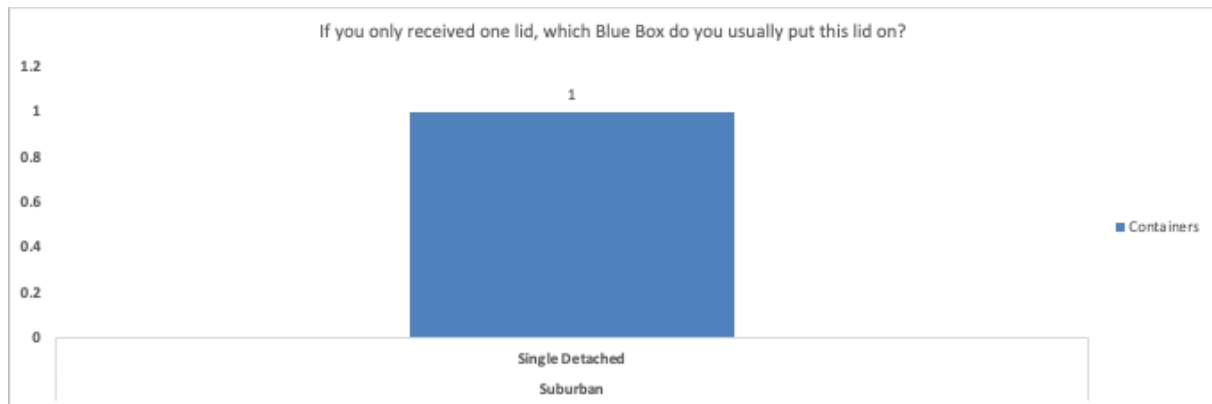


When do you usually put out your recycling boxes for collection?

Year	Night Before	Day of
2020	7 (78%)	2 (22%)
2021	14 (82%)	3 (18%)

On Windy days, do you make any changes to how you set out your Blue Boxes to stop material from flying away?





#### AREA 4 – OSHAWA (SUBURBAN - MEDIUM DENSITY – SINGLE DETACHED 1961-2000)

Located in Oshawa, these houses medium density suburban single family homes built between 1961-2000 single family detached dwellings with an established community (

*Figure 8).*

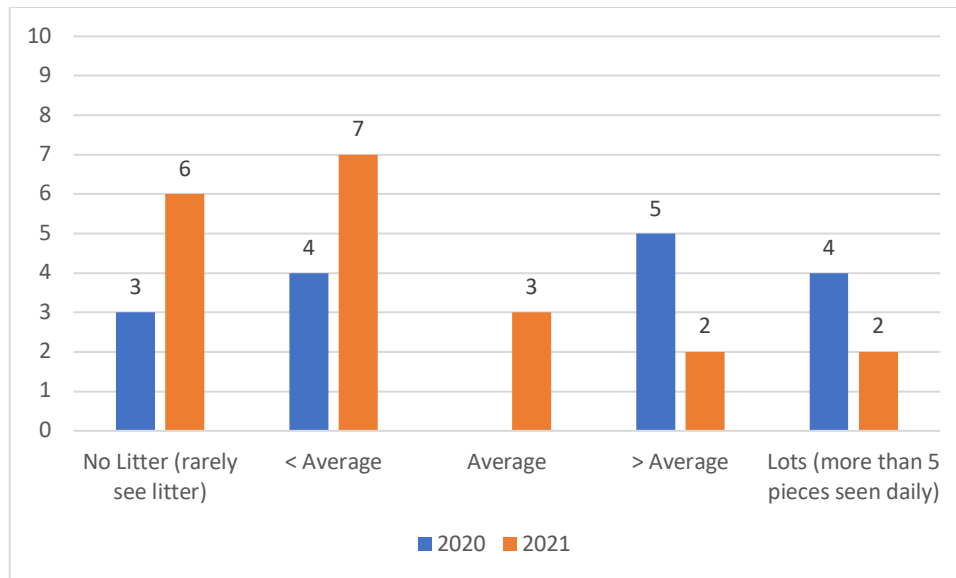


*Figure 8: Area 4 – Oshawa (Medium Density, Suburban)*

A total of 126 houses were provided with 2 new lids in late October 2020. The results of specific survey questions are provided below. Most residents put out blue boxes the before collection and take actions such as stacking boxes and crush/flattening recycling to prevent blue box litter.

As seen in the results below, out of 36 surveys (16 in 2020), in 2020 most residents perceived more litter but less in 2021. In 2020, 44% of residents had noticed recyclables blowing out of blue boxes and 46% reported that their blue boxes had tipped over on windy days. The 2021 survey suggested that they put the lid on blue boxes for every collection or when its windy, believe that the lid stops litter, and would very likely recommend the lid to others.

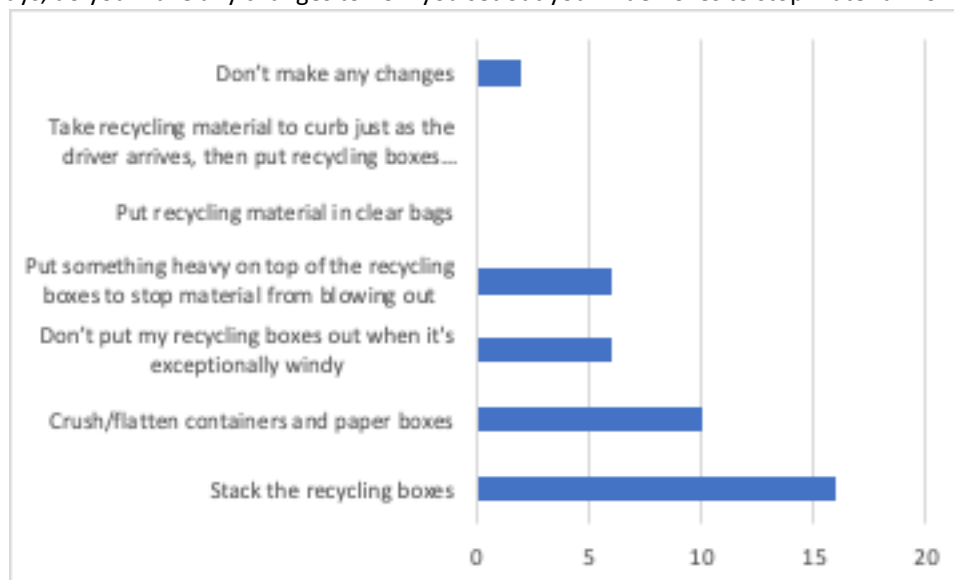
On a scale of 1 to 5, please rate your street with respect to litter

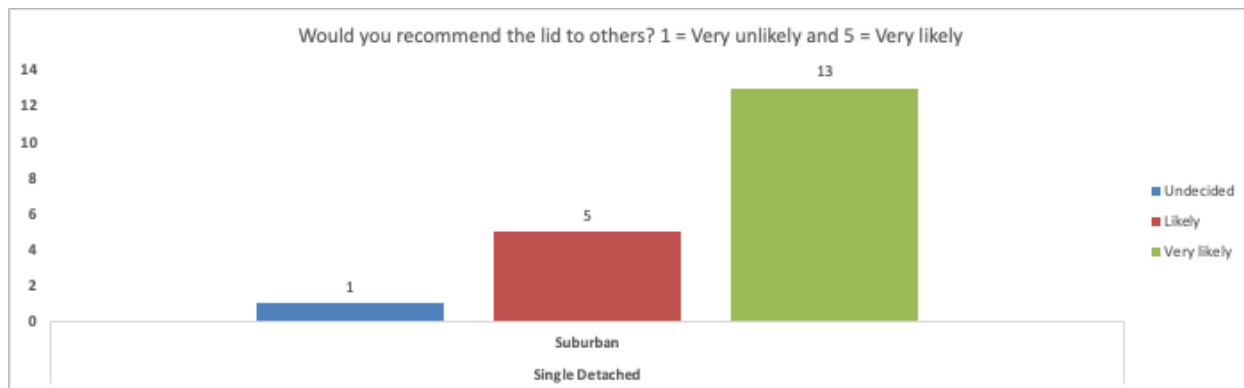
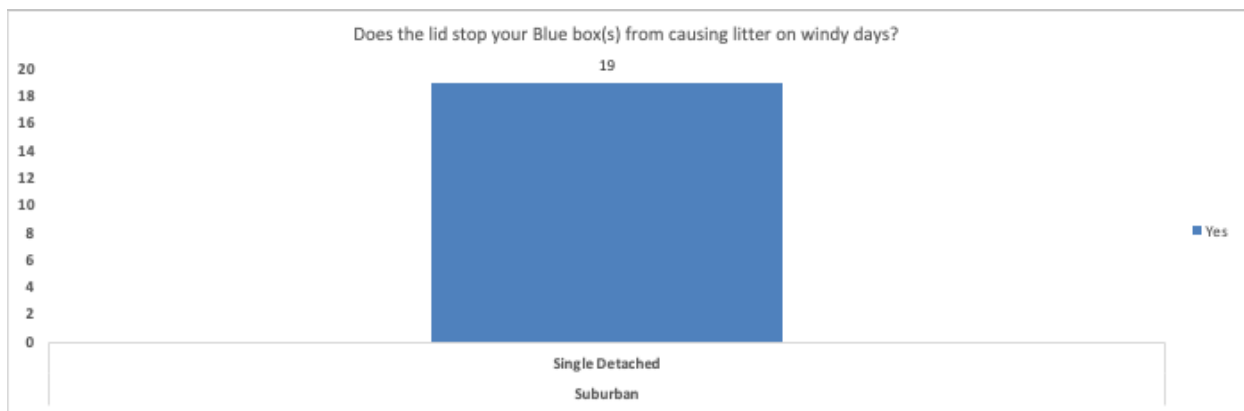
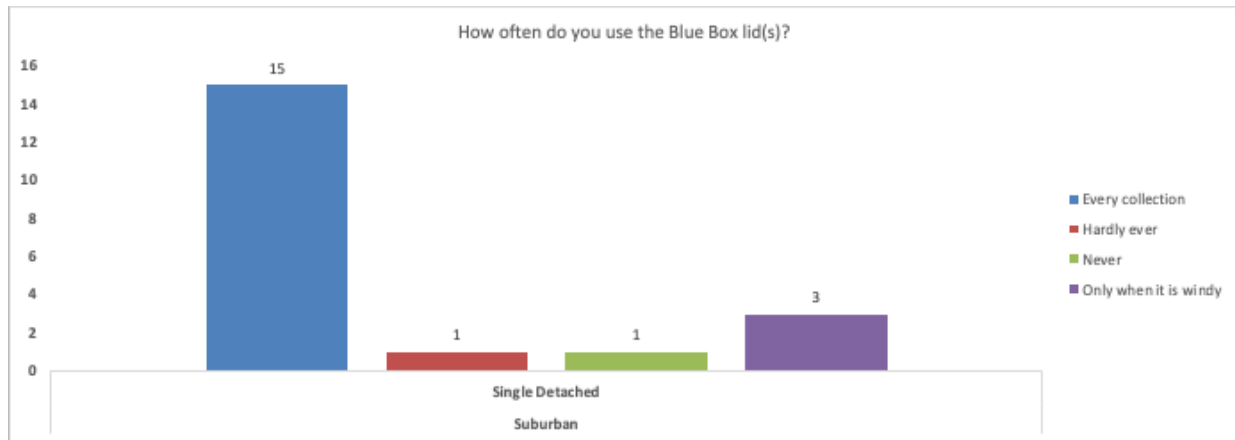


When do you usually put out your recycling boxes for collection?

Year	Night Before	Day of
2020	10 (60%)	6 (40%)
2021	12 (57%)	9 (43%)

On Windy days, do you make any changes to how you set out your Blue Boxes to stop material from flying away?





## AREA 5 – AJAX (SUBURBAN - MEDIUM DENSITY – SINGLE FAMILY 2000+)

Located in Ajax, these houses medium density suburban single family detached homes built after 2000 (*Figure 9*).



*Figure 9: Area 5 – Ajax (Medium Density, Suburban 2000+ Housing)*

A total of 191 houses were provided with 1 lid in 2019. The results of specific survey questions are provided below. Most residents put out blue boxes the night before collection and take actions such as stacking boxes and putting some heavy on the recycling to prevent blue box litter.

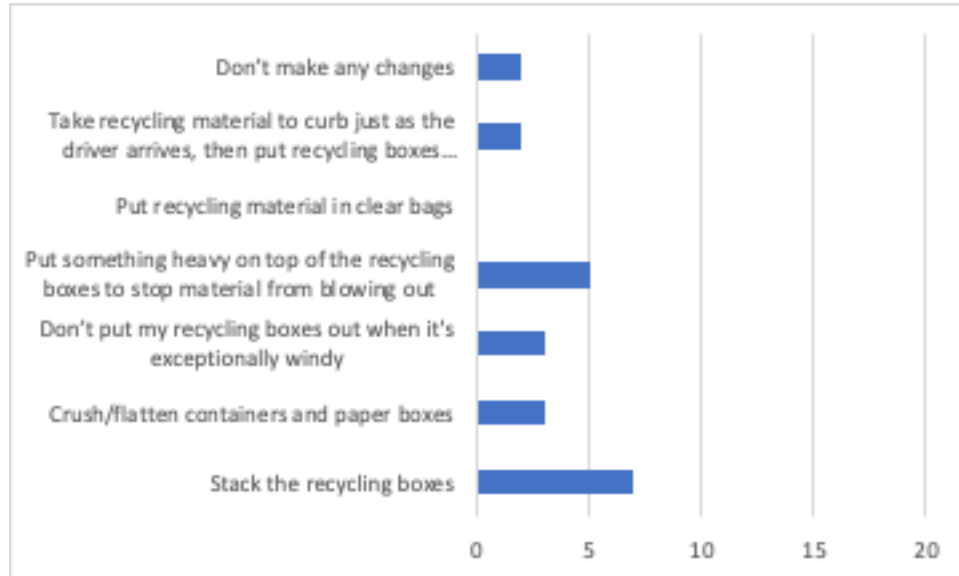
As seen in the results below, out of 23 surveys (7 in 2020), in 2020 and 2021 most residents perceived less than average litter in their neighbourhood. In 2020, 29% of residents had noticed recyclables blowing out of blue boxes and 29% reported that their blue boxes had tipped over on windy days. The 2021 survey suggested that they put the lid on the papers/cardboard box, for every collection, believe that the lid stops litter, and would very likely recommend the lid to others.

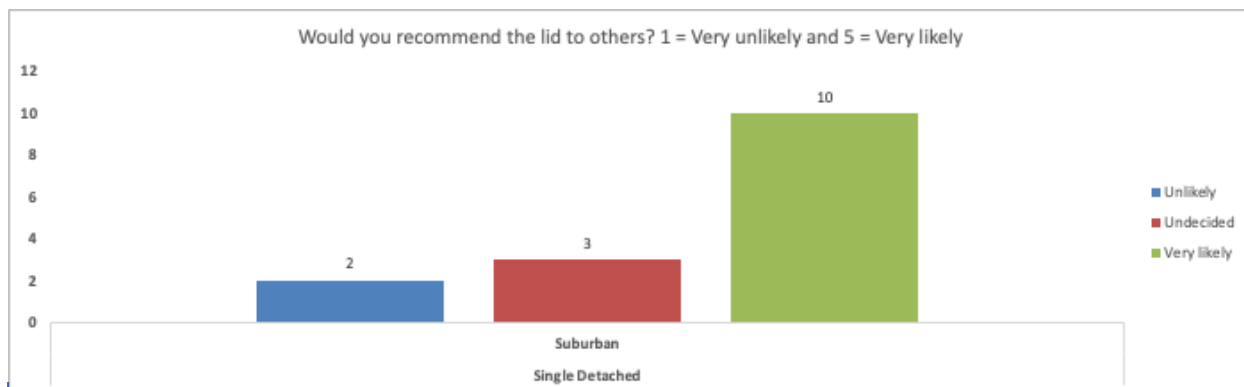
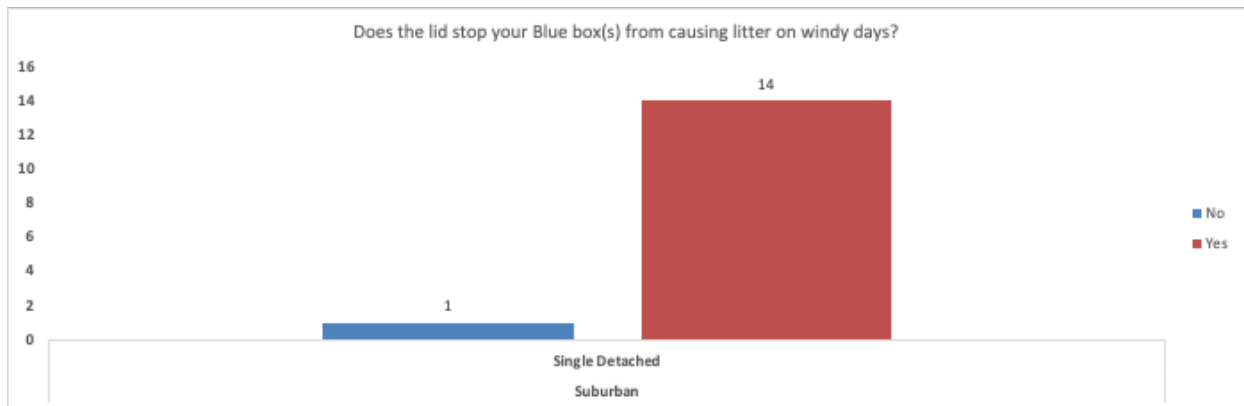
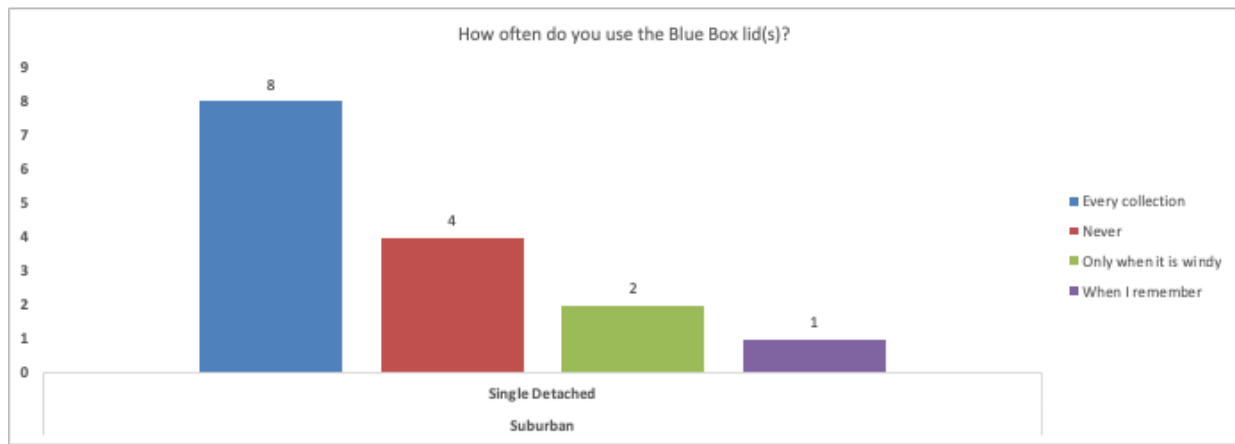
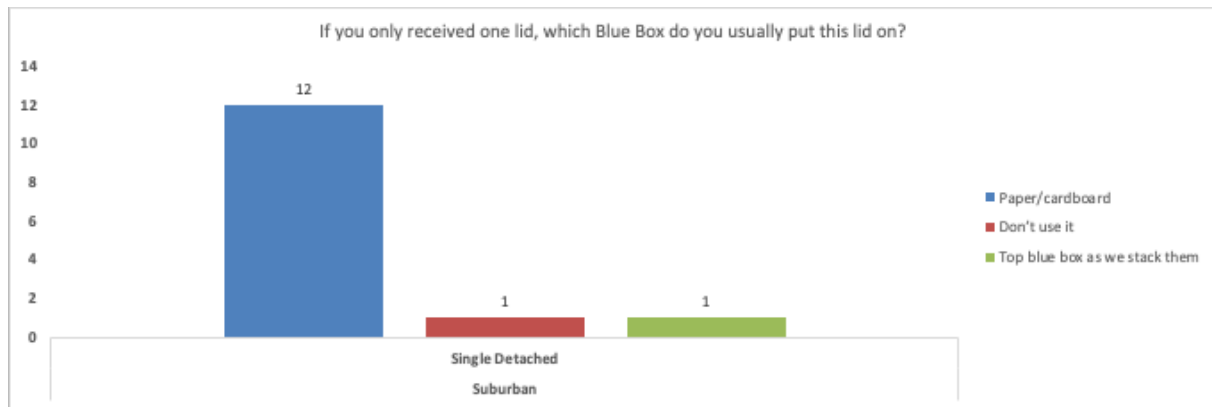


When do you usually put out your recycling boxes for collection?

Year	Night Before	Day of
2020	3 (43%)	4 (57%)
2021	12 (71%)	5 (39%)

On Windy days, do you make any changes to how you set out your Blue Boxes to stop material from flying away?





## AREA 6 – WHITBY (URBAN – DETACHED PRE-1960S HOUSES)

Located in Whitby, these are urban single family detached homes built before the 1960s in an established community (*Figure 10*).

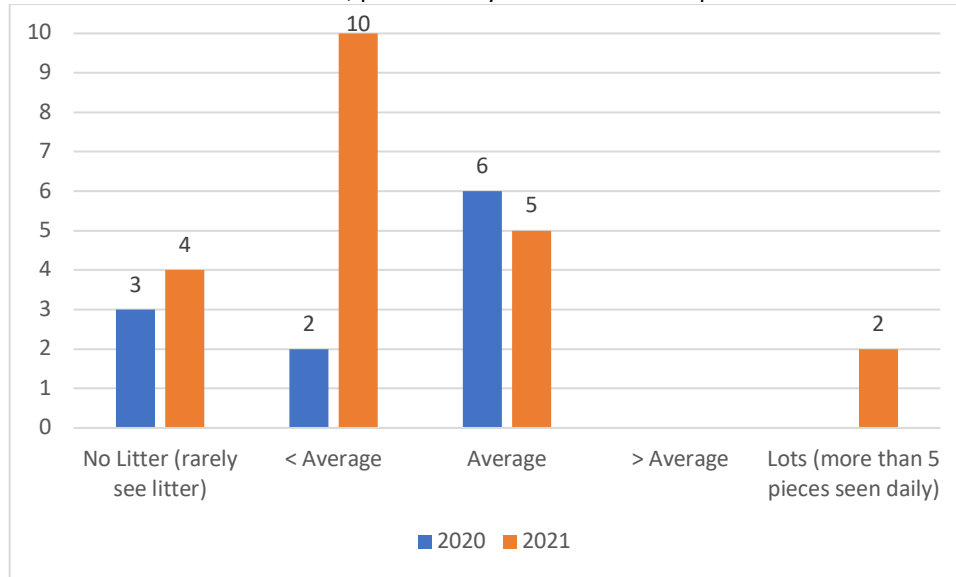


*Figure 10: Area 6 – Whitby (High Density, Urban pre-1960s Housing)*

A total of 126 houses were provided with 2 lids in October 2020. The results of specific survey questions are provided below. Most residents put out blue boxes the night before collection and take actions such as stacking boxes and crushing/flattening recycling to prevent blue box litter.

As seen in the results below, out of 32 surveys (11 in 2020), in 2020 and 2021 most residents perceived less than average litter in their neighbourhood. In 2020, 27% of residents had noticed recyclables blowing out of blue boxes and 29% reported that their blue boxes had tipped over on windy days. The 2021 survey suggested that they put the lid on the papers/cardboard box, for every collection or on windy days, believe that the lid stops litter, and would likely recommend the lid to others.

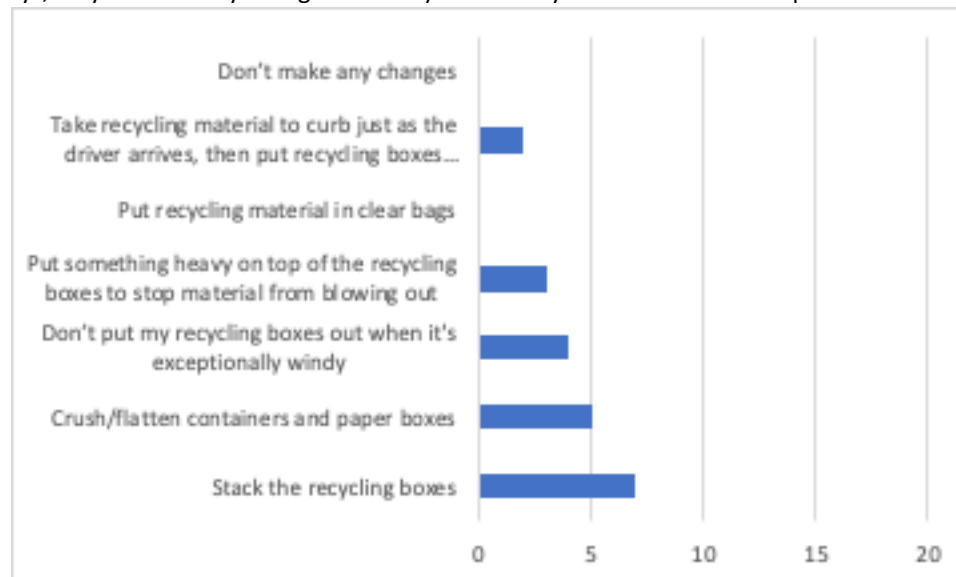
On a scale of 1 to 5, please rate your street with respect to litter.

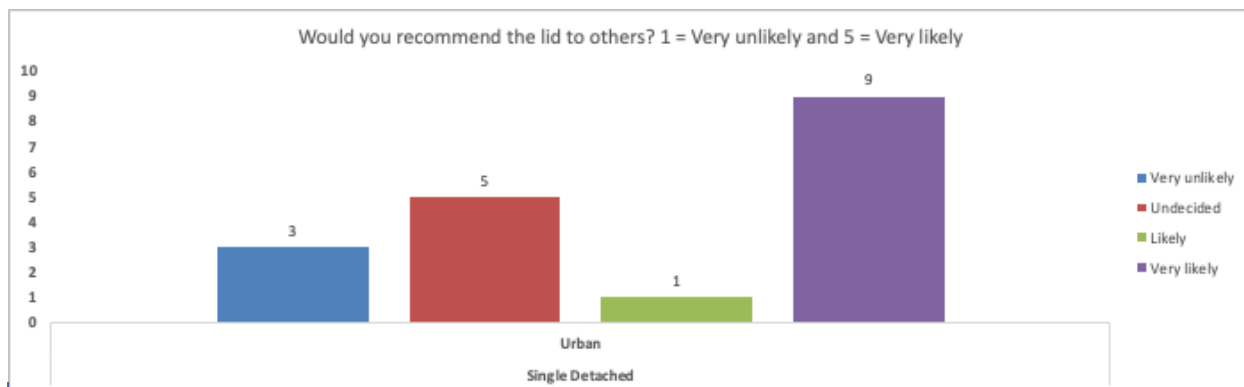
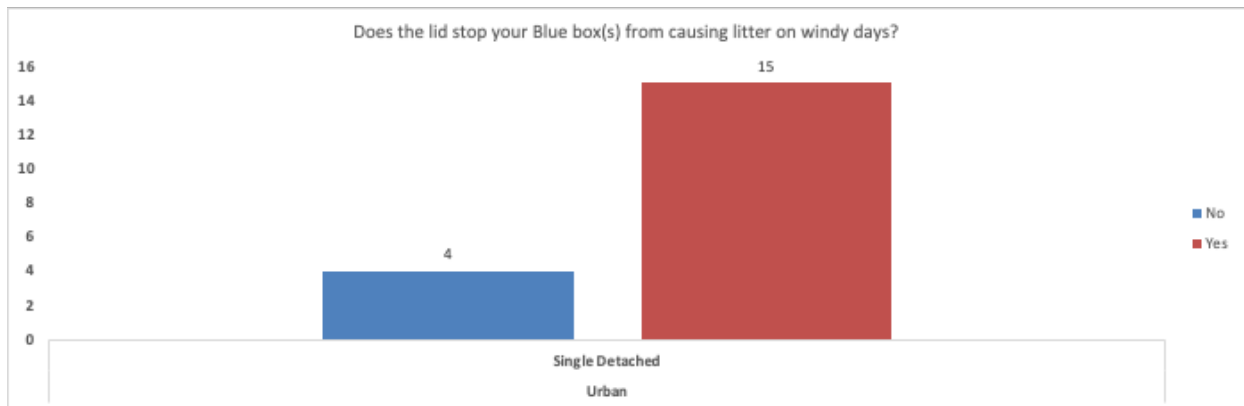
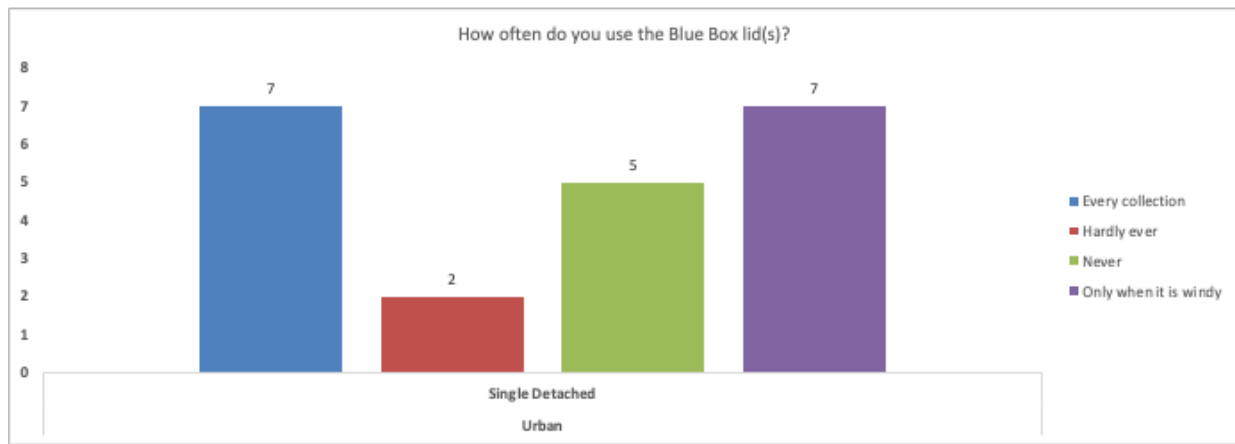
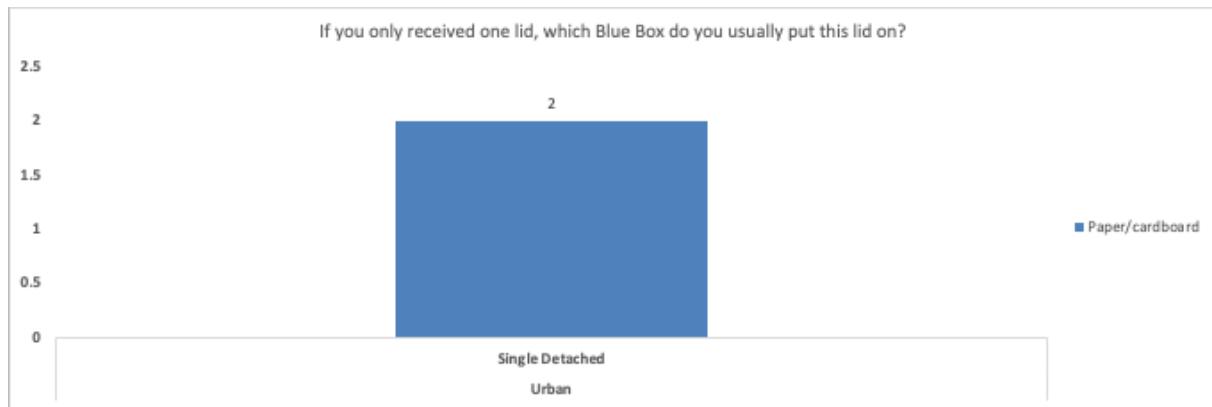


When do you usually put out your recycling boxes for collection?

Year	Night Before	Day of
2020	5 (45%)	6 (55%)
2021	16 (78%)	6 (32%)

On Windy days, do you make any changes to how you set out your Blue Boxes to stop material from flying away?





## AREA 7 – PICKERING (URBAN - DETACHED - 2000 HOMES)

Located in Pickering, these are urban single family detached homes built around the year 2000 (*Figure 11*).



*Figure 11: Area 7 – Pickering (Urban 2000s Housing)*

A total of 105 houses were provided with 2 lids in October 2020. The results of specific survey questions are provided below. Most residents put out blue boxes on the day of collection and take actions such as stacking boxes and crush/flatten recycling to prevent blue box litter.

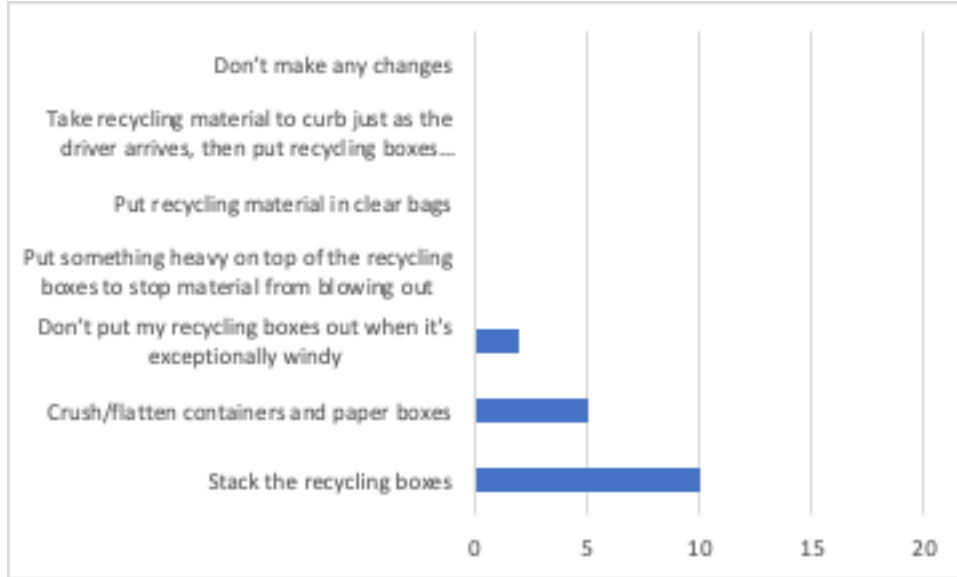
As seen in the results below, out of 29 surveys (13 in 2020), in 2020 and 2021 most residents perceived average or less than average litter in their neighbourhood. In 2020, 27% of residents had ever noticed recyclables blowing out of blue boxes and 55% reported that their blue boxes had tipped over on windy days. The 2021 survey suggested that they use the lid on either box, those that use the lid do so for every collection or when it is windy, believe that the lid stops litter, and would very likely recommend the lid to others.

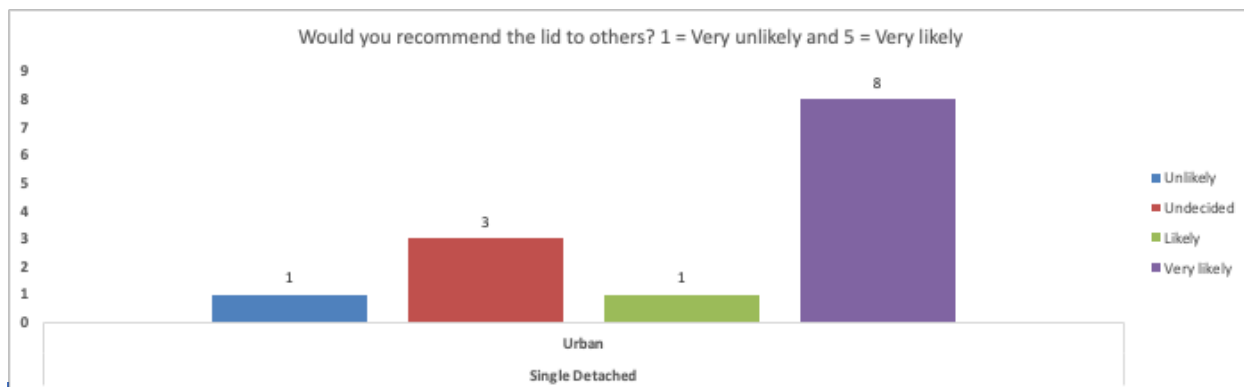
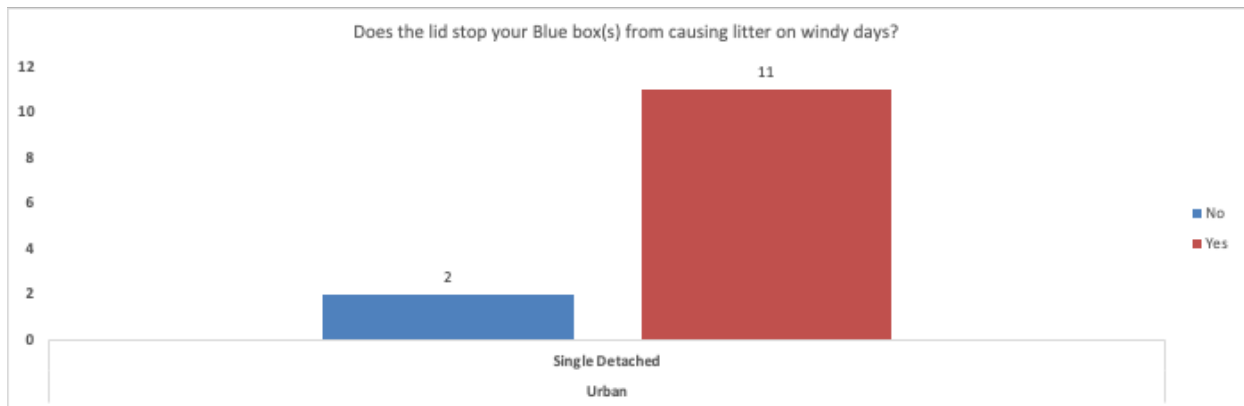
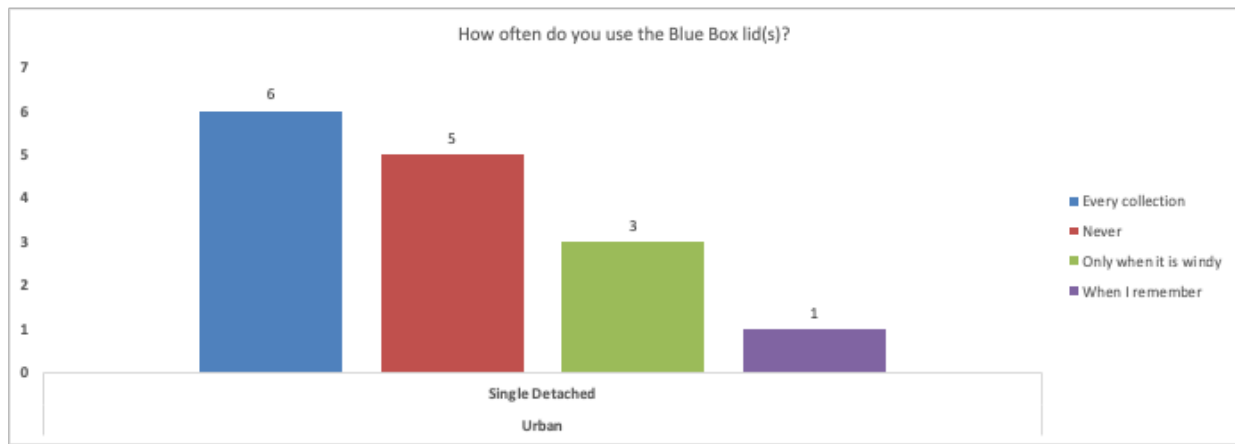
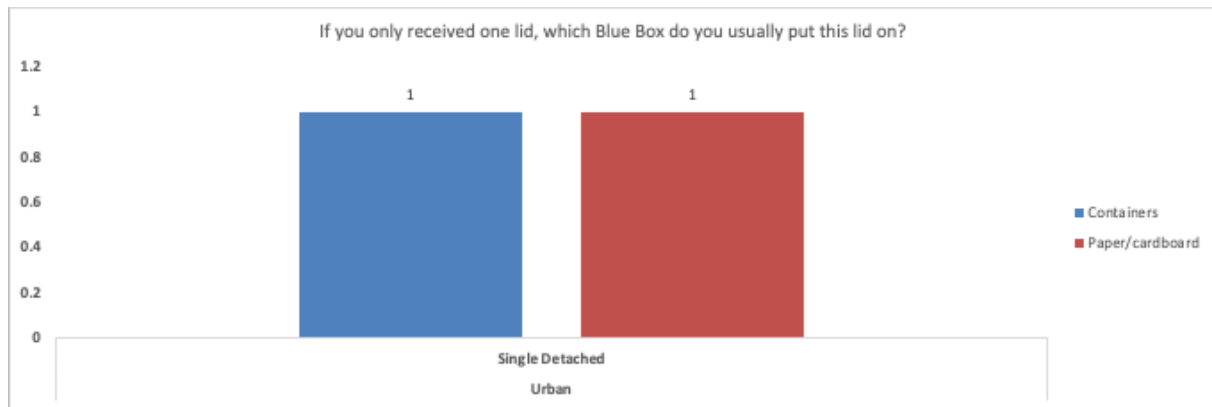


When do you usually put out your recycling boxes for collection?

Year	Night Before	Day of
2020	0 (0%)	13 (100%)
2021	3 (19%)	13 (81%)

On Windy days, do you make any changes to how you set out your Blue Boxes to stop material from flying away?





## AREA 8 – WHITBY (URBAN – SINGLE FAMILY - 2000+)

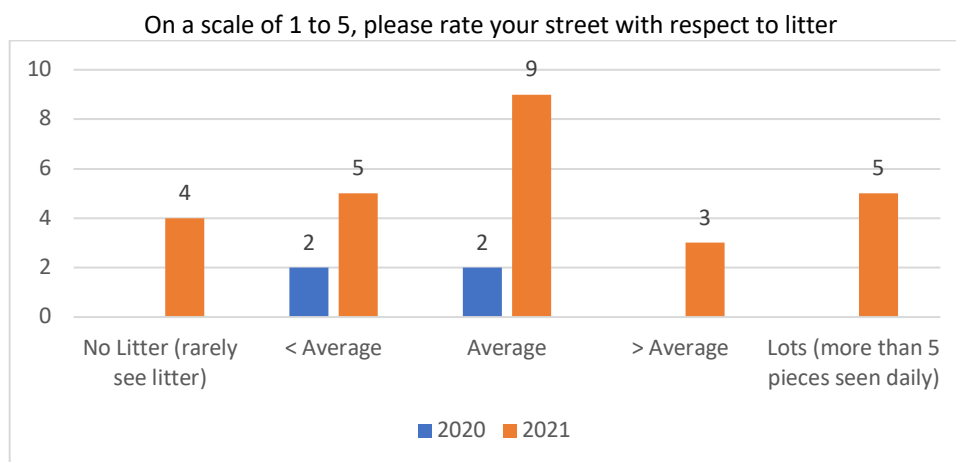
Located in Whitby, these are urban single family detached homes built after the year 2000 (*Figure 12*).



*Figure 12: Area 8 – Whitby (High Density, Urban 2000+ Housing)*

A total of 122 houses were provided with 1 lid in 2019. The results of specific survey questions are provided below. Most residents put out blue boxes on the day of collection and take actions such as stacking boxes and crushing/flattening recycling to prevent blue box litter.

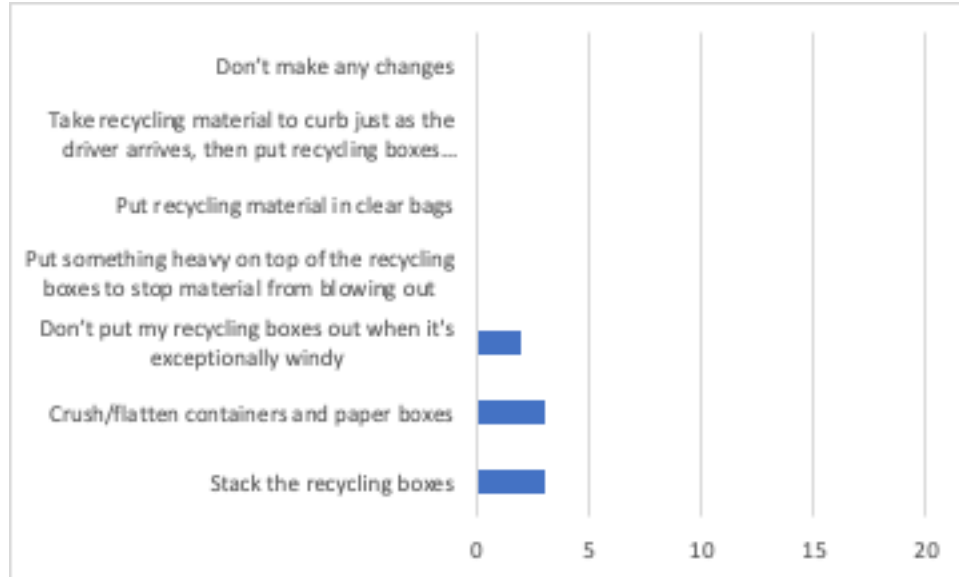
As seen in the results below, out of 30 surveys (4 in 2020), in 2021 most residents perceived average or more than average litter in their neighbourhood. In 2020, no residents had ever noticed recyclables blowing out of blue boxes and 62% reported that their blue boxes had tipped over on windy days. The 2021 survey suggested that they put the lid on the papers/cardboard box, for every collection or when its windy, believe that the lid stops litter, and would very likely recommend the lid to others.

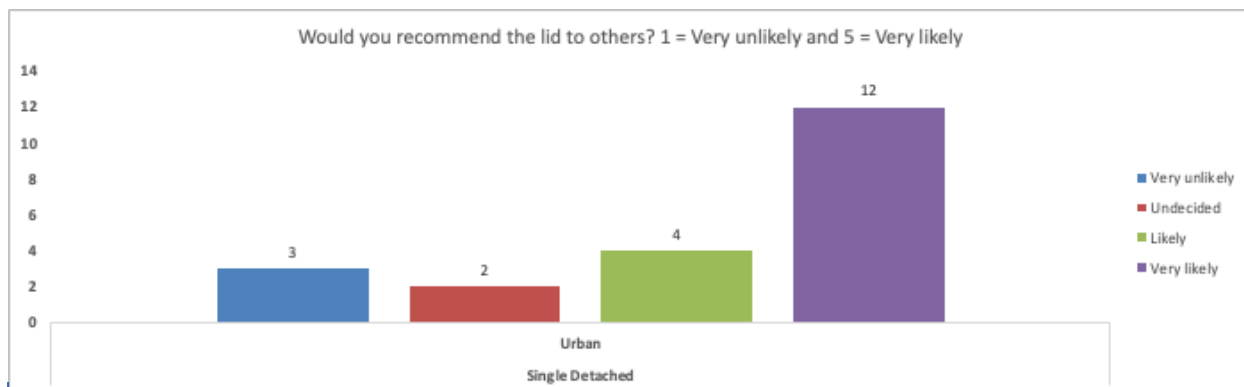
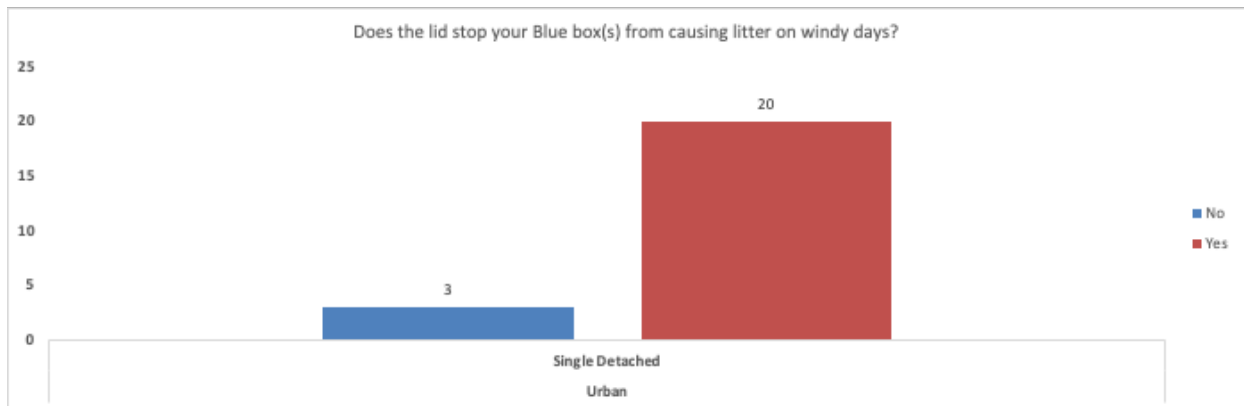
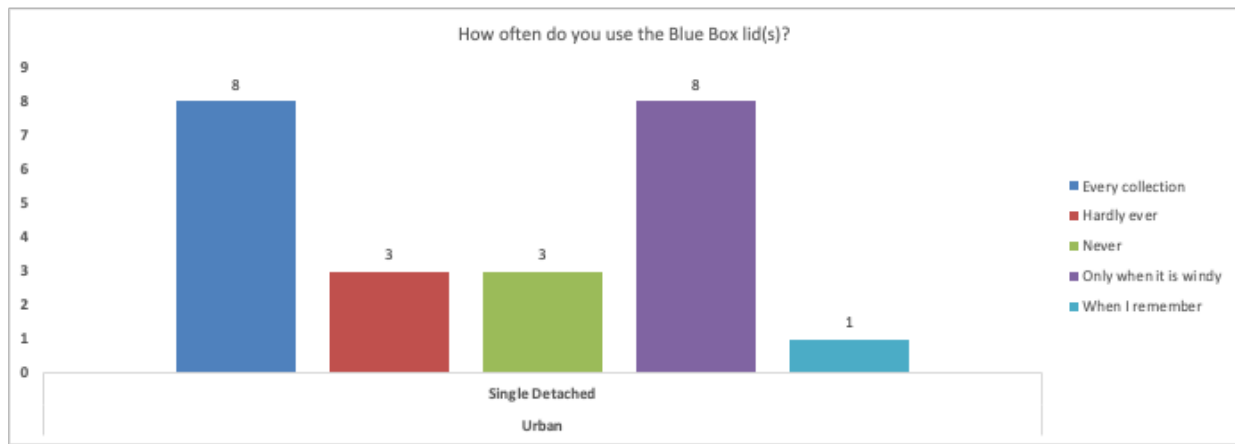
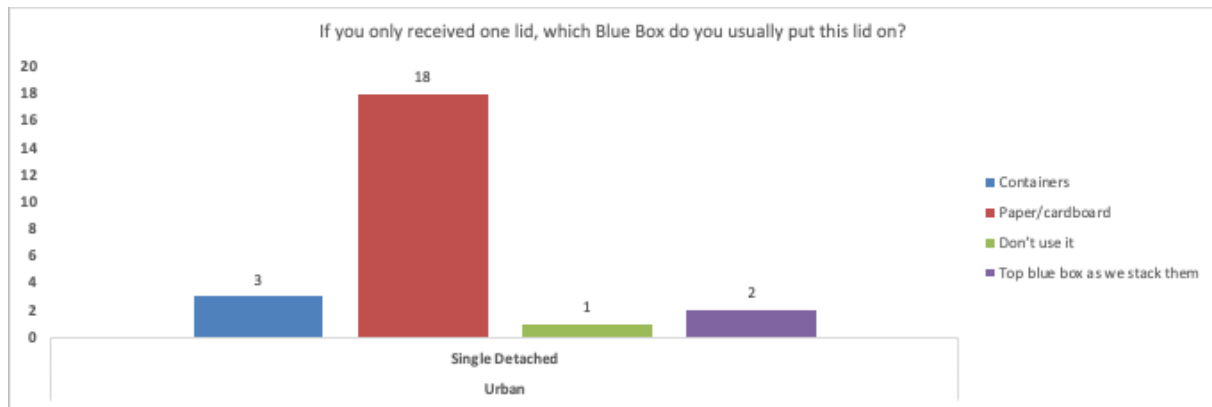


When do you usually put out your recycling boxes for collection?

Year	Night Before	Day of
2020	1 (25%)	3 (75%)
2021	10 (38%)	16 (62%)

On Windy days, do you make any changes to how you set out your Blue Boxes to stop material from flying away?





## AREA 9 – AJAX (SUBURBAN - MULTI-RESIDENTIAL - SEMI-DETACHED CONDO)

Located in Ajax, these are semi-detached condominiums homes (*Figure 13*).

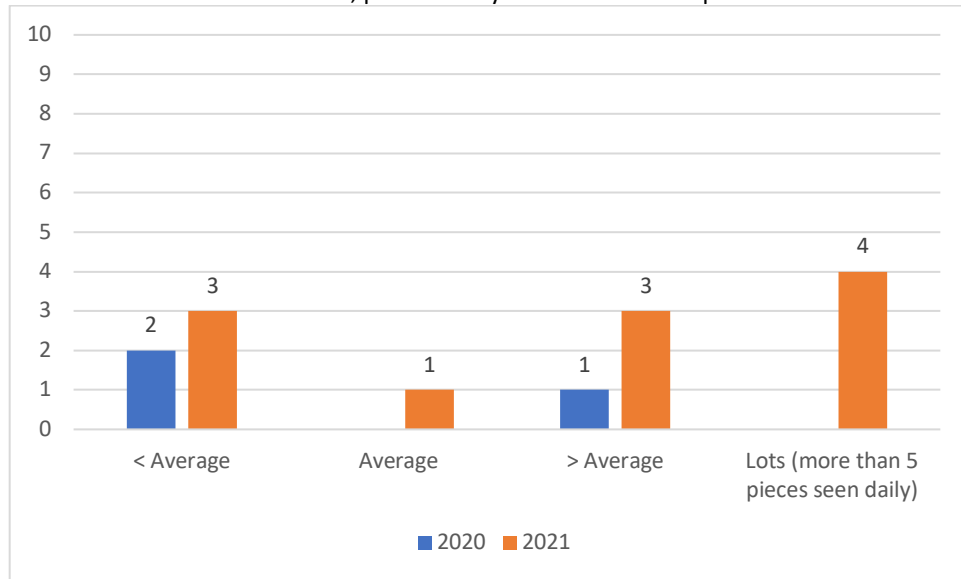


*Figure 13: Area 9 – Ajax (High Density, Suburban Semi-detached Multi-Residential Housing)*

A total of 61 houses were provided with 1 lid in 2019. This area was not included in the original pilot, so no survey information was gathered from 2019. The results of specific survey questions from 2020/21 are provided below. Most residents put out blue boxes on the day of collection and take a variety of actions to prevent blue box litter.

As seen in the results below, out of 14 surveys (3 in 2020), in 2021 most residents perceived greater than average litter in their neighbourhood. In 2020, 67% of residents had seen recyclables blowing out of their blue boxes and 25% of resident blue boxes had tipped over during windy days. The 2021 survey suggested that they put the lid on the papers/containers box, for every collection or when it is windy, believe that the lid stops litter, and residents are either undecided or very likely to recommend the lid to others.

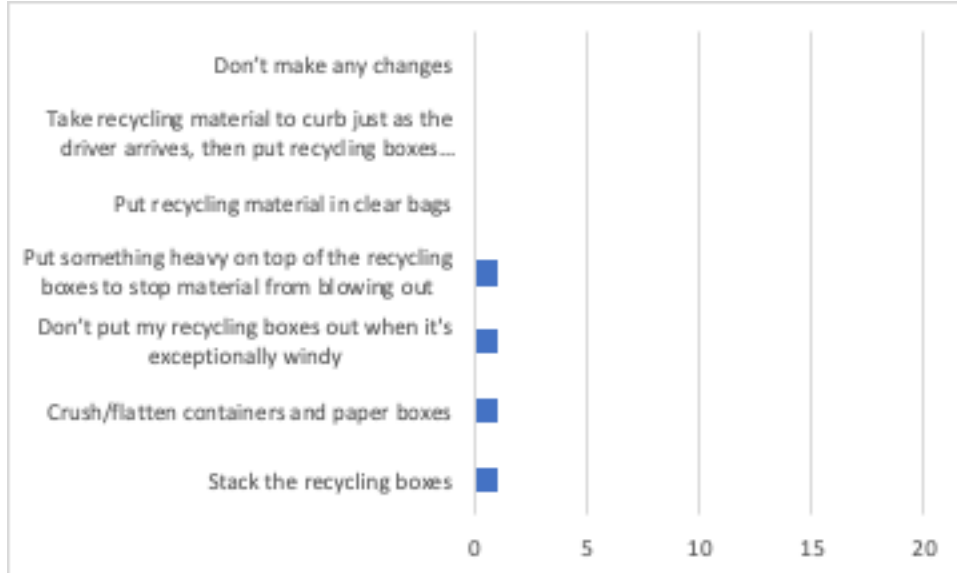
On a scale of 1 to 5, please rate your street with respect to litter

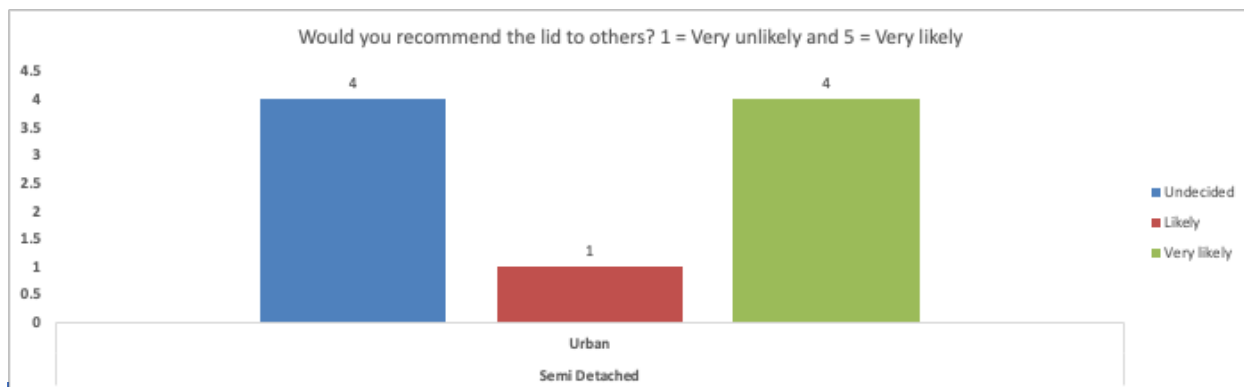
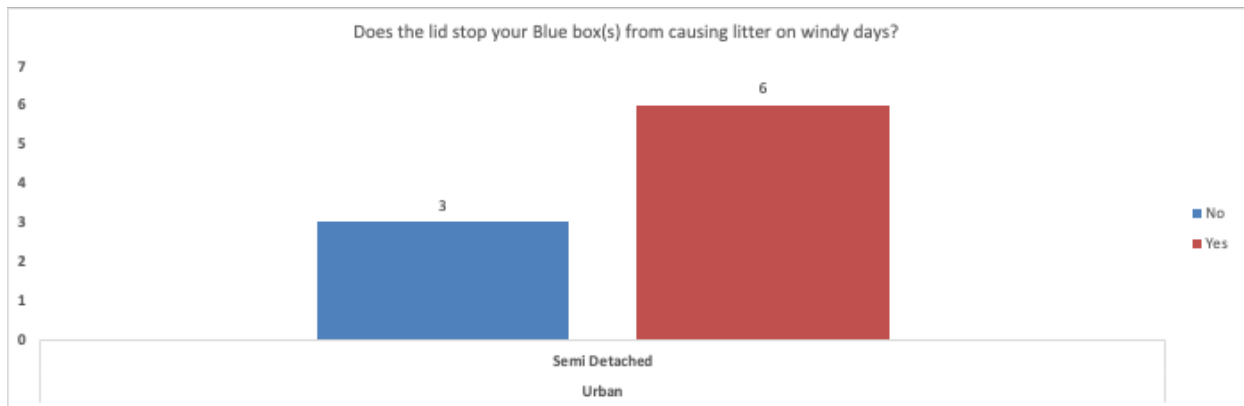
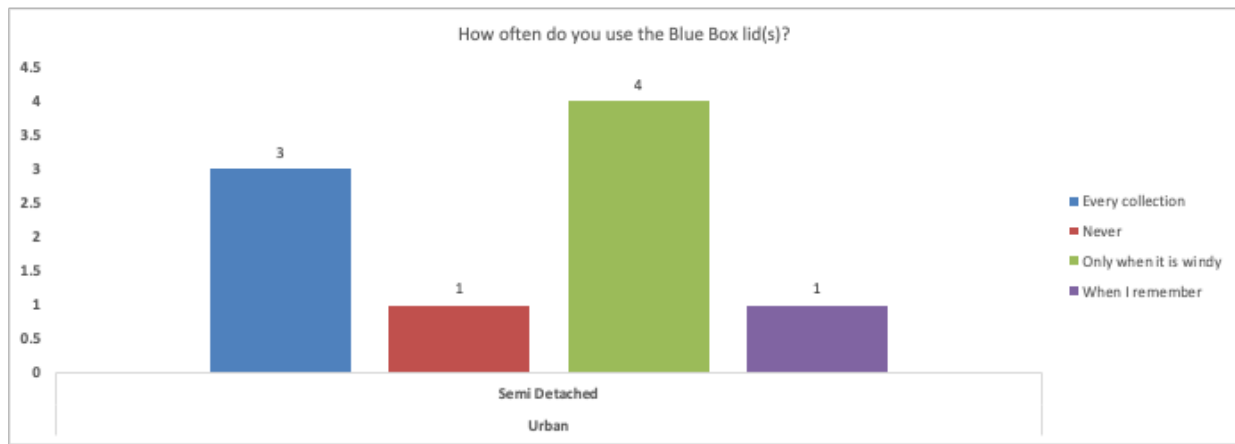
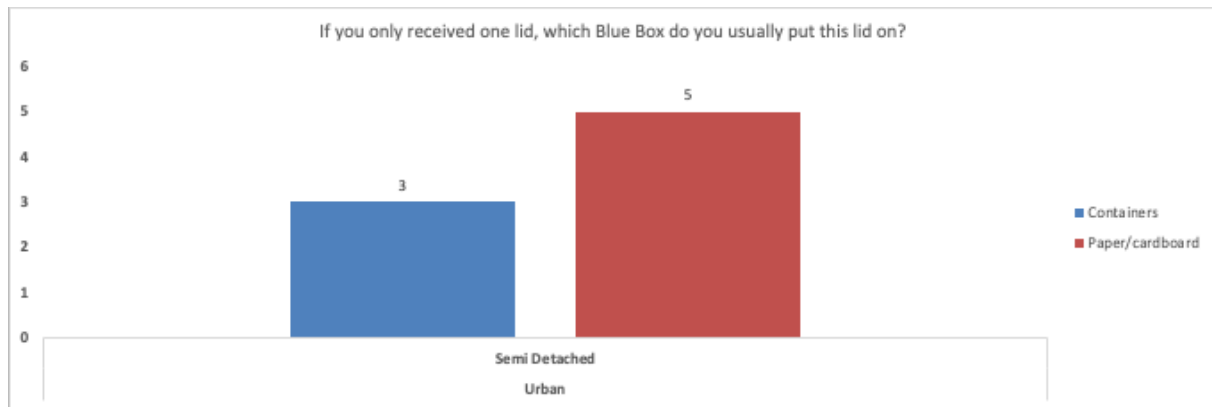


When do you usually put out your recycling boxes for collection?

Year	Night Before	Day of
2020	0 (0%)	3 (100%)
2021	0 (0%)	12 (100%)

On Windy days, do you make any changes to how you set out your Blue Boxes to stop material from flying away?





## AREA 10 – WHITBY (URBAN - MULTI-RESIDENTIAL – ROW HOUSING)

Located in Whitby, these are multi-residential row house (*Figure 14*).



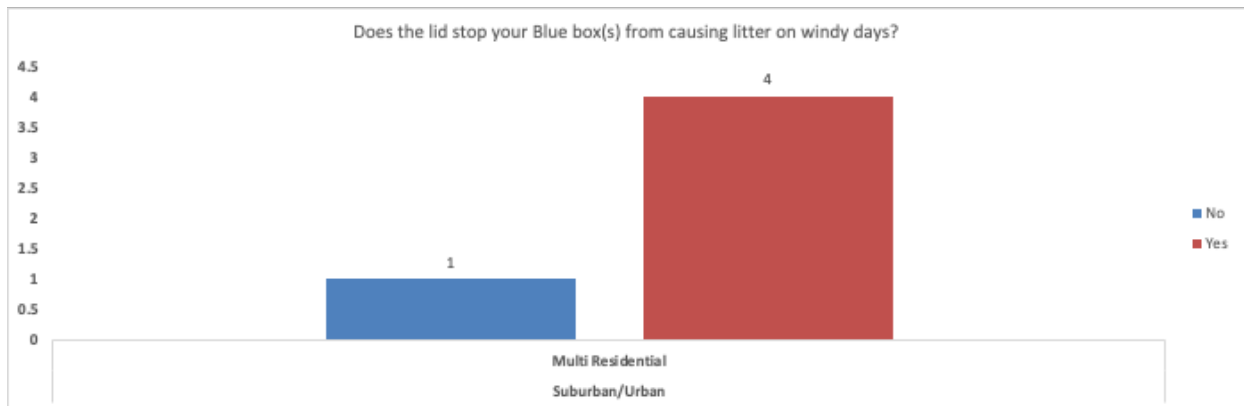
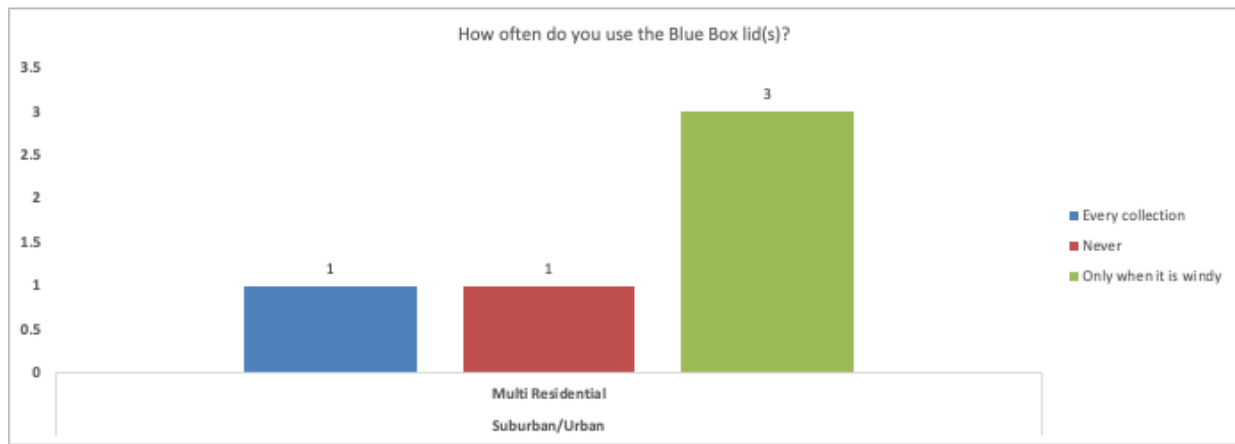
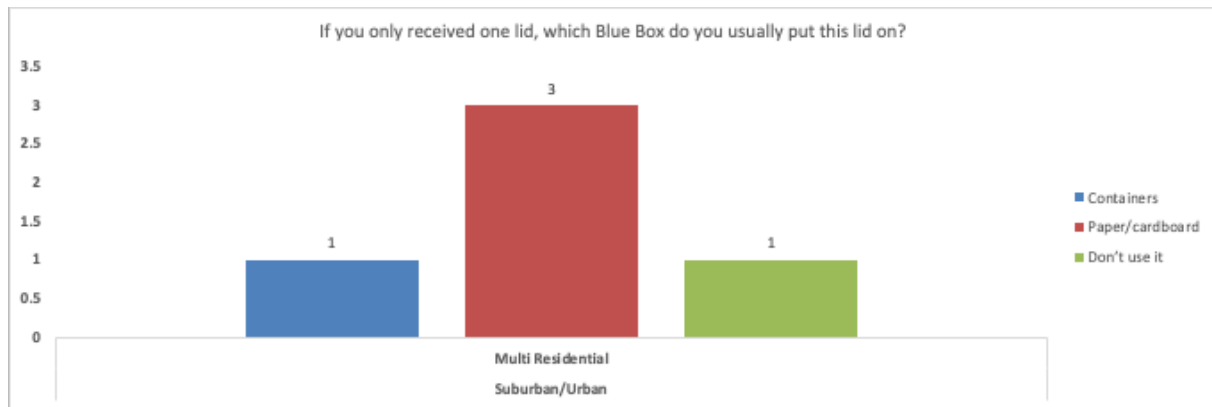
*Figure 14: Area 10 – Whitby (Urban High Density – Multi-Residential Row Housing) – Photo credit: Google*

A total of 31 houses were provided with 1 lid in 2019. No submissions were received from this area in the October 2020 survey. The results of the 2021 specific survey questions are provided below. Most residents put out blue boxes the night before collection. The 2021 survey suggested that they put the lid on the papers/cardboard box, only when it's windy, believe that the lid stops litter, and would very likely recommend the lid to others.



When do you usually put out your recycling boxes for collection?

Year	Night Before	Day of
2021	4 (75%)	2 (25%)



## SUMMARY OF FINDINGS

Based on the surveys conducted and the complaint data provided by the Region, residents from both “old lid areas” and “new lid areas” are aware that litter in residential areas is a problem, are open to learning more through education programs and are willing to do their part to help reduce litter.



*Figure 15: Blue box with lid attached*

Residents that had received lids in 2019 found them easy to use, observed that less recycling material blows out, and would recommend that the Region make lids available to all residents. Residents that received lids in Oct 2020 also found the lids easy to use and noticed that the lid prevents material from blowing out on windy days. The residents are also likely to recommend the lid be made available to other residents within the Region of Durham to reduce overall litter. They have also stated that it would be a good idea for the Region to consider advertising on the lids to help reduce costs to taxpayers.

Based on the survey results and feedback from residents the following recommendations can be made:

- Make lids available to all residents who choose to use them. This may also mean replacing old style boxes as the lids do not fit all shapes; and providing more than one for those with 2 or more boxes set out per week. An opt-in plan for the lids may be the most cost-effective approach so as not to be delivering lids to residents who will not participate.
- Provide education and awareness to residents on the lid program and “tips and tricks” on how to use them, but also provide information on alternatives to reduce windblown litter for those who choose not to opt-in to the lid program, such as: putting boxes out the morning of collection, stacking boxes, placing paper under heavier items etc.
- To further reduce potential litter and to ensure success for any residents using lids, an education program with on-going reminders is needed for the recycling drivers/contractor. This would include reminders about box placement after emptying, picking up materials that spill, not driving distances with material in hoppers etc.

## APPENDIX

### Appendix A: Residential Survey

#### Survey Questions

The following questions were asked in the residential surveys conducted in May 2019, Oct 2020 and April 2021. Questions in black were asked in all 3 surveys, questions in blue were asked only in May 2019, questions in orange were asked only in Oct 2020 and questions in green were asked only in April 2021.

1. Please provide your postal code
2. On a scale of 1 to 5, please rate your street with respect to litter. 1 = lots of litter (more than 5 pieces seen daily); 5 = no litter (rarely see litter)
3. Durham Region supplies residents with two recycling Blue Boxes: one for containers and the other for paper/cardboard. Does your household have two Blue Boxes that are used for recycling?
4. When you put out your Blue Boxes for collection, are they usually full?
5. Do you put your Blue Boxes out for collection every week or only when they are full?
6. When do you usually put out your recycling boxes?
7. Do you ever notice recyclables blowing out of your Blue Box?
8. Do your Blue Boxes ever tip over and spill on windy days?
9. Which Blue Box (containers or paper/cardboard) results in more material blowing out of the box?
10. On windy days, do you make any changes to how you set out your Blue Boxes to stop material from flying away? (check all that apply)
  - a. Stack boxes
  - b. Put something heavy on top
  - c. Crush/flatten containers and paper boxes
  - d. Don't put my recycling boxes out when it's exceptionally windy
  - e. Take recycling material to curb just as the driver arrives, then put recycling boxes back in after emptied
  - f. Don't make any changes
11. Please provide feedback on the following education tools supplied by Durham Region to assist you with managing your Blue Box set out to avoid litter on windy days.
  - a. Calendar
  - b. Website
  - c. Social Media
  - d. Durham Region Waste App
12. Do you have any suggestions for reducing Blue Box litter on windy days that you would like to share with Durham Region?
13. Were you aware that a Blue Box Litter Study was being undertaken in your neighbourhood?
14. Did you receive a Blue Box lid?
15. Did you receive 1 lid so you can place on your choice of Blue Box, or 2 lids to place on container box and paper/cardboard box?
16. Is the lid easy to use?
17. Why was the lid not easy to use?
  - a. Too hard to put on
  - b. Don't like using
  - c. Other (please specify)
18. Would you recommend that the Region make Blue Box lids available to residents of Durham?
19. Can you give us your reason why we should not supply to residents?

20. Please provide any other comments you have about the Blue Box program.
21. Did any of the information and/or tools supplied by Durham Region assist you with managing your blue box set out to avoid litter on windy days?
22. What information and/or tools supplied by Durham Region did you find most helpful with managing your recycling material to avoid litter on windy days?
23. Did you receive a Blue box lid in:
- a. April 2019
  - b. Oct 2020
  - c. Did not receive a lid
24. Some areas received two lids. How many lids were provided to your household?
25. If you only received one lid, which Blue Box do you usually put this lid on?
- a. Containers
  - b. Paper/Cardboard
  - c. Depends (please explain)
26. If you found the lid hard to use, please check all that apply:
- a. Too hard to put on
  - b. Won't fit the box
  - c. Overflowing blue box
  - d. It's too heavy
  - e. I don't like it
  - f. Other (please explain)
27. How often do you use the Blue Box lids?
- a. Every collection
  - b. Only when it is windy
  - c. When I remember
  - d. Hardly ever
  - e. Never (please explain)
28. Does the lid stop your Blue box from causing litter on windy days?
29. To help reduce the cost to Durham taxpayers, how would you feel about having an advertising message printed on the Blue box lid?
- a. Good idea
  - b. Not a good idea
  - c. It depends (please explain)
30. Do you have any other suggestions for managing blue box litter on windy days that you would like to share with the Region?

## Appendix B: ReMM Report Comparisons

### SURVEY RESULTS FROM APR 2021 AND COMPARISON AGAINST OCT 2021 – OLD LID AREAS (LIDS DELIVERED 2019)

The survey results below show a comparison of the responses received by housing types that were surveyed during Oct 2020 and April 2021. There were 63 responses received from old lid areas in April 2021. The housing types surveyed include Single Detached dwellings in Pilot areas 5 and 8 and Semi-Detached dwellings in Pilot Area 9. No responses were received from Pilot Area 10 during Oct 2020. A summary of the results can be seen below.

#### Summary of results:

New Survey Questions – April 2021 – Old Lid Areas				
Questions	Area 5 Single Detached (Suburban)	Area 8 Single Detached (Urban)	Area 9 Semi Detached (Urban)	Area 10 Multi Res Suburban/Urban
Which Blue Box tips more often during windy weather?	57% → Both  29% → Papers/Cardboard	82% → Both 9% → Containers 9% → Papers/Cardboard	64% → Both 36% → Containers	40% → Both 40% → Containers 20% → Papers/Cardboard
When did you receive a Blue Box lid?	71% → April 2019  18% → Oct 2020	77% → April 2019  15% → Oct 2020	33% → April 2019  42% → Oct 2020	67% → April 2019  17% → Oct 2020
If you only received one lid, which Blue Box do you usually put this lid on?	86% → Papers/Cardboard  7% → Top blue box	75% → Papers/Cardboard 13% → Containers 8% → Top blue box	63% → Papers/Cardboard 38% → Containers	60% → Papers/Cardboard 20% → Containers
If you found the lid hard to use, please check all that apply	100% → Overflowing blue box	50% → Overflowing blue box  50% → Didn't like the lid	33% → Overflowing blue box 67% → Too hard to put on	No responses
To reduce cost to Durham taxpayers, how would you feel about having an advertising message printed on the Blue box lid?	79% → Good idea 7% → Not a good idea 14% → It depends on what is advertised	67% → Good idea 19% → Not a good idea 14% → It depends on what is advertised	67% → Good idea 33% → Not a good idea	80% → Good idea 20% → Not a good idea

Comparison of Survey Question Results – October 2020 vs April 2021 – Old Lid Areas							
Questions	Area 5 Single Detached (Suburban)		Area 8 Single Detached (Urban)	Area 9 Semi Detached (Urban)		Area 10 Multi Res Suburban/Urban	
October 2020 Results				April 2021 Results			
Does your household have two blue boxes that they use for recycling?	86% → Yes	71% → Yes	100% → Yes	85% → Yes	100% → Yes	92% → Yes	100% → Yes
	14% → More than two	24% → More than two		15% → More than two		8% → Use one box	
Did you receive 1 lid so you can place on your choice of Blue Box or 2 lids?	100% → 1 Lid	93% → 1 Lid	100% → 1 Lid	100% → 1 Lid	100% → 1 Lid	89% → 1 Lid	100% → 1 Lid
		7% → 2 Lids				11% → 2 Lids	
Is the lid easy to use?	67% → Yes	93% → Yes	100% → Yes	92% → Yes	100% → Yes	75% → Yes	80% → Yes
	33% → No	7% → No		8% → No		25% → No	20% → No

## SURVEY RESULTS FROM APR 2021 AND COMPARISON AGAINST OCT 2021 - NEW LID AREAS (LID DELIVERED OCT 2020)

The survey results below show a summary of the responses received from “New Lid Areas” in Oct 2020 and compares them to the responses received from “New Lid Areas” in April 2021. There were 11 responses received from areas that received 1 new lid and 94 responses from areas that received 2 new lids.

### Summary of survey results:

New Survey Questions – April 2021 – New Lid Areas			
Questions	Area 1 and 2 Rural (Single Detached)	Area 3 and 4 Suburban (Single Detached)	Area 6 and 7 Urban (Single Detached)
Which Blue Box tips more often during windy weather?	57% → Both 29% → Containers 14% → Papers/Cardboard	61% → Both 22% → Containers 17% → Papers/Cardboard	24% → Both 52% → Containers 24% → Papers/Cardboard
When did you receive a Blue Box lid?	100% → Oct 2020	89% → Oct 2020 8% → April 2021	89% → Oct 2020 8% → April 2021
If you only received one lid, which Blue Box do you usually put this lid on?	73% → Papers/Cardboard 27% → Containers	100% → Containers	75% → Papers/Cardboard 25% → Containers
If you found the lid hard to use, please check all that apply	No responses	50% → Won't fit the box 25% → Too hard to put on 25% → Don't like it	13% → Won't fit the box 37% → Too hard to put on 23% → It's too heavy
How often do you use the Blue box lids?	55% → Only when it's windy 27% → Every collection	14% → Only when it's windy 72% → Every collection	28% → Only when it's windy 36% → Every collection
Does the lid stop your Blue box from causing litter on windy days?	100% → Yes	97% → Yes 3% → No	81% → Yes 19% → No
To reduce cost to Durham taxpayers, how would you feel about having an advertising message printed on the Blue box lid?	91% → Good idea 9% → Depends on what is advertised	73% → Good idea 12% → Depends on what is advertised 15% → Not a good idea	56% → Good idea 16% → Depends on what is advertised 28% → Not a good idea
Would you recommend the lid to others?	63% → Very likely 10% → Likely 27% → Undecided	74% → Very likely 17% → Likely 6% → Undecided	55% → Very likely 26% → Undecided 10% → Very unlikely

Comparison of Survey Question Results – October 2020 vs April 2021 – New Lid Areas						
Questions	Area 1 and 2 Rural (Single Detached)		Area 3 and 4 Suburban (Single Detached)		Area 6 and 7 Urban (Single Detached)	
October 2020 Results			April 2021 Results			
Were you aware that a Blue Box Litter Study was being undertaken in your neighbourhood?	50% → Yes 50% → No	100% → Yes	85% → Yes 15% → No	95% → Yes 5% → No	83% → Yes 17% → No	97% → Yes 3% → No
Does your household have two blue boxes that they use for recycling?	75% → Yes 17% → More than two	91% → Yes 9% → More than two	76% → Yes 15% → More than two	76% → Yes 11% → More than two	83% → Yes 14% → More than two	79% → Yes 16% → More than two
Did you receive 1 lid so you can place on your choice of Blue Box or 2 lids?	No responses	100% → 1 Lid	33% → 1 Lid 67% → 2 Lids	3% → 1 Lid 97% → 2 Lids	50% → 1 Lid 50% → 2 Lids	14% → 1 Lid 86% → 2 Lids
Is the lid easy to use?	No responses	100% → Yes	67% → Yes 33% → No	89% → Yes 11% → No	100% → No	56% → Yes 44% → No

## Comparison of Specific Results for All Areas (April 2021)

Specific survey results below show a comparison of the housing types that were surveyed during April 2021.

