



**SUMMARY ANALYSIS OF  
SET-OUT WEIGHTS FOR  
GARBAGE,  
RECYCLING &  
YARD DEBRIS  
IN THE  
CITY OF VANCOUVER**

**Spring, Summer &  
Fall Seasons  
2000**

*Prepared for*  
**Solid Waste Services  
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**Clark County Environmental Services  
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# SUMMARY ANALYSIS OF SET-OUT WEIGHTS FOR GARBAGE, RECYCLING & YARD DEBRIS IN THE CITY OF VANCOUVER

Spring, Summer & Fall Seasons 2000

This report summarizes results from a City of Vancouver Solid Waste Services project to weigh garbage, recycling and yard debris set outs for a sample of 749 single-family residential garbage collection service customers during three four-week periods – one weighing period each during spring, summer and fall seasons of 2000. Table 1, Citywide & Weight Study Service Level Composition, shows the distribution of sample households among the six service levels included in the study – once a month collection of one 32-gallon standard can of garbage (designated by 1x32M), every other week (biweekly) collection of one 20-gallon minican (1x20B), bi-weekly collection of a standard can (1x32B), weekly collection of a minican (1x20W), weekly collection of a standard can (1x32W), and weekly collection of two standard cans (2x32W).

As shown by the comparison in Table 1 with citywide counts for Waste Management (WMI) and Waste Connections (WCI) garbage collection customers for the six service levels, the sample was selected to give a statistically reliable number of households in the sample for each service level rather than to mirror the citywide customer distribution. For example, weekly standard can customers account for over 71% of garbage customers among the six service levels, but Solid Waste Services selected only 35% of the sample at this service level. On the other hand, 10% of the sample is made up of biweekly minican customers, compared with 2% at that service level citywide. To compensate for these sampling design characteristics, this report calculates citywide sampling averages by multiplying weight study results for each service level by the citywide service level proportions shown in Table 1.<sup>1</sup>

At the end of the project the City mailed out survey questions to participants in the weighing study. Solid Waste Services designed the questions to help analyze the weight study data and to better understand customer collection service needs. For example, the survey asked about household size, family income and home ownership. Almost one-third, 240 or 32%, of the 749 weight study households completed the survey. This summary report includes a compilation of this mailed-back survey data as well.

**Table 1**  
**Citywide & Weight Study Service Level Composition**

Service Level	Customer Count (Fall 2000)				Weight Study Sample Count	
	WMI	WCI	Total	Percent	Total	Percent
1x32M	625	911	1,536	4.6%	35	4.7%
1x20B	439	179	618	1.8	76	10.1
1x32B	1,535	1,574	3,109	9.3	73	9.8
1x20W	889	682	1,571	4.7	165	22.0
1x32W	<b>10,427</b>	<b>13,409</b>	<b>23,836</b>	<b>71.2</b>	<b>260</b>	<b>34.7</b>
2x32W	1,154	1,655	2,809	8.4	140	18.7
<b>Total</b>	<b>15,069</b>	<b>18,410</b>	<b>33,479</b>	<b>100.0%</b>	<b>749</b>	<b>100.0%</b>

<sup>1</sup> Vancouver's total residential customer count in the fall of 2000 was 35,250, including 2x32B, 3x32W, and 4x32W service levels. These particular service levels were not included in the study because there were so few customers utilizing these multi-can service levels.

## A. Profile of Vancouver's Average Garbage Customer

The inset on this page summarizes data gathered in the weight study and participant mail survey by showing a profile of the City's average single-family residential garbage collection customer based on study and survey findings. This average single-family household in Vancouver sets out 198 pounds of waste each month -- 100 pounds in garbage cans, 56 pounds in recycling bins and 42 pounds in yard debris carts.<sup>2</sup> The average customer's recycling and yard debris diversion rate is, thus, 49%.<sup>3</sup>

Garbage set out rates average 78% -- about 41 times over the course of a year. Recycling bin set-out rates average 65% -- about 34 weeks during the year by the average household. Yard debris cart set-out rates average only 12% on a weekly set-out rate basis. However, only about 36% of households actually subscribe for the biweekly yard debris collection service, so the actual set-out rate yard debris collection service subscribers is 33% -- about 17 weeks out of the year, or about 66% of their subscribed biweekly set out times. Extras, additional set outs of garbage beyond the number of cans and/or frequency of collection paid for monthly, are set out on average just under three times over the course of a year.

According to participant survey data, the average customer's household has an annual income of \$49,500 supporting 2.3 persons. Based on information from the Clark County Assessor's office, as supplemented to some extent by data from the participant survey, this average household's residence is on a quarter acre lot, and just over three-quarters of garbage service households own their home.

## Average Garbage Customer

• Garbage/month: 100	<u>Garbage:</u> ♣ 33 to 170lbs
• Recycle/month: 56	<u>Diversion:</u> ♣ 70 to 32%
• Yard Debris/mo: 42	as service level up
• Diversion Rate: 49%	<u>Setout Rates:</u>
• Household Size: 2.3	Garbage = 78%
• Income (000): \$49.5	Recycling = 65%
• Own House: 77%	Yard Debris = 12%

<sup>2</sup> As shown in Table 2, the average weight of yard debris when a cart or carts are actually set out for collection is 130.9 pounds.

<sup>3</sup> According to weight data reported by WMI and WCI for residential collections in 2000, the actual diversion rate was 48.8%, 28.3% for recycling and 20.5% for yard debris. Thus, the weight study's citywide average based on the 12 weeks of weight data is remarkably close to the 52-week actual. Average collected waste generation for 2000 was 210.7 pounds, again very close to the average calculated from the weight study of 197.6, as shown in Table 2.

As shown in Table 2 and summarized in the inset on the previous page, the amount of garbage set out each month for collection varies directly with service level, increasing from an average of 32.6 pounds per month at the lowest service level, monthly standard can, up to 170.2 pounds per month for the study's highest service level, two standard cans each week. Interestingly, diversion rates also are strongly associated with service level, but in an inverse manner, falling from 63.8% for the monthly standard can and 70.1% for biweekly minican, down to 50.0% for a weekly standard can and 32.4% for weekly collection of two standard cans.

## B. Key Findings from Weight Study

### 1. Weights, Set-Out Rates, Diversion Rates & Demographics

Table 2, Weights, Set Out Rates, Diversion Rates & Demographics, details results by service level from the weight study and participant survey. Based on citywide service level proportions shown in Table 1, Table 2 also reports citywide averages for data gathered in the weight study and follow-up mail survey. According to citywide sign ups, weekly pickup of a single standard can is overwhelmingly preferred, accounting for 71% of sign ups. Results for this service level are, thus, highlighted in Table 2.

**Table 2**  
**Weights, Set Out-Rates, Diversion Rates & Demographics**

	<u>1x32M</u>	<u>1x20B</u>	<u>1x32B</u>	<u>1x20W</u>	<u>1x32W</u>	<u>2x32W</u>	<u>Citywide Average*</u>
<b>Average Monthly Quantities</b>							
<b>Subscribed Garbage</b>	26.8	38.7	53.5	63.5	<b>96.9</b>	162.2	<b>92.5</b>
<b>Extras</b>	<b>5.8</b>	<b>1.3</b>	<b>8.1</b>	<b>2.9</b>	<b>7.4</b>	<b>8.0</b>	<b>7.1</b>
<b>Total Garbage</b>	32.6	40.0	61.6	66.4	<b>104.3</b>	170.2	<b>99.6</b>
<b>Recycling</b>	38.5	50.2	43.1	58.2	<b>59.4</b>	47.1	<b>55.7</b>
<b>Yard Debris (all households)**</b>	<b>18.9</b>	<b>43.6</b>	<b>33.8</b>	<b>50.6</b>	<b>45.2</b>	<b>34.4</b>	<b>42.3</b>
<b>Total Waste Generation</b>	90.0	133.8	138.5	175.2	<b>209.0</b>	251.8	<b>197.6</b>
<b>Yard Debris Set Outs (only yard debris subscribers)**</b>	107.2	125.7	119.3	132.4	<b>133.8</b>	132.5	<b>130.9</b>
<b>Weekly Set-Out Rates</b>							
<b>Subscribed Garbage</b>	20.6%	44.1%	44.1%	88.4%	<b>85.7%</b>	82.4%	<b>73.4%</b>
<b>Extras</b>	2.2%	1.4%	2.9%	3.7%	<b>5.9%</b>	6.0%	<b>5.3%</b>
<b>Garbage (including extras)</b>	22.8%	44.6%	47.0%	88.4%	<b>85.7%</b>	82.4%	<b>78.3%</b>
<b>Recycling</b>	33.1%	60.4%	46.7%	62.6%	<b>70.7%</b>	57.7%	<b>65.1%</b>
<b>Yard Debris</b>	4.8%	15.9%	10.1%	14.6%	<b>12.5%</b>	9.7%	<b>11.9%</b>
<b>Subscription Utilization Rate</b>	89.2%	88.2%	88.2%	88.4%	<b>85.7%</b>	82.4%	<b>86.0%</b>
<b>Diversion Rates</b>							
<b>Recycling</b>	42.8%	37.5%	31.1%	33.2%	<b>28.4%</b>	18.7%	<b>28.2%</b>
<b>Yard Debris</b>	<b>21.0%</b>	<b>32.6%</b>	<b>24.4%</b>	<b>28.9%</b>	<b>21.6%</b>	<b>13.7%</b>	<b>21.4%</b>
<b>Total</b>	63.8%	70.1%	55.5%	62.1%	<b>50.0%</b>	32.4%	<b>49.6%</b>
<b>Demographics</b>							
<b>Survey Household Size</b>	1.6	1.7	1.8	1.9	<b>2.4</b>	3.2	<b>2.3</b>
<b>Survey Income</b>	\$32,500	\$39,318	\$44,100	\$40,500	<b>\$50,719</b>	\$62,262	<b>\$49,547</b>
<b>Percent Owner Occupied***</b>	92.0%	79.0%	75.0%	92.0%	<b>78.0%</b>	59.0%	<b>77.4%</b>
<b>Lot Size (acres)***</b>	0.28	0.31	0.23	0.24	<b>0.25</b>	0.25	<b>0.25</b>

\* Citywide average computed from citywide service level proportions shown in Table 1.

\*\* Calculation of average monthly yard debris quantity based on all households; calculation of average monthly yard debris set-out quantity based only on households that subscribe to yard debris collection service.

\*\*\* Based on multimap database from the Clark County Assessor's Office; owner occupancy information updated with weight study participant survey data as appropriate.

As one might expect, average subscribed garbage weights, as well as garbage weights including extras, are higher for service levels with greater monthly garbage set-out capacity limits. For example, the lowest service level (1x32M) has 32 gallons, or .16 cubic yards, of garbage set-out capacity per month. That service level's set outs covered by the monthly fee average just 26.8 pounds, which equates to a density of 169 pounds per cubic yard of monthly garbage container capacity. At the highest service level (2x32W), 277.3 gallons or 1.37 cubic yards of monthly capacity, garbage set outs covered by the monthly fee average 162.2 pounds, which equates to a lower density of 118 pounds per cubic yard of monthly capacity.

Extras (garbage set outs above those covered by the monthly fee) average between 6 and 8 pounds per month for service levels using the standard can. By contrast, extras only average between 1 and 3 pounds for minican service levels. At first glance this may seem like a surprising finding because one might expect to find minican customers more likely to exceed their garbage container capacity limit, given its smaller 20-gallon capacity in comparison to the standard 32-gallon can.

However, recycling and yard debris diversion rates suggest that minican customers are in fact diligent waste diverters, a practice that apparently carries over into efforts at minimizing generation of extra garbage. Table 2 shows that biweekly minican customers on average divert 70% of waste, and weekly minican subscribers divert 62%. Among standard can users, only the monthly pickup subscribers beat weekly minican subscribers by achieving a 64% diversion rate. Biweekly and weekly standard can users achieve 56% and 50% diversion rates, respectively. Weekly users of two standard cans bring up the rear at just 32% diversion.

The demographics section at the bottom of Table 2 suggests several partial reasons for the low diversion rate of weekly users of two standard cans. That is, when responses to the participant survey are categorized by service level, this group of subscribers reported having the largest number of household members, 3.2 on average, and the highest household annual income, over \$62,000 on average, among the six service level categories. This group also was far less likely to own their residence, but was average in terms of residence lot size.

In general, the tendency for higher service levels to have substantially lower diversion rates was one quite remarkable finding from the weight study. Both household income and family size also showed strong association with higher service levels, and with greater generation of both garbage and total waste. However, as discussed in section B.6., higher income is associated with greater diversion, while larger family size is associated with lower diversion levels.

One final note about the data in Table 2 is that weekly minican and single standard can subscribers tended to have higher weekly set-out rates for garbage, recycling and yard debris than users of other service levels. At the same time, minican customers tended to have similar recycling and yard debris set-out rates regardless of whether they were biweekly or weekly subscribers. Monthly standard can users had the lowest set-out rates for all three collection streams, another indication that this category of subscribers has by far the lowest overall waste generation.

## **2. Seasonal Variation in Garbage, Recycling and Yard Debris**

Weight study sampling was done in four-week intervals during May-June, August-September, and late October-November during 2000. Figure 1, Average Seasonal Weights per Customer, shows average sampling weights in these three seasons for subscribed garbage, garbage including extras, recycling and yard debris.<sup>4</sup>

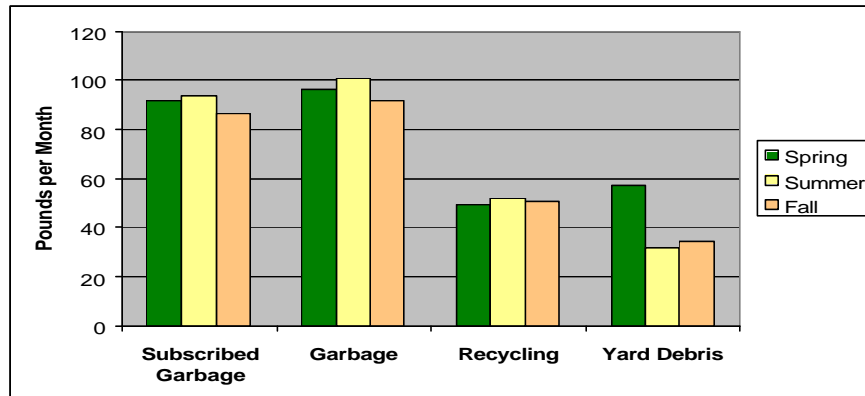
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<sup>4</sup> The weights shown in Figure 1 are sample averages for each season's weights for all service levels. They, thus, differ from the citywide averages shown in Table 2, which are based on sample data adjusted to citywide service level composition.

Figure 1 clearly shows the substantial, and statistically significant, increase in yard debris generation in the spring versus either summer or fall seasons.<sup>5</sup> This result conforms to casual observation of variations in yard debris collection route quantities throughout the year.

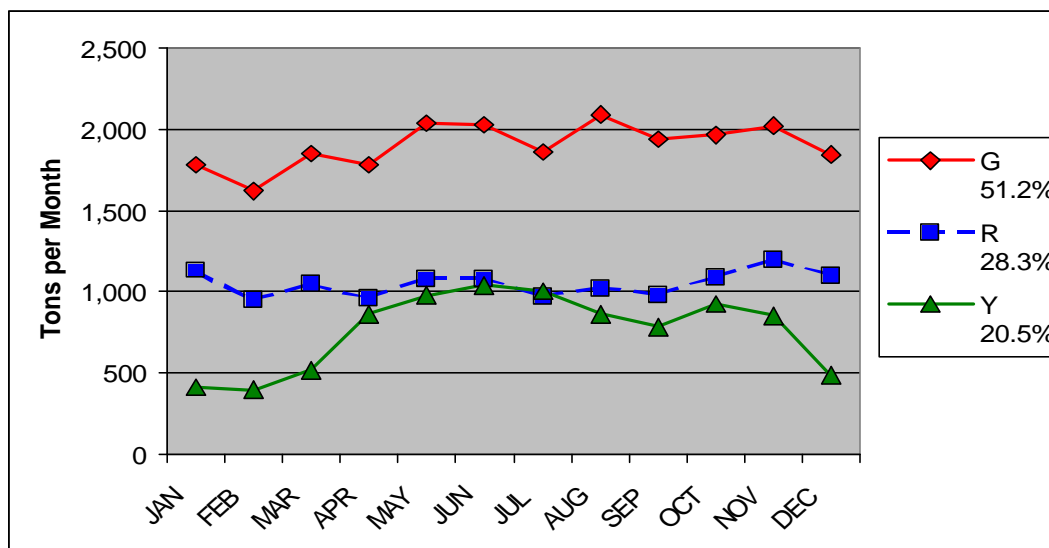
Recycling set outs, by contrast, do not show any significant variation across the three seasons. This result also is consistent with casual observation. Although some in the recycling industry might have expected the summer season to show a greater tendency to exceed spring and fall recycling because of greater consumption of beverages in the summer.

**Figure 1**  
**Average Seasonal Weights per Customer**



Both subscribed garbage and garbage including extras are statistically similar in the spring and summer; but show a significant, although not quantitatively substantial, drop in the fall. Generation of extras is statistically constant across the seasons, ranging between 5 and 6 pounds per customer on average.

**Figure 2**  
**Seasonal Variation in Tons Collected during 2000**



<sup>5</sup> “Significant” is used in this section to indicate statistically significant differences, at 95% confidence or greater, between seasons in average set-out weights.

Figure 2, Seasonal Variation in Tons Collected during 2000, shows monthly garbage, recycling and yard debris collection weights throughout the year 2000. The graph line for garbage tons indicates that the first two to four months of the year are lower than the remaining months. Inasmuch as the weight study did not include these months, it is possible that weights measured in that period would have turned out to be significantly lower than set-out weights sampled later in the year. After adjusting for growth in the City's residential garbage customer base throughout the year from 34,353 customers in January to 36,191 by December, garbage generation is substantially lower early in the year. Average garbage generation per month was 101.5 pounds per customer during the first four months of 2000 compared with an average of 112.3 over the seven months (May through November) during which the weight study's three weighing periods took place.

Variations through out the year in recycling tonnage, by contrast, appear to confirm the weight study's finding of no substantial seasonal variation in recycling set-out weights. At the same time, monthly average recycling set outs do fluctuate -- peaking in January and November at more than 66 pounds per garbage customer, and reaching lows in April and September of just over 54 pounds. Finally, yard debris collection tonnages confirm the May-June peak exhibited for the weight study in Figure 1. However, by not sampling during the December-March period, the weight study did miss the seasonal low in yard debris generation.

### 3. Garbage Density by Service Level

The weight study revealed some very interesting results on garbage density and weight per can. These are portrayed graphically in Figure 3, Garbage Density at Each Service Level. The concept to keep in mind when looking at Figure 3 is that it portrays garbage density in terms of pounds per standard can. The 32-gallon standard can volume is used because for residential garbage collection 32 gallons is more often than not the garbage container capacity reference standard, just as a cubic yard tends to be the reference standard for commercial garbage density.

For the four service levels that use a standard can for their garbage container, the graph shows both density and set-out weight. That is, the weight of each standard can that was set out during the study period is the garbage density for that can.<sup>6</sup> For the minican (20 gallons of capacity per can) service levels, the graph shows set-out weights multiplied by 32/20. This multiplication gives garbage density for a minican in pounds per 32 gallons, so as to be comparable with density for the standard can service levels.

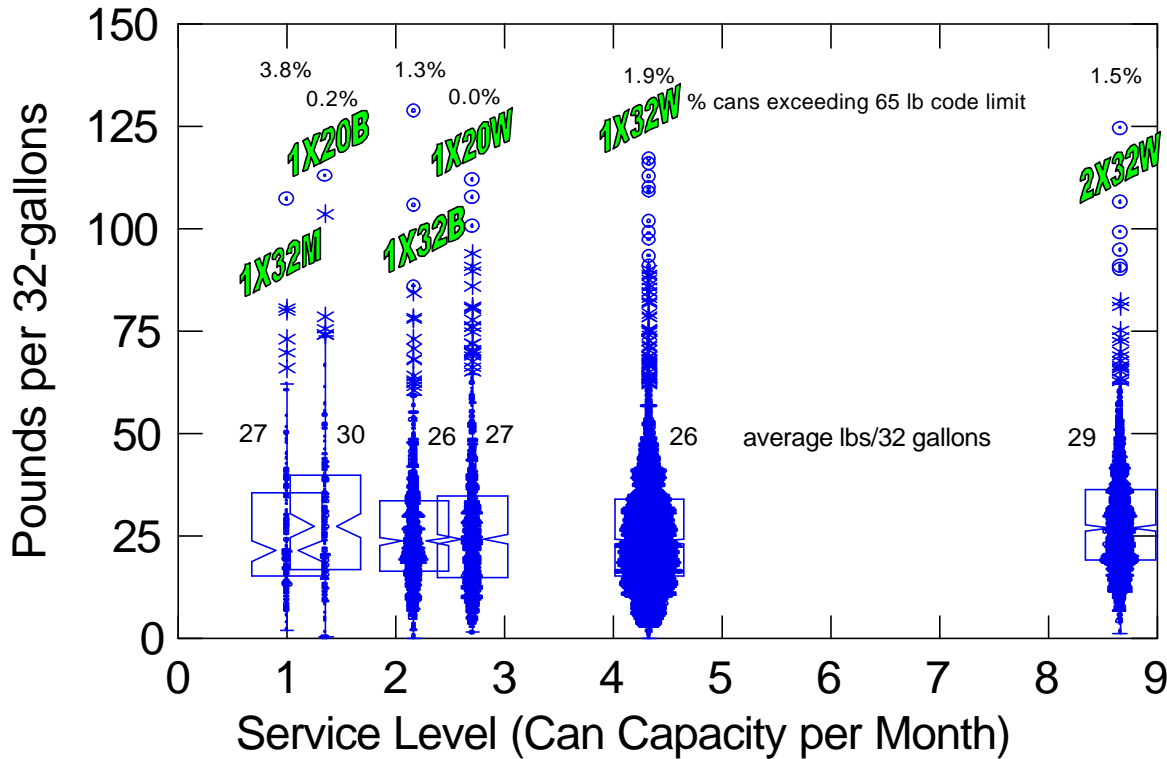
Figure 3, Garbage Density at Each Service Level, shows symmetrical dot density distributions with each dot on the graph representing one observation of a can's density during the study period. The symmetrical shape is the result of spreading dots sideways evenly to the left and right of the centerline for each service level's monthly can capacity whenever there is more than one observation of the same garbage density.

Service levels shown on the horizontal axis of Figure 3 are defined according to number of standard 32-gallon cans of garbage container capacity allowed in a month of set outs. For example, the monthly standard can service level is indicated by 1.00 on the horizontal axis. The weekly standard can is indicated by 4.33 ( $= [32 * 52] / [32 * 12]$ ). Biweekly minican is indicated by 1.35 ( $= [20 * 26] / [32 * 12]$ ) and weekly minican by 2.71 ( $= [20 * 52] / [32 * 12]$ ).

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<sup>6</sup> For the 2x32W service level, Figure 2 shows weight for the heaviest of the two cans allowed in each week's set-out. For this two standard can weekly service level the second can has an average weight of 21.1 pounds and a set-out rate of 48%, compared with 28.8 pounds and a set-out rate of 82% for the first can.

**Figure 3  
Garbage Density at Each Service Level**



The notched box overlaid on each symmetrical dot density distribution covers the middle 50% of observations for garbage density at each service level, with the notch showing the middle (median) observation. Points plotted with a star are outlying densities, while circles indicate far outliers.

The average (mean) garbage density for each service level is printed above the notched boxes. Because garbage density distributions are skewed positively (i.e., the stars and circles only lie above the notched boxes), average density is always greater than the median.

What is intriguing is how similar average garbage densities for the six service levels are, ranging only between 26 and 30 pounds per 32 gallons, or between 165 and 191 pounds per cubic yard. The next to the lowest service level (biweekly minican) and the highest service level (two standard cans weekly) are at the top of the range, while biweekly and weekly standard can service levels are at the bottom. If the “Seattle stomp” phenomenon were operative in the city of Vancouver, as some might expect given the availability of very low monthly capacity service levels and the near linear garbage fee structure, garbage density should be substantially higher for lower capacity service levels. In fact, average garbage density is fairly uniform.

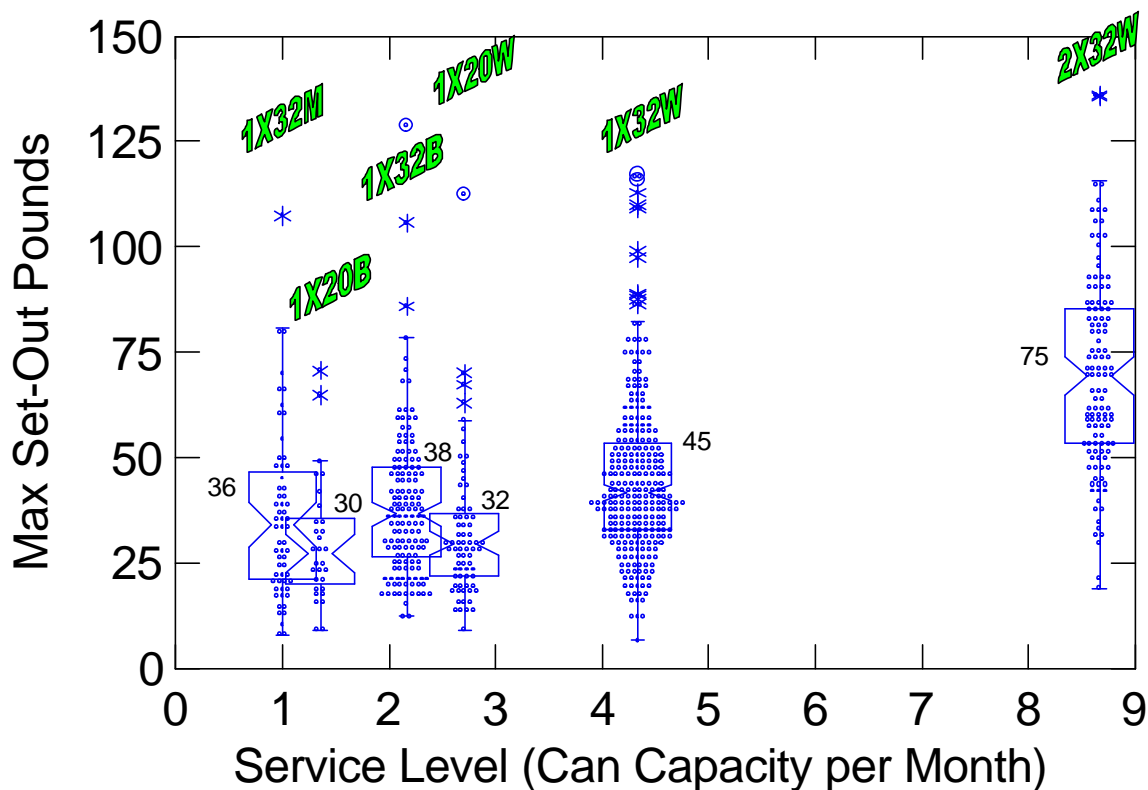
Furthermore, there are set outs at all service levels with densities exceeding the City of Vancouver Code’s weight limit of 65 pounds per can. The monthly standard can does have the highest rate of City code infraction at 3.8%, as shown by the percentages given at the top of the dot density for each service level. But infraction percentages for minican service levels are much lower than for any standard can service level, so that on balance even the rate of code infraction fails to support the garbage stomping hypothesis in any strongly consistent way.



#### 4. Surge Capacity by Service Level

Figure 3 not only shows similarities in density across the six service levels, it also demonstrates substantial overlap in set-out weights among service levels. This raises the question of why more customers aren't using lower capacity service levels. One explanation is, of course, that Figure 3 does not account for frequency of garbage generation, because it compares densities for subscribed garbage set outs regardless of whether those set outs occur monthly, biweekly, or weekly. As discussed previously, Table 2 shows that monthly weights for subscribed garbage are substantially higher for service levels with greater monthly set-out capacity. Table 2 also indicates a tendency for income and household size to be positively correlated with monthly garbage weight, and those relationships are confirmed by graphical analysis presented later in this report.

**Figure 4**  
**Maximum Set-Out Weight for Subscribed Garbage**



This section provides a brief analysis of another factor that many believe is important in choice of service level – periodic surges in garbage generation. In order to accommodate these occasional surges, or the potential for such a surge, a garbage customer needs to select a service level that provides more capacity than that customer will use on a regular basis.

Figure 4, Maximum Set-Out Weight for Subscribed Garbage, shows the dot density distribution and box plot for the heaviest set out of subscribed garbage by each customer using a particular service level throughout the three four-week periods of the weight study. The figure alongside each service level's dot density distribution gives that service level's average for maximum set-out weights.

Figure 4 does indicate that maximum set-out weights are higher for the higher standard can service levels. But the minican customers again behave differently than standard can customers, in this case by having much lower maximum set outs than standard can customers with similar monthly garbage container capacity. Furthermore, there remains substantial overlap among customers at different service levels in maximum set outs. These results suggest that surge capacity may be one factor in service level selection, but it is certainly not strikingly dominant. Of course, the data might point to a different conclusion if the weight study had tracked households throughout a full year during which there would be more than four times as many opportunities to observe a surge in garbage generation.

### 5. Garbage by the Can as a Surrogate for Garbage by the Pound

Table 3, Garbage by the Can Fees vs. Surrogate GBTP Fees, compares volume-based garbage fees (garbage by the can) used by the City against what might be called surrogate garbage by the pound (GBTP) fees that generate the same total monthly revenue as the volume-based fees. The GBTP fees shown in Table 3 are surrogate in the sense that they could be implemented in the current volume-based fee system by charging \$0.123 per pound for the average monthly set-out weight at each service level, rather than charging each customer for that customer's specific garbage weight as would be done under regular GBTP.

**Table 3**  
**Garbage by the Can Fees vs. Surrogate GBTP Fees**

	<u>1x32M</u>	<u>1x20B</u>	<u>1x32B</u>	<u>1x20W</u>	<u>1x32W</u>	<u>2x32W</u>	Citywide <u>Average</u>
Average Monthly Weight*	26.4	32.5	49.6	65.8	<b>98.3</b>	159.8	<b>92.9</b>
Monthly Fee	\$5.07	\$6.76	\$8.45	\$8.45	<b>\$11.27</b>	\$22.54	<b>\$11.45</b>
Surrogate GBTP Fee	\$3.26	\$4.00	\$6.12	\$8.12	<b>\$12.12</b>	\$19.70	<b>\$11.45</b>
Surrogate Fee per Avg. Lb.	\$0.123	\$0.123	\$0.123	\$0.123	<b>\$0.123</b>	\$0.123	<b>\$0.123</b>

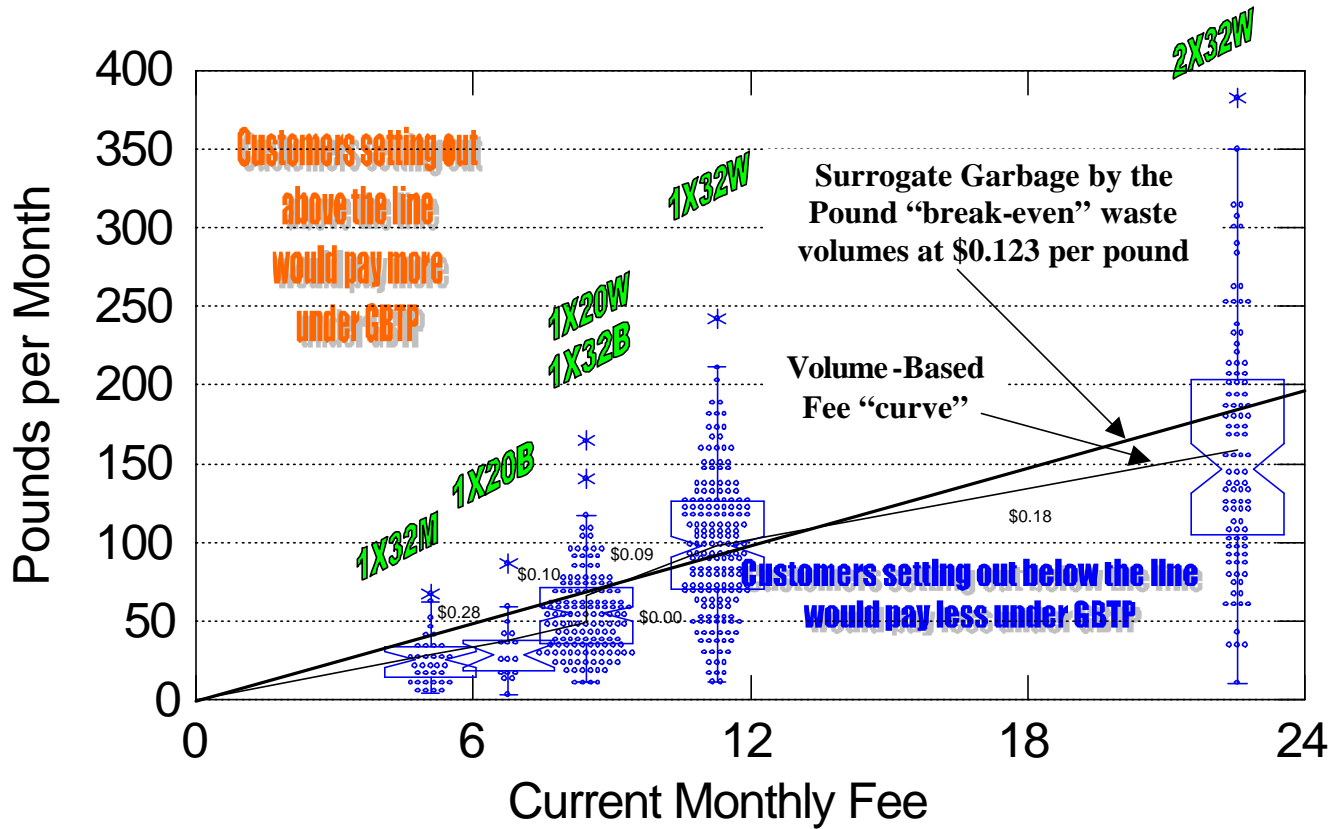
\* Average over three sampling seasons for households that did not change their service level during the weight study.

The surrogate GBTP fees shown in Table 3 would average \$11.45 per month citywide, the same as the City's volume-based fees. However, the monthly fee would be lower at every service level except for weekly standard can service level. This is because the City's volume-based fees are greater than \$0.123 per pound for the average subscribed garbage set-out weight at every service level other than the weekly standard can.

Figure 5, Garbage by the Can and Surrogate GBTP, shows graphically how the City's volume-based fees approximate GBTP at \$0.123 per pound, and where they differ from GBTP. The lighter, piecewise linear line on the graph connects monthly volume-based fees for each service level's average set-out weight. By comparison, the darker line shows monthly fees for various weights at the constant charge of \$0.123 per pound. (Thus, this darker line represents the calculated "break-even" point for where customers setting out consistent volumes would pay the same under GBTP or under surrogate GBTP volume-based fees.)

Under regular GBTP every monthly set-out weight below the darker line would pay less than under a volume-based fee structure, and every set-out weight above the darker line would pay more. Except for weekly standard can (32-gallon) customers, the average monthly set-out weight at each service level is below the darker GBTP line. As noted above, this means that monthly rates for these customers would be lower under surrogate GBTP than they currently are for five of the six service levels shown on Figure 5.

**Figure 5**  
**Garbage by the Can & Surrogate GBTP**



Under surrogate GBTP the incremental per pound rate between average monthly set-out weights would be a constant \$0.123 per pound. Under the current fee structure, incremental charges between service levels range from \$0.000 between biweekly standard and weekly mini-can to \$0.279 between monthly standard and biweekly minican, as shown in Figure 5.

Under regular GBTP each pound of garbage set out by a customer would incur a \$0.123 charge. Implementing this method of charging for garbage collection services would require expenditures for truck scale technology and some type of scanner readable code on each customer's garbage container. Some customers also might find the month-to-month variations in their garbage bill to be an inconvenience or to cause additional uncertainty in their monthly budgeting.

**6. Set Outs & Demographics by Neighborhood for Weekly Standard Can Customers**

According to weight study results shown in Table 2, monthly weights for garbage set outs (including extras) average 99.6 pounds citywide, 55.7 for recycling and 42.3 for yard debris, with an average diversion rate of 49.6% out of generation totaling 197.6 pounds per month. One of the objectives in designing the sample for this weight study was to pick garbage collection customers from a variety of neighborhoods in Vancouver so that the sample would represent neighborhood as well as service level differences across the city.

Table 4, 1x32W Weights & Diversion Rates by Neighborhood, shows set-out weight averages for weekly standard can customers in ten neighborhoods spread from the west to the east across Vancouver. These averages are based on between 42 and 77 observations of monthly

weights in each of the ten neighborhoods. Consequently, averages shown in Table 4 are based on sub samples of sufficient size to give reliable estimates for each neighborhood's waste generation and diversion behavior.

**Table 4**  
**1x32W Weights & Diversion Rates by Neighborhood**

<b>Neighborhood</b>	<b>Garbage</b>	<b>Recycling</b>	<b>Yard Debris</b>	<b>Waste Generation</b>	<b>Diversion Rate</b>
West <b>1</b>	94.9	47.3	56.0	198.2	52.1%
<b>2</b>	102.0	56.9	45.9	204.8	50.2
<b>3</b>	111.5	53.6	55.1	220.2	49.4
<b>4</b>	<b>130.2</b>	<b>83.4</b>	<b>56.3</b>	<b>269.9</b>	51.8
<b>5</b>	94.9	72.6	50.6	218.1	<b>56.6</b>
<b>6</b>	103.3	59.5	49.0	211.8	51.2
<b>7</b>	94.5	52.1	43.6	190.2	50.3
<b>8</b>	121.6	62.4	42.2	226.2	46.2
<b>9</b>	<b>86.2</b>	<b>44.8</b>	<b>29.0</b>	<b>160.0</b>	<b>46.1</b>
East <b>10</b>	100.0	57.8	31.5	189.3	47.2
<b>Average (Table 2)</b>	<b>104.3</b>	<b>59.4</b>	<b>45.2</b>	<b>209.0</b>	<b>50.0</b>

Table 4 shows that for weekly standard can customers, monthly garbage set outs vary from a low of 86.2 in neighborhood 9 to a high of 130.2 in neighborhood 4 among the ten neighborhoods, as indicated by the shaded cells in the table. Interestingly, generation of recyclables and yard debris for weekly standard can customers attain their lows and highs in these same two neighborhoods as well. As a result, waste generation ranges from a low of 160.0 pounds per month in neighborhood 9 to a high of 269.9 pounds in neighborhood 4.

The recycling and yard debris diversion rate is also lowest in neighborhood 9 at 46.1%. However, neighborhood 4 has a relatively higher peak in garbage set outs than it does in recycling and yard debris set outs, so that neighborhood's diversion rate is 51.8%, well below the peak diversion rate of 56.6% in neighborhood 5.

Table 5, 1x32W Demographics by Neighborhood, reports survey data and Clark County property information for weekly standard can participants in the weight study by neighborhood of residence. Comparing the set-out weights and diversion data in Table 4 with demographic data in Table 5 one notes that weight study participants from neighborhood 5 using weekly standard can service have the highest average diversion rate, highest estimated average annual income, and largest average lot size among weekly standard can participants in the ten neighborhoods. Participants from neighborhood 4 using weekly standard can have the highest waste generation rate, but mid-level diversion rate, while having the greatest rate of owner occupancy and the second largest average lot size.

Neighborhood 9 weekly standard can participants have the lowest generation rate and lowest diversion rate, and tend to be mid-level on all demographics. Neighborhood 1 weekly standard can participants have lower level generation and the second highest diversion rate, and have the lowest average annual income and lowest average lot size among weekly standard can users in the ten neighborhoods. These data for neighborhood 1 run contrary to the common belief that high income and large yards are associated with higher recycling and yard debris diversion rates. These variables may tend to be positively correlated with diversion, but the neighborhood 1 data suggest that other factors must also exert a significant influence on a household's success in waste diversion programs.

Neighborhood 8 weekly standard can users have far and away the highest average household size, while ranking second highest in waste generation and second lowest in waste diversion. By contrast, neighborhood 2 has the lowest average household size, and ranks mid-level for waste generation and diversion.

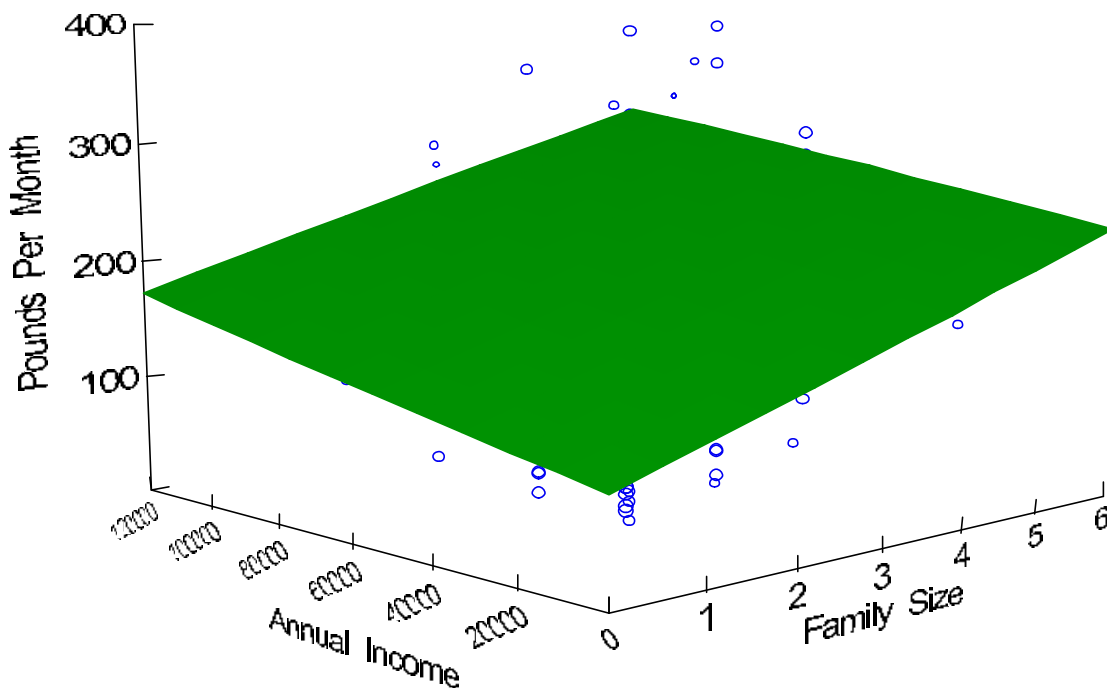
**Table 5**  
**1x32W Demographics by Neighborhood**

<u>Neighborhood</u>	<u>Survey Income</u> (000)	<u>Survey House-</u> <u>hold Size</u>	<u>Lot Size</u> (acres)	<u>Percent</u> <u>Owner Occupied</u>
1	\$34.6	2.4	.13	57.7%
2	45.7	2.0	.34	81.0
3	42.0	2.2	.14	74.4
4	44.2	2.2	.27	89.7
5	70.6	2.5	.49	83.3
6	69.3	2.1	.22	89.5
7	45.4	3.2	.22	85.2
8	38.7	4.2	.21	84.6
9	51.8	2.6	.22	72.2
10	35.6	2.6	.19	53.2

### 7. Influence of Income, Family Size and Lot Size on Generation & Diversions Rates

While it was not one of the formal objectives of this weight study, the mixed relation-

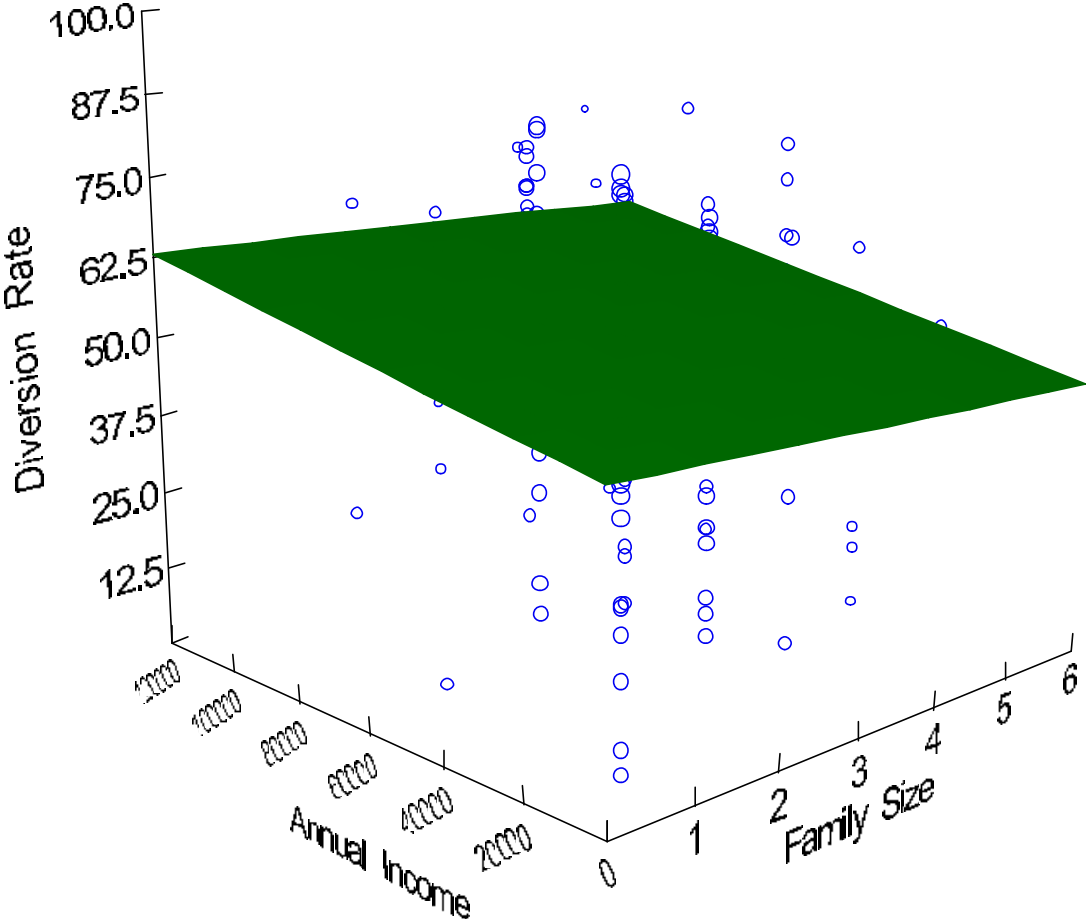
**Figure 6**  
**Waste Generation vs. Income & Family Size**



ships between set-out weights, diversion rates and neighborhood demographic characteristics noted in the previous section suggest the need to explore these associations a bit further. This section exhibits some graphical relationships between set-out weights and demographic characteristics. It remains for a future study to explore these relationships in a more rigorous statistical study using linear regression analysis and/or logit analysis to more exactly pin down the quantitative influence of income, family size, lot size and other factors on waste generation, waste diversion and choice of service level.

Figure 6, Waste Generation vs. Income & Family Size, shows how waste generation increases with either higher income or larger family size according to data gathered in the weight study and follow-on participant survey. The shaded plane in Figure 6 is the best linear representation of this positive association and indicates that larger families with higher incomes generate substantially more waste than households with fewer members and lower annual incomes.

**Figure 7**  
**Diversion Rate vs. Income & Family Size**



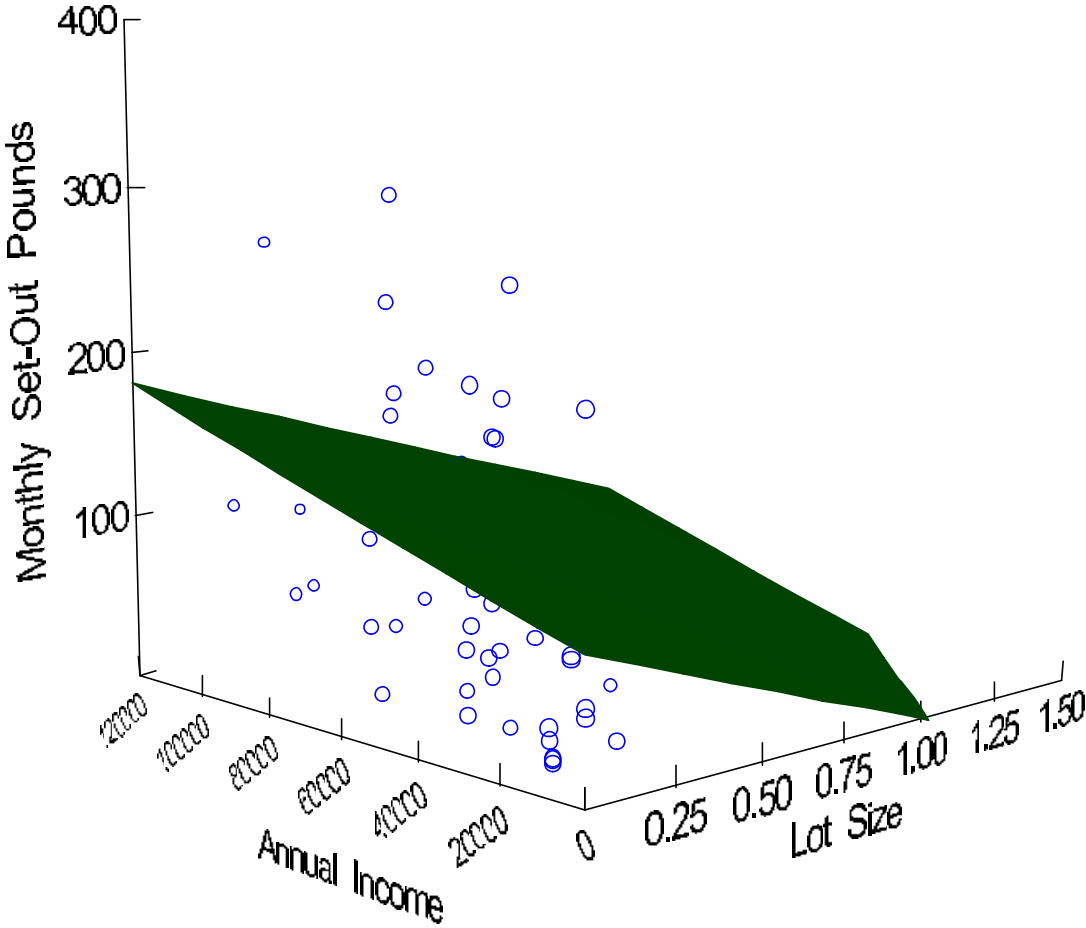
The relationships between monthly garbage, recycling and yard debris set-out weights and income or family size are all similar to the positive association between overall waste generation and income or family size shown in Figure 6. However, as implied by Figure 7, Diversion Rate vs. Income & Family Size, income has a greater impact on recycling and yard debris

generation than it does on garbage generation, so that diversion rates tend to be higher for households with higher income, at least as far as households included in the weight study are concerned.

On the other hand, family size has the opposite effect. The impact of family size on garbage generation is greater than on recycling and yard debris generation, so that diversion rates tend to be lower for households with larger families. This finding bears out one of the associations noted in the previous section -- a neighborhood with the largest average family size and third from the lowest average annual income for weekly standard can subscribers also had the next to lowest diversion rate.

Figure 8, Monthly Yard Debris Set Outs vs. Income & Lot Size, shows the relationship in the weight study data between average monthly weight for set outs over three months for a household that actually subscribed for yard debris collection and used it, and income or lot size. As indicated by the best-fit plane shown in Figure 8, income has a positive association with yard debris set outs, in fact quite a strong association.

**Figure 8**  
**Monthly Yard Debris Set Outs vs. Income & Lot Size**



At the same time, contrary to conventional wisdom, among weight study households that used the City's yard debris collection service, those with smaller lot sizes tended to set out higher amounts of yard debris than did households that had larger lot sizes. One possible explanation for this result is that households with larger lots might be more likely to use a landscaping service.

That landscaping service typically would haul the household's yard debris away, rather than setting it out for curbside collection. The problem with that explanation is that the data shown in Figure 8 were selected to exclude households that did not have yard debris set outs.

Another possible explanation is that households with larger lot sizes according to Clark County Assessor's Office records may in fact not have larger yards. That is, larger lot sizes may be more related to larger homes in the city than to larger expanses of grass, or to larger areas devoted to uses other than lawns or gardens. Finding an actual explanation for the inverse relationship between yard debris set-out weights and lot size shown in Figure 8 appears to be beyond the capabilities of the information gathered in the weight study and participant survey.

## **8. Additional Results from the Participant Survey**

Appendix A to this summary report provides a tabular summation of all data gathered in the City's mail survey of weight study participants conducted in December following the last weight study's sampling in November. The demographic data on household size, annual income, and home ownership were summarized across service levels and neighborhoods in Tables 2 and 5 and discussed in the text accompanying the two tables. One additional note to make here is that 87% of survey respondents owned their residence, compared with 76% in the weight study. Apparently, home owners were much more responsive to the mail survey than were renters.

According to survey respondents, adults are the responsible party for sorting and preparing recycled materials for collection in at least 95% of households. Direct mail is the overwhelmingly preferred single method for receiving recycling information at 57%, with the combination of direct mail and messages in the recycling bin coming in a distant second at 7.1%. About the same proportion of respondents, 60%, recall seeing *Curbside Recycling News*, a newsletter mailed out by Solid Waste Services in October 2000, versus 18% who were sure they had not seen it.

In terms of waste collection services in general, respondents were of diverse opinions as to what criteria were important for their collection services. Convenience was the only criteria listed by 8.3% of respondents, cost the only criteria listed by 4.6%, and wide choice in service options was the only choice of 2.5% of respondents. By contrast, all 6 criteria – aesthetics, convenience, cost, customer service, environmentally sound and wide choice in service options – were picked by 10.8%. Convenience plus cost plus customer service came in third at 7.9%, behind all 6 and only convenience. Those three plus the environment garnered 7.1% of respondents.

Quality of waste collection services in Vancouver was rated as good or excellent by 74.2%, compared with only 0.8% indicating that services are poor. Cost was checked as very affordable or okay by 60.4%, with 29.6% saying that cost was a little too high and 3.7% saying the services were not affordable. This survey, of course, was taken before the recent increase in garbage collection fees.

Finally, 37.5% thought that roller carts for garbage collection were a great idea, 31.7% wanted to hear more, 15.0% thought they would be OK, while just 6.7% thought they were a bad idea.

### ***For additional background or information on this Study please contact:***

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PO Box 1995, Vancouver Washington 98668  
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Sound Resource Management  
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Phone: 360-738-0255  
[www.zerowaste.com](http://www.zerowaste.com)



## Appendix A

### Survey Question A Number of Adults & Children Living in Household

Household Size	Percent of Responses	Number of Responses
One	29.6%	71
Two	42.1	101
Three	15.4	37
Four	6.3	15
Five	5.8	14
No Response	<u>0.8</u>	<u>2</u>
Total Surveys Returned	100.0%	240

### Survey Question B Responsibility for Sorting/Preparing Recyclables

Responsible Person	Percent of Responses	Number of Responses
Female Adult	45.0%	108
Male Adult	36.2	87
Female & Male Adult	12.5	30
Other	4.6	11
No Response	<u>1.7</u>	<u>4</u>
Total Surveys Returned	100.0%	240

### Survey Question C Owner/Renter Occupancy

Occupant	Percent of Responses	Number of Responses
Owner	87.1	209
Renter	12.1	29
No Response	<u>0.8</u>	<u>2</u>
Total Surveys Returned	100.0%	240

### Survey Question D Annual Household Income

Income Category	Percent of Responses	Number of Responses
\$25,000 or under	23.4%	56
\$25,001 to \$50,000	32.9	79
\$50,001 to \$75,000	17.1	41
\$75,001 to \$100,000	7.5	18
\$101,000 or above	5.8	14
No Response	<u>13.3</u>	<u>32</u>
Total Surveys Returned	100.0%	240

**Survey Question F**  
**Preference for Receiving Recycling Information**

Preferred Method	Percent of Responses	Number of Responses
Direct Mail	57.1%	137
Leave in Bin	5.4	13
Columbian	3.3	8
Internet	1.3	3
Mail + Bin	7.1	17
Mail + Neighborhood Assoc.	2.5	6
Mail + Internet	1.7	4
Mail + Bin + Columbian	1.7	4
Mail + Bin + Nbhd. Assoc.	1.3	3
Mail + Columbian + Nbhd. Assoc.	1.3	3
Other Responses*	15.4	37
No Response	<u>2.1</u>	<u>5</u>
<b>Total Surveys Returned</b>	100.0%	240

\* Various answers selected by only 1 or 2 respondents.

**Survey Question G**  
**Recall Seeing *Curbside Recycling News***

Recall Seeing Tabloid	Percent of Responses	Number of Responses
Yes	59.6%	143
No	18.3	44
Not Sure	16.3	39
No Response	<u>5.8</u>	<u>14</u>
<b>Total Surveys Returned</b>	100.0%	240

**Survey Question I**  
**Roller Carts for Garbage Collection**

Response to Idea	Percent of Responses	Number of Responses
Great Idea!	37.5%	90
Tell Me More	31.7	76
OK	15.0	36
Don't Know	7.5	18
Bad Idea	6.7	16
No Response	<u>1.6</u>	<u>4</u>
<b>Total Surveys Returned</b>	100.0%	240

**Survey Question J**  
**Criteria Important for Waste Collection Services**

Preferred Criteria	Percent of Responses	Number of Responses
All 6 Criteria	10.8%	26
Convenience	8.3	20
Convenience + Cost + Service	7.9	19
Convenience + Cost + Service + Environment	7.1	17
All Criteria except Aesthetics	5.8	14
Convenience + Cost + Environment	5.4	13
Convenience + Cost	5.0	12
Cost	4.6	11
Convenience + Environment	3.8	9
Convenience + Service + Environment	3.3	8
Convenience + Cost + Environment + Wide Choice	3.3	8
Wide Choice	2.5	6
Cost + Service	2.5	6
Cost + Environment	2.5	6
Other Responses*	25.9	62
No Response	<u>1.3</u>	<u>3</u>
<b>Total Surveys Returned</b>	<b>100.0%</b>	<b>240</b>

\* Various answers selected by 5 or fewer respondents.

**Survey Question K**  
**Quality of Waste Collection Services**

Response to Idea	Percent of Responses	Number of Responses
Excellent	27.1%	65
Good	57.1	137
Fair	12.1	29
Poor	0.8	2
Don't Know	2.1	5
No Response	<u>0.8</u>	<u>2</u>
<b>Total Surveys Returned</b>	<b>100.0%</b>	<b>240</b>

**Survey Question L**  
**Cost for Waste Collection Services**

Response to Idea	Percent of Responses	Number of Responses
Very Affordable	8.3%	20
OK	52.1	125
Little Too High	29.6	71
Not Affordable	3.7	9
Don't Know	4.2	10
No Response	<u>2.1</u>	<u>5</u>
<b>Total Surveys Returned</b>	<b>100.0%</b>	<b>240</b>