City of San Diego

Waste Characterization Study

Study Design

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In cooperation with

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Study Objectives

The City of San Diego is conducting the 2012 Waste Characterization Study to characterize the amounts and types of waste disposed by multiple sectors, including single family with and without yard waste collection; multifamily; and commercial for three collection vehicle types, for military, and for self-haul. The findings from this study will be used to develop enhanced recycling and diversion strategies. The data may also measure the impact of diversion programs implemented since previous studies and establish a baseline for future comparison.

The study design is crafted so that the final composition and quantity data will:

- Be comparable with the 1999-2000 study.
- Identify materials for potential diversion opportunities due to increased availability or enhanced processing technologies since the 1999-2000 study.
- Provide a baseline for evaluating the future progress of current diversion programs.

Sampling Universe and Sampling Strata

The first step in planning a waste characterization study is to identify and carefully define the waste streams that will be studied, or the "universe" of waste. In this study, the universe will include six substreams. A "substream" is determined by the particular generation, collection, or composition characteristics that make it a unique portion of the total waste stream. In this study, the universe will include the following six substreams:

- Residential – Waste (refuse) generated by single family and multifamily residences located within the City of San Diego:
    - Single family residential waste is generated by single family residences or multifamily residences that contain no more than four units. City collection vehicles collect these wastes curbside. Single family residences may or may not have curbside yard waste collection, but all have comingled recycling collection.
    - Multifamily residential waste is generated by multifamily residences (apartment buildings and condominiums) with more than four units. Franchised hauling companies collect these wastes.
- Commercial – Waste (refuse) generated by businesses and institutions that are located within the City of San Diego. Franchised hauling companies collect commercial wastes.
- Military – Waste (refuse) generated at the F. NAVSTA or (MCAS). Franchised haulers and Navy contract haulers collect these wastes. (Military self-haul vehicles are not included in this substream.)
- Self-haul – Waste (including both Refuse and Demo) generated by residences, businesses and institutions (commercial), or military bases. The waste generator hauls their own waste in the self-haul substream, instead of relying on City collection vehicles or franchised hauling companies. This substream also includes loads originating from outside the City of San Diego.

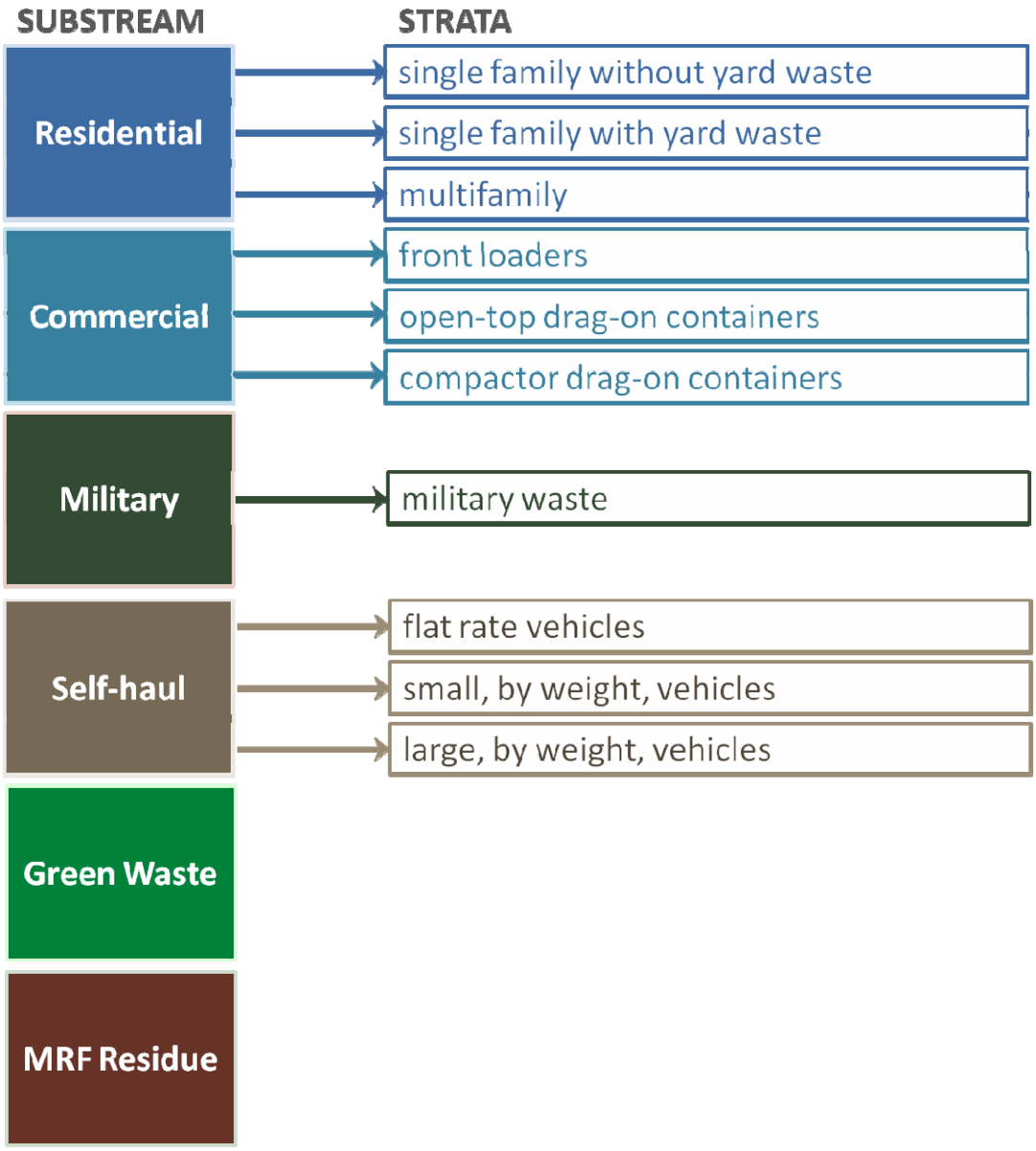
- Green Waste – Compostable materials generated by single family residences within San Diego. City collection vehicles collect these compostable materials curbside.
- MRF Residue – Waste (Demo Residue) that is generated at EDCO's Construction, Demolition and Inert (CDI) Recycling Facility and is non-recyclable or is otherwise undesirable. This waste is typically post-sort waste with recyclable materials removed.[1]

For this study, four of the six substreams have associated sampling strata. Figure 1 lists each substream and its associated sampling strata, where applicable. This study will allocate samples to and document the quantities and composition of waste from each stratum.

The residential substream will be divided into three strata as noted above and in Figure 1: single-family with yard waste collection service, single-family without yard waste collection service, and multifamily. The commercial substream will be divided into three strata by collection vehicle. Self-haul loads are stratified by the type of vehicle disposing of the material. The field crew will note the generator type for self-haul loads, but this study does not set sampling targets for each of the generator types. The self-haul generator types include City departments, commercial generators, military generators, and residential generators. Self-haul loads from military generators include all military self-hauled waste, and are not limited to the F. NAVSTA or MCAS.

[1] Existing tonnage data will be incorporated into final analysis. MRF residue loads will not be hand-sorted or visually characterized.

Figure 1. Sampling Universe and Sampling Strata



Sampling Calendar and Substream Allocations

This study will take place over three seasons. Sampling dates for the three seasons are scheduled to represent each season equally and avoid sampling on or near major holidays. The fall season is scheduled for October 22, 2012 through November 9, 2012. The winter season is scheduled for January 21, 2013 through February 8, 2013. The summer season is scheduled for June 1, 2013 through June 23, 2013. All samples will be collected and sorted at the Miramar Landfill.

Each seasonal event will span 15 to 17 days with samples equally divided among seasons and days of the week. Saturday sampling will be included in the self-haul vehicle study. Table 1 summarizes the sample goals by substream, strata, and season.

Table 1. Sampling Allocation by Substream, Strata, and Season

Substream	Strata	Sample Goals			
		Oct./Nov.	Jan./Feb.	April/May	Total
residential	single family with curbside recycling	30	30	30	90
residential	single family with curbside recycling and yard	30	30	30	90
residential	multifamily	30	30	30	90
commercial	front loader	40	40	40	120
commercial	open-top drag-on containers	40	40	40	120
commercial	compactor drag-on containers	40	40	40	120
military		10	10	10	30
hand sort subtotal		220	220	220	660
self-haul	flat rate vehicle	125	125	125	375
self-haul	small by-weight vehicles	90	90	90	270
self-haul	large by-weight vehicles	52	52	52	156
self-haul visual total		267	267	267	801
green waste		4	4	4	12

Obtaining and Sorting Samples

Load Selection

The first step in obtaining samples is to select loads to extract a sample from. The procedures to select loads will vary by substream. Loads from substreams with regularly scheduled waste collection will be pre-selected, while self-haul loads, military loads, and commercial loads arriving in vehicles other than front loaders will be selected using systematic selection (selecting every n^{th} vehicle):

- Pre-selected loads are selected prior to the actual sort date.
- Systematically-selected loads are selected on the day of sorting.

Table 2 summarizes the load selection method to be used for each sampling substream and strata.

Table 2. Load Selection Method

Substream	Strata	Selection Method
residential		pre-selected
commercial	front loader	pre-selected
commercial	open drag-on containers	systematic selection
commercial	compactor drag-on containers	systematic selection
military		systematic selection
self-haul		systematic selection
green waste		pre-selected

Pre-selected Loads

Cascadia will pre-select regularly scheduled residential, commercial front-end loader, and green waste loads, using route data provided by the City of San Diego. The City will provide Cascadia with complete route data spreadsheets for the following substreams:

- City-hauled single family loads
- Franchise-hauled multifamily and commercial loads delivered in front-end loaders.
- City-hauled green waste loads

Table 3 shows an example of the route data for one day.

Table 3. Example Load Selection

Day	Strata	Route #	Truck #	Tip #	Sample?
Mon	single family with curbside recycling	12	34469	1	N
Mon	single family with curbside recycling	12	36784	2	Y
Mon	single family with curbside recycling	54	39702	1	Y
Mon	single family with curbside recycling	32	33136	1	N
Mon	single family with curbside recycling	22	33710	1	Y
Mon	single family with curbside recycling	22	35310	2	N

Cascadia will select loads from the route data that the City will provide using the following five steps:

1. Compile a complete list of all routes using route data.
2. Sort the list by day of service.
3. Assign each route a random number.
4. Select routes from this randomized list until the daily route selection goals are fulfilled
5. Randomly select load (1st, 2nd, or 3rd load of the day).

Selected loads for each sampling day will be summarized on a *Vehicle Selection Sheet*.

Cascadia will distribute the *Vehicle Selection Sheets* and *Sample Placards* to route supervisors at the franchised haulers and City collections prior to each sampling event. The route supervisors will then distribute *Sample Placards* to the drivers of the loads selected for sampling. The route supervisor will make any changes to the anticipated truck numbers prior to *Sample Placard* distribution to ensure that vehicle identification and sample selection occur as planned at the Miramar Landfill.

This study was designed to sample pure loads of multifamily and commercial waste that is collected by franchised haulers. A pure load is a load that is comprised of material from only one sampling stratum, such as multifamily residential generators. The franchised haulers and the City of San Diego will work together to achieve this on sampling days. For example, The City will ask haulers for selected routes that are normally mixed (e.g. commercial mixed with multifamily residential) to modify their routes to bring in a pure commercial load or a pure multifamily loads.

Examples of field forms appear in Appendix B.

Systematic Load Selection

Cascadia will use a systematic selection process to select loads of self-hauled waste, loads from commercial open top containers, loads from compactor drag-on containers, and loads delivered by franchised and navy contract haulers from the two military bases. Systematic selection consists of taking every n^{th} vehicle entering the facility after a randomly selected start time. The sampling interval (*n*) will be determined for each stratum by dividing the day's expected vehicle count in that stratum by the number of samples needed in that stratum on that day. The expected number of arriving vehicles will be based on vehicle traffic data the City will provide to Cascadia. This data will include the average number of vehicles entering Miramar Landfill, by vehicle type, by day of the week. Table 4 provides an example data table.

Table 4. Example of Miramar Landfill Vehicle Traffic Data Table

		Average Number of Vehicles						
Substeam	**Strata**	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Total**
commercial	open-top drag-on containers							
commercial	compactor drag-on containers							
military								
self-haul	flat rate vehicles							
self-haul	small by-weight vehicles							
self-haul	large by-weight vehicles							

Cascadia will provide scale house attendants with a *Vehicle Selection Sheet*, *Sample Placards*, and instructions regarding scale house staff's roles in selecting the commercial open and compactor drag-on containers, military loads, and self-haul vehicles prior to sampling. When a vehicle is selected for sampling, the attendant will note the vehicle type and source on a *Sample Placard* and place the *Sample Placard* on that vehicle's windshield or ask the driver to place it on the vehicle dashboard. The attendant will then direct selected loads to the designated sampling area.

Miramar Landfill has a system that stores tare weights for most vehicles entering the facility. Therefore most vehicles will have a receipt noting their net weight when they arrive at the landfill face. Vehicles selected for sampling that do not have receipts noting their net weights will be sent back to the scale house with a tag (weigh-back ticket). The scale house staff will collect the weigh-back ticket from the vehicle, note the vehicle's net weight on the ticket, and save it for the field staff to collect at the end of the sampling day.

Sampling Procedures

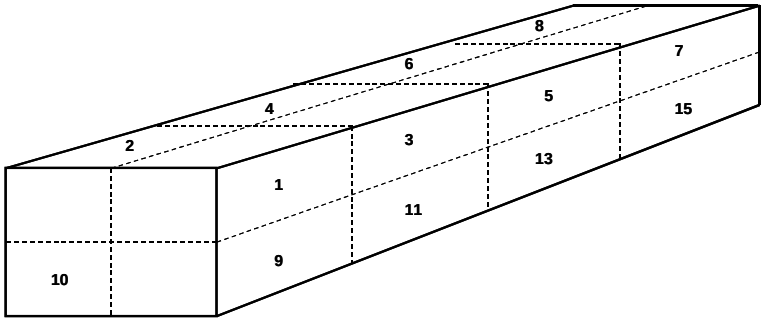
Depending on the substream, samples will be either hand-sorted or visually characterized using the methods outlined below. For both sorting procedures, the field supervisor will first collect the *Sample Placard* from the driver of the selected load and verify the load's description.

Hand-sorting Procedure

Selected samples from loads of City-collected residential refuse, franchised hauler-collected commercial and multifamily refuse delivered in front-end loaders, all drag-on container material, and all military refuse will be hand-sorted using the following procedure:

- The driver will dump the selected load in an elongated pile. The sampling crew manager will select a sample from this pile using an imaginary 16-cell grid (as shown in Figure 2) superimposed over the dumped material. The sampling crew manager will select one cell from this grid to extract a sample from.

Figure 2. 16-Cell Grid for Sampling



- A 200 lb. sample from the selected portion of the load will be placed on a tarp, and the sampling crew member will take a photograph using a digital camera. The *Sample Placard* that identifies each sample will be positioned so that it is visible in each photograph. Figure 3 shows a sample on a tarp with the *Sample Placard* visible.
- The sorting crew will sort the sample by material type into separate baskets. The individual members of the sorting crew typically specialize in groups of materials, such as papers or plastics. The crew manager will monitor the homogeneity of material in the baskets as they accumulate, rejecting any materials that are improperly classified. The material list and definitions are presented in Appendix A.
- The sampling crew manager will verify the purity of each material as it is weighed in its basket, using a pre-calibrated scale, and will record each material weight on the *Sample Tally Sheet.*
- The sorting crew will count the number of sharps in each sample after weighing.
- The sorting crew will set aside any hazardous materials encountered in samples, and notify landfill staff for proper handling and disposal.

Visual Characterization Procedure

All self-hauled Refuse and Demo waste will be characterized using volumetric-based visual estimations. A trained crewmember will use the following steps to characterize these loads:

- **Obtain information about the load.** At the sampling area, the crewmember will record key information, including the sample ID number, vehicle type, and sector on the *Visual Characterization Form*.

Figure 3. Tarped Sampled with Sample Placard

- **Photograph the sample.** The crewmember will take a photograph of the sample using a digital camera. The *Sample Placard* will be positioned so that it is visible in each photograph.
- **Measure load volume.** The crewmember will use a tape measure to record the length, width, and height of the load on the *Visual Characterization Form*.
- **Note which material classes are present.** After the driver dumps the load onto the ground, the crewmember will walk entirely around the load and note on the *Visual Characterization Form* which **material classes** are present in the load. **Material classes** are identified with green headings in Appendix A.

Figure 4. Completing a *Visual Characterization Form*

- **Estimate composition by volume for each material class.** Beginning with the largest **material class** present (e.g., **Paper**), the crewmember will estimate the volumetric percentage of this **material class** and record it on the form. The crewmember will then repeat this process for the next most prevalent **material class**, until the volumetric percentage of every **material class** is estimated. The crewmember will then calculate the sum of all **material class** volumetric percentages, ensuring that they total 100 percent. Figure 4 shows a crewmember completing a visual characterization.
- **Estimate composition by volume for each *material type*.** The crewmember will consider *material types* within each material class separately, and estimate the percentage of each *material type*. For example, *newspaper* is a *material type* within the **Paper material class**. While considering only the **Paper material class**, the crewmember estimates the volume percentage of *newspaper*. The crewmember will do the same for every other *material type* within the **Paper material class** (e.g., *corrugated cardboard*, *compostable paper*). The crewmember will then ensure that the summed estimated volumetric composition percentages of the *material types* equal 100 percent.
- **Check and reconcile percentage data.** The crewmember will ensure the percentage estimates for the **material classes** and for the *material types* within each material class total 100 percent.
- **Convert volume estimates to weight estimates.** This step is done at our team's offices. Data from the *Visual Characterization Forms* are entered into a customized database, and accepted density conversion factors are used to develop estimates of the weight of each material component in each load.

Green Waste Loads

Cascadia will also oversee the hand-sorting of green waste collected curbside from single family residences to determine the types and amounts of contamination. Each load, which typically weigh about seven tons, will be fully sorted into 10 material types:

Compostables

1. Acceptable compostables

Minor Contaminants

2. Paper
3. Plastic
4. Metal

Major Contaminants

5. Glass & Ceramic
6. Non-compostable organics
7. Hazardous items
8. Bagged garbage (MSW)
9. Large metal appliances & equipment

Other Contaminants

10. Other Contaminants

For two days each season, Cascadia will provide the scales and oversight required to conduct the sorts with a City-provided crew. Sampling events will be distributed to ensure sampling spans every week day (Monday, Tuesday, Wednesday, etc.) and that samples are obtained from the two every-other-week (EOW) collection calendars (i.e., orange week sampled at least once) over the three seasons.

As part of our management and oversight role and prior to sorting, Cascadia will take digital photographs of the loads with an identifying placard visible in each photograph. We will also take photographs of the contaminants that are recovered from each sorted load.

Method to Obtain Tonnage Data

Accurate tonnage information is necessary to compile the composition and quantity analysis. It is expected that the City of San Diego will provide the tonnage information for each sampling strata and generator type.

Analysis

Cascadia will develop detailed estimates of waste composition and quantities for each waste sampling stratum and season. All estimates will be presented along with statistical error and confidence intervals at the 90% confidence level. The formulae that Cascadia will use to conduct the required analyses appear below.

Waste Composition Calculations

The composition estimates represent the **ratio of the components' weight to the total sample weight** for each noted subsector. 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:

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

where:

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

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

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

where:

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

Appendix A. Material List and Definitions

Paper

1. **Uncoated Corrugated Cardboard** usually has three layers. The center wavy layer is sandwiched between the two outer layers. It does not have any wax coating on the inside or outside.
2. **Waxed Corrugated Cardboard** usually has three layers. The center wavy layer is sandwiched between the two outer layers. Examples include some water-resistant cardboard containers, such as shipping and moving boxes, as well as boxes designed to contain produce or other perishable goods.
3. **Paper Bags** means bags and sheets made from kraft paper. The paper may be brown (unbleached) or white (bleached). Examples include paper grocery bags, fast food bags, department store bags, and heavyweight sheets of kraft packing paper.
4. **Newspaper** means paper used in newspapers. Examples include newspaper and glossy inserts found in newspapers, and all items made from newsprint, such as free advertising guides, election guides, and tax instruction booklets.
5. **White Ledger Paper** means uncolored bond, rag, or stationary grade paper. It may have colored ink on it. When the paper is torn, the fibers are white. Examples include white photocopy, white laser print, and letter paper.
6. **Mixed Waste Paper** means paper products or packaging made mostly of paper combined with minor amounts of other materials such as wax or glues. This type includes colored ledger, manila folders, manila envelopes, index cards, white envelopes, white window envelopes, notebook paper, carbonless forms, junk mail, and box board packages such as cereal boxes. Note: This type was defined as Other Miscellaneous Paper in the 1999-2000 Study.
7. **Magazines** means items made of glossy coated paper. This paper is usually slick, smooth to the touch, and reflects light. Examples include glossy magazines, catalogs, brochures, and pamphlets.
8. **Phone Books and Directories** means thin paper between coated covers. These items are bound along the spine with glue. Examples include whole or damaged telephone books, “yellow pages”, real estate listings, and some non-glossy mail order catalogs.
9. **Compostable/Soiled paper** means paper packaging or products labeled “compostable” or “biodegradable” or any food-soiled paper. Examples include food-soiled pizza boxes, food-soiled paper plates and cups, food-soiled paper containers (such as fast food), napkins, coffee filters, shredded paper, and paper towels. Note: This type was defined as Remainder/Composite Paper in the 1999-2000 Study.
10. **Aseptic/milk containers** means bleached polycoated paperboard containers or paper containers with a foil liner of various sizes and shapes that contained milk, ice cream, or other liquids. Note: This type was defined as Remainder/Composite Paper in the 1999-2000 Study.
11. **Remainder/Composite Paper** means paper that cannot be put into any other type. This type includes remaining contaminated, non-compostable/non-biodegradable items and items

made mostly of paper but combined with large amounts of other materials such as wax, plastic, paint, glues, and foil. Examples include blueprints, sepia, carbon paper, non-compostable cups and plates, and photographs.

Glass

12. **CRV Clear Bottles** means clear glass bottles with a CRV label.
13. **Non-CRV Clear Bottles and Containers** means clear glass beverage and food containers without a CRV label.
14. **CRV Brown Bottles** means brown glass bottles with a CRV label.
15. **Non-CRV Brown Bottles and Containers** means brown glass beverage and food containers without a CRV label.
16. **CRV Other Colored Bottles** means colored glass containers and bottles with a CRV label.
17. **Non-CRV & Other Colored Bottles and Containers** means colored glass containers and bottles without a CRV label.
18. **Flat Glass** means clear or tinted glass that is flat. Examples include glass window panes, doors and table tops, flat automotive window glass (side windows), safety glass, and architectural glass. This type does not include windshields, laminated glass, or any curved glass.
19. **Remainder/Composite Glass** means glass that cannot be put in any other type. It includes items made mostly of glass but combined with other materials. Examples include Pyrex, Corningware, crystal and other glass tableware, mirrors, and auto windshields, or any curved glass

Metal

20. **Tin/Steel Cans** means rigid containers made mainly of steel. These items will stick to a magnet and may be tin-coated. This type does *not* include CRV tin cans. Examples include canned food and beverage containers, empty metal paint cans, empty spray paint and other aerosol containers, and bimetal containers with steel sides and aluminum ends. Note: Aerosols and other containers that still contain product are sorted according to that that material – for instance, water-based paint.
21. **Major Appliances** means discarded major appliances of any color. These items are often enamel-coated. Examples include washing machines, hot water heaters, stoves, and refrigerators. This type does not include electronics, such as televisions and stereos.
22. **Other Ferrous Metal** means any iron or steel that is magnetic or any stainless steel item. This type includes items comprised of 80% or greater by weight of other ferrous metal. Examples include structural steel beams, metal clothes hangers, stainless steel cookware, security bars, and scrap ferrous items.
23. **CRV Aluminum & Tin Cans** means any food or beverage container made mainly of aluminum or tin with a CRV label. Examples include aluminum soda or beer cans and a few tin beer cans (Sapporo beer).
24. **Non-CRV Aluminum Cans** any food or beverage container, made mainly of aluminum, without a CRV label.

25. **Used Oil Filters** means metal oil filters used in motor vehicles and other engines, which contain a residue of used oil. Note: This type was defined as Used Oil in the 1999-2000 Study.
26. **Other Non-Ferrous Metal** means any metal item that is not stainless steel or magnetic that is not listed above. This type includes items comprised of 80% or greater by weight of other non- ferrous metal. These items may be made of aluminum, copper, brass, bronze, lead, zinc, or other metals. Examples include aluminum window frames, aluminum siding, copper wire, shell casings, brass pipe, and aluminum foil.
27. **Remainder/Composite Metal** means metal that cannot be put in any other type. This type includes metals composed of 20% or more by weight of other materials and items composed of both ferrous metals and non-ferrous metal.

Plastic

28. **CRV HDPE Containers** means natural and colored HDPE containers such as bottles, jars, with a CRV label. This plastic is usually either cloudy white, allowing light to pass through it (natural) or a solid color, preventing light from passing through it (colored). When marked for identification, it bears the number "2" in the triangular recycling symbol
29. **Non-CRV HDPE Containers** means natural and colored HDPE containers such as bottles, jars, tubs, cups, and clamshells without a CRV label. This category includes HDPE buckets designed to hold 5 gallons or less of material (with or without metal handles).
30. **CRV PETE Containers** means clear or colored PETE containers such as bottles, jars, with a CRV label. When marked for identification, it bears the number "1" in the center of the triangular recycling symbol and may also bear the letters "PETE" or "PET". The color is usually transparent green or clear. A PETE container usually has a small dot left from the manufacturing process, not a seam. It does not turn white when bent.
31. **Non-CRV PETE Containers** means clear or colored PETE containers such as bottles, jars, tubs, cups, and clamshells without a CRV label.
32. **Compostable/Biodegradable Containers** means plastic containers such as bottles, jars, tubs, cups, and clamshells labeled “compostable” or “biodegradable. Examples include food packaging and service ware items such as clamshells, cups, plates, PLA water bottles, and bowls that are so marked.
33. **Miscellaneous Plastic Containers** means plastic containers, including cups, made of types of plastic other than HDPE, PETE, or compostable/biodegradable resins. Items may be made of PVC, PP, or PS. When marked for identification, these items may bear the number "3", "4", "5", "6", or "7" in the triangular recycling symbol. This category includes #3-#7 buckets designed to hold 5 gallons or less of material with or without metal handles.
34. **Plastic Grocery and Merchandise Bags** means plastic shopping bags used to contain merchandise to transport from the place of purchase, given out by the store with the purchase. This type includes dry cleaning bags intended for one-time use. Note: This type was defined as Film Plastic in the 1999-2000 Study.
35. **Clean Film Plastic** means flexible plastic film. It is made from a variety of plastic resins including HDPE and LDPE. Examples include packaging wrap, shrink wrap, furniture wrap, and produce bags, bubble wrap, agricultural film, and building wrap.

36. **Dirty Film Plastic** means contaminated flexible plastic film and all other plastic film. Examples include garbage bags, food soiled bags, food wrappers, sandwich bags, potato chip bags, newspaper bags, mailing pouches. Note: This type was defined as Film Plastic in the 1999-2000 Study.
37. **Durable Plastic Items** means plastic objects other than containers and film plastic (typically products) that bear the numbers "1" through "7" in the triangular recycling symbol. These items are usually made to last for more than one use. Examples include outdoor furniture, plastic toys and sporting goods, and plastic housewares, such as mop buckets, dishes, and cutlery. This type also includes building materials such as house siding, window sashes and frames, housing for electronics such as computers, televisions and stereos, and plastic pipes and fittings.
38. **Expanded Polystyrene** means products composed of "Styrofoam." Examples include Styrofoam food service ware and packaging. Note: This type was defined as Remainder/Composite in the 1999-2000 Study.
39. **Remainder/Composite Plastic** means plastic that cannot be put in any other type. This type includes items made mostly of plastic but combined with other materials.

Organic

40. **Food** means food material resulting from the processing, storage, preparation, cooking, handling or consumption of food. This type includes material from industrial, commercial or residential sources. This type includes grape pomace and other processed residues or material from canneries, wineries, or other industrial sources.
41. **Palm, Succulent, Coral Tree** means fibrous plant or plant materials (e.g. leaves, trunk, seed pods, and roots) that tears into long stringy pieces. This type includes bamboo, bird of paradise, yucca, and agave, in addition to the following three:
    a. *Palm* means any plant or plant material of the family Palmae having an unbranched trunk crowned by large pinnate or palmate leaves. Examples include palm fronds and monocot tree trunks of any size.
    b. *Succulent* means any tropical or desert plant or plant materials that have thick fleshy tissue designed to retain water in a leaf or stem. This type includes ice plant, aloe, and pickle weed.
    c. *Coral Tree* means any tree or plant material in the Erythrina family having, a spiny trunk, three leaflets, lobes, or foils and shoots bearing flowers of scarlet to coral red flowers and black seeds.

    NOTE: Attachment 1, The City of San Diego's "Greenery Unacceptable Plants Flyer" provides photographs for the Palm, Succulent, Coral Tree type.
42. **Leaves and Grass** means plant material, except woody material, from any public or private landscapes. This type does not include Palm, Succulent, and Coral Tree.
43. **Prunings and Trimmings** means woody plant material up to 4 inches in diameter from any public or private landscape.
44. **Branches and Stumps** means woody plant material, branches and stumps that exceed 4 inches in diameter from any public or private landscape.

45. **Agricultural Crop Residues** means plant material from agricultural sources. Examples include orchard and vineyard prunings, vegetable byproducts from farming, residual fruits, vegetables, and other crop remains after usable crop is harvested.
46. **Grass Sod** means a section cut or torn from the surface of grassland, containing the matted roots of grass. Note: This type was defined as Leaves and Grass in the 1999-2000 Study.
47. **Manures** means manure and soiled bedding materials from domestic, farm, or ranch animals. Examples include manure and soiled bedding from animal production operations, race tracks, riding stables, animal hospitals, and other sources.
48. **Diapers** reusable (cloth) or disposable (plastic and cloth) diapers as well as any contaminants.
49. **Textiles** means items made of thread, yarn, fabric, or cloth. Examples include clothes, fabric trimmings, draperies, and all natural and synthetic cloth fibers. This type does not include cloth covered furniture, or mattresses.
50. **Remainder/Composite Organic** means organic material that cannot be put in any other type. This type includes items made mostly of organic materials, but combined with other material types. Examples include leather items, cork, hemp rope, garden hoses, rubber items, hair, cigarette butts, feminine hygiene products, small wood products (such as Popsicle sticks and tooth picks), sawdust, animal carcasses and animal feces not mixed with kitty litter.

Construction & Demolition

51. **Concrete** means a hard material made from sand, gravel, aggregate, cement mix and water. Examples include pieces of building foundations, concrete paving, and concrete/cinder blocks.
52. **Asphalt Paving** means a black or brown, tar-like material mixed with aggregate used as a paving material.
53. **Asphalt Composition Shingles** means composite shingles composed of fiberglass or organic felts saturated with asphalt and covered with inert aggregates. Commonly known as three tab roofing. Note: This type was defined as Asphalt Roofing in the 1999-2000 Study.
54. **Roofing Tar Paper/Felt** means a heavy paper impregnated with tar or a fiberglass or polyester fleece impregnated with tar and used as part of a roof for waterproofing. Note: This type was defined as Asphalt Roofing in the 1999-2000 Study.
55. **Roofing Mastic** means a paste-like material used as an adhesive or seal in roofing applications. Note: This type was defined as Asphalt Roofing in the 1999-2000 Study.
56. **Built-Up Roofing** means other roofing material made with layers of felt, asphalt, aggregates, and attached roofing tar and tar paper normally used on flat/low pitched roofs usually on commercial buildings. Note: This type was defined as Asphalt Roofing in the 1999-2000 Study.
57. **Other Asphalt Roofing Material** means any other roofing material containing asphalt that cannot be put into any of the other roofing material types. Note: This type was defined as Asphalt Roofing in the 1999-2000 Study.

58. **Clean Dimensional Lumber** means unpainted new or demolition dimensional lumber. Includes materials such as 2 x 4s, 2 x 6s, 2 x 12s, and other residual materials from framing and related construction activities. May contain nails or other trace contaminants. Note: This type was defined as Clean Dimensional Lumber in the 1999-2000 Study.
59. **Clean Engineered Wood** means unpainted new or demolition scrap from sheeted goods such as plywood, particleboard, wafer board, oriented strand board, and other residual materials used for sheathing and related construction uses. May contain nails or other trace contaminants. Note: This type was defined as Clean Dimensional Lumber in the 1999-2000 Study.
60. **Clean Pallets and Crates** means unpainted wood pallets, crates, and packaging made of lumber/engineered wood. Note: This type was defined as Clean Dimensional Lumber in the 1999-2000 Study.
61. **Other Wood Waste** means wood waste that cannot be put into any other material type. This type may include untreated/unpainted scrap from production of prefabricated wood products such as wood furniture or cabinets, untreated or unpainted wood roofing and siding, painted or stained wood, and treated wood. Note: This type was defined as Clean Dimensional Lumber in the 1999-2000 Study.
62. **Clean Gypsum Board** means unpainted gypsum wallboard or interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples include used or unused, broken or whole sheets. Gypsum board may also be called sheetrock, drywall, plasterboard, gypboard, gyproc, or wallboard.
63. **Painted/Demolition Gypsum Board** means painted gypsum wallboard or interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples include used or unused, broken or whole sheets. Gypsum board may also be called sheetrock, drywall, plasterboard, gypboard, gyproc, or wallboard.
64. **Carpet & Carpet Padding** means organic (e.g., wool) or synthetic carpet, carpet padding, and other soft floor coverings (e.g., synthetic turf).
65. **Rock, Soil and Fines** means rock pieces of any size and soil, dirt, and other matter. Examples include rock, stones, sand, clay, soil and other fines. This type also includes non-hazardous contaminated soil.
66. **Contaminated soil, street sweepings, drain cleanings** means soil contaminated with oil or other toxic materials, as well as material gathered from sweeping streets or cleaning storm drains (activities mainly conducted by City departments).
67. **Remainder/Composite C&D** means construction and demolition material that cannot be put in any other type. This type may include items from different categories combined, which would be very hard to separate. Examples include brick, ceramics, toilets, sinks, and fiberglass insulation.

Household Hazardous Waste

68. **Oil-Based Paint** means containers with oil-based paint in them.
69. **Water-Based Paint** means containers with water-based paint in them. This type does not include dried paint, empty paint cans, or empty aerosol containers.

70. **Vehicle and Equipment Fluids** means containers with fluids used in vehicles or engines. Examples include used antifreeze and brake fluid.
71. **Used Oil** means the same as defined in Health and Safety Code section 25250.1(a). Examples include spent lubricating oil such as crankcase and transmission oil, gear oil, and hydraulic oil.
72. **Lead-Acid Batteries** means batteries fueled by lead-acid cells, such as auto batteries.
73. **Household Batteries** means batteries such as AA, AAA, D, button cell, 9 volt, and rechargeable batteries used for flashlights, small appliances, watches, and hearing aids.
74. **Sharps** means hypodermic needles, pen needles, intravenous needles, lancets, and other devices that are used to penetrate the skin for the delivery of medications derived from sources other than medical facilities. Note: This type was defined as Remainder/Composite Household Hazardous in the 1999-2000 Study.
75. **Pharmaceuticals** means both prescription and over-the-counter medications and supplements in all forms, including pills, liquid medications, creams, and ointments. Does *not* include containers for these items, except for tubes for creams and ointments and other containers that cannot be easily separated from the product they contain. Note: This type was defined as Remainder/Composite Household Hazardous in the 1999-2000 Study.
76. **CFL, Fluorescent Tube and Other Mercury-Containing Items** means both compact and tube-style fluorescent lights, thermostats, thermometers, and other items that are readily identifiable as containing mercury. Since some mercury-containing items are not identifiable in the field, data for this material type should not be considered to be comprehensive. Note: This type was defined as Remainder/Composite Household Hazardous in the 1999-2000 Study.
77. **Remainder/Composite Household Hazardous** means household hazardous material that cannot be put in any other type. This type includes household hazardous material that is mixed.

Special Waste

78. **Ash** means a residue from the combustion of any solid or liquid material. Examples include ash from fireplaces, incinerators, biomass facilities, waste-to-energy facilities, and barbecues. This type also includes ash and burned debris from structure fires.
79. **Sewage Solids** means residual solids and semi-solids from the treatment of domestic waste water or sewage. Examples include biosolids, sludge, grit, screenings, and septage.
80. **Industrial Sludge** means sludge from factories, manufacturing facilities, and refineries. Examples include paper pulp sludge, and water treatment filter cake sludge.
81. **Treated Medical Waste** means medical waste that has been processed in order to change its physical, chemical, or biological character or composition, or to remove or reduce its harmful properties or characteristics, as defined in Section 25123.5 of the Health and Safety Code.
82. **Bulky Items** means large hard to handle items that are not defined elsewhere in the material types list, including furniture such as couches and chairs, mattresses and other large items.

83. **Tires** means vehicle tires.

84. **Remainder/Composite Special Waste** means special waste that cannot be put in any other type. Examples include asbestos-containing materials such as certain types of pipe insulation and floor tiles, auto fluff, auto bodies, trucks, trailers, truck cabs, untreated medical waste, and artificial fireplace logs.

Mixed Residue

85. **Mixed Residue** means material that cannot be put in any other type. This type includes mixed residue that cannot be further sorted. Examples include clumping kitty litter, cosmetics, and residual material from a materials recovery facility or other sorting process that cannot be put in any other material type, including remainder/composite types.

Electronics

86. **Brown Goods** means generally larger, non-portable electronic goods that have some circuitry. Examples include microwaves, stereos, VCRs, DVD players, large radios, and audio/visual equipment. Does not include items with video display devices. Note: This type was defined as Remainder/Composite Metal in the 1999-2000 Study.

87. **CRT** means items containing a cathode ray tube (CRT). Includes televisions, computer monitors, and other items containing a CRT. Note: This type was defined as Remainder/Composite Glass in the 1999-2000 Study.

88. **Computer-Related Electronics** means towers, laptops, and portable computers and computer peripherals (keyboard, mice, printers, disc drives, etc.). Note: This type was defined as Remainder/Composite Metal in the 1999-2000 Study.

89. **Other Consumer Electronics** means small electric appliances that cannot be put in any other type. Examples include power tools, curling irons, smoke detectors, and anything else that runs with a plug or battery. Note: This type was defined as Remainder/Composite Metal in the 1999-2000 Study.

90. **Video Display Devices (non-CRT devices)** means items with video displays larger than 4 inches. Includes portable DVD players and non-CRT televisions (such as LCD televisions). Note: This type was defined as Remainder/Composite Glass in the 1999-2000 Study.

Appendix B. Example Field Forms

This appendix contains examples of the field forms used throughout the study:

- Vehicle Selection Sheet for Pre-Selected Loads
- Vehicle Selection Sheet for Self-haul Loads
- Sample Placard
- Sample Tally Sheet
- Visual Characterization Form
- Greenery Sample Tally Sheet

All example field forms will be updated to match field specifications for the City of San Diego's Waste Characterization Study. Figure 5 provides a data map detailing all pertinent information to include on the field forms.

Figure 5. Data Map of Details to Include on Field Forms

Data Map			
Field Form	**Notes**		**Items to include**
Vehicle Selection Sheet	pre-selected, the City, franchised haulers (MF, Com, Military)		**Heading**: Date, Total Sample Count/day **Column Headings**: Truck Number, Hauler, Substream (Res, Com, Military, self-haul, Green), Strata (SF w/ Rec and Yard, etc.) # of samples, Comments/Notes (If pre-selecting explain any necessary info. If self-haul survey frequency), C&D (Y or N) if Y, new construction, demo, etc?
	self-haul	military self-haul (C&D or MSW))	
		self-haul (non-military) quota sampling taken into account	
Sample Placard	self-haul ->	scalehouse will mark vehicle type and sector and C&D or not	Date, Vehicle type, Sector (res, com, military), sample ID, Cell, C&D (Y or N), If C&D new construction, demo, etc.
	military ->	scalehouse will designated 32nd St. base or not	Date, Hauler, Substream, Strata, sample ID, Cell, Tip#, Route #, Truck #, C&D (Yor N)
	the City and franchised haulers		Date, Hauler, Substream, Strata, sample ID, Cell, Tip#, Route #, Truck #, C&D (Yor N), If C&D new construction, demo, etc.
Sample Tally Sheet			Date Collected, Date Sorted, Sample ID #, Substream, Strata, Hauler, Truck #, Material Class, Material Type VOLUME
Visual Characterization Form			Date, Sample ID #, Net weight, Volume (Total, and length, width, depth) Substream (City dept, com, military, res) Vehicle type (Flate Rate, Sm/Med Trailer, etc.), C&D (Y or N) -> If C&D - new construction, demo, etc. Material Classs, Material Types

Figure 6. Vehicle Selection Sheet for Pre-Selected Loads

Vehicle Selection Sheet **Saturday, February 25, 2012**

Seattle Commercial Waste Composition Study **SRDS**

Sample ID	Sector	Zone	Hauler	Truck No.	Truck Type	Driver	Route	Notes/Biz Names
	COM	4	WM	362945	RL	Joe	A62A	
	COM	4	WM	362945	RL	Joe	A62N	
	COM	4	WM	333221	FL	Don	A21A	
	COM	4	WM	333222	FL	Shawn	A20A	
	COM	2	CS	2006	FL	William	220-S	
	COM	2	CS	3051	RL	Duke	240-S	
	COM	3	CS	2003	FL	Antonio	220-S	
	COM	3	CS	3022	RL	William	240-S	
	COM	2	CS	5005/5006	RO	Kevin/Sam		Travel Lodge
	COM	2	CS	5005/5006	RO	Kevin/Sam		Cascade Properties
	COM	2	CS	5005/5006	RO	Kevin/Sam		Fred Meyers
	COM	3	CS	5005/5006	RO	Kevin/Sam		Virginia Mason Hospital
	COM	3	CS	5005/5006	RO	Kevin/Sam		Seattle Biotech
	COM	3	CS	5005/5006	RO	Kevin/Sam		Oceania Seafood
	COM	4	WM	413029	RO	Donnie		Marine Services Inc
	COM	4	WM	413029	RO	Donnie		Costco
	COM	4	WM	413029	RO	Donnie		Amtrak

Today's Sampling Plan: 7 Packers and 8 Roll-offs

Figure 7. Vehicle Selection Sheet for Self-haul Loads

SEATTLE WASTE COMPOSITION STUDY
Vehicle Selection Form

Site: **SRDS**

Date: **Sunday, February 26, 2012**

Cross off one number for each vehicle entering the station (**both trucks and passenger vehicles**).

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

Continue for each block on the next line until the required number of vehicles is sampled.

SELF-HAUL GARBAGE ONLY **NEED 18 VEHICLES - PLS. SAMPLE EVERY 7TH VEHICLE**

1	2	3	4	5	6	(7)	
8	9	10	11	12	13	(14)	
15	16	17	18	19	20	(21)	
22	23	24	25	26	27	(28)	
29	30	31	32	33	34	(35)	
36	37	38	39	40	41	(42)	
43	44	45	46	47	48	(49)	
50	51	52	53	54	55	(56)	
57	58	59	60	61	62	(63)	
64	65	66	67	68	69	(70)	
71	72	73	74	75	76	(77)	
78	79	80	81	82	83	(84)	
85	86	87	88	89	90	(91)	
92	93	94	95	96	97	(98)	
99	100	101	102	103	104	(105)	
106	107	108	109	110	111	(112)	
113	114	115	116	117	118	(119)	
120	121	122	123	124	125	(126)	

Figure 8. Sample Placard

<table>
<tr><td rowspan="4">Facility: Hawthorne St.</td><td rowspan="4">Hauler: Arcata</td><td colspan="2">Jurisdiction:
Arcata</td><td>Cell: 10</td></tr>
<tr><td>Tip #
2</td></tr>
<tr><td>Route #</td></tr>
<tr><td colspan="2">Sector:
Commercial</td><td>Truck:
<u>14</u></td></tr>
<tr><td colspan="2">Date:2/14/2011</td><td>Sample ID:
Com-1</td></tr>
</table>

Figure 9. Sample Tally Sheet, Front

Tally Sheet - Page 1

2011 Humboldt County Waste Composition Study

PAPER	Uncoated Corrugated Cardboard				
	Waxed Corrugated Cardboard				
	Paper Bags				
	Newspaper				
	White Ledger Paper				
	Other Office Paper				
	Magazines and Catalogs				
	Phone Books and Directories				
	Single Use Paper Cups				
	Other Recyclable Paper				
	Compostable Paper				
	Remainder/Composite Paper				

PLASTIC	PETE Water Bottles				
	Other PETE Containers				
	HDPE Containers				
	EPS Single-Serve Food Service				
	#3-#7 Other Containers				
	Compostable Plastics				
	Plastic Trash Bags				
	Plastic Groc. & Other Merch. Bags				
	Non-Bag Industrial Pack. Film				
	Plastic Film Products				
	Other Film				
	Rigid Plastic Drip Lines				
	Other Recyclable Rigid Plastic				
	Other Non-Recyc. Rigid Plastic				
	Remainder/Composite Plastic				

METAL	Tin/Steel Cans				
	Major Appliances				
	Used Oil Filters				
	Other Ferrous				
	Aluminum Cans				
	Other Non-Ferrous				
	Mixed Recoverable Metal				
	Remainder/Composite Metal				

GLASS	Clear Glass Containers				
	Green Glass Containers				
	Brown Glass Containers				
	Other Colored Glass Cont.				
	Flast Glass				
	Remainder/Composite Glass				

OTHER ORGANIC	Food				
	Leaves and Grass				
	Prunings and Trimmings				
	Branches and Stumps				
	Manures				
	Textiles				
	Carpet				
	Animal Carcasses				
	Remainder/Composite Organic				

ELECTRONICS	Brown Goods				
	Computer Related Elec.-Large				
	Computer Related Elec.-Small				
	Other Small Consumer Elec.				
	Video Display Devices				

DATE **TIME**

JURISDICTION ☐ **Photo?**

SAMPLE #

HAULER **TRUCK #**

IF THIS IS A ROLL OFF, WHERE IS THE BOX HAULED FROM (SAFEWAY, ETC.)?

Figure 10. Sample Tally Sheet, Back

2011 Humboldt County Waste Composition Study

Tally Sheet - Page 2

INERTS AND OTHER	Concrete				
	Asphalt Paving				
	Asphalt Composition Shingles				
	Roofing Tar Paper/Felt				
	Roofing Mastic				
	Build Up Roofing				
	Other Asphalt Roofing Material				
	Clean Dimensional Lumber				
	Clean Engineered Wood				
	Clean Pallets and Crates				
	Other Wood Waste				
	Clean Gypsum Board				
	Painted Gypsum Board				
	Rock, Soils, Fines				
	Remainder/Composite Inerts				
HHW	Paint				
	Vehicle and Equipment Fluids				
	Used Oil				
	Lead Acid (Automotive) Batteries				
	Other Batteries				
	Sharps				
	Pharmaceuticals				
	Fluorescent Lights/Other Mercury				
	Other Non-Incandescent Lights				
	Magnetic Lighting Ballasts				
	Electrical Lighting Ballasts				
	Remainder/Composite HHW				
SPECIAL WASTE	Ash				
	Treated Medical Waste				
	Mattresses				
	Bulky Items				
	Vehicle and Truck Tires				
	Other Tires				
	Remainder/Composite HHW				
	MIXED RESIDUE				

NOTES:

Revised 2/9/11

If Found, Please Call Cascadia Consulting Group at 206 343 9759.

Figure 11. Visual Characterization Form

Step 1:

Jurisdiction: _____

Activity Type and generator: (Ask Driver then circle)

RES NON-RES

New Const. Remodel Demo Roof.

Step 2: Measure & record load volume.
(Include trailer dimensions if applicable.)

Dimensions:

_____in x _____in x _____in

_____in x _____in x _____in (trailer)

Step 3 : Photograph Sample

Step 4: Identify and record all broad material categories (in bold) that appear in the load.

Step 5: Estimate composition of load by volume for each broad material category (in bold).

Step 6: For each material category, estimate comp by volume of each material component.

Step 7: Make sure material categories AND material component EACH total 100%.

☐ **Paper: _____%**

	Uncoated Corrugated Cardboard
	Waxed Corrugated Cardboard
	Paper Bags
	Newspaper
	White Ledger Paper
	Other Office Paper
	Magazines and Catalogs
	Phone Books and Directories
	Single-use Paper Cups
	Other Recyclable Paper
	Compostable Paper
	Remainder/Composite Paper
%	***Subtotal (must equal 100%)***

☐ **Glass: _____%**

	Clear Bottles & Cont.
	Green Bottles & Cont.
	Brown Bottles & Cont.
	Other Bottles & Cont.
	Flat Glass
	Remainder/Composite Glass
%	***Subtotal (must equal 100%)***

☐ **Plastics: _____%**

	PETE Water Bottles
	Other PETE Containers
	HDPE Containers
	Single-use EPS Food Service
	#3-#7 Other Containers
	Compostable Plastics
	Trash Bags
	Grocery and Other Merch Bags
	Non-Bag Com/Indus Packaging Film
	Film Products
	Other Film
	Rigid Plastic Drip Lines
	Other Recyclable Rigid Plastic
	Other Non-recyc, Rigid Plastics
	Remainder/Composite Plastic
%	***Subtotal (must equal 100%)***

☐ **Electronics: _____%**

	Brown Goods
	Computer Related Electronics-Large
	Computer Related Electronics-Small
	Other Small Consumer Electronics
	Video Display Devices
%	***Subtotal (must equal 100%)***

☐ **Metal: _____%**

	Tin/Steel Cans
	Major Appliances
	Used Oil Filters
	Other Ferrous
	Aluminum Cans
	Other Non-Ferrous
	Mixed Recoverable Metals
	R/C Metal
%	***Subtotal (must equal 100%)***

☐ **Other Organic: _____%**

	Food
	Leaves and Grass
	Prunings and Trimmings
	Branches and Stumps
	Manures
	Textiles
	Carpet
	Animal Carcasses
	R/C Organics
%	***Subtotal (must equal 100%)***

☐ **Inerts and Other: _____%**

	Concrete
	Asphalt Paving
	Asphalt Composition Shingles
	Roofing Tar Paper/Felt
	Roofing Mastic
	Built-up Roofing
	Other Asphalt Roofing Material
	Clean Dimensional Lumber
	Clean Engineered Wood
	Clean Pallets and Crates
	Other Wood Waste
	Clean Gypsum Board
	Painted/Demolition Gypsum
	Rock, Soil and Fines
	R/C Inerts and Other
%	***Subtotal (must equal 100%)***

☐ **Special Waste: _____%**

	Ash
	Treated Medical Waste
	Mattresses
	Bulky Items
	Vehicle and Truck Tires
	Other Tires
	R/C Special Waste
%	***Subtotal (must equal 100%)***

☐ **Household Hazardous Waste: ____%**

	Paint
	Vehicle and Equipment Fluids
	Used Oil
	Lead-acid (automotive) batteries
	Other batteries
	Sharps
	Pharmaceuticals
	Fluor. Lights/Other Mercury-containing Items
	Other Non-incandescent Lights
	Magnetic Lighting Ballasts
	Electrical Lighting Ballast
	Remainder/Composite HHW
%	***Subtotal (must equal 100%)***

☐ **Mixed Residue/MSW: _____%**

	Mixed Residue
%	***Subtotal (must equal 100%)***

Grand Total:_____%
(Must equal 100%)

NOTES: _____

Figure 12. Greenery Sample Tally Sheet

2012 San Diego Waste Composition Study
Greenery Sample Tally Sheet

Date: _____

Sample ID: _____

Load Net Weight: _____

Route #: _____

Load #: _____

	Weight A	Weight B	Weight C	Weight D
Compostables				
Acceptable compostables				
Minor Contaminants				
Paper contaminants				
Plastic contaminants				
Metal contaminants				
Major Contaminants				
Glass & Ceramic				
Non-compostable organics				
Hazardous items				
Bagged garbage (MSW)				
Large metal appliances & equipment				
Other Contaminants				
Other Contaminants				

Appendix C. Field Health and Safety Plan

Cascadia Consulting Group, Inc.'s health and safety plan is detailed below.

1. RESPONSIBILITY

HR has the responsibility for implementing and maintaining the Health and Safety Program for Cascadia Consulting Group, Inc. Cascadia supervisors and project managers are responsible for implementing and maintaining safe working practices in their work areas and for answering worker questions about the Health and Safety Plan. A copy of this Health and Safety Plan is provided to all Cascadia Consulting Group, Inc. employees on the intranet (under the HR tab) and reviewed with new employees during the onboarding process.

The Cascadia Consulting Group, Inc. Health and Safety Plan is not a static plan. As conditions and situations arise, this Health and Safety Plan will be updated and augmented in accordance to OSHA and MSHA standards.

2. COMPLIANCE

All workers, including supervisors, are responsible for complying with safe and healthful work practices. Our goal is to ensure that all Cascadia Consulting Group, Inc. workers understand and comply with these practices. To accomplish this, our procedures include informing workers of the provisions of our program via training of current staff and onboarding of new staff, evaluating the on-going safety performance of all workers, and providing additional training to workers whose safety performance may be deficient.

The employees of Cascadia Consulting Group, Inc. often perform their duties as visitors to disposal facilities. The procedures described in our program in no way supersede requirements which may already be in place at these facilities. Instead, this plan is designed to augment and work in conjunction with any site safety plans in place at these facilities. We follow all facility safety requirements that are more stringent than our own. When our safety procedures exceed those of our host, workers must follow our procedures, regardless of whether the host facility has any such requirements.

3. COMMUNICATION

Cascadia Consulting Group, Inc. is committed to providing a safe work environment for all of its workers. All supervisors and/or project managers are responsible for communicating with all workers about occupational safety and health in a form readily understood by all workers. Workers are encouraged to inform their supervisors and/or HR about workplace hazards without fear of reprisal. If you discover something that could cause injury, or is unsafe, tell your manager or supervisor immediately. Cascadia Consulting Group, Inc. routinely communicates with and instructs employees about general safe work practices and hazards unique to each employee's job assignment. Our overall communication system includes the following elements:

- New worker orientation, which includes a discussion of safety and health policies and procedures

- Worker training in the specific protocols of our field procedures
- Scheduled and "tailgate" safety meetings
- Posted or distributed safety information
- Periodic review of our Health and Safety Program

The employee's supervisor is responsible for ensuring that all field personnel have read, and understood, the master copy of this Health and Safety Plan document, and that all workers have received orientation and training in the safety protocols to be followed in conducting our work.

Each supervisor and project manager has the duties and responsibilities to:

- Ensure that the procedures in this document are followed.
- Be familiar with local emergency services, and maintain a list of emergency phone numbers.
- Conduct "tailgate" health and safety meetings to notify workers of any changes in safety protocol.
- Inspect personal protective equipment and to ensure proper use of such equipment.
- Monitor on site hazards and the early health warning signs (e.g., heat stress/stroke, dehydration, or fatigue) of site personnel.
- To stop unsafe operations, and to summon emergency services when needed.

The supervisor and/or project manager will brief workers on health and safety protocols particular to the host site. This will include emergency evacuation and rally point information, to ensure that, in the event of an emergency, all Cascadia Consulting Group, Inc. workers will adhere to site-specific evacuation and management procedures.

4. HAZARD ASSESSMENT AND PREVENTION

We perform assessments of possible work hazards, and the procedures to work safely around them, when:

- New substances, processes, procedures or equipment that present potential new hazards are introduced into our workplace.
- New, previously unidentified hazards are recognized.
- Workplace conditions warrant an assessment.
- When occupational injuries and illnesses occur.

On a daily basis, supervisors and/or project managers are to identify and evaluate workplace hazards which may be present at each work site. We routinely encounter the same day-to-day risks when we conduct our work. Yet, each facility is different, and may present unique hazards that can affect us. These are some possible hazards that may occur during our work:

Physical hazards:

- Cuts and punctures
- Lifting
- Slipping and falling
- Heat stress and fatigue
- Traffic or heavy equipment movement
- Noise exposure

- Animal and/or insect bites

Airborne contaminants:

- Dust and windblown debris

Chemical hazards:

- Liquid spills from containers
- Household and hazardous chemicals

Biological hazards:

- Household hazardous wastes
- Medical wastes
- Blood/body fluid contaminated items
- Hypodermic needles

Vaccinations

Due to the nature of waste composition sampling, exposures to airborne pathogens and subcutaneous introduction of pathogens are possible. In accordance with OSHA regulations, Cascadia employees who will be performing work in which they may be exposed to airborne pathogens and subcutaneous introduction of pathogens will be offered tetanus and hepatitis B vaccines at the cost of Cascadia Consulting Group, Inc. An employee may decline to accept the vaccination by signing a statement acknowledging: (1) that he or she understands that he or she is at risk of acquiring the hepatitis B virus infection; (2) that he or she has been given the opportunity to be vaccinated at no charge; and (3) that he or she is declining the vaccination at the present time, but understands that if he or she continues to be at risk, he or she will still be able to receive the vaccination series at no charge.

5. ACCIDENT/EXPOSURE INVESTIGATIONS

Procedures for investigating workplace accidents and hazardous substance exposures include:

- Interviewing injured workers and witnesses.
- Examining the workplace for factors associated with the accident/exposure.
- Determining the cause of the accident/exposure.
- Taking corrective action to prevent the accident/exposure from reoccurring.
- Recording the findings and actions taken.

6. HAZARD CORRECTION

Timely corrective action will be taken to remedy an unsafe condition, practice or procedure. When an imminent hazard exists which cannot be immediately abated without endangering employee(s) and/or property, we will remove all exposed workers from the area.

7. TRAINING AND INSTRUCTION

All Cascadia Consulting Group, Inc. workers, including supervisors, shall have training and instruction on general and job-specific safety and health practices. Training and instruction is provided:

- To all new workers who will be performing field work.
- To all workers given new job assignments for which training has not previously provided.
- Whenever new substances, processes, procedures or equipment are introduced to the workplace and represent a new hazard.
- Whenever Cascadia Consulting Group, Inc. is made aware of a new or previously unrecognized hazard.
- To supervisors to familiarize them with the safety and health hazards to which workers may be exposed.
- To all workers with respect to hazards specific to each employee's job assignment.

Cascadia Consulting Group provides for its workers the proper safety equipment for performance of duties associated with waste sampling. These items include:

- Coveralls or protective outer wear (optional)
- Rubber gloves and liners (required)
- Lower back support apparatus (optional)
- Hearing protection (optional/based on site requirements)
- Safety glasses (optional/based on site requirements)
- Reflective safety vests (required)
- Hard hats and liners (required)
- Knee pads (optional)
- Tetanus and hepatitis B vaccinations (required/or sign waiver)

During the conduct of our fieldwork, the following personnel health and safety guidelines are to be followed:

- Be in good physical condition, maintain a current tetanus booster and hepatitis B shot, and not be over-sensitive to odors and dust.
- Be able to communicate in English, and be able to read warning signs/labels.
- Routinely check personal protective equipment and work clothing for proper fit and condition; replace or repair defective items immediately.
- Always look at what you are picking up or sorting – the most effective way to prevent cuts and punctures is to see what you are handling. Use a small rake or shovel to move material around for sorting.
- Lift properly, and ask for assistance when lifting heavy or bulky items.
- Be on the lookout for slipping and tripping hazards.
- Do not attempt to identify unknown chemical substances in unlabeled containers; never sniff anything to see what it is.
- Wash hands and face before eating or drinking.
- Smoke only in designated areas.
- Consume plenty of fluids during hot days, and watch for signs of heat-related illness, both in yourself and your crewmates.
- Be aware of your surroundings and alert to the possibility of unexpected hazards.
- Alert your supervisor if you feel ill, overly fatigued, or injured.
- Treat even minor cuts and injuries immediately.