

# APPENDIX A.

## Waste Sampling Methodology

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This appendix explains the methodology used to create the sampling plan and conduct the waste stream sorting. The objective of the waste stream sampling was to provide statistically valid composition data, by weight, for the King County disposed waste stream. This study included the mixed solid waste (MSW) disposed by the commercially collected residential, commercially collected nonresidential, self-hauled residential, and self-hauled nonresidential substreams; it excluded wastes from the construction, demolition and land-clearing (CDL) substream, which was disposed at special facilities designated for that purpose.

To understand the overall solid waste stream better, the total waste can be divided into various **substreams**, according to where the waste comes from and who brings it to the waste facilities. Such analysis is useful because the different substreams often have different waste types, user profiles, and public programs for reaching customers

Substreams were identified according to such factors as the source, or generator, of the waste (residential or nonresidential) as well as how materials were delivered to waste sites (commercially collected or self-hauled).

- **Residential waste** comes from single-family or multi-family dwellings.
- **Nonresidential waste** comes from businesses, schools, government offices, and other institutions that are not residences.
- **Commercially collected waste** was hauled by firms that contract with local governments to operate a garbage collection company or operate under a state franchise in a particular geographic area.<sup>1</sup>
- **Self-hauled waste** was hauled by residents or businesses that bring the waste themselves to transfer stations or drop boxes.<sup>2</sup>

In this study, waste loads and customers surveyed were first divided into residential and nonresidential categories. Then those categories were further divided between commercially collected and self-hauled waste, as shown in Table A-1. In some cases, loads contain a mixture of waste from residential and nonresidential sources, but these “mixed loads” represent only a small portion of the total waste.

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<sup>1</sup> The City of Enumclaw and the Town of Skykomish operate their own waste collection systems, rather than contracting with commercial haulers. Beginning with the 2002-2003 study, King County included these waste deliveries with the commercially hauled loads.

<sup>2</sup> Self-hauled loads are categorized as residential or nonresidential according to the source of the load, not the type of hauler. For example, some companies, such as contractors and landscapers, collect waste from homes or businesses. These loads were considered self-hauled residential if the waste was produced from homes, even though the company, not the residents, delivered the material to a waste facility.

**Table A-1. Substream Definitions**

	<b>Commercially Collected</b>	<b>Self-hauled</b>
<b>Residential Waste</b>	Commercially collected waste from residential sources	Self-hauled waste from residential sources
<b>Nonresidential Waste</b>	Commercially collected waste from nonresidential sources	Self-hauled waste from nonresidential sources

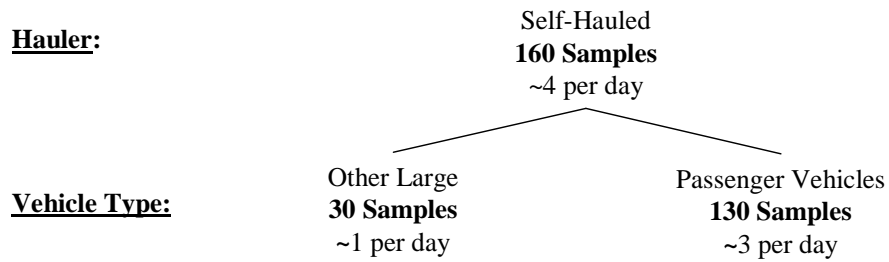
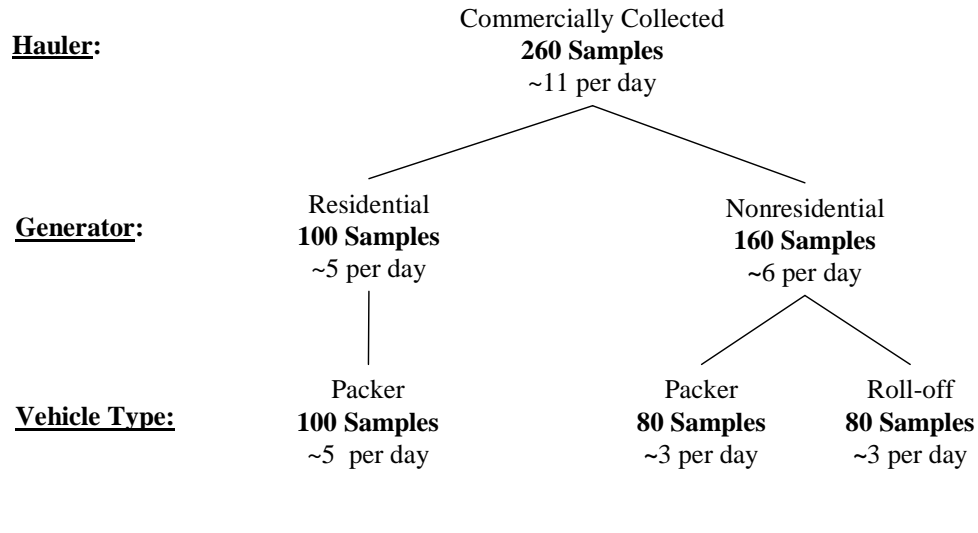
“Mixed loads” are grouped with the nonresidential substream for analysis.

## **SAMPLE DISTRIBUTION**

In order to provide reliable waste composition estimates, the sampling plan allocated specific numbers of samples to different waste streams. Figure A-1 shows the distribution of samples. The sampling plan called for 420 samples collected over 28 sampling days. Figure A-1 shows the average planned sample distribution for weekday sampling events. Because commercially collected vehicles do not operate on weekends, weekend sampling events collected only self-hauled loads.

**Figure A-1. Sample Distribution**

**Sample Plan: 420 Total Samples, 28 Sampling Days**



As shown, greater numbers of samples were allocated to the commercially hauled nonresidential and self-hauled substreams than the residential substream. The waste found in these streams tends to be more highly variable from load to load. The higher variability means that additional samples were required to provide precision levels comparable to the commercially collected residential substream.

Within the commercially collected nonresidential substream, the samples were equally divided among packer trucks and roll-offs (80 samples for each vehicle type). The self-hauled substream was also divided between passenger vehicles (130 samples) and other large vehicles (30 samples).

A total of 421 samples were sorted during the study period. Figure A-2 shows the difference in the number of planned samples versus actual samples obtained.

**Figure A-2. Planned versus Actual Samples Obtained**

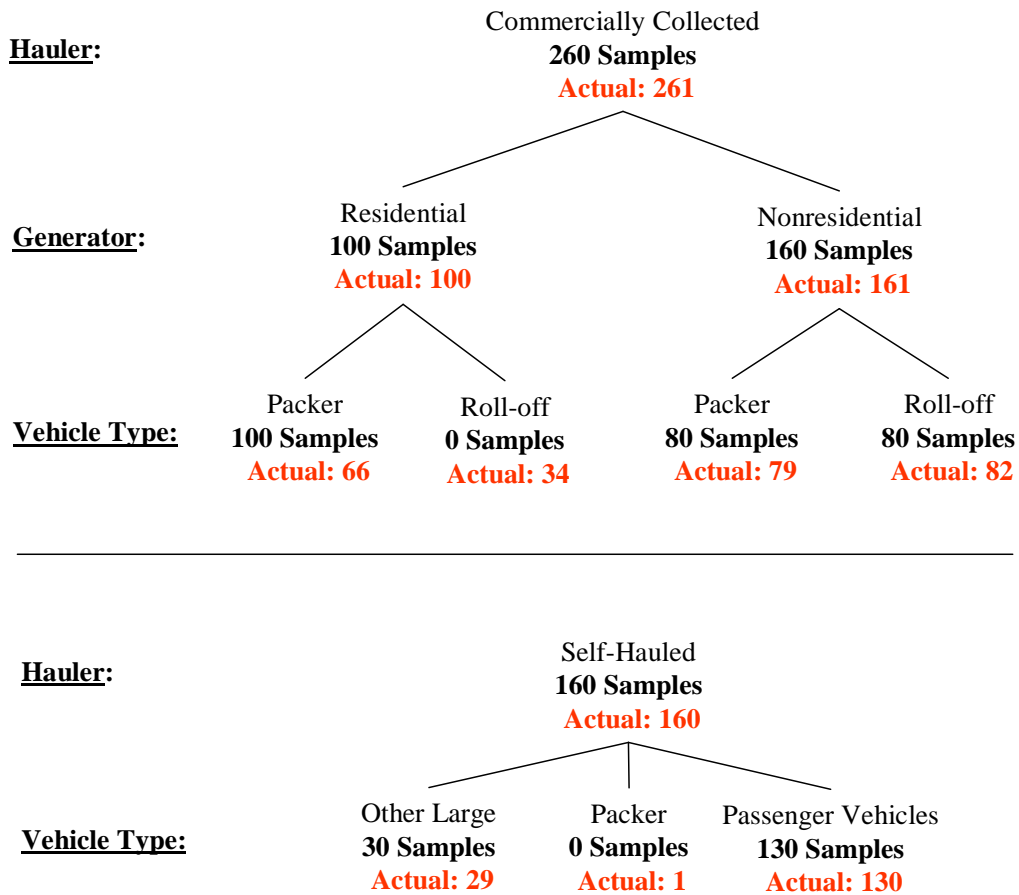


Table A-2 shows the number of waste samples collected per month at each of the nine county transfer facilities included in the study. Shoreline was not included because it was closed for construction in 2007.

**Table A-2. Number of Waste Samples, by Facility  
January 2007 – December 2007**

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria
January	-	-		-	-
February	-	15		-	15
March	-	-		-	-
April	12	15		-	15
May	-	-		-	-
June	-	15		15	15
July	-	-		-	-
August	15	-		-	-
September	14	15		-	-
October	16	16		16	16
November	-	-		-	-
December	14	11		-	19
<b>Total</b>	<b>71</b>	<b>87</b>	<b>-</b>	<b>31</b>	<b>80</b>

	Houghton	Renton	Skykomish	Vashon	OVERALL
January	-	-		-	-
February	-	15		-	45
March	-	-		-	-
April	15	15		-	72
May	-	-		-	-
June	15	-		-	60
July	-	-		-	-
August	15	16		-	46
September	-	-		15	44
October	16	-		-	80
November	-	-		-	-
December	-	15		15	74
<b>Total</b>	<b>61</b>	<b>61</b>	<b>-</b>	<b>30</b>	<b>421</b>

Note: The Skykomish drop box was sampled at Houghton and the Cedar Falls drop box was sampled at Factoria.

## APPORTION SAMPLING DAYS

A total of 28 sampling days were scheduled for the 2007 study, divided into monthly sampling events lasting three or five days each. Waste was sampled from nine King County facilities (including seven transfer stations and two drop boxes).

Sites with relatively more vehicle traffic were allocated additional sampling days. For example, sampling at Bow Lake occurred six times during the study year while Algona, Factoria, and Houghton were sampled five times. Enumclaw and Renton hosted waste

sampling three times, and the Vashon facility, twice. The waste from the Skykomish and Cedar Falls drop box were sampled one time each at Houghton and Factoria, respectively.

## ASSIGN FACILITIES TO SAMPLING DATES

To capture any seasonal variation in the composition of waste, sampling occurred every other month starting in February 2007. To randomly select dates for sampling, the consultant used the random function in Microsoft Excel to select the first sampling day in a given month. The subsequent sampling days in the month were then scheduled consecutively, following the first date. Except for Bow Lake (which is sampled during every sampling month) all sites were randomly assigned to have their first sampling day occur during one of the first four sampling months, using the random function in Microsoft Excel. Subsequent sampling days at each site were then distributed based on the number of planned sampling days for that facility. The interval between sampling days at a site varied depending on how often the site was sampled during the study period.

Table A-3 shows the results of this process, and the sampling dates for each facility.

**Table A-3. Actual Sampling Schedule**

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<b>February</b>	18	19	20				
<b>3 Days</b>	Renton	Bow Lake	Factoria				
<b>April</b>		23	24	25	26	27	
<b>5 Days</b>		Factoria	Renton	Houghton	Algona	Bow Lake	
<b>June</b>			26	27	28	29	
<b>5 Days</b>			Houghton	Bow Lake	Factoria	Enumclaw	
<b>August</b>		27	28	29			
<b>3 Days</b>		Houghton	Algona	Renton			
<b>September</b>					6	7	8
<b>3 Days</b>					Bow Lake	Vashon	Algona
<b>October</b>			23	24	25	26	27
<b>5 Days</b>			Enumclaw	Factoria	Houghton	Algona	Bow Lake
<b>December</b>		10	11	12	13	14	
<b>5 Days</b>		Algona	Bow Lake	Vashon	Renton	Factoria	
<b># of Days</b>	1	4	6	5	5	5	2

## Determine Sampling Frequency

Sampling frequency refers to the process by which particular vehicles were chosen to be sampled. Vehicles were selected for sampling through a randomizing process that involved systematic selection of vehicles as they arrive at each facility during a sampling day. A staff member will be designated as the “gatekeeper.” The gatekeeper interviewed and counted incoming vehicles and applied the process described below to select loads from which samples were extracted.

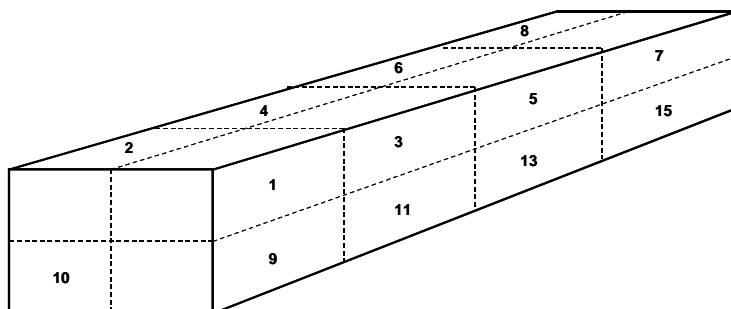
1. For each sampling day and each waste stream, the expected number,  $L$ , of arriving loads from each stream was estimated using vehicle survey data obtained in 2006. The number  $L$  was then reduced by one-fifth (producing  $0.8 \times L$ ). This was done to ensure that the targeted number of loads for each waste stream were selected on each sampling day, even if traffic was lighter than expected.
2. Next, the interval  $n$  was determined to insure systematic sampling of vehicles. If  $r$  represents the number of samples needed for the waste stream, and  $.8 \times L$  represents the number of expected loads from the waste stream, then  $n$  is calculated by dividing  $.8 \times L$  by  $r$ . To help facilitate this process, a *Vehicle Selection Sheet* was constructed for each day and every  $n$ th vehicle was selected for sampling. An example of a sample vehicle selection sheet appears in Appendix H.

## FIELD PROCEDURES

Using the process described in the previous section, the gatekeeper determined which vehicles to sample. For a vehicle to be eligible for sampling, the load must match one of the targeted waste stream categories. If the vehicle is eligible, and is the correct  $n$ th vehicle, the gatekeeper collected data about the sample (e.g., vehicle type, city of origin) on the *Gatekeeper Interview Form* and placed a *Sample Placard* on the vehicle's windshield or dashboard. At the sorting area, the Sort Crew Manager intercepted the vehicle, took the *Sample Placard*, and recorded the sample ID number from the sample placard onto the *Sorting Tally Sheet*. Examples of these field forms are included in Appendix H.

If chosen for sampling, commercially collected loads arriving in compactors, roll-off containers, or packer trucks were instructed to dump their contents in an elongated pile. The sample was selected using an imaginary 16-cell grid (see Figure A-3) that was superimposed over the dumped material. The Sort Crew Manager then located the randomly pre-selected cell to be sorted. If the designated cell was blocked due to site constraints, an alternate cell was randomly selected. Then, approximately 200 to 300 pounds of waste was extracted by machine or hand from the designated cell and placed on a tarp.

**Figure A-3. The 16-Cell Grid as Applied to a Tipped Load**



Samples from large (greater than 500 pounds) self-hauled loads were selected in much the same manner as commercially collected loads, using a random and/or representative cell selection. If the self-hauled load weighed less than 300 pounds, the entire load was sorted as a sample.

After the extracted material was deposited on the tarp, the Sort Crew Manager checked the weight of each sample manually. If judged to be too light, additional material was pulled from the same cell area until the desired weight was achieved. Samples judged to be excessively heavy were pared down by removing a homogenous slice of material from the tarp.

Once a sample was selected, extracted from the load, and placed on a clean tarp, it was sorted by hand into the 78 material categories (Appendix A). Components were placed in plastic laundry baskets to be weighed and recorded. The Sort Crew Manager monitored the homogeneity of the component baskets as material accumulated, rejecting items that were improperly classified. Open laundry baskets allow the Sort Crew Manager to see the material at all times. The Sort Crew Manager also verified the purity of each component as it was weighed and recorded on the sampling form.

All sampling records were checked for accuracy, completeness, and legibility before being entered into a Microsoft Access database customized for this study.



## APPENDIX B.

# Sampling Material Definitions

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Waste samples were sorted to the greatest reasonable detail by hand. The sorting categories used in the 2007 study were similar to those used in the 2002-2003 study. Sampling material definitions that were added, or modified, for the 2007 study are as follows:

### Paper

- **Gift Wrapping** – category combined with *Other Paper*, had been added as separate category for 2002-3003.

### Food

- New material class in 2007; was previously included in *Organics* as “**Food Wastes**—leftovers and wastes from food preparation. Includes food in the original or another container when the container weight is less than 10% of the total weight.” Now is expanded as own class including:
  - **Packaged Bakery Items**—any food item from a bakery, such as breads, pastries, cookies, crackers, and cakes where the package has remained intact. In the sorter’s judgment, packaged bakery items *could* have been donated to a food bank or similar organization, rather than disposed.
  - **Opened, Unpackaged, or Scrap Bakery Items**—any food item from a bakery, such as breads, pastries, cookies, crackers, and cakes where the package has been opened or broken, the food item is not contained in any package or bag, or where the bakery item is found in scraps or pieces. In the sorter’s judgment, these food items *would not have been* acceptable for donation.
  - **Packaged Vegetative Food**—any vegetative food item such as pasta, grains, beans, fruits, vegetables, sauces, soda, tea, juice and water where the package has remained intact. In the sorter’s judgment, packaged vegetative food items *could* have been donated to a food bank or similar organization, rather than disposed. This category may include fresh fruits and vegetables (packaged in waxed boxes, for example) if, in the sorter’s judgment, the food was not spoiled at the time of disposal.
  - **Opened, Unpackaged or Scrap Vegetative Food**—any vegetative food item such as pasta, grains, beans, fruits, vegetables, sauces, soda, tea, juice, water, and ice where the package has been opened or broken, the item is unpackaged, or

where the vegetative food is found in scraps or pieces. In the sorter's judgment, these food items *would not have been* acceptable for donation.

- **Packaged Non-vegetative Food**—any non-vegetative food item such as fresh or canned meat or fish, cheeses, eggs, dairy items, and chili or soup containing meat, where the package has remained intact. In the sorter's judgment, packaged non-vegetative food items *could* have been donated to a food bank or similar organization, rather than disposed.
- **Opened, Unpackaged, or Scrap Non-vegetative Food**—any non-vegetative food item such as fresh or canned meat or fish, cheeses, eggs, dairy items, and chili or soup containing meat, where the package has been opened or broken, the item is unpackaged, or where the food is found in scraps or pieces. In the sorter's judgment, these food items *would not have been* acceptable for donation.

### Other Organics

- **Carpet**— category added in 2007; was previously included as part of *Other Textiles*.

### Other Wastes

- **Asphalt Shingles**— category added in 2007; was previously included as *Construction/Demolition Waste*.

### Household Hazardous/Special Waste

- **Alkaline/Button Cell Batteries** - now included as *Household Batteries*; previously was considered its own category.

A defined list of all component categories follows:

## Paper

1. **Old Newspaper (ONP)**—printed groundwood newsprint and other minimally bleached groundwood. This category also includes some glossy paper typically used in newspaper insert advertisements, unless found separately.
2. **Corrugated Cardboard (OCC/Kraft Bags)**—Kraft linerboard, containerboard cartons, and shipping boxes with corrugated paper medium (unwaxed). This category also includes Kraft (brown) paper bags. Excludes waxed and plastic-coated cardboard, solid boxboard, and bags that are not pure unbleached Kraft.
3. **Low Grade Recyclable**—magazines, phone books, junk mail, used envelopes, other material with sticky labels, construction paper, blueprint and thermal copy paper (NCR paper), fax paper, bright-dyed paper (fiesta or neon colors), paperback books, colored manila envelopes, and groundwood catalogues. This category also includes other low-grade recyclable papers used in packaging, including chipboard and other solid boxboard (not polycoated) such as for beer and soda cans, clothing forms, egg cartons (molded pulp), and other boxes.
4. **High Grade**—printing and writing papers, primarily thermo-chemical pulps. This category is composed of high-grade paper, which includes white ledger, colored ledger, computer cards, bond, copy machine paper, manila envelopes and continuous-feed computer printouts and forms of various types. Excludes glossy coated paper such as magazines, bright papers, groundwood publications such as catalogs.
5. **Bleached Polycoated Paperboard**—polycoated bleached paperboard cartons used for milk, ice cream, and juice (including aseptic packaging). Does not include frozen food packaging, microwave boxes, cups, or other non-food packaging.
6. **Paper and Other Materials**—items that are primarily paper, but combined with other materials. Includes juice cans, oil cans, paper or boxboard with foil laminates, foil-lined papers, notebooks, aluminum foil boxes, and other similar packages or products.
7. **Compostable Paper**—includes tissues and paper soiled with food, such as paper plates, pizza boxes, and paper towels.
8. **Other Paper**—paper not included above that is not easily recyclable. Includes carbon paper, photographs, waxed cardboard, poly-lined chipboard, microwave containers, frozen food boxes, gift wrapping paper, and hardcover books.

## Plastics

9. **PET Bottles**—all bottles made from polyethylene terephthalate (PET), consisting of pop, oil, liquor, and other types of bottles (SPI code 1).
10. **HDPE Bottles**—all bottles made of high-density polyethylene (HDPE), such as milk, juice, detergent, and other bottles (SPI code 2).

11. **Other Containers**—all other rigid containers with SPI codes 3 through 7, and PET and HDPE containers other than bottles.
12. **Expanded Polystyrene**—expanded polystyrene packaging, food trays, cups, plates, clamshells, and other packaging.
13. **Plastic Film and Bags**—all film, bags and thin plastic packaging, including wrappings, vacuum-formed packaging, bubble packs, and other films, as well as plastic strapping and other thin flexible plastic packaging. Also includes shower curtains, plastic sheeting, trash bags, and other thin plastic products.
14. **Other Packaging**—all other non-film packaging that does not fit into the above categories including caps, closures, and other miscellaneous items.
15. **Plastic Products**—primarily rigid or solid consumer items including dishware, utensils and other household items, vinyl products, all-plastic furniture and toys, car parts, and hangers. Also includes thermoset plastics such as Formica, fiberglass, and other related products.
16. **Foam Rubber and Padding**—foam materials, consisting primarily of polyurethane, used for carpet padding, packaging, and other applications (not including insulation).
17. **Plastic and Other Materials**—items that are predominantly made of plastic, but are combined with other material, such as kitchenware and car parts with wood or metal components.

## Wood and Yard Wastes

18. **Dimensional Lumber/Engineered Wood**—both clean and painted wood commonly used in construction for framing and related uses, including 2 x 4's, 2 x 6's, and sheets of plywood, strandboard, and particle board. Includes pallets and crates.
19. **Treated Wood**—wood treated with preservatives such as creosote, including dimension lumber. This category may also include some treated plywood, strandboard, chemically treated wood, and other wood.
20. **Contaminated Wood**—wood contaminated with other wastes in such a way that they cannot easily be separated, but consisting primarily (over 50 percent) of wood. Examples include wood with sheetrock attached.
21. **Roofing and Siding Wood**—painted or unpainted wood from demolition or construction waste that is commonly used for siding or roofing of buildings. This category includes only wood products, such as cedar shingles or shakes.
22. **Stumps**—stumps of trees and shrubs, with any adhering soil.
23. **Large Prunings**—other natural woods, such as logs and branches in excess of four inches in diameter (four inches is the limit used for defining prunings as yard wastes).
24. **Yard Wastes**—leaves, grass clippings, garden wastes, and brush up to four inches in diameter.

25. **Other Wood**—other types of wood including wood products that do not fit into the above categories.

## Food

26. **Packaged Bakery Items**—any food item from a bakery, such as breads, pastries, cookies, crackers, and cakes where the package has remained intact. In the sorter's judgment, packaged bakery items *could* have been donated to a food bank or similar organization, rather than disposed.

27. **Opened, Unpackaged, or Scrap Bakery Items**—any food item from a bakery, such as breads, pastries, cookies, crackers, and cakes where the package has been opened or broken, the food item is not contained in any package or bag, or where the bakery item is found in scraps or pieces. In the sorter's judgment, these food items *would not have been* acceptable for donation.

28. **Packaged Vegetative Food**—any vegetative food item such as pasta, grains, beans, fruits, vegetables, sauces, soda, tea, juice and water where the package has remained intact. In the sorter's judgment, packaged vegetative food items *could* have been donated to a food bank or similar organization, rather than disposed. This category may include fresh fruits and vegetables (packaged in waxed boxes, for example) if, in the sorter's judgment, the food was not spoiled at the time of disposal.

29. **Opened, Unpackaged or Scrap Vegetative Food**—any vegetative food item such as pasta, grains, beans, fruits, vegetables, sauces, soda, tea, juice, water, and ice where the package has been opened or broken, the item is unpackaged, or where the vegetative food is found in scraps or pieces. In the sorter's judgment, these food items *would not have been* acceptable for donation.

30. **Packaged Non-vegetative Food**—any non-vegetative food item such as fresh or canned meat or fish, cheeses, eggs, dairy items, and chili or soup containing meat, where the package has remained intact. In the sorter's judgment, packaged non-vegetative food items *could* have been donated to a food bank or similar organization, rather than disposed.

31. **Opened, Unpackaged, or Scrap Non-vegetative Food**—any non-vegetative food item such as fresh or canned meat or fish, cheeses, eggs, dairy items, and chili or soup containing meat, where the package has been opened or broken, the item is unpackaged, or where the food is found in scraps or pieces. In the sorter's judgment, these food items *would not have been* acceptable for donation.

## Other Organics

32. **Textiles: Clothes & Other Recyclables**—fabric materials including natural and man-made textile materials such as cottons, wools, silks, woven nylon, rayon, polyesters and other materials. This category includes clothing, rags, curtains, and other fabrics.

33. **Other Textiles**—upholstery, shoes, and other nonrecyclable products including leather products.

34. **Carpet**—general category of flooring applications consisting of various natural or synthetic fibers bonded to some type of backing material.
35. **Disposable Diapers**—diapers and similar products made from a combination of fibers, synthetic, and/or natural, and made for the purpose of a single use. Diapers that are all cloth and not originally intended for single use will be classified as a textile. This category includes fecal matter contained within, sanitary napkins and tampons, and adult disposable protective undergarments.
36. **Rubber Products (except tires and foam rubber)**—items made of natural and synthetic rubber, including door mats, car parts, hoses, toys, and other products.
37. **Tires**—whole tires from automobiles, trucks, motorcycles, bicycles, and other vehicles.
38. **Animal Carcasses**—carcasses of small animals and pieces of larger animals, unless the waste is the result of food storage or preparation.
39. **Animal Feces**—feces from animals including kitty litter and bedding.
40. **Miscellaneous Organics**—hair, wax, soap, and other organics not otherwise classified.

## **Glass**

41. **Clear Containers**—bottles and jars that are clear in color; used for food, soft drinks, beer, and wine.
42. **Green Containers**—bottles and jars that are green in color; used for food, soft drinks, beer, and wine.
43. **Brown Containers**—bottles and jars that are brown in color; used for food, soft drinks, beer, and wine.
44. **Other Glass**—window glass, mirrors, light bulbs, cooking wear, and other glass and ceramic products that are not easily recyclable.

## **Metals**

45. **Aluminum Cans**—beverage cans composed of aluminum only.
46. **Other Aluminum**—other types of aluminum containers such as pans and trays; includes foil and foil products or packages and all other aluminum materials including furniture, house siding, cookware, and scrap.
47. **Tinned Food Cans**—tin-plated steel cans (food cans), does not include other bi-metals, paint cans, or other types of steel cans.
48. **Other Ferrous**—ferrous and alloyed ferrous scrap materials derived from iron, including household, industrial, and commercial products including other cans and containers. This category includes scrap iron and steel to which a magnet adheres.
49. **Other Non-Ferrous**—metals that are not materials derived from iron, including copper, brass, bronze, aluminum bronze, lead, pewter, zinc, and other metals to

which a magnet will not adhere. Metals that are significantly contaminated are not included.

- 50. **Mixed Metals and Other Materials**—composite metal products and metals combined with other materials, such as engines, electric motors, umbrellas, coated wire, and aerosol cans.
- 51. **Compressed Gas Cylinders**—metal gas tanks and cylinders most often used to contain propane or butane.

## Other Wastes

- 52. **Construction/Demolition Waste (except wood)**—construction, demolition, or land clearing waste that cannot be placed into one of the above categories, such as concrete, plaster, rocks, gravel, bricks, and non-wood roofing materials, and insulation of various types (including foam, fiberglass etc.).
- 53. **Asphalt Shingles**—roofing material composed of fiberglass or organic felts saturated with asphalt and covered with asphalt and inert aggregates. Commonly known as three-tab roofing shingles.
- 54. **Ash**—material remaining after the combustion process, present in the waste stream as ash from fireplaces and wood stoves, used charcoal from grills, and similar materials.
- 55. **Nondistinct Fines**—soil, sand, dirt, and similar nondistinct materials.
- 56. **Gypsum Wallboard**—calcium sulfate dihydrate sandwiched between heavy layers of Kraft-type paper.
- 57. **Furniture/Mattresses**—furniture and mattresses made of mixed materials and in any condition.
- 58. **Household Appliances**—small household appliances such as, stereos, radios, toasters, broilers, can openers, and blenders.
- 59. **Printers/Copiers/Fax Machines**—computer printers (both inkjet and laser), facsimile machines, and photo copying machines.
- 60. **Office Electronics**—items such as computer central processing units (CPUs), scanners, personal digital assistants (PDAs), and computer peripherals including keyboards and mice.
- 61. **Miscellaneous Inorganics**—non-construction, demolition and landclearing, plaster of paris, concrete items, and materials not otherwise classified.

## Household Hazardous/Special Waste

- 62. **Used Oil**—used lubricating oils, primarily used in cars but including other types with similar characteristics and oil filters.
- 63. **Vehicle Batteries**—car, motorcycle, and other lead-acid batteries used for motorized vehicles.

64. **Household Batteries**—batteries of various sizes and types, as commonly used in households, including alkaline and button cell batteries.
65. **Latex Paint**—water-based paints and similar products.
66. **Oil-Based Paint**—solvent-based paints, varnishes, and similar products.
67. **Solvents and Thinners**—various solvents, including chlorinated and flammable solvents, paint strippers, solvents contaminated with other products such as paints, degreasers and some other cleaners if the primary ingredient is (or was) a solvent, and alcohols such as methanol and isopropanol.
68. **Adhesives and Glue**—glues and adhesives of various sorts, including rubber cement, wood putty, glazing and spackling compounds, caulking compounds, grout, and joint and auto body fillers.
69. **Cleaners and Corrosives**—various acids and bases whose primary purpose is to clean surfaces, unclog drains, or perform other actions.
70. **Pesticides and Herbicides**—variety of chemicals whose purpose is to discourage or kill pests, weeds, or microorganisms. Fungicides and wood preservatives, such as pentachlorophenol, are also included.
71. **Gasoline and Fuel Oil**—gasoline, diesel fuel, and fuel oils.
72. **Antifreeze/Brake Fluid**—automobile and other antifreeze mixtures based on ethylene or propylene glycol; also brake and other automotive fluids (except motor oil)
73. **Medical Waste**—wastes related to medical activities, including syringes, intravenous (I.V.) tubing, bandages, medications, and other wastes.
74. **Computer Monitors**—computer monitors, excluding laptops and LCD Monitors.
75. **Televisions**—televisions.
76. **Cell Phones**—cellular telephones.
77. **Laptops/LCD Monitors**—Liquid crystal display (LCD) and flat-screen monitors, and laptop and notebook computers that contain these types of monitors.
78. **Other Hazardous Waste**—asbestos-containing wastes if this is the primary hazard associated with the waste; gunpowder, unspent ammunition, picric acid and other potentially explosive chemicals; radioactive materials (but smoke alarms are classified as "other plastic"); items that contain mercury, such as thermometers, thermostats, fluorescent lamps and tubes, jewelry and mercury switches; and other hazardous wastes that do not fit into the above categories. Alkaline and button cell batteries, which also contain mercury, are characterized as *household batteries*.



## APPENDIX C.

# Waste Composition Calculations

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Cascadia estimated the waste composition and annual tonnage through analyses of the waste sort data, customer surveys, and disposal tonnage data provided by King County Solid Waste Division. This Appendix details each step of the calculation process.

### Composition Calculations

The composition estimates represent the **ratio of the components' weight to the total sample weight** for each noted substream. They are derived by summing each component's weight across all of the selected records and dividing by the sum of the total sample weight, as shown in the following equation:

$$r_j = \frac{\sum_i c_{ij}}{\sum_i w_i}$$

where: r = ratio of components' weight to the total sample weight

c = weight of particular component

w = sum of all component weights

for i = 1 to n

where n = number of selected samples

for j = 1 to m

where m = number of components

The confidence interval for this estimate is derived in two steps. First, the variance around the estimate is calculated, accounting for the fact that the ratio includes two random variables (the component and total sample weights). The **variance of the ratio estimator** equation follows:

$$\hat{V}_{r_j} = \left(\frac{1}{n}\right) \cdot \left(\frac{1}{\bar{w}^2}\right) \cdot \left(\frac{\sum_i (c_{ij} - r_j w_i)^2}{n-1}\right)$$

where:

$$\bar{w} = \frac{\sum_i w_i}{n}$$

Second, **precision levels** at the 90% confidence interval are calculated for a component's mean as follows:

$$r_j \pm (t \cdot \sqrt{\hat{V}_{r_j}})$$

where:

t = the value of the t-statistic (1.645) corresponding to a 90% confidence level

For more detail, please refer to Chapter 6 "Ratio, Regression and Difference Estimation" of *Elementary Survey Sampling* by R.L. Scheaffer, W. Mendenhall and L. Ott (PWS Publishers, 1986).

## Tonnage Estimates

The estimated 1,021,929 tons of MSW disposed in King County includes municipal solid waste received at the seven open county operated transfer stations, two county-operated drop boxes, and Cedar Hills Landfill plus estimated tons from the closed Shoreline transfer station between January 2007 and December 2007. The Solid Waste Division provided the total tonnage estimate, as well as the tonnage split between the commercially collected and self-hauled substreams. The tonnages allocated to all other substreams (i.e. commercially collected residential) were calculated using customer survey data.

## Weighted Averages

Cascadia calculated the overall waste composition estimates and the composition estimates for each substream by performing a weighted average by hauler type, generator type, and vehicle type. Cascadia calculated weighted averages using customer survey data and the tonnage estimates for each substream.

The **weighted average for an overall composition estimate** is performed as follows:

$$O_j = (p_1 \cdot r_{j1}) + (p_2 \cdot r_{j2}) + (p_3 \cdot r_{j3}) + \dots$$

where:

p = proportion of tonnage contributed by the noted substream

r = ratio of component weight to total sample weight in the noted substream

for j = 1 to m

where m = number of components

The **variance of the weighted average** is calculated:

$$VarO_j = (p_1^2 \cdot \hat{V}_{r_{j1}}) + (p_2^2 \cdot \hat{V}_{r_{j2}}) + (p_3^2 \cdot \hat{V}_{r_{j3}}) + \dots$$

where:

V = ratio estimator's variance in the noted substream

## **APPENDIX D.**

### **Detailed Waste Composition Results**

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This appendix contains detailed waste composition results not found in the main body of the report. Detailed *Composition by Weight* tables are presented for the following substreams:

- Overall disposed waste, page D-2
- Residential substream, page D-3
- Nonresidential substream, page D-4
- Commercially collected substream, page D-5
- Commercially collected residential substream, page D-6
- Commercially collected nonresidential substream, page D-7
- Self-hauled substream, page D-8
- Self-hauled residential substream, page D-9
- Self-hauled nonresidential substream, page D-10

# Overall Disposed Waste

**Table D-1. Composition by Weight – Overall Disposed Waste  
January 2007 - December 2007**

WASTE MATERIAL	TONS	MEAN	+/-	WASTE MATERIAL	TONS	MEAN	+/-
<b>Paper</b>	<b>232,067</b>	<b>22.7%</b>		<b>Glass</b>	<b>22,493</b>	<b>2.2%</b>	
Newspaper (ONP)	20,199	2.0%	0.4%	Clear Containers	7,933	0.8%	0.1%
Corrugated Cardboard (OCC)	59,074	5.8%	0.9%	Green Containers	3,771	0.4%	0.1%
Low Grade Recyclable	59,319	5.8%	0.5%	Brown Containers	5,315	0.5%	0.1%
High Grade	12,729	1.2%	0.2%	Other Glass	5,475	0.5%	0.2%
Bleached Polycoated	4,165	0.4%	0.2%	<b>Metal</b>	<b>52,851</b>	<b>5.2%</b>	
Paper and Other Materials	11,065	1.1%	0.2%	Aluminum Cans	2,908	0.3%	0.0%
Compostable Paper	62,152	6.1%	0.5%	Other Aluminum	2,466	0.2%	0.1%
Other Paper	3,364	0.3%	0.1%	Tinned Food Cans	5,154	0.5%	0.1%
<b>Plastic</b>	<b>130,471</b>	<b>12.8%</b>		Other Ferrous	26,558	2.6%	0.5%
PET Bottles	7,497	0.7%	0.1%	Other Non-Ferrous	573	0.1%	0.0%
HDPE Bottles	3,067	0.3%	0.0%	Mixed Metals/Other Materials	14,786	1.4%	0.3%
Other Containers	9,155	0.9%	0.1%	Compressed Gas Cylinders	406	0.0%	0.0%
Expanded Polystyrene	8,749	0.9%	0.3%	<b>Other Wastes</b>	<b>106,662</b>	<b>10.4%</b>	
Plastic Film and Bags	61,600	6.0%	0.5%	Asphalt Shingles	4,250	0.4%	0.3%
Other Packaging	6,319	0.6%	0.1%	C&D Wastes	48,425	4.7%	0.9%
Plastic Products	19,204	1.9%	0.4%	Ash	2,987	0.3%	0.3%
Foam Rubber and Padding	5,436	0.5%	0.2%	Nondistinct Fines	6,287	0.6%	0.3%
Plastic and Other Materials	9,444	0.9%	0.3%	Gypsum Wallboard	5,594	0.5%	0.2%
<b>Wood/Yard Waste</b>	<b>143,762</b>	<b>14.1%</b>		Furniture/Mattresses	27,622	2.7%	0.9%
Dimensional Lumber/Plywood	54,469	5.3%	1.0%	Household Appliances	4,437	0.4%	0.2%
Treated Wood	16,605	1.6%	0.5%	Printers/Copiers/Fax Machines	1,043	0.1%	0.1%
Contaminated Wood	15,528	1.5%	0.5%	Office Electronics	2,802	0.3%	0.1%
Roofing and Siding Wood	2,409	0.2%	0.2%	Miscellaneous Inorganics	3,217	0.3%	0.2%
Stumps	2,257	0.2%	0.2%	<b>Household Hazardous</b>	<b>9,897</b>	<b>1.0%</b>	
Large Prunings	1,976	0.2%	0.2%	Used Oil	621	0.1%	0.0%
Yard Wastes	45,643	4.5%	0.9%	Vehicle Batteries	228	0.0%	0.0%
Other Wood	4,874	0.5%	0.2%	Household Batteries	531	0.1%	0.0%
<b>Food</b>	<b>189,433</b>	<b>18.5%</b>		Latex Paint	1,766	0.2%	0.2%
Packaged Bakery Items	6,498	0.6%	0.2%	Oil-based Paint	305	0.0%	0.0%
Opened/Unpack/Scrap Bakery	17,372	1.7%	0.4%	Solvents and Thinners	63	0.0%	0.0%
Packaged Vegetative	9,964	1.0%	0.3%	Adhesives and Glue	84	0.0%	0.0%
Opened/Unpack/Scrap Vegetative	102,107	10.0%	0.9%	Cleaners and Corrosives	354	0.0%	0.0%
Packaged Non-vegetative	6,831	0.7%	0.3%	Pesticides and Herbicides	581	0.1%	0.1%
Opened/Unpack/Scrap Non-vegetative	46,662	4.6%	0.6%	Gasoline and Fuel Oil	271	0.0%	0.0%
<b>Other Organics</b>	<b>134,294</b>	<b>13.1%</b>		Antifreeze/Brake Fluid	6	0.0%	0.0%
Textiles:Clothes/Other Recyclables	17,801	1.7%	0.3%	Medical Waste	1,754	0.2%	0.1%
Other Textiles	12,086	1.2%	0.2%	Computer Monitors	223	0.0%	0.0%
Carpet	32,507	3.2%	1.0%	Televisions	870	0.1%	0.1%
Disposable Diapers	29,127	2.9%	0.4%	Cell Phones	4	0.0%	0.0%
Rubber Products	3,534	0.3%	0.1%	Laptops/LCD Monitors	120	0.0%	0.0%
Tires	1,347	0.1%	0.1%	Other Hazardous Waste	2,116	0.2%	0.2%
Animal Carcasses	673	0.1%	0.1%	<b>Total</b>	<b>1,021,929</b>	<b>100.0%</b>	
Animal Feces	23,950	2.3%	0.4%				
Miscellaneous Organics	13,269	1.3%	0.4%				
						No. of samples =	421

Error range calculated at a 90% confidence level

# Residential Substream

**Table D-2. Composition by Weight – Residential Waste  
January 2007 - December 2007**

WASTE MATERIAL	TONS	MEAN	+/-	WASTE MATERIAL	TONS	MEAN	+/-
<b>Paper</b>	<b>101,446</b>	<b>18.7%</b>		<b>Glass</b>	<b>12,294</b>	<b>2.3%</b>	
Newspaper (ONP)	9,922	1.8%	0.6%	Clear Containers	4,585	0.8%	0.1%
Corrugated Cardboard (OCC)	18,594	3.4%	0.5%	Green Containers	2,160	0.4%	0.1%
Low Grade Recyclable	30,380	5.6%	0.6%	Brown Containers	2,603	0.5%	0.1%
High Grade	4,821	0.9%	0.2%	Other Glass	2,946	0.5%	0.1%
Bleached Polycoated	1,228	0.2%	0.0%	<b>Metal</b>	<b>29,304</b>	<b>5.4%</b>	
Paper and Other Materials	4,701	0.9%	0.3%	Aluminum Cans	1,556	0.3%	0.0%
Compostable Paper	30,353	5.6%	0.4%	Other Aluminum	1,623	0.3%	0.3%
Other Paper	1,447	0.3%	0.1%	Tinned Food Cans	3,411	0.6%	0.1%
<b>Plastic</b>	<b>62,707</b>	<b>11.6%</b>		Other Ferrous	14,370	2.7%	0.6%
PET Bottles	4,083	0.8%	0.1%	Other Non-Ferrous	348	0.1%	0.0%
HDPE Bottles	1,712	0.3%	0.0%	Mixed Metals/Other Materials	7,755	1.4%	0.3%
Other Containers	5,228	1.0%	0.2%	Compressed Gas Cylinders	241	0.0%	0.0%
Expanded Polystyrene	4,552	0.8%	0.4%	<b>Other Wastes</b>	<b>65,369</b>	<b>12.1%</b>	
Plastic Film and Bags	24,683	4.6%	0.5%	Asphalt Shingles	2,859	0.5%	0.5%
Other Packaging	3,516	0.6%	0.2%	C&D Wastes	25,941	4.8%	1.1%
Plastic Products	12,621	2.3%	0.7%	Ash	1,634	0.3%	0.4%
Foam Rubber and Padding	1,678	0.3%	0.2%	Nondistinct Fines	1,927	0.4%	0.3%
Plastic and Other Materials	4,635	0.9%	0.2%	Gypsum Wallboard	4,058	0.7%	0.4%
<b>Wood/Yard Waste</b>	<b>86,281</b>	<b>15.9%</b>		Furniture/Mattresses	21,528	4.0%	1.5%
Dimensional Lumber/Plywood	29,036	5.4%	1.3%	Household Appliances	2,835	0.5%	0.3%
Treated Wood	8,297	1.5%	0.6%	Printers/Copiers/Fax Machines	648	0.1%	0.1%
Contaminated Wood	9,729	1.8%	0.6%	Office Electronics	1,756	0.3%	0.2%
Roofing and Siding Wood	2,121	0.4%	0.4%	Miscellaneous Inorganics	2,182	0.4%	0.3%
Stumps	1,703	0.3%	0.4%	<b>Household Hazardous</b>	<b>6,233</b>	<b>1.2%</b>	
Large Prunings	510	0.1%	0.1%	Used Oil	621	0.1%	0.1%
Yard Wastes	31,244	5.8%	1.5%	Vehicle Batteries	228	0.0%	0.1%
Other Wood	3,641	0.7%	0.4%	Household Batteries	387	0.1%	0.0%
<b>Food</b>	<b>97,065</b>	<b>17.9%</b>		Latex Paint	307	0.1%	0.0%
Packaged Bakery Items	2,656	0.5%	0.2%	Oil-based Paint	302	0.1%	0.1%
Opened/Unpack/Scrap Bakery	9,594	1.8%	0.3%	Solvents and Thinners	37	0.0%	0.0%
Packaged Vegetative	4,612	0.9%	0.4%	Adhesives and Glue	76	0.0%	0.0%
Opened/Unpack/Scrap Vegetative	55,159	10.2%	0.9%	Cleaners and Corrosives	287	0.1%	0.0%
Packaged Non-vegetative	2,941	0.5%	0.3%	Pesticides and Herbicides	193	0.0%	0.0%
Opened/Unpack/Scrap Non-vegetative	22,104	4.1%	0.8%	Gasoline and Fuel Oil	13	0.0%	0.0%
<b>Other Organics</b>	<b>80,786</b>	<b>14.9%</b>		Antifreeze/Brake Fluid	6	0.0%	0.0%
Textiles:Clothes/Other Recyclables	12,414	2.3%	0.6%	Medical Waste	718	0.1%	0.1%
Other Textiles	6,537	1.2%	0.3%	Computer Monitors	223	0.0%	0.1%
Carpet	12,694	2.3%	0.9%	Televisions	870	0.2%	0.1%
Disposable Diapers	19,868	3.7%	0.6%	Cell Phones	4	0.0%	0.0%
Rubber Products	1,865	0.3%	0.1%	Laptops/LCD Monitors	120	0.0%	0.0%
Tires	809	0.1%	0.2%	Other Hazardous Waste	1,840	0.3%	0.4%
Animal Carcasses	673	0.1%	0.2%	<b>Total</b>	<b>541,485</b>	<b>100.0%</b>	
Animal Feces	19,595	3.6%	0.8%				
Miscellaneous Organics	6,332	1.2%	0.3%				
							<i>No. of samples = 228</i>

*Error range calculated at a 90% confidence level*

# Nonresidential Substream

**Table D-3. Composition by Weight – Nonresidential Waste  
January 2007 - December 2007**

WASTE MATERIAL	TONS	MEAN	+/-	WASTE MATERIAL	TONS	MEAN	+/-
<b>Paper</b>	<b>130,621</b>	<b>27.2%</b>		<b>Glass</b>	<b>10,199</b>	<b>2.1%</b>	
Newspaper (ONP)	10,276	2.1%	0.5%	Clear Containers	3,348	0.7%	0.2%
Corrugated Cardboard (OCC)	40,481	8.4%	1.9%	Green Containers	1,610	0.3%	0.1%
Low Grade Recyclable	28,939	6.0%	0.9%	Brown Containers	2,712	0.6%	0.2%
High Grade	7,908	1.6%	0.4%	Other Glass	2,529	0.5%	0.4%
Bleached Polycoated	2,937	0.6%	0.5%	<b>Metal</b>	<b>23,547</b>	<b>4.9%</b>	
Paper and Other Materials	6,364	1.3%	0.3%	Aluminum Cans	1,352	0.3%	0.0%
Compostable Paper	31,798	6.6%	1.0%	Other Aluminum	843	0.2%	0.1%
Other Paper	1,917	0.4%	0.1%	Tinned Food Cans	1,743	0.4%	0.1%
<b>Plastic</b>	<b>67,764</b>	<b>14.1%</b>		Other Ferrous	12,188	2.5%	0.8%
PET Bottles	3,414	0.7%	0.1%	Other Non-Ferrous	225	0.0%	0.0%
HDPE Bottles	1,355	0.3%	0.1%	Mixed Metals/Other Materials	7,030	1.5%	0.5%
Other Containers	3,928	0.8%	0.2%	Compressed Gas Cylinders	165	0.0%	0.1%
Expanded Polystyrene	4,198	0.9%	0.3%	<b>Other Wastes</b>	<b>41,293</b>	<b>8.6%</b>	
Plastic Film and Bags	36,917	7.7%	1.0%	Asphalt Shingles	1,391	0.3%	0.3%
Other Packaging	2,803	0.6%	0.2%	C&D Wastes	22,483	4.7%	1.5%
Plastic Products	6,583	1.4%	0.3%	Ash	1,353	0.3%	0.2%
Foam Rubber and Padding	3,758	0.8%	0.5%	Nondistinct Fines	4,360	0.9%	0.5%
Plastic and Other Materials	4,809	1.0%	0.5%	Gypsum Wallboard	1,536	0.3%	0.3%
<b>Wood/Yard Waste</b>	<b>57,481</b>	<b>12.0%</b>		Furniture/Mattresses	6,093	1.3%	0.8%
Dimensional Lumber/Plywood	25,434	5.3%	1.7%	Household Appliances	1,602	0.3%	0.3%
Treated Wood	8,308	1.7%	0.8%	Printers/Copiers/Fax Machines	394	0.1%	0.1%
Contaminated Wood	5,800	1.2%	0.8%	Office Electronics	1,046	0.2%	0.2%
Roofing and Siding Wood	287	0.1%	0.1%	Miscellaneous Inorganics	1,035	0.2%	0.2%
Stumps	555	0.1%	0.2%	<b>Household Hazardous</b>	<b>3,664</b>	<b>0.8%</b>	
Large Prunings	1,466	0.3%	0.3%	Used Oil	0	0.0%	0.0%
Yard Wastes	14,398	3.0%	0.9%	Vehicle Batteries	0	0.0%	0.0%
Other Wood	1,234	0.3%	0.1%	Household Batteries	144	0.0%	0.0%
<b>Food</b>	<b>92,368</b>	<b>19.2%</b>		Latex Paint	1,459	0.3%	0.4%
Packaged Bakery Items	3,843	0.8%	0.4%	Oil-based Paint	3	0.0%	0.0%
Opened/Unpack/Scrap Bakery	7,778	1.6%	0.7%	Solvents and Thinners	26	0.0%	0.0%
Packaged Vegetative	5,352	1.1%	0.4%	Adhesives and Glue	8	0.0%	0.0%
Opened/Unpack/Scrap Vegetative	46,948	9.8%	1.5%	Cleaners and Corrosives	67	0.0%	0.0%
Packaged Non-vegetative	3,890	0.8%	0.5%	Pesticides and Herbicides	389	0.1%	0.1%
Opened/Unpack/Scrap Non-vegetative	24,558	5.1%	1.0%	Gasoline and Fuel Oil	257	0.1%	0.1%
<b>Other Organics</b>	<b>53,508</b>	<b>11.1%</b>		Antifreeze/Brake Fluid	0	0.0%	0.0%
Textiles:Clothes/Other Recyclables	5,388	1.1%	0.3%	Medical Waste	1,035	0.2%	0.2%
Other Textiles	5,549	1.2%	0.3%	Computer Monitors	0	0.0%	0.0%
Carpet	19,813	4.1%	1.9%	Televisions	0	0.0%	0.0%
Disposable Diapers	9,259	1.9%	0.6%	Cell Phones	0	0.0%	0.0%
Rubber Products	1,669	0.3%	0.2%	Laptops/LCD Monitors	0	0.0%	0.0%
Tires	538	0.1%	0.1%	Other Hazardous Waste	276	0.1%	0.1%
Animal Carcasses	0	0.0%	0.0%	<b>Total</b>	<b>480,444</b>	<b>100.0%</b>	
Animal Feces	4,356	0.9%	0.4%				
Miscellaneous Organics	6,937	1.4%	0.7%				
							<i>No. of samples = 193</i>

*Error range calculated at a 90% confidence level*

# Commercially Collected Substream

**Table D-4. Composition by Weight – Commercially Collected Waste  
January 2007 - December 2007**

WASTE MATERIAL	TONS	MEAN	+/-	WASTE MATERIAL	TONS	MEAN	+/-
<b>Paper</b>	<b>211,076</b>	<b>26.6%</b>		<b>Glass</b>	<b>18,764</b>	<b>2.4%</b>	
Newspaper (ONP)	19,142	2.4%	0.5%	Clear Containers	7,301	0.9%	0.1%
Corrugated Cardboard (OCC)	50,700	6.4%	1.2%	Green Containers	3,335	0.4%	0.1%
Low Grade Recyclable	53,408	6.7%	0.6%	Brown Containers	4,587	0.6%	0.1%
High Grade	11,488	1.4%	0.3%	Other Glass	3,541	0.4%	0.2%
Bleached Polycoated	4,083	0.5%	0.3%	<b>Metal</b>	<b>35,340</b>	<b>4.4%</b>	
Paper and Other Materials	9,517	1.2%	0.2%	Aluminum Cans	2,740	0.3%	0.0%
Compostable Paper	59,823	7.5%	0.7%	Other Aluminum	2,269	0.3%	0.2%
Other Paper	2,915	0.4%	0.1%	Tinned Food Cans	4,776	0.6%	0.1%
<b>Plastic</b>	<b>108,925</b>	<b>13.7%</b>		Other Ferrous	15,783	2.0%	0.5%
PET Bottles	7,065	0.9%	0.1%	Other Non-Ferrous	356	0.0%	0.0%
HDPE Bottles	2,902	0.4%	0.0%	Mixed Metals/Other Materials	9,125	1.1%	0.3%
Other Containers	7,849	1.0%	0.1%	Compressed Gas Cylinders	291	0.0%	0.0%
Expanded Polystyrene	6,696	0.8%	0.2%	<b>Other Wastes</b>	<b>53,808</b>	<b>6.8%</b>	
Plastic Film and Bags	57,549	7.2%	0.7%	Asphalt Shingles	1,489	0.2%	0.2%
Other Packaging	5,274	0.7%	0.1%	C&D Wastes	22,276	2.8%	0.9%
Plastic Products	10,448	1.3%	0.2%	Ash	1,406	0.2%	0.1%
Foam Rubber and Padding	2,889	0.4%	0.2%	Nondistinct Fines	5,590	0.7%	0.3%
Plastic and Other Materials	8,255	1.0%	0.3%	Gypsum Wallboard	2,155	0.3%	0.2%
<b>Wood/Yard Waste</b>	<b>69,198</b>	<b>8.7%</b>		Furniture/Mattresses	12,265	1.5%	0.9%
Dimensional Lumber/Plywood	26,359	3.3%	1.0%	Household Appliances	2,510	0.3%	0.2%
Treated Wood	7,674	1.0%	0.5%	Printers/Copiers/Fax Machines	771	0.1%	0.1%
Contaminated Wood	5,678	0.7%	0.5%	Office Electronics	2,448	0.3%	0.2%
Roofing and Siding Wood	263	0.0%	0.0%	Miscellaneous Inorganics	2,899	0.4%	0.2%
Stumps	0	0.0%	0.0%	<b>Household Hazardous</b>	<b>6,569</b>	<b>0.8%</b>	
Large Prunings	1,217	0.2%	0.2%	Used Oil	498	0.1%	0.0%
Yard Wastes	26,639	3.4%	0.8%	Vehicle Batteries	228	0.0%	0.0%
Other Wood	1,367	0.2%	0.1%	Household Batteries	493	0.1%	0.0%
<b>Food</b>	<b>182,563</b>	<b>23.0%</b>		Latex Paint	1,372	0.2%	0.2%
Packaged Bakery Items	6,286	0.8%	0.3%	Oil-based Paint	238	0.0%	0.0%
Opened/Unpack/Scrap Bakery	16,483	2.1%	0.5%	Solvents and Thinners	26	0.0%	0.0%
Packaged Vegetative	9,461	1.2%	0.4%	Adhesives and Glue	80	0.0%	0.0%
Opened/Unpack/Scrap Vegetative	98,758	12.4%	1.1%	Cleaners and Corrosives	230	0.0%	0.0%
Packaged Non-vegetative	6,660	0.8%	0.4%	Pesticides and Herbicides	496	0.1%	0.1%
Opened/Unpack/Scrap Non-vegetative	44,915	5.7%	0.8%	Gasoline and Fuel Oil	271	0.0%	0.0%
<b>Other Organics</b>	<b>108,412</b>	<b>13.6%</b>		Antifreeze/Brake Fluid	0	0.0%	0.0%
Textiles:Clothes/Other Recyclables	13,842	1.7%	0.4%	Medical Waste	1,750	0.2%	0.2%
Other Textiles	9,452	1.2%	0.2%	Computer Monitors	0	0.0%	0.0%
Carpet	19,165	2.4%	1.1%	Televisions	386	0.0%	0.1%
Disposable Diapers	28,151	3.5%	0.5%	Cell Phones	4	0.0%	0.0%
Rubber Products	2,373	0.3%	0.1%	Laptops/LCD Monitors	0	0.0%	0.0%
Tires	874	0.1%	0.1%	Other Hazardous Waste	498	0.1%	0.0%
Animal Carcasses	673	0.1%	0.1%	<b>Total</b>	<b>794,654</b>	<b>100.0%</b>	
Animal Feces	22,230	2.8%	0.5%				
Miscellaneous Organics	11,651	1.5%	0.5%				
							No. of samples = 261

Error range calculated at a 90% confidence level

# Commercially Collected Residential Substream

**Table D-5. Composition by Weight – Commercially Collected Residential Waste  
January 2007 - December 2007**

WASTE MATERIAL	TONS	MEAN	+/-	WASTE MATERIAL	TONS	MEAN	+/-
<b>Paper</b>	<b>83,047</b>	<b>24.0%</b>		<b>Glass</b>	<b>9,061</b>	<b>2.6%</b>	
Newspaper (ONP)	8,957	2.6%	0.9%	Clear Containers	3,986	1.2%	0.2%
Corrugated Cardboard (OCC)	11,454	3.3%	0.5%	Green Containers	1,732	0.5%	0.1%
Low Grade Recyclable	24,985	7.2%	0.7%	Brown Containers	1,875	0.5%	0.1%
High Grade	3,655	1.1%	0.2%	Other Glass	1,468	0.4%	0.1%
Bleached Polycoated	1,147	0.3%	0.1%	<b>Metal</b>	<b>14,958</b>	<b>4.3%</b>	
Paper and Other Materials	3,600	1.0%	0.4%	Aluminum Cans	1,393	0.4%	0.1%
Compostable Paper	28,220	8.2%	0.6%	Other Aluminum	1,462	0.4%	0.4%
Other Paper	1,030	0.3%	0.1%	Tinned Food Cans	3,055	0.9%	0.1%
<b>Plastic</b>	<b>44,652</b>	<b>12.9%</b>		Other Ferrous	5,481	1.6%	0.6%
PET Bottles	3,672	1.1%	0.2%	Other Non-Ferrous	132	0.0%	0.0%
HDPE Bottles	1,556	0.5%	0.1%	Mixed Metals/Other Materials	3,309	1.0%	0.2%
Other Containers	4,026	1.2%	0.2%	Compressed Gas Cylinders	126	0.0%	0.0%
Expanded Polystyrene	2,521	0.7%	0.2%	<b>Other Wastes</b>	<b>20,887</b>	<b>6.0%</b>	
Plastic Film and Bags	21,387	6.2%	0.6%	Asphalt Shingles	98	0.0%	0.0%
Other Packaging	2,498	0.7%	0.1%	C&D Wastes	5,003	1.4%	0.6%
Plastic Products	4,676	1.4%	0.4%	Ash	166	0.0%	0.1%
Foam Rubber and Padding	542	0.2%	0.1%	Nondistinct Fines	1,230	0.4%	0.4%
Plastic and Other Materials	3,775	1.1%	0.3%	Gypsum Wallboard	1,591	0.5%	0.4%
<b>Wood/Yard Waste</b>	<b>20,049</b>	<b>5.8%</b>		Furniture/Mattresses	8,228	2.4%	1.8%
Dimensional Lumber/Plywood	3,230	0.9%	0.6%	Household Appliances	908	0.3%	0.3%
Treated Wood	791	0.2%	0.1%	Printers/Copiers/Fax Machines	377	0.1%	0.2%
Contaminated Wood	1,179	0.3%	0.2%	Office Electronics	1,423	0.4%	0.3%
Roofing and Siding Wood	38	0.0%	0.0%	Miscellaneous Inorganics	1,864	0.5%	0.5%
Stumps	0	0.0%	0.0%	<b>Household Hazardous</b>	<b>3,058</b>	<b>0.9%</b>	
Large Prunings	98	0.0%	0.0%	Used Oil	498	0.1%	0.1%
Yard Wastes	14,191	4.1%	1.5%	Vehicle Batteries	228	0.1%	0.1%
Other Wood	521	0.2%	0.1%	Household Batteries	350	0.1%	0.1%
<b>Food</b>	<b>90,896</b>	<b>26.3%</b>		Latex Paint	54	0.0%	0.0%
Packaged Bakery Items	2,606	0.8%	0.2%	Oil-based Paint	238	0.1%	0.1%
Opened/Unpack/Scrap Bakery	8,815	2.6%	0.5%	Solvents and Thinners	0	0.0%	0.0%
Packaged Vegetative	4,124	1.2%	0.6%	Adhesives and Glue	72	0.0%	0.0%
Opened/Unpack/Scrap Vegetative	52,196	15.1%	1.4%	Cleaners and Corrosives	163	0.0%	0.1%
Packaged Non-vegetative	2,773	0.8%	0.4%	Pesticides and Herbicides	107	0.0%	0.0%
Opened/Unpack/Scrap Non-vegetative	20,382	5.9%	1.2%	Gasoline and Fuel Oil	13	0.0%	0.0%
<b>Other Organics</b>	<b>58,982</b>	<b>17.1%</b>		Antifreeze/Brake Fluid	0	0.0%	0.0%
Textiles:Clothes/Other Recyclables	8,761	2.5%	0.8%	Medical Waste	715	0.2%	0.2%
Other Textiles	4,028	1.2%	0.3%	Computer Monitors	0	0.0%	0.0%
Carpet	1,987	0.6%	0.3%	Televisions	386	0.1%	0.2%
Disposable Diapers	18,967	5.5%	0.9%	Cell Phones	4	0.0%	0.0%
Rubber Products	996	0.3%	0.2%	Laptops/LCD Monitors	0	0.0%	0.0%
Tires	692	0.2%	0.2%	Other Hazardous Waste	231	0.1%	0.0%
Animal Carcasses	673	0.2%	0.3%	<b>Total</b>	<b>345,589</b>	<b>100.0%</b>	
Animal Feces	18,039	5.2%	1.1%				
Miscellaneous Organics	4,838	1.4%	0.4%				
							<i>No. of samples = 100</i>

*Error range calculated at a 90% confidence level*



## Commercially Collected Nonresidential Substream

**Table D-6. Composition by Weight – Commercially Collected Nonresidential Waste  
January 2007 - December 2007**

WASTE MATERIAL	TONS	MEAN	+/-	WASTE MATERIAL	TONS	MEAN	+/-
<b>Paper</b>	<b>128,029</b>	<b>28.5%</b>		<b>Glass</b>	<b>9,703</b>	<b>2.2%</b>	
Newspaper (ONP)	10,185	2.3%	0.5%	Clear Containers	3,315	0.7%	0.2%
Corrugated Cardboard (OCC)	39,246	8.7%	2.0%	Green Containers	1,603	0.4%	0.1%
Low Grade Recyclable	28,424	6.3%	1.0%	Brown Containers	2,712	0.6%	0.2%
High Grade	7,833	1.7%	0.5%	Other Glass	2,073	0.5%	0.4%
Bleached Polycoated	2,936	0.7%	0.6%	<b>Metal</b>	<b>20,383</b>	<b>4.5%</b>	
Paper and Other Materials	5,917	1.3%	0.3%	Aluminum Cans	1,347	0.3%	0.1%
Compostable Paper	31,603	7.0%	1.1%	Other Aluminum	807	0.2%	0.1%
Other Paper	1,885	0.4%	0.1%	Tinned Food Cans	1,721	0.4%	0.1%
<b>Plastic</b>	<b>64,273</b>	<b>14.3%</b>		Other Ferrous	10,302	2.3%	0.8%
PET Bottles	3,393	0.8%	0.1%	Other Non-Ferrous	225	0.1%	0.0%
HDPE Bottles	1,346	0.3%	0.1%	Mixed Metals/Other Materials	5,816	1.3%	0.5%
Other Containers	3,823	0.9%	0.2%	Compressed Gas Cylinders	165	0.0%	0.1%
Expanded Polystyrene	4,175	0.9%	0.3%	<b>Other Wastes</b>	<b>32,921</b>	<b>7.3%</b>	
Plastic Film and Bags	36,162	8.1%	1.0%	Asphalt Shingles	1,391	0.3%	0.3%
Other Packaging	2,775	0.6%	0.2%	C&D Wastes	17,273	3.8%	1.5%
Plastic Products	5,772	1.3%	0.3%	Ash	1,240	0.3%	0.2%
Foam Rubber and Padding	2,347	0.5%	0.3%	Nondistinct Fines	4,360	1.0%	0.5%
Plastic and Other Materials	4,480	1.0%	0.5%	Gypsum Wallboard	563	0.1%	0.1%
<b>Wood/Yard Waste</b>	<b>49,149</b>	<b>10.9%</b>		Furniture/Mattresses	4,037	0.9%	0.8%
Dimensional Lumber/Plywood	23,129	5.2%	1.8%	Household Appliances	1,602	0.4%	0.3%
Treated Wood	6,883	1.5%	0.8%	Printers/Copiers/Fax Machines	394	0.1%	0.1%
Contaminated Wood	4,499	1.0%	0.8%	Office Electronics	1,025	0.2%	0.2%
Roofing and Siding Wood	226	0.1%	0.1%	Miscellaneous Inorganics	1,035	0.2%	0.2%
Stumps	0	0.0%	0.0%	<b>Household Hazardous</b>	<b>3,511</b>	<b>0.8%</b>	
Large Prunings	1,118	0.2%	0.4%	Used Oil	0	0.0%	0.0%
Yard Wastes	12,448	2.8%	0.9%	Vehicle Batteries	0	0.0%	0.0%
Other Wood	845	0.2%	0.1%	Household Batteries	143	0.0%	0.0%
<b>Food</b>	<b>91,667</b>	<b>20.4%</b>		Latex Paint	1,318	0.3%	0.4%
Packaged Bakery Items	3,680	0.8%	0.4%	Oil-based Paint	0	0.0%	0.0%
Opened/Unpack/Scrap Bakery	7,668	1.7%	0.8%	Solvents and Thinners	26	0.0%	0.0%
Packaged Vegetative	5,337	1.2%	0.4%	Adhesives and Glue	8	0.0%	0.0%
Opened/Unpack/Scrap Vegetative	46,561	10.4%	1.6%	Cleaners and Corrosives	67	0.0%	0.0%
Packaged Non-vegetative	3,888	0.9%	0.5%	Pesticides and Herbicides	389	0.1%	0.1%
Opened/Unpack/Scrap Non-vegetative	24,533	5.5%	1.1%	Gasoline and Fuel Oil	257	0.1%	0.1%
<b>Other Organics</b>	<b>49,430</b>	<b>11.0%</b>		Antifreeze/Brake Fluid	0	0.0%	0.0%
Textiles:Clothes/Other Recyclables	5,081	1.1%	0.3%	Medical Waste	1,035	0.2%	0.2%
Other Textiles	5,424	1.2%	0.4%	Computer Monitors	0	0.0%	0.0%
Carpet	17,178	3.8%	2.0%	Televisions	0	0.0%	0.0%
Disposable Diapers	9,184	2.0%	0.6%	Cell Phones	0	0.0%	0.0%
Rubber Products	1,376	0.3%	0.1%	Laptops/LCD Monitors	0	0.0%	0.0%
Tires	182	0.0%	0.0%	Other Hazardous Waste	267	0.1%	0.1%
Animal Carcasses	0	0.0%	0.0%	<b>Total</b>	<b>449,065</b>	<b>100.0%</b>	
Animal Feces	4,192	0.9%	0.4%				
Miscellaneous Organics	6,813	1.5%	0.8%				
							<i>No. of samples = 161</i>

*Error range calculated at a 90% confidence level*

# Self-hauled Substream

**Table D-7. Composition by Weight – Self-hauled Waste  
January 2007 - December 2007**

WASTE MATERIAL	TONS	MEAN	+/-	WASTE MATERIAL	TONS	MEAN	+/-
<b>Paper</b>	<b>20,991</b>	<b>9.2%</b>		<b>Glass</b>	<b>3,729</b>	<b>1.6%</b>	
Newspaper (ONP)	1,057	0.5%	0.2%	Clear Containers	632	0.3%	0.1%
Corrugated Cardboard (OCC)	8,374	3.7%	0.9%	Green Containers	436	0.2%	0.1%
Low Grade Recyclable	5,910	2.6%	0.9%	Brown Containers	727	0.3%	0.3%
High Grade	1,241	0.5%	0.4%	Other Glass	1,934	0.9%	0.4%
Bleached Polycoated	82	0.0%	0.0%	<b>Metal</b>	<b>17,510</b>	<b>7.7%</b>	
Paper and Other Materials	1,548	0.7%	0.3%	Aluminum Cans	168	0.1%	0.0%
Compostable Paper	2,329	1.0%	0.3%	Other Aluminum	197	0.1%	0.0%
Other Paper	449	0.2%	0.1%	Tinned Food Cans	378	0.2%	0.1%
<b>Plastic</b>	<b>21,546</b>	<b>9.5%</b>		Other Ferrous	10,776	4.7%	1.4%
PET Bottles	432	0.2%	0.1%	Other Non-Ferrous	217	0.1%	0.1%
HDPE Bottles	165	0.1%	0.0%	Mixed Metals/Other Materials	5,660	2.5%	0.7%
Other Containers	1,307	0.6%	0.3%	Compressed Gas Cylinders	115	0.1%	0.1%
Expanded Polystyrene	2,054	0.9%	1.0%	<b>Other Wastes</b>	<b>52,854</b>	<b>23.3%</b>	
Plastic Film and Bags	4,051	1.8%	0.6%	Asphalt Shingles	2,761	1.2%	1.1%
Other Packaging	1,045	0.5%	0.5%	C&D Wastes	26,149	11.5%	2.8%
Plastic Products	8,756	3.9%	1.5%	Ash	1,580	0.7%	1.1%
Foam Rubber and Padding	2,548	1.1%	0.9%	Nondistinct Fines	697	0.3%	0.3%
Plastic and Other Materials	1,190	0.5%	0.2%	Gypsum Wallboard	3,439	1.5%	0.8%
<b>Wood/Yard Waste</b>	<b>74,564</b>	<b>32.8%</b>		Furniture/Mattresses	15,356	6.8%	2.4%
Dimensional Lumber/Plywood	28,110	12.4%	3.0%	Household Appliances	1,928	0.8%	0.7%
Treated Wood	8,931	3.9%	1.6%	Printers/Copiers/Fax Machines	271	0.1%	0.1%
Contaminated Wood	9,850	4.3%	1.5%	Office Electronics	354	0.2%	0.1%
Roofing and Siding Wood	2,145	0.9%	1.0%	Miscellaneous Inorganics	318	0.1%	0.1%
Stumps	2,257	1.0%	1.0%	<b>Household Hazardous</b>	<b>3,328</b>	<b>1.5%</b>	
Large Prunings	760	0.3%	0.3%	Used Oil	123	0.1%	0.1%
Yard Wastes	19,004	8.4%	2.9%	Vehicle Batteries	0	0.0%	0.0%
Other Wood	3,507	1.5%	1.0%	Household Batteries	38	0.0%	0.0%
<b>Food</b>	<b>6,870</b>	<b>3.0%</b>		Latex Paint	394	0.2%	0.1%
Packaged Bakery Items	213	0.1%	0.1%	Oil-based Paint	67	0.0%	0.0%
Opened/Unpack/Scrap Bakery	889	0.4%	0.2%	Solvents and Thinners	37	0.0%	0.0%
Packaged Vegetative	502	0.2%	0.1%	Adhesives and Glue	4	0.0%	0.0%
Opened/Unpack/Scrap Vegetative	3,349	1.5%	0.6%	Cleaners and Corrosives	125	0.1%	0.1%
Packaged Non-vegetative	171	0.1%	0.1%	Pesticides and Herbicides	86	0.0%	0.0%
Opened/Unpack/Scrap Non-vegetative	1,747	0.8%	0.5%	Gasoline and Fuel Oil	0	0.0%	0.0%
<b>Other Organics</b>	<b>25,882</b>	<b>11.4%</b>		Antifreeze/Brake Fluid	6	0.0%	0.0%
Textiles:Clothes/Other Recyclables	3,959	1.7%	0.5%	Medical Waste	4	0.0%	0.0%
Other Textiles	2,633	1.2%	0.5%	Computer Monitors	223	0.1%	0.2%
Carpet	13,342	5.9%	2.3%	Televisions	484	0.2%	0.2%
Disposable Diapers	975	0.4%	0.6%	Cell Phones	0	0.0%	0.0%
Rubber Products	1,161	0.5%	0.2%	Laptops/LCD Monitors	120	0.1%	0.1%
Tires	473	0.2%	0.2%	Other Hazardous Waste	1,618	0.7%	1.1%
Animal Carcasses	0	0.0%	0.0%	<b>Total</b>	<b>227,275</b>	<b>100.0%</b>	
Animal Feces	1,720	0.8%	0.6%				
Miscellaneous Organics	1,618	0.7%	0.3%				
							<i>No. of samples = 160</i>

*Error range calculated at a 90% confidence level*

## Self-hauled Residential Substream

**Table D-8. Composition by Weight – Self-hauled Residential Waste  
January 2007 - December 2007**

WASTE MATERIAL	TONS	MEAN	+/-	WASTE MATERIAL	TONS	MEAN	+/-
<b>Paper</b>	<b>18,399</b>	<b>9.4%</b>		<b>Glass</b>	<b>3,233</b>	<b>1.7%</b>	
Newspaper (ONP)	966	0.5%	0.3%	Clear Containers	599	0.3%	0.2%
Corrugated Cardboard (OCC)	7,140	3.6%	1.0%	Green Containers	428	0.2%	0.2%
Low Grade Recyclable	5,395	2.8%	1.0%	Brown Containers	727	0.4%	0.3%
High Grade	1,166	0.6%	0.5%	Other Glass	1,478	0.8%	0.4%
Bleached Polycoated	81	0.0%	0.0%	<b>Metal</b>	<b>14,346</b>	<b>7.3%</b>	
Paper and Other Materials	1,102	0.6%	0.3%	Aluminum Cans	162	0.1%	0.0%
Compostable Paper	2,133	1.1%	0.4%	Other Aluminum	161	0.1%	0.0%
Other Paper	416	0.2%	0.1%	Tinned Food Cans	356	0.2%	0.1%
<b>Plastic</b>	<b>18,056</b>	<b>9.2%</b>		Other Ferrous	8,889	4.5%	1.4%
PET Bottles	412	0.2%	0.1%	Other Non-Ferrous	217	0.1%	0.1%
HDPE Bottles	156	0.1%	0.0%	Mixed Metals/Other Materials	4,446	2.3%	0.8%
Other Containers	1,202	0.6%	0.3%	Compressed Gas Cylinders	115	0.1%	0.1%
Expanded Polystyrene	2,031	1.0%	1.2%	<b>Other Wastes</b>	<b>44,481</b>	<b>22.7%</b>	
Plastic Film and Bags	3,295	1.7%	0.7%	Asphalt Shingles	2,761	1.4%	1.3%
Other Packaging	1,018	0.5%	0.6%	C&D Wastes	20,939	10.7%	2.9%
Plastic Products	7,945	4.1%	1.8%	Ash	1,468	0.7%	1.2%
Foam Rubber and Padding	1,137	0.6%	0.4%	Nondistinct Fines	697	0.4%	0.3%
Plastic and Other Materials	860	0.4%	0.2%	Gypsum Wallboard	2,466	1.3%	0.8%
<b>Wood/Yard Waste</b>	<b>66,232</b>	<b>33.8%</b>		Furniture/Mattresses	13,300	6.8%	2.6%
Dimensional Lumber/Plywood	25,805	13.2%	3.5%	Household Appliances	1,928	1.0%	0.8%
Treated Wood	7,506	3.8%	1.7%	Printers/Copiers/Fax Machines	271	0.1%	0.1%
Contaminated Wood	8,550	4.4%	1.6%	Office Electronics	333	0.2%	0.2%
Roofing and Siding Wood	2,084	1.1%	1.1%	Miscellaneous Inorganics	318	0.2%	0.2%
Stumps	1,703	0.9%	1.1%	<b>Household Hazardous</b>	<b>3,175</b>	<b>1.6%</b>	
Large Prunings	412	0.2%	0.3%	Used Oil	123	0.1%	0.1%
Yard Wastes	17,053	8.7%	3.3%	Vehicle Batteries	0	0.0%	0.0%
Other Wood	3,119	1.6%	1.1%	Household Batteries	37	0.0%	0.0%
<b>Food</b>	<b>6,169</b>	<b>3.1%</b>		Latex Paint	253	0.1%	0.1%
Packaged Bakery Items	50	0.0%	0.0%	Oil-based Paint	64	0.0%	0.0%
Opened/Unpack/Scrap Bakery	779	0.4%	0.3%	Solvents and Thinners	37	0.0%	0.0%
Packaged Vegetative	488	0.2%	0.2%	Adhesives and Glue	4	0.0%	0.0%
Opened/Unpack/Scrap Vegetative	2,963	1.5%	0.6%	Cleaners and Corrosives	125	0.1%	0.1%
Packaged Non-vegetative	168	0.1%	0.1%	Pesticides and Herbicides	86	0.0%	0.1%
Opened/Unpack/Scrap Non-vegetative	1,722	0.9%	0.6%	Gasoline and Fuel Oil	0	0.0%	0.0%
<b>Other Organics</b>	<b>21,804</b>	<b>11.1%</b>		Antifreeze/Brake Fluid	6	0.0%	0.0%
Textiles:Clothes/Other Recyclables	3,652	1.9%	0.6%	Medical Waste	4	0.0%	0.0%
Other Textiles	2,509	1.3%	0.6%	Computer Monitors	223	0.1%	0.2%
Carpet	10,706	5.5%	2.4%	Televisions	484	0.2%	0.2%
Disposable Diapers	901	0.5%	0.7%	Cell Phones	0	0.0%	0.0%
Rubber Products	868	0.4%	0.2%	Laptops/LCD Monitors	120	0.1%	0.1%
Tires	118	0.1%	0.1%	Other Hazardous Waste	1,609	0.8%	1.2%
Animal Carcasses	0	0.0%	0.0%	<b>Total</b>	<b>195,896</b>	<b>100.0%</b>	
Animal Feces	1,556	0.8%	0.6%				
Miscellaneous Organics	1,494	0.8%	0.3%				<i>No. of samples = 128</i>

*Error range calculated at a 90% confidence level*

# Self-hauled Nonresidential Substream

**Table D-9. Composition by Weight – Self-hauled Nonresidential Waste  
January 2007 - December 2007**

WASTE MATERIAL	TONS	MEAN	+/-	WASTE MATERIAL	TONS	MEAN	+/-
<b>Paper</b>	<b>2,592</b>	<b>8.3%</b>		<b>Glass</b>	<b>496</b>	<b>1.6%</b>	
Newspaper (ONP)	91	0.3%	0.3%	Clear Containers	33	0.1%	0.1%
Corrugated Cardboard (OCC)	1,234	3.9%	1.8%	Green Containers	8	0.0%	0.0%
Low Grade Recyclable	515	1.6%	1.5%	Brown Containers	0	0.0%	0.0%
High Grade	76	0.2%	0.2%	Other Glass	456	1.5%	1.4%
Bleached Polycoated	1	0.0%	0.0%	<b>Metal</b>	<b>3,164</b>	<b>10.1%</b>	
Paper and Other Materials	446	1.4%	1.0%	Aluminum Cans	5	0.0%	0.0%
Compostable Paper	196	0.6%	0.7%	Other Aluminum	36	0.1%	0.2%
Other Paper	32	0.1%	0.1%	Tinned Food Cans	22	0.1%	0.1%
<b>Plastic</b>	<b>3,491</b>	<b>11.1%</b>		Other Ferrous	1,886	6.0%	4.4%
PET Bottles	21	0.1%	0.0%	Other Non-Ferrous	0	0.0%	0.0%
HDPE Bottles	8	0.0%	0.0%	Mixed Metals/Other Materials	1,214	3.9%	1.7%
Other Containers	105	0.3%	0.3%	Compressed Gas Cylinders	0	0.0%	0.0%
Expanded Polystyrene	23	0.1%	0.0%	<b>Other Wastes</b>	<b>8,372</b>	<b>26.7%</b>	
Plastic Film and Bags	756	2.4%	1.7%	Asphalt Shingles	0	0.0%	0.0%
Other Packaging	28	0.1%	0.1%	C&D Wastes	5,210	16.6%	9.3%
Plastic Products	811	2.6%	1.2%	Ash	112	0.4%	0.5%
Foam Rubber and Padding	1,411	4.5%	5.7%	Nondistinct Fines	0	0.0%	0.0%
Plastic and Other Materials	329	1.0%	1.2%	Gypsum Wallboard	973	3.1%	3.7%
<b>Wood/Yard Waste</b>	<b>8,332</b>	<b>26.6%</b>		Furniture/Mattresses	2,056	6.6%	6.6%
Dimensional Lumber/Plywood	2,304	7.3%	4.0%	Household Appliances	0	0.0%	0.0%
Treated Wood	1,424	4.5%	3.3%	Printers/Copiers/Fax Machines	0	0.0%	0.0%
Contaminated Wood	1,300	4.1%	2.8%	Office Electronics	22	0.1%	0.1%
Roofing and Siding Wood	62	0.2%	0.2%	Miscellaneous Inorganics	0	0.0%	0.0%
Stumps	555	1.8%	2.9%	<b>Household Hazardous</b>	<b>153</b>	<b>0.5%</b>	
Large Prunings	348	1.1%	0.9%	Used Oil	0	0.0%	0.0%
Yard Wastes	1,951	6.2%	4.4%	Vehicle Batteries	0	0.0%	0.0%
Other Wood	388	1.2%	1.0%	Household Batteries	0	0.0%	0.0%
<b>Food</b>	<b>701</b>	<b>2.2%</b>		Latex Paint	141	0.4%	0.7%
Packaged Bakery Items	163	0.5%	0.6%	Oil-based Paint	3	0.0%	0.0%
Opened/Unpack/Scrap Bakery	109	0.3%	0.4%	Solvents and Thinners	0	0.0%	0.0%
Packaged Vegetative	15	0.0%	0.1%	Adhesives and Glue	0	0.0%	0.0%
Opened/Unpack/Scrap Vegetative	386	1.2%	1.6%	Cleaners and Corrosives	0	0.0%	0.0%
Packaged Non-vegetative	3	0.0%	0.0%	Pesticides and Herbicides	0	0.0%	0.0%
Opened/Unpack/Scrap Non-vegetative	25	0.1%	0.1%	Gasoline and Fuel Oil	0	0.0%	0.0%
<b>Other Organics</b>	<b>4,078</b>	<b>13.0%</b>		Antifreeze/Brake Fluid	0	0.0%	0.0%
Textiles:Clothes/Other Recyclables	307	1.0%	1.0%	Medical Waste	0	0.0%	0.0%
Other Textiles	125	0.4%	0.4%	Computer Monitors	0	0.0%	0.0%
Carpet	2,635	8.4%	7.7%	Televisions	0	0.0%	0.0%
Disposable Diapers	75	0.2%	0.4%	Cell Phones	0	0.0%	0.0%
Rubber Products	293	0.9%	1.3%	Laptops/LCD Monitors	0	0.0%	0.0%
Tires	356	1.1%	1.3%	Other Hazardous Waste	9	0.0%	0.0%
Animal Carcasses	0	0.0%	0.0%	<b>Total</b>	<b>31,379</b>	<b>100.0%</b>	
Animal Feces	164	0.5%	0.7%				<i>No. of samples = 32</i>
Miscellaneous Organics	124	0.4%	0.5%				

*Error range calculated at a 90% confidence level*

## **APPENDIX E.**

### **Waste Composition Results — Commercially Collected Residential Substreams**

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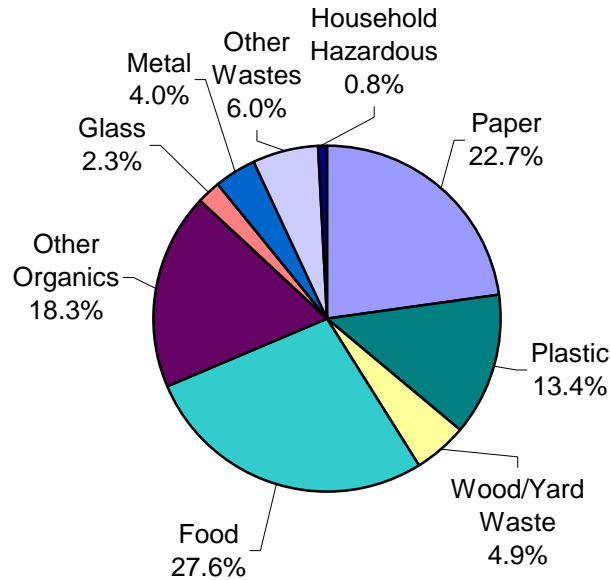
This appendix includes waste composition results for the following two substreams of commercially collected residential waste:

- Residential single-family
- Residential multi-family

Data and analysis of the following two substreams are not included in the main body of the report. For this reason, *Overview of Waste Composition* figures and *Top 10* tables, in addition to detailed *Composition by Weight* tables are included below.

## Commercially Collected Residential Single-family

**Figure E-1. Overview of Waste Composition –  
Commercially Collected Residential Single-family Waste  
January 2007 - December 2007 (n=40)**



**Table E-1. Ten Most Common Materials, by Weight –  
Commercially Collected Residential Single-family Waste  
January 2007 - December 2007**

WASTE MATERIAL	MEAN	CUM. %	TONS
Opened/Unpack/Scrap Vegetative	16.1%	16.1%	34,583
Compostable Paper	8.8%	24.8%	18,848
Plastic Film and Bags	6.5%	31.3%	13,968
Low Grade Recyclable	6.3%	37.6%	13,569
Disposable Diapers	6.3%	43.9%	13,550
Opened/Unpack/Scrap Non-vegetative	6.2%	50.1%	13,321
Animal Feces	6.0%	56.2%	12,934
Yard Wastes	3.8%	60.0%	8,266
Newspaper (ONP)	2.6%	62.6%	5,657
Opened/Unpack/Scrap Bakery	2.6%	65.3%	5,646
<b>Subtotal</b>	<b>65.3%</b>		<b>140,342</b>
<i>All other materials combined</i>	<i>34.7%</i>		<i>74,739</i>
<b>Total</b>	<b>100.0%</b>		<b>215,081</b>

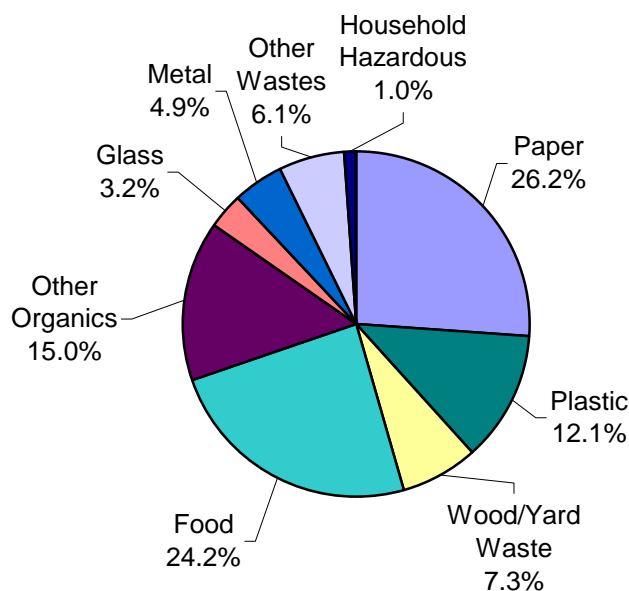
**Table E-2. Composition by Weight –  
Commercially Collected Residential Single-family Waste  
January 2007 - December 2007**

WASTE MATERIAL	TONS	MEAN	+/-	WASTE MATERIAL	TONS	MEAN	+/-
<b>Paper</b>	<b>48,820</b>	<b>22.7%</b>		<b>Glass</b>	<b>4,841</b>	<b>2.3%</b>	
Newspaper (ONP)	5,657	2.6%	1.4%	Clear Containers	2,379	1.1%	0.3%
Corrugated Cardboard (OCC)	5,080	2.4%	0.7%	Green Containers	930	0.4%	0.2%
Low Grade Recyclable	13,569	6.3%	0.9%	Brown Containers	804	0.4%	0.1%
High Grade	2,022	0.9%	0.3%	Other Glass	728	0.3%	0.1%
Bleached Polycoated	766	0.4%	0.1%	<b>Metal</b>	<b>8,621</b>	<b>4.0%</b>	
Paper and Other Materials	2,426	1.1%	0.6%	Aluminum Cans	664	0.3%	0.1%
Compostable Paper	18,848	8.8%	0.9%	Other Aluminum	1,167	0.5%	0.6%
Other Paper	452	0.2%	0.1%	Tinned Food Cans	1,817	0.8%	0.1%
<b>Plastic</b>	<b>28,817</b>	<b>13.4%</b>		Other Ferrous	3,142	1.5%	0.6%
PET Bottles	2,026	0.9%	0.3%	Other Non-Ferrous	76	0.0%	0.0%
HDPE Bottles	955	0.4%	0.1%	Mixed Metals/Other Materials	1,657	0.8%	0.3%
Other Containers	2,552	1.2%	0.2%	Compressed Gas Cylinders	96	0.0%	0.0%
Expanded Polystyrene	1,738	0.8%	0.2%	<b>Other Wastes</b>	<b>12,967</b>	<b>6.0%</b>	
Plastic Film and Bags	13,968	6.5%	0.9%	Asphalt Shingles	94	0.0%	0.0%
Other Packaging	1,683	0.8%	0.2%	C&D Wastes	3,041	1.4%	0.8%
Plastic Products	3,090	1.4%	0.5%	Ash	156	0.1%	0.1%
Foam Rubber and Padding	170	0.1%	0.1%	Nondistinct Fines	890	0.4%	0.7%
Plastic and Other Materials	2,635	1.2%	0.4%	Gypsum Wallboard	1,105	0.5%	0.5%
<b>Wood/Yard Waste</b>	<b>10,543</b>	<b>4.9%</b>		Furniture/Mattresses	3,855	1.8%	2.3%
Dimensional Lumber/Plywood	1,294	0.6%	0.4%	Household Appliances	808	0.4%	0.4%
Treated Wood	335	0.2%	0.1%	Printers/Copiers/Fax Machines	377	0.2%	0.3%
Contaminated Wood	380	0.2%	0.2%	Office Electronics	871	0.4%	0.4%
Roofing and Siding Wood	38	0.0%	0.0%	Miscellaneous Inorganics	1,770	0.8%	0.8%
Stumps	0	0.0%	0.0%	<b>Household Hazardous</b>	<b>1,724</b>	<b>0.8%</b>	
Large Prunings	0	0.0%	0.0%	Used Oil	303	0.1%	0.2%
Yard Wastes	8,266	3.8%	2.2%	Vehicle Batteries	0	0.0%	0.0%
Other Wood	231	0.1%	0.1%	Household Batteries	302	0.1%	0.1%
<b>Food</b>	<b>59,305</b>	<b>27.6%</b>		Latex Paint	9	0.0%	0.0%
Packaged Bakery Items	1,776	0.8%	0.3%	Oil-based Paint	0	0.0%	0.0%
Opened/Unpack/Scrap Bakery	5,646	2.6%	0.6%	Solvents and Thinners	0	0.0%	0.0%
Packaged Vegetative	2,401	1.1%	0.5%	Adhesives and Glue	2	0.0%	0.0%
Opened/Unpack/Scrap Vegetative	34,583	16.1%	1.8%	Cleaners and Corrosives	140	0.1%	0.1%
Packaged Non-vegetative	1,578	0.7%	0.5%	Pesticides and Herbicides	103	0.0%	0.1%
Opened/Unpack/Scrap Non-vegetative	13,321	6.2%	1.7%	Gasoline and Fuel Oil	13	0.0%	0.0%
<b>Other Organics</b>	<b>39,444</b>	<b>18.3%</b>		Antifreeze/Brake Fluid	0	0.0%	0.0%
Textiles:Clothes/Other Recyclables	4,418	2.1%	0.6%	Medical Waste	274	0.1%	0.2%
Other Textiles	2,296	1.1%	0.4%	Computer Monitors	0	0.0%	0.0%
Carpet	1,212	0.6%	0.4%	Televisions	386	0.2%	0.3%
Disposable Diapers	13,550	6.3%	1.3%	Cell Phones	4	0.0%	0.0%
Rubber Products	566	0.3%	0.2%	Laptops/LCD Monitors	0	0.0%	0.0%
Tires	485	0.2%	0.4%	Other Hazardous Waste	187	0.1%	0.1%
Animal Carcasses	673	0.3%	0.5%	<b>Total</b>	<b>215,081</b>	<b>100.0%</b>	
Animal Feces	12,934	6.0%	1.6%				<i>No. of samples = 40</i>
Miscellaneous Organics	3,309	1.5%	0.5%				

*Error range calculated at a 90% confidence level*

## Commercially Collected Residential Multi-family

**Figure E-2. Overview of Waste Composition –  
Commercially Collected Residential Multi-family Waste  
January 2007 - December 2007 (n=60)**



**Table E-3. Top Ten Most Common Materials, by Weight –  
Commercially Collected Residential Multi-family Waste  
January 2007 - December 2007**

WASTE MATERIAL	MEAN	CUM. %	TONS
Opened/Unpack/Scrap Vegetative	13.5%	13.5%	17,613
Low Grade Recyclable	8.7%	22.2%	11,415
Compostable Paper	7.2%	29.4%	9,372
Plastic Film and Bags	5.7%	35.1%	7,420
Opened/Unpack/Scrap Non-vegetative	5.4%	40.5%	7,061
Corrugated Cardboard (OCC)	4.9%	45.4%	6,374
Yard Wastes	4.5%	49.9%	5,925
Disposable Diapers	4.2%	54.1%	5,417
Animal Feces	3.9%	58.0%	5,104
Furniture/Mattresses	3.4%	61.4%	4,373
<b>Subtotal</b>	<b>61.4%</b>		<b>80,074</b>
<i>All other materials combined</i>	38.6%		50,434
<b>Total</b>	<b>100.0%</b>		<b>130,508</b>



**Table E-4. Composition by Weight –  
Commercially Collected Residential Multi-family Waste  
January 2007 - December 2007**

WASTE MATERIAL	TONS	MEAN	+/-	WASTE MATERIAL	TONS	MEAN	+/-
<b>Paper</b>	<b>34,227</b>	<b>26.2%</b>		<b>Glass</b>	<b>4,220</b>	<b>3.2%</b>	
Newspaper (ONP)	3,300	2.5%	0.7%	Clear Containers	1,607	1.2%	0.3%
Corrugated Cardboard (OCC)	6,374	4.9%	0.9%	Green Containers	802	0.6%	0.2%
Low Grade Recyclable	11,415	8.7%	1.1%	Brown Containers	1,072	0.8%	0.2%
High Grade	1,634	1.3%	0.5%	Other Glass	740	0.6%	0.2%
Bleached Polycoated	381	0.3%	0.1%	<b>Metal</b>	<b>6,337</b>	<b>4.9%</b>	
Paper and Other Materials	1,174	0.9%	0.3%	Aluminum Cans	729	0.6%	0.1%
Compostable Paper	9,372	7.2%	0.9%	Other Aluminum	294	0.2%	0.1%
Other Paper	578	0.4%	0.2%	Tinned Food Cans	1,237	0.9%	0.2%
<b>Plastic</b>	<b>15,835</b>	<b>12.1%</b>		Other Ferrous	2,339	1.8%	1.2%
PET Bottles	1,646	1.3%	0.2%	Other Non-Ferrous	56	0.0%	0.0%
HDPE Bottles	600	0.5%	0.1%	Mixed Metals/Other Materials	1,652	1.3%	0.4%
Other Containers	1,473	1.1%	0.5%	Compressed Gas Cylinders	30	0.0%	0.0%
Expanded Polystyrene	783	0.6%	0.1%	<b>Other Wastes</b>	<b>7,920</b>	<b>6.1%</b>	
Plastic Film and Bags	7,420	5.7%	0.7%	Asphalt Shingles	4	0.0%	0.0%
Other Packaging	815	0.6%	0.1%	C&D Wastes	1,962	1.5%	0.8%
Plastic Products	1,586	1.2%	0.3%	Ash	10	0.0%	0.0%
Foam Rubber and Padding	371	0.3%	0.3%	Nondistinct Fines	341	0.3%	0.3%
Plastic and Other Materials	1,140	0.9%	0.4%	Gypsum Wallboard	486	0.4%	0.6%
<b>Wood/Yard Waste</b>	<b>9,506</b>	<b>7.3%</b>		Furniture/Mattresses	4,373	3.4%	2.8%
Dimensional Lumber/Plywood	1,936	1.5%	1.3%	Household Appliances	99	0.1%	0.1%
Treated Wood	456	0.3%	0.2%	Printers/Copiers/Fax Machines	0	0.0%	0.0%
Contaminated Wood	799	0.6%	0.5%	Office Electronics	552	0.4%	0.4%
Roofing and Siding Wood	0	0.0%	0.0%	Miscellaneous Inorganics	94	0.1%	0.1%
Stumps	0	0.0%	0.0%	<b>Household Hazardous</b>	<b>1,334</b>	<b>1.0%</b>	
Large Prunings	98	0.1%	0.1%	Used Oil	195	0.1%	0.2%
Yard Wastes	5,925	4.5%	2.0%	Vehicle Batteries	228	0.2%	0.3%
Other Wood	290	0.2%	0.2%	Household Batteries	48	0.0%	0.0%
<b>Food</b>	<b>31,590</b>	<b>24.2%</b>		Latex Paint	45	0.0%	0.0%
Packaged Bakery Items	830	0.6%	0.3%	Oil-based Paint	238	0.2%	0.3%
Opened/Unpack/Scrap Bakery	3,169	2.4%	0.8%	Solvents and Thinners	0	0.0%	0.0%
Packaged Vegetative	1,723	1.3%	1.3%	Adhesives and Glue	70	0.1%	0.1%
Opened/Unpack/Scrap Vegetative	17,613	13.5%	2.1%	Cleaners and Corrosives	22	0.0%	0.0%
Packaged Non-vegetative	1,194	0.9%	0.7%	Pesticides and Herbicides	4	0.0%	0.0%
Opened/Unpack/Scrap Non-vegetative	7,061	5.4%	1.2%	Gasoline and Fuel Oil	0	0.0%	0.0%
<b>Other Organics</b>	<b>19,538</b>	<b>15.0%</b>		Antifreeze/Brake Fluid	0	0.0%	0.0%
Textiles:Clothes/Other Recyclables	4,343	3.3%	2.0%	Medical Waste	440	0.3%	0.4%
Other Textiles	1,732	1.3%	0.5%	Computer Monitors	0	0.0%	0.0%
Carpet	776	0.6%	0.3%	Televisions	0	0.0%	0.0%
Disposable Diapers	5,417	4.2%	1.0%	Cell Phones	0	0.0%	0.0%
Rubber Products	430	0.3%	0.2%	Laptops/LCD Monitors	0	0.0%	0.0%
Tires	207	0.2%	0.2%	Other Hazardous Waste	43	0.0%	0.0%
Animal Carcasses	0	0.0%	0.0%	<b>Total</b>	<b>130,508</b>	<b>100.0%</b>	
Animal Feces	5,104	3.9%	1.3%				<i>No. of samples = 60</i>
Miscellaneous Organics	1,528	1.2%	0.5%				

*Error range calculated at a 90% confidence level*



## **APPENDIX F.**

# **Waste Composition Comparisons to Previous Study**

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### **BACKGROUND**

King County has performed waste characterization studies periodically over the last decade in an ongoing effort to monitor the types and amounts of materials disposed locally. Differences are often apparent between project years. In this appendix, selected results from the current 2007 study are compared to findings from 2002-2003 study. The purpose of this comparison is to identify changes in the composition of waste streams over time. The reasons why or how these changes occurred are not investigated. Future studies could be designed to identify the potential causes of these variations.

In order to control for population changes and other factors that may influence the total amount of waste disposed from year to year, the tests described in this appendix measure waste proportions, not tonnage. For example, if newspaper accounts for 5% of disposed waste totaling 1,000 tons during one study period and 5% of waste totaling 1,200 tons during another—while the amount of newspaper in terms of total tons has increased, the proportion of newspaper, 5%, in the waste stream has not. The tests would indicate no change in newspaper.

The statistical tests used assume the hypothesis that there is no change. For example, “There is no statistically significant difference, between the 2002-2003 and 2007 study periods in the proportion of newspaper disposed by the single-family substream.”

Statistics are then employed to look for evidence disproving the hypothesis. A “significant” result means that there is enough evidence to disprove the hypothesis and it can be concluded that there is a true difference in composition over time.

“Insignificant” results indicate that either 1) there is no true difference, or 2) even though there may be a difference, there is not enough evidence to prove it because the findings are limited by sample size. It is also possible that changes occurred in waste categories that were not considered in this part of this analysis.

Table F-1 lists the eight waste categories chosen for analysis. Composition variations were measured for the following substreams:

- Overall disposed waste
- Commercially collected waste from single-family residences
- Commercially collected waste from multi-family residences
- Commercially collected waste from nonresidential sources
- Self-hauled waste (from both residential and nonresidential sources)

**Table F-1. Material Groupings Used for Comparisons**

<b>Comparison Label</b>	<b>Material Components</b>
<i>Newspaper</i>	Newspaper
<i>Cardboard and Kraft</i>	OCC/Kraft
<i>Other Curbside Paper</i>	Low Grade Recyclable High Grade Paper Computer Paper
<i>Curbside Containers</i>	PET #1 Bottles HDPE #2 Bottles Clear Glass Containers Green Glass Containers Brown Glass Containers Aluminum Cans Tinned Food Cans
<i>Compostable Organics</i>	All Food Wastes Large Prunings Yard Wastes Compostable Paper Other Paper Animal Carcasses Animal Feces
<i>Construction &amp; Demolition</i>	Roofing/Siding Asphalt Shingles Const/Demo Wastes Gypsum Wallboard
<i>Wood Waste</i>	Dimension Lumber Treated Wood Contaminated Wood Other Wood
<i>Hazardous Wastes</i>	Used Oil Vehicle Batteries Household Batteries Latex Paint Oil-Based Paint Solvents/Thinners Adhesives/Glues Cleaners and Corrosives Pesticides/Herbicides Gas/ Fuel Oil Antifreeze Medical Waste Other Hazardous

## MAIN FINDINGS

Several differences are evident when comparing the results of the 2007 study with the 2002-2003 waste composition study. These differences can be grouped into two main categories:

- **Statistically significant.** These findings can be considered true differences. The probability of observing these results if there had been no actual year-to-year change is low (10% for all tests within each substream).
- **Strong trends.** Although the results did not meet the requirements of the study's conservative statistical tests, there does seem to be a possible indication of change.

### Key Comparison Study Findings

- **Cardboard and Organic materials have shown a decrease in the overall disposed waste stream** since 2002-2003.
- **Paper materials have shown a decrease in multi-family commercially collected wastes** loads since 2002-2003.
- **Newspaper has shown a decrease in nonresidential commercially collected** loads since 2002-2003.
- **Wood Waste materials have increased in self-hauled waste** loads since 2002-2003.

The statistically significant differences between the 2002-2003 and 2007 study periods, along with the trend indicators, are summarized in Table F-2.

**Table F-2. Waste Composition Changes and General Trends, 2002-2003 to 2007 Study Periods**

	MATERIAL GROUPING	MEAN RATIO		STRENGTH OF RESULTS
		<i>(Material Wt/Total Wt)</i>		
		2002/2003	2007	
<b>Overall</b>				
Overall	Cardboard and Kraft	3.1%	2.8% ↓	Strong trend
Overall	Organics	20.9%	19.2% ↓	Statistically significant
<b>Commercially Collected</b>				
Multi-family	Newspaper	4.3%	2.5% ↓	Strong trend
Multi-family	Other Curbside Paper	12.9%	9.7% ↓	Strong trend
Nonresidential	Newspaper	3.4%	2.0% ↓	Statistically significant
Nonresidential	Cardboard and Kraft	6.1%	9.1% ↑	Strong trend
<b>Self-hauled</b>				
	Wood Waste	15.9%	21.7% ↑	Strong trend

## STATISTICAL CONSIDERATIONS

The analyses are based on the component percentages, by weight, for each selected substream. These percentages are calculated by dividing the sum of the selected component weights by the sum of the corresponding sample weights. T-tests (modified for ratio estimation) were used to examine the study year-to-study year variation.

### ***NORMALITY***

The distribution of some of the waste categories (particularly the hazardous materials) are skewed and may not follow a normal distribution. Although t-tests assume a normal distribution, they are very robust to departures from this assumption, particularly with large sample sizes. In addition, most of the selected categories are sums of several individual waste components, which improves our ability to meet the assumptions of normality.

### ***DEPENDENCE***

There may be dependence between waste types (if a person disposes of material A, they always dispose of material B at the same time).

There is certainly a degree of dependence between the calculated percentages. (Since the percentages sum to 100, if the percentage of material A increases, the percentage of some other material must decrease). This type of dependence is somewhat controlled by choosing only a portion of the waste categories for the analyses.

Future studies might be merited to examine these two types of dependence explicitly.

### ***MULTIPLE T-TESTS***

In all statistical tests, there is a chance of incorrectly concluding that a result is significant. The year-to-year comparison required conducting several t-tests, (one for each waste category within each set of substreams) **each** of which carries that risk. However, we were willing to accept only a 10% chance, **overall**, of making an incorrect conclusion. Therefore, each test was adjusted by setting the significance threshold to  $\frac{0.10}{w}$  ( $w$  = the number of t-tests).

*The adjustment can be explained as follows:*

For each test, we set a  $1 - \frac{0.10}{w}$  chance of not making a mistake, which results in a

$\left(1 - \frac{0.10}{w}\right)^w$  chance of not making a mistake during all  $w$  tests.

Since one minus the chance of not making a mistake equals the chance of making a mistake, by making this adjustment, we have set the overall risk of making a wrong

conclusion during any one of the tests at  $\left(1 - \left(1 - \frac{0.10}{w}\right)^w\right) = 0.10$ .

The chance of a “false positive” for this study is restricted to 10% overall, or 1.25% for each test (10% divided by the eight tests within each substream equals 1.25%).

For more detail regarding this issue, please refer to Section 11.2 “The Multiplicity Problem and the Bonferroni Inequality” of *An Introduction to Contemporary Statistics* by L.H. Koopmans (Duxbury Press, 1981).

### **POWER ANALYSIS**

The greater the number of samples, the greater the ability to detect differences. In the future, an *a priori* power analysis might benefit this research by determining how many samples would be required to detect a particular minimum difference of interest.

### **INTERPRETING THE CALCULATION RESULTS**

The following tables include detailed calculation results. An asterisk notes the statistically significant differences.

*For the purposes of this study, only those calculation results with a p-value of less than 1.25% are considered to be statistically significant. As described above, the threshold for determining statistically significant results (the “alpha-level”) is conservative, accounting for the fact that so many individual tests were calculated.*

The t-statistic is calculated from the data: according to statistical theory, the larger the absolute value of the t-statistic, the less likely that the two populations have the same mean. The p-value describes the probability of observing the calculated t-statistic if there were no true difference between the population means.

For example, in Table F-6, the proportion of newspaper in the nonresidential substream decreased from 3.39% to 1.99% across the study periods. The t-statistic is relatively large (3.0128) and the probability (p-value) of observing that t-statistic if there had been no true difference between years is just 0.028%. This value is less than the study’s pre-determined threshold for statistically significant results (alpha-level of 1.25%); thus the decrease in newspaper is considered to be a true difference. On the other hand, the p-value corresponding to the decrease in single-family newspaper is very large (p=0.936). The chance of observing the 2.57 % to 2.55% decrease when the actual proportion had not changed is 93.6%—much too high to be considered a true difference.

**Table F-3. Comparison of Selected Composition Results, 2002-2003 to 2007  
Overall Disposed Waste**

	Mean Ratio (Material Wt/Total Wt)		t-Statistic	p-Value (Cut-off for statistically valid difference = 0.0125)
	2002/2003	2007		
Cardboard and Kraft	0.0307	0.0278	1.9963	0.0462
Construction & Demolition	0.0937	0.1377	0.4706	0.6380
Hazardous	0.0184	0.0049	1.1295	0.2590
Newspaper	0.0087	0.0067	1.6442	0.1005
Organics	0.2091	0.1919	2.7698	0.0057 *
Other Curbside Paper	0.0364	0.0320	0.1715	0.8639
Wood Waste	0.1826	0.1588	0.5560	0.5783
Curbside Recyclable Containers <sup>2</sup>	0.0233	0.0145	0.2801	0.7794
<i>Number of Samples</i>	369	421		

**Table F-4. Comparison of Selected Composition Results, 2002-2003 to 2007  
Commercially Collected Single-family**

	Mean Ratio (Material Wt/Total Wt)		t-Statistic	p-Value (Cut-off for statistically valid difference = 0.0125)
	2002/2003	2007		
Cardboard and Kraft	0.0361	0.0253	1.2698	0.2081
Construction & Demolition	0.0335	0.0237	0.4681	0.6411
Curbside Containers	0.0516	0.0435	1.2404	0.2188
Hazardous	0.0034	0.0060	1.3001	0.1976
Newspaper	0.0257	0.0255	0.0203	0.9838
Organics	0.4528	0.4556	0.0806	0.9360
Other Curbside Paper	0.0829	0.0713	1.2008	0.2336
Wood Waste	0.0382	0.0140	1.0356	0.3038
<i>Number of Samples</i>	36	40		



**Table F-5. Comparison of Selected Composition Results, 2002-2003 to 2007  
Commercially Collected Multi-Family**

	Mean Ratio (Material Wt/Total Wt)		t-Statistic	p-Value (Cut-off for statistically valid difference = 0.0125)
	2002/2003	2007		
Cardboard and Kraft	0.0646	0.0503	1.3966	0.1664
Construction & Demolition	0.0292	0.0173	0.9193	0.3607
Curbside Containers	0.0618	0.0620	0.0142	0.9887
Hazardous	0.0017	0.0111	1.6648	0.0999
Newspaper	0.0429	0.0265	1.8861	0.0630
Organics	0.3642	0.3956	0.8034	0.4241
Other Curbside Paper	0.1287	0.0977	1.8726	0.0648
Wood Waste	0.0460	0.0285	0.8485	0.3987
<i>Number of Samples</i>	24	57		

**Table F-6. Comparison of Selected Composition Results, 2002-2003 to 2007  
Commercially Collected Nonresidential**

	Mean Ratio (Material Wt/Total Wt)		t-Statistic	p-Value (Cut-off for statistically valid difference = 0.0125)
	2002/2003	2007		
Cardboard and Kraft	0.0611	0.0915	2.0126	0.0450
Construction & Demolition	0.0576	0.0392	1.1459	0.2527
Curbside Containers	0.0436	0.0336	1.7994	0.0730
Hazardous	0.0037	0.0070	1.1973	0.2321
Newspaper	0.0339	0.0199	3.0128	0.0028 *
Organics	0.2984	0.3259	1.0016	0.3173
Other Curbside Paper	0.0863	0.0822	0.4169	0.6771
Wood Waste	0.0961	0.0738	1.1225	0.2625
<i>Number of Samples</i>	144	161		

**Table F-7. Comparison of Selected Composition Results, 2002-2003 to 2007  
Self-hauled**

	Mean Ratio <i>(Material Wt/Total Wt)</i>		t-Statistic	p-Value <i>(Cut-off for statistically valid difference = 0.0125)</i>
	2002/2003	2007		
Cardboard and Kraft	0.0278	0.0363	1.3174	0.1887
Construction & Demolition	0.1377	0.1571	0.6836	0.4947
Curbside Containers	0.0145	0.0118	0.6882	0.4918
Hazardous	0.0049	0.0104	0.8742	0.3827
Newspaper	0.0067	0.0047	0.9832	0.3263
Organics	0.1919	0.1426	1.6337	0.1033
Other Curbside Paper	0.0320	0.0294	0.3294	0.7421
Wood Waste	0.1588	0.2174	1.9682	0.0499
<i>Number of Samples</i>	156	160		

## **APPENDIX G.**

### **Quality Control Plan**

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Execution of this quality control plan throughout the 2007 King County Waste Monitoring study helped ensure quality and consistency throughout fieldwork, data entry, and reporting.

#### **Train Sorting Crew**

To provide consistent sorting, the same crewmembers trained at the onset of the study continued to work until the study's completion in December 2007. All sorting crewmembers spent time in the field studying the components and practicing the sampling protocol. The training focused on the precise definitions for each waste component category and also covered safety procedures, sorting techniques, and quality control procedures.

The gatekeeper (the person who selects vehicles for sampling) was a Cascadia staff member trained in survey methods and familiar with transfer station protocol, safety procedures, and vehicle types. However, the gatekeeper also received training in selecting vehicles for sampling.

#### **Select Vehicles**

For each sampling day, the gatekeeper tallied vehicles as they entered the transfer station on a *Vehicle Selection* form. The form indicated the sampling frequency and the total number of vehicles needed for each substream and vehicle type. For each vehicle selected for sampling, the gatekeeper placed a fluorescent pink "Sample" card on the windshield and directed the vehicle to the sorting crew. The brightly colored cards enabled the sorting crew to identify the selected vehicle easily.

The gatekeeper assigned each vehicle a unique identification number and recorded it on both the pink card and the gatekeeper form. When the driver proceeded to the sorting area, the Sort Crew Manager collected the pink card from the vehicles driver.

#### **Sample Waste**

The crew sorted the waste samples by hand into plastic laundry baskets until only a small amount of homogeneous fine material remained. To ensure consistency among the samples, sorting crewmembers specialized in groups of materials, such as papers or plastics. The open laundry baskets allowed the Sort Crew Manager to observe the material at all times and to monitor the homogeneity of the components as they accumulated in the baskets.

#### **Record and Review Data**

The Sort Crew Manager recorded the composition weight information on a specially designed tally sheet. By combining the Cascadia designed tally sheet, database, and

corresponding electronic data-entry forms together, Cascadia was able to ensure accuracy, consistency among forms, and efficient recording of data.

After each month's sampling event, a designated Cascadia staff member entered the tally sheet data, and the sampling task manager reviewed the entered results to ensure accuracy and reliability.

## **Report Preparation**

Cascadia calculated waste composition estimates using automated analytical tools, which Cascadia staff developed. These automated tools reduced the possibility for human error and could be tailored, as required, to meet the needs of the study.

The automated calculation tools provided basic information that Cascadia used as a checkpoint to help ensure valid and correct data analysis. For example, the analysis tools showed the total number of samples and the average net weight of the samples when computing composition estimates. Additionally, the user selected what statistical procedures were applied.

A user's guide for the analytical tools provided new project staff with ongoing references and instructions.

# **APPENDIX H.**

## **Field Forms**

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### **Waste Sampling Field Forms**

- Sampling Fact Sheet
- Gatekeeper Interview Form
- Vehicle Selection Sheet
- Sample Placard
- Sorting Tally Sheet

## Waste Sampling Field Forms

Figure H-1. Sampling Fact Sheet (front)

 <b>King County</b>  <h3>Waste Sampling At Transfer Stations</h3> <p>The King County Solid Waste Division is sampling waste at transfer stations in King County to update information about the type of waste disposed in the County. The sampling will place between February and December 2007.</p> <p><b>Why does the County sample the waste?</b> The County samples waste to better understand what is being disposed at transfer stations and the Cedar Hills Regional Landfill in Maple Valley. This information helps the County anticipate changes in the composition of the waste so it can manage it effectively. One way it uses the information is to identify new materials that might be recycled rather than disposed.</p> <p><b>Why was I selected for the sampling?</b> You were randomly selected by the surveyor in front of the scale house. Today, we will be sampling up to 14 other vehicles from residences, businesses and the commercial haulers who pick up curbside and business waste. By randomly selecting you and other customers for sampling, we will be able to make sure we obtain data that will allow us to draw meaningful conclusions.</p> <p style="text-align: center;">-over-</p>
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## Figure H-2. Sampling Fact Sheet (back)

### **Who is doing the sampling?**

Staff from Cascadia Consulting Group and Sky Valley Associates, on behalf of King County.

### **How do I get more information?**

Alexander Rist, King County Solid Waste Division, 206-296-0268; 711 (TTY Relay). He is the County's program manager for the waste sampling.

***Thank you for participating in today's waste sampling.***

This material will be provided in  
alternate formats upon request.

♻️ Printed on recycled paper

**Figure H-3. Gatekeeper Interview Form (front)**

Sample Number	Random Cell	Record			Ask All Vehicles			
		Collection Type	Vehicle Type	Trailer	City	Waste Type	House/ Business	Comments
Res (1-x) DB (1-x) Com (1-x) SH (1-x) SHO (x)		C com. S self-haul  make sure S has material to dispose not recycle	1 Rear Packer 2 Front Packer 3 Side Packer 4 Drop Box, Loose 5 Drop Box, Compacted 6 Pick-up, Van, Sport Ut. 7 Large Other 8 Car 9 Semi Truck	X if yes	If city is not on the list of King County cities, clarify whether it is a rural area inside King County or a city outside King County	Y Yard Waste C Construct/ Demolition M Mixed Garbage S Special Waste	1 single family 2 multi-family 3 both SF and MF 4 res and biz 5 non-residential	
	12							
	1							
	16							
	13							
	4							
	9							
	8							
	12							
	12							
	5							
	7							
	8							
	12							
	14							
	15							
	3							
	2							
	15							



**Figure H-4. Gatekeeper Interview Form (back)**

<b><u>Complete this section for every page</u></b>		Page _____ of _____
Date _____	<u>Circle the site:</u>	
	Algona	Houghton
Gatekeeper _____	Bow Lake	Renton
	Enumclaw	Vashon Island
	Factoria	
<b><u>Complete this section for first page only</u></b>		
	Inclement Weather? _____	
Start Time _____	Stop Time _____	
<b><i>Other Notes about Today's Sampling:</i></b>		
<b>If found, please call Cascadia Consulting Group at 206/343-9759. Reward offered.</b>		

## Figure H-5. Vehicle Selection Sheet (Renton)

### King County Waste Monitoring Study Vehicle Selection Form

Site: Renton

Date: December 13, 2007

Cross off one number for each type of vehicle entering the station.

When you reach the number circled, this vehicle should be asked to go to the sorting area to dump its load for sampling.

Continue until the required number of vehicles is sampled.

**FRANCHISED RESIDENTIAL: (Res 87-94) NEED 8 TOTAL - SAMPLE AS SHOWN**

1 1 2 3 3 4 5 6 7 8 8 9

packer trucks or drop boxes

**FRANCHISED NONRESIDENTIAL DROPBOX: (DB 83-85) NEED 3 TOTAL - SAMPLE EVERY 3RD VEHICLE**

1 2 3 4 5 6 7 8 9 10 11 12

both compacting and loose drop boxes

**FRANCHISED NONRESIDENTIAL PACKER: (Com 81-83) NEED 3 TOTAL - SAMPLE EVERY VEHICLE**

1 2 3

**SELF-HAUL PASSENGER: ( ) NEED 0 TOTAL**

**SELF-HAUL LARGE OTHER: (SHO 30-32) NEED 3 TOTAL**

1 2 3

Figure H-6. Sample Placard

**SAMPLE ID:**

**RES92**

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**RANDOM CELL #:**

**8**

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Today's RES Sample Count 6 of 8

**Figure H-7. Sorting Tally Sheet**

<b>Paper</b>					<b>Glass</b>				
Corrugated Cardboard (OCC)					Clear Containers				
Newspaper (ONP)					Green Containers				
High Grade					Brown Containers				
Low Grade Recyclable					Other Glass				
Paper and Other Materials					<b>Metals</b>				
Bleached Polycoated					Aluminum Cans				
Compostable Paper					Other Aluminum				
Other Paper					Tinned Food Cans				
<b>Plastic</b>					Other Ferrous				
PET Bottles					Other Non-Ferrous				
HDPE Bottles					Mixed Metals/Other Materials				
Other Containers					Compressed Gas Cylinders				
Expanded Polystyrene					<b>Other Wastes</b>				
Plastic Film and Bags					C&D Wastes				
Other Packaging					Asphalt Shingles				
Plastic Products					Gypsum Wallboard				
Foam Rubber and Padding					Furniture/Mattresses				
Plastic and Other Materials					Household Appliances				
<b>Organics (wood, yard)</b>					Printers/Copiers/Fax Machines				
Yard Wastes					Office Electronics				
Large Prunings					Ash				
Stumps					Nondistinct Fines				
Dimensional Lumber/Plywood					Miscellaneous Inorganics				
Treated Wood					<b>Household Hazardous Waste</b>				
Contaminated Wood					Household Batteries				
Roofing and Siding Wood					Computer Monitors				
Other Wood					Televisions				
<b>Food</b>					Cell Phones				
Packaged Bakery Items					Laptops/LCD Monitors				
Opened/Unpack/Scrap Bakery					Latex Paint				
Packaged Vegetative					Oil-based Paint				
Opened/Unpack/Scrap Veg.					Solvents and Thinners				
Packaged Non-vegetative					Adhesives and Glue				
Opened/Unpack/Scrap Non-veg					Cleaners and Corrosives				
<b>Other Organics</b>					Pesticides and Herbicides				
Textiles:Clothes/Other					Used Oil				
Other Textiles					Gasoline and Fuel Oil				
Carpet					Antifreeze/Brake Fluid				
Disposable Diapers					Vehicle Batteries				
Rubber Products					Medical Waste				
Tires					Other Hazardous Waste				
Animal Carcasses					<b>Notes/Supermix:</b>				
Animal Feces									
Miscellaneous Organics									

Site: \_\_\_\_\_

Date: \_\_\_\_\_

Sample ID: \_\_\_\_\_