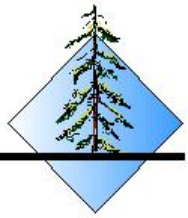
Snohomish County
Washington

SNOHOMISH COUNTY
WASTE COMPOSITION STUDY

APRIL 2009

GREEN SOLUTIONS



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WASTE COMPOSITION STUDY
2008 - 2009

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EXECUTIVE SUMMARY

INTRODUCTION

This report provides the results of a study of the quantity and composition of solid waste (garbage) disposed in Snohomish County, Washington during 2008 - 2009. The Snohomish County Solid Waste Division (the Division) conducts a study such as this about once a decade in order to provide data for program planning, determine future needs, measure the effectiveness of current programs, and note changes in solid waste over time.

The Division hired the environmental consulting firm of Green Solutions, which was assisted by Division staff and the firm Environmental Practices, to conduct the study, perform an analysis of the data, and prepare a report on the findings.

OVERVIEW OF THE METHODOLOGIES USED

The study used transfer station records and information provided by the garbage haulers to determine the amount of waste disposed by different sources. Waste composition data was gathered by sorting randomly-selected samples at the County's transfer stations. For both quantification and composition purposes, all loads of solid waste received at the transfer stations were classified into one of five waste generator categories according to the source of material and the delivery method.

The five categories of waste generators used in this study are:

- **Single-Family Residential**:
  Waste brought in by garbage haulers from single-family homes.
- **Multi-Family Residential**:
  Waste brought in by garbage haulers from apartment buildings.
- **Residential Self-Haul**:
  Residential waste brought in by homeowners, renters and landlords.
- **Non-Residential Self-Haul**:
  Waste from businesses or contractors, brought in by an employee of that business.
- **General Non-Residential**:
  Waste brought in by garbage haulers from commercial, industrial, or institutional sources.

This study only examined solid waste disposed at the transfer stations. The study does not include recyclable materials diverted by generators prior to disposal. This study also does not include special wastes that are disposed at other sites in and out of the County (such as medical wastes, contaminated soils, pulp and paper sludges, and asbestos).

This study was conducted over the course of a year to encompass seasonal variations in the quantities and composition of the County's waste stream. The fieldwork for this study was conducted in April, July and October, 2008, and in January 2009. Sorting activities were conducted for five days each season, including one day on the weekend in order to obtain a representative sampling of residential self-haul customers. Sampling and sorting activities were conducted at each of three main transfer stations in proportion to the amount of waste handled by each station. More information on definitions and procedures can be found in the Glossary and Appendix A of the report.

RESULTS AND CONCLUSIONS

Waste Quantities

The waste quantity results are summarized in Table E-1. As shown below, residential sources disposed of more waste (57.7% of the County's annual amount) than non-residential sources (42.3%). For individual sources, General Non-Residential waste generators disposed of the greatest quantity (34.5% of the total annual amount).

Table E-1
QUANTITIES OF DISPOSED WASTES

Type of Generator	Annual Amounts	
	Tons	Percent
Single-Family	117,500	25.5%
Multi-Family	60,900	13.2%
Residential Self-Haul	87,500	19.0%
Residential Subtotal	**265,900**	**57.7%**
Non-Residential Self-Haul	36,100	7.8%
General Non-Residential	158,700	34.5%
Non-Residential Subtotal	**194,800**	**42.3%**
Total	**460,700**	**100.0%**

Source: County transaction records (Transactions by Customer Summary Report) for 2008 inbound waste tonnages for all sites, as reported by Geoware.

Waste Composition Results

Waste composition results for the entire County are summarized in Figure E-1, and Table E-2 shows the data for each type of waste generator. The noteworthy results for each generator are:

- **Single-Family Residential**: the largest quantity of material in this waste stream is food waste (26.2% by weight). There are also significant quantities of recyclable paper (10.4%), animal excrement (7.2%, which is primarily "kitty litter" and also some dog wastes), metals (7.0%), plastic bags and film (6.0%), compostable paper (5.7%), and disposable diapers (5.7%).

  Significant quantities of recyclable materials remain in this waste stream despite the widespread availability of recycling programs for single-family homes and the availability of free recycling at the Division's facilities. An additional 33.1% of the single-family waste stream could be recycled if materials currently accepted through existing recycling and yard debris programs, and plastic bags and textiles were fully recycled. This equals 38,890 tons per year of additional recyclable materials.

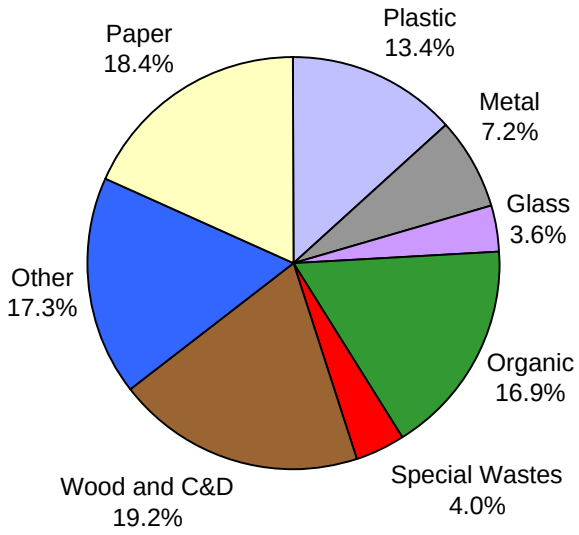
- Multi-Family Residential (apartments): food waste (17.7%) is the single material present in the largest quantity, although the sum of the recyclable grades of paper is higher in aggregate (18.9%). Other materials present in large quantities include wood (6.8%), metals (5.2%), recyclable glass (4.9%), plastic bags and film (4.7%), disposable diapers (4.5%), other plastics (4.4%), textiles (4.2%), compostable paper (4.2%), and yard debris (3.6%).

  The overall percentage of recyclable materials in apartment wastes is higher than for single-family homes, although the tonnage figure for recyclable materials is lower due to the smaller annual quantities of waste from this type of generator. The Multi-Family Residential waste stream contains 44.0% or 26,770 tons per year of recyclable materials.

- **Residential Self-Haul**: self-haul loads from residential sources have more wood, construction debris and metal but less food waste than other residential sources, reflecting activities such as remodeling and the other special projects that are often the source of self-haul waste. Wood is present in the largest quantities (26.0%), followed by metals (11.8%), recyclable paper (9.7%), construction and demolition wastes (7.8%), furniture (6.6%) and other plastics (6.3%). Residential self-haul waste contains 31.6% recyclable materials, or about 27,690 tons per year.

- **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 (29.8%) and other construction waste

Figure E - 1
WASTE COMPOSITION RESULTS



SUMMARY OF RESULTS:

PAPER	Newspaper	1.2%
	Cardboard	3.7%
	Other Recyclable Paper	6.4%
	Compostable Paper	4.9%
	Non-Recyclable Paper	2.2%
	Paper Subtotal	18.4%
PLASTIC	Plastic Bottles	1.4%
	Film and Bags	5.0%
	Other Plastic	7.0%
	Plastic Subtotal	13.4%
METAL	Aluminum Cans	0.4%
	Tin Cans	0.7%
	Other Metals	6.0%
	Metal Subtotal	7.2%
GLASS	Glass Bottles	2.4%
	Other Glass	1.2%
	Glass Subtotal	3.6%
WOOD, C&D	Wood	13.8%
	Const./Demolition	5.4%
	Wood, C&D Subtotal	19.2%
SPECIAL WASTES	Animal Excrement	2.7%
	Other Special Wastes	1.2%
	Special Waste Subtotal	4.0%
ORGANIC	Food Waste	14.6%
	Yard Debris	2.3%
	Organic Subtotal	16.9%
OTHER	Disposable Diapers	2.5%
	Textiles	3.8%
	Carpet and Padding	1.8%
	Furniture	2.4%
	Miscellaneous (1)	6.8%
	Other Subtotal	17.3%
RECYCLABLE SUBTOTAL (2)		33.4%

Notes: All figures are percent by weight.
1) "Miscellaneous" includes tires and other rubber products, cosmetics, ash, dust, and residuals.
2) "Recyclable Subtotal" includes newspaper, cardboard, other recyclable paper, plastic bottles, plastic film and bags, all metals, glass bottles, yard debris and textiles.

Table E-2
COMPOSITION OF DISPOSED WASTES

Type of Material	Annual Average by Waste Generator					Total Waste Stream
	Single-Family	Multi-Family	Res. Self-Haul	Non-Res. Self-Haul	General Non-Res.	
Recyclable Paper	10.4	18.9	9.7	3.1	11.7	11.3
Compostable Paper	5.7	4.2	1.1	0.1	7.7	4.9
Other Paper	2.2	1.2	1.5	1.3	3.2	2.2
Plastic Bottles	1.7	2.5	1.0	0.2	1.4	1.4
Plastic Bags, Film	6.0	4.7	1.9	1.3	7.0	5.0
Other Plastics	5.1	4.4	6.3	3.7	10.5	7.0
Metals	7.0	5.2	11.8	4.9	6.0	7.2
Recyclable Glass	2.1	4.9	2.9	0.2	1.9	2.4
Other Glass	0.4	1.1	2.5	3.3	0.8	1.2
Food Waste	26.2	17.7	5.5	0.6	13.1	14.6
Yard Debris	2.2	3.6	1.5	2.3	2.3	2.3
Disposable Diapers	5.7	4.5	1.4	0	0.6	2.5
Textiles	3.8	4.2	2.9	0.3	5.0	3.8
Furniture	0.8	1.3	6.6	8.0	0.4	2.4
Wood Waste	1.2	6.8	26.0	29.8	15.3	13.8
Const./Demolition	0.6	1.2	7.8	30.1	3.7	5.4
Animal Excrement	7.2	2.8	2.3	0	0.3	2.7
Other Special Wastes	0.9	2.2	1.9	0.2	1.0	1.2
Other Materials	10.9	8.6	5.5	10.7	8.1	8.6
Totals	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Recyclable Materials Subtotal	**33.1**	**44.0**	**31.6**	**12.2**	**35.3**	**33.4**

Notes: All figures are percentages by weight.
The recyclable materials subtotal includes recyclable paper, plastic bottles, plastic film and bags, metals, glass bottles, yard debris and textiles.

(30.1%) in this waste stream clearly shows that construction activities are the major source of this waste stream. Not counting the wood and other construction materials that could be recycled, the Non-Residential Self-Haul waste stream contains 12.2% recyclable materials, or about 4,400 tons per year.

- **General Non-Residential**: waste from this source contains large amounts of wood waste (15.3%), food waste (13.1%), recyclable paper (11.7%), other plastics (10.5%), compostable paper (7.7%), plastic bags and film (7.0%), metals (6.0%), and textiles (5.0%). The General Non-Residential waste stream contains 35.3% recyclable materials, or about 56,050 tons per year.

- **Total Waste Stream**: overall, the County's waste stream contains significant amounts of food waste (14.6%), wood waste (13.8%), recyclable paper (11.3%), metals (7.2%), other plastics (7.0%), construction and demolition waste (5.4%), plastic bags and film (5.0%), compostable paper (4.9%), and textiles (3.8%).

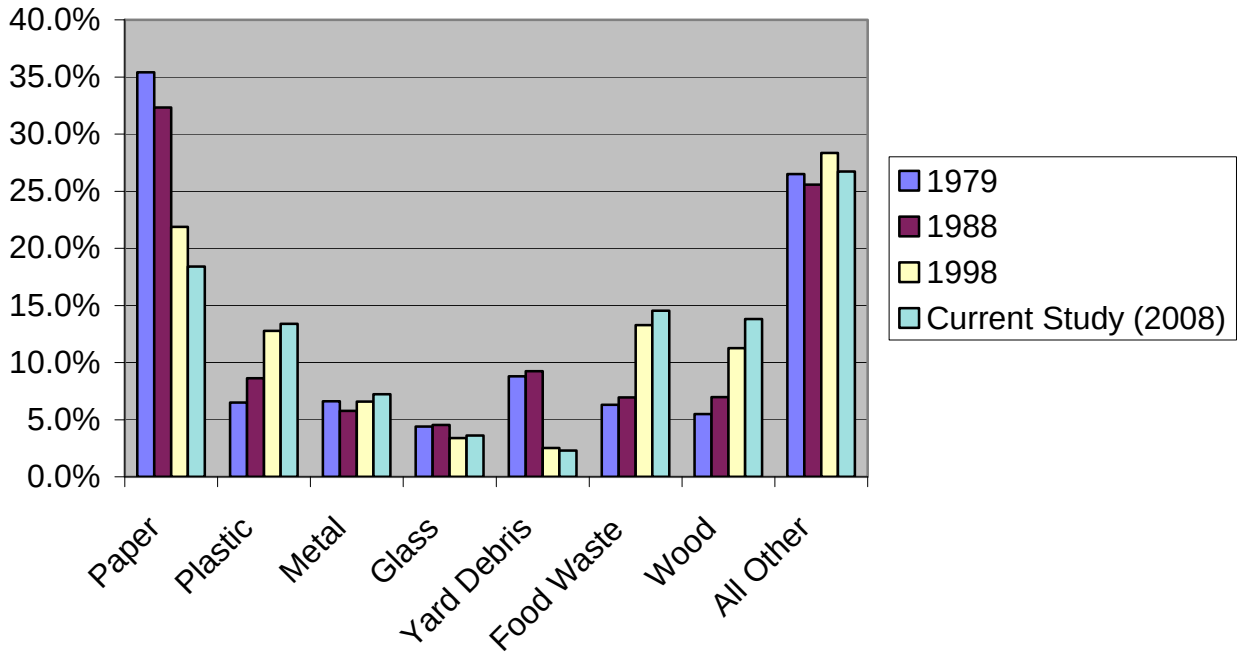
  The total amount of recyclable materials that could be handled through existing programs and facilities is 33.4% or 153,740 tons per year.

Comparison to Previous Studies

Snohomish County has conducted four waste composition studies over the past 30 years, in 1979, 1988, 1998 and now in 2008. Figure E-2 compares the results for these four studies. Drawing firm conclusions from this data is difficult because the design, methodologies, and categories have varied with each study, but the following general observations can be made:

- The impact of expanding recycling and composting programs can be seen in the decreased amounts of paper, glass and yard debris. The amount of recyclable

Figure E-2
DISPOSAL TRENDS



paper in the waste stream has continued to drop, whereas the amounts of glass and yard debris appear about the same as ten years ago.

- The amount of plastic in the waste stream has continued to increase, despite recycling programs for some of these materials.

- The percentage of food waste increased considerably in the previous study and remains high, but this is largely due to the fact that other materials have been removed through recycling and thus what could be the same amount of food waste now appears as a larger percentage of the remainder.

- The amount of wood in the waste stream appears to have increased over the years, despite recycling and energy conversion programs for this material.

RECOMMENDATIONS

The following planning and program recommendations are based on the results of this study:

- There continues to be a significant amount of recyclable materials disposed in Snohomish County's waste stream, and the amount has increased on a percentage basis since the previous study ten years ago. The County could increase waste diversion without creating new infrastructure or programs since a significant portion of the disposed waste stream consists of standard recyclable materials. If Snohomish County desires to increase the recycling rate substantially over current levels, however, a different approach may be needed. Alternative approaches could include mandating recycling, universal garbage and recycling services, processing solid waste to remove recyclable material, or targeted programs such as bottle bills and disposal bans.

- There are substantial amounts of wood and C&D wastes in both self-haul waste streams. Expanding recycling programs targeting self-haul customers should be considered for these materials. Transfer stations should also be designed or provide incentives to encourage more recycling of other materials.

- Diversion of food waste should be considered. Food waste is the largest single item remaining in the waste stream.

- A recent analysis by Green Solutions concluded that the statewide recovery rates for PET bottles, aluminum cans and glass bottles are not keeping up with other recyclable materials. This can be seen here as well, and it may be time for a different approach for these materials (such as a bottle bill) if recovery rates for these materials are going to be increased significantly over the current rate.

- In light of the large amount of recyclable materials still remaining in the waste stream, Snohomish County should consider how best to use County facilities and staff to process additional commodities.

SECTION 1

INTRODUCTION

A. SCOPE AND OBJECTIVES

This report provides the results of a study of the quantity and composition of solid waste (garbage) disposed in Snohomish County, Washington during 2008 - 2009. The Snohomish County Solid Waste Division (the Division) conducts a study such as this approximately once a decade in order to provide data for program planning, determine future needs, measure the effectiveness of current programs, and note changes in solid waste over time.

The Division hired the environmental consulting firm of Green Solutions, which was assisted by Division staff and the firm Environmental Practices, to conduct the study, perform an analysis of the data and prepare a report.

B. BACKGROUND

Previous waste characterization studies have been conducted in Snohomish County in 1979, 1988 and 1997-1998, so that Snohomish County now has four studies spanning a period of 30 years. The materials examined by these studies have changed somewhat over the years in response to current interests (for instance, the 1988 study included a category called "miscellaneous combustibles") and also in response to changes that have occurred in the waste stream itself. Changes in the waste stream have occurred as a result of:

- An extensive recycling and composting system that is diverting a wider variety of materials from the waste stream,
- Changes in packaging and consumer choices, and
- The emergence of new types of materials and new product categories (for example, plastic lumber and small consumer electronics).

After this study began, the United States (and, indeed, the entire world) entered an economic recession that significantly reduced waste volumes due to sharp decreases in construction activities and in consumer spending. This study was not designed to measure the impact of these factors on the composition of the waste stream, which would have required separating the impacts of reduced waste generation from seasonal changes that occur "naturally," but the impact can be seen in a decrease in the overall waste quantities disposed in Snohomish County (see Section 3 of this report for more details on decreased waste quantities).

C. CONTENTS OF THIS REPORT

This report consists of the following sections:

Section 2, Characterization of Snohomish County's Waste Stream - provides data on the quantity and composition of the County's waste stream. This section also provides detailed data on the breakdown of three of the waste categories (wood, construction/demolition and special wastes) and additional data on the breakdown of light bulbs, batteries and hazardous wastes.

Section 3, Conclusions and Recommendations - provides additional interpretation and analysis of the results, and provides recommendations for possible future steps by the County.

Glossary - provides definitions for technical terms used throughout the report as well as the definitions used for sorting categories.

Appendix A, Sorting Plan - describes the procedures used to collect waste quantity and composition data for this study.

Appendix B, Statistical Certainty of Results - provides data on the confidence intervals associated with the waste composition results.

Appendix C, Composition Data for Specific Non-Residential Generators - provides data for specific non-residential generators that were sampled during the fieldwork for this study.

SECTION II

CHARACTERIZATION OF SNOHOMISH COUNTY'S WASTE STREAM

A. INTRODUCTION

This section provides waste quantity and composition results for each of the five types of waste generators and for the county overall, as well as additional information collected during the fieldwork for this study.

B. OVERVIEW OF PROCEDURES

This study examined mixed municipal solid waste brought for disposal to Snohomish County's transfer facilities. 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). This study did not examine source-separated materials brought to the transfer stations or other facilities for recycling, energy recovery, or composting.

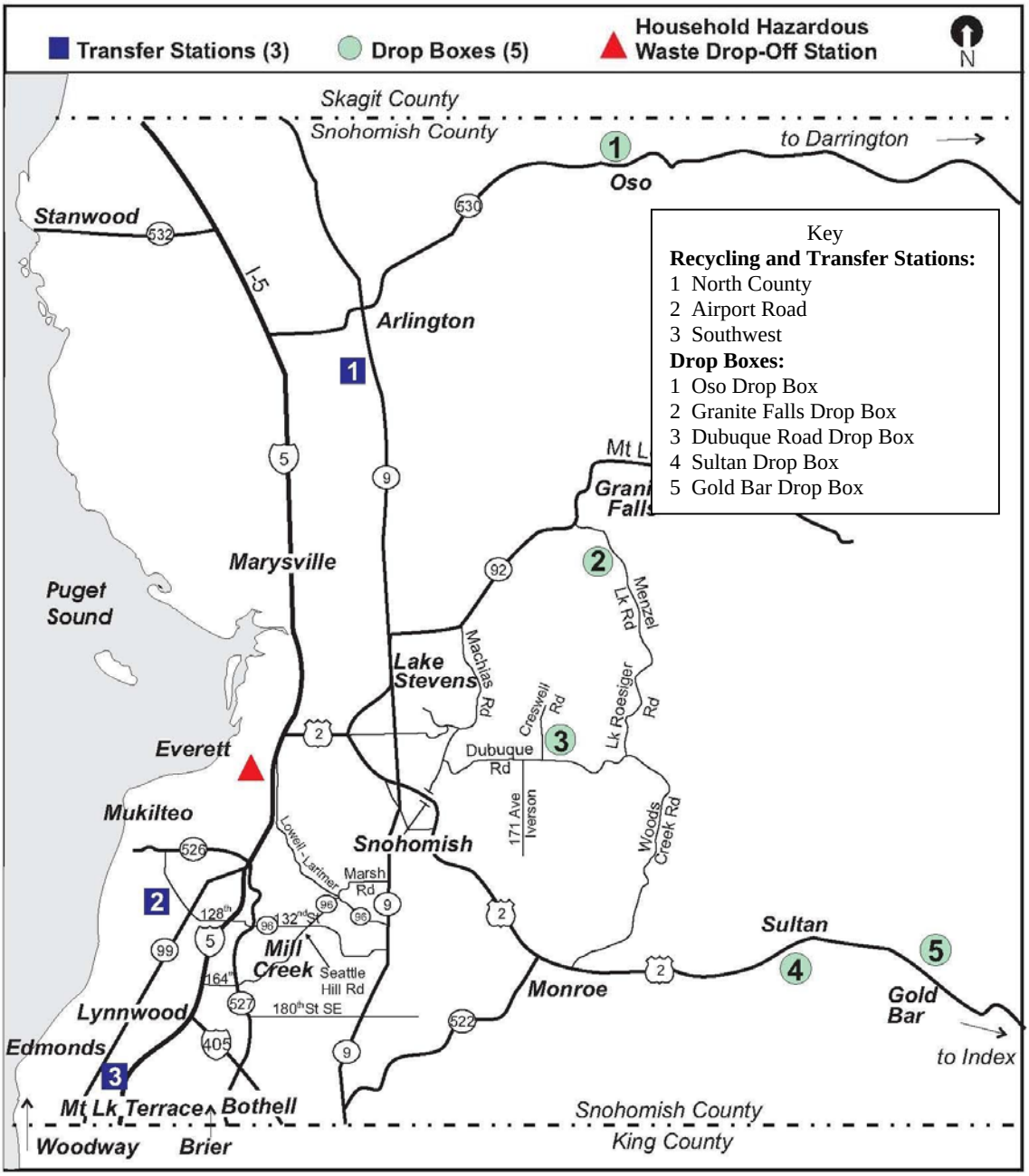
The Snohomish County Solid Waste System

The solid waste collection and transfer system for Snohomish County consists of three large transfer stations: Airport Road Recycling and Transfer Station (ARTS) in Everett, North County Recycling and Transfer Station (NCRTS) in Arlington, and Southwest Recycling and Transfer Station (SWRTS) in Mountlake Terrace. There are also five drop boxes, which are located in Gold Bar, Granite Falls, Oso, Sultan, and on Dubuque Road in Snohomish. The five drop boxes are used almost exclusively for self-haul customers, although some loads in garbage trucks are brought to the Sultan Drop Box by the City of Sultan. Altogether, the five drop boxes handled only 3.4% of the County's total waste stream in 2008. Figure 1 shows a map of the County's solid waste transfer facilities.

At the time of this study, there were four private garbage haulers operating in the county: Allied Waste Services, Rubatino Refuse Removal, Sound Disposal, and Waste Management (operating under the name Stanwood-Camano Disposal and also under Waste Management, depending on the service area). Two cities also conduct their own waste collections: Marysville and Sultan. Data from these six collection operations helped determine the breakdown of waste quantities by type of generator.

After examining the collection and transfer system in Snohomish County, it was determined that samples of waste taken at the three large transfer stations would

Figure 1
SNOHOMISH COUNTY SOLID WASTE TRANSFER FACILITIES



Notes: The map is from Snohomish County web page, http://www.co.snohomish.wa.us/documents/Departments/Public_Works/SolidWaste/swfacil0505.pdf.

adequately characterize the County's waste stream. Samples were allocated to each generator type and transfer station based on preliminary estimates of the number of tons delivered to each site.

Types of Waste Generators

The intent of this study was to provide data for the County's entire waste stream, but the design of the sampling and data collection procedures allows information to be provided on the quantity and composition of waste disposed by different waste generators as well. For this purpose, the County's wastes were divided into five groups according to the source and the method of delivery. The five groups, called **waste generators**, include:

Three residential substreams:

- **Single-Family**: waste originating from single-family homes and delivered to the transfer station by a garbage hauler (i.e., not a self-haul load).
- **Multi-Family**: waste originating from a multi-family dwelling, which is defined as a structure with three or more apartment units in the same building. Duplexes were included with single-family homes. To be counted in this category, the waste must have been brought to the transfer station by someone other than the landlord or tenant (i.e., must not have met the definition of self-haul).
- **Residential Self-Haul**: residential waste delivered to the transfer station by a homeowner, renter or landlord, typically using cars, vans, jeeps, pick-up trucks, and other personal vehicles.

Two non-residential substreams:

- **Non-Residential Self-Haul**: non-residential waste delivered to the transfer station by an employee of the same company that generated the waste, including construction and demolition waste brought in by the construction company that created the waste.
- **General Non-Residential**: all non-residential waste except self-haul. In other words, the waste must have been delivered to the transfer station by a garbage hauler or other third party who is paid to transport the waste.

Construction and demolition waste (C&D) and other special wastes were included in the above categories only to the extent that these wastes were delivered to the County's three transfer stations during the study period. Some of these wastes are disposed at other sites and so are not included in this study.

Waste Quantities

The quantity (tonnage) of solid waste disposed by each type of generator was determined through existing County records and information from the waste haulers. Weekly tonnages for each season were determined in this way, and those tonnages were used to determine weighted averages. Weighted averages were used for determining the annual composition averages for each type of waste generator (by combining seasonal data for individual generators) and for determining the annual average for the entire waste stream (i.e., averaging the composition data from all five types of generators).

Waste Composition

The composition of the County's solid waste stream was determined by randomly selecting and sorting samples of waste at the three main transfer stations. Sampling was conducted for five days each quarter. Each sample was sorted into 79 categories of materials.

The Glossary and Appendix A of this report provide additional detail on the definitions and procedures used for this study.

C. WASTE QUANTITIES

Total Waste Quantities

Table 1 shows the data used for the waste quantity analysis. The data shown in this table is from the County's transaction records for one-week periods each quarter, with comments on how the data was used to determine waste quantities by type of generator. The one-week periods shown in this table correspond to the weeks when sorting activities took place. After allocating the weekly tonnages for each quarter to the five waste generators, the resulting tonnages were summed up and the annual percentage contributed by each generator was calculated (see Table 2).

The quarterly percentages were used to calculate weighted averages for each generator individually, so that seasonal fluctuations in waste quantities are taken into account when calculating the composition of each generator's waste stream. The annual percentage of the waste stream contributed by each generator was used to calculate weighted averages for the composition of the entire county's waste stream, and for calculations such as the tons per year for each material and each generator. Table 2 shows the quarterly percentages as well as the annual percentages and tonnages derived in this way.

Table 1
QUANTITIES OF DISPOSED WASTES BY TYPE OF CUSTOMER

Type of Customer, from County's Transaction Records	Tonnage Data for One Week each Quarter				Comments
	April 6-12, 2008	July 13-19, 2008	October 19-25, 2008	January 11-17, 2009	
Businesses (Miscellaneous Businesses)	233.92	151.03	207.61	239.55	Primarily Non-Residential Self-Haul, but the list of customers was reviewed to pull out a few Residential Self-Haul and third-party paid "haulers" (third party paid haulers such as 1-800-GOT-JUNK were assumed to be 50-50 Single-Family and General Non-Residential).
Cash Customers;					Cash customers were allocated between Residential and Non-Residential Self-Haul based on scalehouse records.
Residential and Seniors	1,771.82	2,098.81	1,524.32	1,530.66	
Commercial	430.93	318.70	306.56	271.39	
Construction	119.54	99.62	85.05	87.97	A review of the list of customers in this category concluded that all were Non-Residential Self-Haul.
Haulers	6,451.42	6,658.37	5,971.91	6,493.68	Tonnages were allocated between Single-Family, Multi-Family and General Non-Residential based on information from the haulers.
Institutional*	134.93	87.92	111.52	138.55	Primarily Non-Residential Self-Haul, but the list of customers was reviewed to pull out a few Residential Self-Haul customers and the City of Sultan tonnages were allocated based on information from them.
Roofers	64.06	99.26	66.34	78.46	A review of the list of customers in this category concluded that all were Non-Residential Self-Haul.
Totals	**9,206.62**	**9,513.71**	**8,273.31**	**8,840.26**	

* City of Sultan tonnages are included in Institutional tonnages, not in Hauler tonnages.

Table 2
SEASONAL AND ANNUAL QUANTITIES OF DISPOSED WASTES

Type of Generator	Percentage by Generator by Quarter				Annual Amounts (2008)	
	April 2008	July 2008	October 2008	January 2009	Tons	Percent
Single-Family	24.7%	24.7%	25.5%	25.8%	117,500	25.5%
Multi-Family	12.9%	12.7%	13.1%	13.4%	60,900	13.2%
Residential Self-Haul	19.4%	22.2%	18.5%	17.4%	87,500	19.0%
Residential Subtotal	**56.9%**	**59.6%**	**57.1%**	**56.6%**	**265,900**	**57.7%**
Non-Residential Self-Haul	9.7%	7.2%	8.5%	8.5%	36,100	7.8%
General Non-Residential	33.3%	33.2%	34.4%	34.9%	158,700	34.5%
Non-Residential Subtotal	**43.1%**	**40.4%**	**42.9%**	**43.4%**	**194,800**	**42.3%**
Totals	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**460,700**	**100.0%**

The amount of waste disposed in an area is often expressed as a per capita rate. In this case, Snohomish County's total waste stream is the equivalent of 0.66 tons per person per year, or 3.62 pounds per person per day (based on data from the Office of Financial Management showing 696,600 residents in the county in 2008). This is a slight decrease from the previous waste composition study, which showed 0.69 tons per person per year or 3.77 pounds per person per day in 1998.

A more precise approach for waste disposal rates is to express residential waste quantities on the basis of population figures, and non-residential waste quantities on the number of employees (see below). Expressing residential and non-residential waste quantities based on population and employment allows these waste streams to be monitored more effectively for waste prevention and program planning purposes.

Residential Waste Quantities

Waste Quantities: The residential waste stream accounts for 57.7% of the County's total waste. This is up from 48.7% in the last waste composition study ten years ago. Single-Family Residential contributes 44.2% of the residential amount, Multi-Family Residential accounts for 22.9%, and Residential Self-Haul accounts for 32.9%.

Per Capita Disposal Rates: Based on 265,900 tons of residential waste per year and the County's 2008 population (696,600 people), the current residential per capita disposal rate for Snohomish County is 0.38 tons per person per year or 2.09 pounds per person per day. This is a slight increase from the disposal rate found in the previous study ten years ago (0.33 tons per person per year or 1.83 pounds per person per day).

Non-Residential Waste Quantities

Waste Quantities: The non-residential waste stream accounts for 42.3% of Snohomish County's total waste. 18.5% of this, or 36,100 tons, was Non-Residential Self-Haul waste, and 81.5%, or 158,700 tons, was General Non-Residential waste.

Disposal Rates per Employee: Based on 194,800 tons of non-residential waste and the County's estimated 2008 employment level of 355,700 workers (from Workforce Explorer, for the civilian labor force), the current non-residential disposal rate for Snohomish County is 0.55 tons per employee per year or 4.30 pounds per employee per day (based on 255 workdays per year). This is significantly less than the non-residential disposal rate found ten years ago (0.94 tons per employee per year or 7.33 pounds per employee per day).

D. WASTE COMPOSITION

Number of Samples

The composition of the County's waste stream was determined by randomly selecting and sorting a total of 201 samples of waste. These samples were allocated between the five 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 inherently more variable (the two self-haul waste streams and General Non-Residential) with fewer of the samples allocated to the two waste streams that are typically less variable (Single-Family and Multi-Family Residential). The samples were also allocated between the three transfer stations and types of generators based on flow patterns at the transfer stations. The number of samples taken each season is shown in Table 3.

Table 3
ALLOCATION OF SAMPLES BY TYPE OF GENERATOR

Type of Generator	April 2008	July 2008	October 2008	January 2009	Total Samples	
					Number	Percent
Single-Family	8	8	8	8	32	16%
Multi-Family	7	8	7	7	29	14%
Residential Self-Haul	11	11	11	11	44	22%
Residential Subtotal	**26**	**27**	**26**	**26**	**105**	**52%**
Non-Residential Self-Haul	11	11	11	11	44	22%
General Non-Residential	13	13	13	13	52	26%
Non-Residential Subtotal	**24**	**24**	**24**	**24**	**96**	**48%**
Totals	**50**	**51**	**50**	**50**	**201**	**100.0%**

Waste Composition Results

Table 4 shows the annual averages for each generator and for the entire County. As can be seen in this table, there are marked differences in the waste streams of the different types of waste generators. The results for the entire County are also illustrated in Figure 2.

Residential Waste Composition

As can be seen in Table 4, there are substantial differences in the composition of wastes from the different residential sources. These differences can be explained by the different activities that create wastes. The waste from single-family homes, for instance, is influenced by the activities associated with living in, owning and maintaining a home. The waste from apartments (Multi-Family Residential) contains less material from home maintenance activities and reflects a different, more mobile lifestyle. 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 projects that often motivate people to make a special trip to the transfer stations.

The results for each residential generator are illustrated in Figures 3-5.

Non-Residential Waste Composition

There are also significant differences between the two types of non-residential waste streams. As with residential wastes, this can be explained by the different activities and sources for these wastes. The General Non-Residential waste stream in Snohomish County is influenced by Boeing and other manufacturing activities, while the Non-Residential Self-Haul waste stream is dominated by construction activities. Some other businesses or institutions may choose to haul their own waste, in which case the waste does not differ greatly from General Non-Residential waste, but self-haul wastes in many cases are from construction or other special projects. Ample evidence of this is provided by the fact that over half of the Non-Residential Self-Haul waste stream is comprised of wood waste (29.8%) and construction/demolition waste (30.1%).

Of the two non-residential waste substreams, self-haul wastes show much more seasonal variability in quantity and composition, variations that are largely tied to construction seasons and activities.

The results for each non-residential generator are illustrated in Figures 6 and 7.

Table 4
WASTE COMPOSITION RESULTS

		Single-Family	Multi-Family	Residential Self-Haul	Non-Res. Self-Haul	General Non-Res.	Average for Entire County
PAPER	Newspaper	1.32%	2.47%	1.06%	0.05%	1.03%	1.22%
	Cardboard	1.31%	5.69%	3.81%	1.88%	5.05%	3.70%
	Phone Books	0.15%	0.74%	0.25%		0.09%	0.21%
	Mixed Waste Paper	7.34%	9.71%	4.53%	1.19%	5.30%	5.94%
	Milk Cartons, Other	0.26%	0.30%	0.09%	0.01%	0.26%	0.21%
	Compostable	5.74%	4.16%	1.07%	0.15%	7.73%	4.89%
	Non-Recyclable Paper	2.20%	1.21%	1.46%	1.33%	3.23%	2.22%
	Paper Subtotal	**18.32%**	**24.28%**	**12.28%**	**4.60%**	**22.68%**	**18.39%**
PLASTIC	PET Bottles	0.98%	1.39%	0.46%	0.13%	0.78%	0.80%
	HDPE Bottles	0.65%	1.01%	0.45%	0.12%	0.56%	0.58%
	Bottles 3-7	0.09%	0.10%	0.06%	0.002%	0.04%	0.06%
	Bags and Film	5.98%	4.67%	1.86%	1.25%	7.00%	5.01%
	Plastic Packaging	2.27%	1.87%	1.00%	0.50%	2.13%	1.79%
	Plastic Products	2.16%	2.03%	5.12%	2.97%	7.68%	4.67%
	Expanded Polystyrene	0.65%	0.54%	0.23%	0.21%	0.67%	0.53%
	Plastic Subtotal	**12.78%**	**11.62%**	**9.17%**	**5.18%**	**18.85%**	**13.44%**
METAL	Aluminum Cans	0.44%	0.98%	0.20%	0.03%	0.40%	0.42%
	Aluminum Foil	0.25%	0.20%	0.06%	0.05%	0.12%	0.15%
	Tin Cans	1.11%	1.35%	0.38%	0.03%	0.57%	0.73%
	Mixed Metals	2.30%	1.54%	4.70%	1.93%	3.35%	2.99%
	Ferrous Metals	1.27%	0.67%	4.17%	2.54%	1.31%	1.85%
	White Goods	1.32%		1.80%			0.68%
	Non-Ferrous Metals	0.11%	0.28%	0.41%	0.25%	0.11%	0.20%
	Aerosol Cans	0.23%	0.19%	0.06%	0.02%	0.15%	0.15%
	Metal Subtotal	**7.03%**	**5.22%**	**11.79%**	**4.85%**	**6.01%**	**7.17%**
ORGANICS	Food Waste	26.24%	17.69%	5.52%	0.62%	13.06%	14.63%
	Yard Waste	2.16%	3.58%	1.47%	2.31%	2.33%	2.29%
	Org. Subtotal	**28.40%**	**21.28%**	**6.99%**	**2.93%**	**15.38%**	**16.91%**
GLASS	Clear Bottles	1.16%	2.35%	1.53%	0.06%	1.09%	1.28%
	Brown Bottles	0.40%	1.28%	0.74%	0.06%	0.45%	0.57%
	Green Bottles	0.50%	1.27%	0.62%	0.03%	0.37%	0.54%
	Non-Recyclable Glass	0.32%	1.08%	2.36%	3.27%	0.79%	1.20%
	Light Bulbs	0.04%	0.06%	0.12%	0.02%	0.01%	0.04%
	Glass Subtotal	**2.41%**	**6.04%**	**5.36%**	**3.44%**	**2.72%**	**3.64%**
OTHER WASTES	Tires			0.29%	0.004%		0.06%
	Rubber Products	0.15%	0.10%	0.05%	0.20%	0.35%	0.20%
	Cosmetics	0.34%	0.38%	0.18%	0.01%	0.08%	0.20%
	Disposable Diapers	5.67%	4.48%	1.36%		0.63%	2.51%
	Textiles	3.78%	4.17%	2.88%	0.28%	4.96%	3.79%
	Carpeting	0.02%	0.17%	1.74%	6.56%	1.48%	1.38%
	Carpet Padding	0.002%	0.03%	0.72%	2.49%	0.15%	0.39%
	Furniture	0.78%	1.29%	6.62%	7.97%	0.41%	2.39%
	Ash, Dust	1.22%	0.14%	0.18%	0.31%	0.21%	0.46%
	Residuals	9.20%	7.78%	2.40%	1.12%	5.81%	5.92%
	Other Waste Subtotal	**21.16%**	**18.54%**	**16.42%**	**18.95%**	**14.08%**	**17.30%**
WOOD and C&D	Wood	1.22%	6.80%	26.00%	29.77%	15.30%	13.75%
	C&D	0.61%	1.22%	7.84%	30.07%	3.67%	5.43%
	Wood, C&D Subtotal	**1.83%**	**8.02%**	**33.84%**	**59.84%**	**18.97%**	**19.18%**
SPECIAL WASTES	Paints and Solvents	0.02%	0.17%	0.03%	0.04%	0.08%	0.06%
	Automotive	0.02%		0.002%		0.02%	0.01%
	Animal Excrement	7.17%	2.75%	2.29%		0.33%	2.74%
	Other	0.86%	2.08%	1.84%	0.16%	0.87%	1.16%
	Actual Hazardous Wastes	0.06%	0.10%	0.15%	0.18%	0.05%	0.09%
	Special Waste Subtotal	**8.06%**	**5.00%**	**4.16%**	**0.20%**	**1.30%**	**3.97%**
TOTALS		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
	Pounds of Samples Sorted:	7,271	6,568	13,129	7,633	11,377	45,979
	Number of Samples Sorted:	32	29	44	44	52	201

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

Figure 2
WASTE COMPOSITION RESULTS

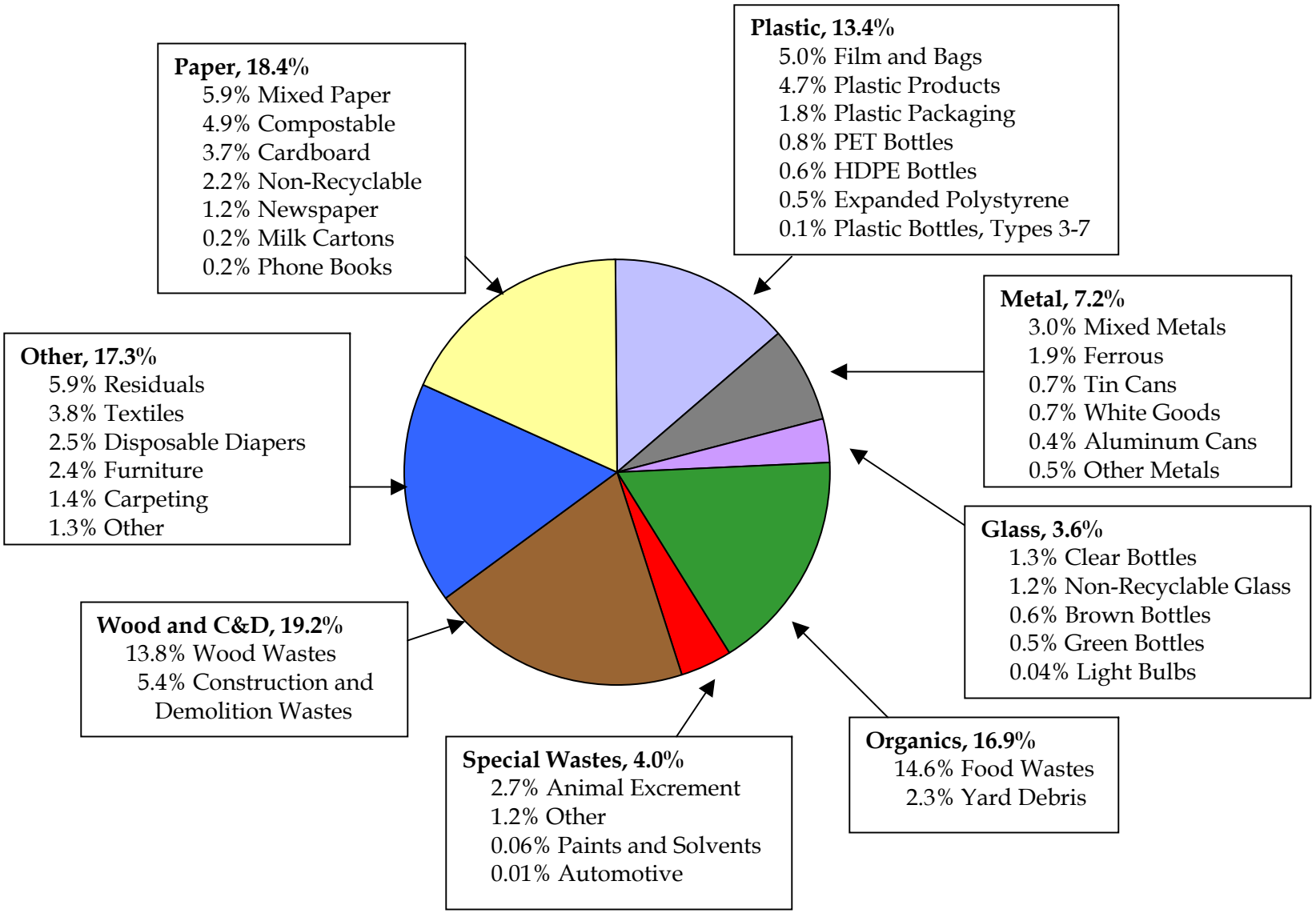
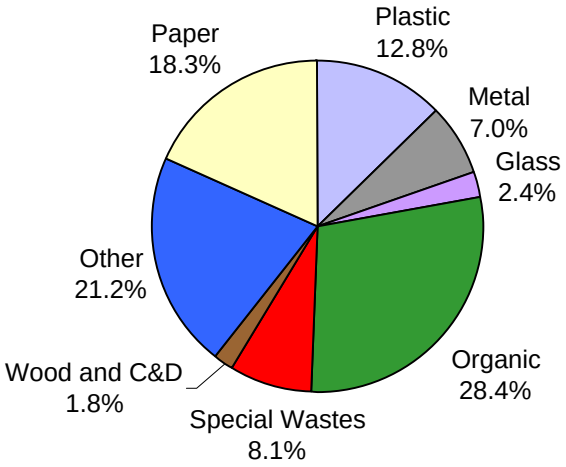


Figure 3
SINGLE - FAMILY WASTE

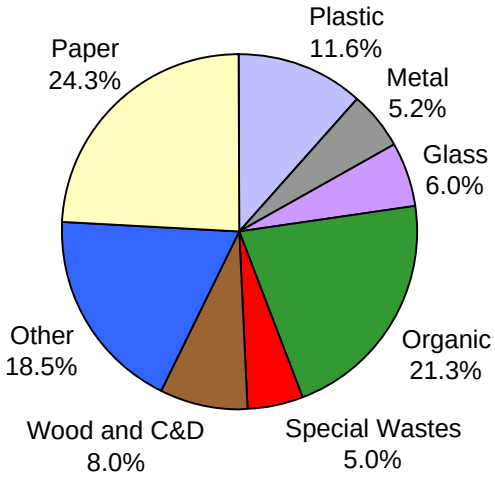


SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	1.3%
	Cardboard	1.3%
	Other Recyclable Paper	7.7%
	Compostable Paper	5.7%
	Non-Recyclable Paper	2.2%
	Paper Subtotal	18.3%
PLASTIC	Plastic Bottles	1.7%
	Film and Bags	6.0%
	Other Plastic	5.1%
	Plastic Subtotal	12.8%
METAL	Aluminum Cans	0.4%
	Tin Cans	1.1%
	Other Metals	5.5%
	Metal Subtotal	7.0%
GLASS	Glass Bottles	2.1%
	Other Glass	0.4%
	Glass Subtotal	2.4%
WOOD, C&D	Wood	1.2%
	Const./Demolition	0.6%
	Wood, C&D Subtotal	1.8%
SPECIAL WASTES	Animal Excrement	7.2%
	Other Special Wastes	0.9%
	Special Waste Subtotal	8.1%
ORGANIC	Food Waste	26.2%
	Yard Debris	2.2%
	Organic Subtotal	28.4%
OTHER	Disposable Diapers	5.7%
	Textiles	3.8%
	Carpet and Padding	0.0%
	Furniture	0.8%
	Miscellaneous (1)	10.9%
	Other Subtotal	21.2%
RECYCLABLE SUBTOTAL (2)		33.1%

Notes: All figures are percent by weight.
1) "Miscellaneous" includes tires and other rubber products, cosmetics, ash, dust, and residuals.
2) "Recyclable Subtotal" includes newspaper, cardboard, other recyclable paper, plastic bottles, plastic film and bags, all metals, glass bottles, yard debris and textiles.

Figure 4
MULTI - FAMILY WASTE

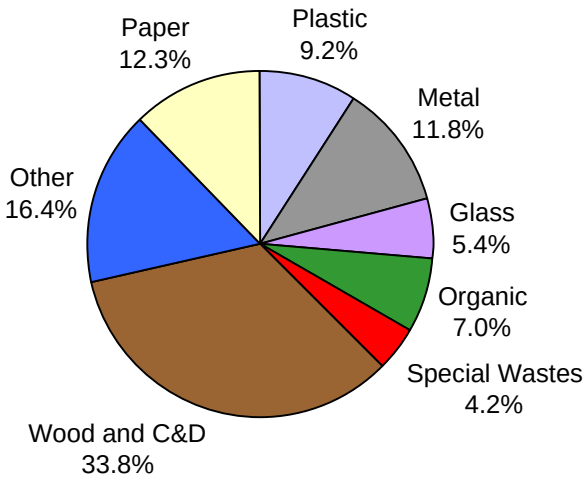


SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	2.5%
	Cardboard	5.7%
	Other Recyclable Paper	10.8%
	Compostable Paper	4.2%
	Non-Recyclable Paper	1.2%
	Paper Subtotal	24.3%
PLASTIC	Plastic Bottles	2.5%
	Film and Bags	4.7%
	Other Plastic	4.4%
	Plastic Subtotal	11.6%
METAL	Aluminum Cans	1.0%
	Tin Cans	1.4%
	Other Metals	2.9%
	Metal Subtotal	5.2%
GLASS	Glass Bottles	4.9%
	Other Glass	1.1%
	Glass Subtotal	6.0%
WOOD, C&D	Wood	6.8%
	Const./Demolition	1.2%
	Wood, C&D Subtotal	8.0%
SPECIAL WASTES	Animal Excrement	2.8%
	Other Special Wastes	2.2%
	Special Waste Subtotal	5.0%
ORGANIC	Food Waste	17.7%
	Yard Debris	3.6%
	Organic Subtotal	21.3%
OTHER	Disposable Diapers	4.5%
	Textiles	4.2%
	Carpet and Padding	0.2%
	Furniture	1.3%
	Miscellaneous (1)	8.4%
	Other Subtotal	18.5%
RECYCLABLE SUBTOTAL (2)		44.0%

Notes: All figures are percent by weight.
1) "Miscellaneous" includes tires and other rubber products, cosmetics, ash, dust, and residuals.
2) "Recyclable Subtotal" includes newspaper, cardboard, other recyclable paper, plastic bottles, plastic film and bags, all metals, glass bottles, yard debris and textiles.

Figure 5
RESIDENTIAL SELF - HAUL WASTE

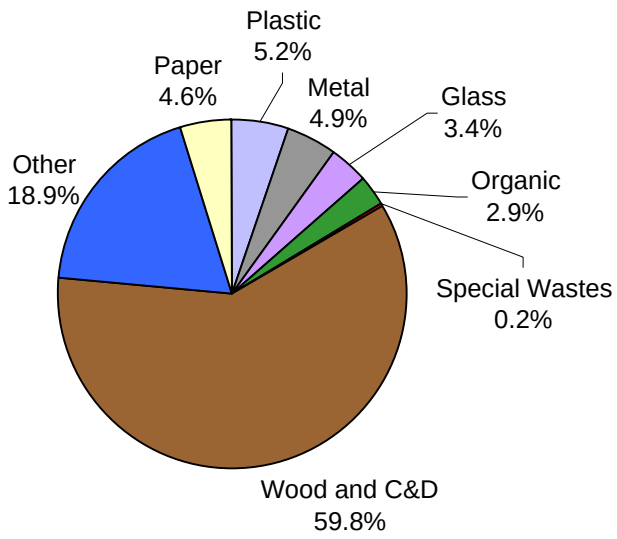


SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	1.1%
	Cardboard	3.8%
	Other Recyclable Paper	4.9%
	Compostable Paper	1.1%
	Non-Recyclable Paper	1.5%
	Paper Subtotal	12.3%
PLASTIC	Plastic Bottles	1.0%
	Film and Bags	1.9%
	Other Plastic	6.3%
	Plastic Subtotal	9.2%
METAL	Aluminum Cans	0.2%
	Tin Cans	0.4%
	Other Metals	11.2%
	Metal Subtotal	11.8%
GLASS	Glass Bottles	2.9%
	Other Glass	2.5%
	Glass Subtotal	5.4%
WOOD, C&D	Wood	26.0%
	Const./Demolition	7.8%
	Wood, C&D Subtotal	33.8%
SPECIAL WASTES	Animal Excrement	2.3%
	Other Special Wastes	1.9%
	Special Waste Subtotal	4.2%
ORGANIC	Food Waste	5.5%
	Yard Debris	1.5%
	Organic Subtotal	7.0%
OTHER	Disposable Diapers	1.4%
	Textiles	2.9%
	Carpet and Padding	2.5%
	Furniture	6.6%
	Miscellaneous (1)	3.1%
	Other Subtotal	16.4%
RECYCLABLE SUBTOTAL (2)		31.6%

Notes: All figures are percent by weight.
1) "Miscellaneous" includes tires and other rubber products, cosmetics, ash, dust, and residuals.
2) "Recyclable Subtotal" includes newspaper, cardboard, other recyclable paper, plastic bottles, plastic film and bags, all metals, glass bottles, yard debris and textiles.

Figure 6
NON - RESIDENTIAL SELF - HAUL WASTE

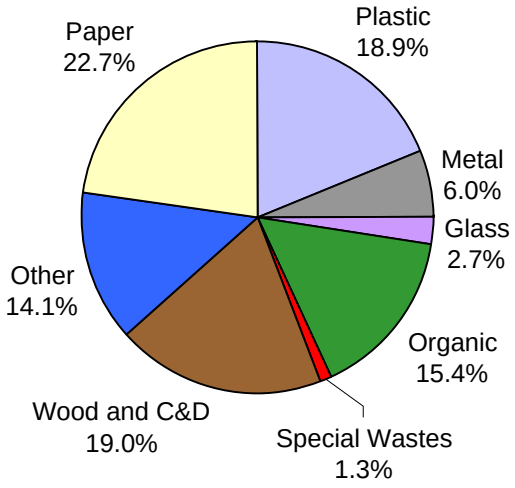


SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	0.0%
	Cardboard	1.9%
	Other Recyclable Paper	1.2%
	Compostable Paper	0.1%
	Non-Recyclable Paper	1.3%
	Paper Subtotal	4.6%
PLASTIC	Plastic Bottles	0.2%
	Film and Bags	1.3%
	Other Plastic	3.7%
	Plastic Subtotal	5.2%
METAL	Aluminum Cans	0.0%
	Tin Cans	0.0%
	Other Metals	4.8%
	Metal Subtotal	4.9%
GLASS	Glass Bottles	0.1%
	Other Glass	3.3%
	Glass Subtotal	3.4%
WOOD, C&D	Wood	29.8%
	Const./Demolition	30.1%
	Wood, C&D Subtotal	59.8%
SPECIAL WASTES	Animal Excrement	
	Other Special Wastes	0.2%
	Special Waste Subtotal	0.2%
ORGANIC	Food Waste	0.6%
	Yard Debris	2.3%
	Organic Subtotal	2.9%
OTHER	Disposable Diapers	
	Textiles	0.3%
	Carpet and Padding	9.1%
	Furniture	8.0%
	Miscellaneous (1)	1.6%
	Other Subtotal	18.9%
RECYCLABLE SUBTOTAL (2)		12.2%

Notes: All figures are percent by weight.
1) "Miscellaneous" includes tires and other rubber products, cosmetics, ash, dust, and residuals.
2) "Recyclable Subtotal" includes newspaper, cardboard, other recyclable paper, plastic bottles, plastic film and bags, all metals, glass bottles, yard debris and textiles.

Figure 7
GENERAL NON-RESIDENTIAL WASTES



SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	1.0%
	Cardboard	5.0%
	Other Recyclable Paper	5.6%
	Compostable Paper	7.7%
	Non-Recyclable Paper	3.2%
	Paper Subtotal	22.7%
PLASTIC	Plastic Bottles	1.4%
	Film and Bags	7.0%
	Other Plastic	10.5%
	Plastic Subtotal	18.9%
METAL	Aluminum Cans	0.4%
	Tin Cans	0.6%
	Other Metals	5.0%
	Metal Subtotal	6.0%
GLASS	Glass Bottles	1.9%
	Other Glass	0.8%
	Glass Subtotal	2.7%
WOOD, C&D	Wood	15.3%
	Const./Demolition	3.7%
	Wood, C&D Subtotal	19.0%
SPECIAL WASTES	Animal Excrement	0.3%
	Other Special Wastes	1.0%
	Special Waste Subtotal	1.3%
ORGANIC	Food Waste	13.1%
	Yard Debris	2.3%
	Organic Subtotal	15.4%
OTHER	Disposable Diapers	0.6%
	Textiles	5.0%
	Carpet and Padding	1.6%
	Furniture	0.4%
	Miscellaneous (1)	6.5%
	Other Subtotal	14.1%
RECYCLABLE SUBTOTAL (2)		35.3%

Notes: All figures are percent by weight.
1) "Miscellaneous" includes tires and other rubber products, cosmetics, ash, dust, and residuals.
2) "Recyclable Subtotal" includes newspaper, cardboard, other recyclable paper, plastic bottles, plastic film and bags, all metals, glass bottles, yard debris and textiles.

E. WOOD, C&D AND SPECIAL WASTES

Additional data on the breakdown of wood, construction and demolition wastes, and special wastes is shown in Table 5. Most of this data does not have the same level of statistical certainty as the primary categories due to the lower quantities and greater variability of these materials in the waste stream, but may still be useful for future planning activities focused on these types of wastes.

Included in the breakdown for special wastes is an assessment of the amount that was classified as hazardous waste. More detail about these wastes is shown in Table 6. Table 6 shows only those materials that were actually classified as hazardous waste (in other words, for several categories there were also non-hazardous items found and these are not included in the figures). The data in Table 6 is for the number of times that each item was found, except for medical waste where the total number of syringes is also shown.

As shown in Table 6, banned electronic wastes ("e-wastes") were found five times over the course of the fieldwork. Items found included two televisions, two computer monitors and one Barbie laptop. As also shown in Table 6, nickel-cadmium (NiCd) batteries were found five times. The total weight of these batteries was 5.39 pounds, and compared to the weight for all household batteries (40.91 pounds), the NiCd batteries were 13.2% by weight of the batteries found.

The data on hazardous waste is not as statistically significant as other data in this report. The small and sporadic incidence of the hazardous wastes means that there is a large degree of random error associated with this data. The data still provides an indication of the types and sources of hazardous wastes in the waste stream, but this data should not be relied on too heavily for determining hazardous waste disposal practices.

F. ADDITIONAL DATA AND OBSERVATIONS

Additional data and other observations gathered during fieldwork include:

- The types of light bulbs found were noted during the fieldwork for this study. For all of the samples taken together, 64.2% by weight of the light bulbs found were the incandescent type, 11.8% were compact fluorescent bulbs (CFLs), 22.9% were fluorescent bulbs, and 1.1% were halogen. The fluorescent tubes and compact fluorescents are classified as hazardous wastes and are included in the hazardous waste subtotal (see Tables 4 and 5). The number of times these two types of light bulbs were found is also shown in Table 6.

Table 5
BREAKDOWN OF WOOD, C&D AND SPECIAL WASTES

	Single-Family	Multi-Family	Residential Self-Haul	Non-Res. Self-Haul	General Non-Res.	Average for Entire County
WOOD WASTE						
Pallets			0.6%	1.2%	1.1%	0.6%
Natural Wood	0.2%	0.1%		1.0%	2.7%	1.1%
Other Clean Wood	0.1%	0.2%	4.8%	12.2%	2.1%	2.6%
Hog Fuel	0.7%	3.2%	9.7%	7.4%	7.5%	5.6%
Roofing, Wood				6.5%		0.5%
Other Contaminated Wood	0.3%	3.3%	10.3%	1.2%	1.6%	3.1%
Other Wood Wastes	0.002%	0.002%	0.6%	0.3%	0.3%	0.2%
Wood Subtotal	**1.2%**	**6.8%**	**26.0%**	**29.8%**	**15.3%**	**13.8%**
CONSTRUCTION AND DEMOLITION (C&D) WASTE						
Ceramics, Porcelain, China	0.03%	0.3%	1.9%	0.6%	0.3%	0.6%
Rocks and Bricks	0.03%	0.1%	0.4%	0.2%	0.1%	0.1%
Concrete	0.2%	0.1%	2.0%	1.0%	0.04%	0.5%
Soil, Dirt, Non-Distinct Fines	0.2%	0.04%	0.9%	0.4%	0.2%	0.3%
Gypsum Board	0.1%	0.2%	1.3%	8.8%	1.0%	1.3%
Fiberglass Insulation	0.01%	0.1%	0.4%	1.1%	0.02%	0.2%
Other Fiberglass				0.1%	0.9%	0.3%
Roofing	0.01%	0.01%	0.4%	13.4%	0.3%	1.2%
Asphalt						
Tyvek					0.02%	0.01%
Other C&D	0.04%	0.4%	0.5%	4.4%	0.8%	0.8%
C&D Subtotal	**0.6%**	**1.2%**	**7.8%**	**30.1%**	**3.7%**	**5.4%**
SPECIAL WASTES						
E-Waste	0.04%	0.83%			0.46%	0.28%
Other Electronics	0.29%	0.94%	1.43%		0.30%	0.57%
Asbestos	0.13%					0.03%
Latex Paint	0.02%	0.12%	0.01%		0.07%	0.05%
Oil Paint	0.001%	0.02%	0.02%	0.04%	0.00%	0.01%
Solvents		0.03%	0.004%		0.004%	0.01%
Adhesives and Glues	0.02%	0.02%	0.08%	0.14%	0.03%	0.04%
Cleaners	0.004%	0.04%	0.04%		0.01%	0.02%
Fertilizer		0.01%	0.05%			0.01%
Pesticides and Herbicides	0.14%		0.01%			0.04%
Pharmaceuticals	0.06%	0.07%	0.10%		0.02%	0.05%
Medical Wastes	0.004%	0.02%	0.002%	0.001%	0.0004%	0.005%
Gasoline and Fuel Oil						
Oil Filters	0.02%				0.01%	0.01%
Motor Oil					0.01%	0.004%
Car Batteries						
Household Batteries	0.16%	0.13%	0.13%	0.02%	0.04%	0.10%
Antifreeze						
Brake Fluid			0.002%			0.0003%
Animal Excrement	7.17%	2.75%	2.29%		0.33%	2.74%
Animal Carcasses	0.01%	0.01%	0.002%		0.01%	0.01%
Other Special Wastes	0.01%					0.002%
Actual Hazardous Waste	0.06%	0.10%	0.15%	0.18%	0.05%	0.09%
Special Waste Subtotal	**8.06%**	**5.00%**	**4.16%**	**0.20%**	**1.30%**	**4.0%**

Notes: All figures are percentages by weight.
Zero values are not shown.

Table 6
NUMBER OF TIMES HAZARDOUS WASTES WERE FOUND

Type of Hazardous Waste	Single-Family	Multi-Family	Res. Self-Haul	Non-Res. Self-Haul	General Non-Res.	Totals
Number of Times Found:						
Compact Fluorescents	3	3	3		1	10
Fluorescent Tubes			1	1	1	3
E-Wastes	1	2			2	5
Asbestos	1					1
Oil Paint	1	1	2	1		5
Solvents		2	1		1	4
Adhesives and Glues	1	1		1	1	4
Cleaners		1	1			2
Fertilizers		1	1			2
Pesticides and Herbicides	2		2			4
Pharmaceuticals	12	12	9	1	6	40
Medical Waste (and Number of Syringes)	3 (10)	3 (50)	2 (8)	1 (18)	1 (2)	10 (88)
Oil Filters	1				1	2
Motor Oil					1	1
Household Batteries (NiCd only)	2		1	1	1	5
Brake Fluid			1			1
Other			1			1
Total Amount of Hazardous Waste, % by Weight	**0.06%**	**0.09%**	**0.15%**	**0.18%**	**0.05%**	**0.09%**

The types of special wastes not shown above include: other electronics (because these are not classified as hazardous wastes); latex paint (not classified as hazardous); gasoline, car batteries and antifreeze (none was found); and animal excrement and carcasses (not classified as hazardous).

- Fewer plastic bottles are currently carrying the SPI code. Several bottles were found without these, including some that had the triangular recycling symbol on the bottom of the bottle but did not have the code number inside the triangle.

- Many small bags of animal waste were found during the waste sorting activities, apparently the result of aggressive "pick it up" campaigns being conducted by various clean water agencies in Snohomish County. The amount of animal excrement in the waste stream has in fact doubled, increasing from 1.3% in the previous waste study to 2.7% in the current study.

SECTION III

CONCLUSIONS AND RECOMENDATIONS

A. CONCLUSIONS

Analysis of Waste Quantity Trends

The impact of the current economic slowdown on Snohomish County's waste stream can be seen by looking at the decrease in waste tonnages from one January to another. Snohomish County, like most areas of the country, has seen a significant drop in waste tonnages beginning in the latter half of 2008. While a large part of this drop can be attributed to the decrease in housing construction, which affects primarily the Non-Residential Self-Haul waste stream, there also seems to be a decrease in consumer demand (affecting all three of the residential waste streams) and in business activity (General Non-Residential).

As can be seen in Table 7, waste tonnages are lower for all types of customers, and the largest decreases occurred in construction and roofing. The decrease for institutional waste, which is largely from municipal functions such as public works, parks maintenance and schools, is also significant and could indicate fewer maintenance and construction projects in that sector as well.

Table 7
YEAR-TO-YEAR COMPARISON OF DISPOSED WASTE QUANTITIES

Type of Customer, from County's Transaction Records	January 2008	January 2009	Percent Decrease
Businesses (Misc. Businesses)	1,124.3	1,038.0	7.7%
Cash Customers	7,882.2	7,205.6	8.6%
Construction	418.9	313.4	25.2%
Haulers	31,115.7	28,883.2	7.2%
Institutional	699.7	542.4	22.5%
Roofers	365.3	218.5	40.2%
Totals	**41,606.1**	**38,201.0**	**8.2%**

Weight of Materials Disposed

The waste quantity and composition results can be combined to show the total weight of disposed materials. Table 8 provides this information for the five waste generators and for the County's entire waste stream. It should be noted here that the figures shown in Table 8 have a specific degree of error associated with them. As with all sampling and survey procedures, a certain degree of error is unavoidable but quantifiable (see Appendix B for more details).

Analysis of Waste Composition Trends

Table 9 shows the current results for the entire waste stream compared to the results from the three previous studies conducted for Snohomish County. Figure 8 provides a graphic illustration of how some types of materials have grown while others have decreased. When examining this data, it is important to bear in mind that:

- There have been significant improvements in the availability of waste reduction and recycling programs since the studies conducted in 1979 and 1988. This can be seen, for instance, in the change in the amount of yard debris for 1979 and 1988 (8.8% and 9.3%, respectively) compared to the amount in 1998 and 2008 (2.5% and 2.2%, respectively).

- The figures shown are percentages, which change due solely to changes in other materials. For example, the annual tonnage of a material such as newspaper could remain unchanged, but a higher percentage would be shown if there were a large reduction in another material (such as yard debris). This factor probably explains why food waste appears to increase for the two latest studies.

- The types of materials and definitions are not identical from study to study, which could cause false differences or even mask actual differences between the data from different studies.

Bearing in mind the difficulty of drawing firm conclusions from this data, per the points raised above, some interesting trends can be observed for each of the major categories:

- **Paper**: the percentage of paper in Snohomish County's waste stream has dropped steadily over the years, from 35.4% in 1979, to 32.3% in 1988, to 21.9% in 1998 and 18.4% currently. Data for the recyclable grades of paper (newspaper, cardboard and office paper) indicates that this decrease is at least partly the result of recycling efforts. The most dramatic decrease has occurred in "other paper," which includes compostable and non-recyclable grades of paper, but this is partly due to changes in definitions. Compared to ten years ago, recycling programs are now able to handle a wider variety of paper grades, including new

Table 8
WEIGHT OF DISPOSED MATERIALS

		Single-Family	Multi-Family	Residential Self-Haul	Non-Res. Self-Haul	General Non-Res.	Totals for Entire County
PAPER	Newspaper	1,550	1,500	930	20	1,630	5,630
	Cardboard	1,540	3,460	3,340	680	8,010	17,030
	Phone Books	180	450	220		140	980
	Mixed Waste Paper	8,620	5,910	3,970	430	8,420	27,350
	Milk Cartons, Other	300	180	80	3	410	970
	Compostable	6,750	2,540	940	50	12,260	22,540
	Non-Recyclable Paper	2,590	740	1,280	480	5,120	10,210
	Paper Subtotal	**21,530**	**14,790**	**10,750**	**1,660**	**35,990**	**84,710**
PLASTIC	PET Bottles	1,150	850	400	50	1,240	3,680
	HDPE Bottles	760	620	400	40	880	2,690
	Bottles 3-7	100	60	50	1	60	280
	Bags and Film	7,030	2,850	1,630	450	11,110	23,060
	Plastic Packaging	2,670	1,140	870	180	3,380	8,250
	Plastic Products	2,540	1,230	4,480	1,070	12,190	21,520
	Expanded Polystyrene	770	330	200	80	1,060	2,430
	Plastic Subtotal	**15,010**	**7,080**	**8,020**	**1,870**	**29,920**	**61,910**
METAL	Aluminum Cans	520	600	170	10	630	1,930
	Aluminum Foil	300	120	60	20	190	690
	Tin Cans	1,310	820	330	10	900	3,380
	Mixed Metals	2,700	940	4,120	690	5,320	13,770
	Ferrous Metals	1,500	410	3,650	920	2,070	8,540
	White Goods	1,550		1,580			3,130
	Non-Ferrous Metals	120	170	360	90	180	930
	Aerosol Cans	270	110	60	10	240	690
	Metal Subtotal	**8,260**	**3,180**	**10,320**	**1,750**	**9,540**	**33,050**
ORGANICS	Food Waste	30,830	10,770	4,830	220	20,720	67,370
	Yard Waste	2,540	2,180	1,290	830	3,690	10,530
	Org. Subtotal	**33,360**	**12,950**	**6,120**	**1,060**	**24,420**	**77,900**
GLASS	Clear Bottles	1,360	1,430	1,340	20	1,740	5,890
	Brown Bottles	470	780	650	20	720	2,640
	Green Bottles	590	780	550	10	590	2,500
	Non-Recyclable Glass	370	660	2,060	1,180	1,250	5,520
	Light Bulbs	40	30	100	10	20	210
	Glass Subtotal	**2,840**	**3,680**	**4,690**	**1,240**	**4,320**	**16,760**
OTHER	Tires			250			260
WASTES	Rubber Products	180	60	50	70	550	910
	Cosmetics	390	230	160	4	130	930
	Disposable Diapers	6,660	2,730	1,190		1,000	11,570
	Textiles	4,440	2,540	2,520	100	7,870	17,460
	Carpeting	20	110	1,520	2,370	2,350	6,370
	Carpet Padding	2	20	630	900	230	1,780
	Furniture	920	780	5,790	2,880	660	11,020
	Ash, Dust	1,440	80	150	110	330	2,120
	Residuals	10,810	4,740	2,100	400	9,230	27,280
	Other Waste Subtotal	**24,860**	**11,290**	**14,370**	**6,830**	**22,350**	**79,700**
WOOD	Wood	1,430	4,140	22,760	10,730	24,280	63,340
and C&D	C&D	720	740	6,860	10,840	5,830	24,990
	Wood, C&D Subtotal	**2,150**	**4,880**	**29,620**	**21,580**	**30,110**	**88,330**
SPECIAL	Paints and Solvents	20	100	30	10	120	280
WASTES	Automotive	20		1		40	60
	Animal Excrement	8,430	1,680	2,000		520	12,630
	Other	1,010	1,260	1,610	60	1,380	5,320
	Actual Hazardous Wastes	70	60	130	70	90	410
	Special Waste Subtotal	**9,470**	**3,040**	**3,640**	**70**	**2,060**	**18,290**
TOTALS		**117,480**	**60,890**	**87,530**	**36,060**	**158,700**	**460,650**
RECYCLABLE SUBTOTAL		**38,890**	**26,770**	**27,690**	**4,400**	**56,050**	**153,740**

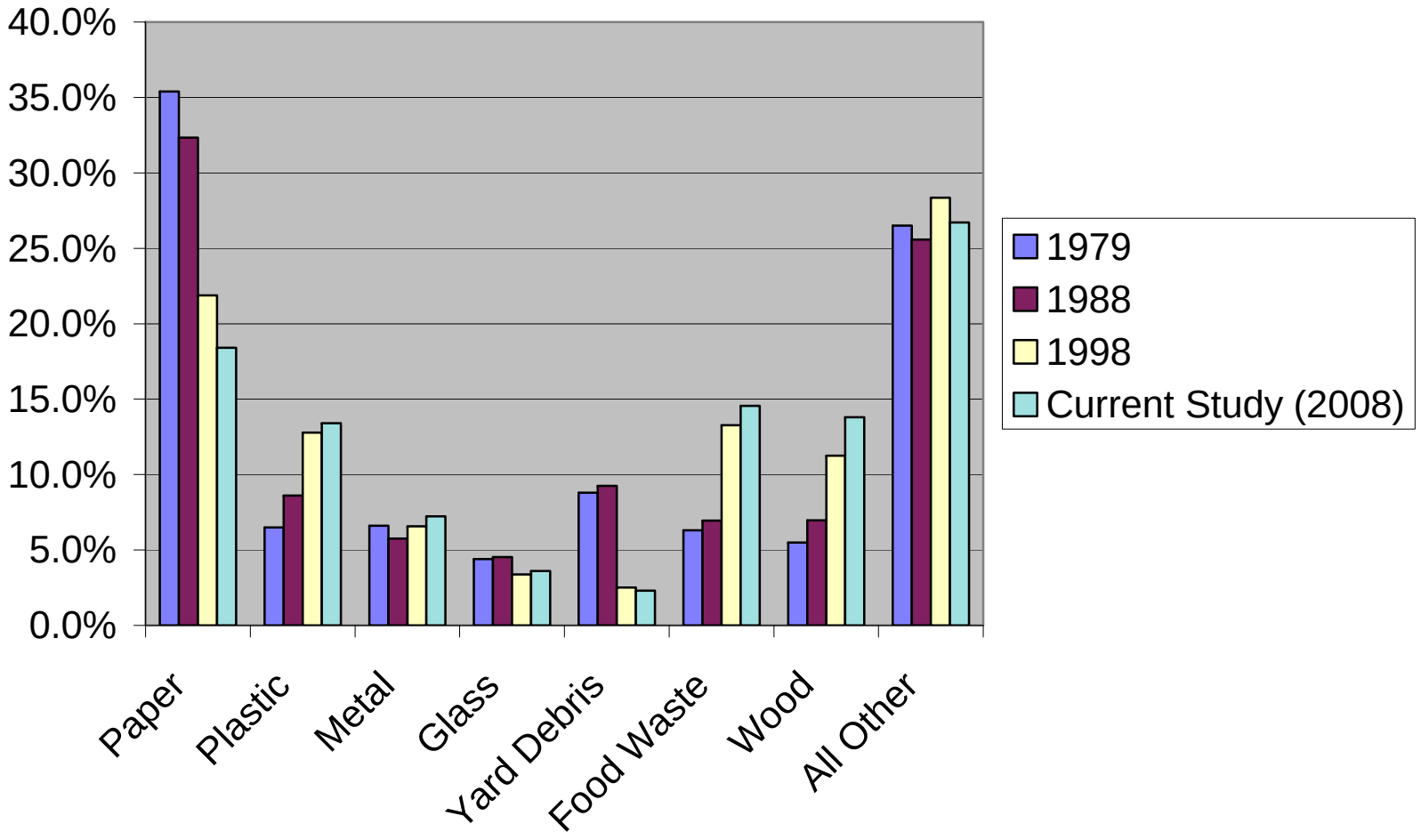
Notes: All figures are tons per year (2008 quantities).
"Recyclable Subtotal" includes newspaper, cardboard, other recyclable paper, plastic bottles, plastic film and bags. all metals, glass bottles, yard debris and textiles.
Zero values are not shown.

Table 9
CURRENT AND PREVIOUS WASTE COMPOSITION STUDIES

		Previous Studies[1]			
		Snohomish County, 1979	Snohomish County, 1988	Snohomish County, 1998	Current Study, 2008
PAPER	Newspaper	6.3%	3.6%	1.9%	1.2%
	Cardboard	8.6%	4.7%	4.0%	3.7%
	Mixed Waste Paper		6.1%	6.9%	6.2%
	Milk Cartons, Other			0.4%	0.2%
	Other Paper	20.5%	17.9%	8.7%	7.1%
	Paper Subtotal	**35.4%**	**32.3%**	**21.9%**	**18.4%**
PLASTIC	PET Bottles		0.1%	0.5%	0.8%
	HDPE Bottles		0.2%	0.6%	0.6%
	Bottles 3-7			0.1%	0.1%
	Plastic Packaging			7.5%	6.8%
	Other Plastic Products			3.4%	4.7%
	Expanded Polystyrene			0.7%	0.5%
	Other Plastic		8.3%		
	Plastic Subtotal	**6.5%**	**8.6%**	**12.8%**	**13.4%**
METAL	Aluminum Cans			0.5%	0.4%
	Aluminum Foil			0.2%	0.1%
	Tin Cans		1.7%	1.1%	0.7%
	Mixed Metals			1.8%	3.0%
	Ferrous Metals		2.9%	2.4%	1.9%
	White Goods			0.0%	0.7%
	Non-Ferrous Metals		1.2%	0.5%	0.2%
	Aerosol Cans			0.2%	0.1%
	Metal Subtotal	**6.6%**	**5.8%**	**6.6%**	**7.2%**
GLASS	Clear Bottles			1.6%	1.3%
	Brown Bottles			0.6%	0.6%
	Green Bottles			0.4%	0.5%
	Recyclable Glass		4.0%		
	Other Glass		0.5%	0.7%	1.2%
	Glass Subtotal	**4.4%**	**4.5%**	**3.4%**	**3.6%**
ORGANICS	Food Waste	6.3%	7.0%	13.3%	14.6%
	Yard Debris	8.8%	9.3%	2.5%	2.3%
	Organics Subtotal	**15.1%**	**16.2%**	**15.8%**	**16.9%**
OTHER WASTES	Tires			0.1%	0.1%
	Rubber Products			0.2%	0.2%
	Cosmetics			0.1%	0.2%
	Disposable Diapers			2.7%	2.5%
	Textiles	3.2%	2.2%	2.4%	3.8%
	Carpeting			2.6%	1.8%
	Leather			0.1%	
	Furniture			0.8%	2.4%
	Fines			3.6%	
	Ash, Dust			1.5%	0.5%
	Misc. Organics/Residuals		9.6%	5.2%	5.9%
	Misc. Inorganics			0.4%	
	Hazardous/Special Wastes		1.8%	2.3%	4.0%
	Misc. Combustibles		7.6%		
	Inert		3.4%		
	All Other	23.3%			
	Other Subtotal	**26.5%**	**24.6%**	**22.1%**	**21.3%**
WOOD and C&D	Wood	5.5%	7.0%	11.3%	13.8%
	Const./Demo. Wastes	NA	NA	6.3%	5.4%
	Wood and C&D Subtotal	NA	NA	**17.5%**	**19.2%**
TOTAL		**100.0%**	**100.0%**	**100.0%**	**100.00%**

Notes: 1. Data shown for the 1979 and 1988 studies is from the "Snohomish County Comprehensive Solid Waste Management Update," December 1989 (Vol. 1, page 5-7). Data shown for 1998 is from the "Snohomish County Waste Composition Study," by Green Solutions, November 1998.

Figure 8
DISPOSAL TRENDS



categories such as milk cartons and increasingly broad definitions for existing categories. "Mixed paper" in particular now includes a wider range of materials, so the apparent increase in this material (from 6.1% in 1988 to 6.9% in 1998) is probably due to that.

- **Plastic**: the amount of plastic has increased steadily, from 6.5% to 8.6% to 12.8% and is now 13.4%. This increase is most likely a reflection of the increasing popularity of plastics for packaging and other applications. Plastic bottles, especially PET bottles, provide an example of how plastics have replaced other container materials such as glass and metal. The amount of PET bottles in the waste stream continues to grow despite increased recycling programs for this material.

- **Metal**: the percentage of metal in the waste stream has remained fairly steady over the years, changing from 6.6% to 5.8%, then back to 6.6% and is now 7.2%. It is surprising to see an increase in the amount of metal in the latest study, since buyback prices for metal were high at least at the beginning of 2008, but metals found in this study are mostly the small bits and pieces that tend to "slip through the cracks" for recovery programs.

- **Glass**: the amount of glass in the waste stream has remained fairly steady. The slight decrease that can be seen in the two most recent studies could be the combined result of increased recycling, "lightweighting" of glass bottles, and the loss of packaging market share to plastic bottles. Although plastic bottles continue to replace glass bottles for some foods and other applications, glass bottles have retained their market share for beer and certain other applications.

- **Yard debris**: the percentage of yard debris in the County's waste stream shrank considerably between 1988 and 1998, and is now only one-quarter of the amount that the waste stream contained 20 years ago. This is the result of yard debris programs encouraging residents to divert and compost green waste.

- **Food waste**: the percentage of food in the County's waste stream has more than doubled over the past 30 years. At least part of this increase may be the result of decreasing amounts of other materials (due to recycling and other factors), leaving the same quantity of food waste to appear as a larger percentage of a shrinking waste stream. In addition, there could be an actual difference due to changes in lifestyle and consumption patterns.

  Wood: the percentage of wood in the County's waste stream has increased over the past 30 years, although, again, this increase could be explained at least in part by the removal of other materials, making the percentage of wood larger. The increase in wood waste could also be from increased construction activities in Snohomish County.

- **Other wastes**: this category includes a number of different materials, and the differences in the definitions used by the different studies prevent any conclusions from being drawn for this category.

Waste Composition Conclusions

There are distinct differences in the waste streams of the different types of waste generators (see Table 4 in Section II of this report). For each of the generators, a few noteworthy conclusions can be drawn:

- **Single-Family Residential**: significant materials present in this waste stream include:

  - food waste is the largest category of material in this waste stream, at 26.2%,
  - mixed waste paper, 7.3%,
  - animal excrement, 7.2%, (primarily "kitty litter" and also some dog wastes),
  - plastic bags and film, 6.0%,
  - compostable paper, 5.7%, and
  - disposable diapers, 5.7%.

  Significant quantities of recyclable materials remain in this waste stream despite the widespread availability of recycling programs for single-family homes. If residents used programs to recycle materials currently accepted through existing recycling and yard debris programs, and recycled plastic bags and textiles, an additional 33.1% of the single-family waste stream could be recycled. This is the equivalent of 38,890 tons per year of additional recyclable materials.

- **Multi-Family Residential** (apartments): the waste stream for this generator includes the following materials:

  - food waste, at 17.7%, is again the single largest category,
  - mixed paper, 9.7%,
  - wood, 6.8%,
  - cardboard, 5.7%,
  - plastic bags and film, 4.7%,
  - disposable diapers, 4.5%, and
  - textiles, 4.2%,.

  The percentage of recyclable materials in apartment wastes is higher than for single-family homes, although the tonnage figure for recyclable materials is lower due to the smaller waste quantities from this type of generator. The Multi-Family Residential waste stream contains 44.0% or 26,770 tons per year of recyclable materials.

- **Residential Self-Haul**: self-haul loads from residential sources have more wood, construction debris and metal but less food waste than other residential sources, reflecting activities such as remodeling and the other special projects that are often the source of self-haul waste. The waste stream for this generator includes the following materials:

  - wood is the material present in the largest quantity, at 26.0%,
  - followed by construction/demolition wastes, 7.8%,
  - furniture, 6.6%, and
  - food waste, 5.5%.

  Residential self-haul waste contains 31.6% recyclable materials, or about 27,690 tons per year. Residential self-haul customers deliver a significant portion (19.0%) of the total waste stream, but because of their smaller load weights this type of customer represents 76% of the transactions at the transfer stations. Traffic flow will continue to be a concern if this number remains high.

- **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 and other construction waste in this waste stream clearly shows the influence of construction activities on this waste stream. The primary materials in this waste stream include:

  - construction and demolition waste, 30.1%,
  - wood, at 29.8%,
  - furniture, 8.0%, and
  - carpeting, 6.6%.

  Not counting the wood and other construction materials that could be recycled, the Non-Residential Self-Haul waste stream contains 12.2% recyclable materials, or about 4,400 tons per year.

- **General Non-Residential**: waste from this source consists primarily of:

  - wood waste, 15.3%,
  - food waste, 13.1%,
  - compostable paper, 7.7%,
  - plastic products, 7.7%,
  - plastic bags and film, 7.0%,
  - mixed paper, 5.3%,
  - cardboard, 5.1%, and
  - textiles, 5.0%.

The General Non-Residential waste stream contains 35.3% recyclable materials, or about 56,050 tons per year. The differences in the waste streams of the two types of non-residential customers (self-haul and general) highlight the different services needed for different business types.

- **Total Waste Stream**: overall, the County's waste stream contains significant amounts of:

  - food waste, 14.6%,
  - wood waste, 13.8%,
  - mixed paper, 5.9%,
  - construction and demolition waste, 5.4%,
  - plastic bags and film, 5.0%,
  - compostable paper, 4.9%,
  - plastic products, 4.7%,
  - textiles, 3.8%, and
  - cardboard, 3.7%.

  The amount of recyclable materials that could be handled through existing programs and facilities is 33.4% or 153,740 tons per year.

B. RECOMMENDATIONS

The following planning and program recommendations are based on the results of this study:

- There continues to be a significant amount of recyclable materials disposed in Snohomish County's waste stream, and this amount has increased on a percentage basis since the previous study ten years ago. The County could increase waste diversion without creating new infrastructure or programs since a significant portion of the disposed waste stream consists of standard recyclable materials. If Snohomish County desires to increase the recycling rate substantially over current levels, however, a different approach may be needed. Alternative approaches could include mandatory recycling, universal garbage and recycling services, processing solid waste to remove recyclable material, or targeted programs such as bottle bills and disposal bans.

- There are substantial amounts of wood and C&D wastes in the two self-haul waste streams, and expanded recycling programs targeting self-haul customers should be considered for these materials. Transfer stations should also be designed or provide incentives to encourage more recycling of other materials.

- Diversion of food waste should be examined closely. Food waste is the largest single item remaining in the waste stream.

- A recent analysis by Green Solutions concluded that the statewide recovery rates for PET bottles, aluminum cans and glass bottles are not keeping up with other recyclable materials. This can be seen here as well, and it may be time for a different approach for these materials (i.e., bottle bill) if recovery rates for these materials are going to be increased significantly over the current rate.

- In light of the large amount of recyclable materials still remaining in the waste stream, Snohomish County should consider how best to use County facilities and staff to process additional commodities.

GLOSSARY

INTRODUCTION

This glossary includes two sets of definitions:

a) Definitions for waste generator types, and

b) Definitions for waste sorting categories, which are shown below in the same order as they appear on the waste sorting form.

A. WASTE GENERATORS

For the purposes of this study, all waste disposed in the County was categorized into one of five sources, including three types of residential waste generators (single-family, multi-family and self-haul) and two types of non-residential (self-haul and general).

Single-Family: waste originating from single-family homes. To be counted in this category, the waste must have been delivered to the transfer station by a garbage hauler (i.e., not a self-haul load).

Multi-Family: waste from a multi-family dwelling. A multi-family dwelling is defined as a structure with three or more apartment units in the same building. Duplexes were included with single-family homes. To be counted in this category, the waste must have been brought to the transfer station by someone other than the landlord or tenant (i.e., must not have met the definition of self-haul).

Residential Self-Haul: residential waste delivered to the transfer station by a homeowner, renter or landlord, typically using cars, vans, jeeps, pick-up trucks, and other personal vehicles.

Non-Residential Self-Haul: non-residential waste delivered to the transfer station by an employee of the same company that generated the waste, including construction and demolition waste brought in by the construction company that created the waste.

General Non-Residential: all non-residential waste except self-haul. In other words, the waste must have been delivered to the transfer station by a garbage hauler or other third party who was paid to transport the waste.

B. WASTE SORTING CATEGORIES

PAPER

Newspaper: printed groundwood newsprint, including glossy ads and Sunday edition magazines delivered with the newspaper (glossy ad and magazine inserts found apart from the newspapers were included with "mixed waste paper").

Cardboard: unwaxed kraft paper corrugated containers and boxes, unless poly- or foil-laminated. Also included brown kraft paper bags.

Phone Books: printed and bound (typically with glue) phone books made primarily of groundwood paper.

Mixed Waste Paper: high- and low-grade potentially recyclable papers, including colored papers, office paper, notebook or other lined paper, envelopes with plastic windows, non-corrugated paperboard, frozen food packaging, carbonless copy paper, egg cartons, hardcover books and junk mail.

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

Compostable Paper: non-recyclable papers that could be composted, such as towels, plates, pizza boxes, and waxed cardboard. This category also included paper that was contaminated or soiled with food or liquid in its normal use.

Non-Recyclable Paper: contaminated papers and non-recyclable types of papers such as carbon paper, cups, tissues, plastic-coated plates and other items, and paper packaging with metal or plastic parts.

PLASTIC

PET Bottles: polyethylene terephthalate (PET) bottles, clear and tinted, with or without the base cup, including soda, liquor and other types of bottles. The SPI code for PET is 1.

HDPE Bottles: high-density polyethylene (HDPE) bottles that were translucent, opaque, or colored, including milk, juice, detergent, motor oil, and other bottles. The SPI code for HDPE is 2.

Bottles Types 3 - 7: all bottles that were not PET or HDPE, where the neck of the container was narrower than the body or the container had a screw-top cap (but not squeeze tubes). Included SPI codes 3 - 7.

Bags and Film: all plastic packaging films and bags. To be counted in this category, the material must have been flexible (i.e., could be bent without breaking or making much noise).

Plastic Packaging: all other plastic packaging, such as tubs, yogurt cups, trays, shipping materials, and other thermoplastics and thermosetting plastic items that are not consumer products.

Plastic Products: finished plastic products such as toys, toothbrushes, vinyl hose and shower curtains, including non-C&D fiberglass resin products and materials (see also "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 included bi-metal beverage cans and steel cat food cans, but not paint cans or other types of cans.

Mixed Metals: small appliances, motors, insulated wire and finished products that contained a mixture of metals and/or other materials, but that were greater than 50% metal. Actual items found were noted for each sample.

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

White Goods: large household appliances or parts thereof.

Non-Ferrous Metals: metallic products and pieces not derived from iron (i.e., to which a magnet would not adhere) and that were not significantly contaminated with other metals or materials. This category included aluminum cat food cans.

Aerosol Cans: metal cans used for holding 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.

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 Debris: grass clippings, leaves and weeds, garden debris, houseplants, and prunings four inches or less in diameter.

GLASS

Clear Glass Containers: bottles and jars that were clear in color.

Brown Glass Containers: brown bottles and jars.

Green Glass Containers: green bottles and jars. Blue bottles were also included here.

Light Bulbs: light bulbs of all types, including incandescent, CFLs, other fluorescent bulbs, and other types of light bulbs.

Non-Recyclable Glass: window glass, glassware, mirrors, automobile glass, and other glass that was not recyclable. Non-C&D ceramics (plates and knickknacks) were included here.

OTHER WASTES

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

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 below).

Cosmetics: bottles and other containers of cosmetics, hair care products, and similar products where the weight of the product was greater than the weight of the container (i.e., the product is 50% or more of the total weight, otherwise the item was categorized according to the type of packaging). This category did not include pharmaceuticals or vitamins (see "pharmaceuticals" under Special Wastes, below).

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

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

Carpet: pieces of carpet, as well as area rugs if made of similar products.

Carpet Padding: foam rubber and other materials used as padding under carpets.

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

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

Residuals: mixed waste that remained on the sorting table after all the materials that could practicably be removed had been sorted out. This material consisted primarily of small pieces of various types of paper and plastic, and also small pieces of broken glass and other materials.

WOOD WASTES

Pallets: partial or whole pallets and similar shipping containers.

Natural 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.

Other Clean Wood: unfinished, clean wood that could be included in a composting program, such as dimension lumber.

Hog Fuel: wood that was not clean enough for a composting system but that could be burned for heat recovery, including plywood and treated wood.

Roofing: wood products commonly used for roofing, such as cedar shingles or shakes.

Other Contaminated Wood: wood that was contaminated with other wastes in such a way that the materials 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.

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

CONSTRUCTION, DEMOLITION AND LANDCLEARING (C&D) WASTES

Ceramics, Porcelain, and China: used toilets and sinks, and ceramic or porcelain tile. Non-C&D ceramics, such as plates and other dishes, were categorized under "non-recyclable glass."

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

Concrete: cement (mixed or unmixed), concrete blocks, and similar wastes. Did not include hardiboard and similar products (those were placed under "other C&D).

Soil, Dirt, and Non-Distinct Fines: this category included soil, sand, dirt and similar materials.

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

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

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

Roofing: asphalt and fiberglass shingles, tarpaper, and similar wastes from demolition or installation of roofs. Did not include cedar shingles or shakes (see "roofing" under Wood Wastes, above).

Asphalt: asphalt paving material.

Tyvek Vapor Barrier: a building material made of Tyvek and used as a vapor barrier in the exterior shell of a building.

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

HAZARDOUS AND SPECIAL WASTES

E-Wastes: electronic wastes as defined by Washington State law (Chapter 173-900 WAC), including computers (base units and monitors), televisions, laptops, and other products with video displays greater than four inches diagonally. The actual items found for each sample were noted.

Other Electronics: other products that contained circuit boards and electronic components as a significant portion of the product, such as radios and similar products. The actual items found for each sample were noted.

Asbestos: products that appeared to contain asbestos based on visual identification, such as pipe insulation, house siding, brake lining, and other products.

Latex Paint: water-based paints.

Oil-Based Paint: solvent-based paints.

Solvents: included chlorinated or flammable solvents, paint strippers, solvents contaminated with other products such as paints, degreasers, other cleaners if the primary ingredient was 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 and autobody fillers.

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

Fertilizers: concentrated nutrients used to stimulate plant growth, in dry or liquid form, and with or without pesticides included in the formulation.

Pesticides and Herbicides: included various poisons intended to discourage or kill pests, weeds or microorganisms. Fungicides and wood preservatives, such as pentachlorophenol, were also included in this category.

Pharmaceuticals: included pills, prescription drugs, medications, salves and lotions with active ingredients (such as antibiotics), and vitamins. These items were counted if there was any amount of active ingredient or product present (except residues inside squeeze tubes and similar items).

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

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

Oil Filters: used filters such as those from cars but including similar filters from other applications.

Motor Oil: used or new lubricating oils, primarily those from cars but also including other materials with similar characteristics.

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 (the type and amount of rechargeable batteries were noted).

Antifreeze: automobile and other antifreeze mixtures based on ethylene or propylene glycol.

Brake and Hydraulic Fluid: brake and hydraulic fluids.

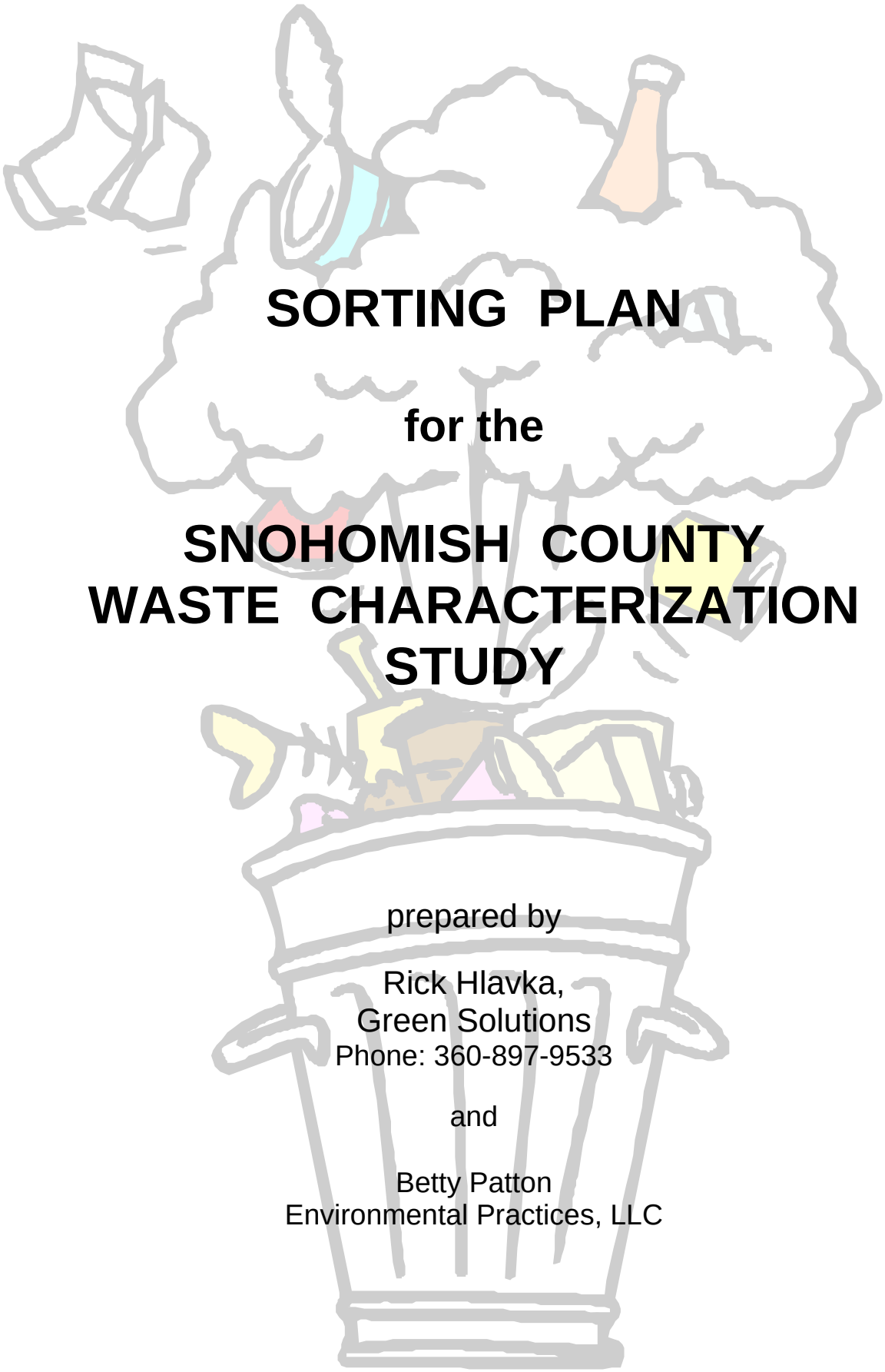
Animal Excrement: feces and associated wastes from animals, such as bags of used kitty litter.

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

Other Hazardous and Special Waste: problem wastes that did not fall into one of the above categories, such as gunpowder, unspent ammunition, and radioactive materials.

APPENDIX A

SORTING PLAN



SORTING PLAN

for the

SNOHOMISH COUNTY WASTE CHARACTERIZATION STUDY

prepared by

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March 2008

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SNOHOMISH COUNTY
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SORTING PLAN

A. PURPOSE

This document describes the procedures that will be used to characterize Snohomish County's solid waste stream. This document provides an opportunity for County staff and others to review the proposed procedures prior to the initiation of fieldwork, as well as providing documentation for future reference.

Two primary sets of data will be collected for the waste characterization study: waste composition data and waste quantity data. These data sets will be collected using different surveys and methods, which are described in the following pages. Each set of data provides valuable information by itself, but the results when combined will provide the weighted averages that are the primary goal of this study.

B. TYPES OF GENERATORS

For both the waste composition and waste quantity surveys, Snohomish County's solid waste stream will be divided into five primary substreams; three substreams of residential waste and two substreams of non-residential waste. This is done to allow examination of the recyclables and other materials disposed by specific types of waste generators (or sources), with the data for each of the generators combined later to construct a picture of the County's entire waste stream. The five substreams are:

Residential Waste

1 - **Single-Family**: waste originating from single-family homes. To be counted in this category, the waste must be delivered to the transfer station by someone other than the homeowner, typically a garbage hauler. This category does not include self-hauled wastes (see below).

2 - **Multi-Family (Apartments)**: waste originating from multi-family dwellings. A multi-family dwelling is a structure with three or more apartment units in the same building. To be counted in this category, the waste must be brought to the transfer station by someone other than the landlord or tenant.

3 - **Residential Self-Haul**: residential waste delivered to the transfer station by a homeowner, renter or landlord, typically using cars, vans, jeeps, pick-up trucks, and rental trucks.

Non-Residential Waste

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

5 - **General Non-Residential**: all other non-residential waste except self-haul. The waste must be delivered to the transfer station by a garbage hauler or other third party who is paid to transport the waste.

Mixed loads will not be used for waste composition samples, with the one exception of possibly taking multi-family samples (pure loads of which are hard to come by) from mixed loads if there is a reasonable assurance of procuring a clean multi-family sample.

Construction, demolition and land clearing (C&D) wastes and other special wastes are included in the above categories as appropriate for the type of generator.

C. PROJECT SCHEDULE

This is a four-season study. Both waste composition and waste quantity data will be collected during each of the four seasons in order to encompass seasonal variations in the types and amounts of waste produced. There will not be a sufficient number of samples sorted to provide accurate "stand-alone" composition data for each season, but it should be possible to assess approximate seasonal trends for some materials.

In developing a schedule for fieldwork and other data collection efforts for this study, the goal is to choose time periods that are representative of each season. The primary concern here is to avoid transition periods between the seasons, where a particular week may not be representative of a given season due to weather and other factors, and to avoid the impacts caused by major holidays and other singular events. A proposed schedule and review of seasonal considerations are provided in Table A-1.

Table A-1
Proposed Schedule

SEASON	TARGET PERIOD *	COMMENTS
Spring	April 8 – 12 (April 6 – 12 for the waste quantity data)	May is sometimes hot enough to resemble summer, and June is often a transition month.
Summer	July 20 – 24 (July 20 – 26 for the waste quantity data)	Goal is to capture impacts of hot weather and summer vacations (for schools and businesses), but August is sometimes rainy and not very summer-like.
Fall	October 21 – 25 (October 19 – 25 for the waste quantity data)	Schedules return to normal after Labor Day, but September is often a transition month and may or may not be summer-like, so early October is a better choice. Best to avoid Halloween and post-Halloween period.
Winter	January 11 – 15 (January 11 – 17 for the waste quantity data)	Mid or late January avoids excessive impacts from Christmas, especially for business waste quantities and composition.

* the target period for the waste composition fieldwork includes a Saturday or a Sunday each season due to the need for a representative sampling of residential self-haul samples.

Another consideration for scheduling fieldwork and data collection efforts for waste quantities is the weekly variations in waste deliveries to the transfer stations. The strongest pattern in this regard is for the delivery of self-haul wastes. For residential self-haul wastes, there are a much larger number of these customers on the weekends than on the weekdays. Non-residential self-haul is just the opposite, with more of these customers bringing loads during the regular work week (Monday through Friday). Depending on the haulers' practices and routing details, there may also be weaker patterns in single-family, multi-family and general commercial waste deliveries. These patterns mean that sampling and sorting activities for waste composition purposes must usually include one day during the weekend (to get a representative sampling of the residential self-haul waste stream) and a variety of days during the week for each facility.

A final practical limitation guiding the scheduling is the need to minimize changing between sites. Mobilizing between sites involves considerable work to move the equipment. This will be done by Green Solutions staff in the evenings or early morning hours to avoid cutting into the crew's productivity, but minimizing the number of moves will still be preferable for maximum efficiency. Since the budget provides for five days of fieldwork each season, traveling to every facility each quarter would lead to an average of one or two days at each facility and three moves each quarter, which does not provide for an efficient or effective schedule. Instead, this sampling plan proposes that sorting and sampling activities (for waste composition purposes) be conducted at only two facilities each season. The amount of time spent at each facility and the resulting number of samples can still be allocated based on the amount of waste handled by each facility (see discussion in next section).

Most of the above discussion focuses on waste composition fieldwork, and the waste quantity data should also be collected for a similar time period. The waste quantity data, however, should be collected for a one-week period at all facilities concurrently, if possible.

D. NUMBERS OF SAMPLES, BY GENERATOR AND BY FACILITY

The methodologies for determining waste composition in Snohomish County are designed to produce data that is representative of the entire waste stream. This study will involve sampling waste as it is delivered to the three primary transfer stations: North County in Arlington, Southwest in Mountlake Terrace, and Airport Road in Everett. Samples will not be taken at the six rural-area drop sites, but it is not expected that this will impact the accuracy of the results due to the low flows and load restrictions for these sites.

Number of Samples per Generator

Previous studies have demonstrated that 20 to 30 samples are the minimum acceptable number of samples 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. This study is designed to provide reasonably reliable data on an annual basis by type of waste generator. Seasonal results for each type of generator can be examined for trends, bearing in mind that these results may be imprecise due to an inadequate number of samples.

Sample numbers for each type of generator targeted by this study have been adjusted to allow greater numbers of samples to be taken for the most variable substreams (i.e., general non-residential and the two self-haul categories). A fewer number of samples will be taken for the single-family generators (eight samples) and multi-family generators (seven samples). With the projected number of samples being approximately 200 total, subtracting the number of single-family and multi-family samples leaves 140 (35

per season) for the other three generators. These samples should be divided roughly equally between the other three generators, with slightly more samples allocated to the general non-residential generators due to their potentially greater variability (see Table A-2).

Table A-2
Target Number of Samples by Generator

TYPE OF GENERATOR	SAMPLES PER SEASON	SAMPLES PER YEAR
Single-Family Residential	8	32
Multi-Family Residential	7	28
Residential Self-Haul	11	44
Non-Residential Self-Haul	11	44
General Non-Residential	13	52
TOTALS	50	200

As explained in greater detail in the next section, samples must be chosen at random to avoid biasing the results, although there are a few exceptions to this rule. The need for "pure" samples of multi-family wastes leads to a greater reliance on compactors for the source of these samples, since loads carried by other garbage trucks (those trucks that service dumpsters) typically end up being a mixture of commercial and multi-family wastes. For the general commercial category, a balance should be struck between the front-loading trucks (again, those that typically service dumpsters) versus roll-offs and compactors (which are generally from a single business). Finally, the number of single-family loads sampled from Everett versus the rest of the county should be monitored to maintain a balance based on population. Based on current (year 2000) estimates for the number of single-family homes in Everett (23,460 units) versus all of Snohomish County (170,540 units), only about 14% of the single-family samples (four to five samples altogether, or about one per quarter) should come from Everett.

Table A-3 employs data on the tonnages delivered by specific types of vehicles in 2007 to allocate samples between the three facilities. For the purposes of this allocation, it is assumed that the tonnage delivered by sedans and pickups/vans with loads under 360 pounds (vehicle types 10 and 11) are representative of the amount of residential self-haul each transfer station receives. Pickups/vans over 360 pounds, single-axle trucks, and single-axle roll-offs (vehicle types 12, 20, 21 and 22) are assumed to represent the amount of non-residential self-haul each station receives. Loads from the other generators (single-family residential, multi-family residential and general non-residential) are brought to the transfer stations by garbage haulers, which are assumed to be vehicle types 23, 31, 32 and 33. No data is available on the proportion of the haulers' loads that can be attributed to single-family, multi-family or general non-residential sources, so at this point the sample numbers for these generators for each facility can only be allocated based on the total tonnage delivered by haulers to each site. A small adjustment in sample allocations has been made, however, on the assumption that North County Transfer Station receives a slightly higher amount of residential waste and the Airport Road and Southwest Transfer Stations receive slightly higher amounts of non-residential wastes.

Table A-3
Proposed Sample Numbers by Generator and Ideal Allocation by Transfer Station,
Sample Numbers per Year

TONNAGES AND % FOR 2007	ARTS	NORTH COUNTY	SOUTHWEST	TOTALS
Res. Self-Haul (truck types 10 and 11);				
Number of tons	6,694	4,427	8,471	19,593
Percentage	34.2%	22.6%	43.2%	100%
Non-Res. Self-Haul (truck types 12, 20, 21, and 22);				
Number of tons	46,256	25,959	43,280	115,496
Percentage	40.1%	22.5%	37.5%	100%
Other Generators (truck types 23, 31, 32, and 33);				
Number of tons	205,651	83,911	118,832	408,394
Percentage	50.4%	20.5%	29.1%	100%
IDEAL BREAKDOWN BY SITE	ARTS	NORTH COUNTY	SOUTHWEST	TOTAL PER YEAR
Single-Family Res.	16	7	9	32
Multi-Family Res.	14	6	8	28
Res. Self-Haul	15	10	19	44
Non-Res. Self-Haul	18	10	16	44
General Non-Residential	26	11	15	52
TOTALS	89	44	67	200

Table A-3 shows the ideal allocation by type of generator and by facility, but actual sample numbers will be affected by the work schedule (see below) and other factors. In addition, it may be possible to sort more than 50 samples each season, but this will hinge on crew productivity, in particular the ability to avoid personnel turn-over to the maximum extent possible (thus minimizing losses in efficiency due to the loss of experienced personnel and the lost time due to repeating the health and safety training for new crewmembers). If additional samples can be taken, these samples will be allocated to the three most variable generators (in order of priority, non-residential self-haul, general non-residential, and residential self-haul).

Sorting Schedule

In preparing to conduct the fieldwork, the challenge is to match sample allocations for each station with the anticipated productivity of the crew and delivery patterns for each type of generator.

The crew's productivity will vary throughout the course of each season's work. Since the focus of the first day is primarily on training, considerably fewer samples will be sorted that day. On the second day, the crew is still becoming experienced, and it is typically not until the third day that they are "up to speed". Hence, one can expect five samples to be sorted on the first day, nine samples on the second day, and 12 or more for the following three days. Once they gain experience, productivity will be influenced by the type of samples being sorted (residential samples take longer on the average than commercial

samples) and the ability to keep the crew busy (primarily the result of sample availability, availability of transfer station equipment for sampling, and other site constraints).

Taking all of these factors into consideration, the proposed schedule is shown in Table A-4. It should be noted that the numbers in Table A-4 are the target allocation, and actual sample numbers will vary somewhat depending on sample availability, crew productivity and other factors.

E. WASTE SORTING PROCEDURES

A list of random numbers will be used to select incoming loads for sampling. As each vehicle arrives, the driver will be asked what type of load (i.e., what type of generator) he/she is carrying. A count is kept for each type of generator, checking loads off of a list of numbers until one happens to correspond to a pre-selected number and is then chosen for sampling. For instance, if the 7th and 11th load for non-residential self-haul has been pre-selected for sampling, then when the 7th and 11th vehicles carrying this type of waste arrive at the facility they are selected for sampling.

When a load is selected for sampling, the driver of the vehicle will be interviewed by an Environmental Practices (EP) staffperson to confirm the source and to determine if there are any unusual characteristics with the load. If it is discovered that the load originates from outside of Snohomish County, then it will be rejected for sampling purposes and the next load of that type will be taken instead. Loads may also be rejected for sampling purposes if there is no room for sample storage (temporary storage space for only 3-4 samples is expected to be available adjacent to the sorting area). Conversely, if there is an immediate need for a sample in order to keep the crew busy, then an additional sample may be pulled as long as the decision to take a sample is made before the vehicle or load is observed (thus maintaining randomness in selecting samples).

The EP staffperson will record basic information about the load in the upper section of a sample data form (see Figure 1, which has been reduced from its normal size of 8.5" by 14"), assign a sample identification number, record any additional comments about the source or characteristics of the load at the bottom of the form, oversee the sampling process and then give the sample data form to the Green Solutions staffperson overseeing the sorting process.

If small, the selected loads will be directed to dump near the sorting area (this will generally be the case with self-haul loads). Large loads will be dumped onto the tipping floor or into the pit of the transfer station per normal procedures and heavy equipment (a loader or backhoe) will be used to move the sample to the sorting area. Visual examination of the samples pulled by backhoe will be used to ensure that it is at least 250 to 300 pounds in weight, since a minimum sample weight of 200 to 250 pounds will be necessary to help ensure the statistical validity of the results. This sample weight has been demonstrated by numerous studies to be necessary for accurately characterizing the waste stream.

Sorting Categories

Samples from all types of generators will be sorted into 79 categories (see Figure A-1, Snohomish County Sample Data Form). The 79 categories include 40 sub-categories that provide a more detailed breakdown for wood, C&D and hazardous/special wastes. The results for these sub-categories are not expected to be as statistically valid as the other sub-categories because of the infrequent occurrence of these materials, but this data will provide an indication of the materials that make up the wood, C&D and hazardous/special categories.

Table A-4
Proposed Sorting Schedule

NUMBER OF SAMPLES BY SEASON AND FACILITY	Target Number of Samples per Season	APRIL 2008					JULY 2008				
		TU, 8	WE, 9	TH, 10	FR, 11	SA, 12	SU, 20	MO, 21	TU, 22	WE, 23	TH, 24
		ARTS	ARTS	SW	SW	SW	NC	NC	ARTS	ARTS	ARTS
Single-Family Res.	8	1	2*	2	1	2		3	1	2*	2
Multi-Family Res.	7	1	2	2	2			2	2	2	1
Res. Self-Haul	11	0	1			9	6	1	1	2	2
Non-Res. Self-Haul	11	1	2	3	4	1		2	3	3	3
General Non-Residential	13	2	2	5	5			1	4	3	4
TOTALS	50	5	9	12	12	12	6	9	11	12	12
		OCTOBER 2008					JANUARY 2009				
		TU, 21	WE, 22	TH, 23	FR, 24	SA, 25	SU, 11	MO, 12	TU, 13	WE, 14	TH, 15
		SW	SW	ARTS	ARTS	ARTS	SW	SW	SW	NC	NC
Single-Family Res.	8		1	3*	2*	2		1	2	3	2
Multi-Family Res.	7		1	3	3			2	2	2	1
Res. Self-Haul	11	1	1			9	6	1	1	1	2
Non-Res. Self-Haul	11	2	4	2	2	1		2	2	3	4
General Non-Residential	13	2	2	4	5			3	4	3	3
TOTALS	50	5	9	12	12	12	6	9	11	12	12

TOTAL NUMBER OF SAMPLES BY FACILITY	ARTS		NC		SW		TOTALS	
	IDEAL	PROPOSED	IDEAL	PROPOSED	IDEAL	PROPOSED	IDEAL	PROPOSED
Single-Family Res.	16	15	7	8	9	9	32	32 **
Multi-Family Res.	14	14	6	5	8	9	28	28
Res. Self-Haul	15	15	10	10	19	19	44	44
Non-Res. Self-Haul	18	17	10	9	16	18	44	44
General Non-Residential	26	24	11	7	15	21	52	52
TOTALS	89	85	44	39	67	76	200	200

* for the 32 samples of single-family waste, 4 – 5 of these (14%) should be from Everett (i.e., about one per quarter, except ARTS is not in the schedule for winter quarter, so take two Everett samples in the fall quarter unless it turns out that some Everett waste is going to SW).

Figure A-1
Data Collection Form

SNOHOMISH COUNTY SAMPLE DATA FORM

SAMPLE ID: _____

SOURCE (CIRCLE ONE)

Residential	Non-Residential
1) S-F Residential	4) Non-Res. Self-Haul
2) Multi-Family	5) General Non-Residential
3) Residential Self-Haul	

SITE DATA

Recorder: _____

Date: _____ Time: _____

VEHICLE / ROUTE DATA

Type: _____

Company: _____ Lic. No.: _____

City / Area: _____

PAPER	WOOD WASTES
Newspaper	Pallets
Cardboard	Natural Wood
Phone Books	Other Clean Wood
MWP	Hog Fuel
Milk Cartons, Other	Roofing
Compostable	Other Contaminated
Non-Recy.	Other Wood Waste;
PLASTIC	
PET Bottles	
HDPE Bottles	**C&D WASTES**
Bottle Types 3 - 7	Ceramics, Porc., China
Bags and Film	Rocks, Brick
Plastic Packaging	Concrete
Plastic Products	Soil, Dirt, Fines
Expanded Polystyrene	Gypsum Board
	Fiberglass Insulation
METALS	Other Fiberglass
Aluminum Cans	Roofing
Aluminum Foil	Asphalt
Tin Cans	Tyvek Vapor Barrier
Mixed Metal/Mtls	Other C&D;
Ferrous Metals	
White Goods	
Non-Ferrous Metals	**SPECIAL WASTES**
Aerosol Cans	E-Waste
	Other Electronics
ORGANICS	Asbestos
Food	Latex Paint
Yard Debris	Oil-Based Paint
	Solvents
GLASS	Adhesives, Glues
Clear Glass	Cleaners, Corrosives
Brown Glass	Fertilizers
Green Glass	Pesticides, Herb.
Light Bulbs	Pharmaceuticals
Non-Recyclable Glass	Medical Wastes
	Gasoline, Fuel Oil
OTHER WASTES	Oil Filters
Tires	Motor Oil
Rubber Products	Batteries, Car
Cosmetics	Batteries, Household
Diapers	Antifreeze
Textiles	Brake/Hydraulic Fluid
Carpet	Animal Excrement
Carpet Padding	Animal Carcasses
Furniture	Other Haz./Spec. Wastes;
Ash, Dust	
Residuals	**Sample ID:**

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

_____

_____

_____

Note: form has been reduced from the normal size of 8.5" by 14."

Sorting Equipment

Sorting equipment will include the following:

- Sort box: a box of plywood construction (approximately 6 ft. x 3 ft. x 1 ft. deep).
- Two scales: one scale has a lower range for waste materials present in smaller quantities. The other scale has a larger range, up to 300 pounds, for larger amounts of wastes. Both scales have an accuracy of about +/- 0.1 pounds. Scales will be calibrated or their accuracy verified at the start of the project, and again later if considered necessary. For objects over 300 pounds, other methods will be used to determine the weight or the weight will be estimated.
- Shovel and push broom: will be used for site clean-up.
- Plastic trash cans: about 50 plastic cans will be used for holding sorted materials. Two sizes will be used; 30-gallon containers will be used for the larger quantities of materials and smaller containers (4-gallon pails) will be used for wastes found in smaller quantities.
- Safety equipment: safety equipment, present at the site at all times during the sorting period, will include a first-aid kit and fire extinguisher. Personal safety equipment will include hard hats, orange visibility vests, gloves, eye protection, and dust masks for each crewmember.

Sorting Process

Actual waste sorting will proceed as follows:

- Sample size will be evaluated and either the whole sample will be taken (as typically will be done for self-haul loads) or the actual sample will be containerized and weighed to ensure a sample of 200 to 250 pounds. The latter will typically be done for samples pulled by heavy equipment, and sampling bias will be minimized by always starting from the same side of the pile.
- Discrete items, such as bags of yard waste or large pieces of carpeting, will be removed and weighed.
- The remaining sample will be placed a bag at a time into the sort box.
- Bags of waste placed in the sorting box will be carefully opened and crewmembers will segregate the materials, placing each type of material into a separate garbage can or pail.
- The above steps will be repeated until the entire sample is sorted. The crewmembers will use their best efforts to retain and sort the entire sample, including fines that might otherwise be left on the ground.
- At the completion of sorting, all materials will be weighed. Weighing will be accomplished by one crewmember placing the garbage cans on a scale while a Green Solutions staffperson checks the contents of the container, reads the scale, and then records the weight. After each garbage can is weighed, one or two other crewmembers will carry them to a disposal area or recycling container, empty them, and then return them to the sorting area.
- While materials are being weighed, other crewmembers will remove the remaining unsorted material from the sorting box (the “residuals”), placing that material into a separate container for weighing, and then preparing the sorting area for the next sample.

Crewmembers will not be allowed to sort until provided with health and safety training. In addition, the first day each season will include extensive instructions on the site layout, sorting methods, and the definitions being used for material categories.

Sorting Locations

As previously indicated, sampling and sorting will be conducted at all three of the County's major transfer stations. Space requirements are about 20' by 20' for the sorting area, plus additional room (as available) for temporary storage of incoming samples. Through discussions with County staff and site visits by Green Solutions staff, work areas at each of the stations have been tentatively identified.

F. WASTE QUANTITY DATA

Background

An important aspect of this project is determining the quantities of waste disposed by different types of waste generators. This information is being collected because it is required for combining composition data for different types of generators to derive County-wide and annual averages. There are, however, 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. For instance, per-capita and per-employee waste disposal rates can be determined so that the impact of future population and employment changes can be more precisely assessed.
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. As mentioned in the paragraph above, waste quantity data is required for deriving weighted averages that are the County-wide and annual results of the waste composition data (see discussion below for a more thorough explanation of weighted averages). The use of weighted averages allows a "stratified sampling," whereby the entire waste stream is divided into different sources (i.e., different types generators) so that each could be characterized individually. This approach provides better information about each type of generator while still providing results for the entire County.

Procedures for Determining Waste Quantities

In Snohomish County, the most cost-effective and accurate means for collecting waste quantity data appears to be a three-pronged approach using scalehouse records. The report, "Transactions by Customer Summary Report," shows several types of customers, which can be combined into three categories for our purposes:

1. individual accounts for construction, roofers, institutional and miscellaneous businesses;
2. haulers (Waste Management, Allied and Rubatino); and
3. cash customers.

For the first category, the source of the waste is generally easy to identify based on the name of the company or organization associated with each account. Most of these wastes are non- residential self-haul, although there are also a few residential and mixed sources that have established this type of account. Some research may be necessary to properly classify each customer, but it will be fairly simple to handle this group.

For the haulers, the types of waste included in their loads fall into three types of waste generators: single-family, multi-family and general commercial. The single-family waste may be collected using a different truck and thus it may be relatively simple to determine the amount of this waste, but multi-family and general commercial are often collected by the same truck (by front-loaders picking up dumpsters or by other trucks carrying roll-offs and compactors). To determine how much of each type of waste is brought in by the haulers would either require a survey of the drivers for a week each season or information provided by them from their records. This project includes an optional task (Task 4A) that would allow a survey to be conducted if necessary, but it is anticipated that the haulers will cooperate in providing the necessary data.

For the third category of customer, cash customers, a few of these are identified as commercial cash customers but the source for most of these customers is uncertain. For a one-week period at ARTS (November 12-18, 2007), 2.8% of the cash customers were identified as commercial, 0.2% as senior citizens, and most were simply classified as "cash customers." Although likely residential, it is unknown how many of the "cash customers" might be from commercial sources. The most cost-effective way to determine this breakdown appears to be more careful record-keeping by scalehouse personnel.

Actual determination of waste quantities will be based on one week's worth of data each season, choosing a one-week period that overlaps or corresponds to the time period for waste sorting fieldwork (see Table A-1). The additional data collection should be conducted by the scalehouse personnel for this one week period. A report (Transactions by Customer Summary Report) for this week for each facility (including the rural sites) should be provided by Snohomish County and the tonnage data from that report will be entered into a spreadsheet by Green Solutions staff using the following procedures:

- the weekly tonnages for individual accounts (BUS, CON, INS, and RFR) will be allocated to non-residential self-haul or to another category as appropriate.
- tonnages for cash customers will be allocated to Residential Self-Haul or Non-Residential Self-Haul based on the scalehouse survey results.
- weekly tonnages for each hauling company will be allocated to Single-Family, Multi-Family and General Non-Residential based on information from the haulers.
- the above process will be conducted for each transfer station and for each season, then the results for each generator type summed up to determine the County-wide results.

Determination of 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 summer. Residential activities in the spring, such as remodeling and yard cleanup, 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 non-residential and multi-family (apartment) waste streams vary less than single-family wastes and 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.

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 each figure being averaged; in this case the weight corresponds to the amount of waste disposed in that season and by that type of generator. The use of weighted averages versus simple averages for each type of generator may only lead to small differences in the results, but even a small difference could be significant in terms calculating the total quantity of a specific material 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).

The scope for this project 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.

APPENDIX B

STATISTICAL CERTAINTY OF RESULTS

STATISTICAL CERTAINTY OF RESULTS

A. INTRODUCTION

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 sometimes shown as a "+ or – value", such as 5% newspaper +/- 1%. For this study, a confidence interval of 90% was used, so that in this example one can be 90% confident that the true value for newspaper falls between 4 and 6%.

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 season. 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 season and each waste generator, it can be manipulated in the same way as the composition figures by using weighted averages as appropriate for the data being combined. The 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

		Single-Family			Multi-Family			Residential Self-Haul		
		Average	LCL	UCL	Average	LCL	UCL	Average	LCL	UCL
PAPER	Newspaper	1.32%	0.88%	1.76%	2.47%	1.37%	3.56%	1.06%	0.22%	1.90%
	Cardboard	1.31%	0.82%	1.80%	5.69%	3.34%	8.04%	3.81%	1.06%	6.56%
	Phone Books	0.15%	0.00%	0.38%	0.74%	0.04%	1.44%	0.25%	0.00%	0.54%
	Mixed Waste Paper	7.34%	5.73%	8.94%	9.71%	7.42%	12.00%	4.53%	1.72%	7.35%
	Milk Cartons, Other	0.26%	0.17%	0.35%	0.30%	0.21%	0.39%	0.09%	0.00%	0.20%
	Compostable	5.74%	4.78%	6.71%	4.16%	3.08%	5.25%	1.07%	0.26%	1.88%
	Non-Recyclable Paper	2.20%	1.31%	3.09%	1.21%	0.83%	1.59%	1.46%	0.62%	2.31%
	Paper Subtotal	**18.32%**	**15.90%**	**20.75%**	**24.28%**	**19.72%**	**28.85%**	**12.28%**	**6.87%**	**17.68%**
PLASTIC	PET Bottles	0.98%	0.72%	1.24%	1.39%	1.05%	1.73%	0.46%	0.18%	0.74%
	HDPE Bottles	0.65%	0.47%	0.83%	1.01%	0.63%	1.40%	0.45%	0.20%	0.71%
	Bottles 3-7	0.09%	0.03%	0.15%	0.10%	0.04%	0.17%	0.06%	0.01%	0.11%
	Bags and Film	5.98%	5.25%	6.71%	4.67%	3.92%	5.43%	1.86%	0.96%	2.76%
	Plastic Packaging	2.27%	1.88%	2.67%	1.87%	1.38%	2.37%	1.00%	0.41%	1.59%
	Plastic Products	2.16%	1.61%	2.71%	2.03%	1.30%	2.76%	5.12%	2.41%	7.82%
	Expanded Polystyrene	0.65%	0.49%	0.81%	0.54%	0.31%	0.76%	0.23%	0.07%	0.38%
	Plastic Subtotal	**12.78%**	**11.53%**	**14.03%**	**11.62%**	**9.91%**	**13.33%**	**9.17%**	**6.20%**	**12.13%**
METAL	Aluminum Cans	0.44%	0.29%	0.59%	0.98%	0.61%	1.36%	0.20%	0.06%	0.34%
	Aluminum Foil	0.25%	0.17%	0.34%	0.20%	0.12%	0.29%	0.06%	0.01%	0.12%
	Tin Cans	1.11%	0.78%	1.45%	1.35%	0.94%	1.76%	0.38%	0.02%	0.74%
	Mixed Metals	2.30%	0.74%	3.86%	1.54%	0.61%	2.48%	4.70%	2.13%	7.27%
	Ferrous Metals	1.27%	0.29%	2.26%	0.67%	0.26%	1.09%	4.17%	1.39%	6.95%
	White Goods	1.32%	0.00%	3.35%	0.00%	0.00%	0.00%	1.80%	0.00%	3.95%
	Non-Ferrous Metals	0.11%	0.02%	0.19%	0.28%	0.00%	0.63%	0.41%	0.00%	0.85%
	Aerosol Cans	0.23%	0.13%	0.32%	0.19%	0.09%	0.29%	0.06%	0.01%	0.12%
	Metal Subtotal	**7.03%**	**3.61%**	**10.45%**	**5.22%**	**3.84%**	**6.60%**	**11.79%**	**5.95%**	**17.62%**
ORGANICS	Food Waste	26.24%	21.50%	30.98%	17.69%	13.35%	22.03%	5.52%	1.68%	9.36%
	Yard Waste	2.16%	0.39%	3.92%	3.58%	0.00%	7.93%	1.47%	0.00%	3.31%
	Org. Subtotal	**28.40%**	**22.72%**	**34.08%**	**21.28%**	**16.07%**	**26.48%**	**6.99%**	**2.40%**	**11.58%**
GLASS	Clear Bottles	1.16%	0.75%	1.57%	2.35%	1.63%	3.08%	1.53%	0.01%	3.04%
	Brown Bottles	0.40%	0.07%	0.73%	1.28%	0.65%	1.91%	0.74%	0.00%	1.54%
	Green Bottles	0.50%	0.14%	0.86%	1.27%	0.66%	1.89%	0.62%	0.00%	1.51%
	Non-Recyclable Glass	0.32%	0.14%	0.50%	1.08%	0.00%	2.20%	2.36%	0.00%	4.81%
	Light Bulbs	0.04%	0.02%	0.06%	0.06%	0.00%	0.11%	0.12%	0.00%	0.23%
	Glass Subtotal	**2.41%**	**1.62%**	**3.21%**	**6.04%**	**4.51%**	**7.58%**	**5.36%**	**1.55%**	**9.17%**
OTHER WASTES	Tires	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.29%	0.00%	0.75%
	Rubber Products	0.15%	0.06%	0.24%	0.10%	0.02%	0.18%	0.05%	0.00%	0.11%
	Cosmetics	0.34%	0.11%	0.57%	0.38%	0.11%	0.66%	0.18%	0.03%	0.34%
	Disposable Diapers	5.67%	4.11%	7.24%	4.48%	2.30%	6.66%	1.36%	0.00%	3.20%
	Textiles	3.78%	2.31%	5.24%	4.17%	2.30%	6.03%	2.88%	1.43%	4.33%
	Carpeting	0.02%	0.00%	0.05%	0.17%	0.00%	0.42%	1.74%	0.00%	3.82%
	Carpet Padding	0.00%	0.00%	0.00%	0.03%	0.00%	0.09%	0.72%	0.00%	1.65%
	Furniture	0.78%	0.00%	1.98%	1.29%	0.00%	3.24%	6.62%	1.03%	12.21%
	Ash, Dust	1.22%	0.16%	2.28%	0.14%	0.02%	0.25%	0.18%	0.00%	0.35%
	Residuals	9.20%	7.54%	10.86%	7.78%	5.91%	9.65%	2.40%	1.27%	3.53%
	Other Waste Subtotal	**21.16%**	**17.65%**	**24.67%**	**18.54%**	**14.42%**	**22.66%**	**16.42%**	**9.83%**	**23.02%**
WOOD	**Wood**	**1.22%**	**0.26%**	**2.17%**	**6.80%**	**1.05%**	**12.55%**	**26.00%**	**12.41%**	**39.59%**
C&D	**Const./Demolition**	**0.61%**	**0.00%**	**1.36%**	**1.22%**	**0.00%**	**2.74%**	**7.84%**	**1.47%**	**14.21%**
SPECIAL	**Special Waste Subtotal**	**8.06%**	**4.92%**	**11.20%**	**5.00%**	**1.85%**	**8.14%**	**4.16%**	**0.68%**	**7.65%**

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

		Non-Residential Self-Haul			General Non-Residential			Annual Average for Entire County		
		Average	LCL	UCL	Average	LCL	UCL	Average	LCL	UCL
PAPER	Newspaper	0.05%	0.00%	0.12%	1.03%	0.37%	1.69%	1.22%	0.57%	1.87%
	Cardboard	1.88%	0.31%	3.44%	5.05%	3.02%	7.08%	3.70%	1.92%	5.48%
	Phone Books	0.00%	0.00%	0.00%	0.09%	0.00%	0.22%	0.21%	0.00%	0.47%
	Mixed Waste Paper	1.19%	0.00%	2.40%	5.30%	2.67%	7.93%	5.94%	3.69%	8.18%
	Milk Cartons, Other	0.01%	0.00%	0.02%	0.26%	0.03%	0.48%	0.21%	0.07%	0.35%
	Compostable	0.15%	0.00%	0.33%	7.73%	2.46%	12.99%	4.89%	2.52%	7.26%
	Non-Recyclable Paper	1.33%	0.00%	3.01%	3.23%	0.31%	6.14%	2.22%	0.64%	3.79%
	Paper Subtotal	**4.60%**	**0.71%**	**8.50%**	**22.68%**	**15.06%**	**30.29%**	**18.39%**	**13.21%**	**23.56%**
PLASTIC	PET Bottles	0.13%	0.01%	0.25%	0.78%	0.44%	1.12%	0.80%	0.51%	1.09%
	HDPE Bottles	0.12%	0.00%	0.28%	0.56%	0.19%	0.92%	0.58%	0.30%	0.87%
	Bottles 3-7	0.00%	0.00%	0.00%	0.04%	0.00%	0.07%	0.06%	0.01%	0.11%
	Bags and Film	1.25%	0.05%	2.45%	7.00%	3.80%	10.20%	5.01%	3.35%	6.66%
	Plastic Packaging	0.50%	0.00%	1.08%	2.13%	0.91%	3.35%	1.79%	1.05%	2.53%
	Plastic Products	2.97%	0.00%	6.15%	7.68%	2.47%	12.90%	4.67%	1.87%	7.47%
	Expanded Polystyrene	0.21%	0.00%	0.51%	0.67%	0.11%	1.22%	0.53%	0.21%	0.84%
	Plastic Subtotal	**5.18%**	**0.32%**	**10.05%**	**18.85%**	**12.41%**	**25.30%**	**13.44%**	**9.73%**	**17.15%**
METAL	Aluminum Cans	0.03%	0.00%	0.05%	0.40%	0.19%	0.61%	0.42%	0.23%	0.61%
	Aluminum Foil	0.05%	0.00%	0.14%	0.12%	0.03%	0.21%	0.15%	0.07%	0.23%
	Tin Cans	0.03%	0.00%	0.07%	0.57%	0.17%	0.97%	0.73%	0.38%	1.08%
	Mixed Metals	1.93%	0.00%	4.20%	3.35%	0.82%	5.89%	2.99%	0.93%	5.05%
	Ferrous Metals	2.54%	0.20%	4.88%	1.31%	0.48%	2.13%	1.85%	0.55%	3.16%
	White Goods	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.68%	0.00%	1.60%
	Non-Ferrous Metals	0.25%	0.00%	0.55%	0.11%	0.00%	0.23%	0.20%	0.00%	0.42%
	Aerosol Cans	0.02%	0.00%	0.06%	0.15%	0.04%	0.27%	0.15%	0.06%	0.24%
	Metal Subtotal	**4.85%**	**1.44%**	**8.27%**	**6.01%**	**3.07%**	**8.96%**	**7.17%**	**3.73%**	**10.62%**
ORGANICS	Food Waste	0.62%	0.00%	1.43%	13.06%	6.37%	19.75%	14.63%	9.75%	19.51%
	Yard Waste	2.31%	0.00%	5.94%	2.33%	0.00%	4.89%	2.29%	0.00%	4.83%
	Org. Subtotal	**2.93%**	**0.00%**	**6.79%**	**15.38%**	**8.39%**	**22.37%**	**16.91%**	**11.19%**	**22.63%**
GLASS	Clear Bottles	0.06%	0.00%	0.14%	1.09%	0.41%	1.78%	1.28%	0.55%	2.01%
	Brown Bottles	0.06%	0.00%	0.16%	0.45%	0.06%	0.84%	0.57%	0.11%	1.03%
	Green Bottles	0.03%	0.00%	0.07%	0.37%	0.00%	0.76%	0.54%	0.06%	1.02%
	Non-Recyclable Glass	3.27%	0.00%	8.57%	0.79%	0.00%	1.78%	1.20%	0.00%	2.62%
	Light Bulbs	0.02%	0.00%	0.06%	0.01%	0.00%	0.03%	0.04%	0.00%	0.09%
	Glass Subtotal	**3.44%**	**0.00%**	**8.79%**	**2.72%**	**1.19%**	**4.25%**	**3.64%**	**1.56%**	**5.71%**
OTHER	Tires	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.06%	0.00%	0.14%
WASTES	Rubber Products	0.20%	0.00%	0.50%	0.35%	0.03%	0.66%	0.20%	0.02%	0.37%
	Cosmetics	0.01%	0.00%	0.02%	0.08%	0.02%	0.15%	0.20%	0.05%	0.35%
	Disposable Diapers	0.00%	0.00%	0.00%	0.63%	0.06%	1.20%	2.51%	1.28%	3.75%
	Textiles	0.28%	0.00%	0.60%	4.96%	0.41%	9.51%	3.79%	1.30%	6.28%
	Carpeting	6.56%	0.00%	13.21%	1.48%	0.00%	3.78%	1.38%	0.00%	3.13%
	Carpet Padding	2.49%	0.00%	5.55%	0.15%	0.00%	0.34%	0.39%	0.00%	0.88%
	Furniture	7.97%	0.00%	19.04%	0.41%	0.00%	0.94%	2.39%	0.00%	5.07%
	Ash, Dust	0.31%	0.00%	0.79%	0.21%	0.00%	0.47%	0.46%	0.01%	0.91%
	Residuals	1.12%	0.29%	1.96%	5.81%	3.46%	8.17%	5.92%	4.16%	7.68%
	Other Waste Subtotal	**18.95%**	**3.77%**	**34.12%**	**14.08%**	**7.89%**	**20.28%**	**17.30%**	**11.29%**	**23.32%**
WOOD	**Wood**	**29.77%**	**11.88%**	**47.65%**	**15.30%**	**6.95%**	**23.65%**	**13.75%**	**5.89%**	**21.61%**
C&D	**Const./Demolition**	**30.07%**	**14.08%**	**46.06%**	**3.67%**	**0.44%**	**6.91%**	**5.43%**	**1.46%**	**9.39%**
SPECIAL	**Special Waste Subtotal**	**0.20%**	**0.00%**	**0.51%**	**1.30%**	**0.00%**	**2.70%**	**3.97%**	**1.58%**	**6.36%**

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

COMPOSITION DATA FOR SPECIFIC NON-RESIDENTIAL GENERATORS

A. INTRODUCTION

This appendix shows data for specific non-residential sources.

B. METHODOLOGY

During the course of the study, waste samples were randomly selected and sorted from a number of specific sources. These samples, which are also included in the average results for the Non-Residential Self-Haul and General Non-Residential waste streams, are from the following businesses and institutions:

- Schools (includes a sample from Alderwood Middle School and an Everett school)
- General retail (includes one sample each from Target, Fred Meyer, and Costco)
- Grocery stores (includes one sample each from Winco Foods and another unspecified grocery store)
- Charities (one sample from Value Village and two samples from Goodwill)
- Roofing (14 samples from various roofing companies)
- Construction (19 samples from various construction companies)

The waste composition data for these generators 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 an indicator of the level of reliability of the results. For instance, the results for schools and for grocery stores are only based on two samples, which means that these results are potentially subject to a significant level of random error.

Although the data in Table C-1 generally has less statistical certainty than the primary results of this study, it is provided here as supplemental data that may assist commercial recycling programs.

Table C-1
SPECIFIC NON-RESIDENTIAL GENERATORS

		Schools	General Retail	Grocery Stores	Charities	Roofing	Con-struction
PAPER	Newspaper	1.1%	0.0%	0.9%	0.3%	0.0%	0.1%
	Cardboard	1.0%	17.8%	5.4%	3.3%	0.6%	3.1%
	Phone Books	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Mixed Waste Paper	22.4%	4.5%	2.5%	5.4%	1.5%	0.9%
	Milk Cartons, Other	1.9%	0.1%	0.01%	0.04%	0.0%	0.02%
	Compostable	12.5%	6.5%	51.3%	1.1%	0.2%	0.2%
	Non-Recyclable Paper	1.7%	1.6%	0.9%	1.7%	0.3%	2.2%
	Paper Subtotal	**40.6%**	**30.5%**	**61.0%**	**11.7%**	**2.6%**	**6.6%**
PLASTIC	PET Bottles	1.5%	0.2%	0.2%	0.0%	0.03%	0.1%
	HDPE Bottles	0.03%	1.3%	0.0%	0.1%	0.004%	0.1%
	Bottles 3-7	0.03%	0.0%	0.03%	0.1%	0.0%	0.0%
	Bags and Film	6.0%	7.0%	4.8%	1.3%	0.9%	1.3%
	Plastic Packaging	3.1%	2.9%	1.9%	0.2%	0.2%	0.7%
	Plastic Products	0.9%	5.5%	0.1%	18.1%	5.5%	1.5%
	Expanded Polystyrene	0.4%	0.4%	2.0%	0.2%	0.01%	0.3%
	Plastic Subtotal	**12.0%**	**17.2%**	**9.0%**	**20.0%**	**6.7%**	**4.0%**
METAL	Aluminum Cans	0.5%	0.1%	0.2%	0.1%	0.004%	0.04%
	Aluminum Foil	0.1%	0.1%	0.01%	0.01%	0.001%	0.1%
	Tin Cans	3.6%	0.4%	0.1%	0.1%	0.03%	0.01%
	Mixed Metals	0.5%	3.0%	0.0%	11.1%	0.0%	2.2%
	Ferrous Metals	2.5%	0.2%	0.0%	5.3%	0.6%	3.5%
	White Goods	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Non-Ferrous Metals	0.0%	0.0%	0.01%	0.5%	0.2%	0.2%
	Aerosol Cans	0.3%	0.0%	0.0%	0.0%	0.01%	0.01%
	Metal Subtotal	**7.5%**	**3.8%**	**0.3%**	**17.1%**	**0.8%**	**6.1%**
ORGANICS	Food Waste	33.9%	31.6%	22.2%	0.6%	0.5%	0.7%
	Yard Waste	0.1%	0.3%	0.0%	0.1%	0.04%	5.6%
	Org. Subtotal	**34.0%**	**32.0%**	**22.2%**	**0.7%**	**0.6%**	**6.4%**
GLASS	Clear Bottles	0.5%	0.8%	0.01%	0.4%	0.0%	0.04%
	Brown Bottles	0.1%	0.2%	0.0%	0.0%	0.0%	0.1%
	Green Bottles	0.0%	0.0%	0.2%	0.0%	0.0%	0.1%
	Non-Recyclable Glass	0.1%	0.3%	0.0%	6.4%	0.0%	0.0%
	Light Bulbs	0.0%	0.02%	0.0%	0.1%	0.0%	0.04%
	Glass Subtotal	**0.7%**	**1.2%**	**0.2%**	**6.9%**	**0.0%**	**0.3%**
OTHER WASTES	Tires	0.0%	0.0%	0.0%	0.0%	0.0%	0.01%
	Rubber Products	0.1%	0.0%	0.1%	0.9%	0.6%	0.003%
	Cosmetics	0.6%	0.1%	0.1%	0.3%	0.01%	0.01%
	Disposable Diapers	0.1%	0.2%	0.1%	0.0%	0.0%	0.0%
	Textiles	0.3%	2.5%	0.0%	14.9%	0.1%	0.2%
	Carpeting	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%
	Carpet Padding	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
	Furniture	0.0%	0.0%	0.0%	3.2%	0.0%	0.3%
	Ash, Dust	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	Residuals	2.7%	6.1%	6.1%	6.0%	0.1%	1.9%
	Other Waste Subtotal	**4.9%**	**9.0%**	**6.3%**	**25.3%**	**0.8%**	**4.6%**
WOOD and C&D	Wood	0.2%	6.2%	0.4%	11.5%	35.1%	34.8%
	C&D	0.0%	0.0%	0.6%	0.1%	53.0%	37.2%
	Wood, C&D Subtotal	**0.2%**	**6.2%**	**1.0%**	**11.6%**	**88.1%**	**72.1%**
SPECIAL	**Special Waste Subtotal**	**0.2%**	**0.2%**	**0.0%**	**6.9%**	**0.4%**	**0.01%**
TOTALS		**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	Number of Samples:	**2**	**3**	**2**	**3**	**14**	**19**