



Thurston County



Waste Composition Study

Final Report
June 2000

1999

WASTE COMPOSITION STUDY
FINAL REPORT

prepared for:

Thurston County
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Solid Waste Management Division

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EXECUTIVE SUMMARY

INTRODUCTION

This study examined the quantity and composition of solid waste (garbage) disposed by homes and businesses in Thurston County in 1999. The goals of this waste composition study were to:

- provide data that can be used in the future to evaluate the performance of waste diversion activities at the new transfer station at the Hawks Prairie Landfill.
- provide accurate data on the composition and quantity of disposed materials, for planning of other waste diversion programs.
- provide baseline data for future waste composition studies.

This waste composition study was conducted by the environmental consulting firm of Green Solutions, with assistance from County solid waste staff and Skumatz Economic Research Associates (SERA). In addition, the Thurston County Corrections Department provided labor for the waste sorting crews.

OVERVIEW OF THE STUDY'S METHODOLOGIES

For the purpose of this study, all solid waste received at the landfill was classified into one of four categories, called waste generators, according to the source and delivery method. The four types of waste generators are:

- **Residential Self-Haul:** residential waste brought in by the homeowners and renters who generated the waste.
- **Non-Residential Self-Haul:** waste from businesses or contractors, brought in by an employee of that business.
- **Single-Family Homes:** waste brought in by garbage haulers from single-family homes.
- **Commercial:** waste brought in by garbage haulers from apartment buildings and from commercial, industrial, or institutional sources.

In addition to the four types of waste generators, waste composition data was separately collected for select commercial sources and for four neighborhoods in Olympia.

The quantity (tonnage) of solid waste disposed by each generator was determined through a combination of existing County records and customer surveys. Existing County records

provided a breakdown of tonnages by type of vehicle, and the survey results allowed these tonnages to be allocated to the four different types of waste generators.

The composition of the County's solid waste was determined by randomly selecting and sorting samples of waste from incoming loads. Sampling was conducted for six days each quarter.

This study only examined solid waste disposed at the County's Hawk Prairie Landfill. Waste was sampled from incoming vehicles at that location. In addition, one sample was taken each quarter from drop boxes being brought in from the Rainier and Rochester Drop Box Sites. These samples were included with the results for Residential Self-Haul. This study did not include recyclable materials diverted by generators prior to disposal or yard debris brought in separately.

This study also did not include some types of special wastes that are disposed at other sites. More information on the definitions and procedures used can be found in the Glossary and Appendix A.

RESULTS AND CONCLUSIONS

Waste Quantities

The waste quantity results are summarized in Table E-1. As shown in Table E-1, Commercial generators dispose of the most waste (42.9% of the County's annual amount), followed by Single-Family Homes (26.4%).

**TABLE E-1
QUANTITIES OF DISPOSED WASTES**

Type of Waste Generator	Annual Amounts	
	Tons	Percent
Residential Self-Haul	25,200	17.4%
Non-Residential Self-Haul	<u>19,140</u>	<u>13.2%</u>
Self-Haul Subtotal	44,340	30.7%
Single-Family Homes	38,130	26.4%
Commercial	<u>62,030</u>	<u>42.9%</u>
Garbage Truck Subtotal	100,160	69.3%
Total	<u>144,500</u>	<u>100.0%</u>

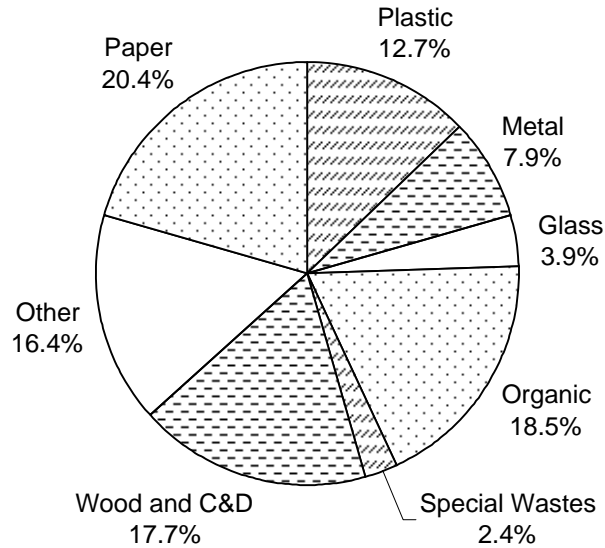
Waste Composition Results

Waste composition results for the entire County are summarized in Figure E-1. As can be seen in that figure, Thurston County's waste stream contains significant amounts of paper (20.4% of the total), organic materials (which is primarily food waste), and wood and C&D (construction and demolition waste). Individual materials that are present in large quantities include food waste (15.5% of the County's total waste stream), wood (10.9%), non-recyclable paper (8.7%), and plastic packaging (7.2%).

There are distinct differences in the waste streams of the different types of waste generators (see Tables 3, 6 and 9 in the full report). For each of the generators, a few noteworthy conclusions can be drawn:

- **Residential Self-Haul:** self-haul loads from residential sources have more wood, construction debris and metal than other residential sources, and less “regular” household trash (paper, plastic and food waste), reflecting the activities such as remodeling and other special projects that are often the source of Residential Self-Haul waste. Food waste is still the material present in the single largest quantity, however, at 16.9%, followed by wood (9.5%), non-recyclable paper (6.3%), and mixed metals (5.4%). Furniture is also relatively high, and the Residential Self-Haul waste stream contributes most of the furniture in Thurston County's waste stream (1,250 tons out of 1,470 tons, or 85% of the total).
- **Non-Residential Self-Haul:** like self-haul waste from residential sources, Non-Residential Self-Haul loads are often the result of construction activities or other special projects. The large amount of wood (28.3%) and other construction waste (24.8%) clearly shows the influence of construction activities on this waste stream. Although the total tons from this waste generator make up only a small portion (13.2%) of the County's waste stream, this source is disposing of 40% of the wood and C&D materials. There is also a significant amount of carpeting (34% of the County's total) and cardboard (about 25% of the County's total) being disposed by this type of generator.
- **Single-Family Homes:** the largest single material in this waste stream is food waste (22.3% by weight), which is disposed at almost twice the quantity as the next largest material, non-recyclable paper (10.5%). There are also significant quantities of plastic packaging (7.2%), diapers (4.9%), textiles (4.1%), and “other special wastes” (5.3%). The “other special waste” is comprised primarily of “animal excrement” (“kitty litter”, at 4.4%).
- **Commercial:** waste from this source also contains large amounts of food waste (15.0% or 9,290 tons) and wood (12.2% or 7,540 tons), followed by non-recyclable paper (9.8% or 6,090 tons) and plastic packaging (9.3% or 5,790 tons). Because this waste stream is so large (42.9% of the County's total tons per year), even small amounts of materials (on a percentage basis) add up to significant tonnages. For example, Commercial waste generators dispose of less mixed waste paper on a percentage basis than Single-Family Homes (3.8% versus 6.2%), but are actually disposing of more of this material (2,340 versus 2,320 tons per year) due to the larger overall amount of waste disposed by Commercial generators.

**FIGURE E - 1
WASTE COMPOSITION RESULTS
THURSTON COUNTY WASTE COMPOSITION STUDY**



SUMMARY OF RESULTS:

PAPER	Newspaper	1.8%	WOOD, C&D	Wood	10.9%	
	Cardboard	3.7%		C&D	<u>6.9%</u>	
	Other Recyclable Paper	6.2%		Wood, C&D Subtotal	17.7%	
	Non-Recyclable Paper	<u>8.7%</u>		SPECIAL WASTES	Animal Excrement	1.6%
	Paper Subtotal	20.4%			Other Special Wastes	<u>0.8%</u>
		Special Waste Subtotal	2.4%			
PLASTIC	Plastic Bottles	1.2%	ORGANIC	Food Waste	15.5%	
	Plastic Packaging	7.2%		Yard Debris	<u>3.0%</u>	
	Other Plastic	<u>4.2%</u>		Organic Subtotal	18.5%	
	Plastic Subtotal	12.7%	OTHER	Disposable Diapers	2.1%	
METAL	Aluminum Cans	0.4%		Textiles	2.6%	
	Steel and Aerosol Cans	1.2%		Miscellaneous (1)	<u>11.7%</u>	
	Other Metals	<u>6.3%</u>		Other Subtotal	16.4%	
	Metal Subtotal	7.9%	RECYCLABLE SUBTOTAL (2)		29.4%	
GLASS	Glass Bottles	2.9%				
	Other Glass	<u>1.0%</u>				
	Glass Subtotal	3.9%				

Notes: All figures are percent by weight.

- 1) "Miscellaneous" includes tires and other rubber products, cosmetics, carpeting, leather, furniture, fines, ash, dust, and miscellaneous organics and inorganics.
- 2) "Recyclable Subtotal" includes newspaper, cardboard, other recyclable paper, plastic bottles, all metals, glass bottles, yard debris and textiles.

In addition to the primary waste composition data discussed above, other information was gathered and is shown in the full report (see Section III and the appendices). This information includes composition data for specific types of businesses; data on the marketability of the recyclable materials found in the samples from different sources; a detailed breakdown of wood, construction/demolition, and special wastes; and data on the amount of reusable materials found in the waste stream.

RECOMMENDATIONS

Based on the results of this study, it is recommended that the following materials and sources be targeted for recovery at the transfer station:

- from Residential Self-Haul wastes, should target metals, yard debris, textiles and wood.
- from Non-Residential Self-Haul wastes, should target cardboard, metals, wood, and C&D.
- from Single-Family Homes, should target yard debris and possibly textiles, as well as higher-value materials such as aluminum cans.
- from Commercial wastes, should target cardboard, metals, yard debris, wood and C&D.
- from Non-Residential Self-Haul and Commercial wastes, should target carpet if a good market can be found.

SECTION I INTRODUCTION

A. SCOPE AND OBJECTIVES

This study examined the quantity and composition of solid waste (garbage) disposed by homes and businesses in Thurston County and the City of Olympia in 1999. The goals of this waste composition study were to:

- provide data that can be used in the future to evaluate the performance of waste diversion activities at the new Hawks Prairie Solid Waste and Resource Recovery Center.
- provide accurate data on the composition and quantity of disposed materials, for evaluating current waste diversion programs and for planning future programs.
- provide baseline data for future waste composition studies.

This study was conducted by the environmental consulting firm of Green Solutions, with assistance from County solid waste staff and Skumatz Economic Research Associates (SERA). In addition, the Thurston County Corrections Department provided labor for the waste sorting crews.

B. BACKGROUND

Thurston County was in the midst of a significant change in the disposal system at the time this study was conducted. This change was based on the local landfill reaching capacity, the Hawks Prairie Landfill, which had served the County for many years, and then implementing a waste export system that will involve shipping waste several hundred miles to a large regional landfill.

As part of the new system, a transfer station was built that includes the capability to recover recyclable materials from the waste stream. This new capability is intended to supplement, not replace, the source separation recycling programs currently operated throughout the County. The contract for the transfer station requires that the private contractor (Allied Waste, Inc.) recover a minimum percentage of the materials for recycling.

Conducting this study was also an opportunity for the County to gain more information about the self-haul customers using the landfill. This information will be useful in addressing any service issues that may arise in the future. Information on the self-haul customers (people who are disposing of their own wastes, typically from homes, small businesses, or construction projects) was collected through a survey conducted each quarter.

SECTION II

WASTE CHARACTERIZATION RESULTS

A. INTRODUCTION

This section provides waste quantity and composition results for each type of waste generator and for the county overall.

B. OVERVIEW OF PROCEDURES

This study examined mixed municipal solid waste from Thurston County brought for disposal (landfilling) to the County's disposal site (Hawks Prairie Landfill). Mixed municipal solid waste is a term commonly used for general residential and commercial wastes, including the waste collected by garbage haulers and the waste delivered to disposal sites by the waste generators themselves (self-haul).

The Solid Waste System in Thurston County

The collection of solid waste in Thurston County is conducted by a municipal hauler (in Olympia) and a franchise/contract hauler (Harold LeMay Enterprises).

At the time of the fieldwork for this study, the solid waste disposal system for Thurston County consisted of the Hawks Prairie Landfill (near Lacey) and three drop box facilities, in Rainier, Rochester and Summit Lake. The three drop box facilities are used exclusively for self-haul customers and handle only a small amount of the total waste stream (2,772 tons in 1999, or 1.9% of the County's total waste stream). Waste from the drop boxes was transferred to the Hawks Prairie Landfill.

After examining the collection and disposal system in Thurston County, it was concluded that samples of waste taken at the Hawks Prairie Landfill would adequately characterize the County's waste stream. The small amount of waste from the drop boxes was addressed by taking one sample per quarter from one of the drop box loads brought to the landfill (alternating between the Rainier and Rochester drop boxes), and including those samples in the results for Residential Self-Haul generators.

Types of Waste Generators

The design of the sampling and data collection procedures for this study allowed information to be provided on the quantity and composition of waste disposed by different waste generators as well as the County's overall waste stream. For this purpose, the County's waste stream was

classified into four groups according to the source and method of delivery. The four groups, called waste generators, are:

- **Residential Self-Haul:** this is waste that is brought in by the homeowners and renters who generated the load of waste, although in some cases they may be assisting a family member, neighbor or acquaintance who actually generated the waste. This type of waste is typically transported to the disposal site using a car or pickup truck, and there is a definite pattern in the timing of such deliveries. Most of the self-haul waste is brought to the disposal site on weekends or in the evenings (i.e., at times other than regular daytime work hours).
- **Non-Residential Self-Haul:** this waste is from businesses or contractors, and is typically brought in by an employee of that business. The pattern in the delivery of this waste tends to be the opposite of Residential Self-Haul wastes, occurring primarily during regular work hours, and typically employs larger vehicles (dump trucks, pickup trucks, vans and other trucks). A substantial amount of this waste stream consists of loads of construction and demolition wastes brought in by construction contractors.
- **Single-Family Homes:** by definition, this waste is brought in by garbage haulers from single-family homes. This waste is typically bagged before collection, very heterogeneous (consisting of small pieces of many different types of materials), and is delivered to the disposal site most often between mid-morning and mid-afternoon Monday through Friday.
- **Commercial:** for this study, “commercial” waste is defined to include wastes from businesses (commercial, industrial, or institutional sources) as well as apartments. This definition is in line with the use of the term “commercial” as normally used by waste haulers, who classify business and apartment wastes together because of the similar type of garbage container used (dumpsters or roll-off containers). These wastes are typically collected using front-loading garbage trucks (for dumpsters) or trucks carrying roll-off containers, and are usually delivered early morning through mid-afternoon Monday through Friday.

Construction and demolition (C&D) wastes and other special wastes were included in the above categories only to the extent that these wastes were delivered to the County’s landfill during the study period. Some of these wastes are disposed at other sites and so are not included in this study. Furthermore, the waste generator category for C&D waste depends on the type of delivery method. While this waste was often delivered by employees of the construction company and so was included with Non-Residential Self-Haul waste, C&D waste was also delivered by homeowners and landlords (i.e., Residential Self-Haul waste), or by waste haulers from construction sites (Commercial waste), or by waste haulers using roll-off’s for do-it-yourself home remodeling projects (Single-Family Homes).

C. WASTE QUANTITIES

The quantity (tonnage) of solid waste disposed by each type of generator was determined through existing County records and a survey of landfill customers. Data from the City of

Olympia was used to determine the amount of residential and commercial waste for that city. Table 1 shows the results of the waste quantity analysis.

**TABLE 1
QUANTITIES OF DISPOSED WASTES**

Type of Waste Generator	Annual Amounts	
	Tons	Percent
Residential Self-Haul	25,200	17.4%
Non-Residential Self-Haul	<u>19,140</u>	<u>13.2%</u>
Self-Haul Subtotal	44,340	30.7%
Single-Family Homes	38,130	26.4%
Commercial	<u>62,030</u>	<u>42.9%</u>
Garbage Truck Subtotal	100,160	69.3%
Total	<u>144,500</u>	<u>100.0%</u>

The survey of landfill customers was conducted for a week each quarter and the results of these surveys were used to allocate tonnages to the different waste generators based on County records by vehicle type. The survey period was the same week as the fieldwork was conducted each quarter. The waste quantity data is used in later steps to calculate weighted averages of the waste composition data.

Waste disposal rates are often expressed as the total amount of waste disposed divided by the population of the area. Based on the County's 1999 population of 202,700 and a total waste quantity of 144,500 tons per year, Thurston County's waste disposal rate is 0.71 tons per person per year, or 3.9 pounds per person per day.

D. WASTE COMPOSITION

The composition of the County's solid waste stream was determined by randomly selecting and sorting samples of waste from loads delivered to the Hawks Prairie Landfill. Sampling was

conducted Monday through Saturday each quarter (February, May, August and November). Each sample was sorted into 79 categories of materials. A copy of the field data form used for this study is shown in Appendix A, and the Glossary provides additional detail on the definitions used for this study. Notes were also recorded on the field data form on the amount of recyclable wood and sheetrock, marketable recyclables, partially-full aerosol cans, hazardous wastes, and reusable materials that were found in each sample.

Sampling Methods

The composition of the County's mixed municipal waste stream was determined by randomly selecting and sorting a total of 268 samples of waste. These samples were allocated between the types of generators based on the need to examine certain types in greater detail. A greater number of samples were taken for the three waste streams that are considered inherently more variable (the two self-haul waste streams and Commercial wastes) with fewer of the samples allocated to the waste stream that is typically less variable (Single-Family Homes). The City of Olympia paid for additional samples to be taken from specific residential areas and commercial sources within the city. Difficulties in arranging the special delivery of samples impacted the number of samples from Olympia sources in two quarters, and weather problems caused an early end to the fieldwork first quarter, but in general the targeted number of samples were achieved. The final numbers of samples for each quarter is shown in Table 2.

**TABLE 2
NUMBER OF SAMPLES BY TYPE OF GENERATOR**

Type of Waste Generator	February	May	August	November	Totals	
					Number	Percent
Residential Self-Haul	14	17	17	16	64	24%
Non-Residential Self-Haul	11	18	18	16	63	23%
Single-Family Homes *	6	8	8	9	31	12%
Single-Family, Olympia	4	5	4	3	16	6%
Commercial	11	16	17	16	60	22%
Special Commercial	9	9	6	10	34	13%
Totals	55	73	70	70	268	100.0%

* These figures are for single-family homes from all areas except the City of Olympia.

Waste Composition Results

Table 3 shows the annual averages for each generator and the County as a whole. The results for the County as a whole are illustrated in Figure 1, and the results for each generator are illustrated in Figures 2 - 5.

As can be seen in Table 3, there are substantial differences in the composition of wastes from the different sources. These differences can be explained by the different activities that created the wastes. Single-Family waste, for instance, is influenced by the activities associated with living in, owning and maintaining a home. Residential Self-Haul waste contains some “regular” household garbage but also contains a large amount of construction debris and other materials that are the result of special projects, since it is these special projects that often motivate people to make a special trip to disposal facilities.

The Commercial waste stream in Thurston County is dominated by various manufacturing and administrative activities, while the Non-Residential Self-Haul waste stream is dominated by construction activities. A business or institution will sometimes choose to haul their own waste, in which case the waste will not differ greatly from Commercial waste, but self-haul wastes in many cases are from construction or other special projects. Ample evidence of the contribution of construction activities to this waste stream is provided by the fact that over half of the Non-Residential Self-Haul waste stream is comprised of wood waste (28.3%) and C&D waste (24.8%).

Both self-haul waste streams display significant seasonal variations in quantity and composition. These variations that are largely tied to construction seasons and activities, and for Residential Self-Haul wastes, to other seasonal activities such as yard work and gardening. Waste from single-family homes used to show a strong variation in waste quantities and composition, but the increased diversion of yard debris has helped to even out the seasonal differences. Commercial wastes show a weak seasonal variation, tied to holiday (especially Christmas) activity levels and summer vacations, but Commercial is generally the least variable of the waste generators.

Table 4 shows the waste composition results organized by self-haul versus garbage truck loads (Single-Family Homes and Commercial). The results were organized in this fashion to assist with operating and evaluating the sorting facility at the new transfer station.

Recyclable subtotals shown in Table 4 and Figures 2 through 5 (see also Figure E-1) are based on the full amount of the materials measured in this study. In addition to the materials easily recycled through curbside and commercial programs (i.e., cans, bottles, paper and yard debris), the recyclable subtotal includes textiles because recycling opportunities for this material are also widely available. By counting the full amount of each material, the recyclable subtotal presumes some type of source-separation program, since the full amount would not be recyclable once mixed with garbage (see Section III.D for information about marketable amounts of recyclable materials recovered from waste).

**TABLE 3
WASTE COMPOSITION RESULTS BY SOURCE
THURSTON COUNTY WASTE COMPOSITION STUDY**

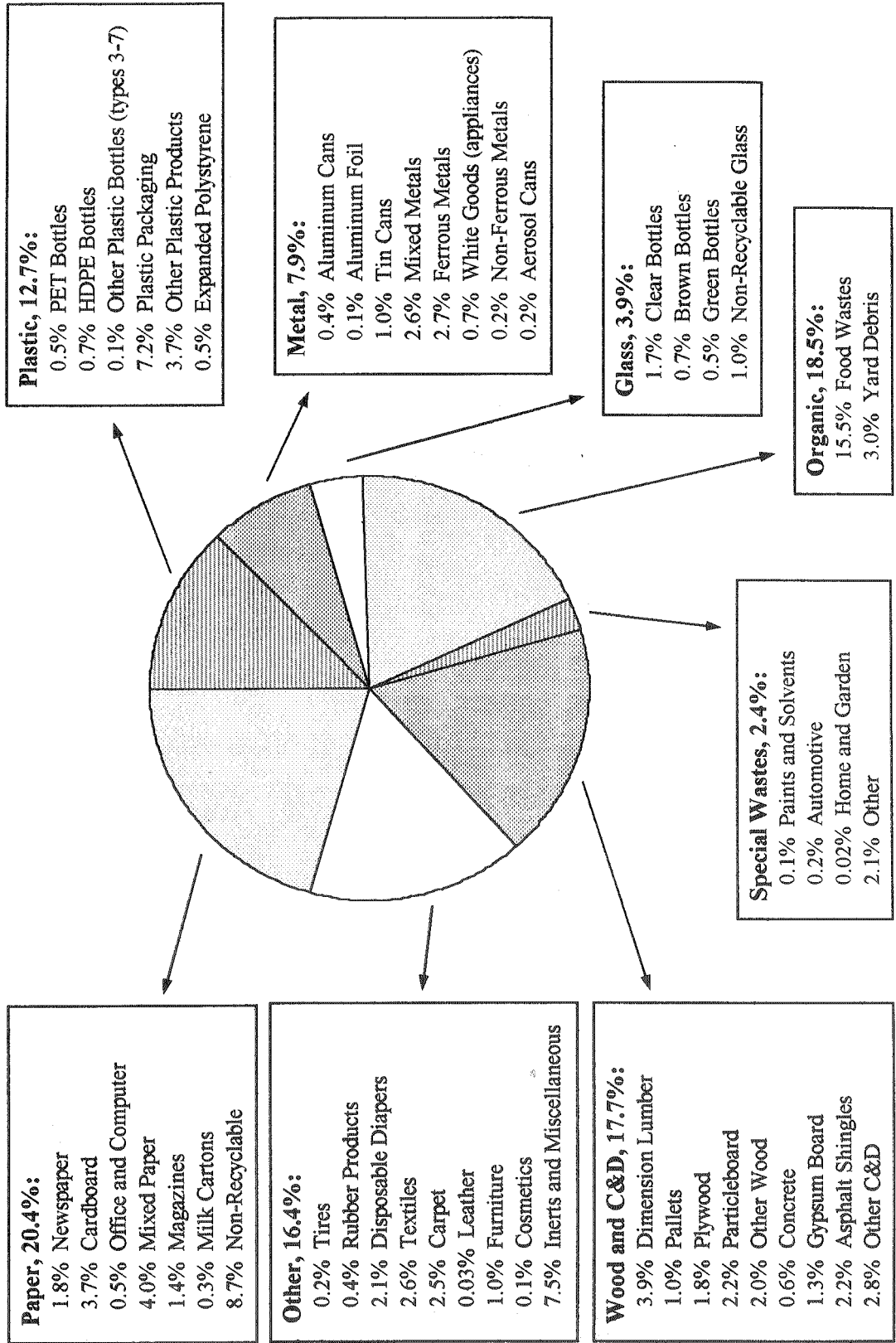
		Residential	Non-Res.	Single-Family	Average for	
		<u>Self-Haul</u>	<u>Self-Haul</u>	<u>Homes (1)</u>	<u>Commercial</u>	<u>Entire County</u>
PAPER	Newspaper	1.35%	0.59%	2.91%	1.71%	1.82%
	Cardboard	1.78%	6.83%	1.68%	4.72%	3.68%
	Office and Computer	0.12%	0.11%	0.45%	0.79%	0.49%
	Mixed Waste Paper	3.65%	1.19%	6.08%	3.76%	4.02%
	Magazines	1.08%	0.76%	1.68%	1.52%	1.38%
	Milk Cartons, Other	0.12%	0.05%	0.46%	0.35%	0.30%
	Non-Recyclable Paper	6.34%	4.95%	10.48%	9.82%	8.74%
	Paper Subtotal	14.43%	14.48%	23.75%	22.67%	20.43%
PLASTIC	PET Bottles	0.50%	0.19%	0.77%	0.49%	0.52%
	HDPE Bottles	0.69%	0.14%	1.02%	0.63%	0.68%
	Bottles 3-7	0.08%	0.01%	0.07%	0.03%	0.05%
	Plastic Packaging	4.93%	3.63%	7.19%	9.33%	7.24%
	Other Plastic Products	2.58%	2.36%	2.01%	5.71%	3.74%
	Expanded Polystyrene	0.54%	0.22%	0.48%	0.48%	0.46%
	Plastic Subtotal	9.32%	6.55%	11.53%	16.67%	12.69%
METAL	Aluminum Cans	0.32%	0.16%	0.61%	0.41%	0.42%
	Aluminum Foil	0.11%	0.02%	0.22%	0.10%	0.13%
	Tin Cans	1.16%	0.20%	1.60%	0.82%	1.00%
	Mixed Metals	5.36%	2.26%	0.74%	2.68%	2.58%
	Ferrous Metals	4.75%	3.78%	1.61%	2.18%	2.69%
	White Goods	3.03%	1.40%	0.00%	0.00%	0.71%
	Non-Ferrous Metals	0.21%	0.61%	0.03%	0.14%	0.18%
	Aerosol Cans	0.34%	0.02%	0.28%	0.15%	0.20%
	Metal Subtotal	15.30%	8.46%	5.09%	6.47%	7.91%
ORGANIC	Food Waste	16.85%	1.61%	22.26%	14.98%	15.46%
	Yard Debris	4.49%	1.37%	3.77%	2.52%	3.04%
		Organics Subtotal	21.34%	2.98%	26.03%	17.50%
GLASS	Clear Bottles	2.37%	0.38%	2.20%	1.62%	1.74%
	Brown Bottles	0.86%	0.21%	0.87%	0.74%	0.73%
	Green Bottles	0.80%	0.06%	0.25%	0.54%	0.45%
	Non-Recyclable Glass	0.73%	0.95%	0.26%	1.65%	1.03%
	Glass Subtotal	4.77%	1.61%	3.58%	4.55%	3.94%
OTHER WASTES	Tires	0.57%	0.19%	0.00%	0.08%	0.16%
	Rubber Products	0.12%	0.37%	0.29%	0.47%	0.35%
	Cosmetics	0.21%	0.03%	0.20%	0.10%	0.14%
	Disposable Diapers	1.63%	0.21%	4.91%	1.17%	2.11%
	Textiles	3.16%	0.96%	4.08%	1.90%	2.57%
	Carpeting	0.74%	6.46%	0.08%	3.51%	2.51%
	Leather	0.05%	0.00%	0.05%	0.01%	0.03%
	Furniture	4.98%	1.03%	0.00%	0.03%	1.02%
	Fines	1.70%	0.74%	4.07%	1.91%	2.29%
	Ash, Dust	0.61%	0.04%	0.43%	0.08%	0.26%
	Misc. Organics	2.41%	2.16%	7.86%	3.63%	4.34%
Misc. Inorganics	0.62%	0.38%	0.21%	0.88%	0.59%	
	Other Subtotal	16.80%	12.59%	22.18%	13.77%	16.36%
WOOD and C&D	Wood	9.54%	28.34%	0.84%	12.15%	10.86%
	C&D	4.41%	24.82%	1.63%	5.56%	6.88%
		Wood, C&D Subtotal	13.95%	53.16%	2.48%	17.72%
SPECIAL WASTES	Paints and Solvents	0.52%	0.01%	0.05%	0.01%	0.11%
	Automotive	0.80%	0.02%	0.03%	0.04%	0.17%
	Home and Garden	0.05%	0.00%	0.03%	0.00%	0.02%
	Other	2.73%	0.13%	5.26%	0.59%	2.14%
	Special Waste Subtotal	4.11%	0.16%	5.36%	0.64%	2.43%
TOTALS		100.0%	100.0%	100.0%	100.0%	100.0%
	Pounds of Samples Sorted:	13,965	20,267	9,768	13,157	57,156
	Number of Samples Sorted (2):	64	63	47	60	234

Notes: All figures are percent by weight (except for the bottom two rows).

1. The figures shown here for Single-Family Homes are the prorated results of samples from both the City of Olympia and from the rest of the County (see Appendix A, pages A-12 and A-13, for more details).

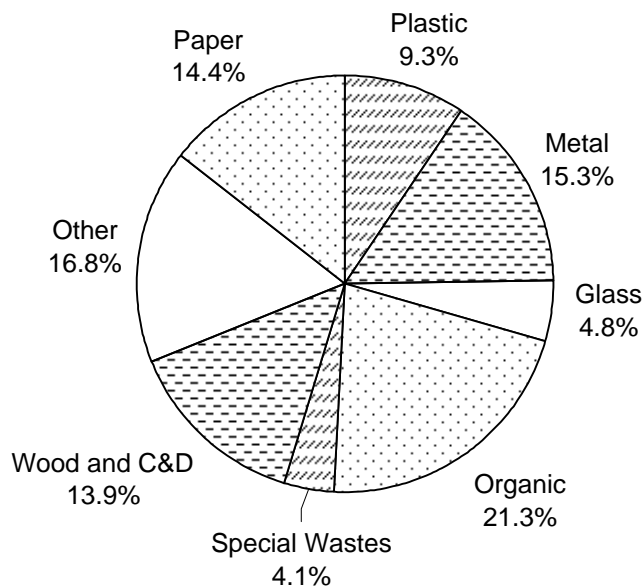
2. The figures shown for number of samples sorted do not include the 34 special commercial samples arranged by Olympia.

FIGURE 1
COMPOSITION OF DISPOSED WASTES
THURSTON COUNTY WASTE COMPOSITION STUDY



Note: All figures are percentage by weight.

**FIGURE 2
RESIDENTIAL SELF - HAUL WASTE
THURSTON COUNTY WASTE COMPOSITION STUDY**



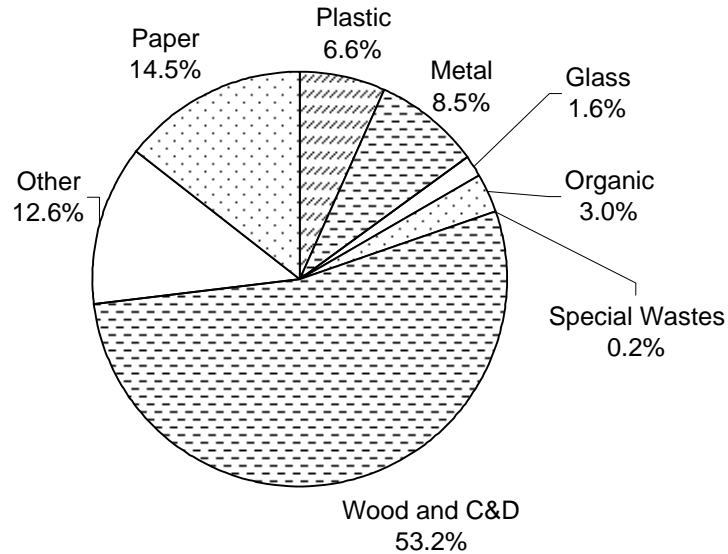
SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	1.4%	WOOD, C&D	Wood	9.5%
	Cardboard	1.8%		C&D	4.4%
	Other Recyclable Paper	5.0%		Wood, C&D Subtotal	13.9%
	Non-Recyclable Paper	<u>6.3%</u>			
	Paper Subtotal	14.4%	SPECIAL WASTES	Animal Excrement	1.7%
PLASTIC	Plastic Bottles	1.3%	Other Special Wastes	<u>2.4%</u>	
	Plastic Packaging	4.9%	Special Waste Subtotal	4.1%	
	Other Plastic	<u>3.1%</u>	ORGANIC	Food Waste	16.8%
	Plastic Subtotal	9.3%		Yard Debris	<u>4.5%</u>
		Organic Subtotal		21.3%	
METAL	Aluminum Cans	0.3%	OTHER	Disposable Diapers	1.6%
	Steel and Aerosol Cans	1.5%		Textiles	3.2%
	Other Metals	<u>13.5%</u>		Miscellaneous (1)	<u>12.0%</u>
	Metal Subtotal	15.3%		Other Subtotal	<u>16.8%</u>
GLASS	Glass Bottles	4.0%	RECYCLABLE SUBTOTAL (2)		36.3%
	Other Glass	<u>0.7%</u>			
	Glass Subtotal	4.8%			

Notes: All figures are percent by weight.

- 1) "Miscellaneous" includes tires and other rubber products, cosmetics, carpeting, leather, furniture, fines, ash, dust, and miscellaneous organics and inorganics.
- 2) "Recyclable Subtotal" includes newspaper, cardboard, other recyclable paper, plastic bottles, all metals, glass bottles, yard debris and textiles.

FIGURE 3
NON - RESIDENTIAL SELF - HAUL WASTE
THURSTON COUNTY WASTE COMPOSITION STUDY



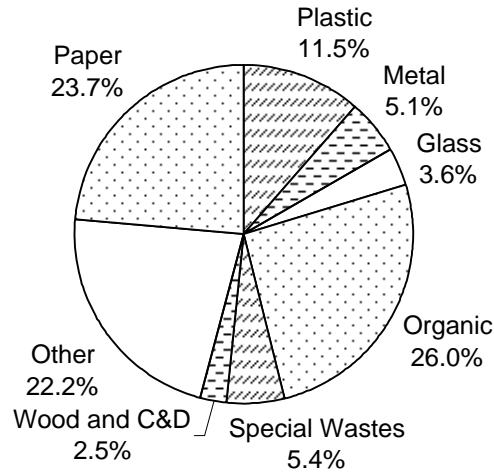
SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	0.6%	WOOD, C&D	Wood	28.3%	
	Cardboard	6.8%		C&D	<u>24.8%</u>	
	Other Recyclable Paper	2.1%		Wood, C&D Subtotal	53.2%	
	Non-Recyclable Paper	<u>4.9%</u>		SPECIAL WASTES	Animal Excrement	0.1%
	Paper Subtotal	14.5%			Other Special Wastes	<u>0.1%</u>
		Special Waste Subtotal	0.2%			
PLASTIC	Plastic Bottles	0.3%	ORGANIC	Food Waste	1.6%	
	Plastic Packaging	3.6%		Yard Debris	<u>1.4%</u>	
	Other Plastic	<u>2.6%</u>		Organic Subtotal	3.0%	
	Plastic Subtotal	6.6%	OTHER	Disposable Diapers	0.2%	
METAL	Aluminum Cans	0.2%		Textiles	1.0%	
	Steel and Aerosol Cans	0.2%		Miscellaneous (1)	11.4%	
	Other Metals	<u>8.1%</u>		Other Subtotal	<u>12.6%</u>	
	Metal Subtotal	8.5%	RECYCLABLE SUBTOTAL (2)		31.0%	
GLASS	Glass Bottles	0.7%				
	Other Glass	<u>1.0%</u>				
	Glass Subtotal	1.6%				

Notes: All figures are percent by weight.

- 1) "Miscellaneous" includes tires and other rubber products, cosmetics, carpeting, leather, furniture, fines, ash, dust, and miscellaneous organics and inorganics.
- 2) "Recyclable Subtotal" includes newspaper, cardboard, other recyclable paper, plastic bottles, all metals, glass bottles, yard debris and textiles.

FIGURE 4
SINGLE - FAMILY HOME WASTE
THURSTON COUNTY WASTE COMPOSITION STUDY



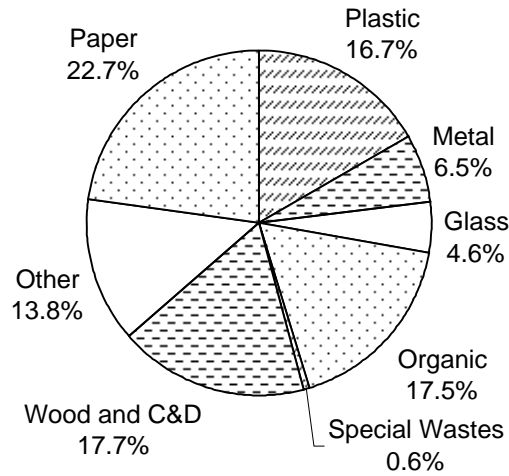
SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	2.9%	WOOD, C&D	Wood	0.8%	
	Cardboard	1.7%		C&D	<u>1.6%</u>	
	Other Recyclable Paper	8.7%		Wood, C&D Subtotal	2.5%	
	Non-Recyclable Paper	<u>10.5%</u>		SPECIAL WASTES	Animal Excrement	4.4%
	Paper Subtotal	23.7%			Other Special Wastes	<u>1.0%</u>
		Special Waste Subtotal	5.4%			
PLASTIC	Plastic Bottles	1.9%	ORGANIC	Food Waste	22.3%	
	Plastic Packaging	7.2%		Yard Debris	<u>3.8%</u>	
	Other Plastic	<u>2.5%</u>		Organic Subtotal	26.0%	
	Plastic Subtotal	11.5%	OTHER	Disposable Diapers	4.9%	
METAL	Aluminum Cans	0.6%		Textiles	4.1%	
	Steel and Aerosol Cans	1.9%		Miscellaneous (1)	<u>13.2%</u>	
	Other Metals	<u>2.6%</u>		Other Subtotal	22.2%	
	Metal Subtotal	5.1%	RECYCLABLE SUBTOTAL (2)		36.5%	
GLASS	Glass Bottles	3.3%				
	Other Glass	<u>0.3%</u>				
	Glass Subtotal	3.6%				

Notes: All figures are percent by weight.

- 1) "Miscellaneous" includes tires and other rubber products, cosmetics, carpeting, leather, furniture, fines, ash, dust, and miscellaneous organics and inorganics.
- 2) "Recyclable Subtotal" includes newspaper, cardboard, other recyclable paper, plastic bottles, all metals, glass bottles, yard debris and textiles.

**FIGURE 5
COMMERCIAL WASTES
THURSTON COUNTY WASTE COMPOSITION STUDY**



SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	1.7%	WOOD, C&D	Wood	12.2%	
	Cardboard	4.7%		C&D	<u>5.6%</u>	
	Other Recyclable Paper	6.4%		Wood, C&D Subtotal	17.7%	
	Non-Recyclable Paper	<u>9.8%</u>		SPECIAL WASTES	Animal Excrement	0.3%
	Paper Subtotal	22.7%			Other Special Wastes	<u>0.3%</u>
		Special Waste Subtotal	0.6%			
PLASTIC	Plastic Bottles	1.2%	ORGANIC	Food Waste	15.0%	
	Plastic Packaging	9.3%		Yard Debris	<u>2.5%</u>	
	Other Plastic	<u>6.2%</u>		Organic Subtotal	17.5%	
	Plastic Subtotal	16.7%	OTHER	Disposable Diapers	1.2%	
METAL	Aluminum Cans	0.4%		Textiles	1.9%	
	Steel and Aerosol Cans	1.0%		Miscellaneous (1)	<u>10.7%</u>	
	Other Metals	<u>5.1%</u>		Other Subtotal	13.8%	
	Metal Subtotal	6.5%	RECYCLABLE SUBTOTAL (2)		33.1%	
GLASS	Glass Bottles	2.9%				
	Other Glass	<u>1.6%</u>				
	Glass Subtotal	4.6%				

Notes: All figures are percent by weight.

- 1) "Miscellaneous" includes tires and other rubber products, cosmetics, carpeting, leather, furniture, fines, ash, dust, and miscellaneous organics and inorganics.
- 2) "Recyclable Subtotal" includes newspaper, cardboard, other recyclable paper, plastic bottles, all metals, glass bottles, yard debris and textiles.

TABLE 4
COMPOSITION OF SELF - HAUL VERSUS GARBAGE COLLECTION VEHICLES
THURSTON COUNTY WASTE COMPOSITION STUDY

		<u>Self-Haul Vehicles</u>		<u>Garbage Trucks</u>		
		<u>% by Wt.</u>	<u>TPY</u>	<u>% by Wt.</u>	<u>TPY</u>	
PAPER	Newspaper	1.0%	450	2.2%	2,170	
	Cardboard	4.0%	1,750	3.6%	3,570	
	Office and Computer	0.1%	51	0.7%	660	
	Mixed Waste Paper	2.6%	1,150	4.6%	4,650	
	Magazines	0.9%	420	1.6%	1,580	
	Milk Cartons, Other	0.1%	39	0.4%	390	
	Non-Recyclable Paper	5.7%	2,540	10.1%	10,090	
	Paper Subtotal	14.5%	6,410	23.1%	23,120	
PLASTIC	PET Bottles	0.4%	160	0.6%	600	
	HDPE Bottles	0.5%	200	0.8%	780	
	Bottles 3-7	0.0%	21	0.0%	47	
	Plastic Packaging	4.4%	1,940	8.5%	8,530	
	Other Plastic Products	2.5%	1,100	4.3%	4,310	
	Expanded Polystyrene	0.4%	180	0.5%	480	
	Plastic Subtotal	8.1%	3,600	14.7%	14,740	
METAL	Aluminum Cans	0.3%	110	0.5%	490	
	Aluminum Foil	0.1%	32	0.1%	150	
	Tin Cans	0.7%	330	1.1%	1,120	
	Mixed Metals	4.0%	1,790	1.9%	1,940	
	Ferrous Metals	4.3%	1,920	2.0%	1,960	
	White Goods	2.3%	1,030	0.0%	0	
	Non-Ferrous Metals	0.4%	170	0.1%	100	
	Aerosol Cans	0.2%	89	0.2%	200	
Metal Subtotal	12.3%	5,470	5.9%	5,960		
ORGANIC	Food Waste	10.3%	4,560	17.8%	17,780	
	Yard Debris	3.1%	1,390	3.0%	3,000	
	Organic Subtotal	13.4%	5,950	20.7%	20,780	
GLASS	Clear Bottles	1.5%	670	1.8%	1,840	
	Brown Bottles	0.6%	260	0.8%	790	
	Green Bottles	0.5%	210	0.4%	430	
	Non-Recyclable Glass	0.8%	370	1.1%	1,120	
	Glass Subtotal	3.4%	1,510	4.2%	4,190	
OTHER WASTES	Tires	0.4%	180	0.1%	51	
	Rubber Products	0.2%	100	0.4%	400	
	Cosmetics	0.1%	60	0.1%	140	
	Disposable Diapers	1.0%	450	2.6%	2,600	
	Textiles	2.2%	980	2.7%	2,740	
	Carpet	3.2%	1,420	2.2%	2,200	
	Leather	0.0%	13	0.0%	26	
	Furniture	3.3%	1,450	0.0%	19	
	Fines	1.3%	570	2.7%	2,740	
	Ash, Dust	0.4%	160	0.2%	210	
	Misc. Organics	2.3%	1,020	5.2%	5,250	
	Misc. Inorganics	0.5%	230	0.6%	630	
	Other Subtotal	15.0%	6,640	17.0%	17,000	
	WOOD and C&D	Wood	17.7%	7,830	7.8%	7,860
		C&D	13.2%	5,860	4.1%	4,080
Wood, C&D Subtotal		30.9%	13,690	11.9%	11,940	
SPECIAL WASTES		2.4%	1,070	2.4%	2,440	
TOTALS		100.0%	44,340	100.0%	100,160	
RECYCLABLE SUBTOTALS		29.8%	13,210	29.1%	29,180	

Note: "% by Wt." means percent by weight, "TPY" = tons per year.
"Recyclable Subtotals" include newspaper, cardboard, other recyclable paper, plastic bottles, all metals, glass bottles, yard debris and textiles.

SECTION III ADDITIONAL DATA

A. INTRODUCTION

This section contains a variety of additional data, including:

- the results of the customer surveys.
- the breakdown of wood waste, construction and demolition wastes, and special wastes.
- marketability data for the recyclable materials found in the waste composition samples.
- the amount of reusable materials and products found in the waste composition samples.
- comparison of Thurston County's results to recent results from two other counties.

This data is presented separately here for several reasons, but primarily because it is viewed as supplemental to the primary results of this study (i.e., the waste composition and quantity data). In addition, Appendix C contains waste composition data for specific non-residential sources that can also be considered supplemental to the primary results of this study.

B. CUSTOMER SURVEY RESULTS

Surveys were conducted each quarter to determine basic facts about the self-haul customers using disposal and other services at the Hawks Prairie Landfill (see Table 5 and Figure A-3). These surveys also provided an opportunity to collect data needed for determining waste quantities by generator type (see Section II.C). The survey questions were changed slightly after the first quarter, preventing the results for a few of the questions from first quarter from being compared or compiled into an annual average, but this appears to have had little impact on the quality of the results.

The survey questions targeted the smaller self-haul vehicles (cars, pickups, and vans), so only a portion of the Non-Residential Self-Haul customers were included. The following information was noted or requested in the surveys:

Gender: The gender of the customer was noted. In cases where there was more than one person in the vehicle, it was the gender of the driver that was noted. As can be seen by the results in Table 5, the customers were predominantly male. These results are influenced somewhat by the inclusion of Non-Residential Self-Haul customers, who were almost completely male, but the Residential Self-Haul customers were predominantly male also.

TABLE 5
SELF-HAUL CUSTOMER SURVEY RESULTS
THURSTON COUNTY WASTE COMPOSITION STUDY

SURVEY QUESTION	QUARTER				TOTALS/ AVERAGES
	February	May	August	November	
Total Surveyed	306	503	538	205	1,552
Gender:					
Female	13.3%	11.3%	11.0%	12.7%	12.1%
Male	86.6%	88.7%	89.0%	87.3%	87.9%
Age:					
18 to 30	25.5%	29.0%	25.3%	17.1%	24.2%
31 to 54	56.2%	39.2%	39.6%	59.0%	48.5%
55 and up	18.3%	31.2%	34.8%	22.9%	26.8%
Unknown	0%	0.6%	0.4%	1.0%	0.5%
Source:					
Home	84.6%	79.7%	85.1%	85.4%	83.7%
Apartment	0.6%	0%	0.7%	1.0%	0.6%
Business	8.8%	15.1%	13.0%	12.7%	12.4%
Mixed	2.3%	1.0%	0%	0%	0.8%
Unknown	3.9%	4.2%	1.1%	1.0%	2.6%
Frequency of Use:					
Once per Week	19.6%	14.1%	21.9%	23.4%	19.8%
Once per Month	45.4%	47.5%	38.3%	46.3%	44.4%
3 to 4 times per year	13.1%	13.7%	14.3%	13.7%	13.7%
1 to 2 times per year	19.9%	18.5%	24.2%	15.1%	19.4%
Unknown	2.0%	6.2%	1.1%	1.5%	2.7%
Garbage Coll. at Home:					
Yes	NA (1)	38.5%	45.5%	31.6%	38.5%
No	NA	45.5%	45.8%	56.5%	49.3%
Unknown	NA	16.0%	8.8%	11.9%	12.2%
Services Used, Residential Self-Haul Customers Only:					
Recycling Center	NA (2)	16.0%	15.1%	14.2%	15.1%
Compost/Yard Waste	NA	4.1%	7.1%	0.6%	3.9%
Hazo-House	NA	1.4%	1.9%	1.1%	1.5%
Landfill	NA	98.1%	96.3%	100%	98.1%
Services Used, Non-Residential Self-Haul Customers Only:					
Recycling Center	NA (2)	7.4%	2.9%	0%	3.4%
Compost/Yard Waste	NA	9.3%	1.5%	0%	3.6%
Hazo-House	NA	0%	0%	0%	0%
Landfill	NA	96.3%	100%	100%	98.8%
Source by City:					
Bucoda	0%	0%	0%	0%	0%
Lacey	26.8%	26.2%	22.3%	23.4%	24.7%
Olympia	42.2%	38.8%	36.8%	24.9%	35.7%
Rainier	0.3%	1.2%	0.6%	1.0%	0.8%
Tenino	1.0%	2.2%	0.9%	0.5%	1.2%
Tumwater	5.6%	4.2%	6.9%	2.9%	4.9%
Yelm	7.5%	7.3%	5.9%	4.9%	6.4%
Unincorporated Area	11.4%	16.1%	24.9%	39.0%	22.9%
Other (3)	5.2%	4.0%	1.7%	3.4%	3.6%

- Notes: 1. The question about garbage collection services at home was not asked in the first quarter.
2. After the first quarter, this survey question was changed to ask what services were used on that day only (so results from the first quarter are not shown because they are not comparable to the other quarters). Note that multiple answers were possible for this question, so the results may add up to more than 100%.
3. "Other" sources include out-of-county and unknown.

Age: Requesting age information from the customers was a sensitive issue, and so survey staff estimated the age of the customer (or of the driver, if there were more than two people in the car) and classified them by three ranges. There appears to be a seasonal trend in the age groups using the landfill, but the reasons or basis for this are unclear. The few “unknowns” for this question are simply due to missing data.

Source: Information on the source of the waste (home, apartment or business) was requested from the customers. As can be seen in the results, with an average of 83.7% of the customers bringing waste from homes, the survey targeted primarily Residential Self-Haul customers. Almost no customers were found to be bringing waste from apartments. In this case, the “unknown” responses were from people who were reluctant to answer this question or due to missing data. The few “mixed” responses were the result of the load being from more than one source (for instance, home and business was a common combination).

Frequency of Use: Information was requested from the customers as to the frequency of their visits to the landfill. It is interesting to see that the responses for this question were fairly consistent throughout the year, and that “once per month” was the response more than twice as much as other responses.

Garbage Collection Services at Home: Only Residential Self-Haul customers were asked this question, which was added to the survey after the first quarter. The responses to this question appear to have a seasonal trend, but it is interesting to see that on the average only slightly more customers of the landfill do not have garbage collection at home than those that do have service at home. This indicates that the landfill is being used for disposal of excess waste or waste from special projects by a significant percentage of the Residential Self-Haul customers. It might be thought that many of these customers also went to the landfill for other services, but the responses to the next question do not support this.

The relatively large number of “unknown” responses is the result of a greater number of people declining to answer this question, apparently reflecting a greater sensitivity to this question.

Services Used: There is a “built-in” bias for the survey in regards to this question especially. By necessity, survey personnel needed to be located before the scalehouse to conduct the survey so that they could also divert vehicles for sampling purposes. This location put the surveyor after the recycling center and Hazo-House, effectively missing the customers who only came to the landfill to use one or both of these services. This bias was, of course, obvious from the start of the study, and it was agreed that this was acceptable since it was the disposal customers that were of primary interest.

Data for this question is provided separately for residential and non-residential customers, as there are a few interesting differences that come to light this way. In general, Non-Residential Self-Haul customers used the other services at the landfill much less than Residential Self-Haul customers, except for substantial usage of the compost area in the spring (May).

This question was changed after the first quarter, to ask what services were being used on that day instead of what services were used in general, to provide a more accurate assessment of the amount of usage for the various services. Hence, data from the first quarter on the services used is not shown in Table 5 because these responses are not comparable to the other quarters.

Source by City: Customers were asked what city they were from or, more precisely, the city of origin for the load of waste. The results for this question show a few interesting trends, the first being the consistency of the proportion of customers from Lacey. This is likely the result of the close proximity of the landfill to Lacey, making trips to the landfill an easy and convenient thing for Lacey residents. The results for other areas are more variable, especially for Olympia and the unincorporated areas.

Additional Information: Additional information collected through the surveys included customer satisfaction and feedback, and reasons for using the landfill. This type of information does not lend itself to an easy summary such as is shown in Table 5, but can be viewed on the copies of the survey forms provided to the County.

C. BREAKDOWN OF WOOD, C&D AND SPECIAL WASTES

Additional data on the materials that comprise the wood, construction and demolition waste, and special waste categories is shown in Table 6. This data generally does not have the same level of statistical certainty as the results for the primary categories, due to the lower quantities and greater variability of these materials, but still may provide useful information for future planning or program development purposes. In consideration for the lower precision, figures in Table 6 have been adjusted to show only one significant digit to the right of the decimal point.

Included in the results for wood waste is an assessment of the amount of “clean wood” that is recyclable by current standards. This category includes the clean (non-painted) fraction of dimension lumber, plywood and particle board, part of the “other wood waste” category (i.e., non-painted furring, siding and molding), plus all of the pallets and stumps.

D. MARKETABILITY DATA

During the course of the study, notes were kept as to the marketable condition of the recyclable materials found in most of the samples (some of the samples were skipped due to time and other constraints). This data was collected in response to concerns about the ability to relate information about the quantity of recyclable materials found versus the amount that could actually be recovered and successfully marketed through a waste processing system. The information recorded was based on the general condition of the recyclables sorted from individual samples, and assessed marketability based on cleanliness, whether bottles were intact, and other factors.

The marketability assessment only focused on the “typical” or “curbside” recyclable materials (paper, bottles and cans), but other record-keeping already in place was also noting the condition

**TABLE 6
BREAKDOWN OF WOOD, C&D AND SPECIAL WASTES
THURSTON COUNTY WASTE COMPOSITION STUDY**

	<u>Residential Self-Haul</u>	<u>Non-Res. Self-Haul</u>	<u>Single-Family Homes</u>	<u>Commercial</u>	<u>Average for Entire County</u>
WOOD WASTE					
Dimension Lumber	5.3%	8.4%	0.3%	4.3%	3.9%
Pallets, Crates	0.1%	1.9%	0.0%	1.8%	1.0%
Treated Wood	0.03%	0.2%	0.1%	0.1%	0.1%
Roofing	0.0%	6.5%	0.0%	0.0%	0.9%
Contaminated	1.5%	1.5%	0.0%	0.1%	0.5%
Stumps, Other Bulky Wood	0.1%	0.2%	0.0%	0.0%	0.04%
Plywood	0.5%	1.6%	0.1%	3.6%	1.8%
Particleboard, Fiberboard	1.7%	7.2%	0.1%	2.1%	2.2%
Wood Products	0.4%	0.5%	0.3%	0.2%	0.3%
Other Wood	0.0%	0.3%	0.1%	0.01%	0.1%
Total Wood Waste	9.5%	28.3%	0.8%	12.2%	10.9%
Subtotal, Clean Wood (1)	3.5%	13.3%	0.3%	6.2%	5.1%
Subtotal, Dirty Wood (1)	4.2%	5.9%	0.2%	5.4%	3.9%
CONSTRUCTION AND DEMOLITION (C&D) WASTE					
Ceramics, Porcelain, China	0.6%	0.1%	0.02%	0.0%	0.1%
Rocks, Bricks	0.02%	0.6%	0.04%	0.5%	0.3%
Concrete	0.7%	2.3%	0.2%	0.3%	0.6%
Soil, Dirt, Fines	1.2%	0.1%	0.7%	0.2%	0.5%
Gypsum Board	0.5%	4.2%	0.04%	1.6%	1.3%
Fiberglass Insulation	0.1%	1.3%	0.01%	0.2%	0.3%
Other Fiberglass	0.01%	0.0%	0.0%	1.3%	0.6%
Roofing	1.1%	14.2%	0.01%	0.2%	2.2%
Asphalt	0.0%	0.3%	0.0%	0.0%	0.04%
Other C&D	0.2%	1.8%	0.7%	1.3%	1.0%
Total C&D Waste	4.4%	24.8%	1.6%	5.6%	6.9%
SPECIAL WASTES					
Paints and Solvents;					
Latex Paint	0.4%	0.01%	0.05%	0.0%	0.1%
Oil-Based Paint	0.1%	0.0%	0.0%	0.0%	0.01%
Solvents	0.02%	0.0%	0.0%	0.01%	0.01%
Automotive Wastes;					
Motor Oil, Other Oils	0.01%	0.02%	0.01%	0.0%	0.01%
Oil Filters	0.3%	0.01%	0.02%	0.04%	0.1%
Gasoline, Fuel Oil	0.0%	0.0%	0.0%	0.0%	0.0%
Antifreeze	0.0%	0.0%	0.0%	0.0%	0.0%
Other Auto Maintenance	0.1%	0.0%	0.0%	0.0%	0.01%
Batteries, Car	0.5%	0.0%	0.0%	0.0%	0.1%
Home and Garden;					
Pesticides, Herbicides	0.01%	0.0%	0.02%	0.0%	0.01%
Fertilizer w/Pest. and Herb.	0.0%	0.0%	0.0%	0.0%	0.0%
Fertilizer w/o Pest., Herb.	0.04%	0.0%	0.0%	0.0%	0.01%
Other;					
Adhesives, Glues	0.3%	0.02%	0.02%	0.01%	0.1%
Cleaners, Corrosives	0.5%	0.02%	0.1%	0.03%	0.1%
Medical Wastes	0.02%	0.0%	0.2%	0.1%	0.1%
Household Batteries	0.2%	0.02%	0.2%	0.05%	0.1%
Animal Excrement	1.7%	0.1%	4.4%	0.3%	1.6%
Animal Carcasses	0.02%	0.0%	0.3%	0.03%	0.1%
Gas Cylinders	0.01%	0.01%	0.01%	0.04%	0.02%
Other Special Wastes	0.0%	0.0%	0.1%	0.1%	0.1%
Total Special Waste	4.1%	0.2%	5.4%	0.6%	2.4%

Notes: All figures are percentages by weight.

1. The sum of "clean wood" and "dirty wood" do not add up to the total amount of wood waste because some types of wood are not included in the clean wood and dirty wood subtotals.

of certain types of wood (as “clean wood”, see discussion in III.C) and sheetrock (as painted or not, also a good indicator of recyclability through current systems).

The amount of marketable materials in each waste stream was observed to be:

10.2%	Residential Self-Haul
11.9%	Non-Residential Self-Haul
6.7%	Single-Family Homes
9.3%	Commercial
9.1%	County Average

The above figures correspond to the amount of recyclable materials (paper, bottles and cans) that were deemed marketable in the samples. These figures are conservative, since fairly strict standards were used in gauging marketability of the materials. The results shown for each of the generators is a simple average based on all of the samples in all of the quarters for which this information was noted. The figure shown for the County average is a weighted average that is based on the amount of waste disposed by each of the generators in 1999.

It is interesting to note that there is an apparent seasonal trend in the marketability data, especially for the two self-haul waste streams. The results for Residential Self-Haul show distinctly higher amounts of marketable recyclables in the May and November sorting periods, while Non- Residential Self-Haul show higher results in May and August. Single-Family Homes show a spike in May, with the other months being consistently lower. The results for Commercial waste are very consistent, varying from a low of 8.2% in August to a high of 10.2% in November. It should be noted, however, that insufficient data was collected to draw these conclusions with any reliability.

The marketability data should only be used as an estimate of the amount of materials that could be recovered through a waste processing. The actual results from a waste processing system will vary significantly depending on system design and operating parameters. Furthermore, source separation programs could recover a significantly larger portion of the total amount of recyclable materials (in other words, more than the amount that is indicated as marketable). Since the approach for the marketability data assessed the condition of the recyclables after these materials were mixed with garbage, it is likely that keeping the materials separate (and intact, dry, etc.) in the first place would allow a substantially greater percentage of the materials to be recycled. Section IV.B and Table 10, later in this report, provides more information on the comparison of source separation programs and mixed waste processing.

E. AMOUNT OF REUSABLE PRODUCTS AND MATERIALS

Reusable materials and products found in the samples were noted during waste sorting and a record was kept of their weight. This data was collected to determine the possible impact of waste prevention programs that might strive to keep reusable materials out of the waste stream.

Reusable materials and products were defined to include:

- textiles (clothing) if in good condition, with at most a small rip or other defect that could have easily been repaired.
- almost all soil, rocks and clay were classified as reusable, unless there appeared to be some type of contamination.
- plastic products such as toys and household items in good condition.
- metal parts, such as nuts, bolts and screws, and small appliances and other products that appeared to be in working condition or easily repaired.
- construction and demolition materials, such as wood building materials (including large and clean pieces of dimension lumber, particleboard or plywood), asphalt shingles (if whole pieces of new 3-tab shingles were found), concrete blocks and whole bags of unused concrete cement, and other items. C&D materials were also included in some of the other reusable categories, especially carpet and metals.
- carpet if it was clean, in good condition, and large enough to cover the floor of a small room.
- food if it was contained in its original packaging, not opened, and appeared to be unspoiled.
- special wastes if the product was in its original packaging, it was in good condition, and there was a usable quantity of it. Items in this category included cleaning solution and automobile rubbing compound.
- miscellaneous items from other material categories if the item was clean, in good condition and/or in sufficient quantity to permit reuse. Items in this category included ceramic plates, cosmetics, wax candles, grass seed and a basketball.

The results of the survey of reusable materials are shown in Table 7. The results shown are very conservative and should be interpreted as the minimum amount of reusable materials in the waste stream. Since this data was of lower priority than the general waste composition results, it was not collected with the same thoroughness as the other data in this report. Hence, data on reusable materials was not collected for every sample. The precision of this survey could also be affected by the small amount of reusables present in the samples.

Another problem with this data is the lack of a standard definition for reusable materials and products. The criteria described above are based on reasonable judgment and should be viewed as conservative in the sense that relatively strict standards were employed in judging materials as reusable, while others may argue for broader acceptance criteria depending on their personal interest in resource conservation.

TABLE 7
REUSABLE PRODUCTS AND MATERIALS
THURSTON COUNTY WASTE COMPOSITION STUDY

<u>Material/Product</u>	<u>Number of Samples with Material</u>	<u>Total Reusables, % by wt.</u>	<u>Criteria for Classification as Reusable</u>
Textiles	39	15.3%	Clothing in good condition.
Soil, Rocks	26	16.5%	Not visibly contaminated.
Plastic Products	24	8.1%	Products in good condition.
Metals	12	14.4%	Products and parts (screws, nails, etc.) in good condition.
C&D Materials	4	22.9%	Usable pieces of wood, shingles, concrete, etc.
Carpet	3	6.1%	New pieces larger than 8 ft. by 8 ft.
Food	3	3.2%	Unspoiled and still in the original packaging.
Special Wastes	2	0.5%	Usable quantity still in original packaging.
Miscellaneous	15	13.0%	Various other materials and products.
		100%	

<u>Type of Generator</u>	<u>Number of Samples with Reusables</u>	<u>Total Number of Samples</u>	<u>Percentage of Samples with Reusables</u>	<u>Average Amt. of Reusables, % by wt.</u>
Residential Self-Haul	35	64	55%	5.2%
Non-Residential Self-Haul	20	63	32%	2.2%
Single-Family	19	47	40%	1.6%
Commercial	16	60	27%	1.2%
Totals/Averages	90	234	36% (1)	2.1% (1)

Notes: 1) Figures shown are weighted averages based on 17.4% residential self-haul, 13.2% non-residential self-haul, 26.4% single-family, and 42.9% commercial.

"% by wt" = percent by weight.

Above figures do not include the special commercial samples arranged by the City of Olympia.

F. COMPARISON OF RESULTS TO OTHER COUNTIES

Table 8 shows results from Thurston County and two other counties. The results include Clark County, the fieldwork for which was conducted in 1999 (on a schedule very close to Thurston County's schedule), and Snohomish County, the fieldwork for which was conducted in October 1997 and May 1998. The results for all three counties appear surprisingly similar. Previous such comparisons have not appeared as close, leading to the thought that perhaps local differences in waste management programs have begun to even out, at least in these three areas.

TABLE 8
COMPARISON OF RESULTS TO OTHER COUNTIES
THURSTON COUNTY WASTE COMPOSITION STUDY

		<u>Results from Other Counties</u>			
		<u>Clark County</u>	<u>Snohomish Co.</u>	<u>Thurston Co.</u>	
		<u>1999</u>	<u>1998</u>	<u>1999</u>	
PAPER	Newspaper	2.14%	1.86%	1.82%	
	Cardboard	4.72%	4.04%	3.68%	
	Office and Computer	0.92%	0.80%	0.49%	
	Mixed Waste Paper	4.16%	5.30%	4.02%	
	Magazines	1.08%	0.80%	1.38%	
	Milk Cartons, Other	0.24%	0.39%	0.30%	
	Non-Recyclable Paper	8.52%	8.69%	8.74%	
	Paper Subtotal	21.78%	21.87%	20.43%	
PLASTIC	PET Bottles	0.39%	0.45%	0.52%	
	HDPE Bottles	0.53%	0.63%	0.68%	
	Bottles 3-7	0.06%	0.12%	0.05%	
	Plastic Packaging	6.80%	7.47%	7.24%	
	Other Plastic Products	4.33%	3.45%	3.74%	
	Expanded Polystyrene	0.78%	0.66%	0.46%	
	Plastic Subtotal	12.89%	12.78%	12.69%	
	METAL	Aluminum Cans	0.39%	0.52%	0.42%
Aluminum Foil		0.12%	0.17%	0.13%	
Tin Cans		0.95%	1.06%	1.00%	
Mixed Metals		2.29%	1.79%	2.58%	
Ferrous Metals		2.09%	2.36%	2.69%	
White Goods		0.25%	0.01%	0.71%	
Non-Ferrous Metals		0.34%	0.46%	0.18%	
Aerosol Cans		0.17%	0.20%	0.20%	
Electronics		0.62%	NA	NA	
Metal Subtotal		7.21%	6.58%	7.91%	
ORGANIC	Food Waste	14.49%	13.26%	15.46%	
	Yard Debris	3.29%	2.51%	3.04%	
	Organic Subtotal	17.78%	15.78%	18.50%	
GLASS	Clear Bottles	1.54%	1.63%	1.74%	
	Brown Bottles	0.72%	0.64%	0.73%	
	Green Bottles	0.39%	0.38%	0.45%	
	Non-Recyclable Glass	0.51%	0.73%	1.03%	
	Glass Subtotal	3.16%	3.38%	3.94%	
OTHER WASTES	Tires	0.30%	0.12%	0.16%	
	Rubber Products	0.27%	0.23%	0.35%	
	Cosmetics	0.11%	0.07%	0.14%	
	Disposable Diapers	3.08%	2.66%	2.11%	
	Textiles	3.47%	2.39%	2.57%	
	Carpet	2.82%	2.61%	2.51%	
	Leather	0.13%	0.09%	0.03%	
	Furniture	0.78%	0.83%	1.02%	
	Fines	2.75%	3.64%	2.29%	
	Ash, Dust	0.34%	1.54%	0.26%	
	Misc. Organics	4.44%	5.21%	4.34%	
	Misc. Inorganics	0.41%	0.39%	0.59%	
	Other Subtotal	18.88%	19.79%	16.36%	
	WOOD and C&D	Wood	8.48%	11.26%	10.86%
		C&D	7.43%	6.29%	6.88%
		Wood, C&D Subtotal	15.91%	17.55%	17.73%
	SPECIAL WASTES		2.39%	2.27%	2.43%
	TOTALS		100.0%	100.0%	100.0%
	TOTAL WASTE STREAM, tons		216,500 TPY (1999)	378,800 TPY (97-98)	144,500 TPY (1999)

Notes: All figures are percentages by weight, except last row of figures which are tons per year (TPY) for year that study was conducted.

SECTION IV CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

This section provides conclusions and recommendations based on the data collected by this study.

B. CONCLUSIONS

Weight of Materials Disposed

The waste quantity and composition results can be combined to show the total weight of disposed materials. Table 9 shows this information for each waste generator, combining the composition data for these generators with their annual waste quantities to show the tons of each material that are disposed each year.

Waste Composition

There are distinct differences in the waste streams of the different types of waste generators, as can be seen in several of the tables and figures in this report. For each of the generators, a few noteworthy conclusions can be drawn:

- **Residential Self-Haul:** self-haul loads from residential sources have more wood, construction debris and metal than other residential sources, and less “regular” household trash (paper, plastic and food waste), reflecting the activities such as remodeling and other special projects that are often the source of self-haul waste. Food waste is still the material present in the single largest quantity, however, at 16.9%, followed by wood (9.5%), non-recyclable paper (6.3%), and mixed metals (5.4%). Furniture is also relatively high, and the Residential Self-Haul waste stream contributes most of the furniture in Thurston County’s waste stream (1,250 tons out of 1,470 tons, or 85% of the total).
- **Non-Residential Self-Haul:** like self-haul waste from residential sources, Non-Residential Self-Haul loads are often the result of construction activities or other special projects. The large amount of wood (28.3%) and other construction waste (24.8%) clearly shows the influence of construction activities on this waste stream. Although the total tons from this waste generator make up only a small portion (13.2%) of the County’s waste stream, this source is disposing of 40% of the wood and C&D materials. There is also a significant amount of carpeting (34% of the County’s total) and cardboard (about 25% of the County’s total) being disposed by this type of generator.

**TABLE 9
WEIGHT OF DISPOSED MATERIALS
THURSTON COUNTY WASTE COMPOSITION STUDY**

		Residential	Non-Res.	Single-Family		Totals for
		<u>Self-Haul</u>	<u>Self-Haul</u>	<u>Homes</u>	<u>Commercial</u>	<u>Entire County</u>
PAPER	Newspaper	340	110	1,110	1,060	2,630
	Cardboard	450	1,310	640	2,930	5,320
	Office and Computer	29	22	170	490	710
	Mixed Waste Paper	920	230	2,320	2,340	5,800
	Magazines	270	150	640	940	2,000
	Milk Cartons, Other	30	9	180	210	430
	Non-Recyclable Paper	1,600	950	4,000	6,090	12,630
	Paper Subtotal	3,640	2,770	9,060	14,060	29,530
PLASTIC	PET Bottles	130	36	290	300	760
	HDPE Bottles	170	26	390	390	980
	Bottles 3-7	19	2	27	20	68
	Plastic Packaging	1,240	690	2,740	5,790	10,460
	Other Plastic Products	650	450	760	3,540	5,410
	Expanded Polystyrene	140	43	180	300	660
	Plastic Subtotal	2,350	1,250	4,400	10,340	18,340
METAL	Aluminum Cans	81	31	230	260	600
	Aluminum Foil	28	5	85	64	180
	Tin Cans	290	39	610	510	1,450
	Mixed Metals	1,350	430	280	1,660	3,730
	Ferrous Metals	1,200	720	610	1,350	3,890
	White Goods	760	270	0	0	1,030
	Non-Ferrous Metals	53	120	11	86	270
	Aerosol Cans	84	5	110	92	290
Metal Subtotal	3,860	1,620	1,940	4,020	11,430	
ORGANIC	Food Waste	4,250	310	8,490	9,290	22,330
	Yard Debris	1,130	260	1,440	1,560	4,400
	Organics Subtotal	5,380	570	9,930	10,860	26,730
GLASS	Clear Bottles	600	73	840	1,000	2,510
	Brown Bottles	220	41	330	460	1,050
	Green Bottles	200	12	100	340	650
	Non-Recyclable Glass	180	180	100	1,020	1,490
	Glass Subtotal	1,200	310	1,370	2,820	5,700
OTHER WASTES	Tires	140	36	0	51	230
	Rubber Products	29	72	110	290	500
	Cosmetics	54	6	76	59	200
	Disposable Diapers	410	40	1,870	730	3,050
	Textiles	800	180	1,560	1,180	3,720
	Carpeting	190	1,240	29	2,180	3,630
	Leather	12	1	20	6	39
	Furniture	1,250	200	0	19	1,470
	Fines	430	140	1,550	1,190	3,310
	Ash, Dust	150	8	160	49	370
	Misc. Organics	610	410	3,000	2,250	6,270
	Misc. Inorganics	160	73	81	550	860
	Other Subtotal	4,230	2,410	8,460	8,540	23,640
WOOD & C&D	Wood	2,400	5,420	320	7,540	15,690
	C&D	1,110	4,750	620	3,450	9,940
	Wood, C&D Subtotal	3,510	10,170	950	10,990	25,620
SPECIAL WASTES	Paints and Solvents	130	2	17	8	160
	Automotive	200	5	11	22	240
	Home and Garden	13	0	10	0	23
	Other	690	24	2,010	370	3,090
	Special Waste Subtotal	1,030	30	2,050	400	3,510
TOTALS		25,200	19,130	38,130	62,030	144,500

Notes: All figures are tons per year (1999 quantities).

- **Single-Family Homes:** the largest single material in this waste stream is food waste (22.3% by weight), which is disposed at almost twice the quantity as the next largest material, non-recyclable paper (10.5%). There are also significant quantities of plastic packaging (7.2%), diapers (4.9%), textiles (4.1%), and “other special wastes” (5.3%). The “other special waste” is comprised primarily of “animal excrement” (“kitty litter”, at 4.4%).
- **Commercial:** waste from this source also contains large amounts of food waste (15.0% or 9,290 tons) and wood (12.2% or 7,540 tons), followed by non-recyclable paper (9.8% or 6,090 tons) and plastic packaging (9.3% or 5,790 tons). Because this waste stream is so large (42.9% of the County’s total tons per year), even small amounts of materials (on a percentage basis) add up to significant tonnages. For example, Commercial waste generators dispose of less mixed waste paper on a percentage basis than Single-Family Homes (3.8% versus 6.2%), but are actually disposing of more of this material (2,340 versus 2,320 tons per year) due to the larger overall amount of waste disposed by Commercial generators.

Assessment of Recycling and Recovery Potential

The data shown in Table 9 can be combined with marketability data collected during the study to address the question of how much more recyclable materials could be diverted from the County’s waste stream. The answer to this question depends on the approach used to capture these recyclable materials, and Table 10 shows how much the potential results can differ. The figures in Table 10 are intended to compare the results of source separation programs to mixed waste processing systems. The source separation programs (or “Total Possible Amount for Recycling”) would actually require a combination of curbside, drop-off, commercial, multi-family and other programs to divert the recyclable materials remaining in the waste stream.

C. RECOMMENDATIONS

Based on the results of this study, it is recommended that the following materials and sources be targeted for recovery at the transfer station:

- from Residential Self-Haul wastes, should target metals, yard debris, textiles and wood.
- from Non-Residential Self-Haul wastes, should target cardboard, metals, wood, and C&D.
- from Single-Family Homes, should target yard debris and possibly textiles, as well as higher-value materials such as aluminum cans.
- from Commercial wastes, should target cardboard, metals, yard debris, wood and C&D.
- from Non-Residential Self-Haul and Commercial wastes, should target carpet if a good market can be found.

TABLE 10
POTENTIAL RECYCLABLE / MARKETABLE QUANTITIES
THURSTON COUNTY WASTE COMPOSITION STUDY

Type of Material	Total Possible Amount for Recycling, TPY (1)	Marketable Amount, Mixed Waste Processing System, TPY	Comments
Typical Recyclables:		NA	
Recyclable Paper	16,900		Data on the “marketable amount” by material is not readily available, so only subtotal is shown for this. Subtotal was calculated as 9.1% (see Section III.D) of the total waste stream (144,500 tons per year).
Plastic Bottles (#1, #2)	1,740		
Aluminum Cans	600		
Other Metals	10,830		
Glass Containers	4,210		
Yard Debris	<u>4,400</u>		
Subtotal	38,680	13,150	
Wood	15,690	7,370	Marketable amount is based on observations of the amount of clean wood (i.e., not painted or contaminated in some manner).
Sheetrock	1,880	1,670	The marketable amount is based on observations that 89% of the sheetrock was clean and unpainted.
Total Potential Additional Diversion; Tons per Year Percent of the Waste	56,250 38.9%	22,190 15.4%	

Notes: All figures are tons per year (TPY), and are 1999 amounts.
1. From Table 9.

GLOSSARY

GLOSSARY

INTRODUCTION

This document defines the types of generators and waste sorting categories used for the Thurston County Waste Characterization Study.

A. GENERATOR CATEGORIES

Residential Self-Haul: residential waste delivered to the landfill by a homeowner, renter or landlord, typically using cars, vans, jeeps, pick-up trucks, rental trucks and trailers. In addition, samples taken from the rural drop site loads from Rainier and Rochester were categorized as residential self-haul.

Non-Residential Self-Haul: non-residential waste delivered to the landfill by the same company which generated the waste, including construction and demolition waste brought in by contractors.

Single-Family Homes: waste originating from single-family homes. To be counted in this category, the waste must have been delivered to the landfill by a municipal collection crew or private garbage hauler.

Commercial: waste from businesses and apartments, delivered by a municipal collection crew or private garbage hauler (i.e., all of the waste delivered by garbage trucks except single-family waste).

B. WASTE SORTING CATEGORIES

PAPER

Newspaper: printed groundwood newsprint, including glossy ads and Sunday edition magazines that are delivered with the newspaper (unless these are found separately during sorting).

Cardboard: unwaxed kraft paper corrugated containers and boxes, unless poly- or foil-laminated. Note that this category does **not** include brown kraft paper bags.

Office and Computer Paper: high-grade white or light-colored bond and copy machine papers and envelopes, and continuous-feed computer printouts and forms of all types, except multiple-copy carbonless paper.

Mixed Waste Paper (MWP): low-grade but potentially recyclable papers, including colored papers, notebook or other lined paper, envelopes with plastic windows, non-corrugated paperboard, carbonless copy paper, egg cartons, and junk mail.

Magazines: magazines, catalogs and similar products with glossy paper.

Milk Cartons and Other Aseptic Containers: milk cartons and similar gable-top containers (such as orange juice cartons), and juice drink boxes.

Non-Recyclable Paper: contaminated papers and non-recyclable types of papers such as carbon paper, tissues, paper towels, paper plates, waxed papers, frozen food containers, paper packaging with metal or plastic parts, and hardcover books.

PLASTIC

PET Bottles: polyethylene terephthalate (PET) bottles, with or without the base cup, including soda, oil, liquor and other types of bottles. No attempt was made to remove base cups, caps, or wrappers, although these materials were categorized separately if received separately. The SPI code for PET is 1.

HDPE Bottles: high density polyethylene (HDPE) milk, juice, detergent, and other bottles. Note that this category does not include motor oil bottles. The SPI code for HDPE is 2.

Bottles Types 3 - 7: all bottles that are not PET or HDPE, where the neck of the container is narrower than the body. Includes SPI codes 3 - 7.

Plastic Packaging: all plastic packaging films, and shipping materials and other plastic items which are not themselves finished consumer products, including thermoplastics and thermosetting plastics used for packaging. Also include HDPE motor oil bottles.

Other Plastic Products: finished plastic products such as toys, toothbrushes, vinyl hose and shower curtains, including non-C&D fiberglass resin products and materials (see “fiberglass insulation” and “other fiberglass” under C&D Wastes, below).

Expanded Polystyrene: packaging and finished products made of expanded polystyrene. The SPI code for polystyrene (PS) is 6.

METAL

Aluminum Cans: aluminum beverage cans.

Aluminum Foil: aluminum foil and food trays.

Tin Cans: tin-coated steel food containers. This category includes bi-metal beverage cans, but not paint cans or other types of cans.

Mixed Metals/Materials: small appliances, motors, insulated wire and finished products containing a mixture of metals and/or other materials, but which are greater than 50% metal.

Ferrous Metals: products and pieces made from metal to which a magnet adheres (but including stainless steel), and which are not significantly contaminated with other metals or materials (in the latter case, the item was instead included under “mixed metals/materials”). This category includes paint cans and other non-food cans.

White Goods: large household appliances or parts thereof. Special note was taken if any of these are found still containing refrigerant.

Non-Ferrous Metals: metallic products and pieces not derived from iron (i.e., to which a magnet does not adhere) and which were not significantly contaminated with other metals or materials (in the last case, the item was instead included under “mixed metals/materials”).

Aerosol Cans: metal cans used for containing and applying products under pressure. If the can was full or partially full, with the contents making up more than 25% of the total weight, it was included under the category appropriate for the contents.

SPECIAL WASTES

Latex Paint: water-based paints.

Oil-Based Paint: solvent-based paints.

Solvents: includes chlorinated or flammable solvents, paint strippers, solvents contaminated with other products such as paints, degreasers, other cleaners if the primary ingredient is a solvent, and alcohols such as methanol and isopropanol. Alcoholic beverages (ethanol) originally intended for human consumption were included under “food waste” or categorized based on the type of container if empty.

Adhesives and Glues: glues and adhesives of various sorts, including rubber cement, wood putty, glazing and spackling compounds, caulking compounds, grout, and joint fillers.

Cleaners and Corrosives: includes various acids and bases whose primary purpose is to clean surfaces, unclog drains, and perform other functions.

Medical Waste: wastes related to medical activities, including syringes, IV tubing, bandages, medications, and other wastes, and not restricted to just those wastes typically classified as pathogenic or infectious.

Motor Oil, Other: used or new lubricating oils and oil filters, primarily those used in cars but possibly also including other materials with similar characteristics.

Oil Filters: used oil filters, primarily those used in cars but possibly including similar filters from other applications.

Gasoline and Fuel Oil: gasoline, diesel fuel and light fuel oils, such as those used for home heating.

Antifreeze: automobile and other antifreeze mixtures based on ethylene or propylene glycol, also brake and other fluids if glycol-based.

Other Automotive Maintenance: other products used for automobile maintenance, generally of a non-hazardous nature, such as car wax, polishes, autobody fillers, etc.

Car Batteries: car, motorcycle, and other lead-acid batteries used for motorized vehicles.

Household Batteries: batteries of various sizes and types, as commonly used in households.

Animal Excrement: feces and associated wastes from animals, such as bags of used kitty litter.

Animal Carcasses: carcasses of small animals and pieces of larger animals unless the item is the result of food preparation. For instance, fish or chicken entrails and raw, plucked chickens were classified as food, not as an animal carcass.

Gas Cylinders: pressurized gas cylinders with the contents making up more than 25% of the total weight (if less than 25% or empty, the gas cylinders were counted as the appropriate type of metal).

Pesticides and Herbicides: includes a variety of poisons whose purpose is to discourage or kill pests, weeds or microorganisms. Fungicides and wood preservatives, such as pentachlorophenol, are also included in this category.

Fertilizers with Pesticides/Herbicides: fertilizers that contain weed killer or other ingredients designed to eliminate weeds and/or pests.

Fertilizers without Pesticides/Herbicides: fertilizers without herbicide or pesticide additives.

Other Hazardous and Special Waste: problem wastes that do not fall into one of the above categories, such as asbestos-containing wastes (if this is the primary hazard associated with the waste), gunpowder, other unspent ammunition, and radioactive materials.

ORGANICS

Food Waste: food waste and scraps, including bones, rinds, etc., and including the food container when the container weight was not appreciable compared to the food inside.

Yard and Garden: grass clippings, leaves and weeds, and prunings four inches or less in diameter.

GLASS

Clear, Green and Brown Glass Containers: these are three separate categories for bottles and jars that are clear, green or brown in color.

Non-Recyclable Glass: window glass, light bulbs, glassware, mirrors, and other glass which is not recyclable. Note that ceramics (plates and knickknacks) were not included here but were placed under “miscellaneous inorganics” (see below).

OTHER WASTES

Tires: vehicle tires of all types, including bicycle tires and including rims if attached.

Rubber Products: finished products and scrap materials made of rubber, such as bath mats, inner tubes, rubber hose and foam rubber (except carpet padding, see “Carpeting”, below).

Cosmetics and Other Health Care Products: includes bottles and other containers of health care products (cosmetics, shampoo, other hair care products, and other health care products, except vitamins which were placed with “food waste” and drugs, which were placed with “medical waste”), where the weight of the product was greater than the weight of the container (i.e., the product was more than 50% of the total weight of the item).

Disposable Diapers: disposable baby diapers and protective undergarments for adults.

Textiles: cloth, clothing, rope, tennis shoes, and rubberized cloth.

Carpeting: pieces of carpeting, as well as foam rubber and other materials used as padding under carpets.

Leather: scraps of leather and finished products such as shoes.

Furniture and Mattresses: furniture and mattresses made of various materials and in any condition.

Inert Material and Fines: material less than one-half inch in diameter that fell through the bottom screen during sorting.

Ash and Dust: fireplace, burn barrel or firepit ash, as well as bags of vacuum cleaner dust.

Miscellaneous Organics: mixed waste that remained on the sorting table after all the materials that could practicably be removed were sorted out. This material consisted primarily of small pieces of various types of paper and plastic, but also contained small pieces of broken glass and other materials. Pieces of wax were also included in this category.

Miscellaneous Inorganics: miscellaneous inorganic materials that could be sorted out of the sample but that did not fit into another category, such as ceramic products.

WOOD WASTES

Dimension Lumber: wood commonly used in construction for framing and related uses, including 2 x 4's and 2 x 6's.

Pallets: partial or whole pallets and similar shipping containers.

Treated Wood: wood treated with preservatives such as creosote, including dimension lumber if treated. Will not include painted or varnished wood. This category may also include some plywood (especially "marine plywood"), strandboard, and other wood.

Roofing: wood that is commonly used for roofing of buildings, such as cedar shingles or shakes. Note that roofing made from non-wood materials was classified under other categories (see "roofing wastes" under C&D, below).

Contaminated Wood: wood that was contaminated with other wastes in such a way that it could not easily be separated, but consisting primarily (over 50%) of wood. Examples include wood with sheetrock nailed to it or with tiles glued to it.

Stumps and Other Bulky Wood: stumps of trees and shrubs, with the adhering soil (if any), and other natural woods, such as logs and branches, in excess of four inches in diameter.

Plywood: a wood product built up of two or more veneer sheets glued or cemented together under pressure.

Particle Board / Fiberboard: building material made up of fibers of various substances (but typically made from wood chips) pressed together to form large sheets or boards.

Wood Products: goods and products fabricated primarily (over 80% by weight) from wood, including toys, household items, and similar goods. Does not include building materials or furniture.

Other Wood Waste: other types of wood that did not fit into the above categories.

CONSTRUCTION AND DEMOLITION (C&D) WASTES

Ceramics, Porcelain, and China: used toilets and sinks. Non-C&D ceramics, such as plates and other dishes, were be categorized under "miscellaneous inorganics".

Rocks and Brick: rock, gravel, and bricks of various types and sizes.

Concrete: cement (mixed or unmixed), concrete blocks, and similar wastes.

Soil, Dirt, and Non-Distinct Fines: this category includes soil, sand, dirt and similar materials, where these could be recovered separately from the fines measured as part of the normal sorting procedure.

Gypsum Board: used or new gypsum wallboard, sheetrock or drywall present in recoverable amounts or pieces (generally any piece larger than two inches square was recovered from the sample).

Fiberglass Insulation: does not include other types of insulation or other fiberglass products.

Other Fiberglass: durable, large products such as shower stalls and bath tubs. Small, non-C&D objects were categorized with "other plastic products".

Roofing Waste: asphalt and fiberglass shingles, tar paper, and similar wastes from demolition or installation of roofs. Does not include cedar shingle or shakes (see wood subcategory, "roofing wood").

Asphalt: restricted to asphalt paving material.

Other C&D: C&D materials that are not included in the above categories.

APPENDIX A
DATA COLLECTION PROCEDURES

APPENDIX A DATA COLLECTION PROCEDURES

A. PURPOSE

This document describes the procedures that were used for Thurston County's waste composition study. The primary intent of this appendix is to provide documentation for future reference.

Two primary sets of data were collected for the purpose of characterizing the County's waste stream: waste composition data and waste quantity data. These two sets of data will be collected using different surveys and methods, as described in the following pages. Each set of data provides valuable information by itself, but the results when combined provide the weighted averages that are the primary goal of this task. Additional data that was collected included a customer survey and assessment of the marketability of the recyclable materials.

B. TYPES OF GENERATORS

For both the waste composition and waste quantity surveys, Thurston County's solid waste stream was divided into four primary substreams. This is done to allow examination of the recyclables and other materials disposed by specific types of waste generators, with the data for each of the generators combined later to construct a picture of the County's entire waste stream. The four substreams are:

- Residential Self-Haul (residential waste brought in by the homeowners and renters who generated the waste).
- Non-Residential Self-Haul (waste from businesses or contractors, brought in by an employee of that business).
- Single-Family Homes (waste brought in by garbage haulers from single-family homes).
- Commercial, including both non-residential waste (waste brought in by garbage haulers from commercial, industrial, or institutional sources) and multi-family residential (waste brought in by garbage haulers from apartment buildings).

In addition, samples were taken from specific commercial sources and four areas of single-family homes in Olympia.

Construction and demolition wastes (C&D) wastes and other special wastes were included in the above categories as appropriate for the type of generator, and as these materials happened to fall within the sampling schedule.

C. WASTE SORTING PROCEDURES

The methodologies for determining waste composition in Thurston County were designed to produce data which is representative of the entire waste stream. This study was designed to provide accurate data on an annual basis by type of waste generator, but not quarterly data for each generator (which would have required significantly more samples and additional expense). Quarterly data for each type of generator could still be examined for seasonal trends, bearing in mind that these results may be imprecise.

Schedule

To sort an adequate number of samples and collect sufficient data on waste quantities, fieldwork was conducted for 23 days distributed over the four quarters of the year (see Figure A-1). The quarterly distribution was necessary to account for seasonal variations in waste quantities and composition.

Number of Samples per Generator

Previous studies have demonstrated that 20 to 30 samples are the minimum acceptable number required to characterize a specific type of waste for a specific time period. This number also depends on the size and variability of a waste stream, with individual waste streams (such as from a single type of business) requiring fewer samples for acceptable accuracy levels. Sample numbers for each type of generator targeted by this study were adjusted to allow greater numbers of samples to be taken for the most variable and/or largest waste substreams (i.e., commercial and the two self-haul categories).

Sample Selection

A list of random numbers was used to select incoming loads for sampling. For loads to be sampled, relevant data about the load was entered in the top part of sample data form (see Figure A-2, which has been reduced from the original size of 8.5 by 14 inches and has been filled in with mock numbers to demonstrate its use). If small, the selected loads were then directed to dump near the sorting area (as was generally the case with self-haul loads). Large loads were dumped at the operating face of the landfill and a sample was brought by a front end loader to the sorting crew.

Once a sample had been procured, it was examined to ensure that it was at least 300 pounds in weight, since a minimum sample weight of 200 pounds was used to help ensure statistical validity of the results. This sample weight has been demonstrated by previous studies to be necessary for accurately characterizing the waste stream. Self-haul loads were taken “as is”, and the entire load was sorted if necessary to achieve a sample weight as close to 200 pounds or more.

Sorting Categories

Samples from all types of generators were sorted into 79 categories. The 79 categories included 40 sub-categories that provide a more detailed breakdown for wood, C&D, and hazardous/special wastes.

Sorting Equipment

Sorting equipment included the following:

- Sort box: a box of plywood construction (approximately 6 ft. x 3 ft. x 1 ft. deep) with a false bottom made from wire mesh with openings of 0.5 inches square.

**FIGURE A - 1
WASTE SORTING SCHEDULE
THURSTON COUNTY WASTE COMPOSITION STUDY**

	FIRST QUARTER																									
	FEBRUARY 1999																									
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26					
	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr					
Quarterly Arrangements					xx	xx	xx	xx	xx																	
Waste Sorting																										

	SECOND QUARTER																						
	APRIL					MAY 1999																	
	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	
Quarterly Arrangements		xx	xx	xx	xx						xx	xx	xx										
Waste Sorting																							

	THIRD QUARTER																					
	JULY									AUGUST 1999												
	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	
	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Sa	
Quarterly Arrangements				xx			xx	xx	xx	xx	xx											
Waste Sorting																						

	FOURTH QUARTER																						
	OCT						NOVEMBER 1999																
	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	
Quarterly Arrangements	xx	xx	xx	xx			xx	xx	xx	xx	xx												
Waste Sorting																							

Notes: Quarterly arrangements includes confirming the schedule and sorting locations with County (including scalehouse) personnel, Corrections, Skagit Sand and Gravel and consultant personnel.


Key:  = period of fieldwork, xx = timing for quarterly arrangements.

FIGURE A - 2: THURSTON COUNTY SAMPLE DATA FORM

SAMPLE ID: 126

SOURCE (CIRCLE ONE)

Self-Haul _____

1) Residential Self-Haul _____

2) Non-Res. Self-Haul _____

Municipal/Certificated _____

3) S-F Residential (3)

4) Olympia S-F Residential _____

5) Commercial / Apt. _____

6) Olympia, Special Comm./Apt. _____

SITE DATA

Date: 2/18/99 Recorder: IF

Time: 11:00

VEHICLE / ROUTE DATA

Type: Rear Loader

Company: Pacific Lic. No.: 4R5750

City / Area: Tumwater

PAPER	Reuse?	ORGANICS	Reuse?
Newspaper <u>6.25, 8.0, 1.2</u>		Food <u>30.75</u>	
Cardboard <u>11.75, 10.5</u>		Yard, Garden <u>1.0</u>	
Office and Computer <u>0-6</u>			
MWP <u>19.5, 20.0</u>		GLASS	
Magazines <u>6-2</u>		Clear Glass <u>8.0, 4.5</u>	
Milk Cartons, Other <u>0.5</u>		Brown Glass <u>2.5</u>	
Non-Recy. <u>8.5</u>		Green Glass <u>2.5</u>	
		Non-Recyclable Glass <u>0.25</u>	
PLASTIC		OTHER WASTES	
PET Bottles <u>4.0</u>		Tires	
HDPE Bottles <u>3.75</u>		Rubber Products	
Bottle Types 3-7 <u>0.25</u>		Cosmetics/Health Care	
Plastic Packaging <u>14.0, 9.5</u>		Disposable Diapers <u>15.5</u>	
Other Plastic Prod. <u>4.2</u>	<u>(2)</u>	Textiles <u>16.0</u>	<u>(5)</u>
Expanded Polystyrene <u>2.25, 1.0</u>		Carpeting	
		Leather	
METALS		Furniture	
Aluminum Cans <u>1-6</u>		Fines <u>11.2</u>	
Aluminum Foil <u>0.5</u>		Ash, Dust	
Tin Cans <u>5.0</u>		Misc. Organics <u>3.00, max - 0.2</u>	
Mixed Metal/MtIs		Misc. Inorganics <u>ceramics - 2.0</u>	<u>(2)</u>
Ferrous Metals <u>1.5</u>			
White Goods *		WOOD WASTES	
Non-Ferrous Metals		Dimension Lumber ** <u>5.0 (d)</u>	
Aerosol Cans <u>0.5</u>		Pallets	
HAZARDOUS AND SPECIAL WASTES	Aerosol?	Treated Wood	
Latex Paint		Roofing	
Oil-Based Paint <u>0.75</u>	<u>Y</u>	Contaminated	
Solvents		Stumps/Other Bulky Wood	
Adhesives, Glues		Plywood **	
Cleaners, Corrosives		Particle Board/Fiberboard **	
Medical Wastes <u>pills - 0.5</u>		Wood Products <u>1.5</u>	
Motor Oil, Other		Other Wood Waste; **	
Oil Filters		CDL WASTES	
Gasoline, Fuel Oil		Ceramics, Porc., China	
Antifreeze		Rocks, Brick	
Other Auto Maintenance		Concrete	
Batteries, Car		Soil, Dirt, Fines	
Batteries, Household <u>0.2</u>		Gypsum Board ** <u>2.75 (c)</u>	
Animal Excrement <u>8.75</u>		Fiberglass Insulation	
Animal Carcasses		Other Fiberglass	
Gas Cylinders		Roofing	
Pesticides, Herb.		Asphalt	
Fert. w/Pest.		Other CDL:	
Fert. w/o Pest.			
Other Haz./Spec. Wastes;			

* note if white goods contain refrigerants. ** note if clean (c) or painted (d).

Sample ID: 126

COMMENTS (describe source of load and any special problems with the load or with the materials shown above)

Marketable: ONP OC Office MWP Mag MilkCar PET HDPE AlCans AlFoil Tin Mixed FE NonFE Yard ClearG BrownG GreenG

- Two scales: one scale had a lower range and greater accuracy for the waste materials present in smaller quantities. The other scale had a larger range, up to 100 pounds, and lower accuracy, +/- 0.25 pounds, for the larger amounts of wastes.
- Shovel and push broom: for site clean-up.
- Plastic trash cans: about 50 plastic cans were used for holding sorted materials. Two sizes were used; 30-gallon containers were used for the larger quantities of materials and smaller ones (4-gallon buckets) were used for wastes found in smaller quantities.
- Safety equipment: safety equipment, present at the site at all times during the sorting period, included a first-aid kit and fire extinguisher. Personal safety equipment included hard hats, orange visibility vests, gloves, eye protection, and dust masks for each field crew member.

Sorting Procedures

Actual waste sorting proceeded as follows:

- Separate items, such as bags of yard waste or large pieces of carpeting, were removed and weighed.
- The remainder of the sample was picked up a bag at a time and placed in the sort box.
- Plastic bags of waste that had been placed into the sorting box were torn open and crew members segregated each type of material, placing it in a separate garbage can.
- The above steps were repeated until the entire sample was sorted. The crew used their best efforts to retain and sort the entire sample, including fines that might otherwise have been lost on the floor.
- At the completion of sorting, all materials were weighed. Weighing was accomplished by one crew member placing the garbage cans on a scale while Green Solutions staff checked the contents of the container, read the scale, and recorded the weight. After each garbage can was weighed, one or two other crew members carried them to a disposal area or recycling container, emptied them, and returned them to the sorting table area.
- While materials were being weighed, other crew members removed the remaining unsorted material from the sorting box (i.e., the “miscellaneous organics”) and then also removed the fines that had fallen through the screen of the sort box, placing these materials in separate containers for weighing, and prepared the sorting area for the next sample.

Crew members were not allowed to sort until provided with health and safety training. In addition to the health and safety training, the first day of each quarter included extensive instructions on the site layout, sorting methods, and the definitions being used for material categories.

D. WASTE QUANTITY DATA

Background

An important aspect of this project was determining the quantities of waste disposed by different types of waste generators. There were several other important reasons for collecting this data, including:

1. Information will be provided as to the weight of waste being generated by different residential and non-residential sectors of the County, thus allowing more precise monitoring and evaluation for future assessments of waste reduction and recycling efforts.
2. The combination of composition data and waste quantity data provides detailed data on the tonnages and sources (generator types) for recyclable materials currently disposed.
3. Waste quantity data is required for deriving “weighted averages” which are the County-wide and annual results of the waste composition data (see discussion at the end of this appendix for a more thorough explanation of weighted averages). Although other approaches are also possible, the use of weighted averages allows a “stratified sampling”, whereby the entire waste stream was divided into different sources (i.e., different types generators) so that each could be characterized individually but the results combined to still provide data on the County’s entire waste stream.

Procedures for Determining Waste Quantities

In Thurston County, the most cost-effective and accurate means for collecting waste quantity data was a combination of surveys and use of existing County records. Since the County desired that a customer survey be conducted (see Figure A-3), additional record-keeping during this survey was easily accomplished, and this data could then be used to break down the data from the County’s scalehouse records. The scalehouse records of interest are the tonnages of waste delivered by vehicle type.

The vehicle types used in the County’s scalehouse records include:

- | | |
|-------------------------------------|-----------------------------|
| 1 - City Transfer Trailer | 14 - Pickup Trucks |
| 2 - Roll-Off (10 to 19 cubic yards) | 15 - Dump Trucks |
| 3 - Roll-Off (20 to 29 c.y.) | 16 - Containers |
| 4 - Roll-Off (30 to 39 c.y.) | 17 - Roll-Off Truck |
| 5 - Roll-Off (40+ c.y.) | 18 - Flat Bed Truck |
| 6 - Rear Loader | 19 - Closed/Step Van |
| 7 - Front Loader | 20 - Not Specified |
| 8 - Side Loader | 21 - Pickup plus Trailer |
| 9 - Other Transfer Trailer | 22 - Van plus Trailer |
| 10 - Other Transfer Tractor | 23 - Car plus Trailer |
| 11 - Truck and Pup Trailer | 24 - Curbside Recycle Truck |
| 12 - Van | 26 - Vactor Waste Truck |
| 13 - Automobile | |

It should be noted that the scalehouse records for vehicle types are not intended to be precise, and that different scalehouse personnel may characterize vehicles differently as a result. Furthermore, any one type of vehicle, even if properly coded, can potentially serve two or more types of waste generators. Thus,

scalehouse records cannot be used without supplemental data such as was collected through the customer survey in this project. The survey data allowed for a “reality check” on how the codes for vehicle types were being used in Thurston County, while also providing the hard data needed to allocate tonnages for specific vehicle types to the waste generator categories used in this study.

Not all of the vehicle types needed to be addressed by this study. The waste brought in by transfer vehicles (types 1, 9, and 10), vector waste trucks (26) and recycling vehicles (24, but this category is not currently being used for any purpose), could be ignored for the purpose of this study. Examining the data from County records on vehicle types and comparing this to the information collected through the survey conducted for this project, several conclusions can be drawn:

- As could be expected, the vehicle types that correspond to the trucks typically used by haulers were found through the survey to be primarily carrying waste from Single-Family Homes and Commercial sources. These types of trucks included roll-off’s (vehicle types 2, 3, 4, 5, 16 and 17) and rear-, front-, and side-loading trucks (vehicle types 6, 7 and 8). There were, however, a number of these trucks that were also found to be carrying Non-Residential Self-Haul waste. These were primarily vehicle type #6, and included examples such as GSA hauling waste from the State Capitol (by definition, this is Non-Residential Self-Haul, although it could be argued that this waste does not differ significantly from other commercial sources).
- The containers from the rural drop boxes are primarily categorized as roll-offs that are 40 cubic yards and more in size (vehicle type #5), but these are not the only roll-off’s in this category. The rural drop boxes contribute about 20% of the transactions for this category (plus a few transactions in other roll-off categories), or 2,771.9 tons in 1999.
- Again as could be expected, smaller vehicles such as cars and pickup trucks were found to carrying Residential Self-Haul and Non-Residential Self-Haul wastes. Larger trucks, such as dump trucks and flat bed trucks, were found to be primarily or wholly carrying Non-Residential Self-Haul wastes. A small amount of waste was delivered by the City of Olympia (225.66 tons) in smaller vehicles (or not specified, which was primarily used by scalehouse personnel for smaller vehicles) and LeMay (135.8 tons in dump trucks, other trucks, and unspecified vehicles). These amounts are the equivalent of less than one percent of the total amount for the smaller vehicles and so were ignored.
- The data for tonnages by vehicle type appears to include certain materials that are not defined as “waste” for the purpose of this study. Other reports from the County records show the weight of these materials, which includes yard debris dropped off separately, compost purchased, transfers from the Hazo-House and recycling area, waste from construction activities at the landfill and litter pickup from the landfill grounds. Furthermore, the tonnages shown for vector waste trucks (vehicle type #26) does not agree with the tons of this material shown in County report of tonnages by material type. Looking at the County’s records on tonnages by material, a total of 1,041.29 tons of vector waste and grit is shown as received in 1999, versus 616.85 tons shown for vector truck waste trucks. The difference, 424.44 tons, is suspected to have been brought in on roll-off’s and other trucks, and thus is included in the tonnage data for truck types 2 through 8.

Based on these observations and the available data, the following process was used to breakdown the County’s total waste stream into quantities from each source (see Table A-1):

1. The annual tonnages (for 1999) for roll-off’s and other garbage collection trucks (types 2 through 8, 16 and 17) were summed up to determine the amount brought in by “garbage collection vehicles”.

TABLE A-1
DETERMINATION OF WASTE QUANTITIES BY TYPE OF GENERATOR
THURSTON COUNTY WASTE COMPOSITION STUDY

TYPE OF VEHICLE AND ACCOUNTING STEP	TOTAL WASTE QUANTITY	ALLOCATION TO TYPE OF GENERATOR			
		Residential Self-Haul	Non-Res. Self-Haul	Single-Family	Commercial
Garbage Collection Vehicles;					
1. Sum of truck types 2 through 8, 16 and 17	108,054.8				
2. Rural drop boxes	- 2,771.9	2,596.3	174.6		
3. Olympia tonnages	- 31,530.2			7,040.2	24,490.0
4. LeMay tonnages	- 68,631.7			31,090.2	37,541.5
5. Est. amt. of Non-Res. Self-Haul	- 546.0		546.0		
6. Remainder (ignore)	= 4,574.9				
Other Commercial Vehicles;					
7. Sum of truck types 15, 18 and 19	13,806.4				
8. Deliveries by Olympia and LeMay	- 69.0				
9. Remainder	= 13,737.4		13,737.4		
Self-Haul Vehicles;					
10. Sum of vehicle types 11 - 14, and 20 - 23	28,704.0				
11. Deliveries by Olympia and LeMay	- 292.6				
12. Est. amt. from Non-Res. Self-Haul sources	- 113.7		113.7		
13. Amt. of yard waste and compost	- 1,124.1				
14. Self-haul waste, adjusted amount	= 27,173.6	22,608.4	4,565.2		
15. Totals		25,204.7	19,136.9	38,130.4	62,031.5
TOTAL WASTE STREAM = 144,504 tons per year					

Note: All figures are tons per year (1999 data).

2. The tonnage contributed by the rural drop boxes was removed from the figure for garbage collection vehicles. This waste is primarily Residential Self-Haul but likely a small amount of Non-Residential Self-Haul is also included in this figure. The division between residential and non-residential sources is based on survey data for weekends at the landfill, on the assumption that this is the best available indicator of the trends at the rural drop boxes.
3. The tonnage contributed by the City of Olympia was removed from the figure for garbage collection vehicles, and this amount was characterized into Single-Family Homes and Commercial waste based on information from the City. There is a difference of almost 3,000 tons (2,988.7 tons) between the figures used by Olympia and the figures reported by Thurston County for the Olympia's waste deliveries. The reason(s) for this difference are uncertain, but it is thought to possibly be the result of as-yet-uncorrected errors in the County's records, so Olympia's figure was used for this analysis and the total waste tonnage shown in Step #1 was also adjusted by this amount.
4. The tonnage contributed by LeMay was removed from the figure for garbage collection vehicles, and this amount was characterized into Single-Family Homes and Commercial waste based on the survey results.
5. The amount of Non-Residential Self-Haul waste deliveries that are included in the figure for garbage collection vehicles was estimated based on the average weekly amount found in the survey. The estimated amount, 546 tons, is a conservative figure because not all vehicles were surveyed and so not all of these vehicles were measured through this approach.
6. The remaining tonnage shown for garbage collection vehicles, 4,574.9 tons, appears to be a mixture of waste from various generators and non-waste materials (yard debris, vector waste and possibly other materials). For instance, the additional amount of vector waste, 424.44 tons, which was not accounted for in the breakdown by vehicle type, is probably included in this figure. The approximate 4,000 tons remaining after accounting for the additional vector waste is significant (at 2.8 percent of the County's total waste stream), but is ignored for the remainder of this analysis due to the uncertainty of the waste or other materials that are included in this amount.
7. Other large vehicles, including dump trucks (vehicle type 15), flat bed trucks (18) and closed/step vans (19) were found through the survey to contain primarily Non-Residential Self-Haul. The amount of waste delivered by these trucks was summed up to determine the weight from "other commercial vehicles".
8. The amount of waste for other commercial vehicles was adjusted to remove known deliveries from LeMay and the City of Olympia. These amounts have already been accounted for in the figures shown in steps 3 and 4.
9. The end result, 13,737.4 tons, was attributed to Non-Residential Self-Haul waste generators. This figure likely also contains a small amount of Residential Self-Haul waste, but the amount of error introduced by this approach should be relatively small and should in fact help to counter error in the opposite direction that may be introduced in the next few steps.
10. The remaining vehicles of interest to this analysis are mostly smaller vehicles such as cars and pickup trucks that are generally used for residential or non-residential self-haul waste. The weights of waste brought in by these vehicles (types 11 through 14 and 20 through 23) were summed up to provide the starting point for determining self-haul waste quantities.
11. The amount of waste contributed to the self-haul vehicle categories by LeMay and the City of Olympia were then subtracted. These amounts have already been accounted for in the figures shown in steps 3 and 4.
12. The customer survey made special note of large deliveries by Non-Residential Self-Haul generators, and to the extent that these could be correlated to County records (for the purpose of filling in the weight of the load dropped off), the survey results can be used to estimate an average weekly amount

of this type of load. The average figure was used to account for these larger loads to provide additional precision in the allocation of waste delivered by self-haul vehicles.

13. The amount of self-haul waste was further adjusted by the amount of compost that was purchased, a figure that is presumed to be included in the data by vehicle type.
14. The adjusted amount of self-haul waste delivered, which is a figure that corresponds to the amount of waste delivered primarily by smaller vehicles, can be allocated between Residential Self-Haul and Non-Residential Self-Haul generators based on the number of vehicles for each group (as determined by the survey). Because of the patterns in waste deliveries that exist for weekdays versus weekends, this calculation was conducted separately for Monday through Friday versus Saturday and Sunday.
15. Finally, the total amount of waste disposed by each type of generator can be summed up using the amounts shown in each column of Table A-1.

E. WEIGHTED AVERAGES

Need for Weighted Averages

The waste quantity results will be used to derive weighted averages for the waste composition data. The use of weighted averages addresses the fact that the contribution made by each type of generator is different, and so the relative amount of waste disposed must be taken into account when calculating the average composition for the County's entire waste stream. Since waste flows for most types of generators vary throughout the year, weighted averages can also be used to take into account seasonal variation in waste quantities and composition when calculating an annual average for specific types of waste generators.

For example, the quantity and composition of residential self-haul waste varies considerably throughout the year. The typical pattern for cool-winter climates such as the Pacific Northwest is that the lowest quantity is brought in during the winter months and the largest quantity is generally disposed in the spring and fall. Residential activities in the spring, such as remodeling and yard clean-up, contribute to the seasonal increase in self-haul waste while also causing a change in the composition of this waste stream. Thus, there is a significantly higher percentage of some materials (such as wood waste and brush) present in the higher waste flows in the spring for this type of generator. If equal weight (through a simple averaging of all sample results) were given to samples taken during the lower waste flows occurring in the winter months, the annual average percentage and total amount of materials such as wood waste and brush would be significantly under-stated.

Because the waste flow for each type of waste generator varies throughout the year, and the cycles are distinctly different for residential and non-residential generators, the percentage of the County's waste stream that is contributed by each type of generator varies significantly throughout the year. The composition of each waste stream also varies seasonally, although in general the composition of the commercial and single-family wastes vary less than the two self-haul waste streams. Thus, the County's entire waste stream varies throughout the year due both to changes in the quantity and composition of individual waste substreams. The process of deriving weighted averages is described in greater detail below.

Derivation of Weighted Averages

Weighted averages differ from simple averages in that they take into account the relative amounts contributed by the figures being averaged. In other words, this approach attributes a given weight to the each figure being averaged, in this case the weight corresponds to the relative amount of the waste stream disposed in that season or by that type of generator. The following scenario is provided as a hypothetical example to illustrate the process of deriving a weighted average:

- 1) Assume the single-family waste stream is found to contain 2% newspaper in the first season and 4% in the second season. Furthermore, assume that the waste quantities for single-family generators for each season are found to be 2,600 tons and 2,000 tons, respectively, representing 56.5% and 43.5% of the annual waste flow for this type of generator. A simple average of the above figures for newspaper (2 and 4%) would yield the incorrect conclusion that the annual average for newspaper in the single-family waste stream is 3.0%, whereas the correct method of calculating a weighted average would show the annual average to be 2.9%. The weighted average is derived by multiplying the percentage of newspaper for each season by the fraction of the annual waste stream contributed in that season, or: $(2\% * .565) + (4\% * 0.435) = 2.9\%$.

Although the difference between 3.0% and 2.9% may not appear to be that substantial, it is significant in terms calculating the total quantity of newspaper available for recycling. It is also significant in its potential to have a cumulative impact on the general waste composition results (due to the use of percentages, an error in one number also affects other figures), and there would be larger differences for materials with greater seasonal variations.

- 2) If the annual average for newspaper is 2.9% for single-family wastes, 10.0% for multi-family wastes, 8.0% for residential self-haul, 4.0% for non-residential self-haul, and 8.0% for general non-residential, and these waste streams contribute 35%, 15%, 5%, 5%, and 40% of the entire waste stream, respectively, then the weighted average for newspaper in the County's waste stream is calculated by: $(2.9\% * 0.35) + (10\% * 0.15) + (8\% * 0.05) + (4\% * 0.05) + (8\% * 0.40) = 6.3\%$.

The scope for this task currently calls for results (weighted averages) showing the annual composition and amounts disposed by the five types of generators and for the County-wide average. These results will be calculated by applying an average of the seasonal data to annual disposal tonnages. As an additional task, waste quantity data could instead be applied to quarterly or monthly waste tonnage reports by vehicle type to derive annual figures that are potentially more accurate.

Combined Results for Single-Family Homes

Weighted averages were used to combine single-family results from the City of Olympia and the rest of the County. In this case, the use of weighted averages allowed additional samples to be taken from the City instead of adhering strictly to random selection or a proportionate number of samples. Additional samples were taken from four areas of the City of Olympia (at the City's expense) to assist in evaluating the success of the curbside recycling program. This data (quarterly results and annual averages) was provided directly to the City. The City's results were later combined with results from the rest of the County according to the relative amounts of waste discarded in each area. The results shown in the main report for single-family homes are the combined results for the City and the rest of the County, based on the City discarding 18.6% of the single-family wastes and the rest of the County discarding 81.4% (see Table A-2).

TABLE A-2
SINGLE - FAMILY RESULTS BY SOURCE
THURSTON COUNTY WASTE COMPOSITION STUDY

		Single-Family Homes in <u>Olympia</u>	Single-Family Homes, rest <u>of County</u>	Combined Average for all Single- <u>Family Homes (1)</u>
PAPER	Newspaper	1.85%	3.15%	2.91%
	Cardboard	1.45%	1.73%	1.68%
	Office and Computer	0.22%	0.51%	0.45%
	Mixed Waste Paper	5.70%	6.17%	6.08%
	Magazines	1.77%	1.66%	1.68%
	Milk Cartons, Other	0.38%	0.48%	0.46%
	Non-Recyclable Paper	11.33%	10.29%	10.48%
	Paper Subtotal	22.70%	23.99%	23.75%
PLASTIC	PET Bottles	0.50%	0.83%	0.77%
	HDPE Bottles	0.67%	1.10%	1.02%
	Bottles 3-7	0.08%	0.07%	0.07%
	Plastic Packaging	8.53%	6.88%	7.19%
	Other Plastic Products	2.44%	1.91%	2.01%
	Expanded Polystyrene	0.53%	0.46%	0.48%
	Plastic Subtotal	12.75%	11.25%	11.53%
METAL	Aluminum Cans	0.34%	0.67%	0.61%
	Aluminum Foil	0.32%	0.20%	0.22%
	Tin Cans	1.42%	1.65%	1.60%
	Mixed Metals	0.85%	0.71%	0.74%
	Ferrous Metals	0.46%	1.87%	1.61%
	White Goods	0.00%	0.00%	0.00%
	Non-Ferrous Metals	0.06%	0.02%	0.03%
	Aerosol Cans	0.29%	0.27%	0.28%
	Metal Subtotal	3.74%	5.39%	5.09%
ORGANIC	Food Waste	26.41%	21.32%	22.26%
	Yard Debris	4.42%	3.62%	3.77%
	Organics Subtotal	30.83%	24.94%	26.03%
GLASS	Clear Bottles	1.92%	2.27%	2.20%
	Brown Bottles	0.69%	0.91%	0.87%
	Green Bottles	0.14%	0.27%	0.25%
	Non-Recyclable Glass	0.67%	0.17%	0.26%
	Glass Subtotal	3.42%	3.62%	3.58%
OTHER WASTES	Tires	0.00%	0.00%	0.00%
	Rubber Products	0.09%	0.33%	0.29%
	Cosmetics	0.46%	0.14%	0.20%
	Disposable Diapers	4.06%	5.11%	4.91%
	Textiles	2.53%	4.43%	4.08%
	Carpeting	0.09%	0.07%	0.08%
	Leather	0.18%	0.02%	0.05%
	Furniture	0.00%	0.00%	0.00%
	Fines	4.54%	3.96%	4.07%
	Ash, Dust	0.09%	0.50%	0.43%
	Misc. Organics	8.37%	7.75%	7.86%
	Misc. Inorganics	0.12%	0.23%	0.21%
	Other Subtotal	20.52%	22.56%	22.18%
WOOD and C&D	Wood	1.30%	0.74%	0.84%
	C&D	1.10%	1.76%	1.63%
	Wood, C&D Subtotal	2.39%	2.50%	2.48%
SPECIAL WASTES	Paints and Solvents	0.00%	0.06%	0.05%
	Automotive	0.02%	0.03%	0.03%
	Home and Garden	0.11%	0.01%	0.03%
	Other	3.51%	5.66%	5.26%
	Special Waste Subtotal	3.64%	5.75%	5.36%
TOTALS		100.0%	100.0%	100.0%
	Pounds of Samples Sorted:	3,311	6,457	9,768
	Number of Samples Sorted:	16	31	47

Notes: All figures are percent by weight.

1. The combined average of the results for single-family homes is based on the relative contribution to the waste stream by each source (Olympia = 18.6% and rest of County = 81.4%).

APPENDIX B
STATISTICAL CERTAINTY OF RESULTS

APPENDIX B STATISTICAL CERTAINTY OF RESULTS

A. INTRODUCTION

There is a quantifiable degree of error associated with the waste composition results shown in this report, and this error can be expressed as confidence intervals. This appendix shows the confidence intervals associated with waste composition results.

B. METHODOLOGY

For this type of study, statistical certainty can be expressed using confidence intervals. Confidence intervals are the range of values for which one can be confident (to a given degree, such as 90% confident) that the true value falls within. The confidence limits are also sometimes shown as a “plus or minus value”. For example, the results of this study show that the potential amount of aluminum cans in the waste stream is 0.42% +/- about 0.2%. This is based on a confidence interval of 90%, so that in this example one can be 90% confident that the true value for newspaper falls between 0.22% to 0.61%.

The calculation of confidence intervals for this study is complicated slightly by the use of weighted averages. The calculation of confidence intervals for weighted averages begins with calculating standard deviations for each material for each generator and for each quarter. The standard deviation is then converted to the standard error of the mean (SEM) by dividing the standard deviation by the square root of the number of samples. Once the SEM has been determined for each material, each quarter and each waste generator, it can be manipulated in the same way as the average composition figures by using weighted averages as appropriate for the data being combined. The final SEM's can then be multiplied by a factor of 1.64 and then added or subtracted from the average composition values to derive the upper and lower confidence limits, respectively. The factor of 1.64 is determined by the choice of a 90% confidence interval.

C. RESULTS

Table B-1 shows the confidence limits associated with the composition results for each generator and for the entire County.

**TABLE B-1
CONFIDENCE LIMITS BY TYPE OF GENERATOR
THURSTON COUNTY WASTE COMPOSITION STUDY**

	Residential Self-Haul			Non-Residential Self-Haul			Single-Family, exc. Olympia		
	Average	LCL	UCL	Average	LCL	UCL	Average	LCL	UCL
Newspaper	1.35%	0.28%	2.42%	0.59%	0.00%	1.31%	3.15%	2.19%	4.12%
Cardboard	1.78%	0.63%	2.93%	6.83%	1.79%	11.86%	1.73%	0.94%	2.53%
Office and Computer	0.12%	0.00%	0.25%	0.11%	0.00%	0.26%	0.51%	0.14%	0.88%
Mixed Waste Paper	3.65%	1.90%	5.41%	1.19%	0.01%	2.37%	6.17%	4.38%	7.96%
Magazines	1.08%	0.11%	2.04%	0.76%	0.14%	1.39%	1.66%	1.00%	2.31%
Milk Cartons, Other	0.12%	0.04%	0.20%	0.05%	0.00%	0.10%	0.48%	0.32%	0.63%
Other Paper	6.34%	2.89%	9.78%	4.95%	1.41%	8.49%	10.29%	8.81%	11.76%
Paper Subtotal	14.43%	8.96%	19.90%	14.48%	6.43%	22.53%	23.99%	21.27%	26.70%
PET Bottles	0.50%	0.22%	0.78%	0.19%	0.00%	0.38%	0.83%	0.50%	1.16%
HDPE Bottles	0.69%	0.33%	1.05%	0.14%	0.02%	0.26%	1.10%	0.65%	1.55%
Bottles 3-7	0.08%	0.00%	0.15%	0.01%	0.00%	0.02%	0.07%	0.02%	0.12%
Plastic Packaging	4.93%	3.43%	6.44%	3.63%	1.02%	6.24%	6.88%	5.54%	8.22%
Other Plastic Products	2.58%	1.20%	3.97%	2.36%	0.40%	4.33%	1.91%	1.06%	2.75%
Expanded Polystyrene	0.54%	0.15%	0.93%	0.22%	0.00%	0.45%	0.46%	0.32%	0.61%
Plastic Subtotal	9.32%	7.01%	11.63%	6.55%	2.53%	10.57%	11.25%	8.87%	13.64%
Aluminum Cans	0.32%	0.12%	0.53%	0.16%	0.03%	0.29%	0.67%	0.45%	0.89%
Aluminum Foil	0.11%	0.04%	0.18%	0.02%	0.00%	0.05%	0.20%	0.13%	0.28%
Tin Cans	1.16%	0.26%	2.06%	0.20%	0.00%	0.42%	1.65%	1.16%	2.13%
Mixed Metals	5.36%	2.09%	8.64%	2.26%	0.13%	4.40%	0.71%	0.27%	1.15%
Ferrous Metals	4.75%	0.68%	8.83%	3.78%	1.16%	6.40%	1.87%	0.21%	3.53%
White Goods	3.03%	0.00%	7.22%	1.40%	0.00%	2.95%	0.00%	0.00%	0.00%
Non-Ferrous Metals	0.21%	0.00%	0.46%	0.61%	0.00%	1.40%	0.02%	0.00%	0.04%
Aerosol Cans	0.34%	0.12%	0.55%	0.02%	0.00%	0.05%	0.27%	0.13%	0.41%
Metal Subtotal	15.30%	7.21%	23.38%	8.46%	3.39%	13.54%	5.39%	3.77%	7.01%
Clear Bottles	2.37%	0.75%	3.99%	0.38%	0.00%	0.78%	2.27%	1.36%	3.18%
Brown Bottles	0.86%	0.10%	1.63%	0.21%	0.00%	0.53%	0.91%	0.33%	1.48%
Green Bottles	0.80%	0.00%	1.84%	0.06%	0.00%	0.13%	0.27%	0.05%	0.50%
Other Glass	0.73%	0.15%	1.30%	0.95%	0.00%	2.16%	0.17%	0.09%	0.25%
Glass Subtotal	4.77%	1.81%	7.73%	1.61%	0.00%	3.30%	3.62%	2.55%	4.69%
Food Waste	16.85%	9.62%	24.08%	1.61%	0.17%	3.05%	21.32%	17.69%	24.95%
Yard Debris	4.49%	0.00%	9.37%	1.37%	0.00%	3.30%	3.62%	1.31%	5.93%
Organics Subtotal	21.34%	12.88%	29.79%	2.98%	0.14%	5.83%	24.94%	20.92%	28.96%
Tires	0.57%	0.00%	1.47%	0.19%	0.00%	0.45%	0.00%	0.00%	0.00%
Rubber Products	0.12%	0.00%	0.24%	0.37%	0.00%	0.92%	0.33%	0.08%	0.59%
Cosmetics	0.21%	0.02%	0.41%	0.03%	0.00%	0.07%	0.14%	0.04%	0.24%
Disposable Diapers	1.63%	0.00%	3.33%	0.21%	0.00%	0.51%	5.11%	2.98%	7.24%
Textiles	3.16%	1.63%	4.69%	0.96%	0.22%	1.70%	4.43%	2.58%	6.28%
Carpeting	0.74%	0.00%	1.64%	6.46%	0.00%	14.55%	0.07%	0.00%	0.19%
Leather	0.05%	0.00%	0.12%	0.00%	0.00%	0.01%	0.02%	0.00%	0.06%
Furniture	4.98%	0.00%	10.07%	1.03%	0.00%	2.36%	0.00%	0.00%	0.00%
Fines	1.70%	0.97%	2.43%	0.74%	0.18%	1.31%	3.96%	3.19%	4.73%
Ash, Dust	0.61%	0.00%	1.32%	0.04%	0.00%	0.10%	0.50%	0.01%	1.00%
Misc. Organics	2.41%	1.12%	3.71%	2.16%	0.56%	3.76%	7.75%	6.38%	9.11%
Misc. Inorganics	0.62%	0.00%	1.28%	0.38%	0.00%	0.91%	0.23%	0.00%	0.49%
Other Subtotal	16.80%	9.57%	24.03%	12.59%	3.71%	21.47%	22.56%	18.78%	26.33%
Wood	9.54%	2.79%	16.28%	28.34%	16.08%	40.60%	0.74%	0.39%	1.10%
C&D Wastes	4.41%	0.29%	8.52%	24.82%	13.00%	36.64%	1.76%	0.00%	3.95%
Special Wastes	4.11%	0.73%	7.48%	0.16%	0.01%	0.31%	5.75%	2.45%	9.06%

Notes:

LCL = Lower Confidence Limit for 90% confidence interval.
UCL = Upper Confidence Limit for 90% confidence interval.
All figures are percentages by weight.

TABLE B-1, continued
CONFIDENCE LIMITS BY TYPE OF GENERATOR
THURSTON COUNTY WASTE COMPOSITION STUDY

	Single-Family, Olympia			Commercial			Annual Average for Entire County		
	Average	LCL	UCL	Average	LCL	UCL	Average	LCL	UCL
Newspaper	1.85%	0.82%	2.89%	1.71%	0.66%	2.77%	1.82%	0.83%	2.81%
Cardboard	1.45%	0.09%	2.80%	4.72%	2.26%	7.18%	3.68%	1.52%	5.84%
Office and Computer	0.22%	0.05%	0.39%	0.79%	0.25%	1.32%	0.49%	0.13%	0.85%
Mixed Waste Paper	5.70%	3.75%	7.64%	3.76%	2.06%	5.47%	4.02%	2.34%	5.69%
Magazines	1.77%	0.40%	3.15%	1.52%	0.34%	2.70%	1.38%	0.42%	2.35%
Milk Cartons, Other	0.38%	0.20%	0.55%	0.35%	0.04%	0.65%	0.30%	0.10%	0.49%
Other Paper	11.33%	10.14%	12.52%	9.82%	6.63%	13.01%	8.74%	5.93%	11.56%
Paper Subtotal	22.70%	19.19%	26.21%	22.67%	16.92%	28.42%	20.43%	15.19%	25.67%
PET Bottles	0.50%	0.33%	0.66%	0.49%	0.20%	0.77%	0.52%	0.25%	0.80%
HDPE Bottles	0.67%	0.34%	0.99%	0.63%	0.14%	1.13%	0.68%	0.27%	1.08%
Bottles 3-7	0.08%	0.00%	0.17%	0.03%	0.00%	0.06%	0.05%	0.00%	0.09%
Plastic Packaging	8.53%	6.85%	10.22%	9.33%	5.78%	12.88%	7.24%	4.74%	9.74%
Other Plastic Products	2.44%	1.01%	3.87%	5.71%	1.00%	10.42%	3.74%	0.97%	6.52%
Expanded Polystyrene	0.53%	0.34%	0.72%	0.48%	0.17%	0.79%	0.46%	0.18%	0.73%
Plastic Subtotal	12.75%	10.68%	14.81%	16.67%	10.25%	23.10%	12.69%	8.39%	17.00%
Aluminum Cans	0.34%	0.08%	0.60%	0.41%	0.23%	0.59%	0.42%	0.22%	0.61%
Aluminum Foil	0.32%	0.14%	0.50%	0.10%	0.03%	0.17%	0.13%	0.06%	0.20%
Tin Cans	1.42%	0.75%	2.09%	0.82%	0.37%	1.26%	1.00%	0.49%	1.52%
Mixed Metals	0.85%	0.35%	1.34%	2.68%	0.98%	4.37%	2.58%	0.88%	4.28%
Ferrous Metals	0.46%	0.00%	1.01%	2.18%	0.44%	3.92%	2.69%	0.50%	4.88%
White Goods	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.71%	0.00%	1.65%
Non-Ferrous Metals	0.06%	0.00%	0.17%	0.14%	0.00%	0.27%	0.18%	0.00%	0.40%
Aerosol Cans	0.29%	0.11%	0.47%	0.15%	0.03%	0.26%	0.20%	0.07%	0.33%
Metal Subtotal	3.74%	2.86%	4.63%	6.47%	3.58%	9.37%	7.91%	4.19%	11.63%
Clear Bottles	1.92%	1.21%	2.63%	1.62%	0.68%	2.55%	1.74%	0.77%	2.71%
Brown Bottles	0.69%	0.19%	1.20%	0.74%	0.09%	1.39%	0.73%	0.12%	1.33%
Green Bottles	0.14%	0.00%	0.28%	0.54%	0.00%	1.08%	0.45%	0.00%	0.92%
Other Glass	0.67%	0.21%	1.12%	1.65%	0.00%	4.07%	1.03%	0.00%	2.37%
Glass Subtotal	3.42%	2.52%	4.31%	4.55%	1.46%	7.64%	3.94%	1.60%	6.28%
Food Waste	26.41%	21.56%	31.26%	14.98%	8.44%	21.52%	15.46%	10.18%	20.73%
Yard Debris	4.42%	0.09%	8.76%	2.52%	0.00%	5.79%	3.04%	0.00%	6.26%
Organics Subtotal	30.83%	23.68%	37.99%	17.50%	9.54%	25.46%	18.50%	12.02%	24.98%
Tires	0.00%	0.00%	0.00%	0.08%	0.00%	0.21%	0.16%	0.00%	0.41%
Rubber Products	0.09%	0.01%	0.16%	0.47%	0.11%	0.83%	0.35%	0.04%	0.65%
Cosmetics	0.46%	0.00%	0.94%	0.10%	0.00%	0.19%	0.14%	0.01%	0.26%
Disposable Diapers	4.06%	1.73%	6.38%	1.17%	0.09%	2.25%	2.11%	0.74%	3.48%
Textiles	2.53%	1.56%	3.51%	1.90%	0.55%	3.26%	2.57%	1.18%	3.97%
Carpeting	0.09%	0.00%	0.23%	3.51%	0.00%	7.60%	2.51%	0.00%	5.53%
Leather	0.18%	0.00%	0.41%	0.01%	0.00%	0.03%	0.03%	0.00%	0.07%
Furniture	0.00%	0.00%	0.00%	0.03%	0.00%	0.08%	1.02%	0.00%	2.10%
Fines	4.54%	3.56%	5.52%	1.91%	1.21%	2.62%	2.29%	1.57%	3.01%
Ash, Dust	0.09%	0.03%	0.15%	0.08%	0.00%	0.20%	0.26%	0.00%	0.55%
Misc. Organics	8.37%	6.58%	10.16%	3.63%	2.39%	4.86%	4.34%	2.99%	5.69%
Misc. Inorganics	0.12%	0.02%	0.21%	0.88%	0.00%	2.08%	0.59%	0.00%	1.35%
Other Subtotal	20.52%	17.42%	23.62%	13.77%	7.61%	19.93%	16.36%	10.32%	22.41%
Wood	1.30%	0.03%	2.56%	12.15%	2.70%	21.61%	10.86%	3.86%	17.85%
C&D Wastes	1.10%	0.00%	2.41%	5.56%	1.23%	9.90%	6.88%	2.20%	11.55%
Special Wastes	3.64%	1.13%	6.16%	0.64%	0.19%	1.10%	2.43%	0.79%	4.07%

Notes:

LCL = Lower Confidence Limit for 90% confidence interval.
UCL = Upper Confidence Limit for 90% confidence interval.
All figures are percentages by weight.

APPENDIX C

**COMPOSITION DATA FOR SPECIFIC
NON - RESIDENTIAL GENERATORS**

APPENDIX C COMPOSITION DATA FOR SPECIFIC NON - RESIDENTIAL GENERATORS

A. INTRODUCTION

This appendix shows the data for specific businesses and institutions, or specific types of non-residential generators where the name of the business may not be available. This data generally has less statistical certainty than the primary results of this study, but it is provided here as supplemental information that may assist commercial recycling programs.

B. RESULTS

Table C-1 shows the results of sorting samples from various businesses and institutions. The results include samples that happened to be chosen through random selection of incoming vehicles, in which case the results are included in the general results shown for Non-Residential Self-Haul and Commercial generators, and also includes samples that were arranged by the City of Olympia. In the latter case, where the samples were pre-arranged by Olympia, the results are not included in the general results for Non-Residential Self-Haul and Commercial generators since those samples were not randomly selected.

Through either random selection or pre-arrangements, samples were taken from the following businesses and institutions:

- Schools, including one elementary school, South Puget Sound Community College, and five high schools in Lacey, Olympia and Tumwater.
- General Retail includes two samples from K-Mart, and single samples from Fred Meyer, Rite-Aid and Costco,
- Retail, Lumber, includes a sample from Lumberman's and one from Tumwater Lumber.
- Grocery stores includes four samples from various Albertson's stores, two from Top Foods, and one from a Safeway store.
- Hotels includes two samples from a Cavanaugh's and one from Tyee Inn.
- State Capitol samples includes one from the grounds and two of general garbage.
- Beverage Bottlers and Distributors includes a sample each from Columbia Beverage, Crown Beverage, and Miller Brewing.
- Country Clubs includes a sample each from the Indian Summer Golf Course and the Olympia Country Club.
- The Construction and Demolition samples included seven samples from roofing loads, but this was the only subcategory that appeared to have sufficient numbers to be characterized separately. In the second column, under "All Construction", the roofing samples are included along with all other samples that could be identified as being from construction, demolition or remodeling projects.

The waste composition data for these sources is shown in Table C-1. At the bottom of Table C-1 is shown the number of samples for each generator, which is provided as a indicator of the level of reliability of the results. For instance, the results for grocery stores are based on seven samples, which

provides a relatively accurate assessment of the composition of waste from this source. The data for country clubs and several other businesses is based on only two or three samples and so should not be considered very reliable.

There were a substantial number of other samples that were taken from specific businesses, but that are represented by only one or two samples and are not easily grouped with other businesses. Grouping of samples would be helpful in improving the reliability of the results by avoiding the random variability that potentially exists with any one sample, as long as meaningful groupings can be done. Businesses and institutions for which only one or two samples were taken include a McDonalds, a hospital, Cardinal Glass, Carmen Manufacturing, the County jail, Intel, Keystone Masonry, Olympia City Hall, Pacific Marble and Granite, Pine Meadows Gardening, a church, and several others.

**TABLE C-1
SELECT NON-RESIDENTIAL GENERATORS
THURSTON COUNTY WASTE COMPOSITION STUDY**

		General		Retail,		
		<u>Schools</u>	<u>Retail</u>	<u>Lumber</u>	<u>Grocery</u>	<u>Hotels</u>
PAPER	Newspaper	0.9%	2.5%	0.0%	1.0%	2.9%
	Cardboard	2.1%	13.6%	4.8%	5.3%	1.0%
	Office and Computer	0.8%	2.0%	0.0%	0.3%	3.1%
	Mixed Waste Paper	5.0%	8.1%	0.0%	1.0%	3.5%
	Magazines	1.2%	0.3%	0.0%	0.1%	0.1%
	Milk Cartons, Other	2.8%	0.1%	0.0%	0.2%	0.6%
	Non-Recyclable Paper	15.7%	8.3%	2.0%	20.2%	10.1%
	Paper Subtotal	28.4%	34.9%	6.7%	28.1%	21.4%
PLASTIC	PET Bottles	2.2%	0.4%	0.0%	0.2%	0.8%
	HDPE Bottles	0.6%	0.1%	0.0%	0.5%	0.4%
	Bottles 3-7	0.0%	0.0%	0.0%	0.0%	0.0%
	Plastic Packaging	9.7%	10.8%	3.9%	11.2%	5.6%
	Other Plastic Products	1.4%	8.7%	0.0%	0.6%	2.0%
	Expanded Polystyrene	0.8%	1.1%	0.0%	0.8%	0.0%
	Plastic Subtotal	14.7%	21.2%	3.9%	13.4%	8.9%
METAL	Aluminum Cans	0.8%	0.4%	0.1%	0.1%	0.7%
	Aluminum Foil	0.3%	0.0%	0.0%	0.2%	0.1%
	Tin Cans	1.0%	0.3%	0.0%	1.1%	0.6%
	Mixed Metals	1.1%	0.8%	1.6%	0.0%	0.1%
	Ferrous Metals	0.5%	5.9%	1.3%	0.2%	0.4%
	White Goods	0.0%	0.0%	0.0%	0.0%	0.0%
	Non-Ferrous Metals	0.3%	0.2%	0.0%	0.0%	0.2%
	Aerosol Cans	0.0%	0.2%	0.0%	0.1%	0.4%
Metal Subtotal	4.1%	7.8%	2.9%	1.8%	2.5%	
GLASS	Clear Bottles	2.8%	0.8%	0.0%	0.7%	3.1%
	Brown Bottles	0.1%	0.1%	0.0%	0.0%	4.0%
	Green Bottles	0.0%	0.2%	0.0%	0.1%	4.6%
	Other Glass	0.0%	0.0%	0.0%	0.0%	0.4%
	Glass Subtotal	2.9%	1.2%	0.0%	0.8%	12.1%
ORGANIC	Food Waste	29.8%	14.2%	0.0%	47.3%	44.8%
	Yard Debris	2.7%	0.2%	0.0%	2.4%	1.0%
	Organics Subtotal	32.5%	14.4%	0.0%	49.7%	45.9%
OTHER WASTE	Tires	0.0%	0.0%	0.0%	0.0%	0.0%
	Rubber Products	0.1%	0.4%	0.0%	0.0%	0.1%
	Cosmetics	0.0%	0.2%	0.0%	0.0%	0.9%
	Disposable Diapers	0.7%	0.2%	0.0%	0.0%	0.8%
	Textiles	2.3%	0.1%	0.0%	0.2%	0.7%
	Carpeting	0.0%	0.0%	0.0%	0.0%	0.0%
	Leather	0.0%	0.0%	0.0%	0.0%	0.0%
	Furniture	0.0%	0.0%	0.0%	0.0%	0.0%
	Fines	3.4%	2.2%	3.0%	0.9%	1.7%
	Ash, Dust	0.0%	0.0%	0.0%	0.0%	0.0%
	Misc. Organics	6.3%	2.1%	0.0%	2.4%	4.4%
	Misc. Inorganics	0.8%	1.0%	0.0%	0.1%	0.2%
	Special Wastes	0.1%	2.1%	0.0%	0.0%	0.1%
	Other Subtotal	13.9%	8.2%	3.0%	3.6%	8.9%
WOOD and C&D	Wood	3.0%	10.4%	71.0%	2.4%	0.3%
	Const./Demo. Wastes	0.6%	2.0%	12.4%	0.1%	0.0%
	Wood, C&D Subtotal	3.6%	12.4%	83.4%	2.6%	0.3%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%
	Number of Samples	8	5	2	7	3

All figures are percentages by weight, except for the sample numbers shown in the bottom row.

TABLE C-1, continued
SELECT NON-RESIDENTIAL GENERATORS
THURSTON COUNTY WASTE COMPOSITION STUDY

		State	Beverage	Country	Construction and Demolition	
		<u>Capitol</u>	<u>Bottlers and Dist.</u>	<u>Club</u>	<u>Roofing</u>	<u>All Const.</u>
PAPER	Newspaper	0.5%	0.0%	0.9%	0.3%	0.1%
	Cardboard	9.8%	4.1%	5.8%	0.4%	4.2%
	Office and Computer	1.0%	0.0%	0.5%	0.1%	0.1%
	Mixed Waste Paper	1.9%	4.8%	6.2%	2.4%	0.5%
	Magazines	0.4%	0.0%	4.3%	0.9%	0.1%
	Milk Cartons, Other	0.4%	0.0%	0.0%	0.1%	0.0%
	Non-Recyclable Paper	11.8%	11.9%	5.3%	2.8%	2.6%
	Paper Subtotal	25.9%	20.7%	23.1%	6.9%	7.6%
PLASTIC	PET Bottles	0.3%	0.2%	0.4%	0.0%	0.1%
	HDPE Bottles	0.8%	5.5%	0.4%	0.2%	0.1%
	Bottles 3-7	0.0%	0.0%	0.0%	0.0%	0.0%
	Plastic Packaging	5.3%	25.1%	3.1%	0.4%	2.4%
	Other Plastic Products	1.4%	1.1%	0.8%	0.7%	3.5%
	Expanded Polystyrene	0.7%	0.0%	0.4%	0.0%	0.1%
	Plastic Subtotal	8.5%	31.8%	5.0%	1.4%	6.2%
METAL	Aluminum Cans	0.4%	0.1%	0.8%	0.0%	0.0%
	Aluminum Foil	0.1%	0.0%	0.2%	0.0%	0.0%
	Tin Cans	0.8%	0.0%	0.6%	0.2%	0.1%
	Mixed Metals	0.3%	0.0%	0.2%	0.4%	3.1%
	Ferrous Metals	1.0%	0.1%	3.5%	0.4%	5.7%
	White Goods	0.0%	0.0%	0.0%	0.0%	2.2%
	Non-Ferrous Metals	0.9%	0.0%	0.5%	0.0%	0.9%
	Aerosol Cans	0.0%	0.0%	0.2%	0.0%	0.0%
Metal Subtotal	3.5%	0.2%	6.0%	1.0%	12.0%	
GLASS	Clear Bottles	1.1%	0.1%	1.5%	0.2%	0.1%
	Brown Bottles	0.2%	0.5%	1.2%	0.0%	0.0%
	Green Bottles	0.0%	0.3%	0.0%	0.0%	0.0%
	Other Glass	0.1%	12.8%	0.0%	0.0%	1.6%
Glass Subtotal	1.4%	13.7%	2.6%	0.2%	1.7%	
ORGANIC	Food Waste	6.9%	3.5%	3.0%	0.3%	0.3%
	Yard Debris	0.0%	0.0%	5.8%	0.2%	0.3%
	Organics Subtotal	7.0%	3.5%	8.8%	0.5%	0.7%
OTHER WASTE	Tires	0.0%	0.0%	0.7%	0.0%	0.0%
	Rubber Products	0.2%	1.0%	0.0%	0.0%	0.0%
	Cosmetics	0.0%	0.0%	0.0%	0.0%	0.0%
	Disposable Diapers	0.0%	0.0%	0.0%	0.0%	0.0%
	Textiles	0.1%	0.0%	1.6%	0.1%	0.7%
	Carpeting	0.0%	0.0%	0.0%	0.0%	5.7%
	Leather	0.0%	0.0%	0.0%	0.0%	0.0%
	Furniture	0.0%	0.0%	0.0%	0.0%	1.9%
	Fines	0.8%	0.5%	0.6%	0.2%	0.9%
	Ash, Dust	0.0%	0.0%	0.0%	0.0%	0.0%
	Misc. Organics	4.5%	1.1%	4.5%	0.9%	1.8%
	Misc. Inorganics	0.0%	0.0%	0.8%	0.0%	1.7%
	Special Wastes	0.1%	0.0%	0.9%	0.1%	0.1%
	Other Subtotal	5.7%	2.6%	9.2%	1.4%	13.0%
WOOD and C&D	Wood	3.9%	27.3%	44.7%	31.9%	37.8%
	Const./Demo. Wastes	44.1%	0.0%	0.6%	56.8%	21.0%
	Wood, C&D Subtotal	48.1%	27.3%	45.2%	88.6%	58.9%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	
	Number of Samples	3	3	2	7	34

All figures are percentages by weight, except for the sample numbers shown in the bottom row.