

REPORT
Single Family Curbside Waste and Participation
Audit

City of Toronto

August 2016



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Executive Summary

The City of Toronto (City) retained 2cg Inc. (2cg) to undertake the following:

1. Four season waste audit/set-out audit (waste audits) of the same 200 households; 100 in District 2 and 100 in District 3 (Table 1.1); and
2. Four season participation audit of the same 800 households; 400 in District 2 and 400 in District 3 (Table 1.2).

The objective of the waste audits and set out audits (Table ES.1) was to measure the weight, composition and household set out of relevant waste streams (i.e. residual material/green bin or recycling/green bin) over two consecutive weeks. Data analysis was undertaken by garbage bin size (i.e. Small, Medium, Large, Extra Large etc.).

The objective of the participation audits (Table ES.2) was to measure the set out of relevant waste streams (i.e. black cart/green cart or blue cart/green cart) by the garbage bin size (i.e. residual garbage/green bin or recycling/green bin) over four consecutive weeks. Data analysis was undertaken by garbage bin size (i.e. Small, Medium, Large, Extra Large etc.). The households denoted in Table ES.2 abutted the relevant households denoted in Table ES.1

Table ES.1 Waste Audit and Set-Out Audit- Households per Day

Day	District 2	District 3	Total
Tuesday	25	25	50
Wednesday	25	25	50
Thursday	25	25	50
Friday	25	25	50
Total	100	100	100

Table ES.2 Participation Audit- Households per Day

Day	District 2	District 3	Total
Tuesday	100	100	200
Wednesday	100	100	200
Thursday	100	100	200
Friday	100	100	200
Total	400	400	800

Table ES.3 depicts the set-out of residual material, recycling and green bin by garbage bin size for the 200 waste audit households. Households with extra large garbage bins had the highest set out for residual material and recycling and lowest set out for the green bin. Households with small garbage bins had the lowest set out for residual material but highest setout for the green bin.

Table ES.3 Set out of Residual Material, Recycling and Green Bin by Garbage Bin Size

Garbage Bin	Assets	Set Out		
Size	#	Residual Material	Recycling	Green Bin
		%		
S	46	70.0	84.0	75.1
M	75	75.4	85.8	73.2
L	59	80.1	88.0	67.6
XL	20	87.0	98.7	62.5
Total	200	78.2	87.3	69.6

Table ES.4 depicts the results of the set out and participation of the 800 participation audit households. Households with small garbage bins had the lowest participation rate for residual material and the lowest participation rate for the green bin. Households with large garbage bins had the highest participation rate for all three streams. The total set out for residual material and recycling was lower for the participation audit as compared to the waste audit with green bin set out about the same.

Table ES.4 Set out of Residual Material, Recycling and Green Bin by Garbage Bin Size- Set out and Participation Audit

		Residual Material	Recycling	Green Bin
S	Set out- %	66.0	77.1	67.7
	Participation- %	79.6	88.8	84.1
M	Set out- %	75.3	80.5	68.1
	Participation- %	87.5	92.8	85.5
L	Set out- %	78.9	84.3	69.9
	Participation- %	91.6	95.3	86.9
XL	Set out- %	83.8	84.6	66.2
	Participation- %	91.2	92.1	86.1
Total	Set out- %	73.8	81.0	68.3
	Participation- %	84.3	92.4	85.6

On average Toronto households in this waste audit dispose 260 kg/hhld/year residual waste and divert 273 kg/hhld/year recyclables and 253 kg/hhld/year green bin materials.

Table ES.5 depicts household green bin and recycling diversion, highlighting the contamination in both of those streams as well as the amount of green bin waste and recyclables in the residual waste stream. For these waste audits and the three waste streams, households had a 60% diversion rate and potential 80% diversion rate. The contamination rate of recycling was 18% and for the green bin 3% (although this does not account for non biodegradable contaminants removed during processing).

Table ES.5 Summary of Green Bin and Recycling Diversion

	Green Bin	Recycling	Residual Material	
Diversion (kg/hhld/year)	245.99	222.86		
Contamination (kg/hhld/year)	7.47	49.75	150.55	
% Contamination	2.9%	18.2%	57.9%	
% Diversion Rate	31.3%	28.4%		59.7%
Potential Diversion Rate				79.9%

Figure ES.1 provides the overall waste composition for all three streams. It shows that organics make up 46% of the overall waste stream followed by paper and other materials.

Figure ES.1 Overall Waste Composition- Four Seasonal Waste Audits

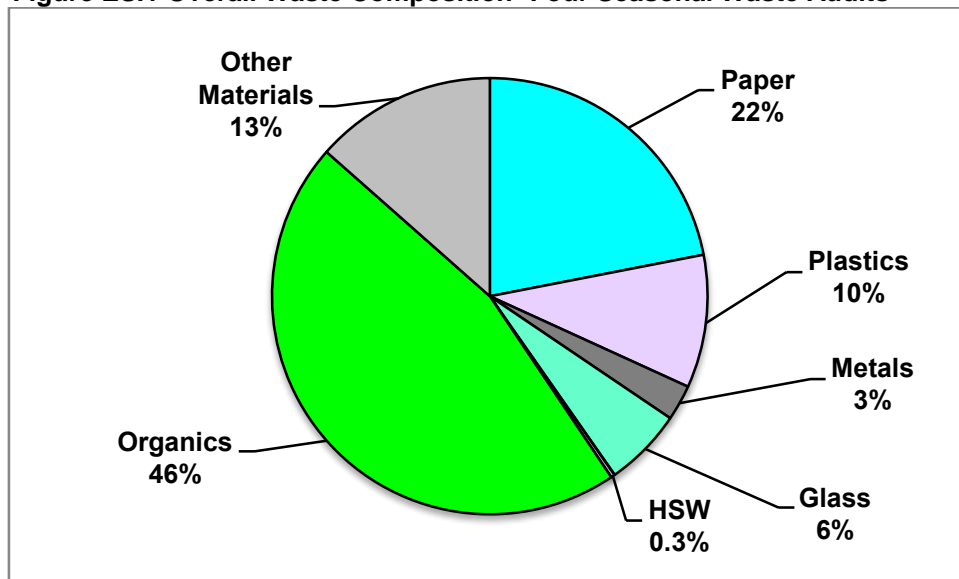


Figure ES.2 provides the overall waste composition for residual materials. It shows that organics make up 38% of the residual materials followed by other materials and plastics.

Figure ES.2 Residual Material Waste Composition - Four Seasonal Waste Audits

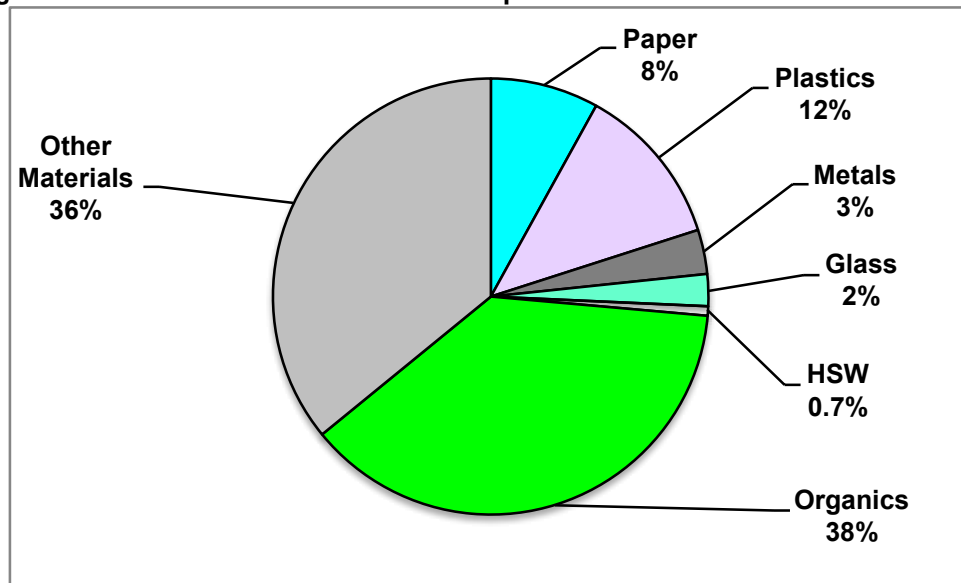


Figure ES.3 depicts the estimated annual amount of residual waste disposed by garbage bin size and shows an increase in waste disposal from small to extra large bin sizes.

Figure ES.3 Residual Material by Garbage Bin Size - Four Seasonal Waste Audits

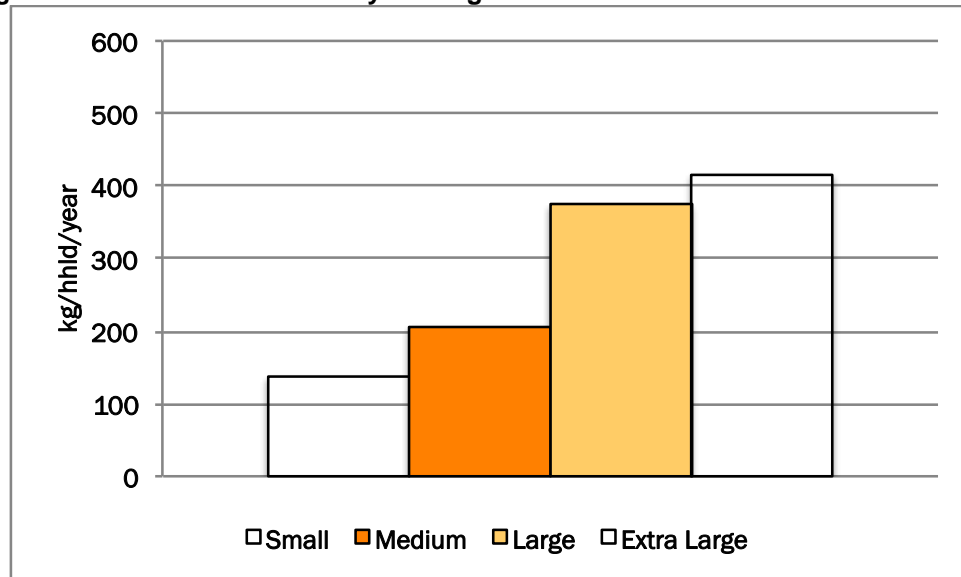


Figure ES.4 provides the overall waste composition for recycling. It shows that paper makes up 55% of recycling followed by plastics and glass.

Figure ES.4 Recycling Waste Composition - Four Seasonal Waste Audits

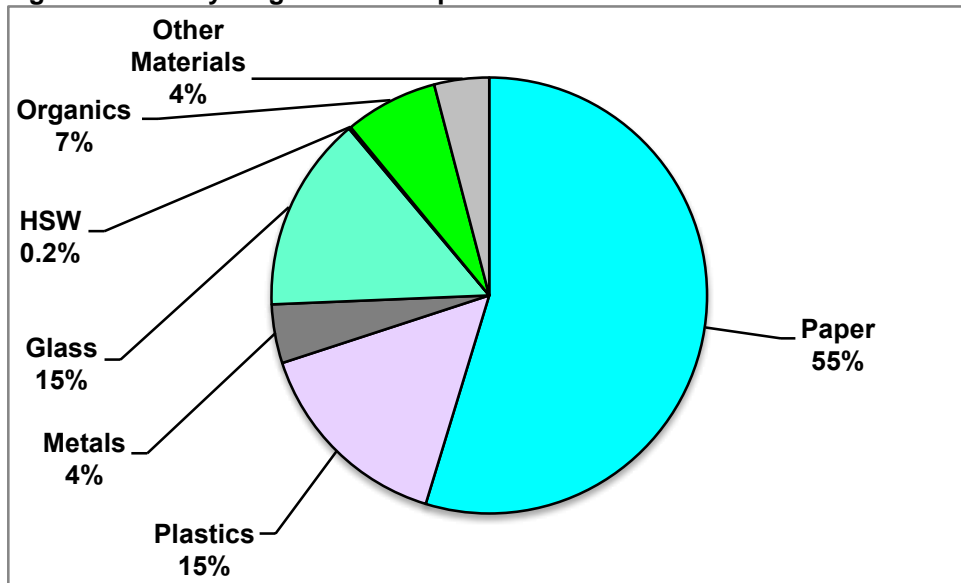


Figure ES.5 depicts the estimated annual amount of recycling by garbage bin size and shows an increase in recycling as bin size increases, particularly for households with extra large garbage bins.

Figure ES.5 Recycling by Garbage Bin Size - Four Seasonal Waste Audits

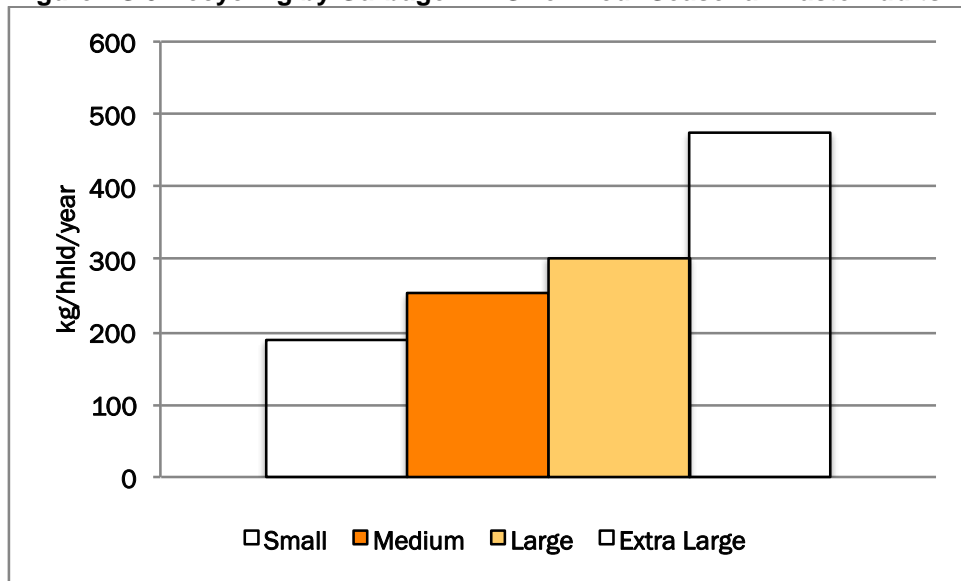


Figure ES.6 provides the overall waste composition for the green bin. It shows that approximately 96% of materials received in the green bin fit within the organics category.

Figure ES.6 Green Bin Waste Composition- Four Seasonal Waste Audits

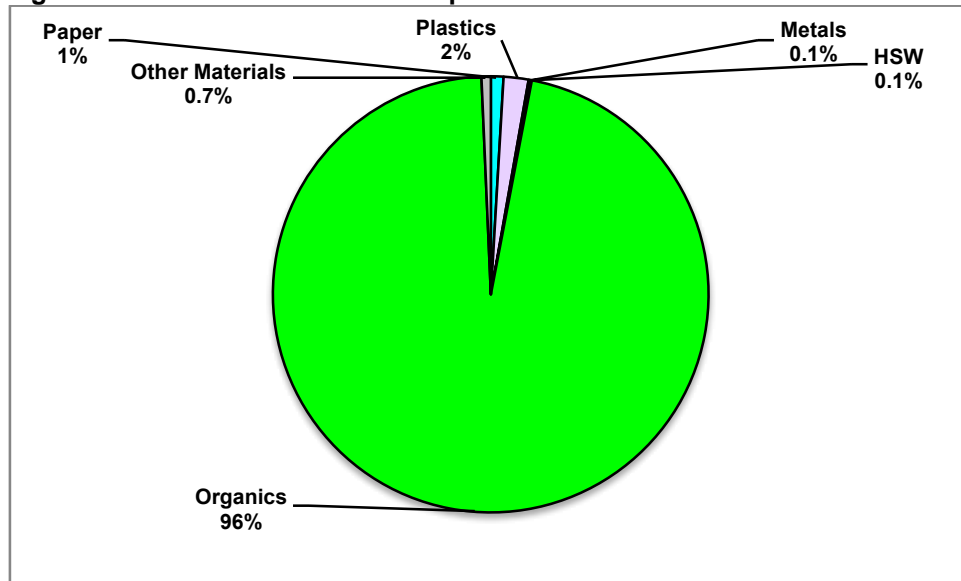
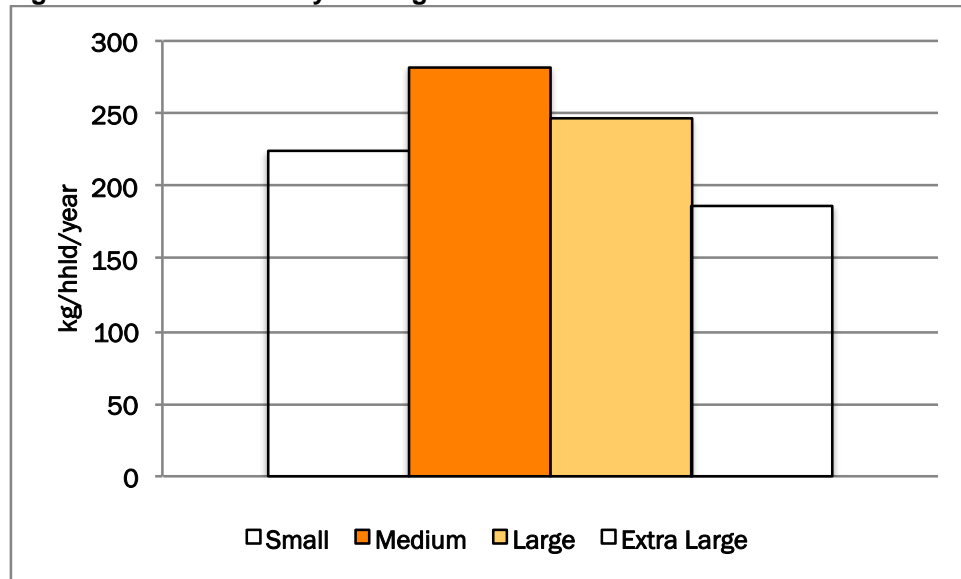


Figure ES.7 depicts the estimated annual amount of green bin material by garbage bin size and shows households with medium and large garbage bins divert the most green bin material and households with extra large garbage bins the lowest.

Figure ES.7 Green Bin by Garbage Bin Size - Four Seasonal Waste Audits



In conclusion over the four seasons waste audit households set out 78% garbage bins; 87% recycling bins and 70% green bins, while for the participation audit it was 74% garbage bins; 81% recycling bins and 68% green bins. Over the four seasons participation audit households had a participation rate of 84% for garbage bins; 92% for recycling bins and 86% for green bins.

As household garbage bin size increased there was more residual material and recycling material set out. Households with small garbage bins diverted more green bin materials than households with extra large bins. Households with medium and large garbage bins diverted the most green bin material.

1.0 Introduction

The City of Toronto (City) retained 2cg Inc. (2cg) to undertake the following:

3. Four season waste audit/set-out audit (waste audits) of the same 200 households; 100 in District 2 and 100 in District 3 (Table 1.1); and
4. Four season participation audit of the same 800 households; 400 in District 2 and 400 in District 3 (Table 1.2).

The waste audits and participation audits began in November 2015 and concluded in August 2016.

The objective of the waste audits and set out audits (Table 1.1) was to measure the weight, composition and household set out of relevant waste streams (i.e. residual material/green bin or recycling/green bin) over two consecutive weeks. Data analysis was undertaken by garbage bin size (i.e. Small, Medium, Large, Extra Large etc.).

The objective of the participation audits (Table 1.2) was to measure the set out of relevant waste streams (i.e. black cart/green cart or blue cart/green cart) by the garbage bin size (i.e. residual garbage/green bin or recycling/green bin) over four consecutive weeks. Data analysis was undertaken by garbage bin size (i.e. Small, Medium, Large, Extra Large etc.). The households denoted in Table 1.2 abutted the relevant households denoted in Table 1.1

Table 1.1 Waste Audit and Set-Out Audit- Households per Day

Day	District 2	District 3	Total
Tuesday	25	25	50
Wednesday	25	25	50
Thursday	25	25	50
Friday	25	25	50
Total	100	100	100

Table 1.2 Participation Audit- Households per Day

Day	District 2	District 3	Total
Tuesday	100	100	200
Wednesday	100	100	200
Thursday	100	100	200
Friday	100	100	200
Total	400	400	800

2.0 Methodology

The waste audit and participation audits were clearly prescribed by the City of Toronto (Toronto) in Request for Quotation 9180-15-3069 and is attached in Appendix 1.

For waste audits wastes were collected from relevant households by 2cg and taken back to a City sorting area. Wastes were collected/tracked/sorted by the size of the garbage bin (i.e. black cart). The set out of waste streams was measured.

For participation wastes the set out of waste streams was measured by documenting the set out of relevant carts over a four-week period.

Data was analyzed and presented as overall and by garbage bin size. The data from the four seasons was combined to present an overall average and to identify any trends.

3.0 Results- Fall 2015

The Fall waste audit took place 10-13 November and 17-20 November 2015. The participation audit took place during the aforementioned weeks as well as 24-27 November and 1-4 December 2015. Overall results are presented in the following sections.

3.1 Set Out and Participation

Table 3.1 depicts the set-out of residual material, recycling and green bin by garbage bin size for the 200 waste audit households. Households with extra large garbage bins had the highest set out for residual material and recycling and lowest set out for the green bin. Households with small garbage bins had the lowest set out for residual material and recycling and the second highest for the green bin.

Table 3.1 Set out of Residual Material, Recycling and Green Bin by Garbage Bin Size

Garbage Bin		Set Out		
Size	Assets	Residual Material	Recycling	Green Bin
	#	%		
S	46	66.1	84.8	76.5
M	75	80.9	93.3	78.2
L	59	84.8	91.5	71.5
XL	20	83.3	100.0	62.0
Total	200	78.8	91.5	72.1

Table 3.2 depicts the results of the set out and participation of the 800 participation audit households. Households with small garbage bins had the lowest participation rate for residual material, recycling and the green bin. Households with extra large garbage bins had the highest participation rate for residual material and recycling. Households with large garbage bins had the highest participation for the green bin. The total set out for residual material and recycling was lower for the participation audit as compared to the waste audit with green bin set out about the same.

Table 3.2 Set out of Residual Material, Recycling and Green Bin by Garbage Bin Size- Set out and Participation Audit

		Residual Material	Recycling	Green Bin
S	Set out- %	65.8	78.7	66.3
	Participation- %	78.2	90.8	78.1
M	Set out- %	77.4	82.8	70.8
	Participation- %	86.4	92.5	84.6
L	Set out- %	77.1	85.6	73.5
	Participation- %	88.1	93.8	86.3
XL	Set out- %	80.6	86.3	66.7
	Participation- %	90.0	95.0	81.5
Total	Set out- %	73.7	82.9	70.0
	Participation- %	84.6	92.7	83.2

3.2 Quantity of Waste Streams Collected

Approximately 6,274kg of all wastes were collected over the two-week waste audit. Figure 3.1 depicts the quantities of residual material, recycling and green bin waste samples, by garbage bin size. Data has been normalized to present the average set out per household, by garbage bin size. The quantity of residual material increases with garbage bin size, as does recycling. Households with medium garbage bins diverted the most green bin waste.

Figure 3.1 Residual, Recycling and Green Bin Waste Quantities Collected During Fall Audit

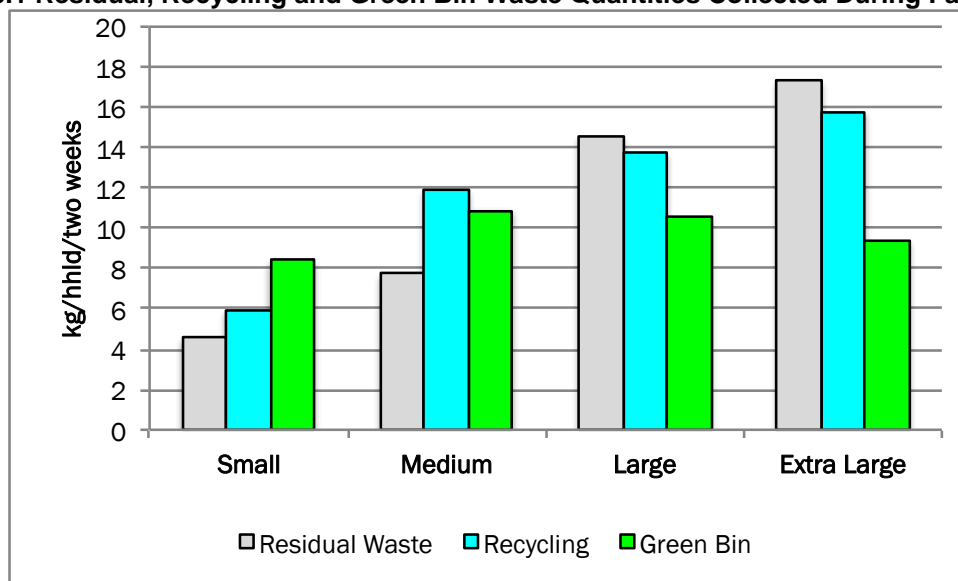


Table 3.3 depicts a summary of the three waste streams per garbage bin size. It includes a gross waste diversion rate (i.e. contamination is not netted out) for each garbage bin size. Households with small or medium bins had the highest gross waste diversion while households with an extra large garbage bin had the lowest.

Table 3.3 Summary of Waste Streams Collected and a Gross Diversion Rate per Garbage Bin Size

	Green Bin	Recycling	Residual Material	Diversion
	kg			%
Small	402.5	284.9	220.3	75.7
Medium	796.1	869.6	565.7	74.6
Large	644.1	838.4	888.6	62.5
Extra Large	169.0	283.9	311.4	59.3
Total	2,011.7	2,276.7	1,986.0	68.3

Table 3.4 depicts household green bin and recycling diversion, highlighting the contamination in both of those streams as well as the amount of green bin waste and recyclables in the residual waste stream. For this waste audit and the three waste streams households had a 60% diversion rate and potential 82% diversion rate.

Table 3.4 Summary of Green Bin and Recycling Diversion

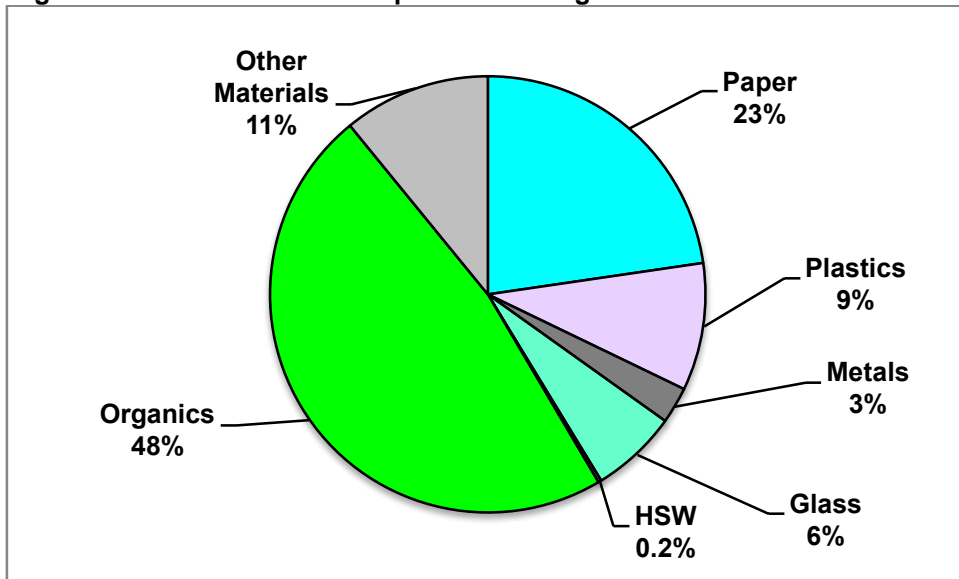
	Green Bin	Recycling	Residual Material	
Diversion (kg/hhld/year)	254.74	236.27		
Contamination (kg/hhld/year)	6.79	59.70	166.08	
% Contamination	2.6%	20.2%	64.3%	
% Diversion Rate	31.2%	29.0%		60.2%
Potential Diversion Rate				81.8%

3.3 Waste Composition

3.3.1 Overall

Table 3.5 (Appendix 2) presents a detailed estimate of waste composition for each waste stream. Figure 3.2 provides the overall waste composition for all three streams. It shows that organics make up 48% of the overall waste stream followed by paper and plastics.

Figure 3.2 Overall Waste Composition During Fall Audit



3.3.2 Residual Material

Figure 3.3 provides the overall waste composition for residual materials. It shows that organics make up 43% of the residual materials followed by other materials and plastics.

Figure 3.3 Residual Material Waste Composition During Fall Audit

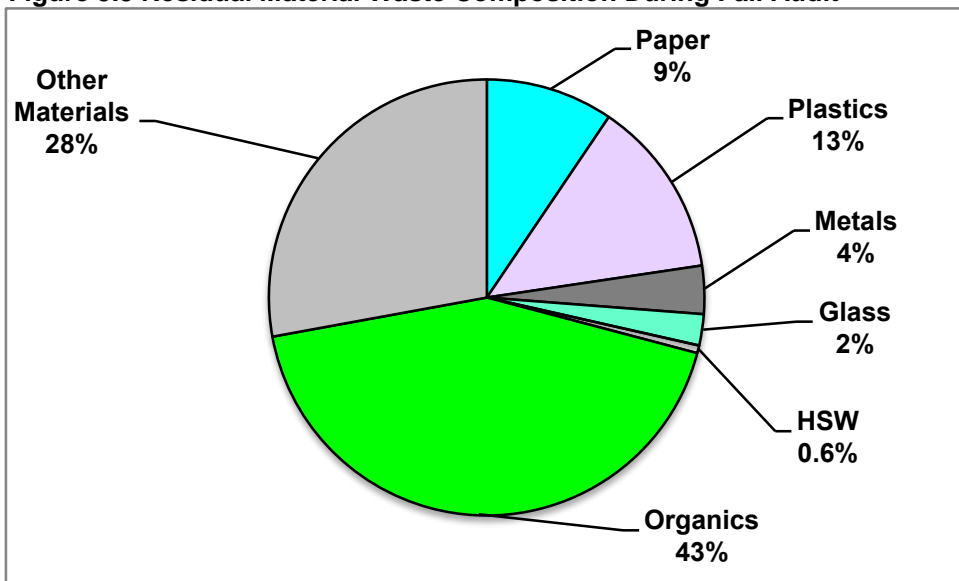


Figure 3.4 depicts the estimated annual amount of residual waste disposed by garbage bin size and shows an increase in waste disposal as bin size increases. Figure 3.5 provides some detail on residual waste data by garbage bin size. It shows that there are increasing amounts of the various waste types as bin size increases and that households with large and especially extra large garbage bins dispose of considerably more of all wastes than households with smaller bins.

Figure 3.4 Residual Material by Garbage Bin Size During Fall Audit

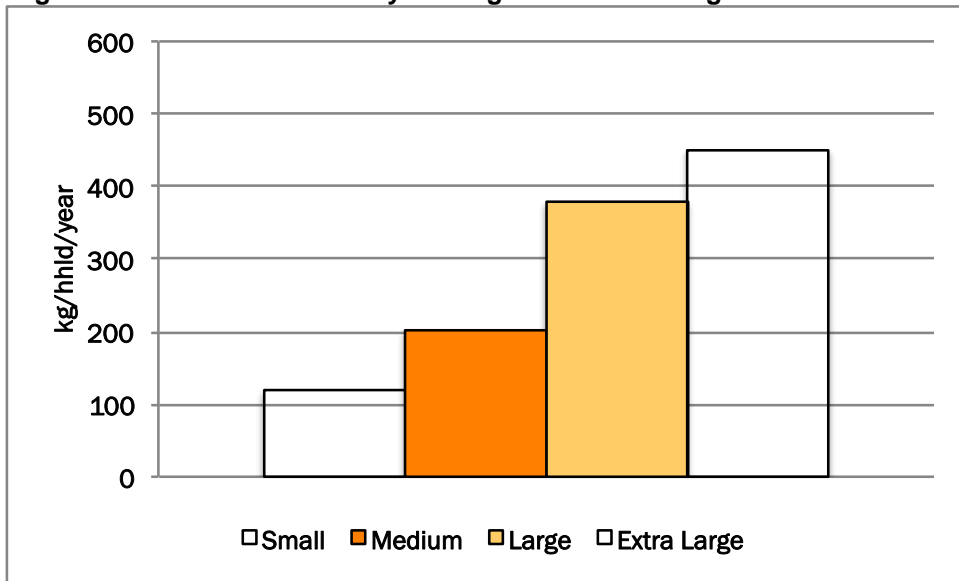
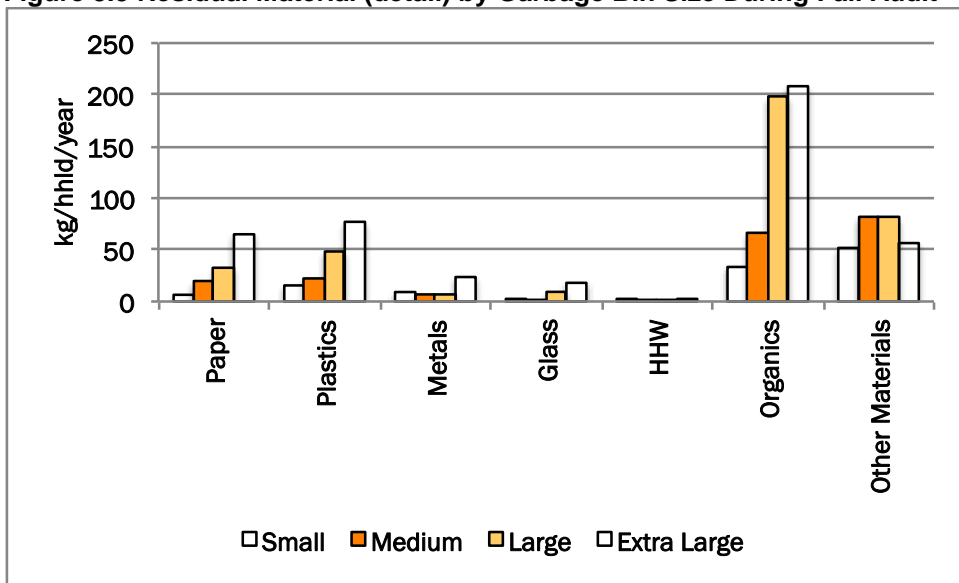


Figure 3.5 Residual Material (detail) by Garbage Bin Size During Fall Audit



3.3.3 Recycling

Figure 3.6 provides the overall waste composition for recycling. It shows that paper makes up 54% of recycling followed by plastics and glass. Figure 3.7 provides some additional detail on recycling composition. It shows that printed paper (a total of newspapers, magazines, phone books, books, mixed fine paper and other paper) makes up about 31% of what is in the recycling bin. Key plastics include PET, LDPE and polystyrene. Organics and other materials make up the key contaminants.

Figure 3.6 Recycling Waste Composition During Fall Audit

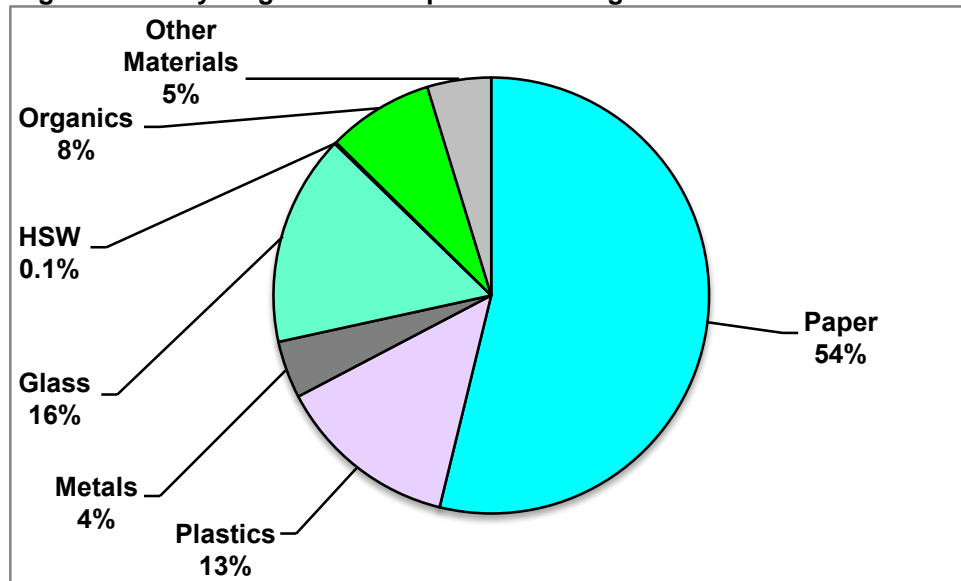


Figure 3.7 Recycling Waste Composition Detail- Fall Audit

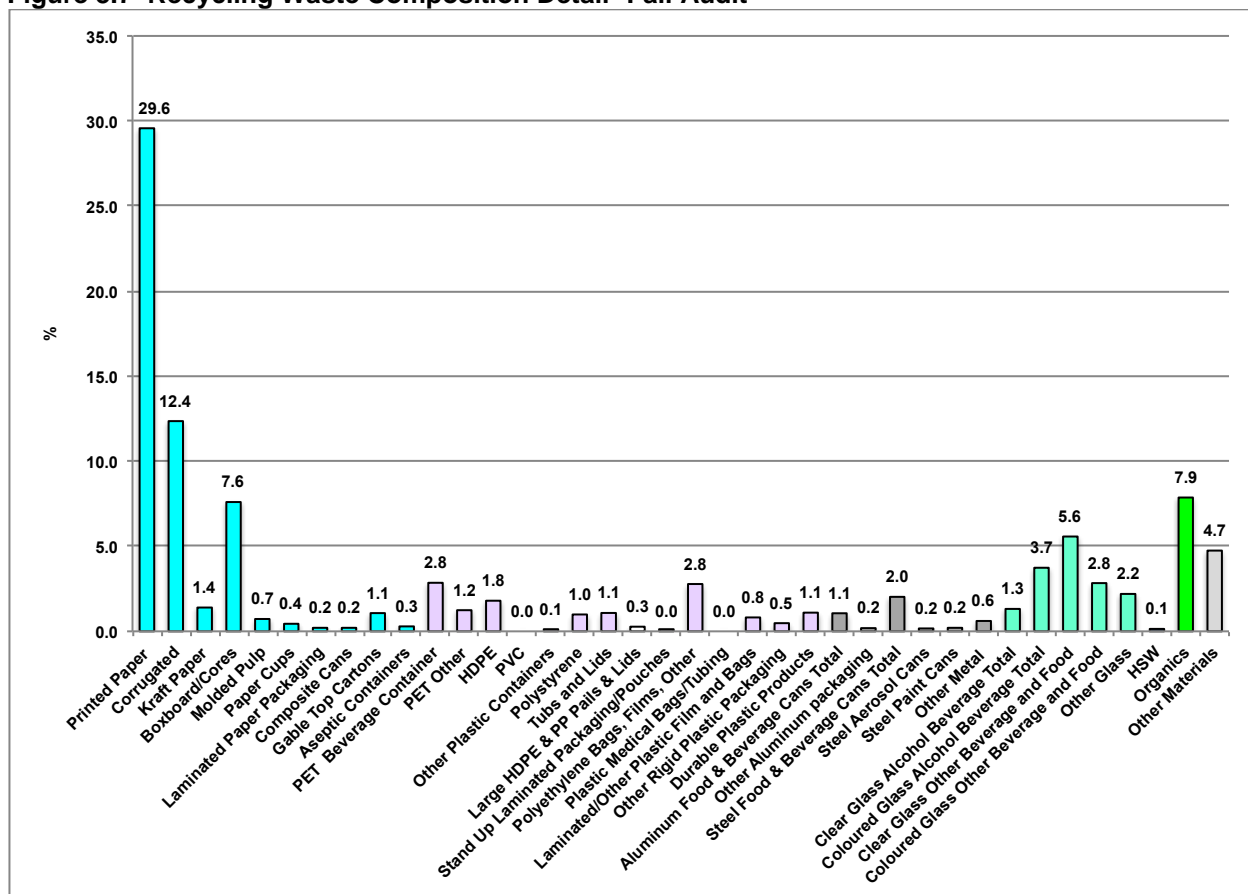


Figure 3.8 depicts the estimated annual amount of recycling by garbage bin size and shows an increase in recycling as bin size increases. Figure 3.9 provides some detail on recycling data by garbage bin size. It shows that there are generally increasing amounts of the various

recyclables, except for metals and to a lesser extent plastics, as bin size increases and that households with extra large garbage bins divert considerably more of all recyclables than households with smaller bins.

Figure 3.8 Recycling by Garbage Bin Size During Fall Audit

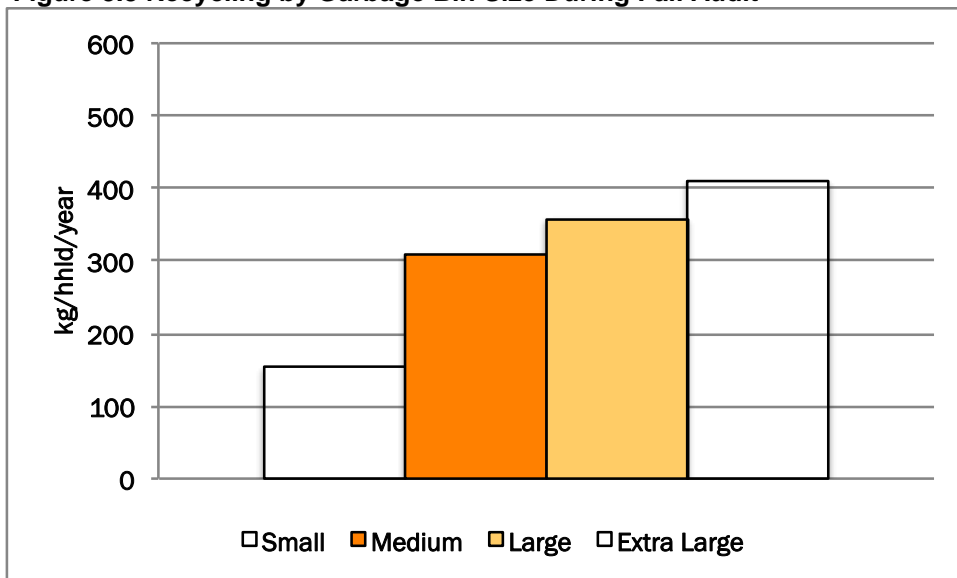
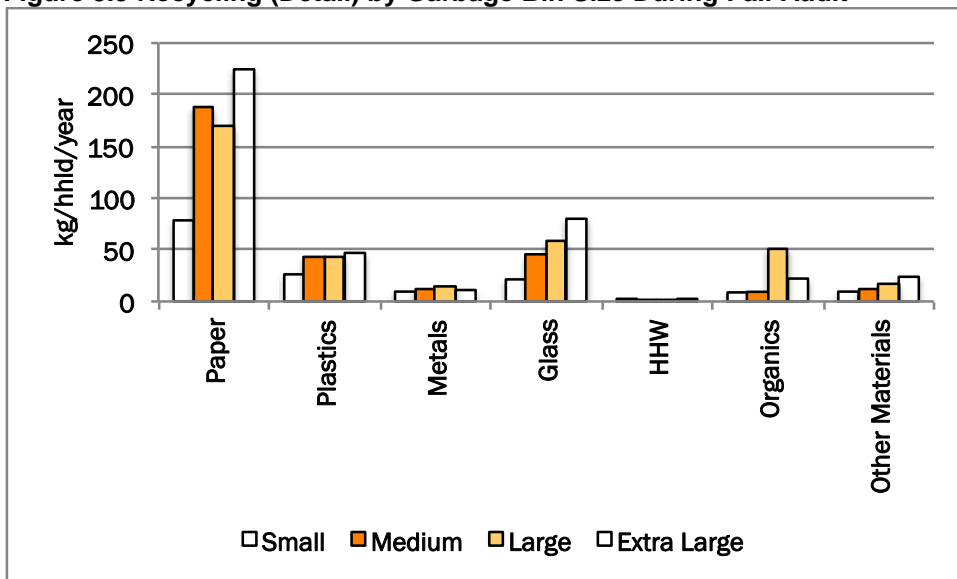


Figure 3.9 Recycling (Detail) by Garbage Bin Size During Fall Audit



3.3.4 Green Bin

Figure 3.10 provides the overall waste composition for the green bin. It shows that approximately 97% of materials received in the green bin fit within the organics category. Figure 3.11 provides some additional detail. It shows that food waste makes up almost 60% of the material in the green bin followed by diapers & sanitary, pet waste and yard waste.

Figure 3.10 Green Bin Waste Composition During Fall Audit

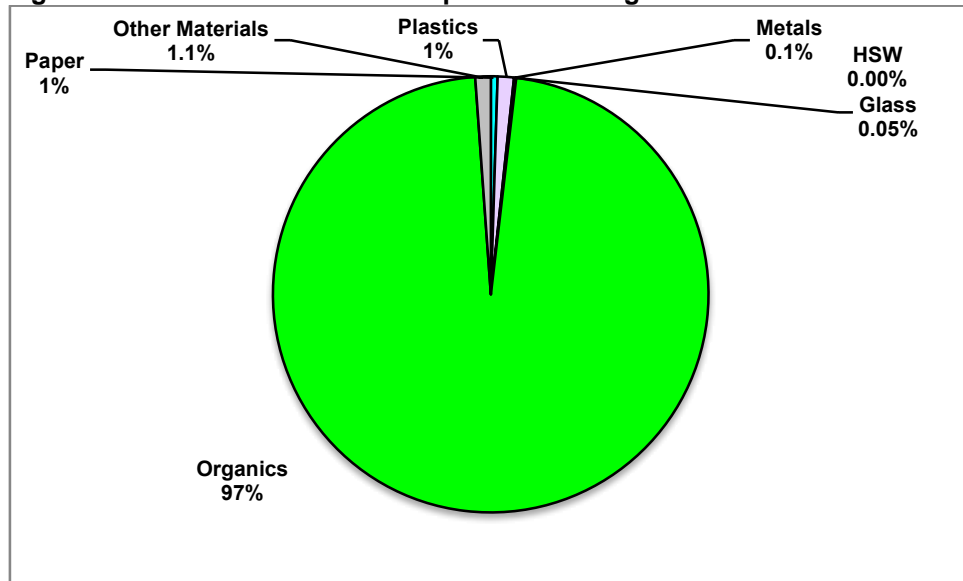


Figure 3.11 Green Bin Waste Composition Detail- Fall Audit

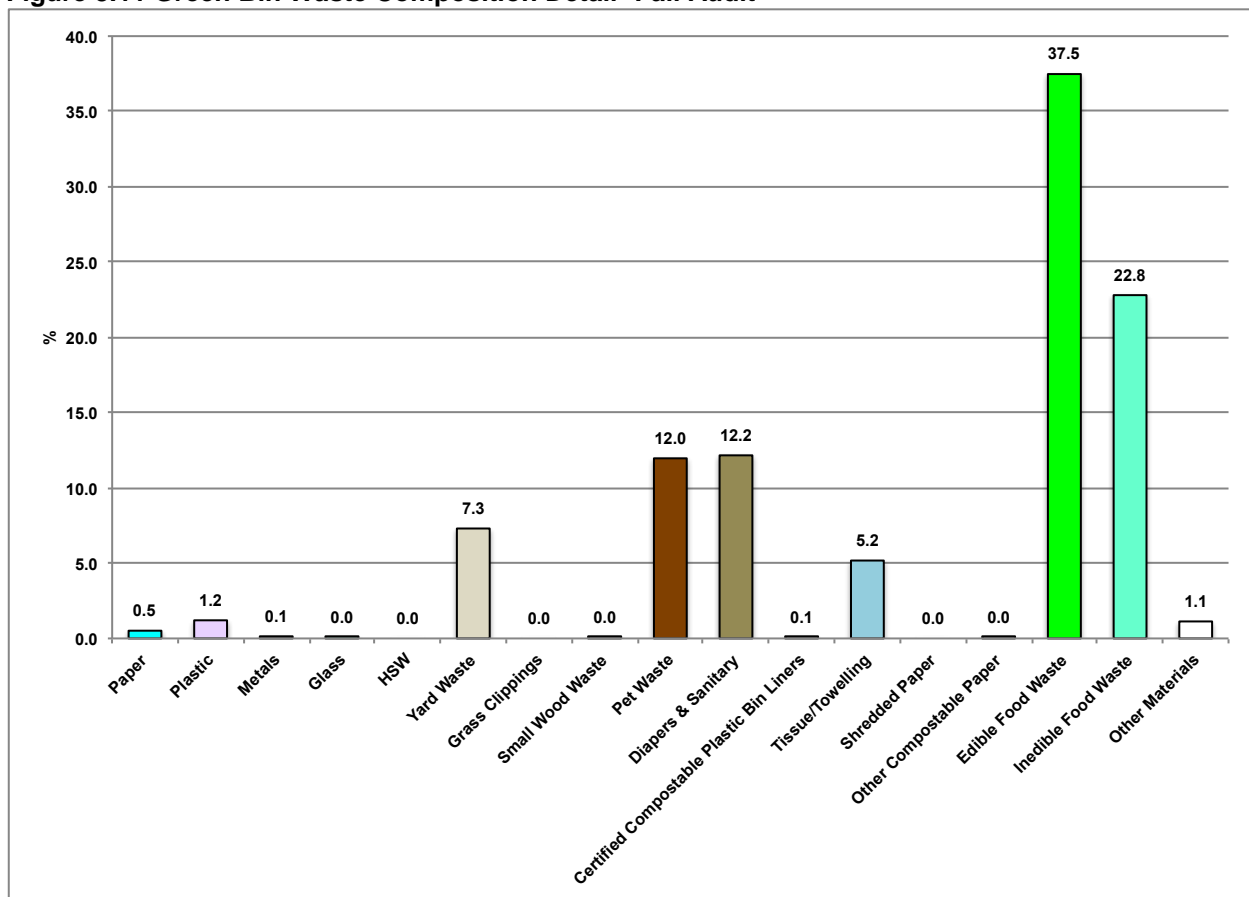


Figure 3.12 depicts the estimated annual amount of green bin material by garbage bin size and shows households with medium and large garbage bins divert the most green bin material. Figure 3.13 provides some detail on green bin data by garbage bin size. It shows that essentially all of the materials in the green bin are green bin materials.

Figure 3.12 Green Bin by Garbage Bin Size During Fall Audit

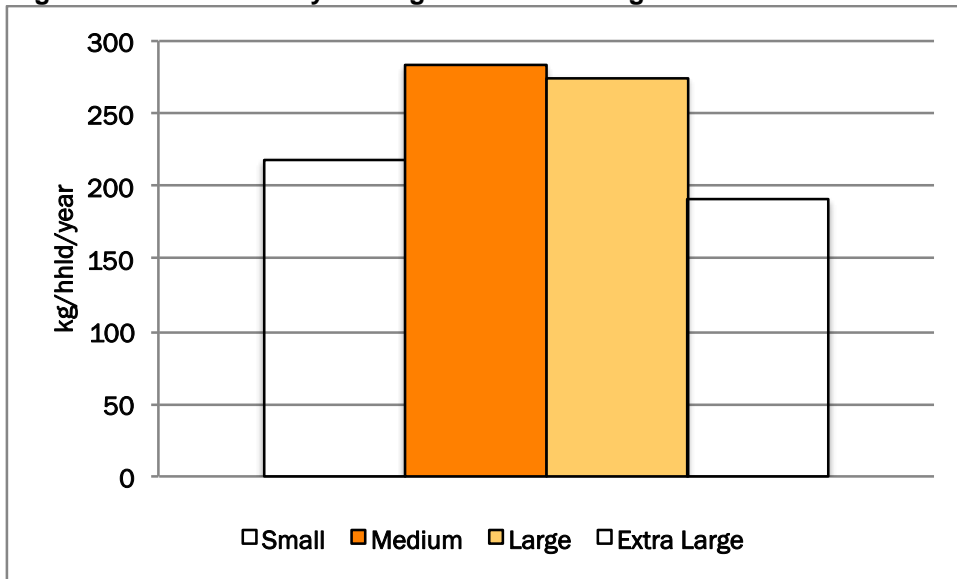
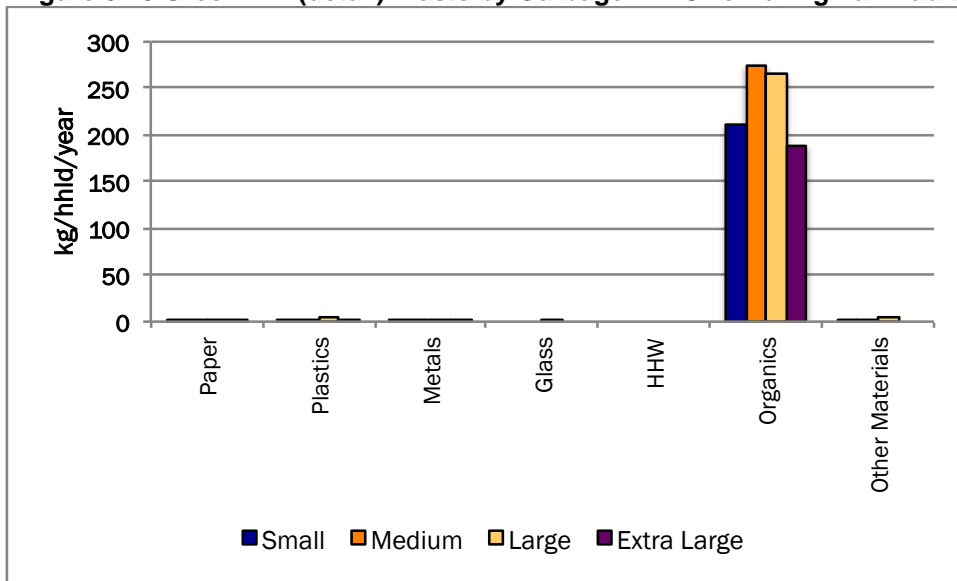


Figure 3.13 Green Bin (detail) Waste by Garbage Bin Size During Fall Audit



4.0 Results- Winter 2016

The Winter waste audit took place 26-29 January and 2-5 February 2016. The participation audit took place during the aforementioned weeks as well as 9-12 and 16-19 February 2016. Overall results are presented in the following sections.

4.1 Set Out and Participation

Table 4.1 depicts the set-out of residual material, recycling and green bin by garbage bin size for the 200 waste audit households. Households with extra large garbage bins had the highest set out for residual material and recycling and lowest set out for the green bin. Households with small garbage bins had the lowest set out for residual material and recycling but highest for the green bin.

Table 4.1 Set out of Residual Material, Recycling and Green Bin by Garbage Bin Size

Garbage Bin		Set Out		
Size	Assets	Residual Material	Recycling	Green Bin
	#	%		
S	48	62.8	81.3	76.5
M	73	70.6	84.9	73.7
L	60	75.6	86.7	65.9
XL	19	86.1	94.7	56.3
Total	200	73.8	85.5	68.1

Table 4.2 depicts the results of the set out and participation of the 800 participation audit households. Households with extra large garbage bins had the highest participation rate for residual material. Households with small garbage bins had the lowest participation rate for residual material and green bin. Households with large garbage bins had the highest participation rate for recycling and the green bin. The total set out for residual material and green bin was about the same for the participation audit as compared to the waste audit with recycling set out lower for the participation audit.

Table 4.2 Set out of Residual Material, Recycling and Green Bin by Garbage Bin Size- Set out and Participation Audit

		Residual Material	Recycling	Green Bin
S	Set out- %	62.2	78.2	69.5
	Participation- %	74.0	88.4	84.6
M	Set out- %	75.0	78.9	68.4
	Participation- %	87.7	91.9	85.5
L	Set out- %	80.8	85.2	74.7
	Participation- %	90.7	97.9	88.2
XL	Set out- %	85.4	82.3	71.4
	Participation- %	91.7	91.7	88.1
Total	Set out- %	73.3	80.6	70.5
	Participation- %	85.2	92.6	86.2

4.2 Quantity of Waste Streams Collected

Approximately 5,677kg of all wastes were collected over the two-week waste audit. Figure 4.1 depicts the quantities of residual material, recycling and green bin waste samples, by garbage bin size. Data has been normalized to present the average set out per household, by garbage bin size. The quantity of residual material increases with garbage bin size, as does recycling. Households with medium garbage bins diverted the most green bin waste.

Figure 4.1 Residual, Recycling and Green Bin Waste Quantities Collected During Winter Audit

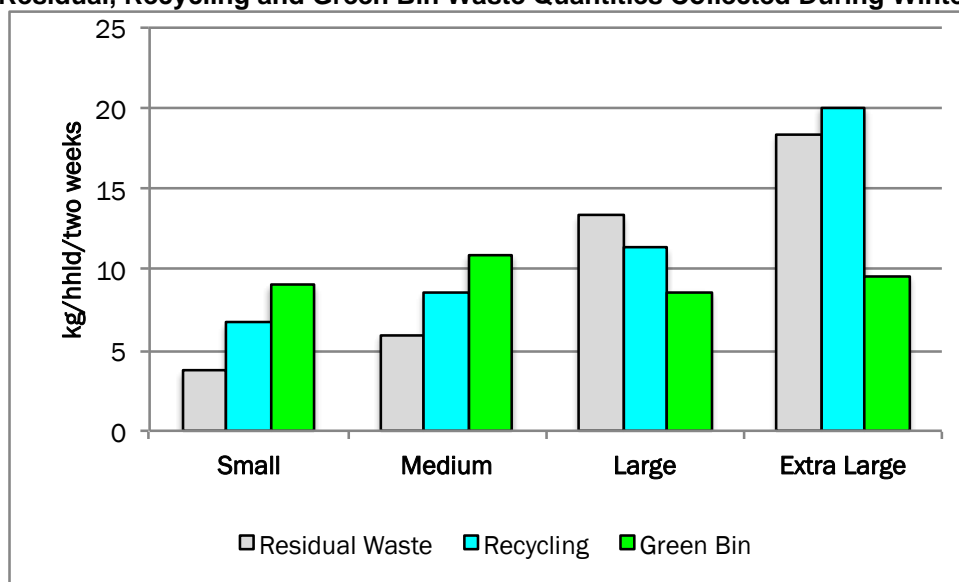


Table 4.3 depicts a summary of the three waste streams per garbage bin size. It includes a gross waste diversion rate (i.e. contamination is not netted out) for each garbage bin size. Households with small or medium bins had the highest gross waste diversion while households with a large garbage bin had the lowest.

Table 4.3 Summary of Waste Streams Collected and a Gross Diversion Rate per Garbage Bin Size

	Green Bin	Recycling	Residual Material	Diversion
	kg			%
Small	433.6	320.1	178.1	80.9
Medium	794.0	626.2	434.4	76.6
Large	524.5	692.2	811.7	60.0
Extra Large	172.5	360.9	329.2	61.8
Total	1,924.6	1,999.4	1,753.4	69.1

Table 4.4 depicts household green bin and recycling diversion, highlighting the contamination in both of those streams as well as the amount of green bin waste and recyclables in the residual waste stream. For this waste audit and the three waste streams, households had a 61% diversion rate and potential 81% diversion rate.

Table 4.4 Summary of Green Bin and Recycling Diversion

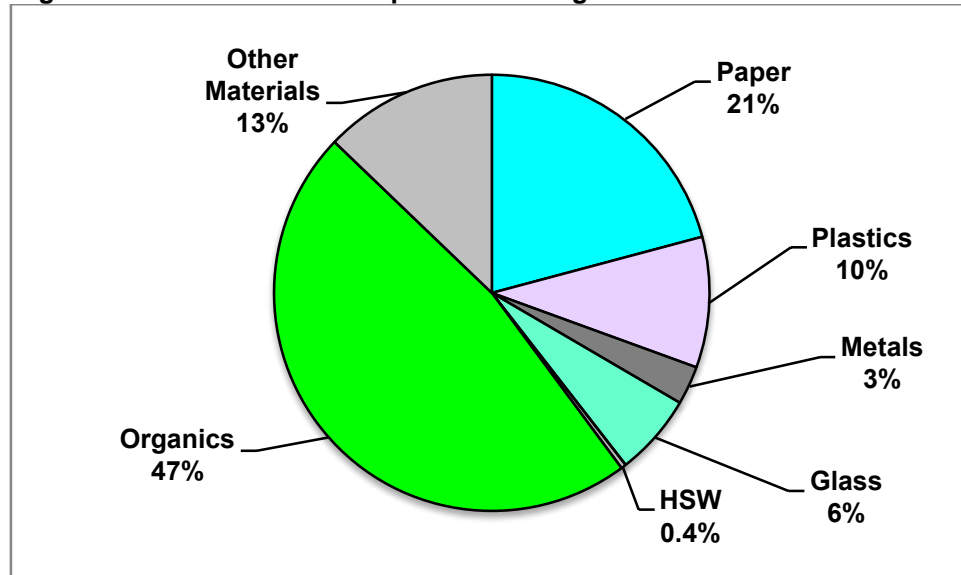
	Green Bin	Recycling	Residual Material	
Diversion (kg/hhld/year)	242.61	209.48		
Contamination (kg/hhld/year)	7.58	50.38	136.07	
% Contamination	3.0%	19.4%	59.7%	
% Diversion Rate	32.9%	28.4%		61.3%
Potential Diversion Rate				81.5%

4.3 Waste Composition

4.3.1 Overall

Table 4.5 (Appendix 2) presents a detailed estimate of waste composition for each waste stream. Figure 4.2 provides the overall waste composition for all three streams. It shows that organics make up 47% of the overall waste stream followed by paper and plastics.

Figure 4.2 Overall Waste Composition During Winter Audit



4.3.2 Residual Material

Figure 4.3 provides the overall waste composition for residual materials. It shows that organics make up 38% of the residual materials followed by other materials and plastics.

Figure 4.3 Residual Material Waste Composition During Winter Audit

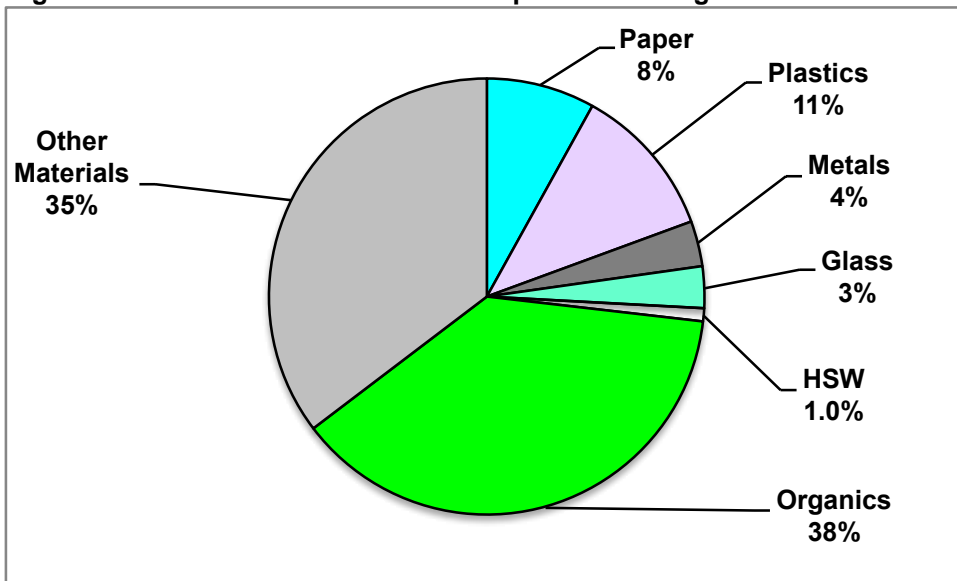


Figure 4.4 depicts the estimated annual amount of residual waste disposed by garbage bin size and shows an increase in waste disposal as bin size increases. Figure 4.5 provides some detail on residual waste data by garbage bin size. It shows that there are increasing amounts of the various waste types as bin size increases and that households with large and especially extra large garbage bins dispose of considerably more of all wastes than households with smaller bins.

Figure 4.4 Residual Material by Garbage Bin Size During Winter Audit

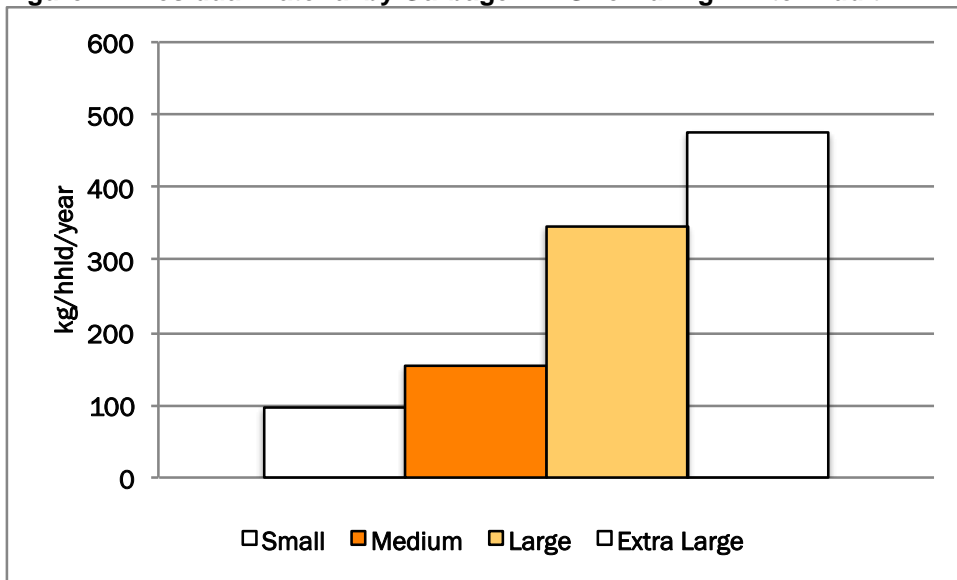
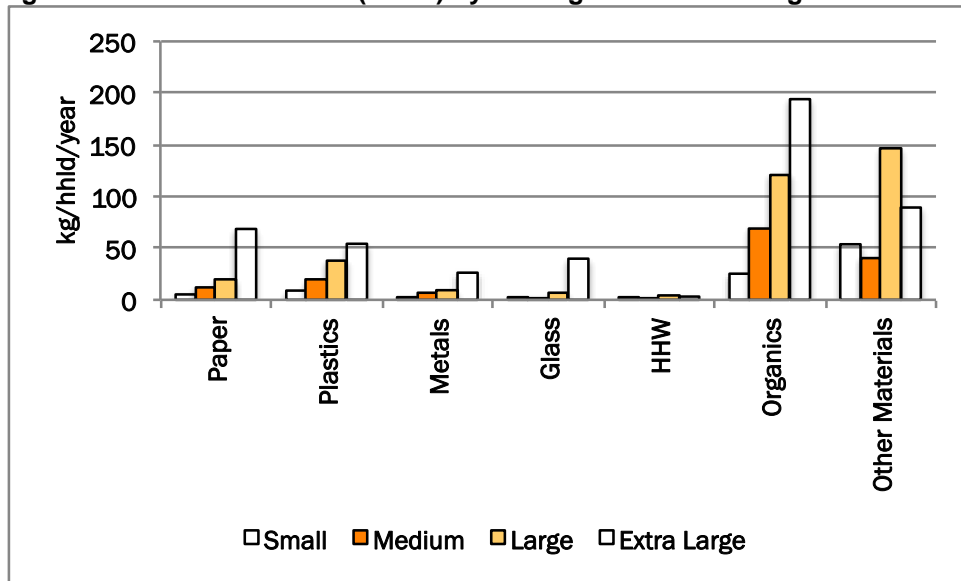


Figure 4.5 Residual Material (detail) by Garbage Bin Size During Winter Audit



4.3.3 Recycling

Figure 4.6 provides the overall waste composition for recycling. It shows that paper makes up 52% of recycling followed by plastics and glass. Figure 4.7 provides some additional detail on recycling composition. It shows that printed paper (a total of newspapers, magazines, phone books, books, mixed fine paper and other paper) makes up about 24% of what is in the recycling bin. Key plastics include PET, HDPE, LDPE and PS. Organics and other materials make up the key contaminants.

Figure 4.6 Recycling Waste Composition During Winter Audit

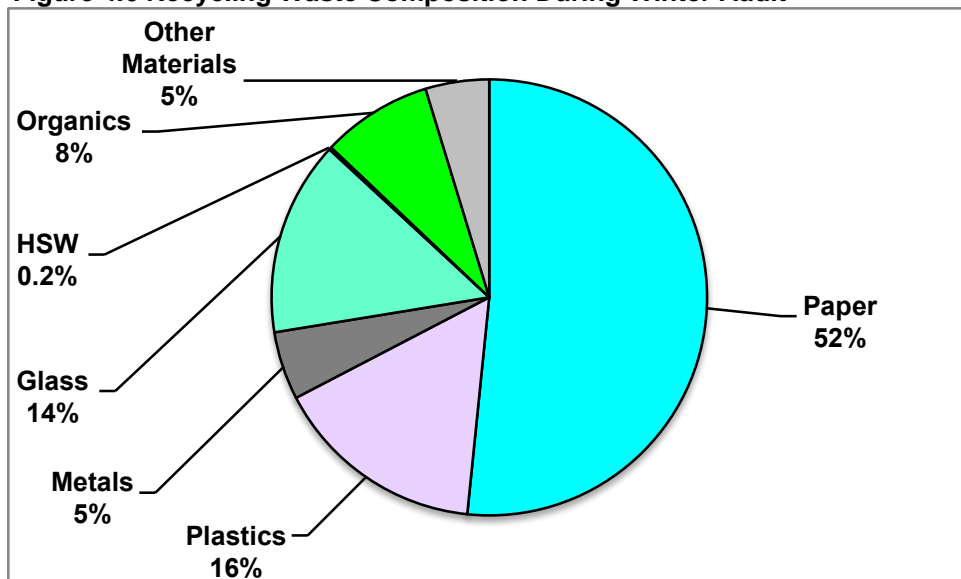


Figure 4.7 Recycling Waste Composition Detail- Winter Audit

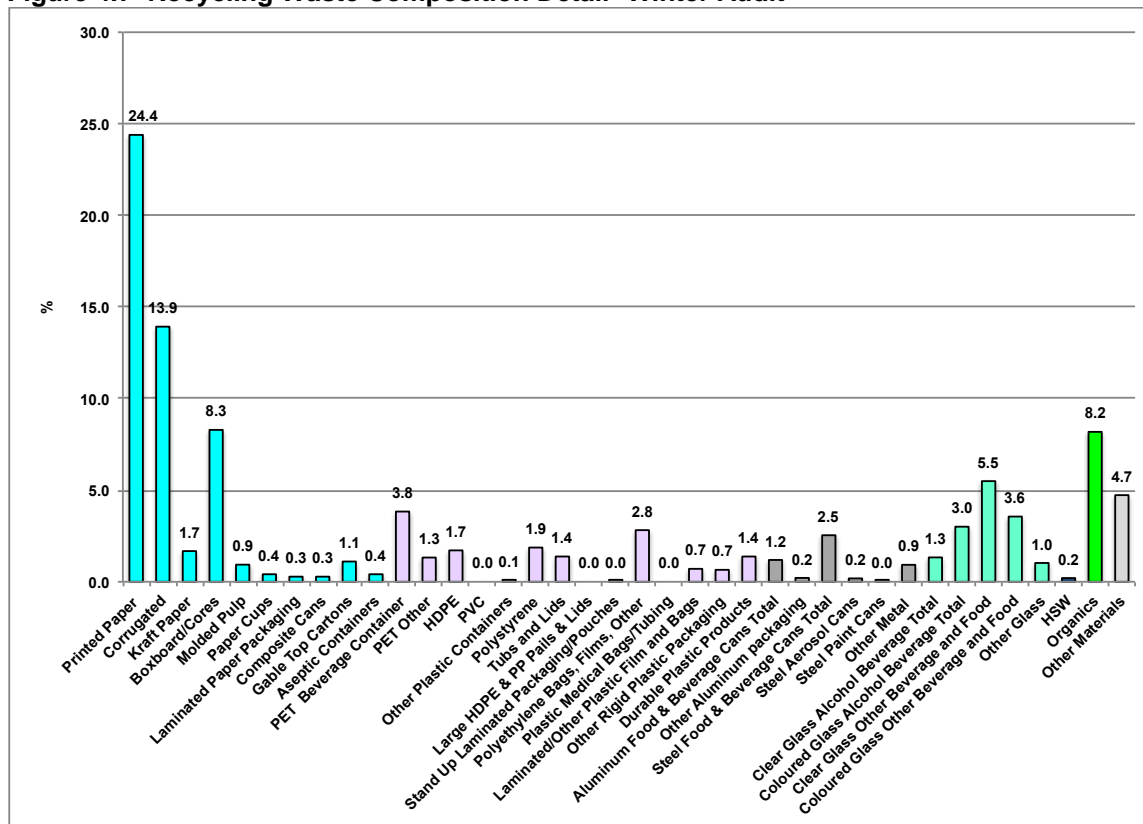


Figure 4.8 depicts the estimated annual amount of recycling by garbage bin size and shows an increase in recycling as bin size increases. Figure 4.9 provides some detail on recycling data by garbage bin size. It shows that there are increasing amounts of the various recyclables, except for metals, as bin size increases and that households with extra large garbage bins divert considerably more of all recyclables than households with smaller bins.

Figure 4.8 Recycling by Garbage Bin Size During Winter Audit

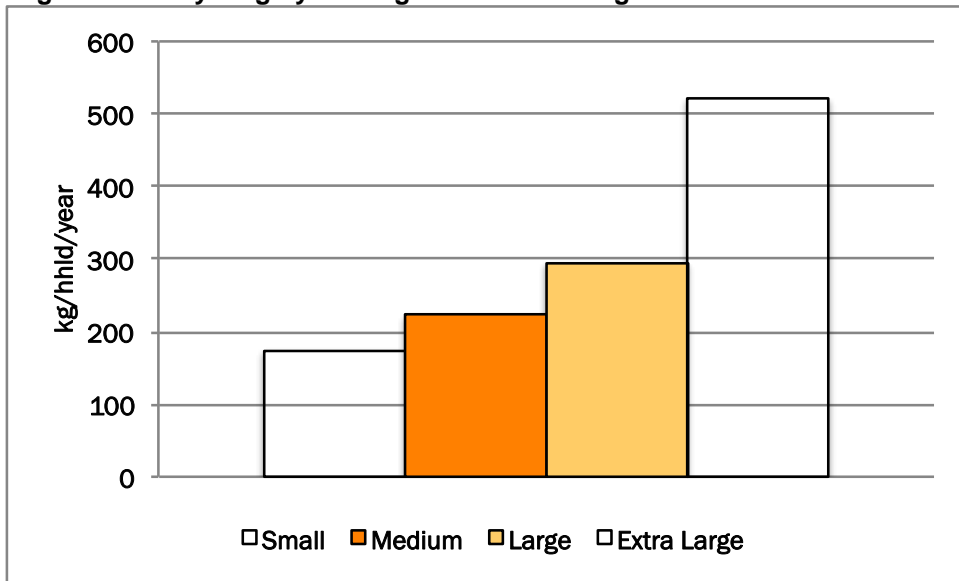
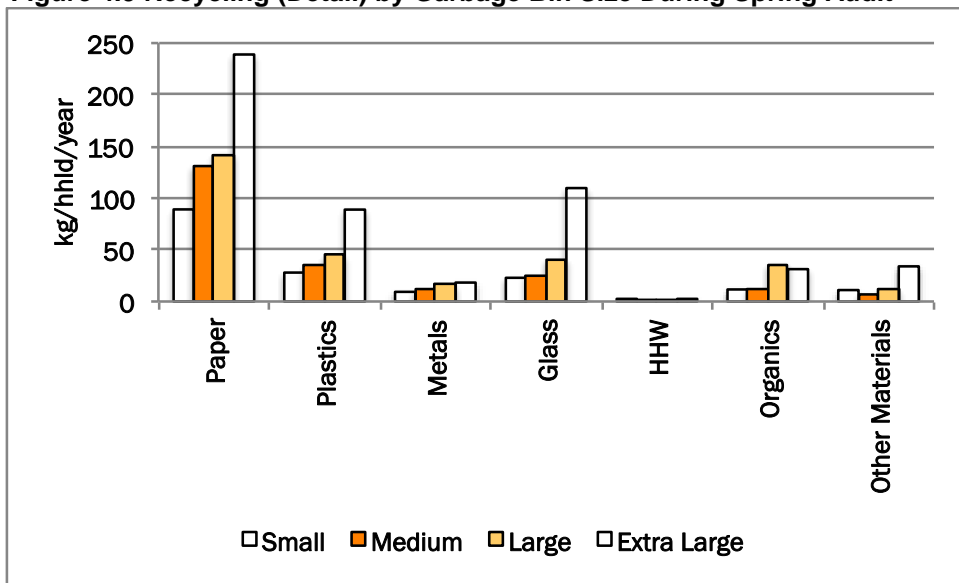


Figure 4.9 Recycling (Detail) by Garbage Bin Size During Spring Audit



4.3.4 Green Bin

Figure 4.10 provides the overall waste composition for the green bin. It shows that approximately 97% of materials received in the green bin fit within the organics category. Figure 4.11 provides some additional detail. It shows that food waste makes up almost 63% of the material in the green bin followed by pet waste, diapers & sanitary and tissue toweling.

Figure 4.10 Green Bin Waste Composition During Spring Audit

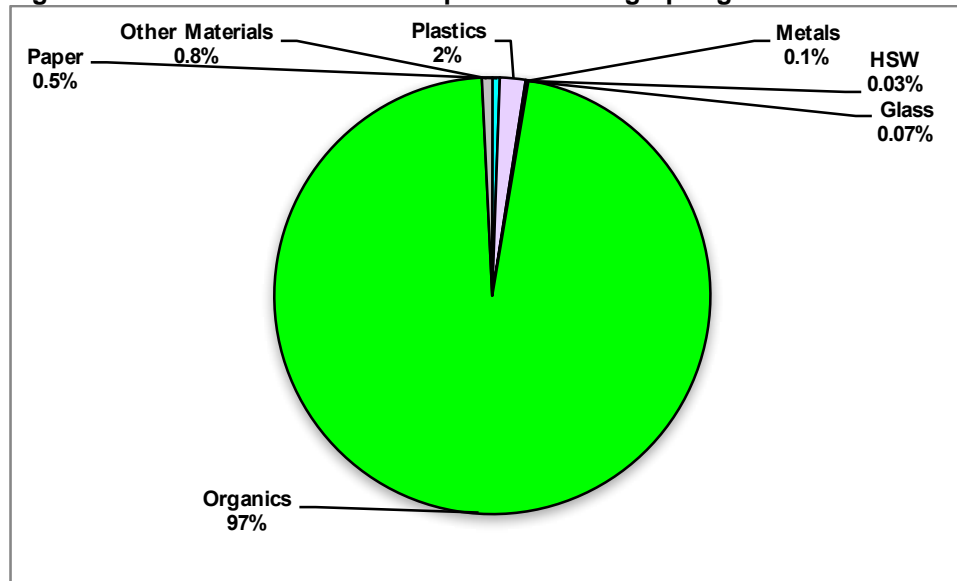


Figure 4.11 Green Bin Waste Composition Detail- Spring Audit

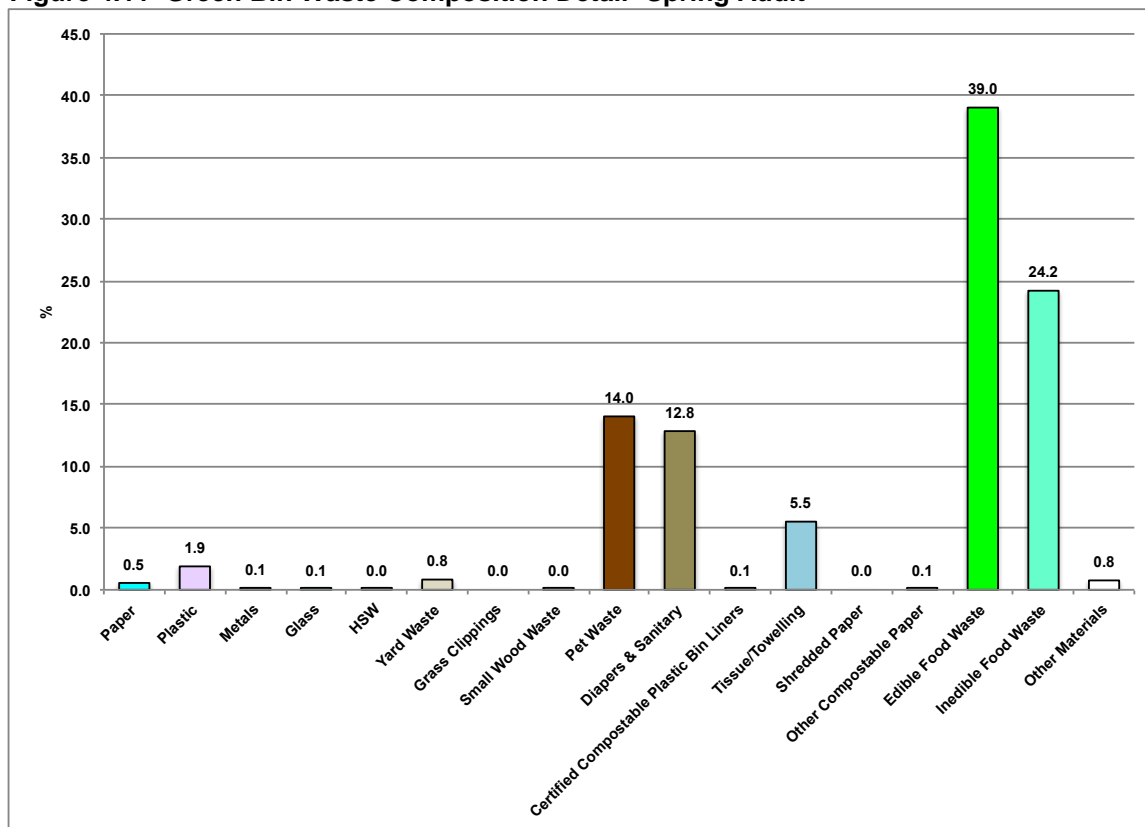


Figure 4.12 depicts the estimated annual amount of green bin material by garbage bin size and shows households with small and medium garbage bins divert the most green bin material. Figure 4.13 provides some detail on green bin data by garbage bin size. It shows that essentially all of the materials in the green bin are green bin materials.

Figure 4.12 Green Bin by Garbage Bin Size During Winter Audit

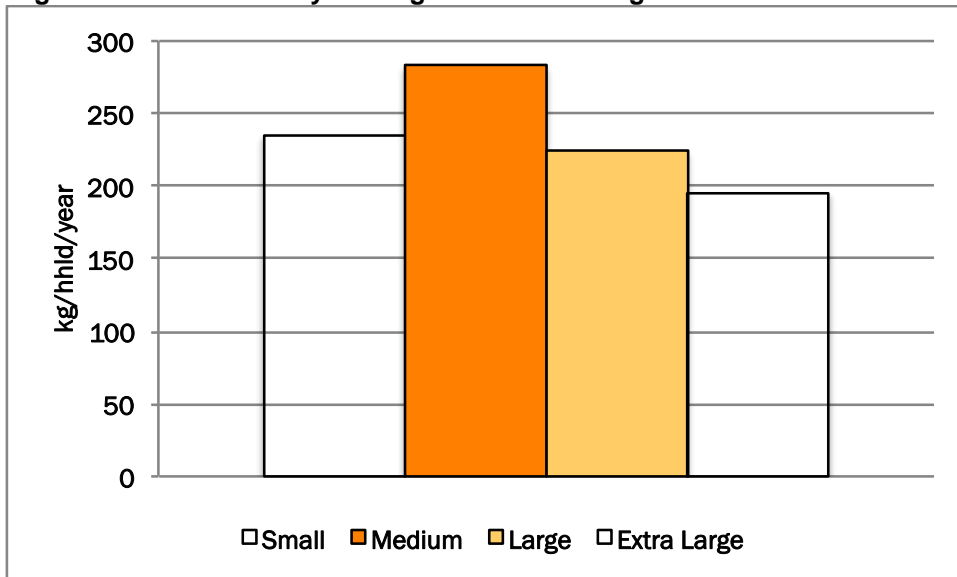
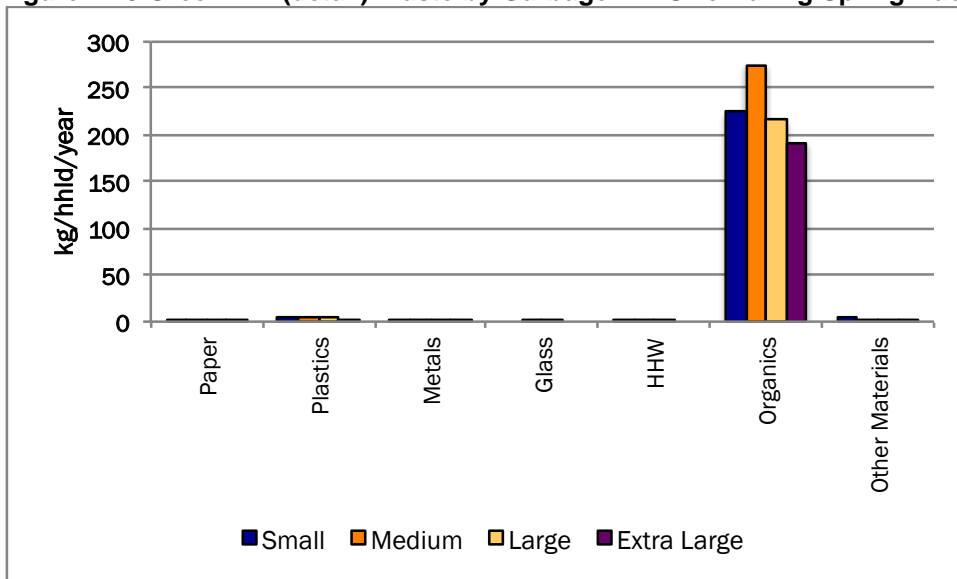


Figure 4.13 Green Bin (detail) Waste by Garbage Bin Size During Spring Audit



5.0 Results- Spring 2016

The Spring waste audit took place 3-6 May and 10-13 May 2016. The participation audit took place during the aforementioned weeks as well as 17-20 and 24-27 May 2016. Overall results are presented in the following sections.

5.1 Set Out and Participation

Table 5.1 depicts the set-out of residual material, recycling and green bin by garbage bin size for the 200 waste audit households. Households with extra large garbage bins had the highest set out for residual material and recycling and second highest set out for the green bin. Households with large garbage bins had the lowest set out for residual material and for the green bin. Households with small garbage bins had the highest set out for the green bin.

Table 5.1 Set out of Residual Material, Recycling and Green Bin by Garbage Bin Size

Garbage Bin		Set Out		
Size	Assets	Residual Material	Recycling	Green Bin
	#	%		
S	48	80.7	91.7	78.1
M	73	79.7	83.6	70.5
L	61	79.4	88.5	68.5
XL	18	86.9	100.0	71.8
Total	200	81.7	88.5	72.2

Table 5.2 depicts the results of the set out and participation of the 800 participation audit households. Households with small garbage bins had the lowest participation rate for residual material but the highest participation rate for green bin. Households with extra large garbage bins had the highest participation rate for recycling and second highest participation rate for green bin. The total set out for residual material, recycling and the green bin was lower for the participation audit as compared to the waste audit.

Table 5.2 Set out of Residual Material, Recycling and Green Bin by Garbage Bin Size- Set out and Participation Audit

		Residual Material	Recycling	Green Bin
S	Set out- %	68.8	77.4	68.0
	Participation- %	83.7	89.7	90.3
M	Set out- %	75.4	81.8	68.9
	Participation- %	90.5	91.7	88.5
L	Set out- %	80.4	85.9	69.0
	Participation- %	94.2	94.8	88.6
XL	Set out- %	82.9	87.6	66.9
	Participation- %	91.6	95.2	89.2
Total	Set out- %	75.2	82.3	68.5
	Participation- %	80.4	92.3	89.0

5.2 Quantity of Waste Streams Collected

Approximately 6,150kg of all wastes were collected over the two-week waste audit. Figure 5.1 depicts the quantities of residual material, recycling and green bin waste samples, by garbage bin size. Data has been normalized to present the average set out per household, by garbage bin size. The quantity of residual material increases with garbage bin size, as does recycling. Households with medium garbage bins diverted the most green bin waste.

Figure 5.1 Residual, Recycling and Green Bin Waste Quantities Collected During Spring Audit

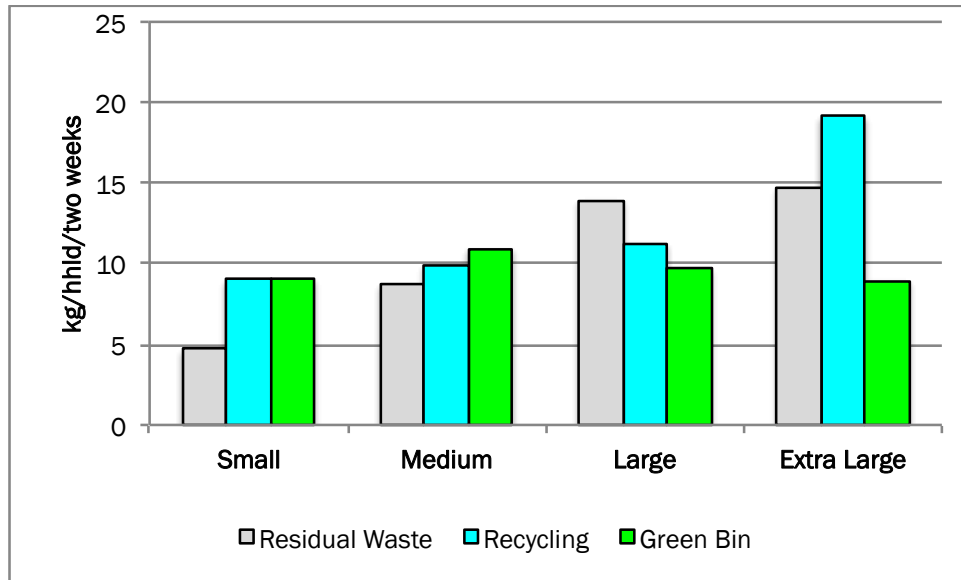


Table 5.3 depicts a summary of the three waste streams per garbage bin size. It includes a gross waste diversion rate (i.e. contamination is not netted out) for each garbage bin size. Households with small or medium bins had the highest gross waste diversion while households with a large garbage bin had the lowest.

Table 5.3 Summary of Waste Streams Collected and a Gross Diversion Rate per Garbage Bin Size

	Green Bin	Recycling	Residual Material	Diversion
	kg			%
Small	435.1	431.8	225.2	79.4
Medium	796.9	725.7	637.3	70.5
Large	591.4	688.9	848.5	60.1
Extra Large	161.0	344.3	264.2	65.7
Total	1,984.4	2,190.7	1,975.3	67.9

Table 5.4 depicts household green bin and recycling diversion, highlighting the contamination in both of those streams as well as the amount of green bin waste and recyclables in the residual waste stream. For this waste audit and the three waste streams households had a 61% diversion rate and potential 81% diversion rate.

Table 5.4 Summary of Green Bin and Recycling Diversion

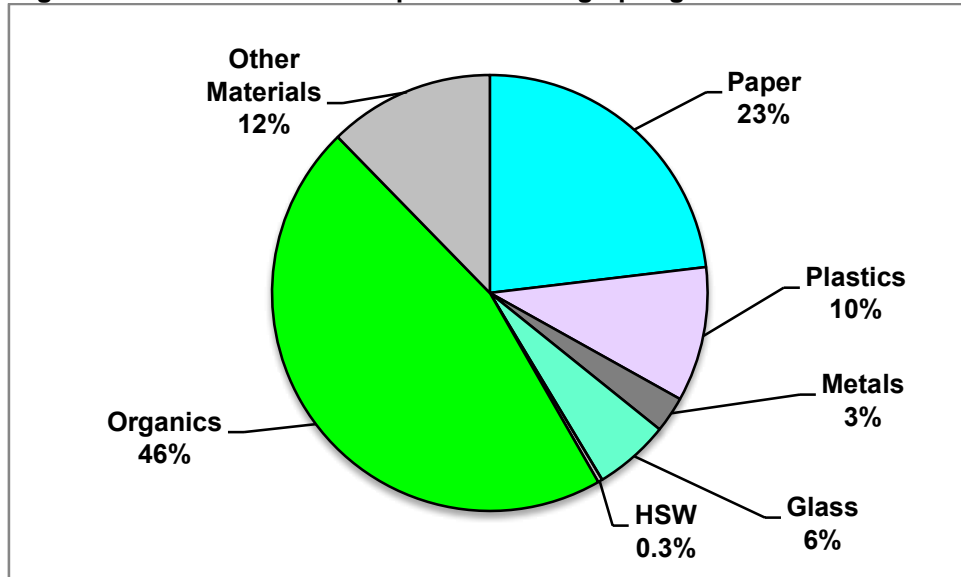
	Green Bin	Recycling	Residual Material	
Diversion (kg/hhld/year)	251.68	238.53		
Contamination (kg/hhld/year)	6.30	46.26	154.12	
% Contamination	2.4%	16.2%	60.0%	
% Diversion Rate	31.5%	29.8%		61.3%
Potential Diversion Rate				81.2%

5.3 Waste Composition

5.3.1 Overall

Table 5.5 (Appendix 2) presents a detailed estimate of waste composition for each waste stream. Figure 5.2 provides the overall waste composition for all three streams. It shows that organics make up 46% of the overall waste stream followed by paper and other materials.

Figure 5.2 Overall Waste Composition During Spring Audit



5.3.2 Residual Material

Figure 5.3 provides the overall waste composition for residual materials. It shows that organics make up 40% of the residual materials followed by other materials and plastics.

Figure 5.3 Residual Material Waste Composition During Spring Audit

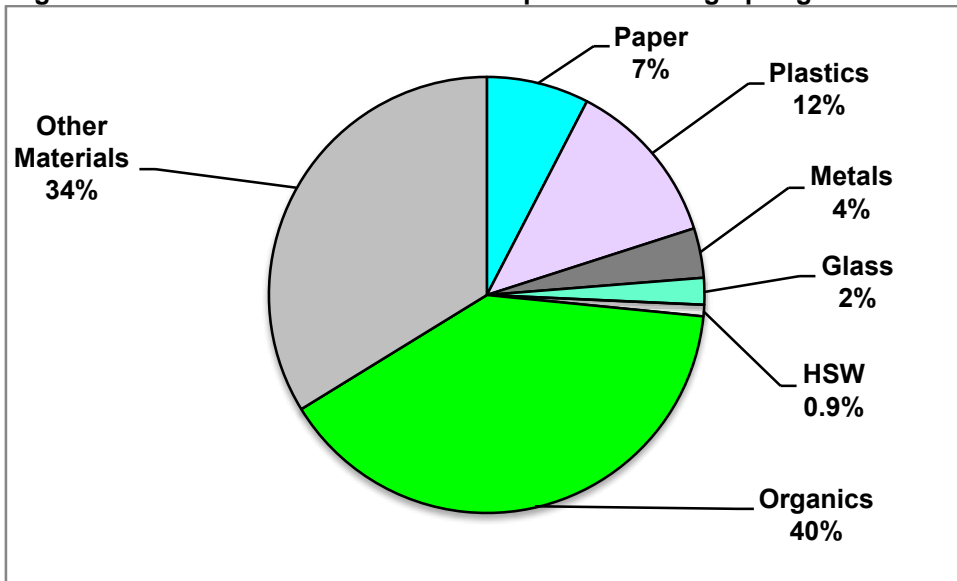


Figure 5.4 depicts the estimated annual amount of residual waste disposed by garbage bin size and shows an increase in waste disposal as bin size increases. Figure 5.5 provides some detail on residual waste data by garbage bin size. It shows that there are generally increasing amounts of the various waste types as bin size increases and that households with large and especially extra large garbage bins dispose of considerably more of all wastes than households with smaller bins, except for other materials.

Figure 5.4 Residual Material by Garbage Bin Size During Spring Audit

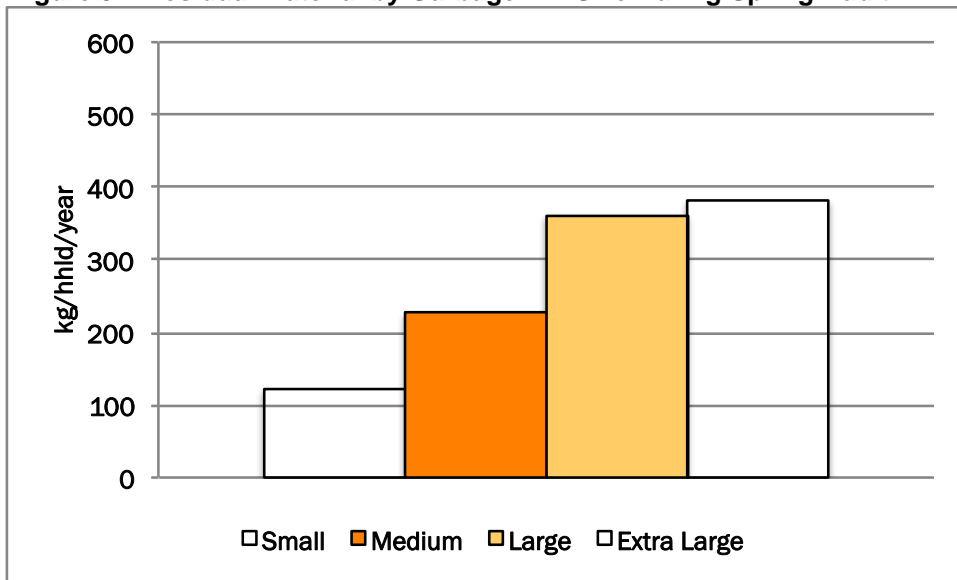
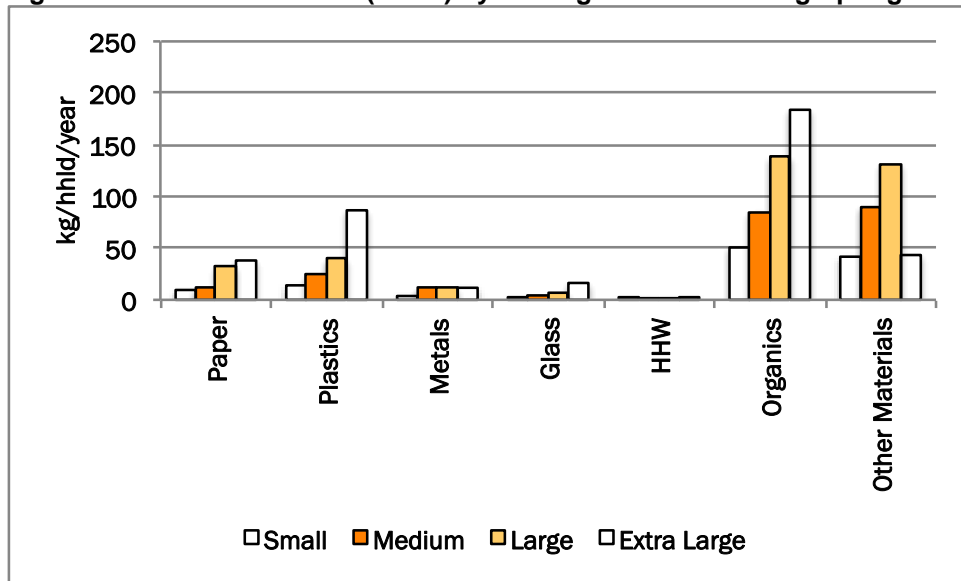


Figure 5.5 Residual Material (detail) by Garbage Bin Size During Spring Audit



5.3.3 Recycling

Figure 5.6 provides the overall waste composition for recycling. It shows that paper makes up 58% of recycling followed by plastics and glass. Figure 5.7 provides some additional detail on recycling composition. It shows that printed paper (a total of newspapers, magazines, phone books, books, mixed fine paper and other paper) makes up about 32% of what is in the recycling bin. Key plastics include PET, HDPE and LDPE. Organics and other materials make up the key contaminants.

Figure 5.6 Recycling Waste Composition During Spring Audit

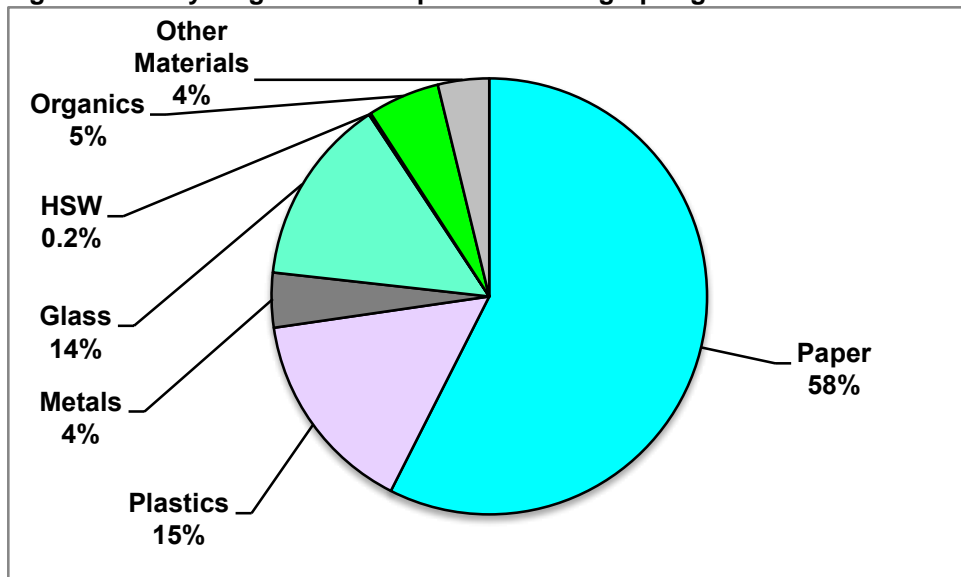


Figure 5.7 Recycling Waste Composition Detail- Spring Audit

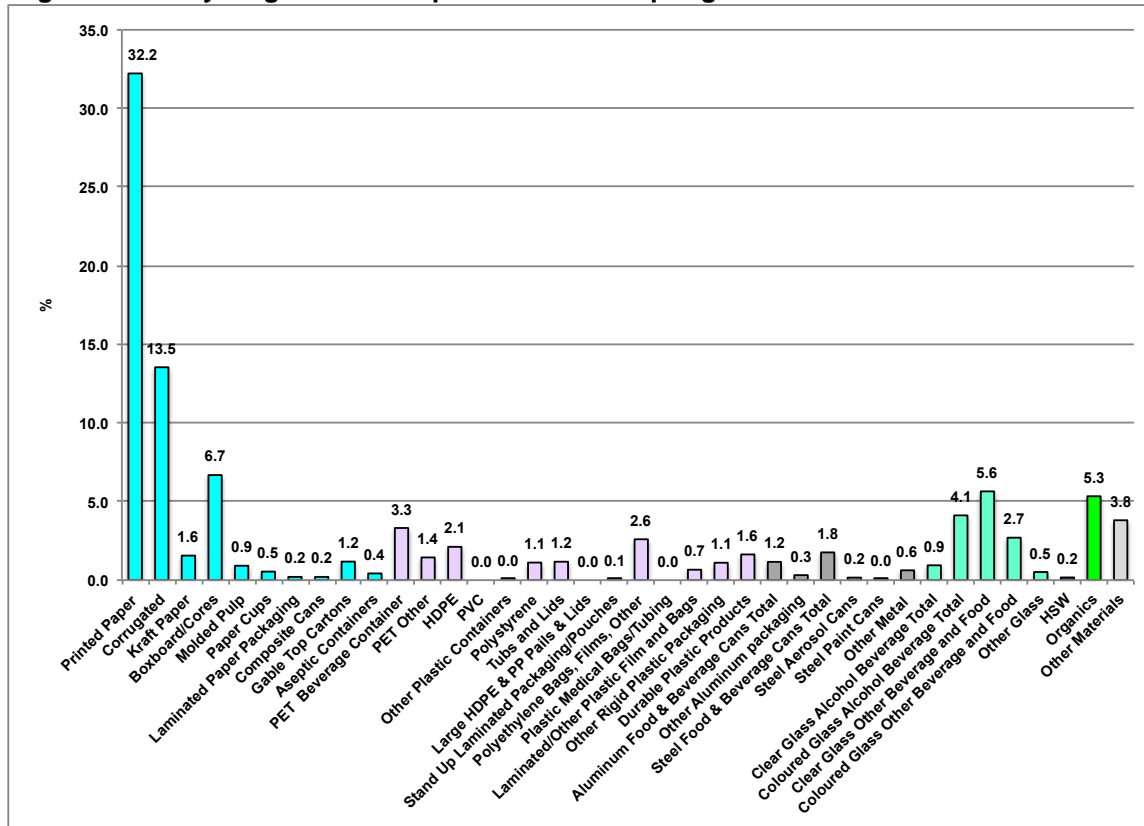


Figure 5.8 depicts the estimated annual amount of recycling by garbage bin size and shows an increase in recycling as bin size increases. Figure 5.9 provides some detail on recycling data by garbage bin size. It shows that there are increasing amounts of the various recyclables, except for metals, as bin size increases and that households with extra large garbage bins divert considerably more of all recyclables than households with smaller bins.

Figure 5.8 Recycling by Garbage Bin Size During Spring Audit

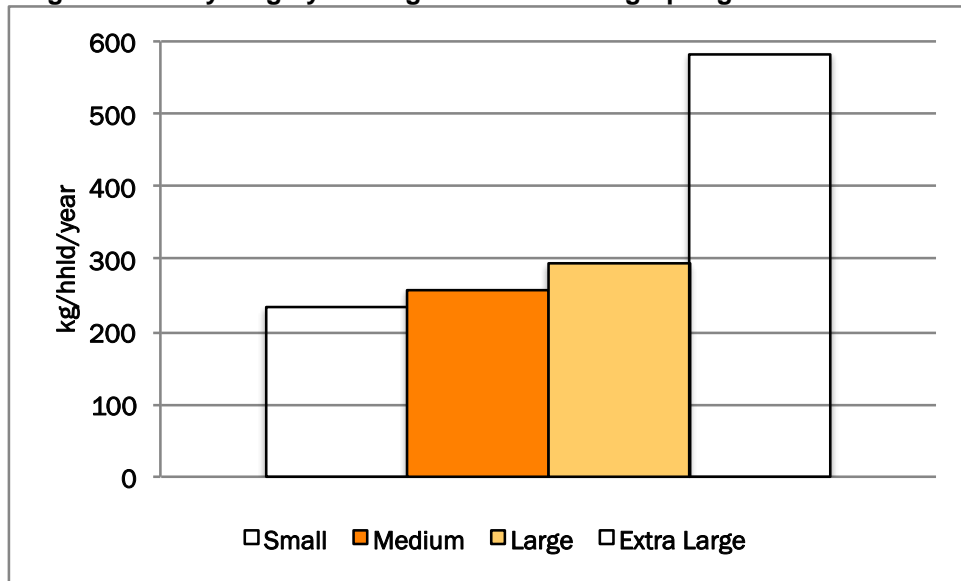
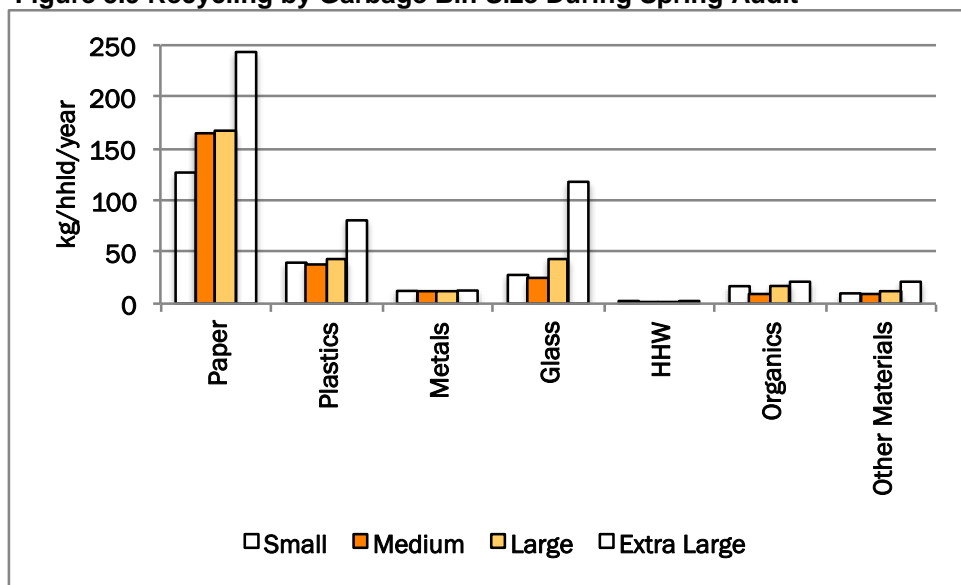


Figure 5.9 Recycling by Garbage Bin Size During Spring Audit



5.3.4 Green Bin

Figure 5.10 provides the overall waste composition for the green bin. It shows that approximately 97% of materials received in the green bin fit within the organics category. Figure 5.11 provides some additional detail. It shows that food waste makes up almost 70% of the material in the green bin followed by diapers & sanitary, pet waste and tissue toweling.

Figure 5.10 Green Bin Waste Composition During Spring Audit

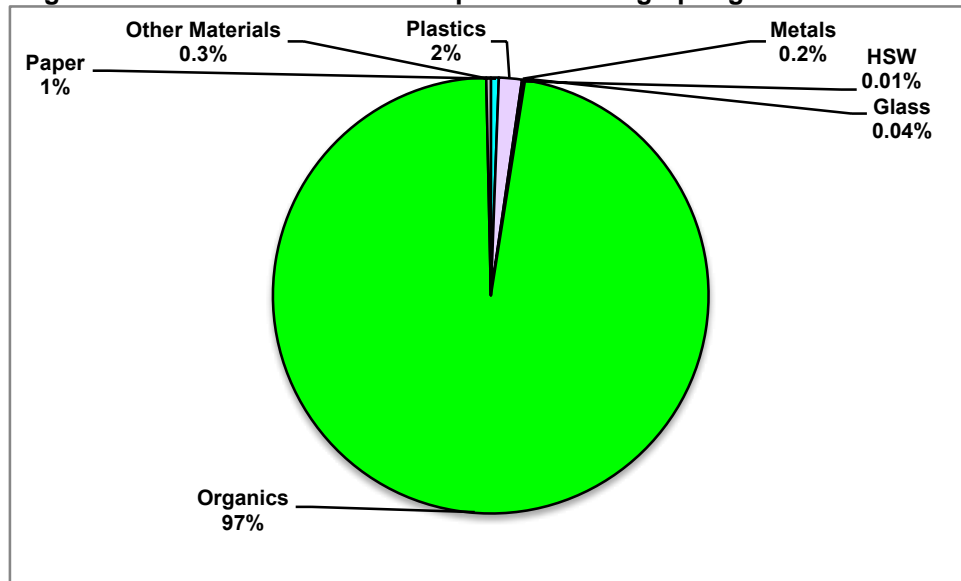


Figure 5.11 Green Bin Waste Composition Detail- Spring Audit

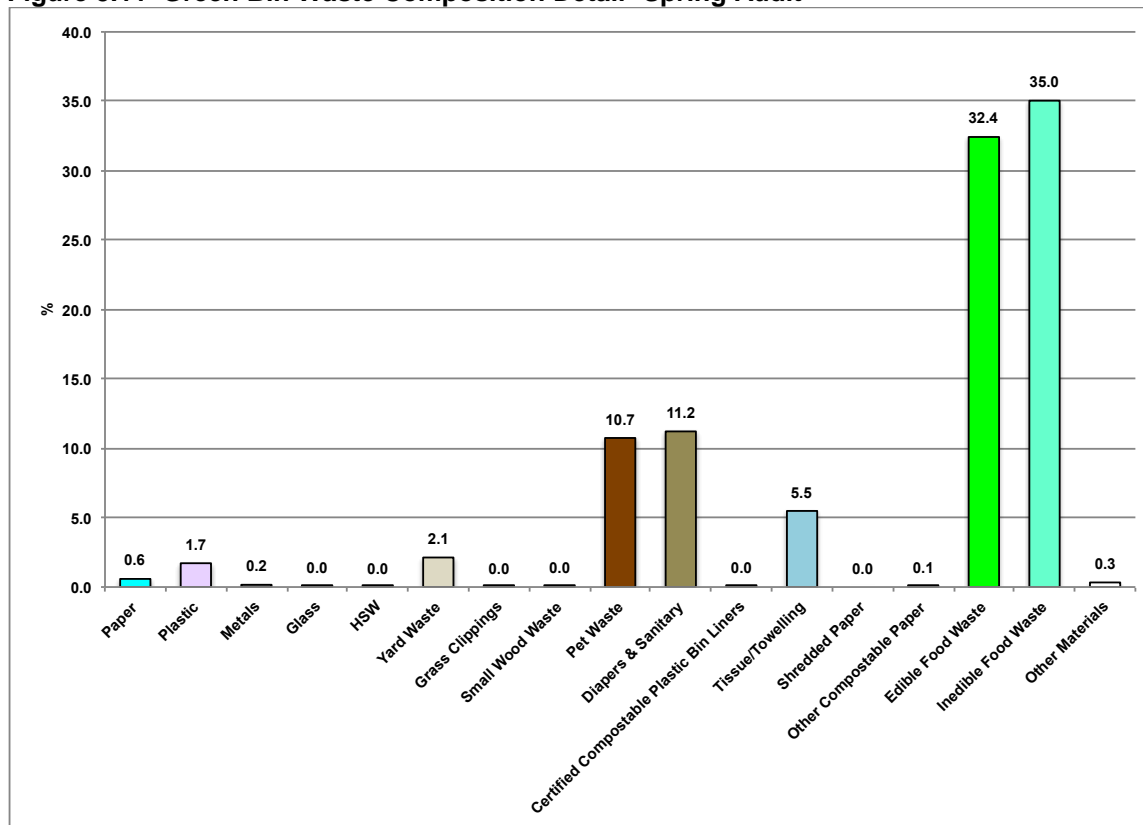


Figure 5.12 depicts the estimated annual amount of green bin material by garbage bin size and shows households with medium and large garbage bins divert the most green bin material. Figure 5.13 provides some detail on green bin data by garbage bin size. It shows that essentially all of the materials in the green bin are green bin materials.

Figure 5.12 Recycling by Garbage Bin Size During Spring Audit

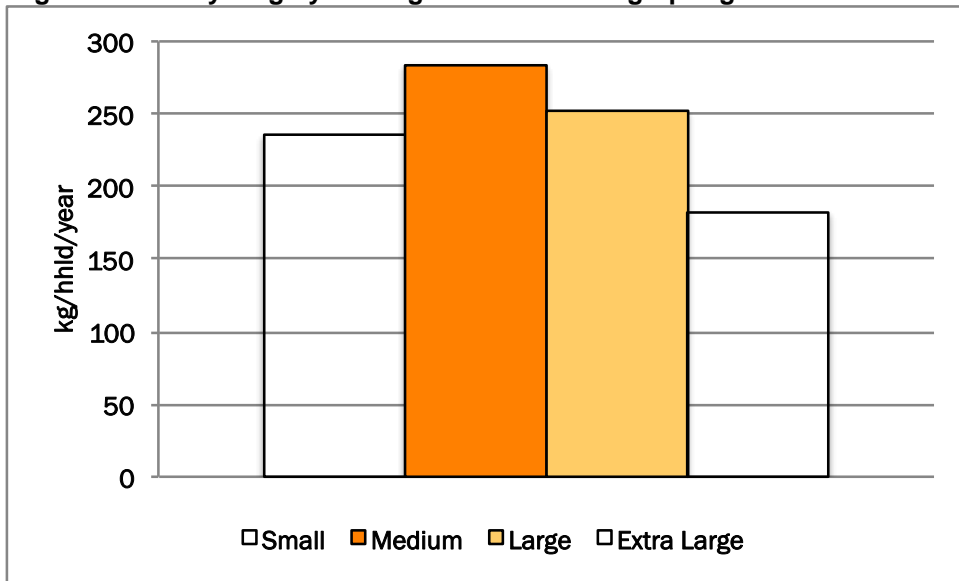
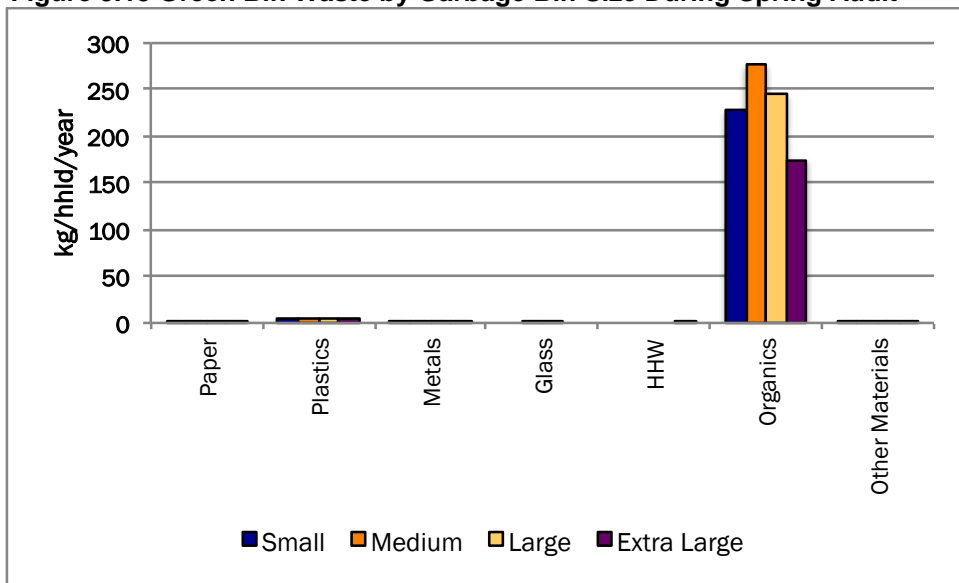


Figure 5.13 Green Bin Waste by Garbage Bin Size During Spring Audit



6.0 Results- Summer 2016

The Summer waste audit took place 12-15 July and 19-22 July 2016. The participation audit took place during the aforementioned weeks as well as 26-29 July and 2-5 August 2016. Overall results are presented in the following sections.

6.1 Set Out and Participation

Table 6.1 depicts the set-out of residual material, recycling and green bin by garbage bin size for the 200 waste audit households. Households with extra large garbage bins had the highest set out for residual material and recycling and lowest set out for the green bin. Households

with medium garbage bins had the lowest set out for residual material but highest setout for the green bin.

Table 6.1 Set out of Residual Material, Recycling and Green Bin by Garbage Bin Size

Garbage Bin		Set Out		
Size	Assets	Residual Material	Recycling	Green Bin
	#	%		
S	46	70.5	84.8	71.6
M	75	70.3	82.7	72.1
L	61	80.7	88.5	65.6
XL	18	91.9	100.0	59.9
Total	200	78.3	86.5	67.3

Table 6.2 depicts the results of the set out and participation of the 800 participation audit households. Households with small garbage bins had the lowest participation rate for all three streams. Households with large garbage bins had the highest participation rate for residual material and second highest participation rate for recycling and the green bin. Households with extra large garbage bins had the highest participation rate for the green bin. The total set out for residual material and recycling was lower for the participation audit as compared to the waste audit with green bin set out about the same.

Table 6.2 Set out of Residual Material, Recycling and Green Bin by Garbage Bin Size- Set out and Participation Audit

		Residual Material	Recycling	Green Bin
S	Set out- %	67.4	73.9	67.0
	Participation- %	82.6	86.4	83.2
M	Set out- %	73.4	78.6	64.4
	Participation- %	85.4	95.2	83.4
L	Set out- %	77.5	80.6	62.3
	Participation- %	93.2	94.8	84.5
XL	Set out- %	86.0	82.2	59.6
	Participation- %	91.6	86.7	85.5
Total	Set out- %	73.0	78.3	64.0
	Participation- %	87.1	92.2	83.9

6.2 Quantity of Waste Streams Collected

Approximately 6,080kg of all wastes were collected over the two-week waste audit. It should be noted that 3 recycling bins and 7 green bins had been emptied prior to waste auditing crew arrival. This impacted overall waste totals collected and would have had a modest impact on waste diversion calculations.

Figure 6.1 depicts the quantities of residual material, recycling and green bin waste samples, by garbage bin size. Data has been normalized to present the average set out per household, by garbage bin size. The quantity of residual material increases with garbage bin size up to the large garbage bin size. Households with extra large garbage bins generated less garbage

than households with large garbage bins. The quantity of recycling increases with garbage bin size. Households with medium garbage bins diverted the most green bin waste.

Figure 6.1 Residual, Recycling and Green Bin Waste Quantities Collected During Summer Audit

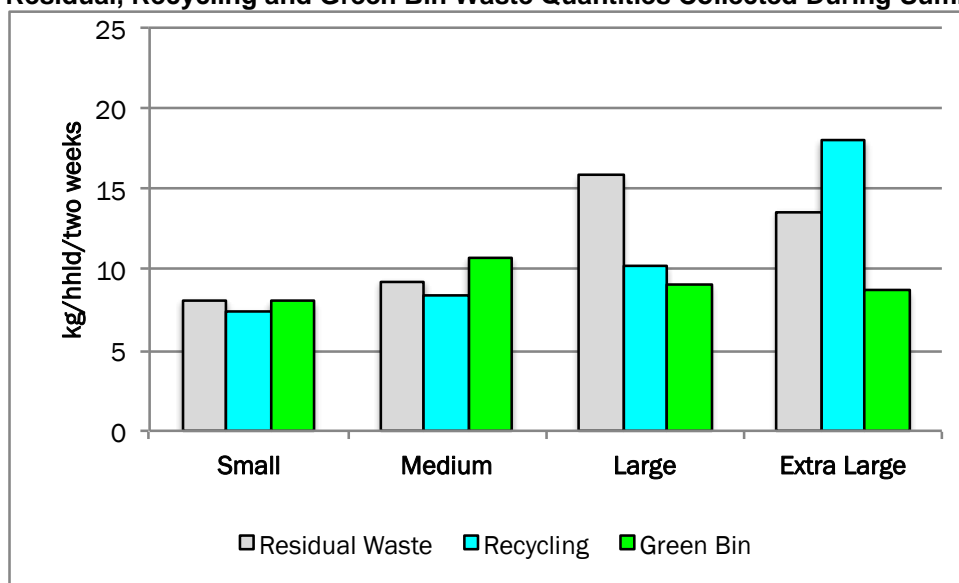


Table 6.3 depicts a summary of the three waste streams per garbage bin size. It includes a gross waste diversion rate (i.e. contamination is not netted out) for each garbage bin size. Households with medium or extra large bins had the highest gross waste diversion while households with a large garbage bin had the lowest.

Table 6.3 Summary of Waste Streams Collected and a Gross Diversion Rate per Garbage Bin Size

	Green Bin	Recycling	Residual Material	Diversion
	kg			%
Small	384.1	358.0	390.7	65.5
Medium	783.4	614.3	679.3	67.3
Large	554.1	624.3	965.7	55.0
Extra Large	156.3	324.6	245.1	66.2
Total	1,877.9	1,921.3	2,280.7	62.5

Table 6.4 depicts household green bin and recycling diversion, highlighting the contamination in both of those streams as well as the amount of green bin waste and recyclables in the residual waste stream. For this waste audit and the three waste streams households had a 56% diversion rate and potential 75% diversion rate.

Table 6.4 Summary of Green Bin and Recycling Diversion

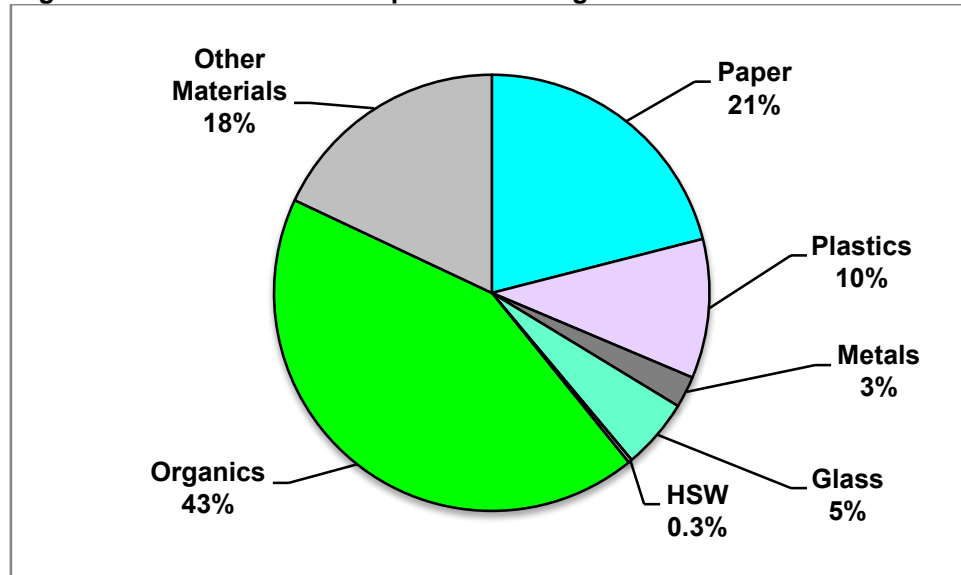
	Green Bin	Recycling	Residual Material	
Diversion (kg/hhld/year)	234.91	207.17		
Contamination (kg/hhld/year)	9.22	42.60	145.94	
% Contamination	3.8%	17.1%	49.2%	
% Diversion Rate	29.7%	26.2%		55.9%
Potential Diversion Rate				75.0%

6.3 Waste Composition

6.3.1 Overall

Table 6.5 (Appendix 2) presents a detailed estimate of waste composition for each waste stream. Figure 6.2 provides the overall waste composition for all three streams. It shows that organics make up 43% of the overall waste stream followed by paper and other materials.

Figure 6.2 Overall Waste Composition During Summer Audit



6.3.2 Residual Material

Figure 6.3 provides the overall waste composition for residual materials. It shows that other materials make up 45% of the residual materials followed by organics and plastics.

Figure 6.3 Residual Material Waste Composition During Summer Audit

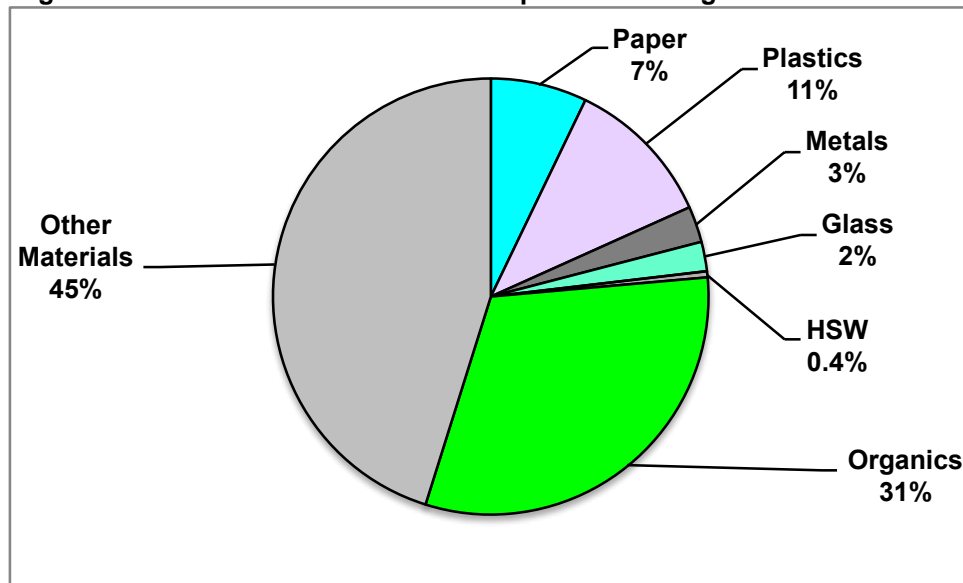


Figure 6.4 depicts the estimated annual amount of residual waste disposed by garbage bin size and shows an increase in waste disposal from small to large bin sizes with extra large bins having less waste disposal than large garbage bins. Figure 6.5 provides some detail on residual waste data by garbage bin size. It shows that for paper, plastic, metal and glass there are generally increasing amounts of the various waste types as bin size increases. This pattern is less clear for organics and other materials. The greater amount of other materials coming from households with small garbage bins is largely due to a large amount of wood waste collected in one sample area (i.e. District 2, Friday).

Figure 6.4 Residual Material by Garbage Bin Size During Summer Audit

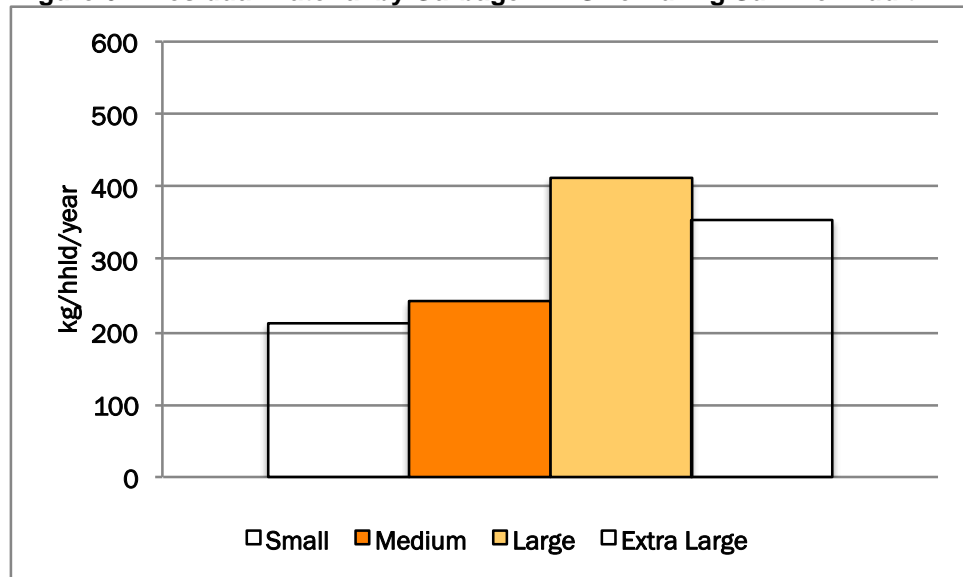
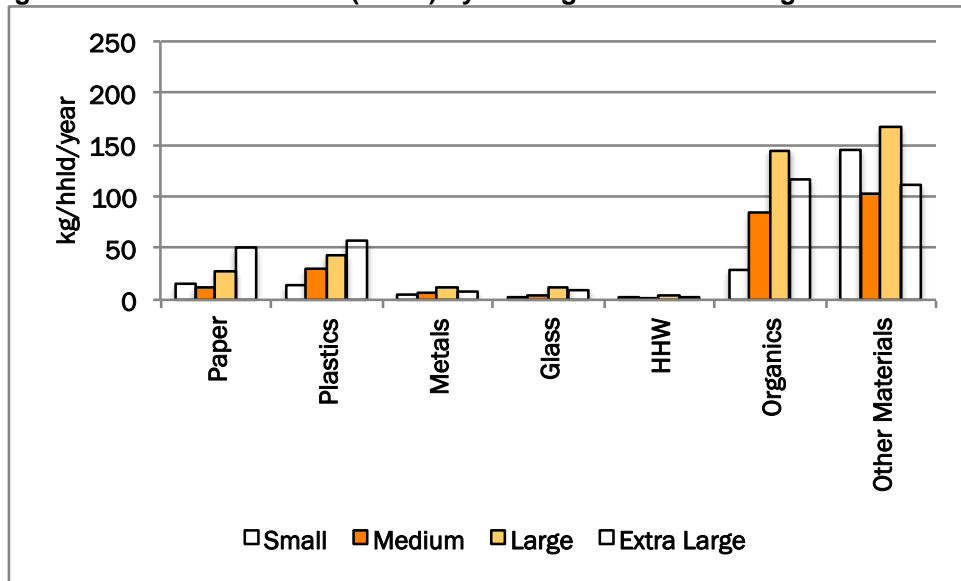


Figure 6.5 Residual Material (detail) by Garbage Bin Size During Summer Audit



6.3.3 Recycling

Figure 6.6 provides the overall waste composition for recycling. It shows that paper makes up 56% of recycling followed by plastics and glass. Figure 6.7 provides some additional detail on recycling composition. It shows that printed paper (a total of newspapers, magazines, phone books, books, mixed fine paper and other paper) makes up about 32% of what is in the recycling bin. Key plastics include PET, HDPE and LDPE. Organics and other materials make up the key contaminants.

Figure 6.6 Recycling Waste Composition During Summer Audit

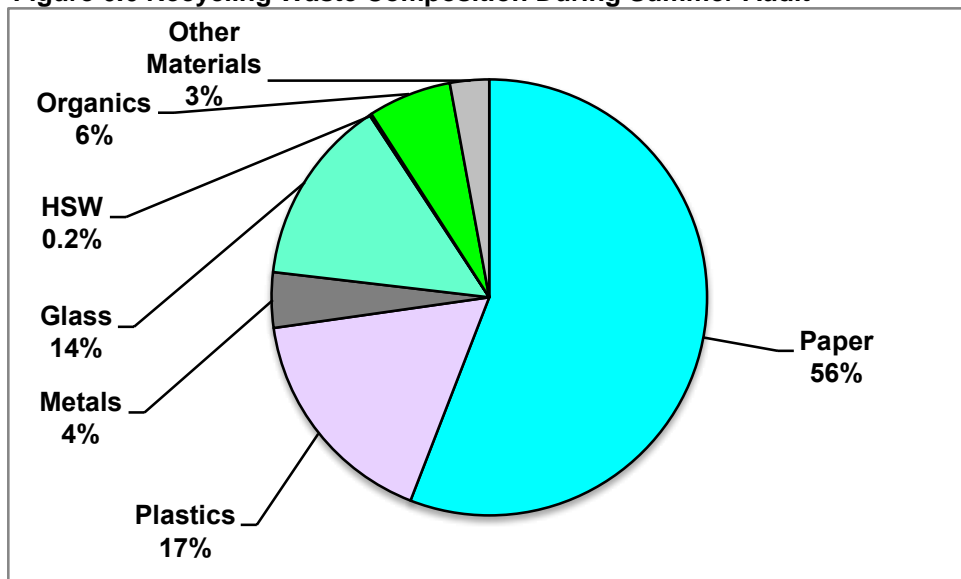


Figure 6.7 Recycling Waste Composition Detail- Summer Audit

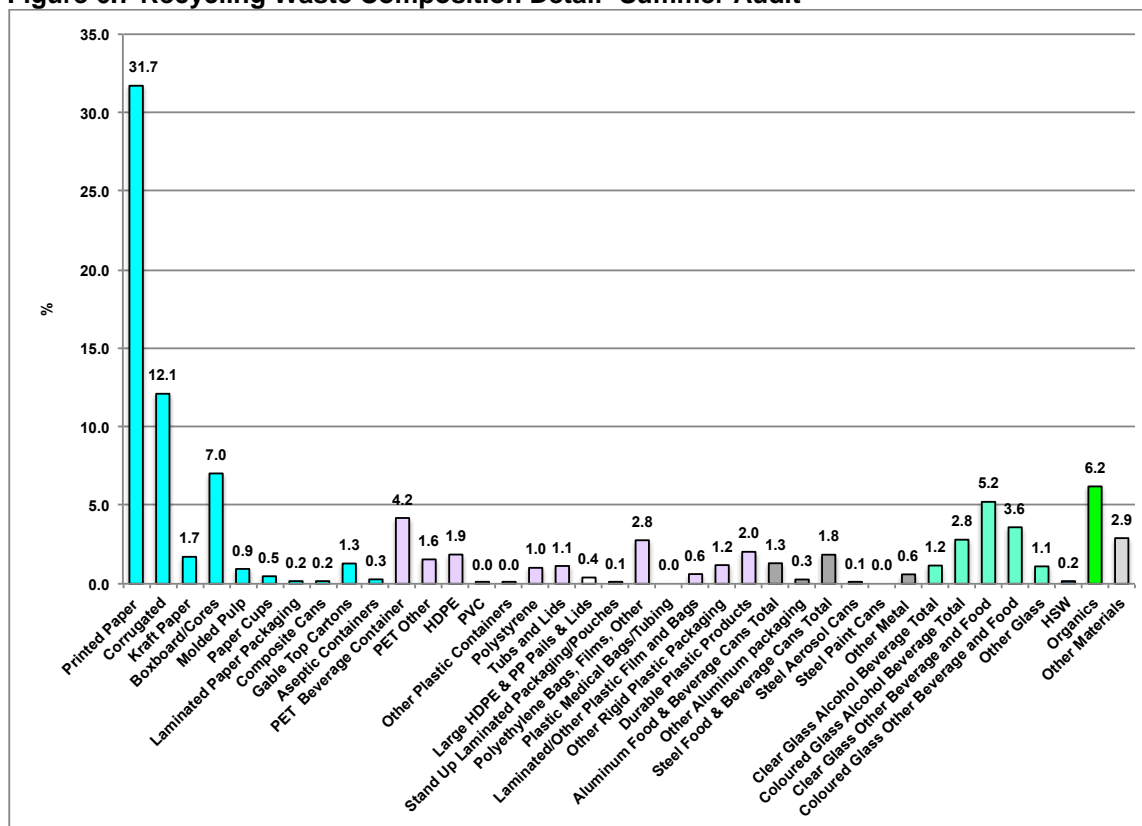


Figure 6.8 depicts the estimated annual amount of recycling by garbage bin size and shows an increase in recycling as bin size increases, particularly for households with extra large garbage bins. Figure 6.9 provides some detail on recycling data by garbage bin size. It shows that there are increasing amounts of the various recyclables, except for metals, as bin size increases and that households with extra large garbage bins divert considerably more of all recyclables than households with smaller bins.

Figure 6.8 Recycling by Garbage Bin Size During Summer Audit

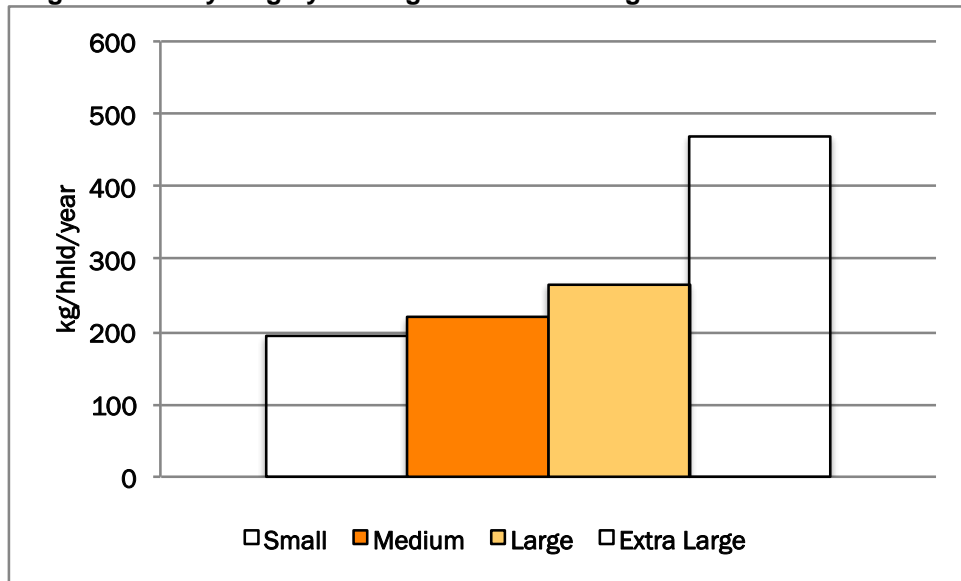
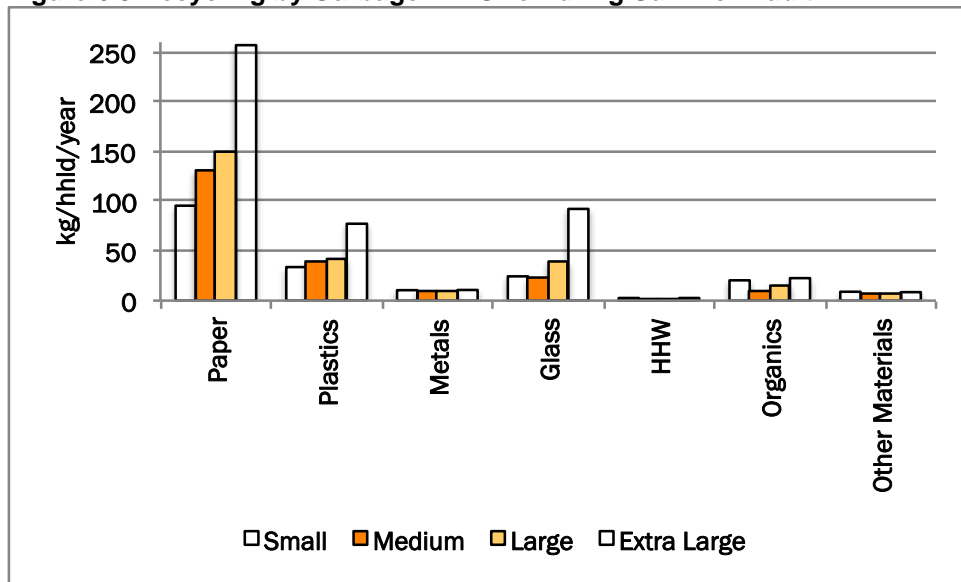


Figure 6.9 Recycling by Garbage Bin Size During Summer Audit



6.3.4 Green Bin

Figure 6.10 provides the overall waste composition for the green bin. It shows that approximately 94% of materials received in the green bin fit within the organics category. Figure 6.11 provides some additional detail. It shows that food waste makes up almost 64% of the material in the green bin followed by pet waste, diapers & sanitary and tissue toweling.

Figure 6.10 Green Bin Waste Composition During Summer Audit

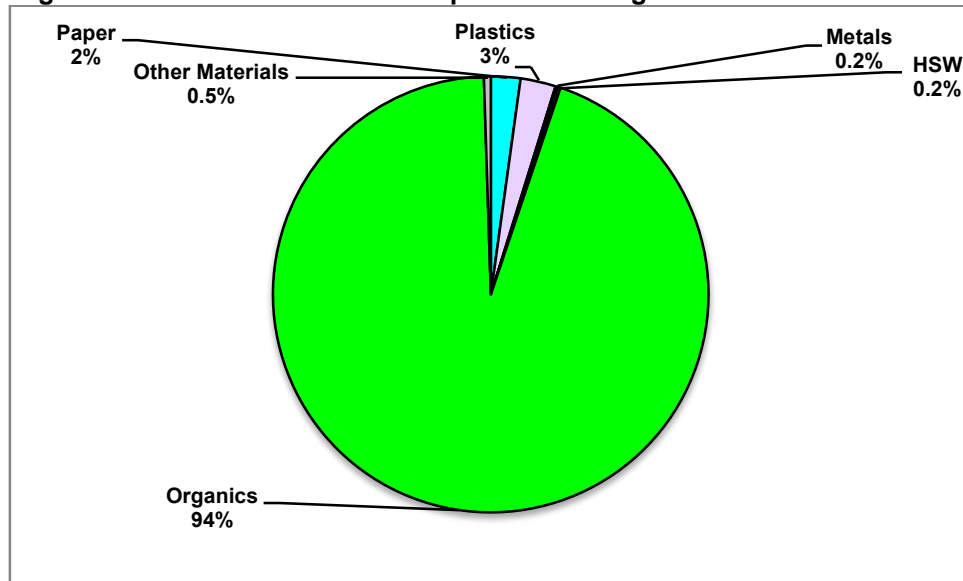


Figure 6.11 Green Bin Waste Composition Detail- Summer Audit

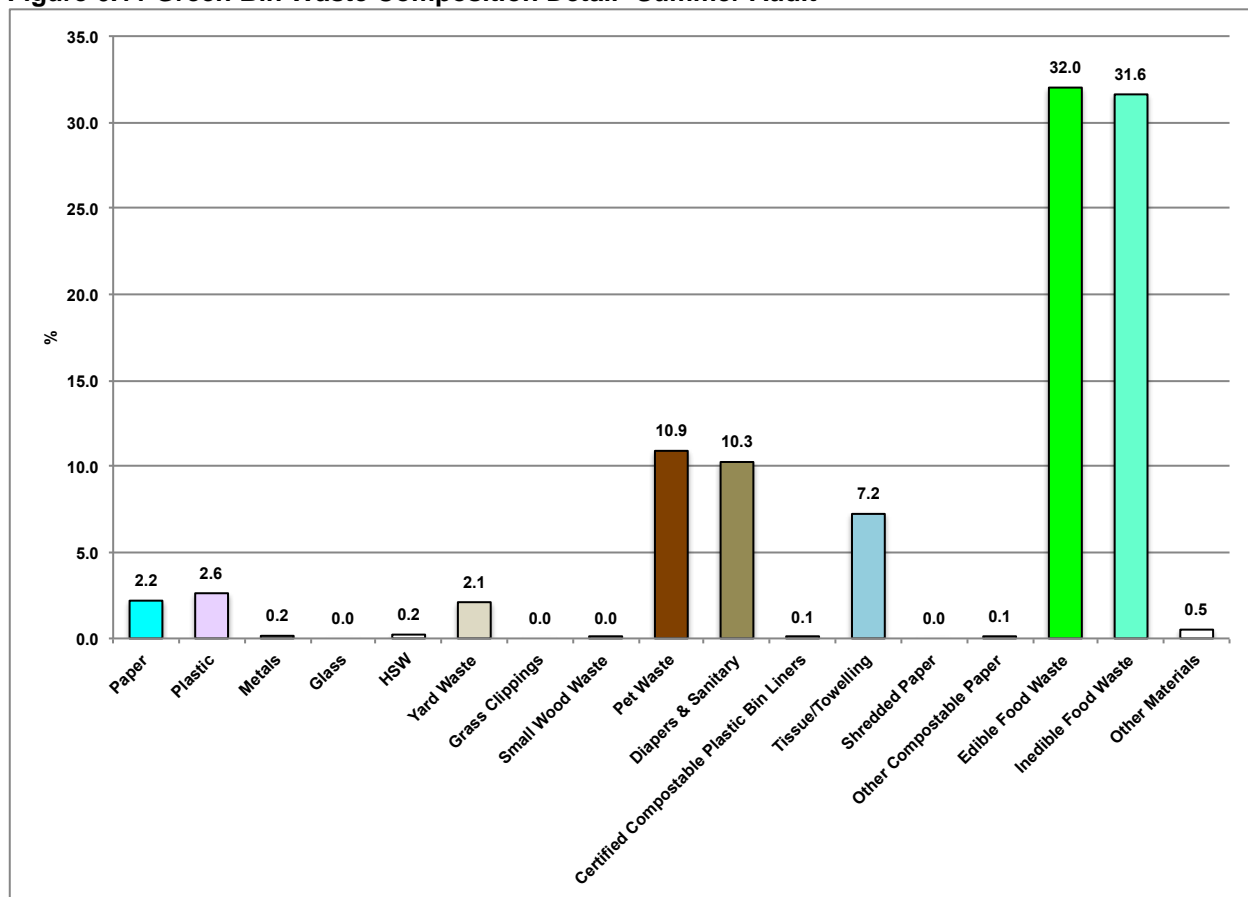


Figure 6.12 depicts the estimated annual amount of green bin material by garbage bin size and shows households with medium and large garbage bins divert the most green bin material. Figure 6.13 provides some detail on green bin data by garbage bin size. It shows

that essentially all of the materials in the green bin are green bin materials, although there was more paper and plastics than in previous audits.

Figure 6.12 Green Bin by Garbage Bin Size During Summer Audit

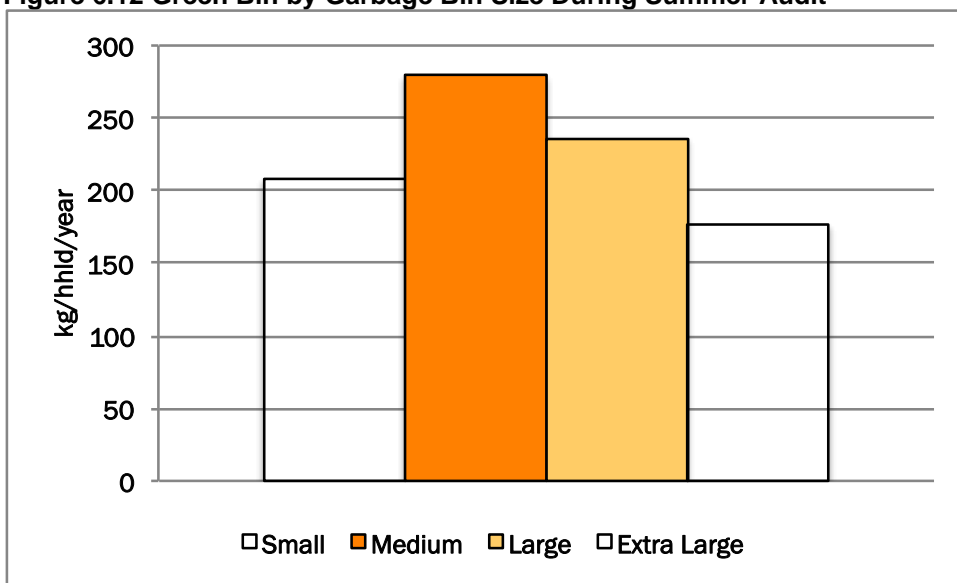
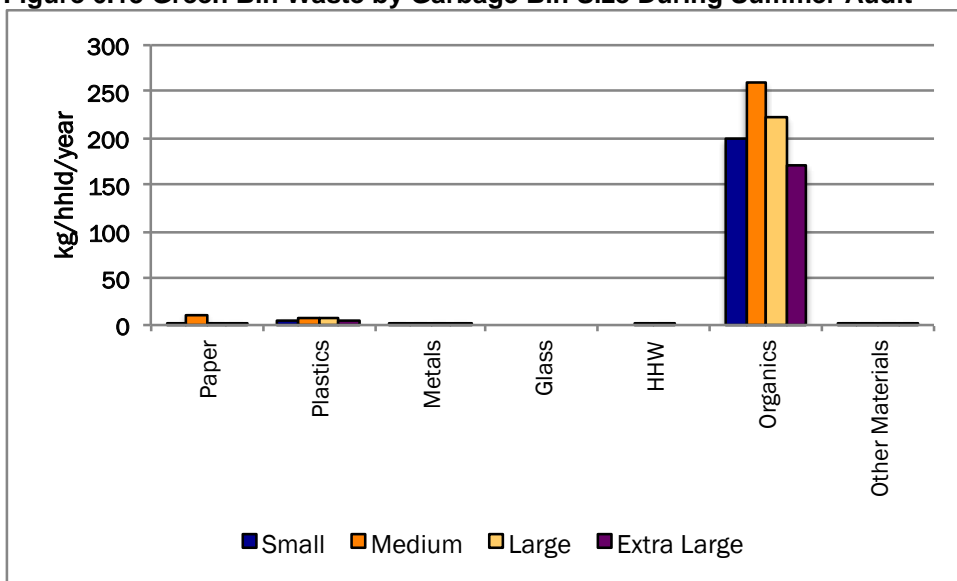


Figure 6.13 Green Bin Waste by Garbage Bin Size During Summer Audit



7.0 Results- Overall

The waste audits took place from November 2015 through July 2016. The participation audit took place during the aforementioned time and concluded in early August 2016. Overall results are presented in the following sections.

7.1 Set Out and Participation

Table 7.1 depicts the set-out of residual material, recycling and green bin by garbage bin size for the 200 waste audit households. Households with extra large garbage bins had the highest set out for residual material and recycling and lowest set out for the green bin. Households

with small garbage bins had the lowest set out for residual material but highest setout for the green bin.

Table 7.1 Set out of Residual Material, Recycling and Green Bin by Garbage Bin Size

Garbage Bin	Assets	Set Out		
Size	#	Residual Material	Recycling	Green Bin
		%		
S	46	70.0	84.0	75.1
M	75	75.4	85.8	73.2
L	59	80.1	88.0	67.6
XL	20	87.0	98.7	62.5
Total	200	78.2	87.3	69.6

Figures 7.1-7.3 depict set out of the residual, recycling and green bin streams over the four seasons and overall (i.e. across the four seasons). Figure 7.1 clearly shows that residual waste set out increased with the size of the garbage bin. Figure 7.2 shows that recycling set out increased with the size of the garbage bin, with households with extra large garbage bins setting out recycling bins at a rate of almost 100%. Figure 7.3 shows that the opposite trend is true for green bin set out with households that have small garbage bins having the highest set out and those with extra large garbage bins the lowest set out.

Figure 7.1 Residual Waste Set Out During Four Seasonal Waste Audits

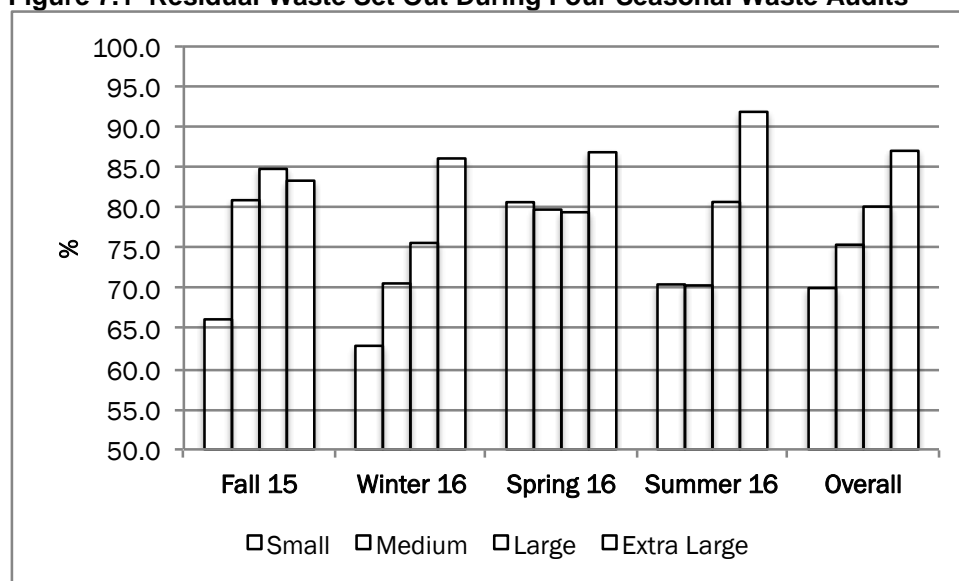


Figure 7.2 Recycling Set Out During Four Seasonal Waste Audits

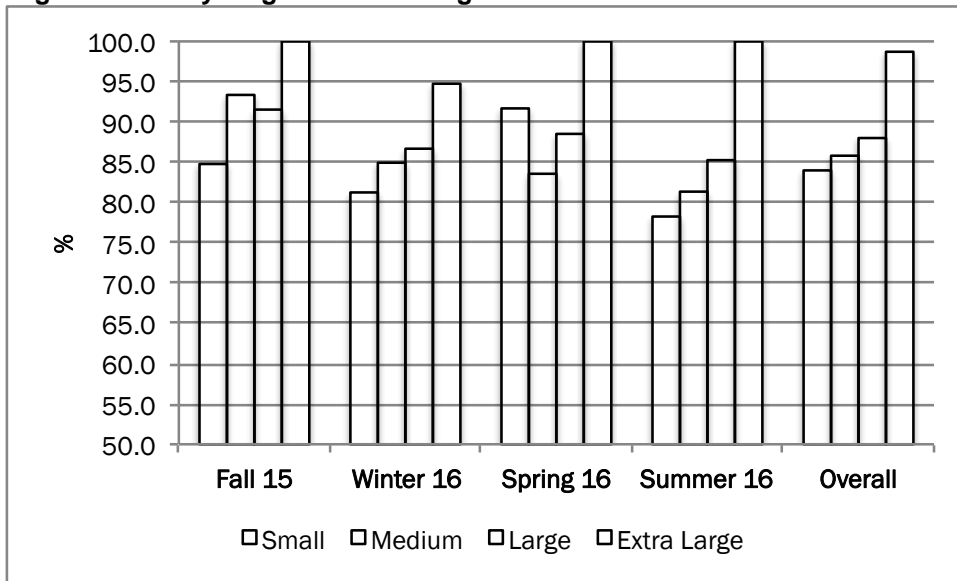


Figure 7.3 Green Bin Set Out During Four Seasonal Waste Audits

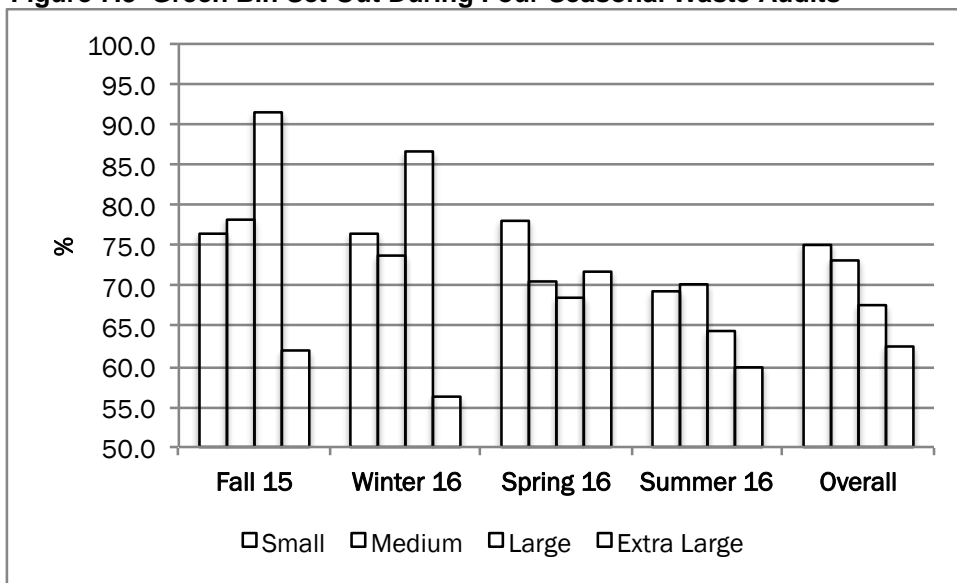


Table 7.2 depicts the results of the set out and participation of the 800 participation audit households. Households with small garbage bins had the lowest participation rate for residual material and the lowest participation rate for the green bin. Households with large garbage bins had the highest participation rate for all three streams. The total set out for residual material and recycling was lower for the participation audit as compared to the waste audit with green bin set out about the same. The participation rate will always be at least as high as the set out rate because it is measured over a four week period.

Table 7.2 Set out of Residual Material, Recycling and Green Bin by Garbage Bin Size- Set out and Participation Audit

		Residual Material	Recycling	Green Bin
S	Set out- %	66.0	77.1	67.7
	Participation- %	79.6	88.8	84.1
M	Set out- %	75.3	80.5	68.1
	Participation- %	87.5	92.8	85.5
L	Set out- %	78.9	84.3	69.9
	Participation- %	91.6	95.3	86.9
XL	Set out- %	83.8	84.6	66.2
	Participation- %	91.2	92.1	86.1
Total	Set out- %	73.8	81.0	68.3
	Participation- %	84.3	92.4	85.6

Figures 7.4-7.6 depict participation of the residual, recycling and green bin streams over the four seasons and overall (i.e. across the four seasons). Figure 7.4 shows that residual waste participation increased with the size of the garbage bin before leveling off at households with extra large garbage bins. Figure 7.5 shows that recycling participation increased with the size of the garbage bin (from small to large) but decreasing for households with extra large garbage bins. Figure 7.6 shows green bin participation resulted in a similar, although less pronounced, trend as for recycling participation.

Figure 7.4 Residual Waste Participation During Four Seasonal Waste Audits

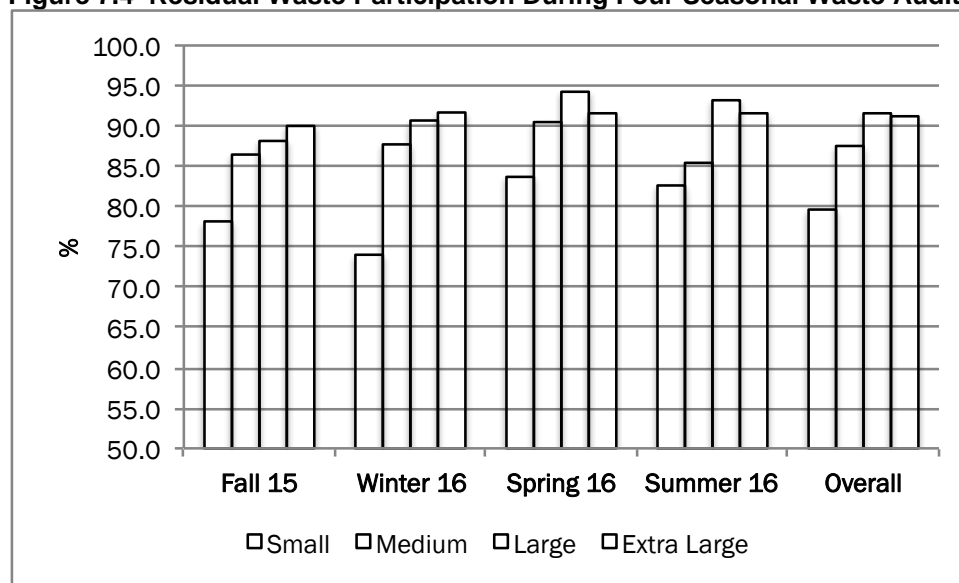


Figure 7.5 Recycling Participation During Four Seasonal Waste Audits

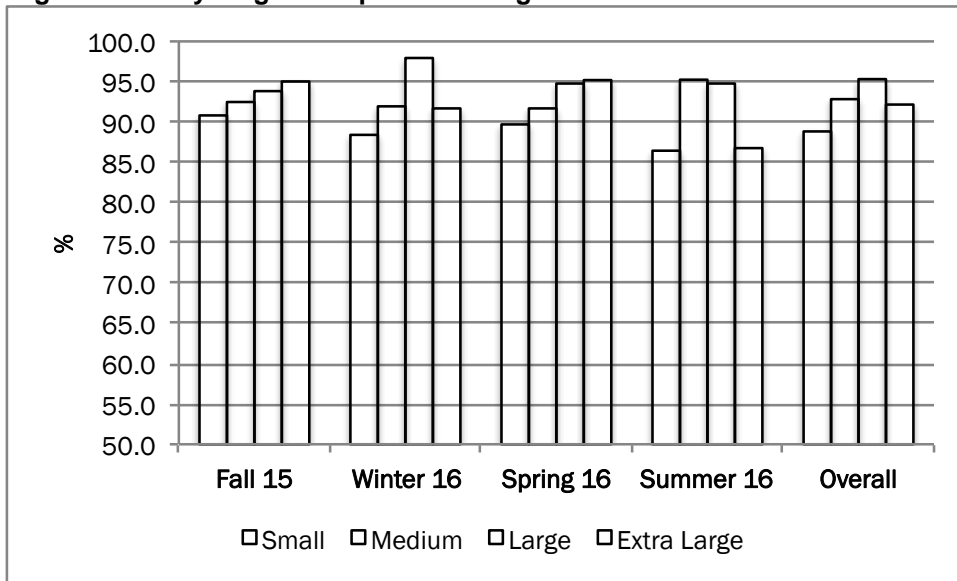
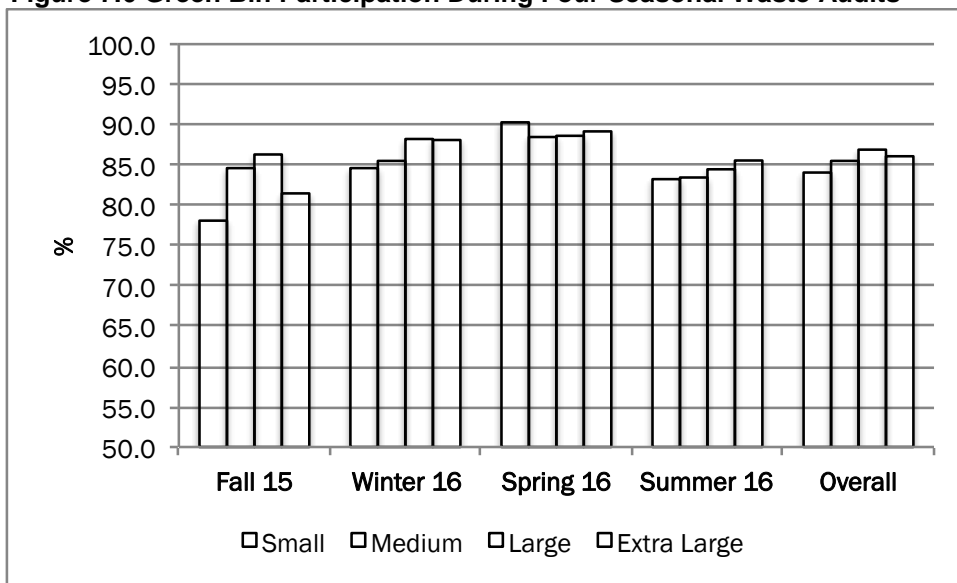


Figure 7.6 Green Bin Participation During Four Seasonal Waste Audits



7.2 Estimated Quantity of Waste Disposal and Diversion

On average Toronto households in this waste audit dispose 260 kg/hhld/year residual waste and divert 273 kg/hhld/year recyclables and 253 kg/hhld/year green bin materials.

Table 7.3 depicts household green bin and recycling diversion, highlighting the contamination in both of those streams as well as the amount of green bin waste and recyclables in the residual waste stream. For these waste audits and the three waste streams, households had a 60% diversion rate and potential 80% diversion rate. The contamination rate of recycling was 18% and for the green bin 3% (although this does not account for non biodegradable contaminants removed during processing).

Table 7.3 Summary of Green Bin and Recycling Diversion

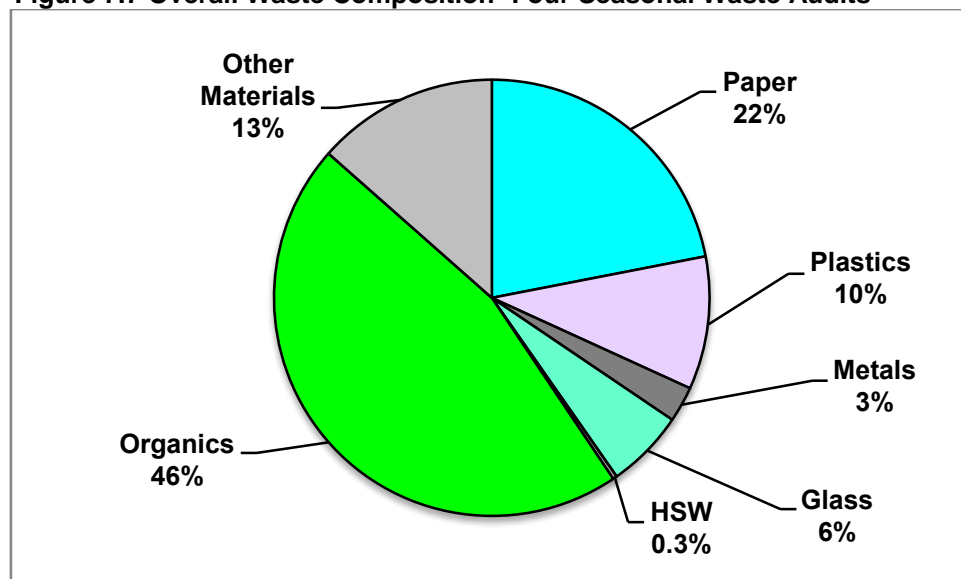
	Green Bin	Recycling	Residual Material	
Diversion (kg/hhld/year)	245.99	222.86		
Contamination (kg/hhld/year)	7.47	49.75	150.55	
% Contamination	2.9%	18.2%	57.9%	
% Diversion Rate	31.3%	28.4%		59.7%
Potential Diversion Rate				79.9%

7.3 Waste Composition

7.3.1 Overall

Table 7.4 (Appendix 2) presents a detailed estimate of waste composition for each waste stream. Figure 7.7 provides the overall waste composition for all three streams. It shows that organics make up 46% of the overall waste stream followed by paper and other materials.

Figure 7.7 Overall Waste Composition- Four Seasonal Waste Audits



7.3.2 Residual Material

Figure 7.8 provides the overall waste composition for residual materials. It shows that organics make up 38% of the residual materials followed by other materials and plastics.

Figure 7.8 Residual Material Waste Composition - Four Seasonal Waste Audits

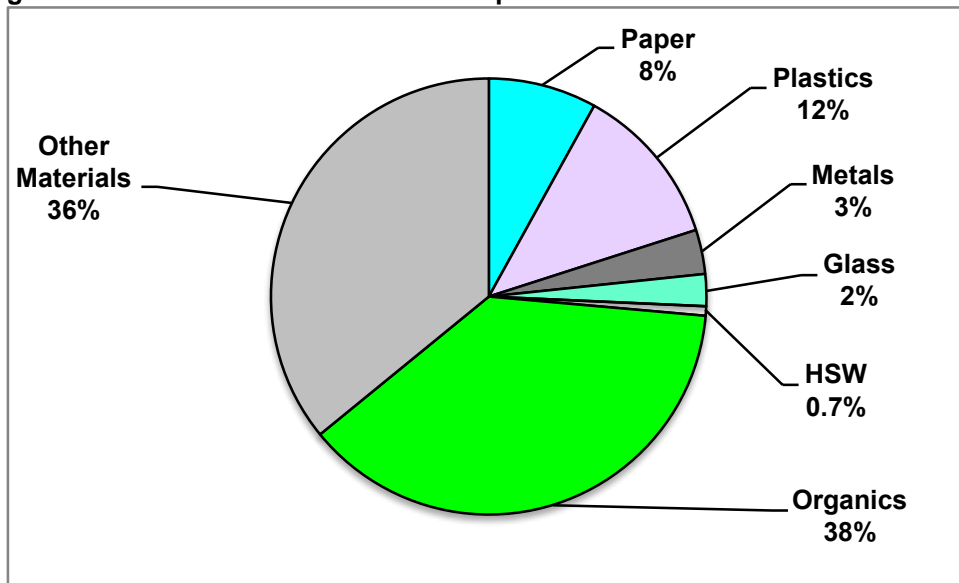


Figure 7.9 depicts the estimated annual amount of residual waste disposed by garbage bin size and shows an increase in waste disposal from small to extra large bin sizes. Figure 7.10 provides some detail on residual waste data by garbage bin size. It shows that for paper, plastic, metal, glass and organics there are increasing amounts of the various waste types as bin size increases. This pattern is less clear for other materials.

Figure 7.9 Residual Material by Garbage Bin Size - Four Seasonal Waste Audits

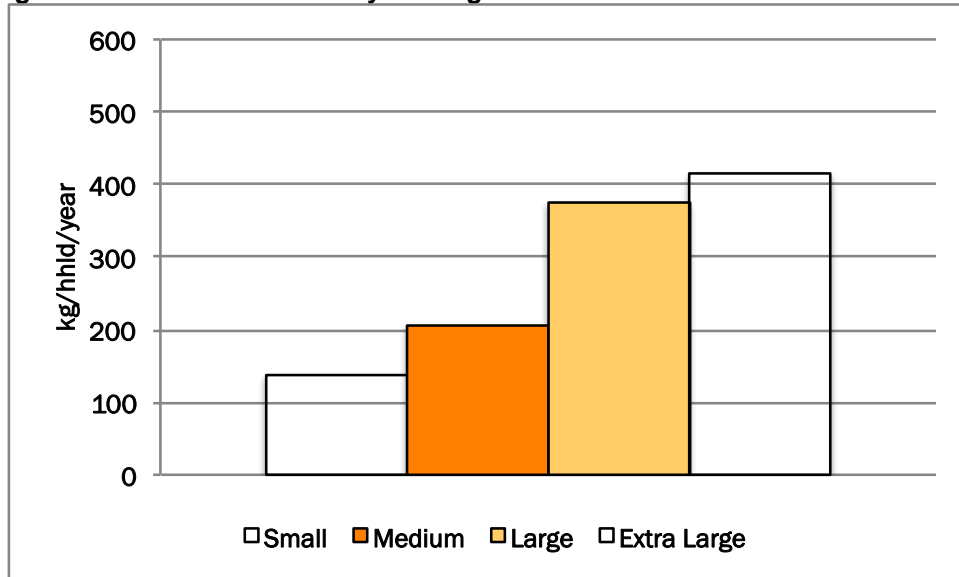
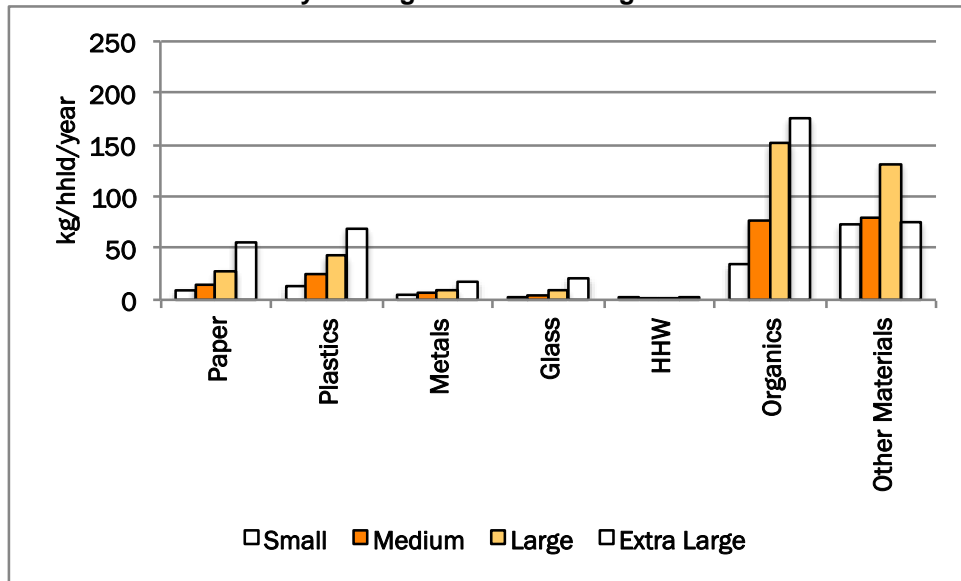


Figure 7.10 Residual Material by Garbage Bin Size During - Four Seasonal Waste Audits



An analysis of divertible wastes in the residual waste stream was undertaken. Materials with a disposal rate of more than 2 kg/hhld/year (i.e. sufficient material disposal around which promotion and education and other programs could be developed) were identified and split into currently divertible materials (i.e. diversion error) and materials that are divertible elsewhere (i.e. missed opportunities). Table 7.5 presents a summary of these materials. It shows that there are approximately 111 kg/hhld/year of currently divertible materials in the residual waste stream, with 97kg/hhld/year of those being organics. It shows there are approximately 69 kg/hhld/year of other materials which currently have no curbside diversion program, most notably textiles, wood and construction and renovation materials. There are other City, organization or private sector opportunities to divert these materials.

Table 7.5 Summary of Divertible and Potentially Divertible Materials in the Residual Waste Stream

	Diversion Error	Missed Opportunities	
Recyclables	kg/hhld/year		
Other Printed Paper (Non-Obligated)	2.70		
Corrugated Fibre	2.46		
Boxboard Cores	3.80		
Polyethylene Plastic Bags & Film - Packaging Carry Out	2.40		
Polyethylene Plastic Bags & Film - Packaging Other	2.72		
	14.09		
Organics			
Yard Waste	14.27		
Pet Waste	7.64		
Diapers & Sanitary	13.85		
Tissue/Towelling	14.38		
Edible Food	34.29		
Inedible Food	12.60		
Other	97.03		
Textiles/Clothing		15.49	
Wood		16.50	
Construction & Renovation		20.58	
Furniture - Wood		10.80	
Other Metal		5.50	
Total	111.11	68.87	179.98

7.3.3 Recycling

Figure 7.11 provides the overall waste composition for recycling. It shows that paper makes up 55% of recycling followed by plastics and glass. Figure 7.12 provides some additional detail on recycling composition. It shows that printed paper (a total of newspapers, magazines, phone books, books, mixed fine paper and other paper) makes up about 30% of what is in the recycling bin. Key plastics include PET, HDPE and LDPE. Organics and other materials make up the key contaminants.

Figure 7.11 Recycling Waste Composition - Four Seasonal Waste Audits

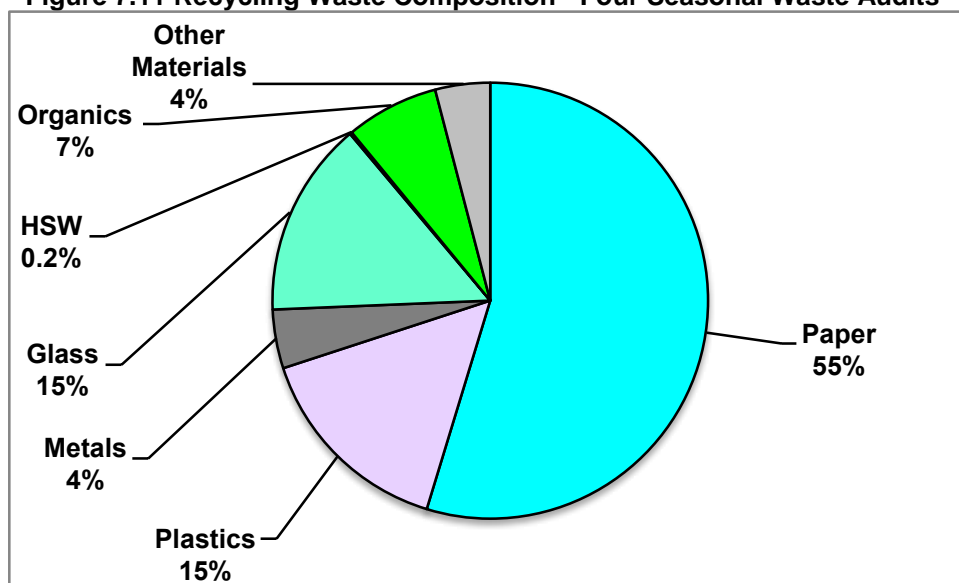


Figure 7.12 Recycling Waste Composition Detail- Four Seasonal Waste Audits

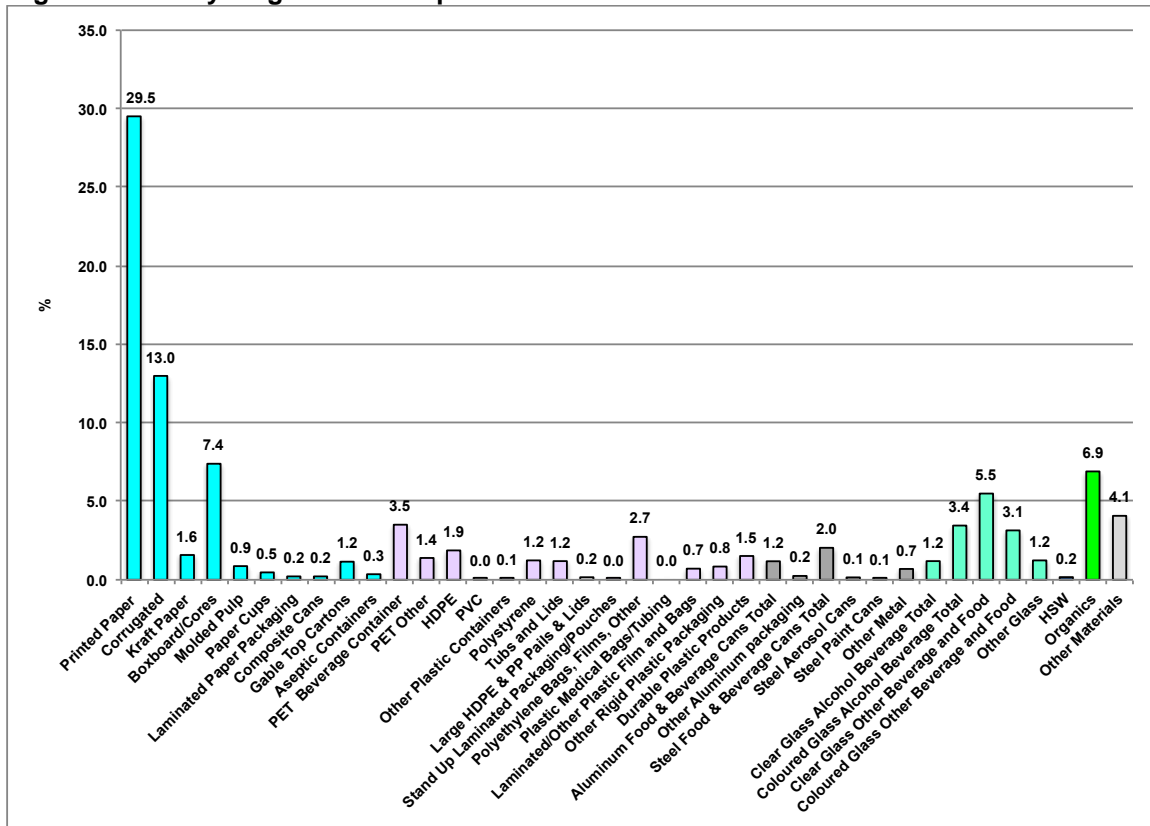


Figure 7.13 depicts the estimated annual amount of recycling by garbage bin size and shows an increase in recycling as bin size increases, particularly for households with extra large garbage bins. Figure 7.14 provides some detail on recycling data by garbage bin size. It shows that there are increasing amounts of the various recyclables, except for metals, as bin size increases and that households with extra large garbage bins divert considerably more of all recyclables than households with smaller bins.

Figure 7.13 Recycling by Garbage Bin Size - Four Seasonal Waste Audits

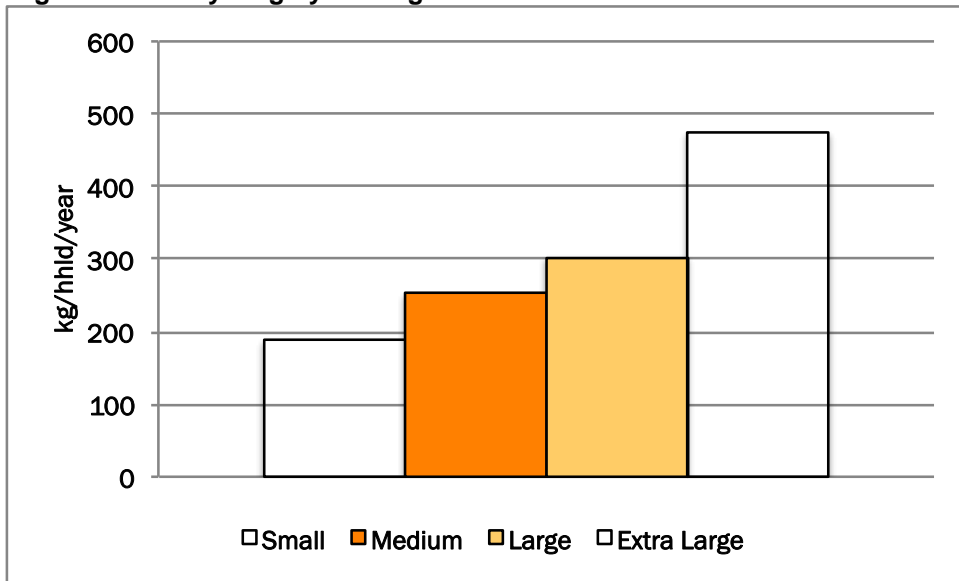
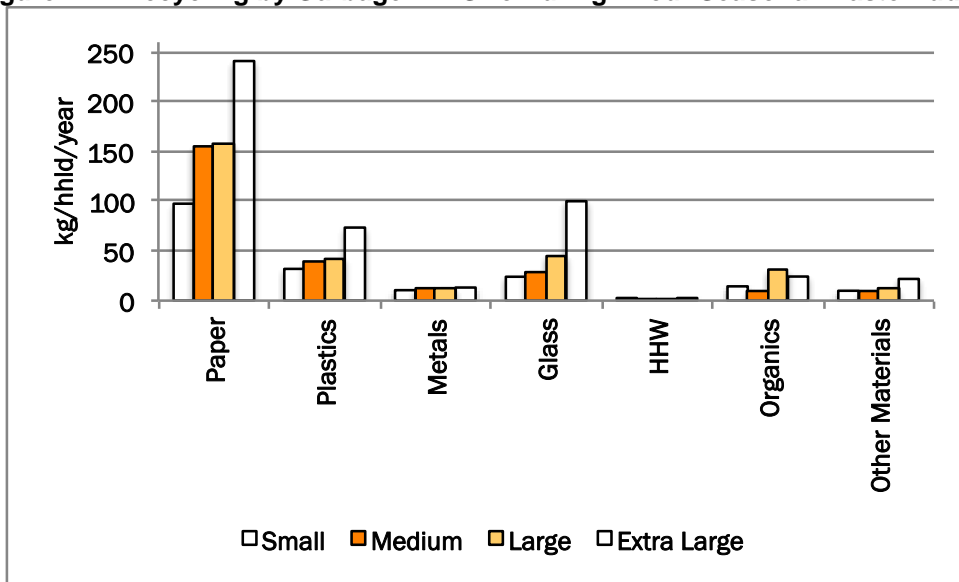


Figure 7.14 Recycling by Garbage Bin Size During - Four Seasonal Waste Audits



7.3.4 Green Bin

Figure 7.15 provides the overall waste composition for the green bin. It shows that approximately 96% of materials received in the green bin fit within the organics category. Figure 7.16 provides some additional detail. It shows that food waste makes up almost 64% of the material in the green bin followed by pet waste, diapers & sanitary and tissue toweling.

Figure 7.15 Green Bin Waste Composition- Four Seasonal Waste Audits

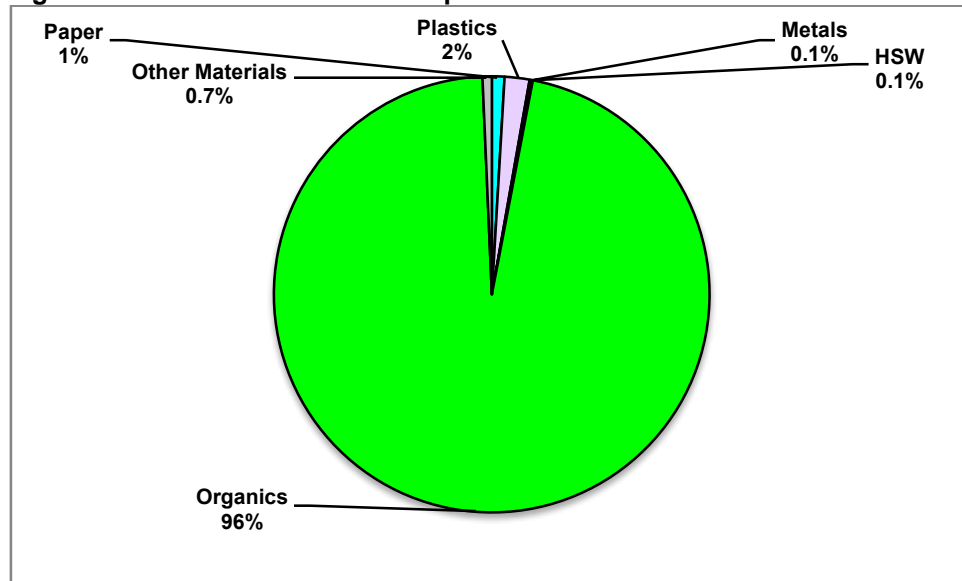


Figure 7.16 Green Bin Waste Composition Detail- Four Seasonal Waste Audits

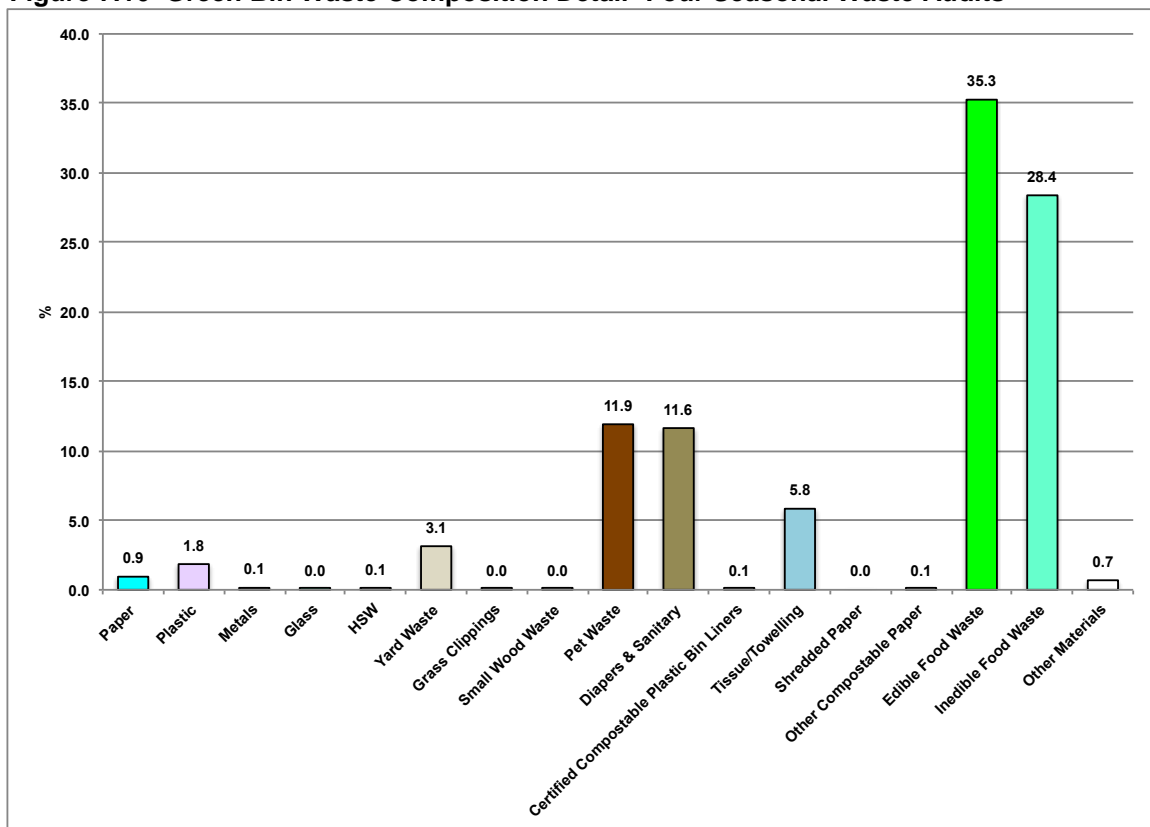


Figure 7.17 depicts the estimated annual amount of green bin material by garbage bin size and shows households with medium and large garbage bins divert the most green bin material and households with extra large garbage bins the lowest. Figure 7.18 provides some detail on green bin data by garbage bin size. It shows that essentially all of the materials in the green bin are green bin materials.

Figure 7.17 Green Bin by Garbage Bin Size - Four Seasonal Waste Audits

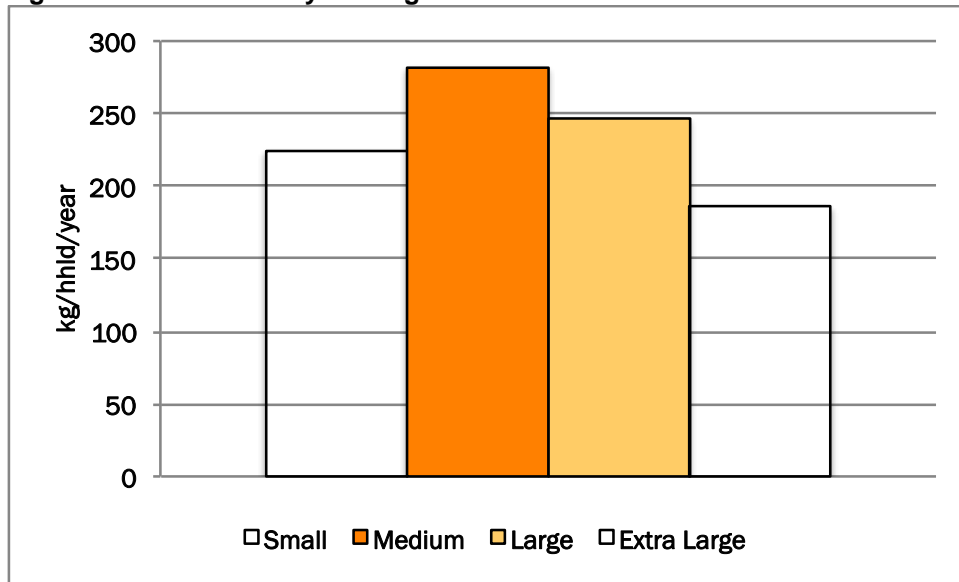
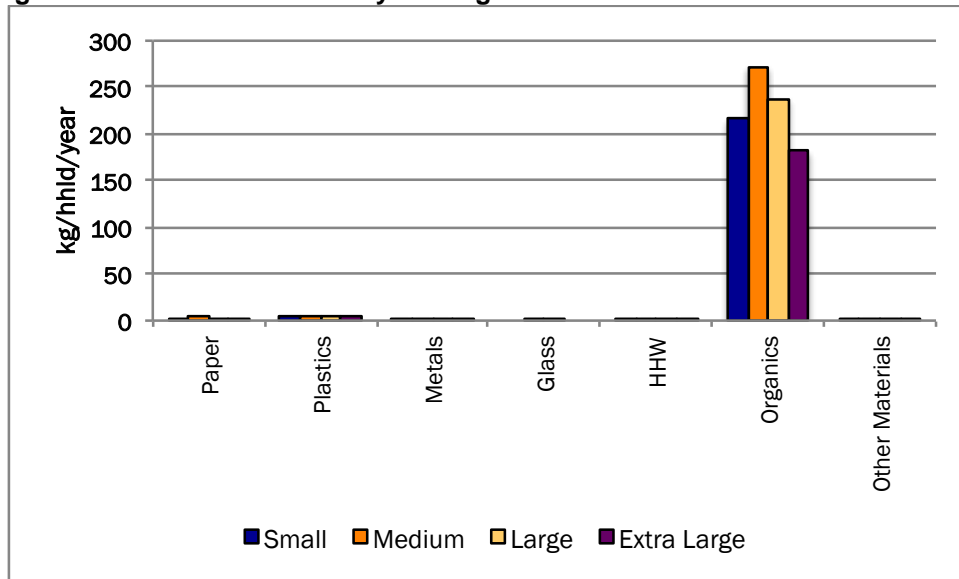


Figure 7.18 Green Bin Waste by Garbage Bin Size - Four Seasonal Waste Audits



7.3.5 Food Waste

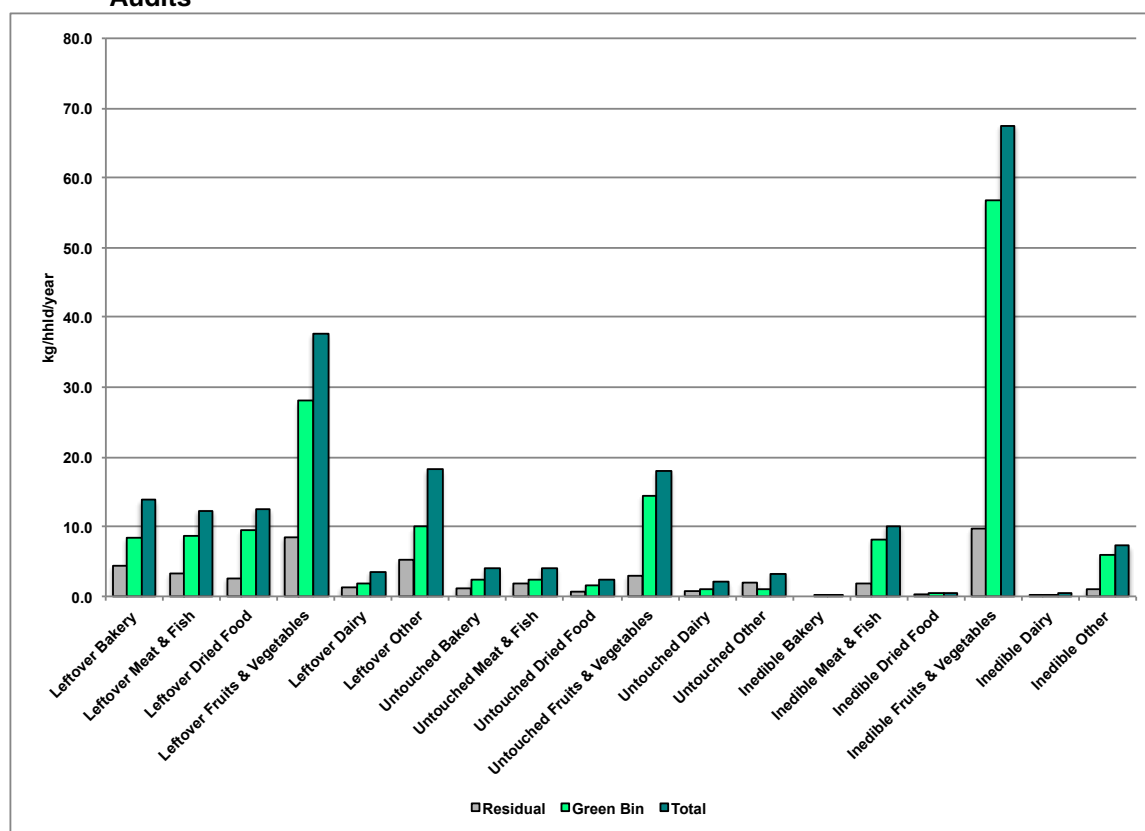
An analysis of food waste disposal and diversion was undertaken. Approximately 28% of the three waste streams, 18% of residual materials and 64% of green bin materials consisted of food waste. During the waste audits food waste was divided into edible (i.e. food that was at one time edible) and inedible food (e.g. bones, vegetable peels, eggshells). Table 7.6 summarizes food waste disposal and diversion. It shows that approximately 60% of food disposed and diverted was edible. In the green bin 55% of food waste was edible while in the residual waste stream 73% of food waste was edible.

Table 7.6 Summary of Food Waste in the Green Bin and Residual Waste Streams

	Green Bin		Residual		Total	
Edible Food Waste	kg/hhld/year	%	kg/hhld/year	%	kg/hhld/year	%
Leftover	66.29	41.1	25.11	53.6	91.40	43.9
Untouched	23.09	14.3	9.18	19.6	32.27	15.5
Total	89.37	55.4	34.29	73.1	123.67	59.4
Inedible Food Waste	71.94	44.6	12.60	26.9	84.54	40.6
Total	161.32		46.89		208.21	

Edible food was further divided into leftover and untouched food. Figure 7.19 summarizes food waste in the green bin and residual waste streams. It shows that most food waste ends up in the green bin. As well it shows that fruits and vegetables makes up the highest amount of edible (44%) and inedible (79%) food waste. Edible food wastes included varying amounts of food sub categories (e.g. bakery, meat & fish).

Figure 7.19 Food Waste in the Residual Waste and Green Bin Streams- Four Seasonal Waste Audits



8.0 Conclusions

In conclusion over the four seasons waste audit households set out 78% garbage bins; 87% recycling bins and 70% green bins, while for the participation audit it was 74% garbage bins; 81% recycling bins and 68% green bins. Over the four seasons participation audit households had a participation rate of 84% for garbage bins; 92% for recycling bins and 86% for green bins.

As household garbage bin size increased there was more residual material and recycling material set out. Households with small garbage bins diverted more green bin materials than households with extra large bins. Households with medium and large garbage bins diverted the most green bin material.