



California State University East Bay WASTE AUDIT AND INVENTORY

FINAL REPORT

Prepared by Cascadia Consulting Group, Inc.

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**CALIFORNIA STATE
UNIVERSITY**
EAST BAY



EXECUTIVE SUMMARY

California State University East Bay (CSU EB) engaged Cascadia Consulting Group (Cascadia) in the fall of 2015 to evaluate the performance of the University's current waste and recycling programs at its Hayward and Concord campuses. CSU EB commissioned the study with the following CSU waste management goals in mind:

- Address regulatory and institutional priorities aimed at increasing waste diversion from the landfill;
- Develop strategies to enable the university to achieve net zero waste in the future;
- Develop a Request for Proposal (RFP) for a new waste hauler;
- Reduce labor and material costs associated with materials management;
- Set up programs to increase collection of green waste and other organics; and
- Improve or enhance the education and communications provided to staff, students, and faculty about existing and new materials management operations and programs.

Cascadia began with a Phase 1 of the project in October of 2015, during which we focused on establishing a baseline understanding of CSU EB's current garbage, recycling, and organics landscape. This effort consisted of two tasks:

- (1) **Waste Inventory:** Cascadia conducted an onsite and desktop inventory of the placement, size, service schedule, and generation amounts of garbage, recycling, and organics (compost) containers on the CSU EB Hayward and Concord campuses.
- (2) **Waste Audit:** With the help of several enthusiastic CSU EB staff members and students, Cascadia orchestrated a waste audit that included collecting waste samples, hand-sorting material into predetermined categories, and recording composition data for each of the three waste streams on both campuses to develop a composition baseline and identify opportunities for higher diversion.

During **Task 1: Waste Inventory**, Cascadia found that:

- CSU EB may be overestimating its waste diversion rate by up to 13.1%, primarily due to overestimates of recycling generation.
- There is inconsistency in bin signage around campus.
- Most containers are below capacity when serviced.
- There are discrepancies between how bins on the Hayward campus are classified on operations maps and how they are labeled and/or serviced. Several of the containers designated as recycling on campus maps and colored as recycling containers by Waste Management (WM) are in fact labeled as garbage containers and/or contain materials that were clearly intended for the garbage.

During **Task 2: Waste Audit**, Cascadia made the following observations about CSU EB's waste streams:

- **Garbage Stream:** Nearly 80% of the materials in the garbage could be either recycled or composted. Food, food-soiled paper, recyclable plastic, and recyclable metal are the most common recoverable materials in the

garbage. Academic buildings, administration buildings, and dining commons have the highest potential for more diversion of recoverable materials currently in the garbage.

- **Recycling Stream:** Over 30% of the materials in the recycling are not recyclable. Food, food-soiled paper, waxed cardboard, and non-recoverable residuals (including plastic film and composite materials) are the most common contaminants in the recycling. Dining commons, student housing (apartment), and academic buildings have the highest potential for reduced contamination in the recycling stream.
- **Organics Stream:** Over 22% of the materials in the recycling stream are not compostable. Residuals (including latex gloves, composite materials, and plastic utensils) and cardboard are the most common contaminants in the organics stream.

With leadership support for an improved and efficient approach to managing waste, and committed and enthusiastic staff ready to create and implement new methods for increasing waste diversion, CSU EB is in a unique position to take a big step forward on its journey towards zero waste. Based on the results of our waste inventory and audit, Cascadia recommends the following next steps:

- Clarify WM's collection and processing practices.
- Optimize infrastructure and internal operations.
- Use the information that this report provides to inform a waste collection service provider RFP that reflects the campuses' current and future waste needs and goals.
- Develop an education plan that prioritizes the generator areas with the largest opportunity for waste diversion.
- Develop a plan for ongoing visual monitoring of container fullness levels and composition.

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INTRODUCTION

PROJECT BACKGROUND

California State University East Bay (CSU EB) engaged Cascadia Consulting Group (Cascadia) in the fall of 2015 to evaluate the performance of the University's current waste and recycling programs at its Hayward and Concord campuses. CSU EB commissioned the study with the following CSU waste management goals in mind:

- Address regulatory and institutional priorities aimed at increasing waste diversion from the landfill;
- Develop strategies to enable the university to achieve net zero waste in the future;
- Develop a Request for Proposal (RFP) for a new waste hauler;
- Reduce labor and material costs associated with materials management;
- Set up programs to increase collection of green waste and other organics; and
- Improve or enhance the education and communications provided to staff, students, and faculty about existing and new materials management operations and programs.

METHODOLOGY

Cascadia began with a Phase 1 of the project in October of 2015, during which we focused on establishing a baseline understanding of CSU EB's current garbage, recycling, and organics landscape. We focused the majority of analysis on CSU EB's two main locations: the Hayward campus and the Concord campus. This effort consisted of two tasks:

- (1) **Waste Inventory:** Cascadia conducted an onsite and desktop inventory of the placement, size, service schedule, and generation¹ amounts of garbage, recycling, and organics (compost) containers on the CSU EB Hayward and Concord campuses. We also estimated waste generation at the Oakland campus using headcount data provided by CSU EB along with generation data collected during CalRecycle's 2008 Waste Characterization Study.
- (2) **Waste Audit:** With the help of several enthusiastic CSU EB staff members and students, Cascadia orchestrated a waste audit that included collecting multiple waste samples from generator areas throughout CSU EB's Hayward and Concord campuses over a week-long period, hand-sorting material into predetermined categories, and recording composition² data for each of the three waste streams³ to develop a composition baseline and identify opportunities for higher diversion. We did not conduct a waste audit at the Oakland campus given that generation at that campus is negligible and CSU EB shares containers there with other tenants

Diversion rate is a common metric used to measure the amount of waste that is being kept out of the landfill. For example, a 60% diversion rate means that 60% of all waste generated is either recycled, composted, reused, reduced, or otherwise processed to be kept out of a landfill.

¹ Generation refers to all waste produced, whether it is disposed or diverted.

² Composition data refers to the percentage (by weight) of audited waste that falls into the eleven pre-determined material categories used for this study.

³ A waste stream is any material output produced by CSU EB that is collected as garbage, recycling, or organics by the hauler.

The data from Phase 1 of this study provides CSU EB with an in-depth snapshot of the quantities and composition of waste generated in various locations around its campuses, and highlights currently disposed materials that could be diverted through improved recycling and composting programs and/or infrastructure and service changes.

TASK 1: WASTE INVENTORY

METHODOLOGY

Cascadia conducted a comprehensive inventory of CSU EB's existing waste data and operations, which included the following:

- Divide the CSU EB Hayward campus into groups of similar buildings, or generator areas;
- Review bills from Waste Management, the waste hauler for the CSU EB Hayward campus;
- Audit existing generation and diversion calculations performed by CSU EB; and
- Conduct one site visit to develop an inventory of existing container sizes, locations, and bin fullness to inform the Waste Audit sampling plan.

Cascadia then compared the waste generation and diversion data provided by CSU EB and WM with its own observed generation and diversion data.

GENERATOR AREAS

The CSU EB Hayward campus contains a wide variety of building types, each with its own waste needs. In order to facilitate the data collection process and aggregate the results of audits conducted for each container, Cascadia grouped the Hayward campus buildings into generator areas. A generator area is defined as a group of buildings that all have similar operations and waste profiles. Cascadia collaborated with CSU EB to define six generator areas on the CSU EB Hayward campus, and the project team decided to classify the Concord campus as a single generator area because of its small size and limited number of buildings. Cascadia and CSU EB staff agreed on the following generator areas for the Hayward and Concord campuses⁴:

- Academic
- Administration
- Athletics
- Dining Areas
- Student Housing (Dormitory)
- Student Housing (Apartment)
- Concord Campus

⁴ Given that we did not conduct a detailed waste inventory or audit at the CSU EB Oakland campus, we did not include an Oakland campus generator area in this list.

Figure 1 contains a map of the generator areas on the CSU EB Hayward campus, with an inset for the Concord campus.

Figure 1: Generator Areas

- Dining Commons + Food Court
- Academic
- Administration
- Student Housing (Apartment)
- Student Housing (Dormitory)
- Athletics
- Concord



CONTAINER OBSERVATIONS

Hayward

The Hayward campus has three primary waste streams – garbage, recycling, and organics – serviced by CSU EB’s contracted waste hauler, Waste Management (WM). There are 25 front load garbage containers and 24 front load recycling containers on campus. Frequency of service for these containers ranges from once per week to five times per week. The garbage and recycling containers in the student housing generator areas are primarily 2- and 3-yard bins, while the containers in other generator areas are primarily 4- or 7-yard bins. Although garbage and recycling are disposed of separately, CSU EB believes that WM collects most garbage and recycling containers simultaneously, deposits the material in the same truck, and then sorts both streams post-collection at WM’s Davis Street (San Leandro) material recovery facility.

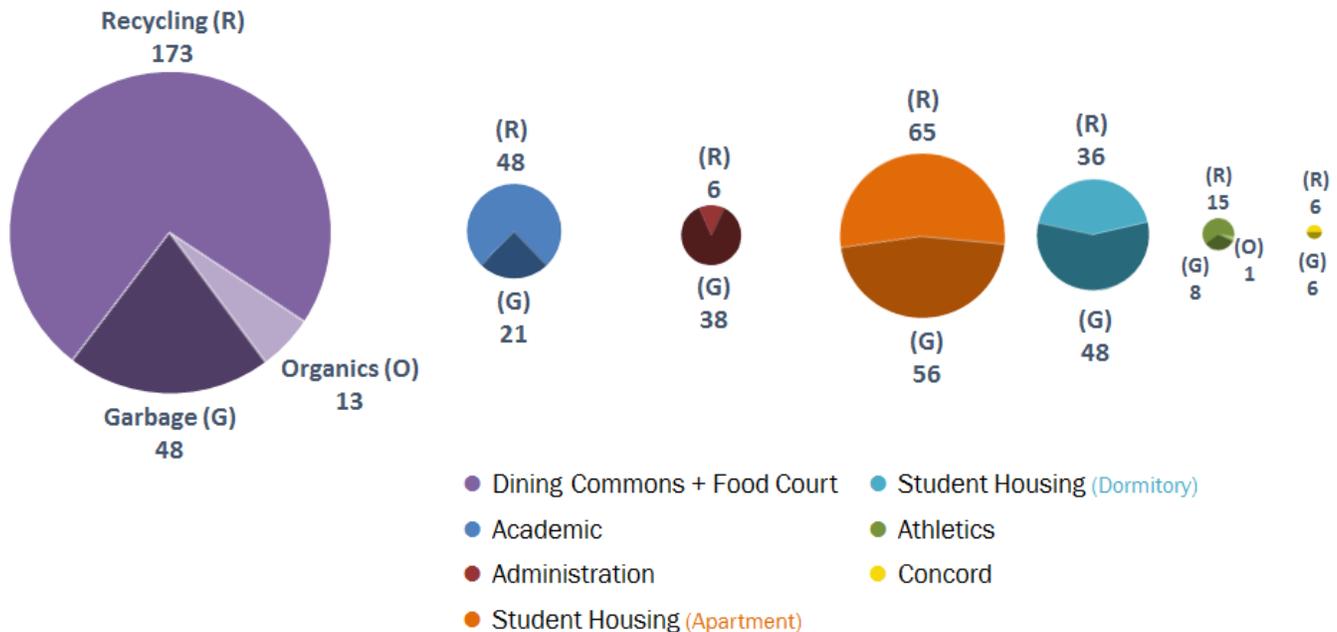
There are four organics bins on campus, ranging from 1- to 3-yards in size, located in or near food service areas.



Figure 2. Paired garbage (green) and recycling (white) containers.

Figure 3 displays the existing collection capacity for CSU EB by generator area. Student Housing (Apartment) and Student Housing (Dormitory) have the largest weekly garbage capacity, at 56 and 48 cubic yards per week, respectively. Dining Commons + Food Court areas have the largest weekly recycling capacity at 173 yards per week, followed by Student Housing (Apartment) at 65 yards per week. Dining Commons + Food Court areas and Athletics are the only areas on campus with organics capacity, at 13 and 1 yard per week, respectively.

Figure 3: Collection Capacity by Generator Area (cubic yards/week)



The Hayward campus also procures larger “roll-off” container service for specific material streams. These containers capture construction and demolition debris, metals, landscaping waste, wood waste, and any overflow of garbage or recycling that occurs during move-in or move-out periods. These bins are for on-call collection service; WM or another specialty hauler collects them when necessary.

During site visits, Cascadia noticed discrepancies between how bins on the Hayward campus are classified on operations maps and how they are labeled and/or serviced. Several of the containers designated as recycling on campus maps and colored as recycling containers by WM are in fact labeled as garbage containers and/or contain materials that were clearly intended for the garbage. See **Figure 4** for an example of this.

CSU EB informed Cascadia that the recycling containers serving the Dining Commons + Food Court and Student Housing (Apartment and Dormitory) areas may be collected and processed as recycling. Therefore, it is not generally clear how the Hayward campus recycling containers are collected and their contents processed.



Figure 4. Recycling bin outside Meiklejohn that is used for garbage (based on Cascadia’s observations during the waste audit)

Concord

The Concord satellite campus contracts with Concord Disposal Services (CDS), a local hauler, for collection of all waste streams. In addition to garbage, CDS collects cardboard, mixed paper, and beverage containers, each of which has a separate collection container. CDS does not offer organics collection service. **Figure 5** shows the central waste collection area at the Concord campus.

Figure 5. Concord campus collection area.



ASSUMED WASTE GENERATION AND DIVERSION

CSU EB provided Cascadia with estimates of current waste generation tonnages and diversion rates for the Hayward campus in MS Excel spreadsheets supplied by WM. These include exact generation tonnages for any roll-off containers (which Cascadia incorporated into our updated calculations) and estimated generation tonnages for front load containers based on the following volumetric assumptions:

- All bins are 100% full when serviced
- Bin sizes and service frequencies match hauler bills

Based on these volumetric assumptions and the density factors outlined in **Table 1**, WM and CSU EB calculate campus-wide generation tonnages, which we refer to throughout this report as *assumed* generation.⁵ The assumed monthly generation of garbage on the Hayward campus ranged from 164 tons (in December 2014) to 236 tons (in May 2015), with an average of 204 tons/month. The assumed monthly generation of divertible material (recycling, green waste, compostable materials, and construction and demolition debris) ranged from 108 tons (December 2014) to 170 tons (May 2015).

Density factors are used to convert volumes to weight. These factors are based on statistical averages of waste samples from material streams generated by entities similar to CSU EB. Most density factors are presented in pounds per cubic yard (lbs./CY).

⁵ Assumed generation and diversion are based on data reported by WM and/or CSU EB.

CSU EB uses this generation data to calculate a monthly diversion rate to track its overall performance. The CSU EB Hayward campus’ assumed diversion rate from July 2014-June 2015 (the most recent 12-month period for which CSU EB provided data) was **67.8%**, which includes all on-call roll-off containers.

OBSERVED WASTE GENERATION AND DIVERSION

After having reviewed CSU EB’s and WM’s assumed generation and diversion data, Cascadia then calculated its own waste generation and diversion numbers using data we collected during two sets of visits: an on-site visit prior to the full waste audit, and a 4-day waste audit. The data Cascadia collected and analyzed during these visits represents a snapshot of CSU EB’s current disposal and diversion efforts. The sample weeks we selected are representative of typical campus operations – they occurred during the fall academic quarter and did not overlap with any holidays or special events. We also incorporated tonnage data for the extra roll-off containers that CSU EB orders every year during peak waste-generation times (e.g. during student move-in or move-out weeks) in our diversion rate calculation. However, due to the highly variable nature of university operations, there will be natural fluctuations in waste generation and diversion throughout the year that Cascadia’s waste inventory and audit cannot capture. Throughout this report, we refer to the data that Cascadia collected as *observed* generation and diversion data.⁶

To calculate observed generation, Cascadia converted observed material volumes to tonnages using our own density factors. While WM’s assumed generation data is based on generic density factors, Cascadia’s observed generation calculations are based on density factors tailored to the individual waste streams on campus; we have developed these density factors based on 20 years of industry weight and volume data collected from sites in dozens of industries. Although the differences between WM’s density factors and Cascadia’s density factors seem small, when extrapolated to annual generation amounts they can have a drastic impact. **Table 1** contains the WM and Cascadia density factors.

Table 1. Waste Management and Cascadia Density Factors

Stream	Waste Management Density Factors (lbs./CY)	Cascadia Density Factors (lbs./CY)	Notes
Garbage	200	(a) 123.9 (b) 157.1	Cascadia (a) used for non-student housing buildings Cascadia (b) used for student housing
Recycling	150	(a) 87.6 (b) 95.8	Cascadia (a) used for non-student housing buildings Cascadia (b) used for student housing
Organics	320	427.0	
Paper	-	158.0	Concord only
Beverage Containers	-	141.7	Concord only
Cardboard	-	53.0	Concord only

Figure 6 shows observed weekly generation (including garbage, recycling, and organics) by generator area for CSU EB overall. CSU EB collectively generates over 19 tons of waste each week. The Dining Commons + Food Court generator area has the highest weekly generation rate at 6.6 tons per week. The Academic generation area has the second highest weekly generation rate (4.1 tons/week), followed by Administration (2.6 tons/week) and Student Housing (Apartment) (2.5 tons/week).

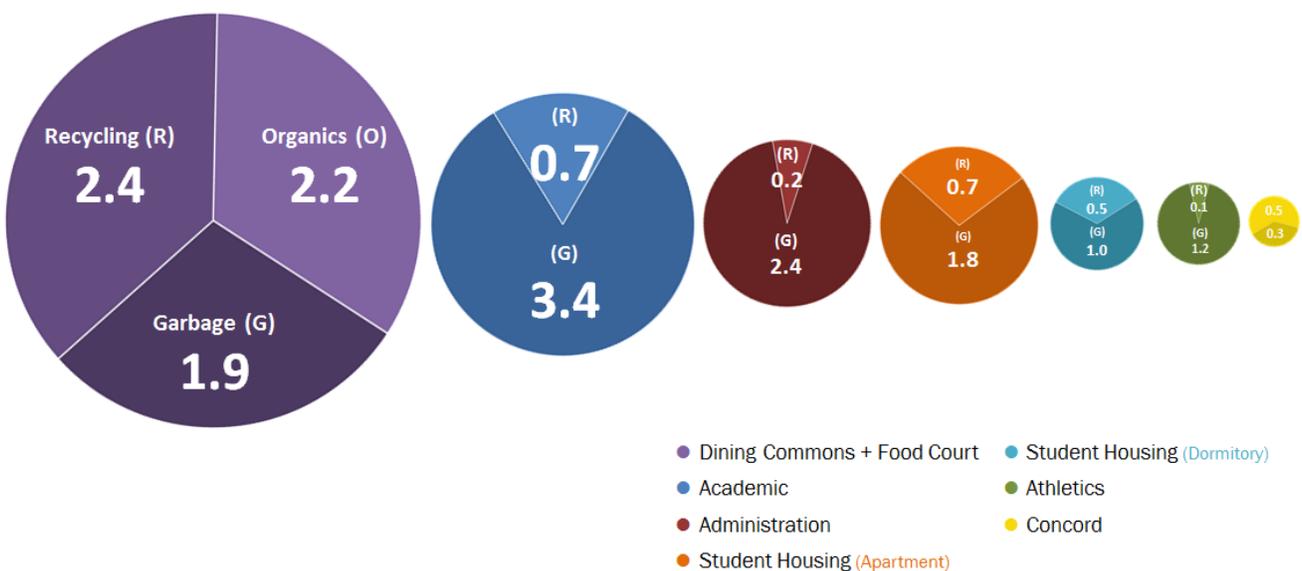
⁶ Observed generation and diversion: waste generation and diversion calculations based on data that Cascadia collected during site visits and bin fullness audits

Figure 6: Observed waste generation by generator area (tons/week)



Figure 7 displays the observed weekly generation by generator area and waste stream for CSU EB overall. Garbage is the largest individual stream (11.9 tons per week, or 62% of total generation), followed by recycling (5.1 tons/wk, or 27%). Organics (2.2 tons/wk, or 11%) is the smallest stream. Food and food-soiled paper – the two most commonly-found divertible materials in CSU EB’s garbage stream – could be diverted if collected in the organics stream.

Figure 7: Waste generation by generator area and waste stream (tons/week)

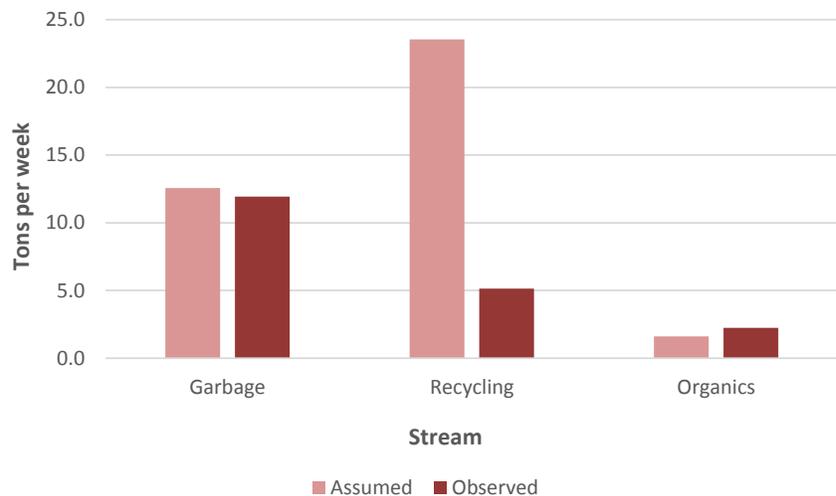


ASSUMED VS. OBSERVED GENERATION AND DIVERSION

Figure 8 displays the differences between assumed⁷ and observed⁸ weekly generation amounts by waste stream.

Assumed garbage generation is similar to observed garbage generation; similarly, assumed organics generation is similar to observed organics generation. Assumed recycling generation, on the other hand, is significantly higher than observed recycling generation.

Figure 8. Assumed vs. Observed Generation by Stream



Assumed and observed generation tonnages are different for three primary reasons. First, WM’s assumed generation estimates are based on the assumption that all bins are 100% full when collected; however, when Cascadia visited the CSU EB Hayward campus, we found that most containers were below capacity on the day of service. Second, WM’s density factors for recyclable materials are substantially higher than Cascadia’s. Third, WM’s data does not take into account the fact that generation is substantially lower during school vacations and other times when classes are not in session or are on diminished schedules; as a result, it overestimates generation throughout the year. Fourth, assumed recycling generation is inflated because two recycling bins that are intended for the new administration building are in a temporary enclosure near Einstein’s Bagels, which is the only customer currently using these containers; it is likely that observed generation will increase as the new building’s occupants begin using these containers.

There is a similar discrepancy in diversion data: the observed diversion rate on the Hayward campus is 54.7%, which is 13.1% lower than the assumed diversion rate of 67.8%. There are two primary reasons for this. First, as explained above, WM’s calculations significantly overestimate the tonnage of recyclables generated on campus.⁹ Second, some containers marked on the campus map as recycling containers (and therefore reported as recycling) may instead be treated as garbage containers when collected.

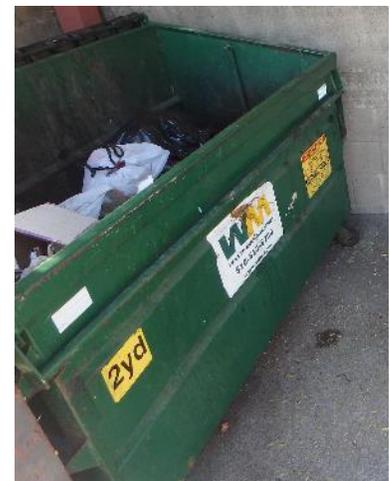


Figure 9. Partially full garbage container the day before collection.

⁷ Assumed generation and diversion: waste generation and diversion calculations based on data reported by WM and/or CSU EB.

⁸ Observed generation and diversion: waste generation and diversion calculations based on data that Cascadia collected during site visits and bin fullness audits.

⁹ WM’s numbers also underestimate organics generation; however, given that organics generation amounts are so much smaller than garbage and recycling, this underestimation has minimal impact on the resulting diversion rate.

TASK 2: WASTE AUDIT

METHODOLOGY

To develop a better understanding of the specific materials present in each waste stream, Cascadia conducted an in-depth waste audit at the Hayward and Concord campuses. With the help of several enthusiastic CSU EB staff members and students, Cascadia orchestrated the waste audit on the Hayward campus – which took place from November 2-6, 2015 – and on the Concord campus, which occurred on November 16, 2015. During the audits, Cascadia collected 24 garbage, 18 recycling, and 5 organics samples from containers on both campuses, and then hand-sorted the collected material into eleven categories that Cascadia and the CSU EB team agreed upon prior to the audit. The project team designed the material list below to provide both a high-level snapshot of the composition of CSU EB’s waste stream and detailed data to pinpoint problem materials and inform a specific, actionable diversion plan for the entire campus.



Figure 10. Samples collected in a box truck.

- Old corrugated cardboard (OCC) & Kraft paper
- Mixed recyclable paper
- Recyclable plastic containers
- Recyclable glass containers
- Recyclable metal containers
- Other recyclables
- Food
- Compostable paper
- Other organics
- Hazardous materials (including e-waste)
- Residuals (i.e. non-recoverable waste)

Cascadia recorded the weights of sorted materials in each material category into a customized analysis database, and then aggregated the results to inform stream- and generator area-specific composition estimates for each campus.

The tables in this section present an estimated composition of the waste collected from each stream and generator area. We have provided estimates for individual material types, as well as four different “recoverability” classes:¹⁰

- **Recyclable:** materials that can be collected and processed in existing recycling containers.
- **Compostable:** organic materials the can be collected and processed in existing organics containers, such as food and food-soiled paper.
- **Other Recoverable:** materials that could be recovered but would require a separate collection from the hauler, such as clean plastic shrink wrap.
- **Non-recoverable:** waste that cannot be recycled, composted, or otherwise processed outside of a landfill, such as hazardous waste or soiled plastic film.

The composition results for the Concord campus can be found at the end of each section. We included generation amounts for the Oakland campus in the overall generation calculations for each stream, but there is no composition data for the Oakland campus given that we did not conduct a waste audit there.

An overview of findings for each generator area can be found in **Appendix A: Waste Generation, Recoverability, and Contamination Profiles by Generator Area.**

¹⁰ Recoverable: any material that could be recycled, composted, reused, or otherwise processed to be kept out of a landfill.

GARBAGE AUDIT

Garbage Composition: Campus-Wide

As shown previously in **Figure 7**, garbage¹¹ is CSU EB’s largest individual waste stream, accounting for over 60% of waste collected from front-end load containers. CSU EB generates nearly 12 tons¹² of garbage each week. The Academic (3.4 tons), Administration (2.4 tons), and Dining Commons + Food Court generator areas (1.9 tons) are the three largest garbage-generating areas.

Figure 11 displays total garbage recoverability by generator area. The majority of material in the garbage stream from each generator area is recoverable. The percent of material in the garbage stream that is recoverable ranges from 76% (Academic) to 89% (Concord).

Figure 11: Garbage recoverability by generator area (% of garbage stream and tons/week)

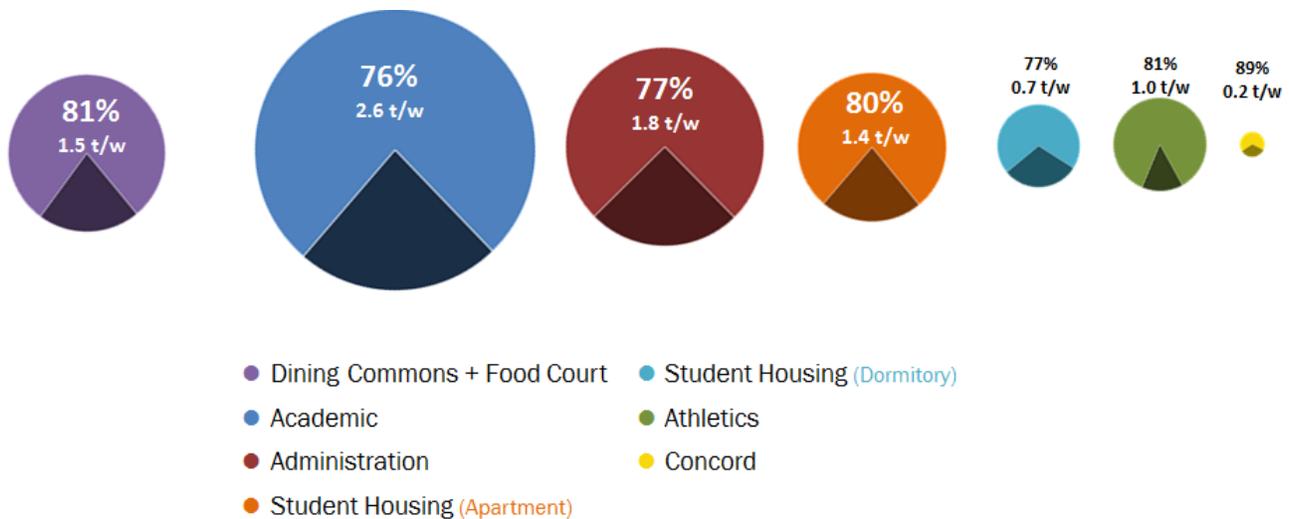


Table 2. Detailed Garbage Composition – Overall

Material	Estimated %
Recyclable	27%
Cardboard	8%
Mixed paper	11%
Recyclable plastic	5%
Recyclable metal	1%
Recyclable glass	2%
Compostable	51%
Food	27%
Food-soiled paper	24%
Other Recoverable	1%
Other recyclables	1%
Other organics	0%
Non-recoverable	21%
Hazardous materials	1%
Other residuals	21%
Total	100%

Table 2 contains detailed composition results for the garbage stream across all campuses. *Food* (27%, compostable) and *food-soiled paper* (24%, compostable) are the two most prevalent recoverable material categories campus-wide, followed by *other residuals* (21%, non-recoverable) and *mixed paper* (11%, recyclable). 79% of the material in the garbage stream could be either recycled or composted.

¹¹ Garbage is any waste that is disposed of in a garbage container on the CSU EB campus and collected as garbage by the hauler, regardless of its recoverability; residuals are any non-recoverable materials.

¹² The Oakland campus accounts for 70 pounds of garbage generation each week.

Garbage Composition: By Generator Area

Tables 3 through 9 contain detailed composition estimates for each generator area.

Table 3. Detailed Garbage Composition – Academic

Material	Estimated %
Recyclable	33%
Cardboard	9%
Mixed paper	17%
Recyclable plastic	5%
Recyclable metal	1%
Recyclable glass	2%
Compostable	42%
Food	21%
Food-soiled paper	21%
Other Recoverable	2%
Other recyclables	1%
Other organics	1%
Non-recoverable	24%
Hazardous material	1%
Other residuals	23%
Total	100%

As shown in Figure 7 and Figure 11, Academic areas generate nearly 3.5 tons of garbage each week, of which 76% is recoverable. Table 3 contains detailed composition results for the Academic generator area garbage stream. *Residuals* (23%, non-recoverable) is the most prevalent material type in the stream, followed by *food* (21%, compostable), *food-soiled paper* (21%, compostable), and *mixed paper* (17%, recyclable).

Table 4. Detailed Garbage Composition – Administration

Material	Estimated %
Recyclable	26%
Cardboard	5%
Mixed paper	12%
Recyclable plastic	5%
Recyclable metal	1%
Recyclable glass	3%
Compostable	49%
Food	20%
Food-soiled paper	29%
Other Recoverable	2%
Other recyclables	2%
Other organics	0%
Non-recoverable	23%
Hazardous materials	3%
Other residuals	20%
Total	100%

As shown in Figure 7 and Figure 11, Administration areas generate nearly 2.5 tons of garbage each week, of which 77% is recoverable. Table 4 contains detailed composition results for the Administration generator area garbage stream. *Food-soiled paper* (29%, compostable) represents the largest material type in the stream, followed by *food* (20%, compostable) and *residuals* (20%, non-recoverable).

Table 5. Detailed Garbage Composition – Athletics

Material	Estimated %
Recyclable	29%
Cardboard	13%
Mixed paper	12%
Recyclable plastic	3%
Recyclable metal	0%
Recyclable glass	0%
Compostable	52%
Food	22%
Food-soiled paper	30%
Other Recoverable	0%
Other recyclables	0%
Other organics	0%
Non-recoverable	19%
Hazardous materials	0%
Other residuals	19%
Total	100%

As shown in Figure 7 and Figure 11, Athletics areas generate 1.2 tons of garbage each week, of which 81% is recoverable. Table 5 contains detailed composition results for the Athletics generator area garbage stream. *Food-soiled paper* (30%, compostable) and *food* (22%, compostable) are the two largest material types in the stream, followed by *residuals* (19%, non-recoverable).

Table 6. Detailed Garbage Comp. – Dining Commons + Food Courts

Material	Estimated %
Recyclable	26%
Cardboard	5%
Mixed paper	11%
Recyclable plastic	7%
Recyclable metal	3%
Recyclable glass	0%
Compostable	55%
Food	34%
Food-soiled paper	21%
Other Recoverable	1%
Other recyclables	1%
Other organics	0%
Non-recoverable	19%
Hazardous materials	0%
Other residuals	19%
Total	100%

As shown in Figure 7 and Figure 11, Dining Commons + Food Court areas generate 1.9 tons of garbage each week, of which 81% is recoverable. Table 6 contains detailed composition results for the Dining Commons + Food Courts generator area garbage stream. *Food* (34%, compostable) and *food-soiled paper* (21%, compostable) are the two most prevalent material types in the stream, followed by *other residuals* (19%, non-recoverable).

Table 7. Detailed Garbage Composition – Student Housing (Dormitory)

Material	Estimated %
Recyclable	23%
Cardboard	9%
Mixed paper	5%
Recyclable plastic	6%
Recyclable metal	1%
Recyclable glass	3%
Compostable	51%
Food	26%
Food-soiled paper	25%
Other Recoverable	2%
Other recyclables	1%
Other organics	1%
Non-recoverable	23%
Hazardous materials	0%
Other residuals	23%
Total	100%

As shown in **Figure 7** and **Figure 11**, Student Housing (Dormitory) areas generate just under one ton of garbage each week, of which 77% of which is recoverable. **Table 7** contains the detailed composition results for the **Student Housing (Dormitory)** generator area garbage stream. *Food* (26%, compostable) and *food-soiled paper* (25%, compostable) are the two most prevalent material categories, followed by *other residuals* (23%, non-recoverable).

Table 8. Detailed Garbage Composition – Student Housing (Apartment)

Material	Estimated %
Recyclable	22%
Cardboard	6%
Mixed paper	7%
Recyclable plastic	4%
Recyclable metal	2%
Recyclable glass	3%
Compostable	58%
Food	40%
Food-soiled paper	18%
Other Recoverable	1%
Other recyclables	1%
Other organics	0%
Non-recoverable	20%
Hazardous materials	0%
Other residuals	20%
Total	100%

As shown in **Figure 7** and **Figure 11**, Student Housing (Apartment) areas generate 1.8 tons of garbage each week, of which 80% is recoverable. **Table 8** contains detailed composition results for the **Student Housing (Apartment)** generator area garbage stream. *Food* (40%, compostable) is the most prevalent material category in the stream, followed by *other residuals* (20%, non-recoverable) and *food-soiled paper* (18%, compostable).

Table 9. Detailed Garbage Composition – Concord Campus

Material	Estimated %
Recyclable	20%
Cardboard	5%
Mixed paper	9%
Recyclable plastic	3%
Recyclable metal	3%
Recyclable glass	0%
Compostable	69%
Food	27%
Food-soiled paper	43%
Other Recoverable	0%
Other recyclables	0%
Other organics	0%
Non-recoverable	11%
Hazardous material	0%
Other residuals	11%
Total	100%

As shown in **Figure 7** and **Figure 11**, the Concord campus generates just over a quarter of a ton of garbage each week, of which 89% of which is recoverable. **Table 9** contains detailed composition results for the **Concord campus'** garbage stream. *Food-soiled paper* (43%, compostable) is the most prevalent material type in the stream, followed by *food* (27%, compostable) and *residuals* (11%, non-recoverable).

Common Recoverable Materials Found in the Garbage Stream

Figure 12 displays common recoverable materials found in the garbage stream. These recoverable materials included food, food-soiled paper, recyclable plastic, and recyclable metal in all garbage streams campus-wide.

Figure 12. Common Garbage Contaminants



RECYCLING AUDIT

Recycling Composition: Campus-Wide

As shown previously in **Figure 7**, recycling¹³ is the second largest waste stream at CSU EB, which generates over five tons of recycling each week in front-end load containers. Dining Commons + Food Courts (2.4 tons/week), Student Housing (Apartment) (0.7 tons/week), and Academic Areas (0.7 tons/week) are the areas that generate the most recycling.

Table 10. Detailed Recycling Composition – Overall

Material	Estimated %
Recyclable	68%
Cardboard	41%
Mixed paper	21%
Recyclable plastic	2%
Recyclable metal	0%
Recyclable glass	3%
Compostable	19%
Food	9%
Food-soiled paper	10%
Other Recoverable	0%
Other recyclables	0%
Other organics	0%
Non-recoverable	13%
Hazardous materials	0%
Other residuals	13%
Total	100%

Table 10 contains composition data for CSU EB’s overall recycling stream. Over 30% of the materials found in the recycling stream are non-recyclable; anything other than materials in the Recyclable recoverability group (including Compostable, Other Recoverable, and Non-Recoverable materials) is considered a contaminant to the stream.

The **Concord** campus has separate containers for cardboard, mixed paper, and beverage containers, and it has the lowest recycling contamination rate (8%) of all generator areas. Every other generator area has contamination rates above 10%. *Other residuals* (13%), *food-soiled paper* (10%), and *food* (9%) are the most commonly-found contaminants in the overall recycling stream.

¹³ Recycling is any waste that is disposed of in a recycling container on the CSU EB campus and collected as recycling by the hauler, regardless of its recoverability; recyclable materials are any waste materials that could be recovered and processed as recycling by the hauler.

Recycling Composition: By Generator Area

Tables 11 through 17 contain detailed composition estimates for each generator area.

Table 11. Detailed Recycling Composition – Academic

Material	Estimated %
Recyclable	49%
Cardboard	28%
Mixed paper	18%
Recyclable plastic	2%
Recyclable metal	0%
Recyclable glass	2%
Compostable	33%
Food	9%
Food-soiled paper	25%
Other Recoverable	0%
Other recyclables	0%
Other organics	0%
Non-recoverable	17%
Hazardous material	0%
Other residuals	17%
Total	100%

As shown in **Figure 7**, Academic areas generate 0.7 tons of recycling each week. **Table 11** contains detailed composition results for the **Academic** generator area recycling stream. *Cardboard* (28%, recyclable), *food-soiled paper* (25%, compostable), *mixed paper* (18%, recyclable), and *residuals* (17%, non-recoverable) are the most prevalent materials in the stream. 51% of the Academic recycling stream is non-recyclable.

Table 12. Detailed Recycling Composition – Administration

Material	Estimated %
Recyclable	88%
Cardboard	65%
Mixed paper	17%
Recyclable plastic	5%
Recyclable metal	0%
Recyclable glass	0%
Compostable	8%
Food	2%
Food-soiled paper	7%
Other Recoverable	0%
Other recyclables	0%
Other organics	0%
Non-recoverable	4%
Hazardous materials	0%
Other residuals	4%
Total	100%

As shown in **Figure 7**, Administration areas generate 0.2 tons of recycling each week. **Table 12** contains detailed composition results for the **Administration** generator area recycling stream. The most prevalent materials in the stream are *cardboard* (65%, recyclable), *mixed paper* (17%, recyclable), and *food-soiled paper* (7%, compostable). 12% of the Administration recycling stream is non-recyclable.

Table 13. Detailed Recycling Composition – Athletics

Material	Estimated %
Recyclable	73%
Cardboard	68%
Mixed paper	4%
Recyclable plastic	1%
Recyclable metal	0%
Recyclable glass	0%
Compostable	15%
Food	6%
Food-soiled paper	9%
Other Recoverable	0%
Other recyclables	0%
Other organics	0%
Non-recoverable	11%
Hazardous materials	0%
Other residuals	11%
Total	100%

As shown in **Figure 7**, Athletics areas generate 0.1 tons of recycling each week. **Table 13** contains detailed composition results for the **Athletics** generator area recycling stream. *Cardboard* (68%, recyclable), *residuals* (11%, non-recoverable), and *food-soiled paper* (9%, compostable) are the three most prevalent materials in the stream. 27% of the Athletics recycling stream is non-recyclable.

Table 14. Detailed Recycling Composition – Dining Commons and Food Courts

Material	Estimated %
Recyclable	76%
Cardboard	72%
Mixed paper	3%
Recyclable plastic	1%
Recyclable metal	0%
Recyclable glass	0%
Compostable	10%
Food	1%
Food-soiled paper	10%
Other Recoverable	2%
Other recyclables	2%
Other organics	0%
Non-recoverable	12%
Hazardous materials	0%
Other residuals	12%
Total	100%

As shown in **Figure 7**, Dining Commons + Food Court areas generate 2.4 tons of recycling each week. **Table 14** contains detailed composition results for the **Dining Commons + Food Courts** generator area recycling stream. *Cardboard* (72%, recyclable), *other residuals* (12%, non-recoverable), and *food-soiled paper* (10%, compostable) are the three most prevalent material types in the stream. 24% of the recycling stream is non-recyclable.

Table 15. Detailed Recycling Composition – Student Housing (Dormitory)

Material	Estimated %
Recyclable	42%
Cardboard	21%
Mixed paper	13%
Recyclable plastic	5%
Recyclable metal	0%
Recyclable glass	1%
Compostable	41%
Food	24%
Food-soiled paper	17%
Other Recoverable	0%
Other recyclables	0%
Other organics	0%
Non-recoverable	17%
Hazardous materials	0%
Other residuals	17%
Total	100%

As shown in **Figure 7**, Student Housing (Dormitory) areas generate 0.5 tons of recycling each week. **Table 15** contains detailed composition results for the **Student Housing (Dormitory)** recycling stream. *Food* (24%, compostable), *cardboard* (21%, recyclable), *other residuals* (17%, non-recoverable), and *food-soiled paper* (17%, compostable) are the most prevalent materials in the stream. 58% of the recycling stream is non-recyclable.

Table 16. Detailed Recycling Composition – Student Housing (Apartment)

Material	Estimated %
Recyclable	58%
Cardboard	43%
Mixed paper	8%
Recyclable plastic	3%
Recyclable metal	0%
Recyclable glass	4%
Compostable	26%
Food	18%
Food-soiled paper	8%
Other Recoverable	0%
Other recyclables	0%
Other organics	0%
Non-recoverable	16%
Hazardous materials	0%
Other residuals	16%
Total	100%

As shown in **Figure 7**, Student Housing (Apartment) areas generate 0.7 tons of recycling each week. **Table 16** contains detailed composition results for the **Student Housing (Apartment)** generator group recycling stream. *Cardboard* (43%, recyclable), *food* (18%, compostable), and *other residuals* (16%, non-recoverable) are the most prevalent materials in the stream. 42% of the recycling stream is non-recyclable.

Table 17. Detailed Cardboard Composition – Concord

Material	Estimated %
Recyclable	100%
Cardboard	100%
Mixed paper	0%
Recyclable plastic	0%
Recyclable metal	0%
Recyclable glass	0%
Compostable	0%
Food	0%
Food-soiled paper	0%
Other Recoverable	0%
Other recyclables	0%
Other organics	0%
Non-recoverable	0%
Hazardous materials	0%
Other residuals	0%
Total	100%

The Concord campus separates recyclables into cardboard, mixed paper, and beverage containers. Those three streams collectively account for 0.5 tons of recycling each week. Detailed composition results for each of the three recycling stream can be found in tables 17 through 19. **Table 17** contains detailed composition estimates for the cardboard recycling stream at **Concord**. Cascadia only found *cardboard* in this container when auditing its contents.

Table 18. Detailed Paper Composition – Concord

Material	Estimated %
Recyclable	100%
Cardboard	0%
Mixed paper	100%
Recyclable plastic	0%
Recyclable metal	0%
Recyclable glass	0%
Compostable	0%
Food	0%
Food-soiled paper	0%
Other Recoverable	0%
Other recyclables	0%
Other organics	0%
Non-recoverable	0%
Hazardous materials	0%
Other residuals	0%
Total	100%

Table 18 contains detailed composition estimates for the paper recycling stream at **Concord**. Cascadia only found *recyclable paper* in this container when auditing its contents.

Table 19. Detailed Beverage Composition – Concord

Material	Estimated %
Recyclable	61%
Cardboard	4%
Mixed paper	12%
Recyclable plastic	2%
Recyclable metal	0%
Recyclable glass	43%
Compostable	3%
Food	2%
Food-soiled paper	0%
Other Recoverable	0%
Other recyclables	0%
Other organics	0%
Non-recoverable	36%
Hazardous materials	0%
Other residuals	36%
Total	100%

Table 19 contains detailed composition estimates for recyclable beverage container stream at **Concord**. *Recyclable glass* (43%, recyclable), *other residuals* (36%, non-recoverable), and *mixed paper* (14%, recyclable) are the most prevalent materials in the stream. Nearly 39% of this stream is non-recyclable.

Common Contaminants in the Recycling Stream

Figure 13 displays common contaminants found in the recycling stream. *Food, food-soiled paper, waxed cardboard, and non-recoverable residuals* are common contaminants across all generator areas.

Figure 13. Common contaminants in the recycling stream



ORGANICS AUDIT

Dining Commons + Food Courts is the only generator area where an organics¹⁴ bin is available. There is one additional organics container located near the Recreation and Wellness Center, which the Cascadia team attributed to the **Athletics** generator area; however, we did not find any material in this bin during our pre-audit site visit or during the week-long audit.

Table 20. Detailed Organics Composition – Dining Commons and Food Courts

Material	Estimated %
Recyclable	8%
Cardboard	1%
Mixed paper	3%
Recyclable plastic	2%
Recyclable metal	1%
Recyclable glass	0%
Compostable	78%
Food	66%
Food-soiled paper	12%
Other Recoverable	0%
Other recyclables	0%
Other organics	0%
Non-recoverable	14%
Hazardous materials	0%
Other residuals	14%
Total	100%

As shown in **Figure 7** and **Figure 11**, Dining Commons + Food Court areas generate 2.2 tons of organics each week, of which 22% is not compostable. **Table 20** contains detailed composition results for the **Dining Commons + Food Court** organics stream. *Food* (66%, compostable), *other residuals* (14%, non-recoverable), and *food-soiled paper* (12%, compostable) are the three most prevalent materials in the stream.

Figure 14 displays common contaminants – including *recyclable plastic* and *recyclable paper* – in the organics stream.

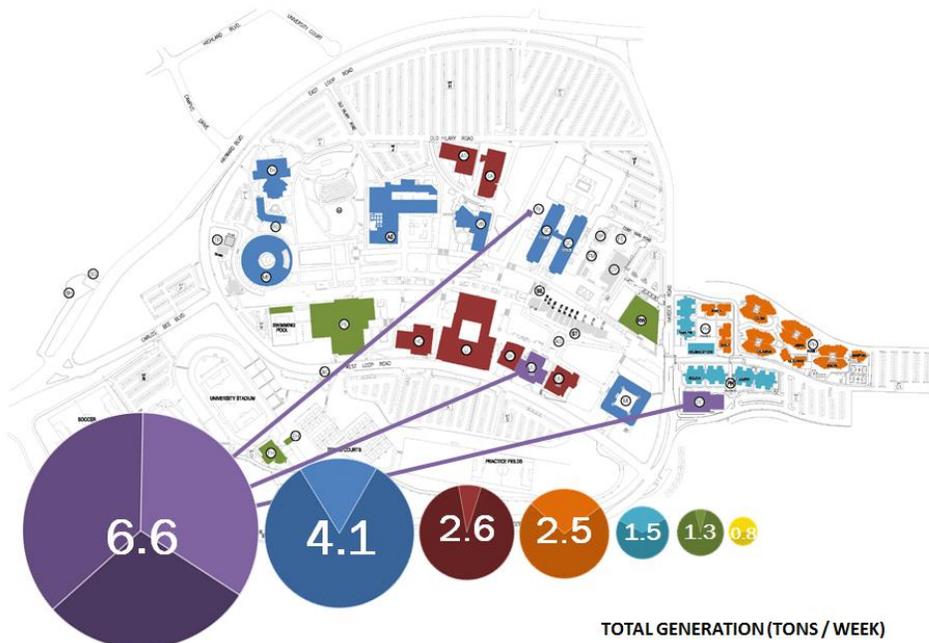
Figure 14. Common contaminants in the organics stream.



¹⁴ Organics is any waste that is disposed of in an organics container on the CSU EB campus and collected as organics by the hauler, regardless of its recoverability; compostable materials are any organic waste that could be recovered and processed as organic material by the hauler.

APPENDIX A: WASTE GENERATION, RECOVERABILITY, AND CONTAMINATION PROFILES BY GENERATOR AREA

DINING COMMONS AND FOOD COURT



Dining Commons + Food Court

Generation

6.6 Tons generated / week

- 1.9 Garbage
- 2.4 Recycling
- 2.2 Organics

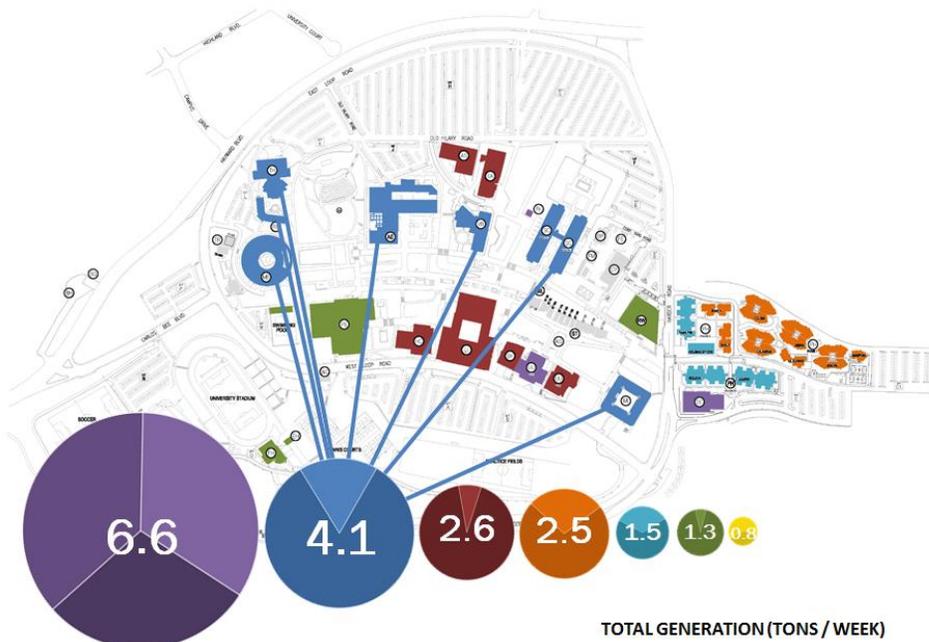
Recoverability

81% of the Garbage stream is recoverable

Contamination

- 24% of the recycling stream is non-recyclable
- 22% of the organics stream is non-compostable

ACADEMIC



Academic

Generation

4.1 Tons generated / week

- 3.4 Garbage
- 0.7 Recycling
- 0.0 Organics

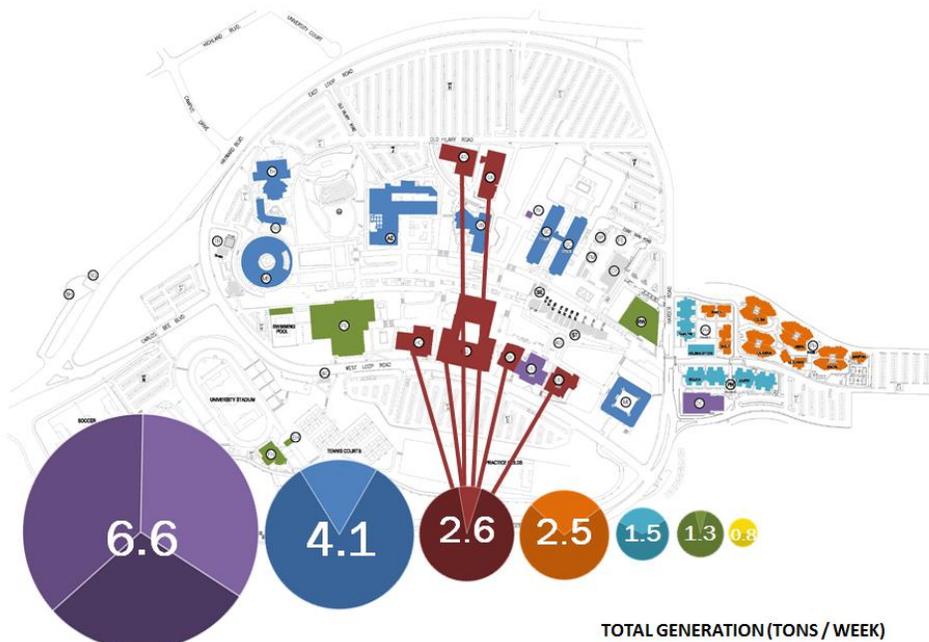
Recoverability

76% of the Garbage stream is recoverable

Contamination

51% of the recycling stream is non-recyclable

ADMINISTRATION



Administration

Generation

2.6 Tons generated / week

- 2.4 Garbage
- 0.2 Recycling
- 0.0 Organics

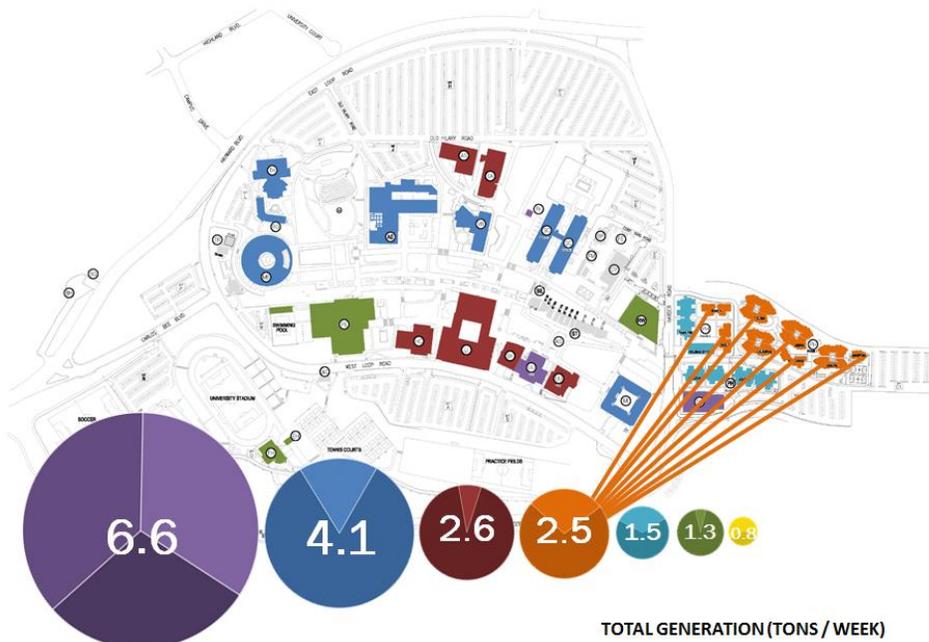
Recoverability

77% of the Garbage stream is recoverable

Contamination

13% of the recycling stream is non-recyclable

STUDENT HOUSING (APARTMENT)



Student Housing (Apartment)

Generation

2.5 Tons generated / week

- 1.8 Garbage
- 0.7 Recycling
- 0.0 Organics

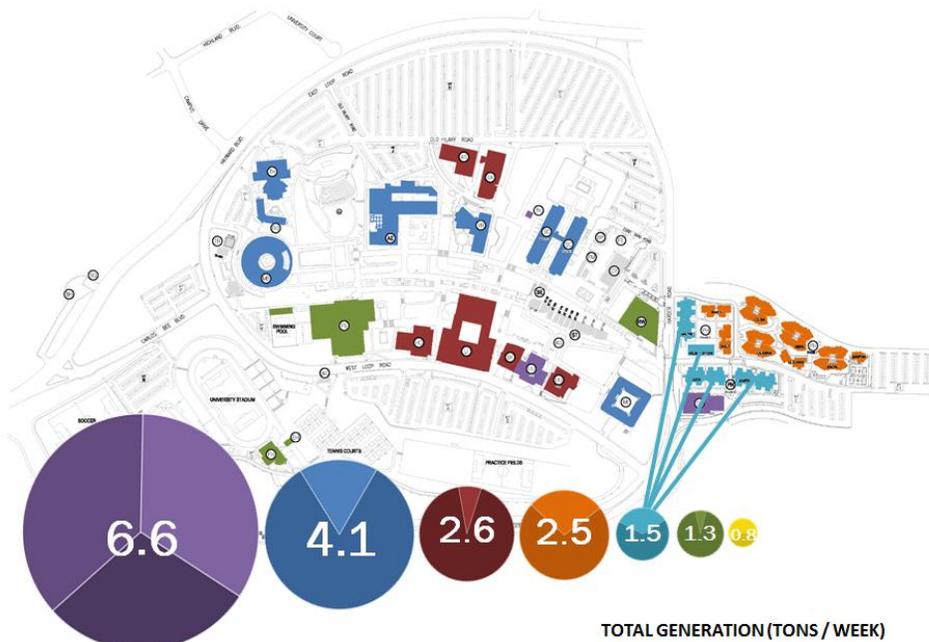
Recoverability

80% of the Garbage stream is recoverable

Contamination

42% of the recycling stream is non-recyclable

STUDENT HOUSING (DORMITORY)



Student Housing (Dormitory)

Generation

1.5 Tons generated / week

- 1.0 Garbage
- 0.5 Recycling
- 0.0 Organics

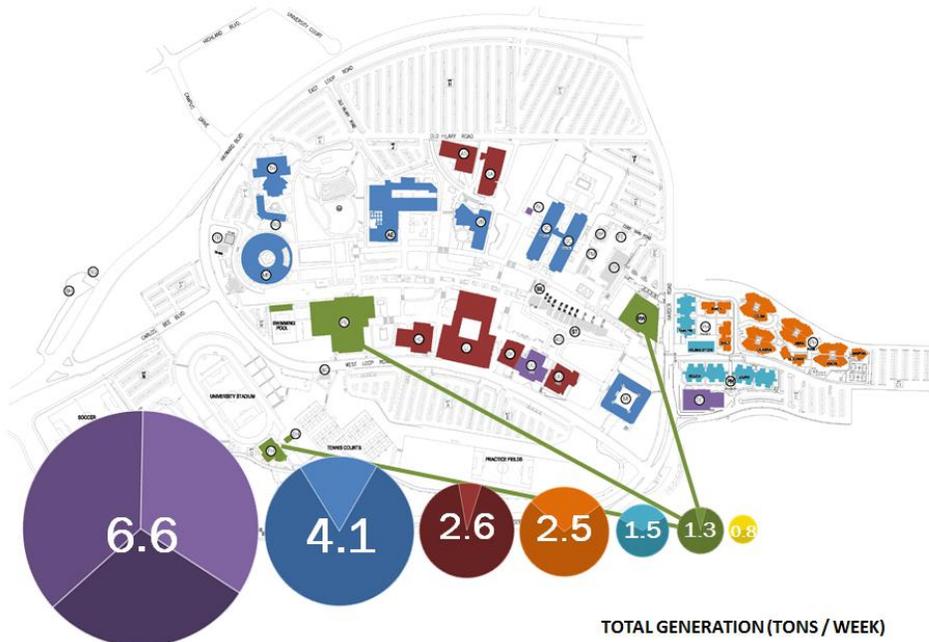
Recoverability

77% of the Garbage stream is recoverable

Contamination

58% of the recycling stream is non-recyclable

ATHLETICS



Athletics

Generation

1.3 Tons generated / week

- 1.2 Garbage
- 0.1 Recycling
- 0.0 Organics

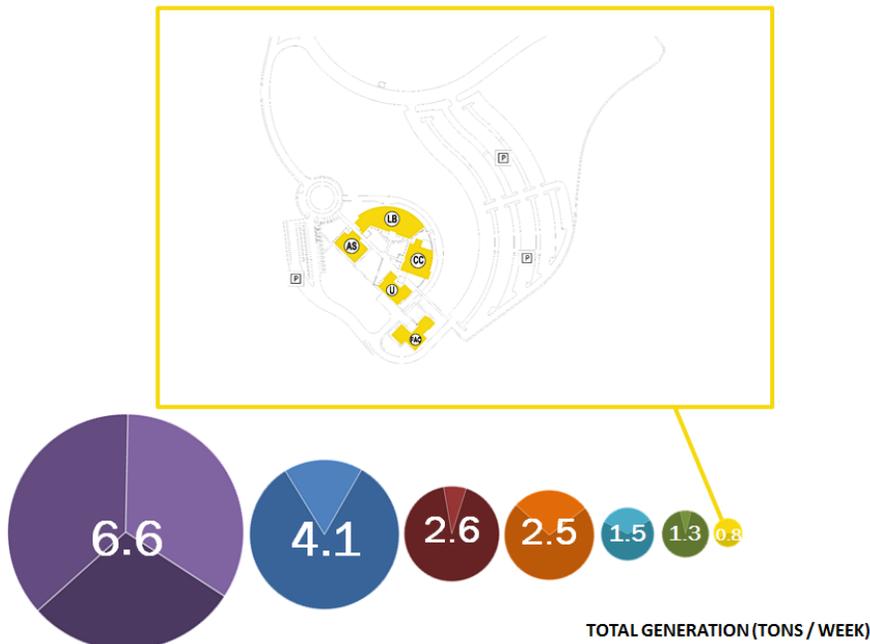
Recoverability

81% of the Garbage stream is recoverable

Contamination

26% of the recycling stream is non-recyclable

CONCORD



Concord

Generation

0.8 Tons generated / week

- 0.3 Garbage
- 0.5 Recycling
- 0.0 Organics

Recoverability

89% of the Garbage stream is recoverable

Contamination

8% of the recycling stream is non-recyclable

APPENDIX B: GLOSSARY OF KEY TERMS

Generation: all waste produced, whether it is disposed or diverted

Diversion rate: a common metric used to measure the amount of waste that is being kept out of the landfill. For example, a 60% diversion rate means that 60% of all waste generated is either recycled, composted, reused, reduced, or otherwise processed to be kept out of a landfill.

Generator area: a group of buildings that all have similar operations and waste profiles.

Assumed generation and diversion: waste generation and diversion calculations based on data reported by WM and/or CSU EB.

Observed generation and diversion: waste generation and diversion calculations based on data that Cascadia collected during site visits and bin fullness audits.

Recoverable: any material that could be recycled, composted, reused, or otherwise processed to be kept out of a landfill.

Recycling vs recyclable materials:

- **Recycling:** any waste that is disposed of in a recycling container on the CSU EB campus and collected as recycling by the hauler, regardless of its recoverability.
- **Recyclable materials:** any waste materials that *could* be recovered and processed as recycling by the hauler.

Organics vs compostable materials:

- **Organics:** any waste that is disposed of in an organics container on the CSU EB campus and collected as organics by the hauler, regardless of its recoverability.
- **Compostable materials:** any organic waste that *could* be recovered and processed as organic material by the hauler.

Garbage vs residuals:

- **Garbage:** any waste that is disposed of in a garbage container on the CSU EB campus and collected as garbage by the hauler, regardless of its recoverability.
- **Residuals:** any non-recoverable materials.

Density Factor: a measure, based on statistical averages of waste samples from material streams generated by similar entities, used to convert volumes to weight. Most density factors are presented in pounds per cubic yard (lbs./CY).

Waste stream: any material output that is collected as garbage, recycling, or organics by the hauler.

Material composition: The percentage (by weight) of audited waste that falls into the eleven pre-determined material categories used for this study.