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LEED O+M Materials Audit: Blumel Hall

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Executive Summary

This report provides the Campus Sustainability Office with an objective, third party Materials Audit for Blumel Hall in Portland, Oregon. The data collected for this audit provides Campus Sustainability Office with insight into Blumel's current waste composition and diversion rate as well as identifies opportunities to improve recycling, composting, and areas for reduction of materials consumption. Community Environmental Services (CES) conducted Materials Audits for 100% of Blumel Hall's landfill-bound, commingled recycling, glass bottles and jars recycling, and compost streams during a 24-hour period.

Of the entire 1,077.19 lbs. of Blumel Hall's combined materials streams, the following materials were misplaced[1] and had potential for diversion in the following ways:

- 23.9% (206.12 lbs.) of materials placed in the landfill could have been diverted through Blumel's existing commingled recycling program
- 13.0% (107.33 lbs.) of materials placed in the landfill could have been diverted through Blumel's existing compost program
- 15.6% (134.04 lbs). of materials placed in the landfill could be diverted through other current recycling programs (E-waste, reuse, textiles) or expanded recycling programs
- 47.5% (403.93 lbs.) of materials placed in the landfill were non-recoverable

Of Blumel Hall's combined materials stream, 20.1% was diverted through Blumel's commingled recycling, glass bottles and jars recycling, and composting programs. 13.8% of commingled recycling, glass bottles and jars recycling, and composting was diverted correctly. At 23.9%, commingled recycling made up the largest category by weight of misplaced materials within the landfill stream, the majority of which was made up of mixed paper materials. Food scraps misplaced in the landfill bound stream were also significant, considering such a low amount of food scraps were properly placed in the compost stream.

Based on these key findings, areas where Blumel Hall can make improvement include:

- Improving signage in the Blumel corral
- Improve signage about waste collection rooms, and consider adding compost to the waste collection rooms
- Add buddied collection bins to shared areas in Blumel Hall
- Continue and improve education for students on proper waste placement
- Provide trainings and multilingual signage for janitorial staff
- Reinforce current waste diversion programs and implement new recycling streams

Section 1: Background

In February of 2017, Molly Bressers and Anthony Hair of Portland State University's (PSU) Campus Sustainability Office (CSO) contacted Community Environmental Services (CES) to conduct a LEED O+M Materials Audit of Blumel Residence Hall (Blumel). CES is a research and services unit at Portland State University (PSU), specializing in materials audits and diversion improvement education. The Blumel Materials Audit conducted by CES was sorted to LEED standards.

The building is located at 1705 SW 11th Ave, Portland, OR, 97201. The 124,607 square foot building consists of 9 floors and consists of 189 one-bedroom units. It also includes a two-level parking structure. Surrounding Blumel are various PSU academic and residential buildings. The waste materials corral utilized by Blumel residents is public facing and the area receives a high amount of pedestrian traffic.

The objectives of the current LEED Materials Audit are as follows:

1. Determine the composition of Blumel's material streams which include landfill bound materials, commingled recycling, compost, and glass bottle and jar recycling. The audit of all materials streams provides an accurate snapshot of material compositions and daily activities of the building.
2. Assess the materials generated from a time period that reflects typical business operations. The audit includes hand sorting the materials streams into specific categories, weighing sorted materials, recording the data, and making qualitative and quantitative observations.
3. Determine Blumel's material diversion rates based on the Materials Audits, and make recommendations to improve diversion practices for each material stream.
4. Provide documentation for LEED O+M credit application under the "Materials and Resources: Solid Waste Management – Waste Stream Audit" credit section of "Operation and Maintenance.

Blumel's Current Diversion Program

Currently, Blumel's diversion program is managed through CSO and PSU's Housing and Residence Life (Res Life). Res Life provides students with recycling and composting information upon move-in, as well as one recycling bin and one compost bin per unit. In the main areas of the residence hall such as the lobby and laundry room, commingled recycling bins are provided (see *Images 1.1 and 1.2*). Students use a trash chute on every other floor of Blumel. Commingled recycling and glass bottles and jars are collected on every other floor in a room adjacent to the laundry rooms (see *Image 1.3*). Commingled recycling and glass bottles and jars are also collected outside at the nearby King Albert corral, the nearest corral that offers recycling containers outside of those offered within Blumel itself (*see Image 1.4*). The Blumel corral contains three large landfill dropboxes where students can dispose of their landfill-bound waste materials (*Image 1.5*) as well as one 96-gallon compost roll-cart (see *Image 1.6*). Blumel also offers e-waste recycling to residents located in the Students Lobby, which also houses an informal reuse area (see *Image 1.7*). Gaia boxes are also located within close proximity to the King Albert corral and collect textile donations for the Gaia Movement, a local non-profit (see *Image 1.8*).

Blumel residents have been engaged in recycling, composting, reuse, and waste reduction education through multiple projects spearheaded by CSO's volunteer group, the Waste Reduction Task Force, as well as Res Life's EcoReps program. CSO has worked with the Waste Reduction Task Force to implement composting in residence halls since Spring of 2015. CSO also worked with the task force to conduct a waste sort of the building in Fall of 2014 in conjunction with their Waste Audit Living Lab Experience (WALL-E) program. The EcoReps were responsible for offering an E-waste container in the Blumel Lobby. In addition to these efforts, CSO has helped place the Gaia box collection bins near the Blumel corral, and has collected materials for reuse for bi-annual clothing swaps. Blumel Hall is also heavily targeted during Chuck It for Charity, a move-out program conducted by CSO to help collect all reusable materials that normally would be thrown away during the student move-out process.

Materials generated by Blumel are collected by Trashco Services. Landfill-bound materials are collected five days a week. Landfill-bound materials are collected in four (4) 3-yard containers and commingled materials are collected twice a week via two (2) 4-yard containers. Glass is collected around once a month, and is stored in one (1) 95-gallon container. Compost is collected as needed, approximately twice a week, and stored in one (1) designated 65-gallon container[1].

Photos of Blumel's Current Diversion Program

Image 1.1: Signage provided from Housing and Residence life stating "Paper only" for a commingled recycling bin

Image 1.2: recycling bin in hallway with no waste bins provided

[1] While materials have a specified collection schedule, Trashco is available on an on-call basis to pick up materials when containers reach capacity

Image 1.3: Commingled and glass recycling in recycling rooms

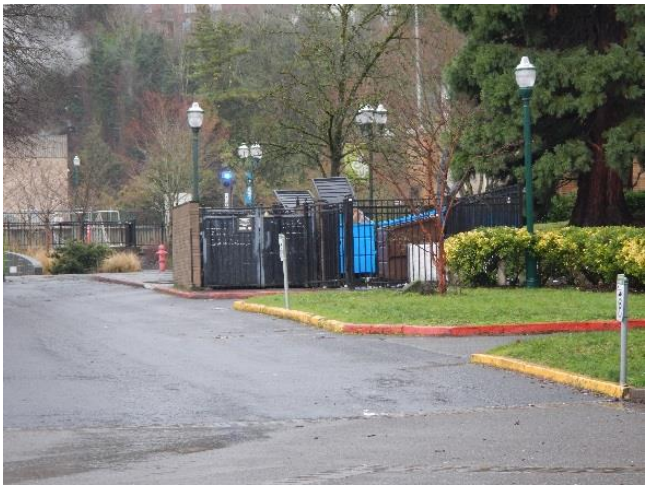

Image 1.4: Commingled and glass recycling in King Albert corral

Image 1.5: Landfill dropboxes in the Blumel corral

Image 1.6: Compost collection in the Blumel corral

Image 1.7: E-waste and reuse collection in the student lounge

Image 1.8: Gaia collection bins in the Blumel corral

Section 2: Methods

Four (4) materials stream audits were conducted by the CES staff for Blumel, which included materials audits for each of the following materials streams: landfill-bound materials, compost, commingled recycling, and glass bottles and jars. The landfill-bound materials and commingled recycling materials audits were performed at the Metro Central Transfer Station (Metro Central), located at 6161 NW 61st Ave, Portland, Oregon. The compost and glass bottle and jar recycling streams audits were held at PSU's Market Center Building at 1600 SW 4th Avenue, Portland, Oregon. The materials audit date and time periods were chosen to reflect materials generation during typical business operations over the course of 24-hours at Portland State University's Blumel. The tenants were not informed of the audit in advance to avoid differentiation in materials generation and practices. CES worked with building management to ensure that the time period of materials generation was not subject to variations in building-occupant activities.

Materials Audits

The materials audit for streams were conducted by CES staff over the course of two days. The landfill-bound audit and commingled recycling audit took place on Friday, March 17th, at the Metro Central. The loads of both landfill-bound materials and commingled recycling materials were generated during the 24-hour period between the mornings of Thursday, March 16th and Friday, March 17th, then dropped off at Metro Central on the morning of March 17th. The compost materials audit and glass bottles and jars materials audit took place on Thursday, March 9th. Both the compost and glass bottles and jars streams contained materials generated over a one week period from Wednesday March 1st to Thursday morning March 9th. To account for waste generated in a 24-hour period, CES sorted 1/7th of the compost and glass bottles and jars loads. The formula used is as follows:

[total glass/compost poundage] / 7 (days per week) = representative 24-hours of materials generation

All materials were sorted by CES staff in accordance with the LEED O+M waste audit requirements. The material categories used for the audit are detailed in the materials categories section.

Material Categories

For the audits, materials from each stream were sorted into the 24 material categories listed in Table 2.1 below, and presented in Images 2.1 and 2.2. A detailed description of each material category is provided in Appendix A: Glossary of Material Categories.

Eighteen (18) of the material categories listed below were utilized according to LEED O+M and CES standards. The additional six (6) categories were chosen due to their observed presence in the materials stream during the sorting process. Materials that make up a significant portion of the waste stream are highlighted and addressed by CES in Section 3: Observations and Section 4: Findings in order to discuss the opportunities for reduction and diversion associated with these material categories.

Commingled Recyclable	Compost	Additionally Recoverable	Non-Recoverable
Mixed paper	Food scraps	Plastic film	True waste
Corrugated cardboard	Food-soiled fibers	Rigid plastic	Restroom waste
Mixed metals	Compostable food serviceware	E-waste	Single-use cold cups
Plastic bottles & tubs		Styrofoam	Single-use hot cups
Glass bottles & jars		Reuse	Single-use food serviceware
Aseptic		Television	Liquid
		Intact food	
		Textiles	
		Wood	

Table 2.1: Material Categories

The four (4) general material classifications take into account the existing diversion opportunities in the Portland Metro region, at PSU, and Blumel. These classifications are further defined as:

Commingled recyclable materials category includes corrugated cardboard, mixed paper, plastic bottles and tubs, mixed metals, and aseptic containers. This category also includes glass bottles and jars. These materials are required to be recycled by businesses under the Metro regional government's business recycling requirements. Please note that in the Metro region, glass bottles and jars are recycled separately from the plastic, paper, metals, and any other commingled recyclable materials. This dual stream method of recycling glass bottles and jars separately allows for better quality and viability of recyclable materials as products and commodities. Commingled recyclable materials are collected by PSU's primary commercial hauler, Trashco. Please note that glass bottles and jars are included within the commingled recyclable category in all materials streams' data analysis for this audit. Glass bottles and jars are considered a contaminant within the plastic, metals, and paper stream since this materials stream is not accepted within the general commingled recycling stream. Acceptable commingled recycling materials are presented as one general category for the commingled recycling Materials Audit and exclude glass bottles and jars.

Compostable materials are items that are accepted under Metro's current compostable material guidelines for commercial businesses. These include food scraps and BPI certified compostable bags. Trashco also accepts food-soiled fibers and compostable food serviceware as per PSU's contracted agreement.

Additionally recoverable materials are those that have the opportunity to be recovered through an expanded diversion program or an existing non-primary hauler diversion system at PSU. These include plastic film, rigid plastics, e-waste, Styrofoam, reuse, textiles, wood, television and intact food. PSU is currently recovering a number of additionally recoverable materials including: E-waste, reuse, and textiles. Items not currently diverted on-site include plastic film, rigid plastics, etc. experience fluctuations in recoverability due to the volatility of global secondary commodity markets. These

materials are sometimes more readily recyclable than during other times, such as during times of market downturns. Please note that all additionally recoverable materials are unacceptable in the commingled recycling stream.

Non-Recoverable materials are those that cannot be diverted from the landfill through PSU's existing collection systems' markets and/or processing facilities. For analytical purposes, this was divided into the following subcategories: true waste, restroom waste, single-use hot cups, single-use cold cups, single-use food serviceware, and liquid.

Image 2.1: Sorting method used for landfill-bound materials

Image 2.2: Sorting method used for commingled recycling materials

Section 3: Observations

The following qualitative observations were made for each material stream. Associated photos can be found on the proceeding page.

Walk-Through Observations

1. Single recycling bins were found throughout Blumel hall shared spaces, including the lobby, mail room, and main laundry room (*see Images 3.1, 3.2, and 3.3*).
2. Landfill dropboxes are uncovered (*see Image 3.4*).
3. Compost in the Blumel corral was overflowing, indicating that the building may need more compost collection bins in the corral, or additional services by Trashco. Additionally there was only one official compost container. Next to the official container was an unofficial compost container that was not being serviced by Trashco or any other hauler (*see Image 3.5*)

mage 3.1: Lone receptacle in hallway without clear signage

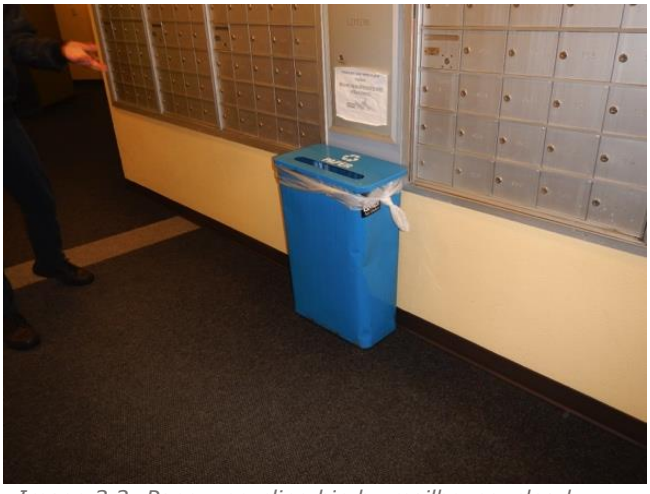

Image 3.2: Paper recycling bin by mailboxes, clearly marked for paper only

Image 3.3: Recycling bin in laundry room without clear signage

Image 3.4: Uncovered landfill dumpsters in Blumel corral

Image 3.5: Compost containers and unidentified container Blumel corral

Landfill-bound Materials Stream

1. Blumel's landfill-bound load can be seen in its entirety (*See Image 3.5*).
2. A large amount of food waste was found in the landfill-bound load (*see Image 3.6*).
3. A television was found in the landfill-bound load (*see Image 3.7*).
4. A high amount of the mixed paper found in the landfill-bound load consisted of paper shopping bags. It appeared that students were using paper bags to carry their trash to the trash chutes and dumpsters (*see Image 3.8*).
5. Entire bags of recyclable material were found in the landfill-bound load (*see Image 3.9*).
6. A large bag of mixed paper was found in the landfill-bound load. This appeared to all be newspapers and letters, and appeared to have come from the 'paper only' bin in the lobby near the mailboxes (*see Image 3.10*).
7. A few items of intact food were found in the landfill-bound load (*see Image 3.11*).
8. There was a lot of glass in the landfill-bound load (*see Image 3.12*).
9. Textiles were found in the landfill-bound load (*see Image 3.13*).
10. Cold cups and hot cups were found in the landfill-bound load (*see Images 3.14 and 3.15*).

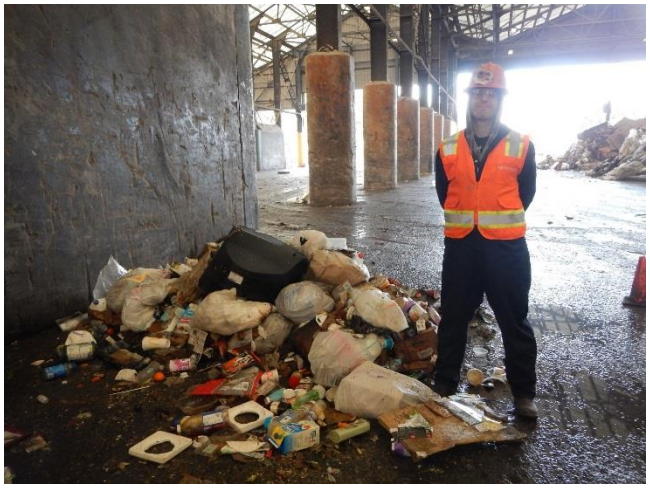

Image 3.5: Blumel Hall's landfill-bound load

Image 3.6: Food waste in the landfill-bound load

Image 3.7: Television found in the landfill-bound load

Image 3.8: Paper gabs in the landfill-bound load

Image 3.9: Entire bags of recyclable material were found in the landfill-bound load

Image 3.10: An entire bag of mixed paper, mostly mail was found in the landfill-bound load

Image 3.11: Intact food was found in the landfill-bound load

Image 3.12 : Glass in the landfill-bound load

Image 3.13: Texties in the landfill-bound load

Image 3.14: Single use cold cups were observed

Image 3.15: Single-use hot cups were observed

Commingled Recycling Stream

1. The commingled recycling load for Blumel hall (*see Image 3.16*.).
2. A high amount of true waste materials were found in the commingled recycling stream. Many of this seemed to be food wrappers (*see Image 3.17*).
3. Glass bottles and jars were misplaced into the commingled recycling stream (*see Image 3.18*).
4. Reuse materials were found in the commingled recycling stream. These may have been placed here because they were made of rigid plastics (*see Image 3.19*).

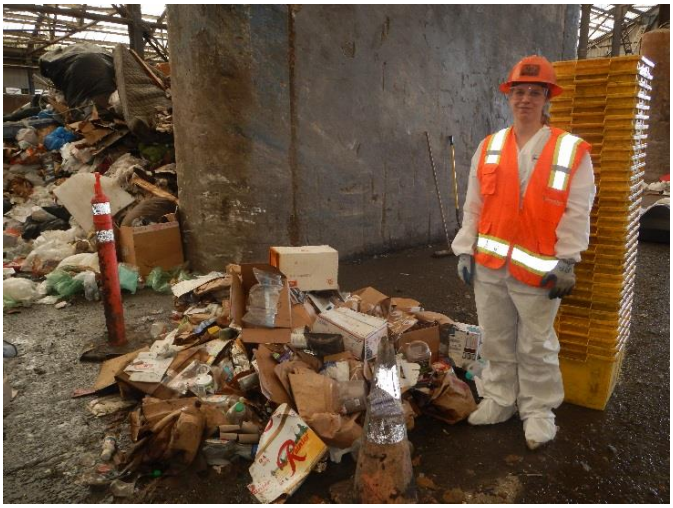

Image 3.16: Entire commingled recycling load for Blumel Hall

Image 3.17: True waste in the commingled recycling stream.

Image 3.18: Glass bottles and jars misplaced in the commingled recycling load

Image 3.19: Reuse materials in the commingled recycling stream

Compost Stream

1. Twenty-four hour compost stream sample from Blumel. Consisted of both compostable food scraps, food soiled fibers, and true-waste items (*see images 3.22*).
2. Intact food items found in compostable bags in the compost stream (*see image 3.23*).
3. True-waste items found in compost stream, such as plastic bags and a plastic film-lined shipping envelope (*see Image 3.24*).

Image 3.22: Twenty-four hour sample of Blumel compost stream

Image 3.23: Intact food items in compostable bags in Blumel compost stream originating from Meetro

Image 3.24: True waste in the Blumel compost stream

Due to the glass stream being comprised of a single bottle, no observations are offered within this report.

Section 4: Findings

Findings and recommendations resulting from the Materials Audits are cited in terms of the material weight in pounds. Lighter materials such as plastic film, Styrofoam, plastic bottles and tubs, and single-use drink cups/service ware can contribute to a large percentage of volume in the waste stream, yet when considered by weight alone, these materials may not appear as a significant component of the load. Please refer to the photos in **Section 8: Materials Audit Photos** for a visual representation of the different materials streams.

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All Streams Combined

The combined weights of all streams—landfill-bound, commingled recycling, compost, and glass bottle and jar recycling—generated over 24-hours of operation at Blumel—totaled 1,072.54.pounds. Of this total, 12.3% was properly diverted through the commingled recycling stream(s), 1.6%% was diverted through the compost stream (*see Table 4.1*).

Within the commingled and compost streams, 6.3% were contaminant materials (*see Table 4.1*). Contaminant materials may be non-recoverable, recoverable through existing diversion streams other than the one in which they were found (i.e., '**commingled recycling**' or '**compostable'**), or potentially recoverable through an expanded diversion program (i.e. '**additionally recoverable**'). Of the landfill-bound materials, 42.2% were divertible through (**commingled recoverable**, **compostable**, or **additionally recoverable** streams).

Figure 4.1 displays the total diverted and landfill-bound materials regardless of proper or improper placement. Table 4.1 displays the composition of each materials stream, showing misplaced materials (i.e, contaminants) and properly placed materials within each stream. Table 4.1 displays the composition of each materials stream, showing misplaced materials and properly placed materials within each stream.

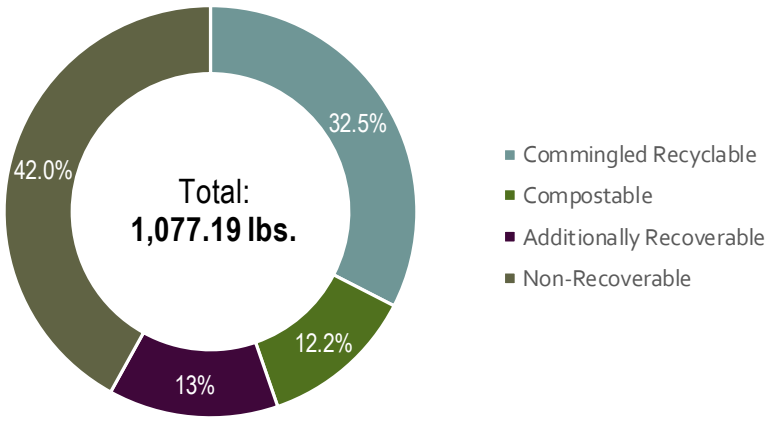

Figure 4.1: Overall composition of combined materials streams

Note: This chart does not reflect the proper diversion of these materials, this is only a snapshot of what percentages of each material category made up both streams combined. For example, while 24.1%of the commingled recyclable materials were found within the combined streams, not all 24.1% was properly diverted. This is further described in the text below.

	MATERIALS	WEIGHT (LBS)	PERCENT OF GRAND TOTAL
Curbside Recoverable	Mixed paper*	76.99	7.1%
	Corrugated cardboard	39.32	3.7%
	Plastic bottles & tubs	9.64	0.9%
	Mixed metals	5.57	0.5%
	Misplaced Materials:		
	Glass bottles & jars	12.86	1.2%
	Compostable Materials	2.03	0.2%
	Additionally Recoverable Materials	7.97	0.7%
	Non-Recoverable Material	41.52	3.9%
	Glass bottles & jars	**0.08**	**0.0%**
	Misplaced Materials:		
	Commingled Recoverable	0.00	0.0%
	Compostable Materials	0.00	0.0
	Additionally Recoverable Materials	0.00	0.0
	Non-Recoverable Material	0.00	0.0
	Total Properly Diverted	**131.60**	**12.2%**
	Overall Contamination	**64.38**	**6.0%**
Compostable	Food scraps	15.74	1.5%
	Food-soiled fibers	0.88	0.1%
	Compostable bags	0.39	0.0%
	Yard debris	0.09	0.0%
	Compostable single-use hot drink cups	0.00	0.0%
	Misplaced Materials:		
	Curbside Recoverable Materials	0.02	0.00
	Additionally Recoverable Materials	1.49	0.00
	Non-Recoverable Materials	1.87	0.00
	Total Properly Diverted	**17.11**	**1.6%**
	Overall Contamination	**3.38**	**0.3%**
Landfill- bound	True waste	345.73	32.1%
	Single-use food serviceware	4.65	0.4%
	Restroom waste	30.7	2.9%
	Liquids	22.49	2.1%
	Single-use cold drink cups	2.68	0.2%
	Single-use hot drink cups	2.33	0.2%
	Misplaced Materials:		
	Curbside Recoverable Materials	206.12	19.1%
	Compostable Materials	111.98	10.4%
	Additionally Recoverable Materials	134.04	12.4%
	Total Diverted	**408.58**	37.9%
	Misplaced Recoverable Materials*	**452.14**	42.0%
	TOTAL PROPERLY DIVERTED	**557.29**	51.7%
	TOTAL CONTAMINATION*	**519.90**	48.3%
	GRAND TOTAL	**1077.19**	**100%**

Table 4.1: Composition of all materials streams

"Total Properly Diverted" includes properly placed commingled and compostable materials.

"Total Contamination" includes non-recoverable, additionally recoverable, commingled, and compostable materials that were improperly placed in either the commingled or compostable streams

By accounting for the misplaced materials from any given stream, a clearer picture of the true rate of diversion for that material stream emerges. Table 4.2 shows that 37.5% of commingled recycling and glass bottles and jars recycling materials found through the load were being properly diverted. For compostable materials, only 0.5% of materials were properly place in the compost stream while the majority of the food scraps and food-soiled fibers were found in the landfill-bound stream. load.

Classification	Total Lbs. in All Streams	Properly Diverted	Diversion Rate
Commingled Recyclable	350.60	131.60	37.5%
Compostable	131.12	17.11	13.0%
Streams Combined	481.72	148.71	30.9%

Table 4.2: Diversion rates by stream

Note: "Commingled Recyclable" includes commingled recycling and glass bottles and jars combined for diversion rate purposes. Additionally, the "Streams Combined" classification is a sum of both "Commingled Recyclable" and "Compostable" streams which make up the currently recoverable materials serviced by Trashco.

The proceeding subsections provide more detail on each individual material stream, presenting data collected from the materials audits. Findings from the landfill-bound, commingled recycling, glass bottle and jar recycling, and compost streams are presented separately. Figures 4.2 through 4.5 and Tables 4.2 through 4.5 provide a breakdown of the specific materials found in each assessed materials stream, beginning with landfill-bound materials and concluding with the compost stream.

Landfill-bound stream

A total of 856.07 pounds of landfill-bound materials were generated over 24-hours of operation at Blumel. Figure 4.2 and Table 4.3 present the material weights according to the different material categories outlined in **Section 2: Methods**.

According to the data, 24.1% of the landfill-bound materials could have been diverted through Blumel's existing recovery systems for, commingled recycling and glass bottle and jar recycling. Of this ***commingled recycling*** category, mixed paper comprised the largest portion, comprising 13.4% of the total landfill-bound load.

Compostable materials made up 13.1% of the landfill-bound stream, which was made up largely of food scraps.

Additionally recoverable materials comprised 15.7% of the landfill-bound load. While some of these materials can currently be diverted through PSU's additional streams – reuse, textiles, and e-waste in particular – other materials including plastic film and rigid plastics have the potential to be diverted, should PSU explore additional diversion programs. The largest category within this classification was the television found in the load, which made up 7.2% of the landfill-bound load.

Non-recoverable materials comprised 47.2% of the landfill-bound load. True waste comprised the largest portion of the category at 85.6% of non-recoverables. Restroom waste was the second largest material in this category, only comprising 3.6% of the total load. While also paling in comparison to true waste, liquids comprised 2.6% of the total landfill-bound load, weighing 22.49 lbs.

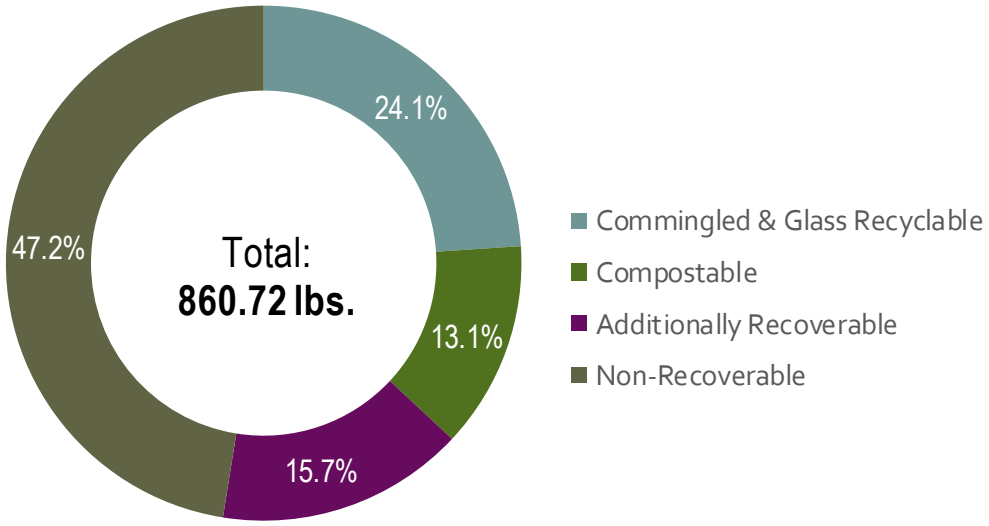

Figure 4.2: Landfill-bound stream general composition

	Material	LBS	%
Commingled Recyclable	Mixed paper	114.33	13.3%
	Corrugated cardboard	39.72	4.6%
	Plastic bottles & tubs	11.58	1.3%
	Mixed metal	11.10	1.3%
	Aseptic	0.83	0.1%
	Glass bottles & jars	28.56	3.3%
	Total	**206.12**	**23.9%**
Compostable	Food scraps	82.25	9.6%
	Food-soiled fibers	19.33	2.2%
	Compostable single-use food serviceware	10.4	1.2%
	Total	**111.98**	**13.0%**
Additionally Recoverable	Television	62.00	7.2%
	Textiles	24.69	2.9%
	Plastic film	12.19	1.4%
	Reuse	11.26	1.3%
	Intact food	10.33	1.2%
	Rigid plastics	8.53	1.0%
	Wood	2.34	0.3%
	E-waste	2.01	0.2%
	Styrofoam	0.69	0.1%
	Total	**134.04**	**15.6%**
Non-recoverable	True waste	345.73	40.2%
	Single-use food serviceware	4.65	0.5%
	Restroom waste	30.70	3.6%
	Liquid	22.49	2.6%
	Single-use cold cups	2.68	0.3%
	Single-use hot cups	2.33	0.3%
	Total	**408.58**	**47.5%**
	GRAND TOTAL	**860.72**	**100.0%**

Table 4.2: Landfill bound stream specific material composition

Commingled and Glass Bottles and Jars Recycling Streams

A total of 195.70 pounds of materials were diverted to the commingled recycling stream over the 24-hour generation periods at Blumel. Figure 4.2 presents the stream's generalized composition, based on properly placed materials versus contaminants. This indicates that 67.1% of materials in the commingled recycling stream were properly placed, while 32.9% were contaminant materials made up of compostable, additionally recoverable, and non-recoverable materials.

Tables 4.3 and 4.4 detail the material weights according to the different material categories outlined in **Section 2: Methods**. Of the properly-placed commingled recycling materials, mixed paper compromised the largest material observed, with 39.3% of the commingled load. The second-largest portion was corrugated cardboard, which comprised 20.1% of the load.

Of the total commingled recycling stream, **non-recoverable** materials accounted for 21.2%, comprised mostly of true waste. Glass bottles and jars were also found in the load and made up a 6.6% of the total stream. **Additionally recoverable** materials compromised 4.1%, and **compostable** materials compromised only 1.0%

	Material	LBS	%
Commingled Recyclable	Mixed paper	76.99	39.3%
	Corrugated cardboard	39.32	20.1%
	Plastic bottles & tubs	9.64	4.9%
	Mixed metal	5.57	2.8%
	Total	**131.52**	**67.1%**
Contaminants	Glass bottles & jars	12.86	6.6%
	Food scraps	0.99	0.5%
	Food-soiled fibers	1.04	0.5%
	Rigid plastic	3.13	1.6%
	Plastic film	2.48	1.3%
	Styrofoam	0.42	0.2%
	Reuse	1.75	0.9%
	E-waste	0.19	0.1%
	True waste	39.51	20.2%
	Liquid	1.07	0.5%
	Single-use food serviceware	0.20	0.1%
	Single-use hot cups	0.54	0.3%
	Single-use cold cups	0.2	0.1%
	Total	**64.38**	**32.9%**
	GRAND TOTAL	**195.90**	**100.0%**

Table 4.3 Commingled recycling stream specified material composition

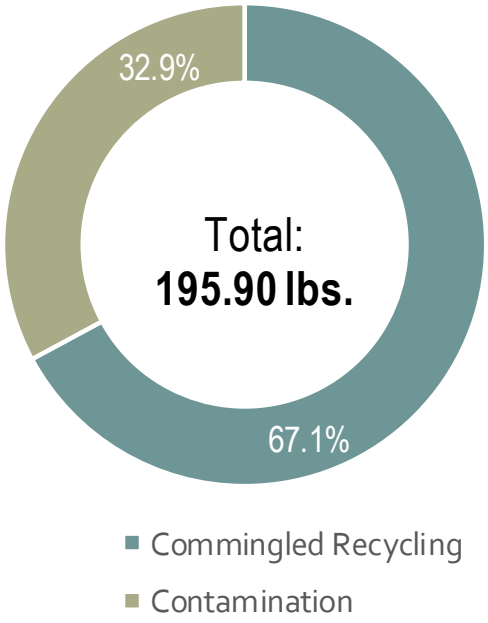

Figure 4.3: Commingled recycling stream generalized composition

Material	LBS	%
Glass bottles & jars	0.08	100.0%
GRAND TOTAL	**0.08**	**100.0%**

Table 4.4. Glass bottles and jars stream specified material composition

Compost Stream

A total of 132.86 pounds of materials were diverted to the compost stream over the 7-day generation period at Blumel. The total load weight was divided by 7 in order to find the average weight of materials generated per day within the stream. Doing so resulted in an estimated 20.94 lbs of material found in the load. Figure 4.4 presents the compost stream's generalized composition, based on properly placed materials versus contaminants. Figure 4.4 shows 83.5% of materials in the compost stream were properly placed by weight. Of the properly diverted compostable materials, 76.9% were food scraps. There was some contamination in the compost load at 16.5%. This contamination included intact food, restroom waste, and true waste items.

Table 4.5 details the material weights according to the different material categories outlined in **Section 2: Methods**. Although the compost stream is well-sorted and generally free of contaminants, it is important to note that the bulk of the compost load may have come from Meetro, a nearby café, mixing its compost items in with those of Blumel.

	Material	LBS	%
Compostable	Food scraps	15.74	76.9%
	Compostable fibers	0.88	4.3%
	Compostable bags	0.39	1.9%
	Yard debris	0.09	0.4%
	Compostable single-use hot cups*	0.00	0.0%
	Total	**17.11**	**83.5%**
Contaminants	Mixed metal	0.02	0.1%
	Intact food	1.37	6.7%
	Rigid plastics	0.13	0.6%
	Restroom waste	1.66	8.1%
	True waste	0.20	1.0%
	Single-use hot cups	0.01	0.0%
	Total	**3.38**	**16.5%**
	GRAND TOTAL	20.49	100.0%

Table 4.5: Compostable stream specified materials composition
** A single compostable single-use hot cup was found, therefore a*

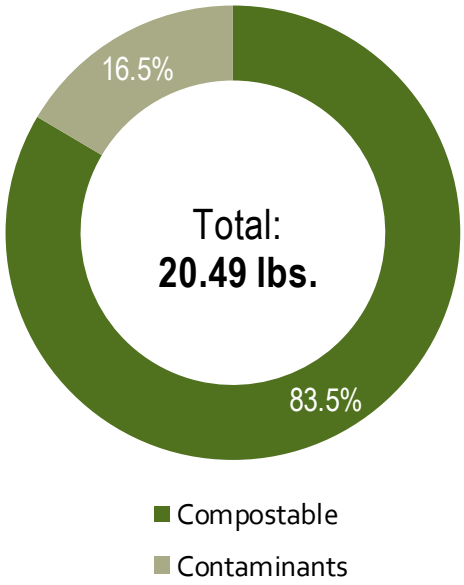

Figure 4.4: Commingled recycling stream generalized composition

Section 5: LEED O+M Materials Generation and Diversion Table

Table 5.1 shows the material categories according to the LEED O+M Materials Generation and Diversion guidelines. The *Total in Waste Stream* column gives the total weight of the specific material regardless of which material stream it was deposited in. For example, the cardboard weight is a combination of cardboard found in the commingled recycling, compost, and landfill-bound streams. The *Percentage of Total Waste Stream* column displays how much of the building's entire waste stream is comprised of that material. The *Waste Diverted* column gives the weight of the specific material that was actually diverted to the recycling stream. For example, the plastic weight is the amount found in the commingled recycling stream, but not in the landfill-bound stream. The *Percentage of Waste Type Currently Diverted from Waste Stream* column displays the percentage of each specific material that was properly diverted. This indicates, for example, that 60% of the mixed paper at the building is not being properly diverted and is being deposited into landfill-bound containers. Please note that 'Other Waste' does not have figures for the *Waste Diverted* or *Percentage of Waste Type Currently Diverted from Waste Stream* columns because 'Other Waste' is not divertible within LEED O+M Standards/ Blumel's existing diversion systems.

Waste Type	Waste Stream	Percentage of Total Waste stream	Waste Diverted	Percentage of Waste Type Currently
Metal	16.69	1.5%	5.57	33.4%
Mixed Paper	192.15	17.8%	76.99	40.1%
Cardboard	79.04	7.3%	39.32	49.7%
Glass	41.50	3.9%	0.08	0.2%
Plastic	21.22	2.0%	9.64	45.4%
Wet Waste	142.81	13.3%	17.11	12.0%
Other Waste	583.78	54.2%	N/A	N/A
Total	1077.19	100%	148.71	

Table 5.1: LEED Materials Generation and Diversion rates

Figure 5.1 (see next page) provides the diversion rate of each material for which a diversion system currently exists at Blumel. The chart displays the rate at which each material was properly diverted as a percentage of that material's total assessed weight in all materials streams combined. The data show that Blumel had more success separating and diverting some materials than others. Blumel was able to divert nearly half of its cardboard, at 49.7%, with mixed paper (which includes aseptic containers) following at 40.1%. 45.4% of plastic bottles and tubes were properly diverted, along with 33.4% of mixed metals generated over 24-hours of operation. Only 0.2% of the sample was successfully diverted into the glass bottles and jars system at Blumel.

Lastly, the successful diversion of materials into the compost stream for Blumel was only 12.0%. Figure 5.2 shows that all materials have some room for improvement in their diversion rates, but that certain

specific materials could be more actively targeted for improvement, in terms of their collection and diversion practices. Compost and glass bottle and jar collection significantly weighed down the overall diversion rate due to not being properly diverted. Targeted improvement in this area is important in increasing the overall rate of diversion at Blumel

A detailed description of each material category used in Table 5.1 is provided in the LEED O+M Materials Generation and Diversion Table Glossary on the next page.

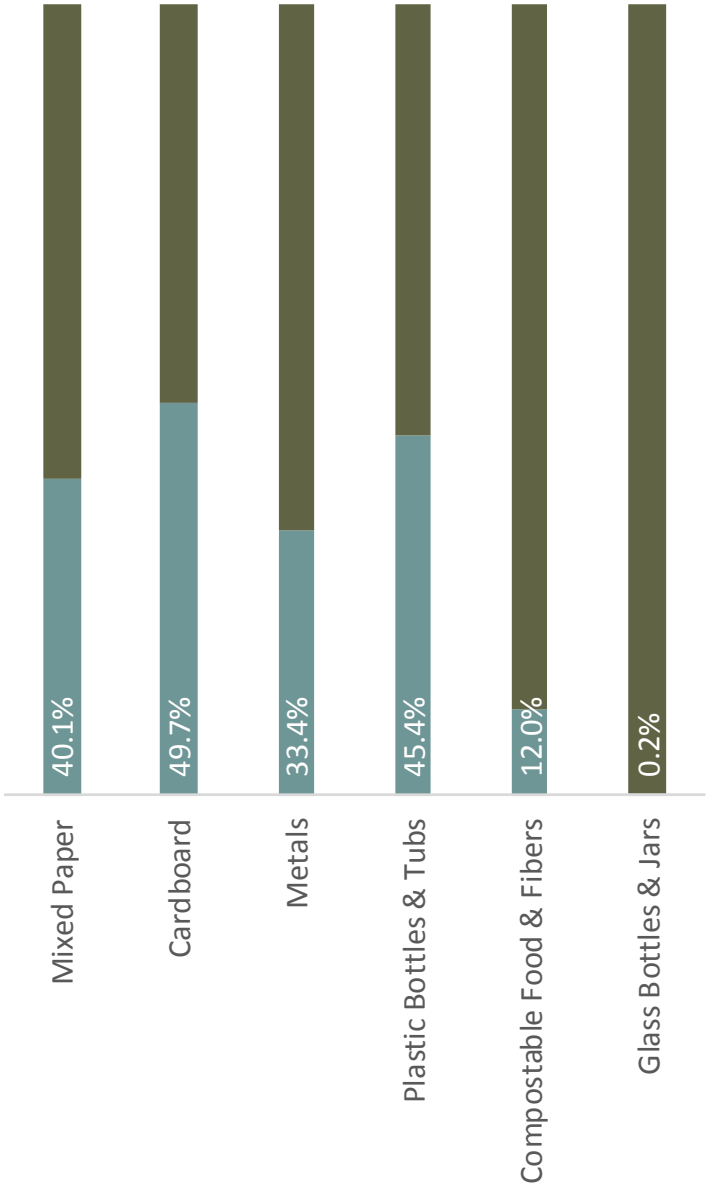

Figure 5.1: Diversion rates for each divertible material

LEED O+M Materials Generation and Diversion Table Glossary

Metal – Containers made of aluminum, steel, or tin, including containers for beverages, food, and other materials; this includes aerosol cans and clean aluminum foil.

Mixed Paper – Office paper, newspaper, magazines, phonebooks, paper board/soft cardboard, folders, scrap paper, sticky notes, shredded paper, paper bags, egg cartons, cereal boxes, and all other non-corrugated cardboards; this includes aseptic containers such as gable-top milk and juice cartons and square-shaped cartons often used for soups or soymilk.

Corrugated Cardboard – Corrugated boxes or sheets used for shipping and packaging materials.

Glass – Bottles and jars made of glass.

Plastics – Plastic bottles and tubs; this includes containers for beverages and other fluids, plastic tubs of primarily food grade plastic often used for yogurt, margarine, and other food or non-food materials, rigid plant pots larger than four inches, and plastic buckets five gallons or smaller.

Wet Waste – Vegetables, fruit, grain-based food scraps, meat, fish, fat, bones, eggshells, coffee grounds and paper fibers contaminated with food, including coffee filters, soiled napkins, soiled paper bags, that meet the guidelines set by City of Portland Bureau of Planning and Sustainability. This is the definition that LEED uses for wet waste. The solid waste community may define wet waste differently. It is sometimes defined as a general mix of landfill-bound materials, which is in contrast to 'dry waste,' or construction materials such as wood, metals, and glass, and other recyclables.

Other Waste/Miscellaneous – This category includes both non-recoverable materials (single-use drink cups, single-use food containers, restroom waste, liquid, etc.) and other recoverable materials (rigid plastics, plastic film, office reuse/donatable materials, printer toner, polystyrene expanded foam block, and polyethylene expanded foam sheets.)

Section 6: Discussion

The quantitative data in Section 4: Findings paired with observations in Section 3 indicates that PSU's Blumel Residence Hall is having difficulty diverting materials from its landfill-bound stream. Blumel has a diversion rate of 51.5% among all of its streams, with only 13.9% of all commingled recycling, glass bottles and jars recycling, and compost materials being properly diverted. At present, 52.9% of Blumel's landfill-bound stream is recoverable , 49.8% of which could be recovered through PSU's current commingled, compost, and additionally recoverable streams. This contamination primarily consists of commingled recycling materials, weighing 206.12 lbs, followed by both additionally recoverable materials and compostable materials, at 134.04 lbs. and 111.98 lbs. respectively (*see Tables 4.1 and 4.3*).

Section 3: Observations and pictures from Section 1: Background provide qualitative data that makes it evident as to why there is such a low diversion rate for Blumel Hall. We noticed that currently there was no commingled recycling drop box or glass bottles and jars roll cart placed in the waste corral nearest Blumel (the aforementioned Blumel Corral). If students chose to forego the option of using the in-house commingled recycling and compost roll carts located on every other floor within the building, students were expected to use the nearby King Albert corral for diverting their recycling materials (see Image 1.4). Our findings indicate that students are not always utilizing the designated commingled recycling corral (King Albert). We found full bags of recyclable material that appeared to be generated by students intending to recycle, but were dumped in the landfill-bound droboxes (*see Image 3.9*). Either signage must be improved to help students find the recycling options nearby, or the commingled recycling or glass recycling bins should be added back to the Blumel Corral[2].

We also noticed that there may be a need for some janitorial training on waste diversion. We noticed during the landfill-bound sort that there was an entire bag of mail and newspapers that appeared to be from the "paper only" bin in the Blumel lobby (*see Image 3.10*). This may have been mistakenly dumped into the landfill dropboxes by janitorial due to a lack of recycling bins in the Blumel corral, or a lack of training regarding placement of the commingled recycling dropboxes.

We noticed a lack of compostable materials in the compost collection bins (*see Figure 4.5*), and glass bottles and jars in the glass collection bin in the King Albert corral (see Figure 4.4), which also indicates that students in King Albert are not properly placing their glass bottles and jars and composting materials. We did, however, find large amounts of glass and compostable materials in the commingled and landfill-bound loads (*see Table 4.1*). This could be improved by adding clear signage in the corral of where glass and compost is collected, as well as providing clearer signage in the residence halls of where glass and compost can be diverted both inside and outside of the building. Signage in corrals can also be much larger, include more pictures, and be multilingual for the aid of students, janitorial, and passerby of the exposed corrals. It may also be beneficial to introduce some more education and engagement opportunities via EcoReps or CSO surrounding commingled recycling and compost diversion targeted at Blumel Hall residents.

Of the current waste diversion system inside Blumel Hall, we found instances of confusing signage, such as "paper only" which may discourage students from recycling other commingled recycling materials (*see Image 1.1*). We also found areas in the lobby, main area, and laundry rooms where there were recycling bins,

[2] Please note that any recommendations offered in Section 7: Discussion are described in more detail in Section 8: Recommendations. Please refer to Section 8 for more information.

but no other types of waste collection bins (*see Image 1.2*). This led to these bins being repurposed to collect all materials, and consequently all being dumped into the landfill-bound droboxes by janitorial staff.

Students are also given a recycling bin and a compost bin for use in their rooms, but not a trash bin or glass recycling bin. Giving students bins for each stream readily diverted at Portland State as well as easy to understand signage could help students increase the diversion rate for Blumel Hall. Lastly, it may be difficult for residents to find the materials recovery rooms on every floor adjacent to the laundry rooms. They are on opposite floors than the trash chutes, and there is no wayfinding signage to help students find these rooms and divert these materials. Pairing the current recycling bins in the lobby with buddied bins for landfill, compost, and glass bottles and jars could help reinforce the waste diversion behaviors in the rooms of Blumel Hall.

We also noted some confusion around commingled recycling, as 32.9% of assessed materials – including compostable materials, additionally recoverable materials, and non-recoverable materials - in commingled recycling stream were improperly placed. Again, this sort contained materials from the King Albert corral, meaning that the materials generated here may also be from students living in King Albert and/or the nearby Meetro Café. The most common misplaced items were glass bottles and jars, plastic film, rigid plastics, and reuse materials (*see Table 4.4*). Large, clear signage with pictures on what can and cannot go in commingled recycling could help target these specific contaminants. Another materials we found in commingled recycling was true waste candy and snack wrappers (*see Image 3.20*). These seemed to be from vending machines in the Blumel and King Albert lobbies. Having buddied bins and clear signage can help prevent true waste from ending up in the commingled recycling load.

In addition to this, we noticed materials that are currently divertible at Blumel Hall or have the potential to be diverted in the near future that could be reduced from the landfill-bound stream with the use of education and proper signage. These included some reuse items, which could be diverted to the Reuse room using signage and some educational programming (*see Image 3.23*). Textiles were also found in the landfill-bound load, and could have been diverted to the Gaia boxes near the Blumel corral (*see Image 3.13*). There was also a large amount of intact food in the compost collection bin, which may be diverted through the use of the Foodrunners program in the near future[3] (*see Image 3.26*).

[3] Most of the compostable materials were identified as being from the Meetro Café, which has recently been closed for the duration of the school year.

Section 7: Recommendations

These recommendations are based on the findings and observations from Blumel Hall. The reasoning behind these recommendations can be found in Section 7: Discussion. Primary recommendations from CES include:

Improve signage at the Blumel Hall corral, and either reintroduce commingled recycling and glass recycling within this corral or provide wayfinding signage to help students find where they should be placing their recycling and glass recycling.

- Reintroducing recycling and glass recycling to the Blumel Hall corral could lead to an improved commingled recycling and glass bottles and jar recycling rate.
- If this is not possible, provide large, clear signage to help students locate the designated recycling area in the King Albert corral.
- In addition to wayfinding signage, there is a unique project opportunity for Waste Reduction Task Force volunteers to create larger signage for the dropboxes and a large educational sign in the corral. This sign could highlight where materials should be diverted to, where those bins are located, additional diversion streams on campus, and who to contact in case they have any questions. The signage could also include some artistic information about the Campus Sustainability Office, Waste Reduction Taskforce, and EcoReps.
- Signage should include large photos of what belongs in each stream, as well as common items that don't belong in each stream. Signage could also be multi-lingual. Temporary signage could be added to Blumel Hall during the summer for the various international groups that are hosted.

Improve Waste Collection Rooms in Blumel Hall

- On every other floor's trash collection room, there should be a sign alerting students that there are other materials diversion options in the residence hall. This signage could highlight that there is compost collection in the Blumel corral, as well as commingled recycling and glass recycling in the laundry rooms on every other floor. This signage could also highlight the Reuse room, E-waste bin in the lobby, and textiles recycling in the Blumel corral.
- The laundry rooms contain a waste diversion room, but the room is not marked in the laundry rooms. Signage should be included on the laundry room door, as well as the door to the waste diversion room that lets students know where they can place their recycling.
- The current waste diversion rooms include commingled recycling and glass bottles and jars recycling. There is room for a small compost collection bin, the same size as those found in kitchens across PSU.

Provide students with more bins when they move in

Currently, students are given one commingled recycling bin and one compost bin upon move-in.

- Providing students with a separate glass recycling bin and a landfill-bound stream may help create the habit in students to properly divert their waste. Having all the options available for each room can also help reinforce the waste diversion signage found in the Blumel corral and waste diversion rooms.

Have buddied collection bins in shared areas.

- One big issue we noticed was the lack of other collection bins in shared areas. We noticed a lot of recycling bins with minimal, if any, signage on them. Providing buddied collection bins in common areas will make it easier for students to divert waste in shared areas.
- These bins should be accompanied with clear signage that matches signage found in the Blumel corral and elsewhere.

Continue and improve educational programming for students

- Composting and recycling workshops can be really helpful for incoming students, especially students from out-of-state or international students who have different recycling rules and/or knowledge depending on their place of origin. We noticed some items in the commingled recycling stream that may be recycled in other areas, but not in Portland. These could be conducted by the Waste Reduction Task Force (WRTF) or the EcoReps.
- Another option could be to have WRTF members or EcoReps members pair up with on-site Resident Assistants (RAs) in the residence hall to do a door knock series. These could be quick 5-10 minute talks as part of a waste diversion door knock series. One talk could be on compost, another on commingled recycling and glass recycling, and another on additional diversion opportunities on campus.
- It may be helpful to conduct a survey for residents in Blumel hall to identify areas where further programming is needed.
- With the addition of sensors on dropboxes, it could be possible that residence halls could compete in Recyclemania to reduce the amount of materials that end up in the landfill-bound stream. This could be paired with Campus Conservation Nationals, a campus-wide competition to reduce energy and water consumption. Buildings that win the competition could receive credit at Cartwell's or a credit for waste utilities saved by the building per student.

Provide trainings for janitorial

Based on what we found during the sort, we believe that janitorial maybe throwing recyclable material from the lobby into the landfill-bound stream.

- Provide a memo or guidebook to Blumel janitors on where recycling should be disposed.
- In addition to this memo, provide building-specific trainings for each building on campus highlighting the waste diversion protocol.
- Provide a contact person for workers to contact if they have a waste diversion question.
- Consider adding multi-lingual signage and guidance to aid janitorial in proper materials placement.

Reinforce Current Programs and Implement New Programs to Target Currently Additionally Recoverable Materials

Additionally recoverable materials made up 13.4% of all streams generated during a 24-hour period in Blumel Hall. The most common items found in this category were e-waste, reuse materials, intact food, textiles, plastic film, Styrofoam, and rigid plastics.

- Currently, there are programs in Blumel Hall and at Portland State to help divert textiles, reuse, and e-waste from the landfill-bound stream. Increasing signage for the Reuse Room, Gaia boxes, and e-waste bin in the Blumel hall can help further divert these materials from ending up in the landfill. Increasing educational programming about these reuse and recycling opportunities can also help reduce these items from ending up in the landfill.
- Additionally, new programs could be implemented to help increase diversion. Foodrunners, similar to Mugrunners, could be used to collect intact, non-expired food from residence halls to divert towards the Portland State Food Pantry.
- Depending on current market trends, it may be financially feasible to introduce special recycling bins for plastic film, rigid plastics, and Styrofoam. These materials could be collected in the Blumel lobby and serviced as needed. Materials could be collected across campus and then recycled once a high enough volume of materials has been reached to make it financially feasible. Explore plastic film, rigid plastics, corks, and wood scrap recycling options through Metro's Find a Recycler webpage: http://www.oregonmetro.gov/index.cfm/go/by.web/id=1383.
- Alternatively, these materials could be diverted to other places on campus or in Portland for repurposing, such as the Art Department's Supply Studio.

Section 8: Materials Audit Photos

The proceeding photos are intended to provide visual examples of the material categories, their standard composition, and evidence of individual materials' presence in the land-fill bound, compost, commingled recycling, and glass bottles and jars streams.

Landfill-Bound Stream

Image 8.1: Full landfill-bound load pre-sort

Image 8.2: Corrugated cardboard

Image 8.3: Mixed paper

Image 8.4: Plastic bottles & tubs

Image 8.5: Mixed metals

Image 8.6: Aseptic containers

Image 8.7: Glass bottles & jars

Image 8.8: Food scraps (example)

Image 8.9: Food-soiled fibers (example)

Image 8.10: Compostable single-use food serviceware

Image 8.11: Television

Image 8.12: Textiles

Image 8.13: Plastic film

Image 8.14: Reuse

Image 8.15: Intact food

Image 8.16: Rigid plastics

Image 8.17: Wood

Image 8.18: E-waste

Image 8.19: Styrofoam

Image 8.20: True waste

Image 8.21: Single-use food serviceware

Image 8.22: Restroom waste

Image 8.23: Liquid

Image 8.24: Single-use cold cups

Image 8.25: Single-use hot cups

Commingled Recycling Stream

Image 8.26: Commingled stream post

Image 8.27: Corrugated cardboard

Image 8.28: Mixed paper

Image 8.29: Plastic bottles & tubs

Image 8.30: Mixed metals

Image 8. 31: Glass bottles & jars

Image 8.32: Food scraps

Image 8.33: Food-soiled fibers

Image 8.34: Rigid plastic

Image 8.35: Plastic film

Image 8.36: Styrofoam

Image 8.37: Reuse

Image 8.38: E-waste

Image 8.39: True waste

Image 8.40: Liquid

Image 8.41: Single-use food serviceware

Image 8.42: Single-use hot cups

Image 8.43: Single-use cold cups

Compost Stream

Image 8.44: Compost stream post-sort

Image 8.45: Food scraps

Image 8 .45: Food-soiled fibers

Image 8.46: Compostable bags

Image 8.47: Yard debris

Image 8.48: Compostable single-use hot cups and rigid plastics

Image 8.49: Mixed metal

Image 8.50: Intact food

Image 8.51: Restroom waste

Image 8.52: True waste

Image 8.53: Single-use hot cups

Appendix A: Glossary of Material Categories

Aseptic containers – Aseptic containers such as gable-top milk and juice cartons and square-shaped cartons often used for soups or soymilk. This category is an accepted material in the commingled recycling.

Compostable single-use food service ware – Non-durable containers, plates, dishes and flatware designed for single use and used to serve and transport food. These are comprised of compostable materials.

Corrugated cardboard – Corrugated boxes or sheets used for shipping and packaging materials.

E-waste – Discarded electronics such as central processing units (CPUs), monitors, televisions, cell phones, microwaves, radios, printers, fax machines, cords, and related office equipment.

Food scraps– Vegetable, fruit, grain-based food scraps, meat, fish, fat, bones, eggshells, tea bags, and coffee grinds. This category excludes non-compostable hot and cold drink cups, gable-top or square shaped aseptic cartons, waxed cardboard, and utensils, straws, lids, or bags made of plastic.

Food soiled fibers - Paper fibers contaminated with food, including soiled napkins, soiled paper bags, pizza boxes, and paper towels.

Glass bottles and jars – Bottles and jars made of glass. This category excludes light bulbs, flat glass, flower vases, drinking glasses, window glass, and tempered glass such as baking dishes.

Intact food – Food that is not spoiled and would have potential for food donation, rather than disposal.

Liquid – Liquids that were in containers in the load.

Mixed paper – Includes office paper, newspaper, magazines, phonebooks, paper board/soft cardboard, folders, scrap paper, sticky notes, shredded paper, paper bags, egg cartons, cereal boxes, and all other non-corrugated cardboards. This category may include or exclude aseptic materials such as gable-top milk and juice cartons and square-shaped cartons often used for soups or soymilk in this report. In figures or tables where aseptic containers have been called out in their own category, the mixed paper category excludes aseptics.

Metals – Containers and metal pieces made from any type of metal except aluminum; includes metal containers as well as scrap metal.

Plastic bottles and tubs – Plastic containers with a neck, including containers for beverages and other fluids; plastic tubs of primarily food grade plastic often used for yogurt, margarine, and other food or non-food materials, rigid plant pots larger than four inches, and plastic buckets five gallons and smaller.

Plastic film – All clean plastic film bags including grocery and sandwich bags. Also includes shrink-wrap, pallet wrap, bubble wrap, and plastic films.

Polyethylene materials (Styrofoam) – Polyethylene expanded foam sheets used primarily as packing material. This material is generally collectible for recycling along with plastic films.

Reuse – Items that may be re-used through donation to a program or by in-house programs such as for office supplies or furniture.

Restroom waste – Bathroom paper towels and other related items.

Rigid plastic – Non-bottle and non-tub shaped plastics that are not accepted through the regional commingled recycling programs, but are acceptable at various plastics recycling facilities in the region. Includes plastic pallets and spools.

Single-use cold/hot cups – Non-durable, non-recyclable single-use cups for either hot or cold beverages. These cups may be made of plastic, plastic-lined paper, plastic-embedded paper, expanded polystyrene foam, or compostable plastics.

Single-use food service ware – Non-durable containers, plates, dishes and flatware designed for single use and used to serve and transport food. These may be made of plastic, plastic-lined paper, plastic-embedded paper, expanded polystyrene foam, or compostable plastics.

Textiles – cloth or woven fabrics

True waste – Materials that cannot currently be diverted. These materials are known as "true waste" because there are currently no recycling markets for these materials, and the materials are not compostable at local composting facilities, or the materials are not readily reused or fit for donation. Common materials include candy wrappers, chip bags, soiled textiles unfit for donation or recycling, polyvinyl chloride items such as gift cards, and non-recyclable mixed material items without current recycling markets

Wood- lumber material used for construction or pallets

Yard Debris—Organic plant material