

# Township of Algonquin Highlands Evaluation of Roll-Off Bin Covers P1065

Final Report  
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Prepared for:  
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## 1. Introduction

Starting in December 2018, the Township of Algonquin Highlands (the Township) field tested and evaluated a plastic lid system for open top roll-off bins new to the Ontario marketplace. The lid system provided an alternative to open top or tarped bins which performed poorly in heavy snow, rain or wind events and failed to prevent material degradation. The benefits of the plastic covers are expected to be greatest in municipalities with few bin movements during off-season periods.

## 2. Background

In August of 2018, the Township was awarded funding to complete a pilot project to test the effectiveness and efficiency of the use of covers for 40-yard fibre recycling bins. The goal of the project was to assess whether a covered bin would improve the quality of materials and help avoid increases in processing costs due to contamination. Covered bins were expected to contain less moisture (particularly ice and snow), have improved material quality, and help to keep materials better contained (less wind-blown litter).

### 2.1 Community Profile

The Township of Algonquin Highlands (the Township) is a rural municipality located in Haliburton County. It covers 1,000 square kilometers and services 2,500 permanent residents, and between 9-12,000 seasonal residents during the summer months (see Figure 1)

### 2.2 Waste Management System

The Township operates five (5) solid waste disposal sites, four (4) of which are actively landfilling. Each site offers a “recycling centre” to provide for collection of Blue Box (BB) Program materials. This is a two-stream system, with Containers (including plastic, glass and metal containers) and Fibres (including OCC, and mixed fibres including gable cartons and tetra type packaging).

Three (3) sites utilize 40-yard roll-off bins for BB material collection, one site has compactors and one site utilizes a two compartment “depot” style roll-off bin.

Collection is primarily from single family dwellings, both seasonal and permanent. There are no multi-residential properties in the Township, and very little IC&I, primarily small owner-operated businesses.

There is no municipal organics diversion, though home composting is encouraged through a promotion and education program. All BB materials are hauled by Waste Connections Canada to their MRF in Bracebridge, ON, for processing.

Current By-laws require use of clear bags for all materials disposed of at Township sites. By-Law 2012-15 made recycling mandatory and sites refuse unsorted loads (i.e. where recycling is mixed with waste).

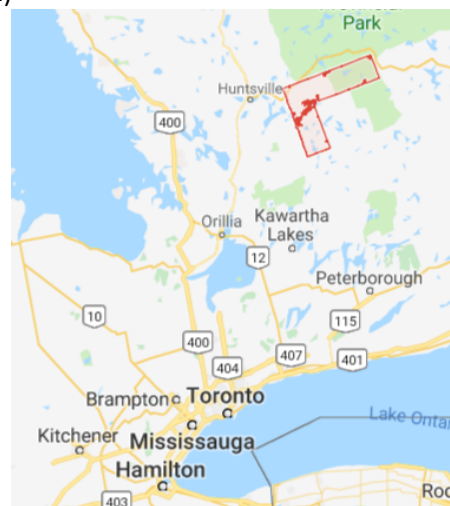


Figure 1: Map of Algonquin Highlands

Table 1: Waste Management System Overview for the Township of Algonquin Highlands (2018 data)

| Single Family Service | Service Description                    | Hauling & Processing Provider |
|-----------------------|--|-------------------------------|
| Garbage               | Depot – 5 sites                        | 4 Active Landfill Sites       |
| Recycling             | Depot – 5 sites<br>2 stream collection | Waste Connections Canada      |

### 2.3 Current Waste Management Performance

In 2017, the Township confirmed an overall diversion rate of 34.1% from its 3,453 households (See Appendix A: PW-021-19 2018 Solid Waste Management Annual Report). Below provides a waste management system overview. Please note that the Township has no Multi-residential units.

Table 2: Waste Generation Overview for the Township of Algonquin Highlands (2017)

|                |         | Blue Box Recycling |            | Total Waste Diversion |            | Disposal |       | Generation (Total) |            |
|----------------|---------|--------------------|------------|-----------------------|------------|----------|-------|--------------------|------------|
|                | Units   | rate               | % of total | rate                  | % of total |          | Units | rate               | % of total |
| Single Family* | tonnes  | 353                | 19%        | 642                   | 34.1%      | 1,241    | 65.9% | 1,883              | 100%       |
|                | Kg/hhld | 10                 |            | 193                   |            | 373      |       | 566                |            |

\*Based on 3,328 total households = 1,108 permanent and 2,345 seasonal

### 2.4 Program Challenges

Historically, “gate” style covered bins have been utilized to keep bears from accessing materials in recycling bins. As the company that had been fabricating the “gate” style covered bins was no longer able to supply needed units to the Township, the Township decided to investigate alternatives to this type of “Bear bins”.



Figure 2: Gate Style “Bear Bin”

This was also taken as an opportunity to make improvements to the existing program. Anticipated increases to processing costs per tonne gave an incentive to find bin covers that would keep materials dry, decreasing material weights.

To be considered a viable option, the bin covering product had to meet the following criteria:

**Bin Cover Criteria Checklist:**

- Easily operated by one person
- Safe – no special safety equipment or considerations required
- Weatherproof
- Relatively maintenance free
- Allow for compaction of materials with a backhoe
- Inhibit animal access to materials

## 2.5 Baseline Research

For this project, the Township completed research on existing municipal bin cover operations and analyzed the potential impact of precipitation on existing program costs.

### *a. Covered Bins in Ontario Municipal Recycling Systems*

Some municipalities use roll-off containers with solid tops that permit residents to deposit materials through open ends of the containers. This method was not considered a viable option due to poor densification of materials resulting in higher transportation costs as less material is shipped per load.

The Township researched a variety bin covers used by other municipalities and did not find any examples of hard covers in use that would protect materials from both the elements and wildlife while at the same time be easy to use without the aid of equipment, while still allowing for access to densify materials. Further, in discussions with Waste Connections Canada representatives (the Township's transfer haul and processing contractor) no covered bins were found to be in use by any of their clients in the area. Per CIF's knowledge base, some larger municipalities use available heavy equipment to place steel covers on top of roll-off containers at the end of each collection day. This type of equipment was not available on a daily basis to the Township.

The Township connected with more than five vendors of roll-off bin cover products that generally met the identified parameter. Ergonomic, safety, and cost factors narrowed the list to one. The selected product was a roll-off bin lid system made of plastic materials, on a steel frame. The lid system is used extensively in the US related to controlling storm water runoff from precipitation mixing with waste materials. The Township's processing contractor has had some experience working with this particular bin system as well, but in the agricultural industry, and provided some assurance as to the function and quality of the setup.

### *b. Open Bins Weight Analysis*

Historically, Township bins have been left uncovered as materials are accumulated for a full load. Open bins result in wet/frozen lower quality materials sent to the local MRF for processing and subsequent marketing. As wet materials are heavier than dry, additional processing costs are incurred as the

Township pays a per tonne amount for processing. Materials are weighed only at the processing facility scale prior to being dumped on the tip floor.

At the collection site, materials are regularly manually compacted using heavy equipment (backhoe or excavator) to achieve maximum densities. The contractor is called for pick-up of roll-off containers when they are full. Historically, bin weight data indicates bin weights were approximately 25% less (~ 1 tonne) during summer months when compared to the rest of the year. Summer months are characterized by higher temperatures which facilitate evaporation and may in effect dry out fibre materials in open top roll-off bins. It was hypothesized that the higher bin weights observed during fall through spring were a reflection of moisture contained within bins.

Roll off containers are commonplace amongst in rural and remote municipalities and are often found at depots offered as complimentary diversion opportunities by many other municipalities in Ontario. Similarly, processing costs are often based on scale weights of incoming materials at processing centers. In effect, municipalities may be paying for many tonnes of both moisture laden fiber materials and snow.

The results of this project will provide evidence as to the systemic impact of costs related to processing payments for moisture content in incoming loads. Further, the results of this project may provide justification as to purchasing covered bins to protect fibre materials from the elements as a means of controlling costs.

## 2.6 Expected Project Outcomes

The anticipated benefits of a covered bin lid system included:

- Reducing load weights by keeping materials dry
- Better quality product, particularly paper packaging
- Reducing “fly away” litter on waste collection site
- Reducing contamination from animals and their feces

Concerns regarding implementation of lid systems:

- Product capacity to handle snow load
- Ease of operation
- Site attendant ability to open and close the bin for public access
- Equipment operator capability to mechanically compact material
- Product durability, including safeguarding materials from animals
- Cost

## 3. Approach

### 3.1 Set Up and Implementation

Initially one lid system was purchased from Hydraline, located in Brampton, ON. Staff shortages from the original quoted installer delayed the project however, Waste Connections Canada in Bracebridge, ON came forward to complete the installation and on December 13, 2018, a covered Fibre bin was delivered to the Maple Lake Site.



Pre-delivery, Waste Connections Canada completed training with their drivers to ensure they were familiar with the lid system operation and requirements for safe transport. The lid system is equipped with a locking mechanism and secondary mechanical clips to ensure the lid is secure in transport.



Figure 3: New Covered Bins (Dec 2018)



Covered Bin – Fully closed

Figure 4: Covered Bins partially opened and fully closed

The cover is typically opened less than a metre wide while the site is open to the public and kept closed at all other times. This limited opening reduces the amount of snow/rain that enters the bin and keeps materials from blowing out of the bin. A smaller opening requires that boxes are flattened before being deposited in the bin. This reinforces the signage instructing patrons to “Please, flatten boxes” (see Figure 4).



An aftermarket addition to the cover was a simple 6" pull handle (see Figure 5). The handle provided a safe grip to adjust the lid position from the "top" side.



Figure 5: Covered Bin Fully Open and 6" pull handle



Figure 6: Fibre materials on tip floor at MRF

On January 7, 2019, the covered bin was tipped for the first time. The materials looked to be clean and quite dry, no blocks of snow or ice were found (as are typically in winter loads).

Waste Connections Canada indicated that the load looked good, and the load tipped quite easily. In the past there have been incidences where fibre loads are almost impossible to get out of bins as they are frozen into solid blocks. The weight of the materials in the bin was about 50% lower than the average bin.

Typically, in the winter months, when bins are switched less frequently and snow/ice can build up in the bins, weights are highest. Bin weight can vary significantly but early indications suggested that the covered bin weights would be lower than uncovered bins. Lighter materials can result in some cost savings and improvements to material quality help ensure the marketability of materials in the future.

### 3.2 Monitoring and Measurement Methodology

The following table outlines the monitoring and measuring planned to track the impact of the new plastic roll-off bin covers.

Table 3: Summary of Monitoring and Measurement Plan

| Monitor                  | Measure  | Reason  |
|--------------------------|--|---|
| Material Moisture Levels | Track precipitation from Environment Canada and measure materials in bin with moisture meter     | Determine if weight of bin was related to amount of precipitation   |
| Bin Weights              | Compare open to closed roll-off bins from 2017 to 2019   | Assist in determining moisture levels and estimate processing cost savings  |
| Bin Movements            | Compare total bin movements 2018 vs. 2019  | Evaluate volume of materials transported – expected less snow in bins in winter conserves space and improves compact ability increasing bin weights |
| Operations               | Photographs and ongoing communication with site attendants, collection and processing contractor | Provide insights into overall public acceptability and ease of use for operations   |

### 3.3 Monitoring Challenges and Solutions

Although measuring the moisture of materials in open vs. closed top was proposed the following challenges were experienced during the collection of the data.



**Sampling:** Obtaining a sample with large enough volume and with similar material composition seemed impossible to attain. The time to collect, sample, weigh and dry materials did not result in viable results. The variability in material composition (e.g. OCC vs boxboard) resulted in moisture content that also varied widely. It was not possible in the natural environment to complete enough sampling to overcome the variability found simply in material composition.



**Staff:** Limited staff resources and weather-related challenges further impacted some of the proposed sampling and monitoring. For example, the first two test bins, two fibre bins, filled simultaneously (i.e. both bins were open for residents to drop off materials), were planned to be hauled and tipped within days of each other. The covered bin was successfully tipped, on schedule, unfortunately the uncovered “control” bin was frozen solid in place and was unable to be hauled from the site for many months (until it thawed in spring).



**Solution:** In the end, analysis of actual bin weights was felt to be a better indication of moisture performance vs any “lab” testing that could be completed. Bin weights were collected over a longer period of time (a full year vs months as proposed in the initial funding application). In addition, the purchase of a second lid system gave further data to provide for more statistically valid analysis.

## 4. Project Results and Analysis

### 4.1 Bin Weights

As shown in the table below, open bins have higher average weights than covered bins, particularly in winter and spring. The lower standard deviation shows more consistency in covered bin weights.

Table 4: 2019 Bin Weights, Bin Counts, and Standard Deviation Open vs. Covered

| Season            | Average of Fibre - 40yd Open | Count of Fibre - 40yd Open | StdDev of Fibre - 40yd Open | Average of Fibre - Covered | Count of Fibre - Covered | StdDev of Fibre - Covered |
|-------------------|------------------------------|----------------------------|-----------------------------|----------------------------|--------------------------|---------------------------|
| Fall              | 3.79                         | 5                          | 0.91                        | 3.09                       | 1                        | NA                        |
| Spring            | 4.70                         | 6                          | 1.91                        | 2.76                       | 4                        | 0.64                      |
| Summer            | 2.79                         | 13                         | 0.66                        | 2.12                       | 5                        | 0.31                      |
| Winter            | 4.90                         | 4                          | 1.55                        | 3.14                       | 3                        | 0.88                      |
| Average/Total All | 3.68                         | 28                         | 1.44                        | 2.63                       | 13                       | 0.68                      |

Based on comparing yearly data of the weighted average of bin weights, overall covered (closed) bins were 22% lighter than open top roll-offs (see Figure 7).

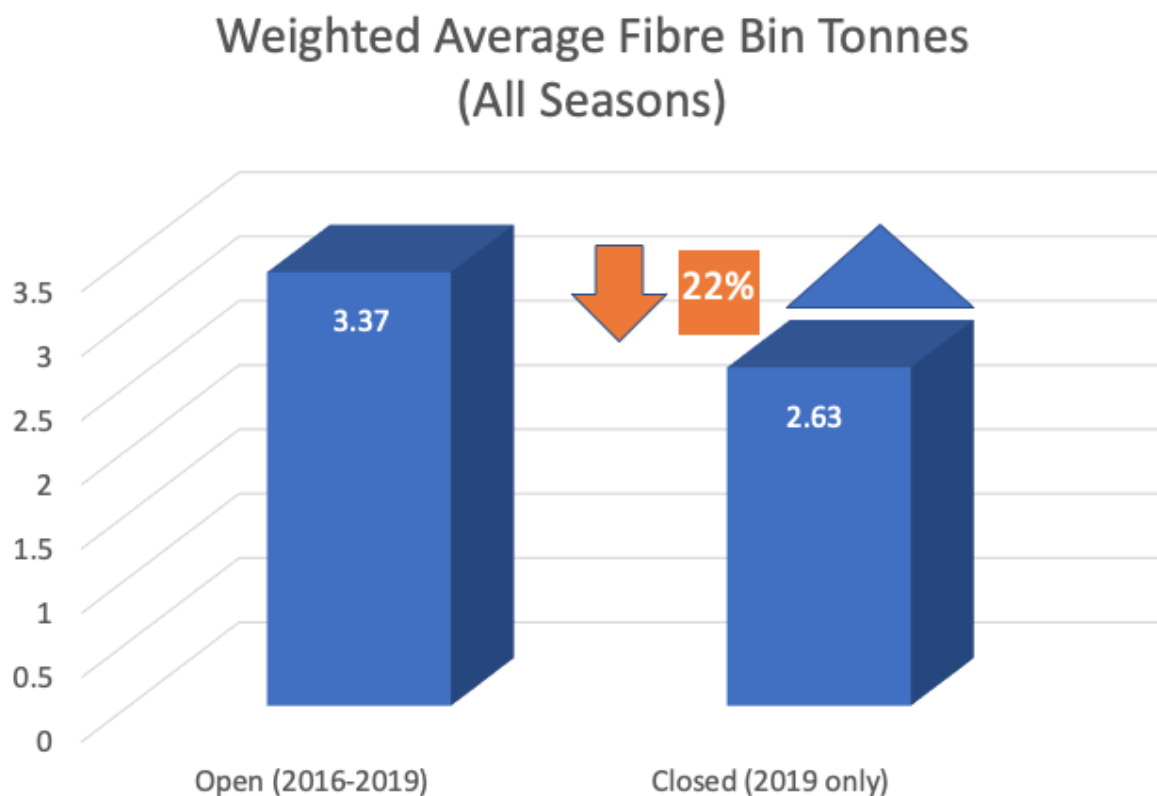


Figure 7: Weighted Average Bin Weights – Open vs. Covered

## 4.2 Moisture Analysis

Two statistical tests were completed (see Appendix C for details).

1. T-test to determine if there was a significant difference between bin weights of open and covered bins.
2. Co-relation test to see if there was a relationship between precipitation and bin weight.

The results of the statistical analysis suggest that there was a significant difference between open and covered bin weights and that rain is likely a contributing factor to higher bin weights in open bins. Other factors to consider would be fibre composition, moisture of fibres at collection, and densification of materials.

## 4.3 Transportation and Processing Costs

In the fall through spring months, it was expected that bin covers would keep materials drier (lighter) and also prevent snow from building up inside the bin. Less snow in the bins conserves space and improves the ability to compact materials which ultimately could decrease the frequency of bin movements. As outlined in Table 5 below, bin movements did decrease in 2019. A conservative estimated savings of 1 bin transfer annually was used in the calculated savings for the project.

Table 5: Bin Movements 2016-2019

|                            | 2016      | 2017      | 2018      | 2019      |
|----------------------------|-----------|-----------|-----------|-----------|
| Open                       | 39        | 40        | 40        | 24        |
| Covered                    |           |           |           | 13        |
| <b>Total Bin Movements</b> | <b>39</b> | <b>40</b> | <b>40</b> | <b>37</b> |

Based on a comparison of bin weights from all seasons from multiple years, a 20% moisture rate was employed in the analysis of tonnage costs savings. With processing costs at \$120/tonne this calculated out to over \$1,000 per year.

Furthermore, feedback from the collection contractor suggested that tipping bins, especially during the winter months, was much easier and faster as materials were less “frozen” inside the bin. The processing contractors has not increased the cost per tonne fee nor have they refused/redirected loads of any covered bin materials.

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“Chunks of frozen materials and snow cannot be sorted at the MRF and end up in residue increasing contamination rates and ultimately processing costs”

George South, Waste Connections Canada  
District Manager, Northern Ontario

## 4.4 Other Notable Benefits

Site Attendants have reported that the cover is working well and, other than clearing snow off the cover, there have been no operational challenges. A roof rake and wide broom with extension proved to be an asset to remove snow from the bin lid at times when the load was significant. Most often, snow is simply removed by opening the lid (with caution given to standing back so as the snow does not fall on the operator opening the lid). With a heavy snow load the lid held up well, it was just too heavy to move.

Members of the public have not reported any challenges or complaints with the new cover. The bin cover makes it easy for site users to know where materials should go and also provides an added opportunity for promotion and education (when signage is securely mounted). The narrower bin opening prevents people from dumping larger objects without the attendants notice which has reduced contamination.

Improved containment of materials and reduced blown materials from bins at depot has decreased labour costs associated with site litter pick-Up.

Lid system has kept birds, raccoons, and even bears, along with their waste products (i.e. poop) out of the bins.

“At the MRF, snow and ice can make it extremely difficult for both mechanical and human sorters to effectively separate the different materials. This results in either recyclables ending up in the residue, or more residue ending up in the materials to be marketed. The ice and snow that accumulates on the inbound fibre can also impact the quality of the material shipped to the end markets. Fibre mills do not want to pay for the unwanted moisture soaked into the loads. Moisture is also a big issue for aluminum buyers, so a good practice is to store loads inside if possible. Overall, it is important to know and meet the allowable tolerances of the broker/mill you are working with to ensure your load is not downgraded or rejected”

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#### 4.3 Lessons Learned

The following was learned throughout the process of this project.

- **Installation of the product was challenging.** It is recommended that prior to purchasing lid systems utility, cost, availability, and installation services need to be comprehensively researched. A lack of experience in the marketplace with lid systems has potential to create challenges such as higher than expected costs or improper installation.
- **Update standard operating procedures.** Bin covers don’t provide any benefit if they are left open. Training and monitoring of site attendants is important to ensure the bins are kept closed when sites are closed, particularly in the winter when operating hours are short.
- **Accurate monitoring of material moisture** within the bins (as was originally proposed) required a more formal sampling approach for higher confidence levels.
- On site, it is important to have a good **level base for bins** with this lid system. The lid system must be level to operate properly. When bins are not level the lid can be difficult to move and has a tendency to slide, open or closed depending on the angle of the bin. Normally the lid

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<sup>1</sup> <https://www.remm.ca/single-post/2017/02/03/Recycling-for-the-Seasons-and-Being-Better-Prepared>. Under “Winter”

balances very solidly on the bin, but when the bin is out of level the balance is upset. In one case, a very poorly leveled bin required a secondary tie strap to keep the lid from rolling open.

- New opportunity. Once bins were placed, the **opportunity for placing educational signs** on the lids became obvious. The township is currently investigating this option – as the signs may need to be removed before transportation or they have to be very securely mounted.
- **Transferability to container bins.** As the greatest financial benefit was to be found in having Fibre bins covered, there is opportunity with keeping Container collection bins covered as well. Although Containers do not absorb moisture like fibres, snow and water still accumulate in the bins and could be reduced with the use of a lid system.

## 5. Project Budget

Table 6: Project Budget vs. Actual Costs

| Item                                      | Proposed (1 lid) | Actual (2 lids) |
|---|------------------|-----------------|
| Purchase of equipment (includes shipping) | \$3,035          | \$6,472         |
| Installation                              | \$1,500          | \$4,579         |
| <b>Total</b>                              | <b>\$4,535</b>   | <b>\$11,051</b> |

CIF funded \$3,337 of the total project costs. Installation costs were above what was initially quoted as an alternative installer had to be sought out from the one who quoted the job originally. Installation was one of the greatest challenges to overcome as there was not anyone in the region who had experience with the product. To date, there have been no additional costs associated with the installation of the lid. No maintenance or repairs have been required.

In addition to the initial bin cover funded through CIF, the Township installed a second cover in April of 2019. Costs for the second cover were similar to the first, with an increase in the installation cost. The installer (Waste Connections) had the experience of the first cover to have a better idea of the time and materials involved in the installation. It is anticipated that the knowledge gained through this project will help to reduce the cost of future installations.

The following table provides a summary of the calculated payback period.

Table 7: Payback Period Calculation

|                                   |                   |
|-----------------------------------|-------------------|
| Amortized cost of two bin lids    | \$-1,105          |
| Bin Movement Savings              | \$277             |
| Processing savings (fewer tonnes) | \$1,051           |
| <b>Annual Savings (costs)</b>     | <b>\$223</b>      |
| <b>Payback period</b>             | <b>4.96 Years</b> |



## 6. Conclusions

Covers for 40-yard roll-off bins such as the lid system tested in this project have proved to be beneficial to site operations and in reducing material weights, as was expected. The reduction in material weight was challenging to accurately quantify but statistically has proven to be valid. Operational challenges in utilizing the covers were easily overcome and avoided with employee training and improved site conditions.

With current processing costs (which will likely increase in the future), the return on the investment for the covers was estimated at 5 years (based on 10-year amortization of costs).

### Considerations for the future

The scope of this project was limited, with only two installations of the lid system. With plans to install two more covered bins in 2020, the Townships will be able to evaluate the benefits of various bin configurations including the need to open lids from opposite sides at other waste sites.

Recent contract negotiations resulted in significant increases to processing costs for the Township. The use of covered bins was introduced during negotiations and the positive impact on material quality was one topic discussed. The processing contractor emphasized that anything the Township could do in the future to improve material quality and reduce processing time, would be beneficial. While the use of covered bins didn't net a direct reduction in processing fees, it was a contributing factor in the negotiating process and is expected to provide the type of improvements to material quality and processing time.

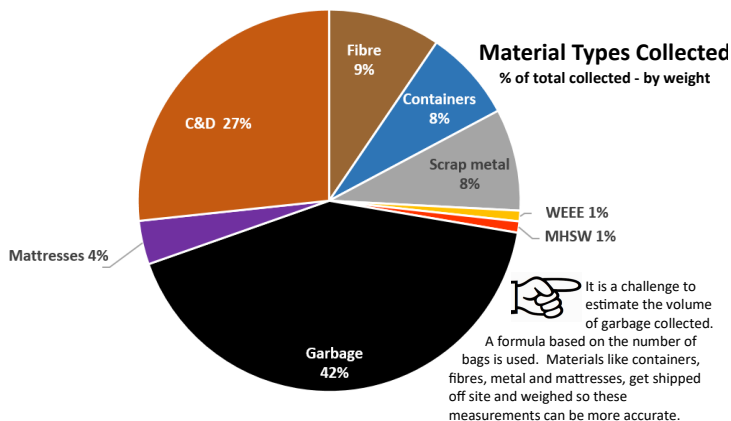
The next test of these roll-off covers will be for use on container bins. The benefits, as far as material weight, are not expected to be as significant and there is uncertainty as to whether the lid can withstand the demands of increased animal activity (primarily bears) associated with potentially smellier materials.

This type of roll-off cover is recommended in situations to allow access for compaction of materials while at the same time reducing material exposure to the elements in order to reduce bin weights ultimately reduces program costs.

## Appendix A: PW-021-19 2018 Solid Waste Management Annual Report



### 2018 Solid Waste Management Annual Report



#### The Township of Algonquin Highlands diverts waste from landfill through the following programs:

1. Blue Box - Containers and Fibres
2. Household Hazardous Wastes (also called Municipal Hazardous and Special Waste) - this includes HHW Events, Aerosol containers, CFL and Fluorescent tubes, batteries, empty oil containers and propane cylinders.
3. Construction and demolition materials
4. Tires
5. End-of-life electronics
6. Scrap Metal
7. Reuse - Centres at Maple, Dorset and Oxtongue sites help to keep good useable items out of landfill.

Mattresses and furniture, bulky plastics, a portion of Construction waste, household waste and organics are landfilled.



#### Blue Box program material handling

Over time we are seeing reductions in the volume of material transported from our sites and an increasing trend in tonnage. A major change in our Blue Box material collection program occurred in Dec 2015/Jan 2016 with the installation of compactor units at the Dorset Transfer Station, this shift is clearly visible in the charts below. As noted in the 2017 Datacall report, Blue Box material weights continue to decline. Less glass and metal and lighter weight plastic packaging is largely to account for this.



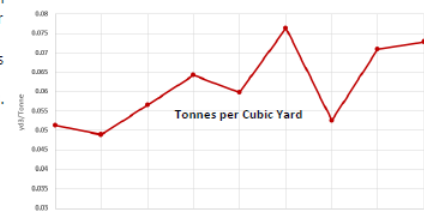
Increasing our degree of compaction, through use of compactor units, equipment, or better material handling, reduces haulage costs. Haulage (transporting materials from AH sites to processing facility in Bracebridge), is the largest component of material handling costs. Impacts of compaction can be seen through analysis of weight vs volume (Tonnes per cubic yard). We must be careful in this analysis though - lighter materials, drier

materials and less

contamination all tend to lower this ratio, in a good way!

With the use of covered bins we will also start to see slight reductions in tonnage, and hopefully volumes, in the near future. Covered materials are lighter (less water/ice weight) and also take up less space (snow in winter can be a significant amount of bin volume).

In the coming years we expect to see processing costs increase significantly. Reductions in weight will have greater value as we see those increases come into effect.



|       | Total Residential Waste Generated |        | Total Residential Waste Diverted |        | Total Residential Waste Disposed |        | Residential Waste Diversion Rate |
|-------|-----------------------------------|--------|----------------------------------|--------|----------------------------------|--------|----------------------------------|
|       | Tonnes                            | Kg/Cap | Tonnes                           | Kg/Cap | Tonnes                           | Kg/Cap |                                  |
| 2013  | 1,634                             | 450    | 774                              | 213    | 861                              | 237    | 47.34%                           |
| 2014  | 2,072                             | 570    | 923                              | 254    | 1,149                            | 316    | 44.5%                            |
| 2015  | 1,520                             | 418    | 522                              | 144    | 998                              | 275    | 34.4%                            |
| 2016  | 1,619                             | 486    | 575                              | 173    | 1,044                            | 314    | 35.5%                            |
| 2017  | 1,883                             | 934    | 642                              | 318    | 1,241                            | 615    | 34.1%                            |
| 2018* | 1,950                             | 586    | 722                              | 217    | 1,228                            | 369    |                                  |

## Appendix B: Roll off bin cover options

| Manufacturer   | Product name   | Material          | Negatives  | Positives   | Cost                               |
|--|--|-------------------|--|---|------------------------------------|
| CONFAB<br><a href="http://www.confab.com/2-piece-rolling-roof">http://www.confab.com/2-piece-rolling-roof</a>  | Rolling 2 pc roof  | Steel             | Cannot be removed to compact bin<br>Snow removal may be challenging<br>Rollers would need maintenance  | Solid<br>Adaptable  | Not assessed – not a viable option |
| CONFAB<br><a href="http://www.confab.com/dual-crank-roof">http://www.confab.com/dual-crank-roof</a>  | Dual crank   | Steel             | Very heavy to crank<br>Safety concerns with cables/cranks and inexperienced operators<br>Snow/Ice load could make it difficult to lift lid   | Solid<br>Can change direction lid opens                                     | Not assessed – not a viable option |
| DUMPSTER-GARD<br><a href="http://www.dumpstergard.com/">http://www.dumpstergard.com/</a>   | Multi piece lid  | Plastic           | Need two people to install<br>Only held on by strapping – Bears would be an issue  | Light   | Not assessed – not a viable option |
|  | Tarp   |                   | Time consuming to install<br>Prone to damage by animals<br>Short lifespan<br>Need frame system to keep tarp from sagging and snow/rain accumulating<br>Materials get thrown on top of tarp | Cheap   | \$100-200 - not a viable option    |
| TB INDUSTRIES<br><a href="https://www.rolloffcovers.com/shop/st-8000-s/">https://www.rolloffcovers.com/shop/st-8000-s/</a>   | Storm-Top ST-8000S   | Plastic           | Once open there are rails that “stick out” making compaction challenging   | Simple operation<br>Light   | \$2500 USD – not a viable option   |
| Shanahan   | Steel roof   | Steel             | Heavy<br>Requires equipment to remove<br>Must be removed for transport   | Simple  | Requested – not a viable option    |
| IMPACT PLASTICS<br><a href="https://www.impactinnovates.com/products/roll-off-parts/roll-off-covers/">https://www.impactinnovates.com/products/roll-off-parts/roll-off-covers/</a> | Roll off cover   | Plastic           | <b>Heavy to get moving</b>   | <b>Simple operation<br/>Cover slides out of way to allow for compaction</b> | <b>\$3050 CDN</b>                  |
| Environmental Metals Works*  | Tilt crank cover   | Aluminum /plastic | Very difficult to ship (manufactured in AB)  | Simple operation<br>Light   | \$2400 CDN                         |
|  | New product close to launch that would allow for easy shipping – lighter aluminum frame, plastic covers. |                   |  |   | \$1500-\$2000                      |

\* EMW has cover option that was viable, unfortunately it is manufactured in Alberta and difficult to ship.

# Appendix C: Statistical Analysis on Bin Weights and Precipitation

| Is there a difference in tonnage between the Open and Closed bins?  |          |          |   |  |  |  |
|---|----------|----------|---|--|--|--|
| t-Test: Two-Sample Assuming Unequal Variances   |          |          |   |  |  |  |
|   | Fiber_O  | Fiber_C  |   |  |  |  |
| Mean  | 3.488667 | 2.603636 | Significant difference in mean weights between Open and Covered Bins              |  |  |  |
| Variance  | 2.850712 | 0.543665 |   |  |  |  |
| Observations  | 15       | 11       |   |  |  |  |
| Hypothesized Mean Difference  | 0        |          |   |  |  |  |
| df  | 20       |          |   |  |  |  |
| t Stat  | 1.808552 |          | @ 5% significance level there is a difference between Open and Closed Bin Weights |  |  |  |
| P(T<=t) one-tail  | 0.042791 |          |   |  |  |  |
| t Critical one-tail   | 1.724718 |          |   |  |  |  |
| P(T<=t) two-tail  | 0.085581 |          |   |  |  |  |
| t Critical two-tail   | 2.085963 |          |   |  |  |  |
| Is bin weight related to precipitation?   |          |          |   |  |  |  |
| Significant r=0.514   |          |          |   |  |  |  |
|   | Fiber_O  | P_O      | Significant relationship  |  |  |  |
| Fiber_Open  | 1        |          | Open Bin is significantly correlated with precip amount                           |  |  |  |
| P_O   | 0.664046 | 1        |   |  |  |  |
|   |          |          |   |  |  |  |
| Significant r=0.602   |          |          |   |  |  |  |
|   | Fiber_C  | F_P      | NO relationship   |  |  |  |
| Fiber_Covered   | 1        |          | Covered Bin weight is not significantly correlated with precip amount             |  |  |  |
| F_P   | 0.536667 | 1        |   |  |  |  |
| Overall Conclusion: Rain is likely a factor contributing to the heavier weights of Open versus Covered bins |          |          |   |  |  |  |

## Appendix D: Financial analysis – payback period (two lids)

|                                   |               | Note  |
|-----------------------------------|---------------|-------|
| Amortized cost of asset           | -\$ 1,105     | 1     |
| Bin Movements                     | \$ 277        | 2     |
| Processing Savings (fewer tonnes) | \$ 1,051      | 3     |
| Annual savings (costs)            | <u>\$ 223</u> |       |
| Payback period                    | <u>4.96</u>   | years |

### Note 1: Amortized cost (annual)

*The bin cover systems are capitalized initially, then expensed on an annual basis, over the life of the asset, through straight-line depreciation*

|                              |                 |
|------------------------------|-----------------|
| Bin lid system               | \$ 3,035        |
| Installation                 | \$ 2,000        |
| Asset cost                   | \$ 5,035        |
| Useful life                  | 10 years        |
| Amortization                 | \$ 504 yearly   |
| Open top bins in circulation | 2               |
| Total amortization           | <b>\$ 1,007</b> |

### Note 2: Bin movements (winter)

*Less snow in bins through winter months conserves space and improves compaction decreasing bin movements*

|                                |                         |
|--------------------------------|-------------------------|
| Fall/Spring weights            | 3.84 tonnes             |
| Winter weights                 | 4                       |
| Difference                     | 0.16                    |
| 2017 Winter bin movements      | 11                      |
| Winter bin movements projected | 9                       |
| Reduction in bin movements     | 1 Conservative estimate |
| Total Cost per bin movement    | <b>\$ 277</b>           |
| Winter savings                 | <b>\$ 277</b>           |

### Note 3: Processing savings (fewer tonnes)

*Protection from the elements reduces saturation of fiber products from rainfall; and reducing overall processing costs*

*snow/ice accumulation in bins resulting in fewer tonnes 'weighed' at tip-floor thereby*

|   |                           |
|---|---------------------------|
| Annual fiber tonnes annually                      | 43.78                     |
| Composition of water/ice content                  | 20% Conservative estimate |
| Weight of water/ice contents                      | 8.76                      |
| Anticipated processing rate - dry fiber materials | \$ 120                    |
| Annual savings                                    | <b>\$ 1,051</b>           |