

# University of Idaho Waste Characterization



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## Introduction

### Waste Management at Institutions of Higher Education

At higher education institutions across the United States an unexpected and rather filthy subject is receiving a good deal of attention. Garbage, and reducing its production, has become a focus of many colleges and universities as they strive to reduce their environmental impacts. Institutions are working to minimize the amount of waste they generate and maximize the diversion rate of generated waste. This recent focus on waste in higher education can be seen by the steady increase in participation in the yearly waste minimization competition RecycleMania. The friendly competition pits colleges and universities against one another in a battle to minimize waste and maximize waste diversion (recycling and composting). RecycleMania began in 2001 with 2 participants and has expanded to over 500 participants for the 2009 competition with at least one school from all 50 states.<sup>1</sup> As schools work to reduce their waste and increase the amount of materials they recycle and compost it becomes imperative to have a better understanding of the waste stream.

With the goal of discovering exactly what makes up their waste stream many colleges and universities have undertaken waste characterization studies. The scale and intensity of these studies vary greatly depending upon the funds and volunteers available. At some institutions, such as the New York University Washington Park campus, waste characterizations are completed by university staff members.<sup>2</sup> Other institutions have focused on getting students involved. At Meredith College in Raleigh, North Carolina, student volunteers and faculty and staff conducted a waste characterization in January, 2009.<sup>3</sup> By including students in the process the value of the waste characterization increases, the event is transformed from merely an opportunity to collect data to an educational experience. Taking part in a waste characterization is an eye opening experience for students, and it will hopefully make them more conscious of the things they throw away.

Armed with the data gained from waste characterizations, schools are restructuring their waste management systems to maximize waste diversion, thereby reducing waste management expenditures. The University of Idaho generates around 1,500 tons of waste annually and spends more than \$350,000 a year disposing of this waste.<sup>4</sup> Minimizing waste production and optimizing the waste collection system could reduce expenditures by tens of thousands of dollars. The UI Sustainability Committee has identified the opportunity to both reduce environmental impacts and financial expenditures through improved waste management and has set a goal to reduce waste by 20% and increase the recycling rate to 60% by 2013.<sup>5</sup> With tipping fees expected to increase in the future as landfills become full and the amount of space available for new landfills decreases, the financial benefits of a strong recycling and composting program will only increase with time.

### Current State of Waste Management at University of Idaho

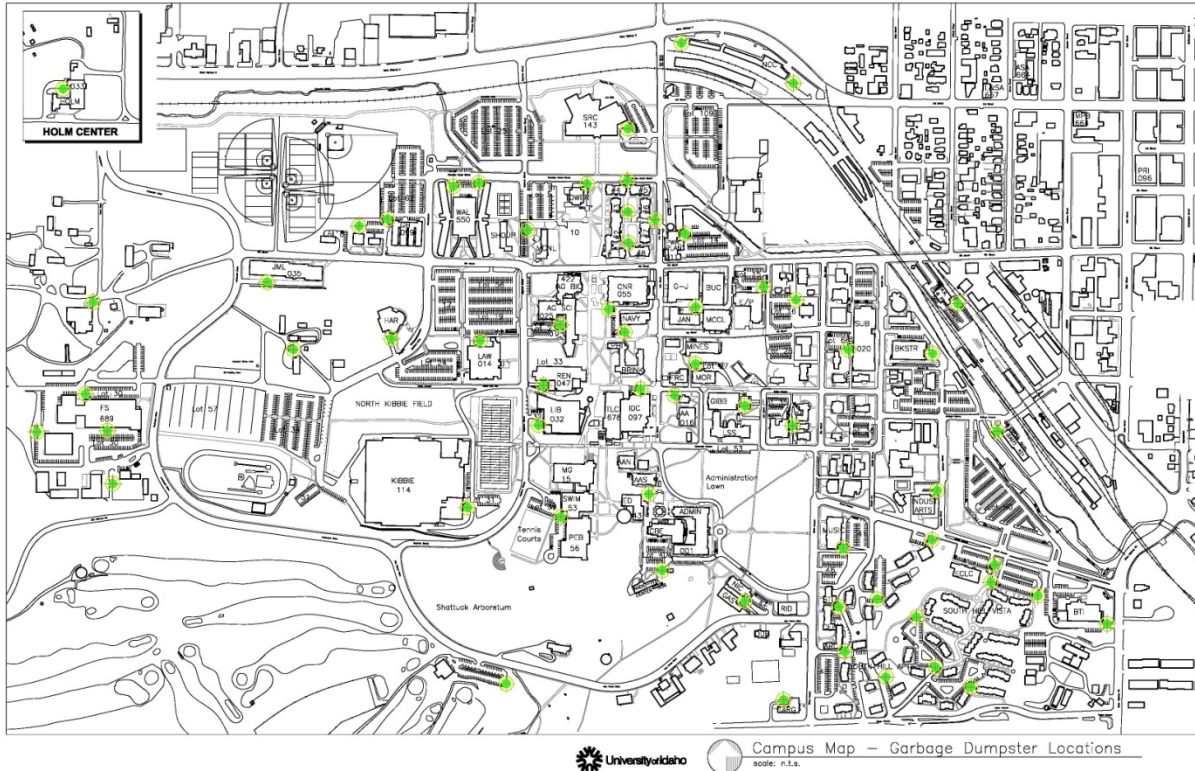
Recycling/Surplus/Solid Waste (RSSW) is the University unit in charge of waste management on campus. The program is a branch of UI Facilities Services and is responsible for the management and operation of a handful of programs related to waste. In order of priority, RSSW manages and operates the solid waste program, surplus program, hazardous waste/universal waste program, recycling program and lost and found program. RSSW has a staff of 5 full time employees (FTE); 2.5 FTE are dedicated to solid waste/surplus/hazardous waste and lost and found, and 2.5 FTE are dedicated to the recycling

program. The only official major waste management activity not directly controlled by RSSW is manure diversion and composting. Primary management of these programs is controlled by Palouse Research, Education and Extension Center due to the high volumes of animal waste produced. Many smaller, volunteer-based recycling efforts also occur on campus as individuals and small groups attempt to fill in around Facilities operated programs.

## Waste

There are 62 dumpsters located on the UI Moscow campus ranging in size from 2 to 8 cubic yards (Figure 1). Along with these dumpsters there are four 20 yard compactors. It is estimated that the total waste generated at the University of Idaho yearly is 1,500 tons. Due to the logistics of collection by Latah Sanitation Inc. it is cost prohibitive to directly weigh the waste generated by the university, and therefore estimating is the only alternative. The current estimation of 1,500 tons is based on a 2003 study conducted by UI and Latah Sanitation.

This estimation is a combination of three sources of waste data: waste generated from compactors, total waste hauled to the transfer station by UI, and total waste collected by Latah Sanitation from UI dumpsters. The estimate of waste collected by Latah Sanitation from UI dumpsters is calculated based on waste surveys of collection vehicles one week per month for one year. For each collection day, the total weight of waste in the truck was compared to the total cubic yards of dumpster space emptied to determine an average of pounds per cubic yard. This average was then used to estimate the total waste generated for the month. These 1,500 tons of waste are shipped 225 miles to the Columbia Ridge Landfill located in Arlington, Oregon.



Source: RSSW website <http://www.dfm.uidaho.edu/default.aspx?pid=91497>

Figure 1: Map showing dumpster locations on campus

The daily solid waste generated as a result of normal university operations is divided into two categories, General Education waste and Non-General Education waste. General Education waste refers to the waste in dumpsters associated with academic buildings on campus. Any processing that occurs at General Education dumpsters prior to pick up by Latah Sanitation is done by RSSW. UI pays around \$170,000 annually to Latah Sanitation for the disposal of General Education waste.<sup>6</sup> The costs of General Education waste collection is paid using a set fund controlled by UI Facilities Services, meaning that actual academic departments producing the waste are unaware of the costs for disposal.

Non-General Education waste refers to waste in dumpsters associated with auxiliary services (e.g. Campus Dining) and University Housing. Any processing that occurs at Non-General Education dumpsters prior to pick up by Latah Sanitation is controlled by the specific entity such as University Housing, not RSSW. In fiscal year 2008, University Housing alone spent over \$180,000 on garbage disposal.<sup>7</sup> The costs of Non-General Education waste collection are paid directly by the entity that produces the waste, thereby creating an incentive to reduce costs via waste reduction.

There are two different processes used to pick up and process General Education and Non-General Education waste at the University of Idaho. The first method is the emptying of dumpsters and processing of waste by Latah Sanitation, the local waste collection provider in Moscow, Idaho. This is the method utilized for all dumpsters 4 cubic yards in size and larger, which includes most of the General Education dumpsters. Latah Sanitation charges for collection of this waste based on the size of dumpster and frequency of pick-up (Table 1). Therefore, the amount of waste within the dumpster upon pickup is inconsequential to the fee charged, assuming the waste is not overflowing from the dumpster.

Size	Rental	Times per Week				
		1	2	3	4	5
4 yds.	\$ 24.60	\$ 210.50	\$ 421.05	\$ 631.60	\$ 842.10	\$ 1,052.60
6 yds.	\$ 32.50	\$ 299.35	\$ 598.65	\$ 898.00	\$ 1,197.30	\$ 1,496.65
8 yds.	\$ 40.40	\$ 389.30	\$ 778.65	\$ 1,167.95	\$ 1,545.60	\$ 1,932.30

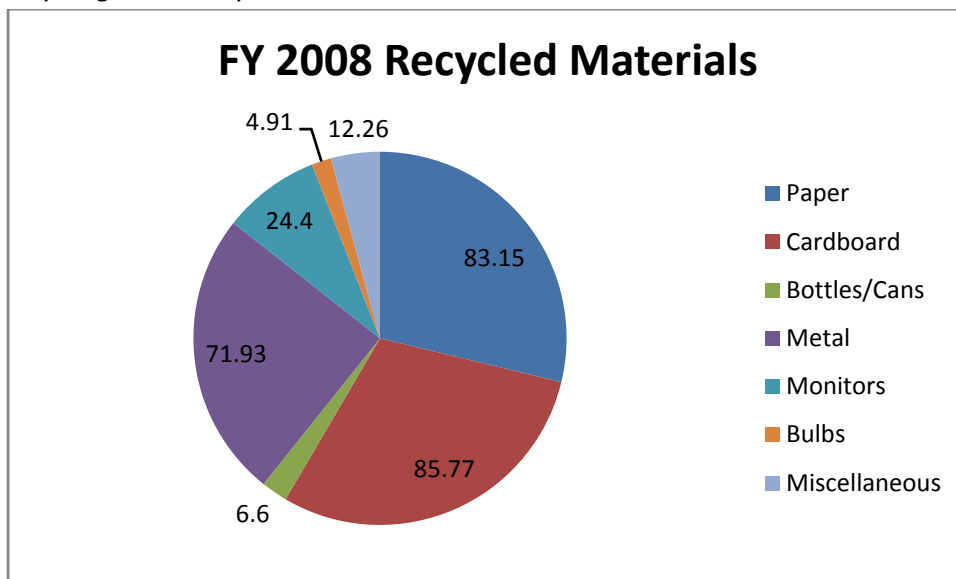
Table 1: Amount UI is charged monthly by Latah Sanitation for different dumpster sizes and pick up frequencies

The other method, used for most 2 cubic yard dumpsters on campus, involves the transport of waste by UI personnel to a compactor, which is then collected by Latah Sanitation and transported to the landfill for disposal. Compacting the waste maximizes the weight of waste that can be fit into the composter, enabling more waste to be collected before Latah Sanitation must pick up and process the waste, and thereby saving UI money. For the disposal of compacted waste UI is charged a tipping fee of \$68.75 per ton and a transport fee of \$185 per trip to the landfill. On average 8 tons are transported per trip; this results in a per ton charge for the disposal of compacted waste of about \$92. This process is utilized for most of the Non-General Education dumpsters and for a few of the smaller General Education dumpsters.

## Recycling

The recycling program, controlled by RSSW, currently accepts the following items: white ledger paper, mixed paper including paper board, #1 and #2 plastics, aluminum cans, cardboard, metal, computer monitors, and light bulbs. The major items commonly accepted for recycling but not taken at UI include glass and #3 - #7 plastics. In fiscal year 2008, UI recycled 289 tons of materials (Figure 2). This

is equivalent to a 19% recycling rate; which is significantly higher than the state rate of 8% (2004)<sup>8</sup>, slightly higher than the city of Moscow rate of 11% (2007)<sup>9</sup>, but below the national recycling rate of 25% (2007)<sup>10</sup>. Having a recycling rate lower than the national average is inconsistent with UI's dedication to sustainability. Drilling down a little deeper, the results are even more startling, considering just paper, cardboard, and bottles and cans (the items students, faculty, and staff recycle on a daily basis) UI's recycling rate is only 12%.



Source: Data from UI Recycling, <http://www.dfm.uidaho.edu/default.aspx?pid=90327>

Figure 2: Amount, in tons, of items recycled at UI from June 2007 to July 2008.

### Manure Diversion and Composting

There are two major farms on campus, the north farm which houses around 130 dairy cows, and the west farm that houses around 200 beef cows and 75 horses. All of the animals combined generate around 3,000 tons of manure annually. Currently the north farm land applies its manure thereby diverting it from the landfill. The west farm is currently the location of composting on campus. At the west farm the manure is composted along with 180 tons of wood waste from the steam plant and 36 tons of leaves from street sweeping. Thus, manure diversion and composting currently results in the diversion of around 3,216 tons of materials from the landfill. If these materials were not diverted from the landfill it would triple the annual waste generated at UI.

As part of its participation in RecycleMania, UI completed a 10-week composting pilot program that focused on composting the food waste from Bob's place, the biggest dining location on campus. The pilot project resulted in composting approximately 7,000 pounds of food waste. The low amount of compostable materials collected was due to frequent logistical problems that occurred during the pilot program. UI plans to build on the success of the pilot program with the introduction of a food waste composting program by the start of the fall 2009 semester. This program will compost food waste from all campus dining facilities on campus, including the two largest, Bobs Place and the Commons Food Court. These facilities are estimated to generate 86 tons of food waste a year, and diverting this waste from the landfill will save the university around \$7,900 annually.

## Study Methods

The waste study performed at the University of Idaho consisted of three major components: an in-depth waste sort of selected dumpsters on campus, in-building waste stream analyses of UI dining facilities, and a survey of large capacity dumpsters to determine cost effectiveness of current hauling procedures.

### Dumpster Waste Sorts

A total of 11 dumpsters were sorted, one in December 2008 and nine in January 2009. The dumpsters were sorted on days that did not fall on or near holidays to ensure that the results were representative of the norm. At least one dumpster from each of the following categories was sorted to ensure the sample accurately represented the total waste generated at UI: student services, classrooms/offices, residence halls, and other facilities (Table 2). The dumpsters in each category were selected based on the high volume of waste they generate, and the knowledge that they did not contain any materials that would pose a serious health and safety danger to volunteers. The day of the week the dumpsters were emptied was also used in the selection process to ensure dumpsters would contain a fair amount of waste.

Building Classification	Dumpsters
Student Services	Memorial Gym
	Library
Classrooms/Offices	Art and Architecture South/Education
	College of Natural Resources
	Niccolls Building
	Morrill Hall
	Brink/Phinney Hall
Residence Halls	McConnell Hall
	Theophilus Tower
Other Facilities	UI Greenhouse
	Hartung Theater

Table 2: Classification system utilized to group dumpsters

The waste was sorted into one of 16 categories: Table 3 provides a brief description of each category. These categories were selected based on research of previous waste characterizations conducted at other universities and specifics of the UI waste management system.<sup>11</sup> Once sorted into the respected categories the waste was weighed using a non-digital bathroom scale. One student was selected to do all the weighing for the sake of accuracy. The selected student was weighed empty-handed, and then weighed holding a bag of waste. The weight of the student holding the bag was then subtracted from the weight of the student empty-handed to determine the weight of the waste.

Recyclable: Items currently recycled at UI	White Ledger Paper: printer paper
	Newspaper
	Mixed Paper: colored paper, paper board
	Cardboard
	Plastics #1 and #2
	Aluminum/Tin
Compostable: Any Items that could be composted if a system were in place.	Organics: paper towels, food waste
Potentially Compostable: Any items that could be composted if compostable alternative was purchased	Potentially Compostable: coffee and soft drink cups
Landfill: Waste generated at UI that is sent to the landfill	Plastics #3 - #7
	Glass
	Other Metals
	Construction and Demolition Materials
	Electronic Waste
	Hazardous Waste
	Other Metals
	Trash
	Other Plastics : plastic bags, and non-labeled plastic containers

Table 3: Categories used for waste sort and materials found in each category

These sorts were carried out by undergraduate students enrolled at UI. Nine of the 10 dumpsters sorted were sorted by about 200 students from the Field Activities in Environmental Science course. The other sort was done by a small group of students from the Globalization course. All student volunteers were provided gloves for warmth and safety, and led by members of the University of Idaho Sustainability Center with assistance from Moscow Recycling.

### Dining Facility Waste Stream Analysis

Waste stream analyses were done at the two major dining facilities on campus, Bob’s Place and the Commons. The focus of these audits was to determine the amount of compostable waste generated at these facilities annually.

#### Bob’s Place

This study was carried out by Jay Loveland, an undergraduate student in Environmental Science, with assistance from the author and other members of the University of Idaho Sustainability Center, and with the cooperation of UI Campus Dining. The study was performed in the fall semester of 2007 and spring semester of 2008. Volunteers and Campus Dining staff separated out all post-consumer food waste for predetermined meals. The separated waste was weighed and recorded. Sampling was organized to ensure adequate and accurate food waste data for breakfast, lunch, and dinner.





Source: Jay Loveland

Figure 3: An example of post-consumer food waste seen at Bob’s Place Dining Facility.

### The Commons

This study was carried out by Kirsty Pendlebury and Holly Diehl as part of a 400/500 level geography course entitled Climate Action Planning, with the assistance of the author and other members of the UISC during the fall semester of 2008. Pre- and post-consumer waste was collected by Campus Dining Staff and set aside for sorting. The sorting took place in the late afternoon thereby ensuring the presence of adequate waste. Table 4 lists the categories used to sort the waste and provides a description of each.

Compostable	Currently Compostable – Food waste, napkins, paper, and compostable serveware (plates, bowls, and to go containers).
Potentially Compostable	Potentially Compostable – silverware, soft drink cups, coffee cups and non compostable serverware (food boats).
Recyclable	Plastics - #1 and #2 plastics
	Cardboard/Paperboard – cardboard boxes and paperboard boxes (i.e. cereal boxes)
	Other Recyclables – Aluminum and tin cans
Waste	Glass
	All other waste – items that do not fall in any of the other categories and are therefore trash

Table 4: Categories utilized for dining facilities waste stream analysis and materials found in each category

### Dumpster Surveying

From March to April 2009, dumpsters were routinely surveyed and photographed the day before pick up to estimate their fullness. Surveying was not done during spring break since waste generation changes greatly during this period. Since dumpsters are picked up in the early hours of the morning, the best option for photographing and surveying the dumpsters was around 4:00 pm the previous day. Surveying included photographing the dumpster, recording the portion of the dumpster filled using a fraction estimate, and making any comments of high volume contaminants. The survey focused on the top waste generating, general education dumpsters on campus as determined from contact with the head of solid waste management on campus. The dumpsters surveyed were between 4 and 8 cubic yards in capacity.

## Results

### Waste Sorts

The waste currently found in dumpsters at the University of Idaho, excluding waste from dining facilities, is comprised of more recyclable and compostable materials than waste that should be sent to the landfill. In fact, as can be seen in Table 5 only 34% of materials found in dumpsters was actually waste. The high percentage of recyclables found in dumpsters shows a need for increased communication and education to students, faculty, and staff. These numbers could also reflect a need for more or better placed recycling stations, an issue that will be further discussed later.

Waste Categories	% of Total
<b>Recyclable</b>	38%
<b>Compostable</b>	23%
<b>Potentially Compostable</b>	5%
<b>Landfill</b>	34%

Table 5: Composition of waste generated by weight at University of Idaho (excluding dining facilities)

Breaking down the recyclable waste category into its respective materials gives a better idea of the materials commonly being thrown in the dumpster instead of recycled. Figure 4 shows that the top two recyclable materials (by weight) found in dumpsters, making up 69% of the total, are mixed paper and cardboard. Thus, at first glance it appears that organization and educational changes should be made to increase the recycling of these two commodities. But another factor must be taken into consideration, the amount of space these materials take up relative to one another.

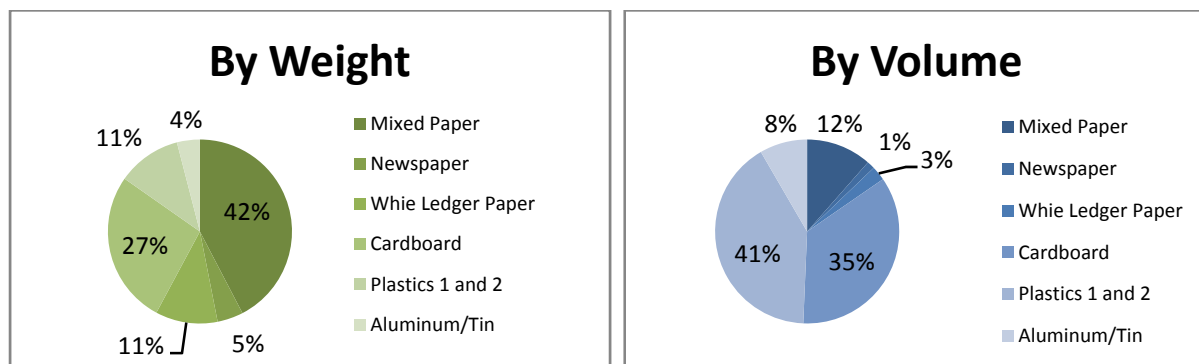


Figure 4: Composition of recyclable materials by weight and by volume

For dumpsters picked up by Latah Sanitation, the University of Idaho is charged each time the dumpster is emptied, regardless of the weight of materials in the dumpster. Therefore, looking at things strictly from a financial perspective UI should focus on reducing the presence of high volume recyclables in dumpsters. This will enable the university to reduce the frequency which dumpster are emptied and/or reduce the size of dumpsters, thereby saving money. Table 6 shows the number of pounds of each recyclable needed to fill one cubic yard of dumpster space. Taking this information into consideration completely changes which materials UI should focus on diverting from the landfill.

Recyclable Material	Pounds per Cubic Yard
Mixed Paper	484
Newspaper	433
White Ledger Paper	568
Cardboard	100
Plastics 1 and 2	36
Aluminum/Tin	63

Table 6: Volume to weight conversion factors (taken from recyclemania.com) of materials recycled at UI. All paper is assumed to be loose, cardboard is assumed to be flattened and plastics and aluminum/tin are assumed to be uncrushed.

Paper products that make up 58% of the recyclable materials found in dumpsters by weight only make up 16% by volume. Plastics 1 and 2 and aluminum/tin that make up only 15% of recyclable materials by weight, make up 49% by volume. Cardboard is the only material that makes up similar percentages whether considered by weight or volume; 27% by weight and 35% by volume (Figure 4). To both minimize waste expenditures and increase the waste diversion rate it makes the most sense to focus operational and educational changes on maximizing the recycling of cardboard and plastics 1 and 2. At the same time increased diversion needs to be seen in all of these categories if UI hopes to reach its goals of reducing waste 20% and increasing the recycling rate to 60% by 2013

Taking a look at the waste compositions of the different generator groups exposes an extensive amount of difference (Figure 5). This data shows that to maximize waste diversion the approach used will vary dependent upon building type, and that certain building types should be focused on more than others. In essence, this data can help identify points of focus in a waste reduction campaign. For example, the presence of extensive compostable material in the other facilities categories is an indicator that further investigation is necessary. By digging a little deeper into the data it is seen that this high percentage of compostable materials is caused by the UI Greenhouse, whose waste stream was found to be composed of 84% compostable materials by weight. Thus, the Greenhouse is an obvious candidate for the introduction of a composting program because it will result in a significant increase in diversion with minimal time and effort.

This data also exposes which generator groups have waste streams dominated by recyclable materials, information that should be used in the planning operational changes and educational campaigns focused on recycling. The area commonly focused on by recycling campaigns at institutions of higher education, student residences, has a small percentage of recyclables in the waste stream in comparison to the other categories. Therefore, it seems that the educational focus needs to be shifted out of the residences and into the classrooms/offices and student services buildings. The dissemination of information and organization of collection facilities in these buildings are more complex, but these areas of campus also generate more waste, therefore making the extra effort worthwhile.

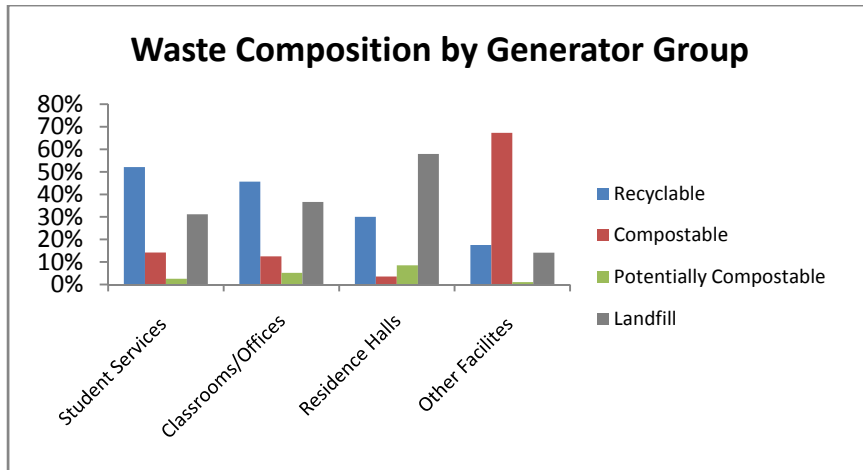


Figure 5: Waste composition by volume of different waste generator groups.

Quantifying the cost savings from reducing the percentage of recyclables and compostable materials in the overall waste stream is difficult due to the volumetric cost system used for dumpster collection. The University of Idaho’s cost savings must be determined on a dumpster by dumpster basis since savings can only be realized by changing the frequency of dumpster collection or the size of the dumpster. The use of this system prohibits the estimation of cost savings based solely on data quantifying pounds of waste reduction. Cost savings from tipping fees can be estimated using this method but these costs are a small fraction of the overall cost associated with the disposal of waste at UI. The dumpster surveying section that follows will investigate potential cost savings from adjusting the collection methods at certain dumpsters on campus.

## Dining Facility Waste Stream Analysis

### Bob’s Place

Bob’s Place offers meals 7 days a week to students, faculty and staff during the academic year. During the normal work week three meals are offered and on the weekend the offering is reduced to two meals. During the average weekday the facility produces 430 pounds of post-consumer food waste. Taking into consideration the reduced waste generation found on the weekends and the fact the dining facility only operates about 8 months of the year, over 81,000 pounds of post-consumer waste are generated in a year. But this estimate is only for post-consumer waste which makes up about 75% of the food waste generated at Bob’s place. If pre-consumer food waste, which makes up the other 25% of the waste generated, is included, then Bob’s Place produces around 109,000 lbs or 54 tons of waste annually. Food waste from Bob’s Place is sent to the Wallace Café Compactor, which includes waste from all residences halls located nearby. The food waste generated from Bob’s place makes up about one-third of the annual waste emptied from the compactor. Composting this waste instead of sending it to the compactor and then to the landfill will save around \$4,900 annually.

### Commons

The Commons food court serves student, faculty and staff five days a week during the academic year. The majority of facilities are open from 10 am to 3 pm, with about 75% of customers being served from 11:30 am to 1:30 pm. The Commons food court offers a variety of different dining options and is

set up much like a mall food court, thereby creating a more diverse waste stream than is found in conventional university dining halls. Even with a more complex waste stream, 72% of waste generated could be diverted via composting and recycling and a few simple product changes could lead to a 90% diversion rate (Figure 6).

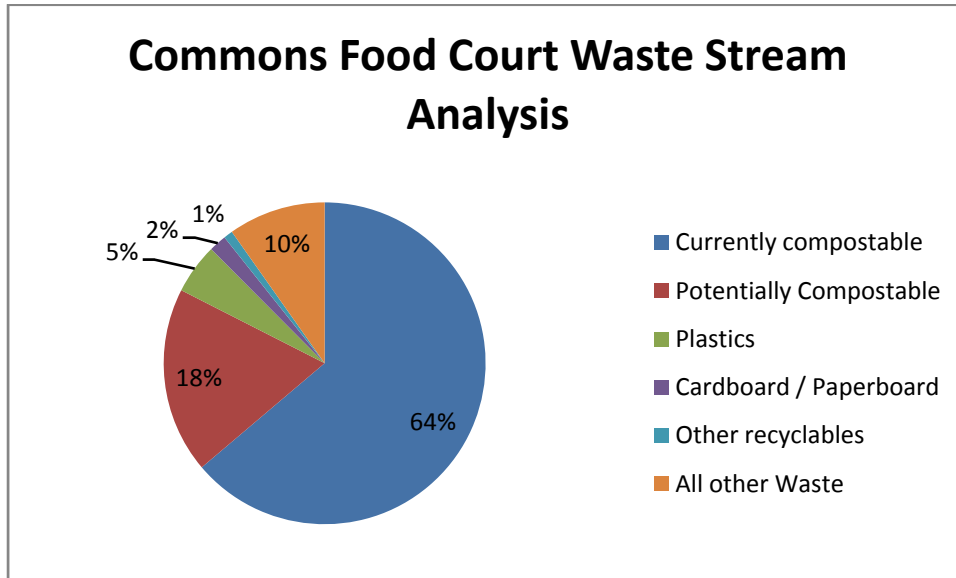


Figure 6: Breakdown of materials by weight found in the Commons food court waste stream.

The Commons food court generates about 100,000 pounds or 50 tons of waste annually, a figure that would decrease to around 35,000 pounds with the introduction of a composting program. This 32 ton decrease in waste production would result in a savings of around \$3,000 annually. Annual waste could be decreased even further to about 17,000 pounds a year by switching all serverware and silverware to compostable materials saving an additional \$800 annually.

### Dumpster Surveying

After the two month dumpster surveying study was complete it became apparent that the university has a major opportunity to reduce costs by reducing frequency of dumpster pick up and/or reducing dumpster sizes at certain locations on campus. The top 17 waste generating dumpsters on campus were surveyed, with the focus falling on those dumpsters emptied most frequently. On a weekly basis the emptying of these dumpsters represents the emptying of 162 cubic yards of dumpster space, 65% of the total General Education dumpsters emptied on a weekly basis, at a monthly cost of \$8,920. The dumpster survey found that only about 80 cubic yards of waste are generated by these dumpster weekly, meaning UI is paying to have 82 cubic yards of air emptied weekly. The optimization of this waste stream will probably not be able to reduce the amount of air emptied to zero but significantly reducing it presents a large opportunity for cost savings. With UI spending over \$62,000 to empty these dumpsters during the approximate 7 months of the academic term, optimizing the system could result in tens of thousands of dollars in savings. It is the dumpsters emptied most frequently that present UI with the largest money saving opportunity.

The three largest waste producing dumpsters on campus: Art and Architecture South/College of Education, Administration/Albertson, and Engineering Gauss Johnson/Buchanan/Janssen are emptied

every Monday, Wednesday and Friday. Table 7 below shows the results of the dumpster surveying study. The dumpsters surveyed were rarely more than half full prior to pick up.

Dumpster	Size (yd <sup>3</sup> )	Percentage Full									
AAS/ED	8	40%	50%	40%	40%	33%	29%	13%	29%	33%	13%
Admin	6	40%	75%	50%	50%	40%	50%	50%	33%	50%	50%
ENG	8	33%	29%	100%	70%	33%	25%	13%	33%	40%	25%

Table 7: Dumpster surveying results of three high volume dumpsters, data spans from March 3 to April 16, 2009

In fact the Art and Architecture South/College of Education dumpster averaged a fullness of 32%, while the Administration/Albertson averaged a fullness of 49%, and the Engineering Gauss Johnson/Buchanan/Janssen dumpster averaged a fullness of 40%. This data shows that the Art and Architecture South/College of Education and Administration/Albertson can either be reduced in size or reduced in frequency of pick up. While the Engineering Gauss Johnson/Buchanan/Janssen is a little more complicated since it did reach near capacity a couple of times due to individuals cleaning out laboratories. With a little communication and coordination this dumpster could also be reduced in size or frequency of pick up.

By consulting Table 8 below, which provides the rates Latah Sanitation charges for dumpster rental and pick up, it can be determined which option will save UI more money. Switching the Art and Architecture South/College of Education dumpster or the Engineering Gauss Johnson/Buchanan/Janssen dumpster to pick up twice a week instead of three times would save UI \$389.30 monthly, while downsizing to a 6 yd<sup>3</sup> dumpster emptied three times a week would save UI \$277.85 monthly. Adjusting the Administration/Albertson dumpster schedule to twice a week would save \$299.35 monthly, compared to a savings of \$274.30 monthly from downsizing to a 4 yd<sup>3</sup> dumpster. These data show that it is more financially beneficial for UI to reduce pick-up to twice a week for these dumpsters, but this change would first have to be approved by Latah Sanitation since it would change the pick-up schedule and therefore potentially impact other scheduled waste routes. If these three dumpsters were switched from tri to bi-weekly pick up it would save UI over \$7,500 during the seven months that classes are in session. Further research is necessary to determine potential savings from adjusting schedules during the summer months and winter break.

Size	Rental	Times per Week				
		1	2	3	4	5
4 yds.	\$ 24.60	\$ 210.50	\$ 421.05	\$ 631.60	\$ 842.10	\$ 1,052.60
6 yds.	\$ 32.50	\$ 299.35	\$ 598.65	\$ 898.00	\$ 1,197.30	\$ 1,496.65
8 yds.	\$ 40.40	\$ 389.30	\$ 778.65	\$ 1,167.95	\$ 1,545.60	\$ 1,932.30

Table 8: Amount UI is charged monthly by Latah Sanitation for different dumpster sizes and pick up frequencies

These three dumpsters are not the only ones that present a potential for cost savings. Table 9 shows the average fullness for the other 14 dumpsters surveyed. The data above the black line is more dependable because it is based on about a month's worth of observations. The data below the black line is based on limited surveying and does provide information for deciding the dumpsters to focus future studies on, but should not be used to change the current waste collection system at these sites. Adjusting the collection logistics of the three dumpster above the black line with a less than 50% average fullness could save UI another \$4,000 annually. The potential opportunity to optimize waste

collection will only increase as more waste minimization initiatives and educational campaigns are enacted.

Dumpster	Size (yd <sup>3</sup> )	Times emptied per week	Times Surveyed	Average Fullness
Memorial Gym	4	2	7	70%
College of Natural Resources	6	2	7	48%
Landscape Architecture	4	2	7	46%
Brink/Phinney Hall	6	1	4	75%
UI Greenhouse	4	1	4	60%
Hartung Theater	6	1	4	22%
Life Sciences South	6	2	3	44%
Renfrew Hall	6	2	3	29%
Niccoll Hall	6	1	3	61%
Morrill Hall	6	1	3	65%
Print Design/Steele/Alumni Office	6	1	3	69%
Human Resources	2	1	2	50%
Industrial Education	4	1	2	29%
Art and Architecture East	4	1	2	50%

Table 9: Data from dumpster surveying

Along with identifying the potential for monetary savings from restructuring the waste pick up system at UI the dumpster surveying also helped identify common recyclables found in the waste stream, thereby reinforcing the waste sort findings. The major contaminant easily identified during the surveying process was cardboard. Figure 7 shows cardboard contamination at a variety of different dumpsters on campus.



Figure 7: Photographic examples of cardboard contamination found during dumpster surveying.

The prevalence of cardboard contamination raises the obvious questions of whether or not the infrastructure of the current cardboard recycling program in place is adequate in number and in placement. The current receptacles are placed within eye sight of dumpsters, and in most cases within 20 feet, and during the surveying process the nearby bins were never overflowing with cardboard. Only two of the buildings surveyed, Hartung Theater and the UI Greenhouse, did not have a cardboard recycling facility nearby. Therefore it seems that the problem is not with infrastructure. Thus the cardboard contamination must be due to a lack of knowledge about the presence or purpose of the cardboard recycling stations, or an abundance of apathy among students, faculty and staff. These are two conditions that could be successfully combated with a well organized educational campaign.

## Discussion

### Waste Estimation

Currently UI is utilizing waste data from a waste study more than 5 years old. In order for UI to successfully reach its goals of waste reduction it is imperative that the university accurately track its progress. Having accurate data concerning waste generation will enable the evaluation of the success of implemented initiatives and educational programs, resulting in the most effective initiatives and programs in the future. Therefore, waste generation needs to be estimated on a yearly basis. Generating a yearly estimation should not be a difficult task since the collection of 2 of the three sources of waste data, compactor weights and weight of waste taken to the transfer station by UI, are straightforward. It is the estimation of the waste picked up by Latah Sanitation that is difficult to organize and time consuming.

The current estimation is based on dumpster surveys done one week per month for a year. By reducing this to 6 times annually the time needed will be reduced and the data should be almost as accurate. Four of the surveys would occur during the normal academic year and one during each major academic break, Christmas and summer break. The surveys done during the breaks would enable an estimation of the waste generated during the time when students are not on campus. The four surveys done during the academic year would occur at the following times to best estimate waste generation during the academic term; mid February, mid April, mid September, and mid October. Having an estimation of waste that updates annually will be crucial in the development of a successful waste minimization program at the University of Idaho. An annual estimation will enable the tracking of progress toward UI's goals of waste reduction and the evaluation of enacted initiatives.

### Campus Composting System

In September 2009 a new composting facility is set to open at the University of Idaho. This facility will be located at the North farm and will compost food waste, manure from the north farm and animal carcasses. For the first year of operation the food waste from dining facilities on campus will be sent to the compost facility. Composting the waste from these two facilities will result in the elimination of 86 tons of waste annually or about 6% of the overall UI waste profile, resulting in a saving of around \$7,900 annually. The development of a composting facility on campus also presents the opportunity to expand composting to other parts of the university, thereby further increasing waste diversion.



One of the first places that should be targeted for inclusion in the composting program is the UI Greenhouse located on 6<sup>th</sup> street. Waste sorts and dumpster surveying of this facility have uncovered a large volume of compostable materials currently being sent to the landfill. Data from these studies suggest that taking out the current 6 cubic yard dumpster emptied once a week and replacing it with two 2 cubic yard dumpsters emptied once a week, one for compost and one for waste would be adequate to handle the waste stream of the building, and help increase waste diversion and decrease money spent on waste management. Using data from the dumpster surveys, it is estimated that introducing composting at this facility would lead to the composting of around 1 ton of plant material. Also the close proximity of this building to Facilities Services means that a 2-ton waste dumpster could be transported to the compactor, therefore eliminating direct pick up by Latah Sanitation and saving UI upwards of \$1,500 annually.

The installation of a composting facility on campus will also present the opportunity to divert some of the other organic waste found in the UI waste stream. Not counting the plant materials found in the Greenhouse dumpster it is estimated that organics still makes up 10% of the UI waste stream. The majority of this 10% is in the form of used paper towels from restrooms throughout campus. Thus, if a system can be developed to compost this waste before it reaches the dumpsters UI could reduce the waste it sends to the landfill annually. Also, eliminating paper towels from dumpsters could lead to the possibility of adjusting the pick-up schedule of other dumpsters on campus thereby saving UI money. The logistics and time necessary to capture the paper towel waste from all restrooms would be extensive, therefore it makes the most sense to focus on high usage restrooms on campus.

## **Relationship between Waste Composition and Presence of Recycling Facilities**

Analyzing the relationship between the presence and abundance of recycling facilities and the prevalence of recyclable materials found in the dumpster will help provide useful data as UI considers restructuring its recycling program. Determining this relationship will enable UI to maximize recycling while using the least resources possible. Of the 11 dumpsters sorted all of the buildings had UI Facilities controlled indoor recycling facilities except Hartung Theater, UI Greenhouse, McConnell, and Theophilus tower. The two residence halls, McConnell and the tower, have recycling facilities controlled by UI housing. Indoor recycling facilities accept mixed paper, newspaper, white ledger paper, plastics #1 and #2 and aluminum. The exact goods accepted by indoor recycling facilities vary by building.

It was expected that buildings without recycling facilities would have a higher prevalence of recyclables in the waste stream, and that there would be a negative correlation between the abundance of recycling bins and the amount of recyclables in the waste stream. The findings did not support these expectations. The two buildings without recycling facilities had significantly different amounts of recyclables in their waste stream; in Hartung 44% of the waste found was recyclable using indoor recycling facilities, while only 5% of the waste found in the Greenhouse was recyclable using indoor facilities. As for the relationship between the abundance of recycling bins and the percentage of recyclables in the waste stream there were too many variable and too little data to make any significant findings. Since the occupants of every building differ, any difference seen could be due to the ideology of the individuals in the building and have nothing to do with the amount of recycling bins available.

In order to minimize the amount of recyclables that end up in a dumpster building specific studies will need to be performed to determine whether current bins are placed in the proper locations and whether or not more or less bins are necessary. Carrying out such studies would help increase the efficiency of recycling facilities and help raise knowledge and awareness among students, faculty and staff. These building specific audits of the recycling system are just one way to get students, faculty, and staff thinking about, talking about, and acting to reduce their waste and increase their recycling.

### Expanding the UI Recycling Program

One solution that has been suggested to increase UI’s recycling rate and minimize waste is to increase the number of commodities accepted by UI recycling. The two commodities that UI currently does not recycle but could through the expansion of its program are glass and #3 - #7 plastics. Figure 8 shows that these materials make up only 14% of landfill materials, which translates to 4% of the total waste stream. Given the current financial state at UI, it does not make sense to expand a recycling program, which is already stretched thin, to capture 4% of the waste stream. Instead the focus needs to be on maximizing the recycling of currently accepted commodities and reducing the usage of these non-recyclable commodities. Focusing on reducing the 38% of the waste stream that is currently recyclable will have a much larger impact upon the UI waste stream and will cost much less than it would cost to expand the current system.

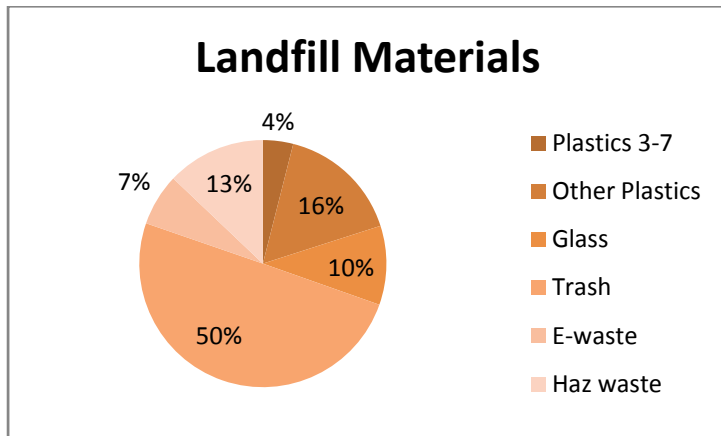


Figure 8: Composition by weight of landfill materials found in dumpsters

### Waste Education: Reduce, Reuse and Recycle

The University of Idaho and other institutions of higher education across the country must not become so overwhelmed with their commitments to reach carbon neutrality that they lose sight of the importance of waste reduction, an issue that will have very little impact upon a university’s emissions profile. It is imperative that waste reduction become a focus of sustainability at UI and all other institutions because it presents an opportunity for individuals to get involved and feel like they are helping steer the institution in the right direction. This is a feeling institutions will have to maintain as they attempt to enact a wide array of sustainability initiatives, and one of the easiest ways to maintain this feeling is by continuing to focus on the participatory system of waste minimization and recycling.

Recently UI has enacted a variety of waste minimization initiatives that have helped educate individuals and foster involvement from the campus community. Offering discounts to individuals who use reusable mugs at campus coffee shops is one such initiative that has enabled people to feel like they

are helping make UI more sustainable. Another example is the educational campaigns focused on waste reduction and recycling that have been led by the University of Idaho Sustainability Center (UISC). These are the types of programs that need to be built upon in the future, it is imperative that UI focuses not just on recycling but also on waste reduction and the reuse of materials.

The information received from the campus-wide waste characterization and dumpster surveys could serve as indispensable resources in the development of these initiatives and educational campaigns. As was mentioned previously, the data will enable the prioritization of different waste minimization initiatives and educational campaigns based upon the impact they will have upon the waste stream. Of course this should not be the only prioritization criteria utilized, but in a time of economic downturn it will help maximize the impact of the limited resources available. The data also needs to be used in an educational/awareness campaign to alert the campus community of the shortcomings of their efforts. The campus community as a whole needs to be held accountable for the success and shortcomings of waste minimization and recycling at UI. This accountability along with information concerning actions that can be taken will help create a campus community motivated to evoke change in the area of waste minimization and sustainability as a whole.

### **Potential Cost Savings from Optimal Waste Minimization**

The overall goal of all waste minimization and recycling initiatives is to reduce the waste stream until the only thing left are materials that cannot be recycled and composted, and thus must be sent to the landfill. If UI accomplished this goal it would mean a 66% reduction in waste generation, leaving only 34% of the waste stream to be sent to the landfill. This extensive reduction in waste would enable the reduction in frequency of pick-up and/or dumpster size of all dumpsters currently emptied by Latah Sanitation. Using the results from dumpster surveying and the results from the waste characterization enables an estimation of the cost savings of optimizing waste pickup of these dumpsters. Multiplying the average fullness percentages from the dumpster surveying study by the 34% of waste that will not be diverted gives the new fullness of each dumpster; for dumpsters without surveying data it was assumed that they had an average fullness of 60% at pickup. This new fullness estimation was then used to determine a new pick-up schedule for each dumpster. Then by comparing the costs of the old pick up schedule with the new schedule it was determined that UI could save \$70,000 annually.

Reducing waste generation 66% would also lead to less frequent emptying of campus compactors, leading to cost savings. Using waste production data from 2 of the compactors on campus the waste production of the other two compactors was estimated. The estimated waste production of these dumpsters was then multiplied by 66% to estimate the weight of waste reduction. Simply multiplying the waste reduction by the cost per ton for disposal of compactor waste, \$92, results in the total cost savings from compactor waste of about \$20,000 annually. Adding this cost savings to the cost savings from transforming dumpster pick up results in a total annual cost saving of \$90,000. Obtaining a 66% reduction in waste generation is not an easy task, but it does present an opportunity for significant cost savings.

## Conclusion

An analysis of the University of Idaho waste stream has made it clear that there is potential to significantly reduce the waste stream via improved recycling and the introduction of a composting program. Composting food waste alone will help reduce waste generated at UI by about 5%. There is also a potential to significantly reduce the amount of money UI spends on waste collection by optimizing the waste collection system. Currently UI is paying to dump upwards of 2,200 cubic yards of air a year. Optimizing the UI waste collection system could save UI tens of thousands of dollars annually, savings that could be utilized for waste minimization initiatives and educational campaigns. Table 10 below shows the possible cost savings and waste reduction potential of all the projects discussed.

The implementation of these projects would reduce waste expenditures at UI by about \$24,000 or 7% and reduce the overall waste stream by about 6%. Plus, completion of the above projects would come at little to no cost to the university. These projects represent the first wave of initiatives that need to be implemented, and the momentum gained from their implementation can be utilized to initiate more far reaching waste minimization projects. This \$24,000 is just the tip of the iceberg, aggressive waste minimization and collection optimization campaigns have the potential to save UI upwards of \$90,000 annually.

Project	Cost Savings (per year)	Waste Reduction (tons)
Composting Food Waste from Bob's Place	\$4,900	54
Composting Food Waste from Commons	\$3,000	32
Switching all Commons serverware and silverware to compostable materials and composting said materials	\$800	9
Composting UI Greenhouse plant materials	\$1,500	1
Adjusting waste management at Art and Architecture South/College of Education, Engineering Gauss Johnson/Buchanan/Janssen, and Administration/Albertson dumpsters	\$7,500	n/a
Adjusting waste management at College of Natural Resources, Landscape Architecture, and Hartung Theater dumpsters	\$4,000	n/a
Adjusting waste management at Life Sciences South and Renfrew dumpsters*	\$2,400	n/a
<b>Total</b>	<b>\$24,100</b>	<b>96</b>

\*further data needs to be collected prior to making this change

Table 10: Summary of potential waste related projects along with the cost and waste savings they would create

<sup>1</sup> RecycleMania Participating Schools. <http://recyclemania.com/>

<sup>2</sup> NYU Waste Characterization Study Report, Spring 2008. [http://www.nyu.edu/fcm/waste\\_study\\_report.pdf](http://www.nyu.edu/fcm/waste_study_report.pdf)

<sup>3</sup> Meredith College Waste Characterization, January 2009.

<http://www.meredith.edu/sustainability/documents/MeredithCollegeWasteCharacterizationReport.pdf>

<sup>4</sup> Zillinger, Charles. RSSW Synopsis at UI, October 2007.

<sup>5</sup> Goal set by University of Idaho Waste Minimization and Recycling Committee in January 2008.

<sup>6</sup> Ibid.

<sup>7</sup> Pekié, Kenneth. University Housing 2008 Garbage Removal.

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<sup>8</sup> Arsova, L., Van Haaren R., Goldstein, N., Kaufman S. M., and Themelis J. The State of Garbage In America. BioCycle December 2008, Vol. 49, No. 12, p. 22. [http://www.jgpress.com/archives/\\_free/001782.html](http://www.jgpress.com/archives/_free/001782.html)

<sup>9</sup> E-mail Communication with Andy Boyd, Manager of Moscow Recycling. March 25, 2009.

<sup>10</sup> Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2007. United States Environmental Protection Agency. <http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw07-fs.pdf>

<sup>11</sup> NYU Waste Characterization Study Report, Spring 2008. [http://www.nyu.edu/fcm/waste\\_study\\_report.pdf](http://www.nyu.edu/fcm/waste_study_report.pdf); Meredith College Waste Characterization, January 2009.

<http://www.meredith.edu/sustainability/documents/MeredithCollegeWasteCharacterizationReport.pdf>; University of Washington Waste Characterization. Performed by Cascadia Consulting Group, Inc. 2004.