

Environmental Audit of Ground Zero

Environment and Resource Studies 250

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1.0 Vision Statement

As environmental studies students we wish to help provide a more sustainable student area on campus. Through the environmental audit at Ground Zero Cafe we feel that we can help accomplish this goal. In conducting the audit, we attempt to promote awareness of issues regarding energy and water consumption, air quality, and waste production. It is anticipated that our findings and recommendations will influence those in decision making positions within the University of Waterloo to make Ground Zero a more sustainable business. In accordance with the *Greening the Campus* vision statement of the University of Waterloo, the goal of our research project is, not only to promote a more sustainable business within the University of Waterloo, but also to serve as a model for other food service providers (WATgreen, 2002).

2.0 Introduction

Businesses today need to ensure that their practices are not harmful to our ecological environment while at the same time meeting the financial obligations of the business. They must also ensure that the needs of their customers and all stakeholders involved are met. It is for this purpose that the University of Waterloo Federation of Students (FEDs) requested that students from ERS 250 perform an environmental audit on Ground Zero.

WATgreen is part of FEDs and is an umbrella for staff, faculty and the Environment Commission. The Environment Commission is a student-run environmental organization that corresponds with the objectives of WATgreen.

“WATgreen is an administrative initiative with a committee composed of students (undergraduate, graduate), staff, and a representative from each faculty”.

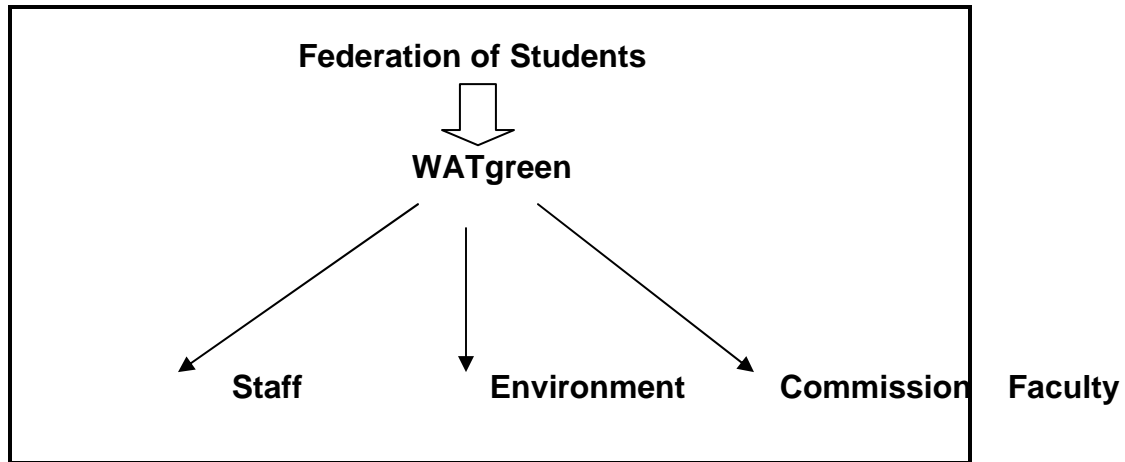


Figure 1: Development of Environment Commission

This audit was in correspondence with the objectives of WATgreen and the FEDs Environment Commission (WATgreen, 2002). These objectives are:

- Help improve the state of the environment at the University of Waterloo.
- Increase environmental awareness on campus.
- Build a network of people, contacts and resources to support environmental pursuits on campus.
- Encourage active participation from the entire university community.

There has never been an environmental audit performed on Ground Zero (Cook, 2002A), although there have been previous audits performed on the Bombshelter, a restaurant and bar that shares certain facilities, such as the kitchen, with Ground Zero.

It is likely that recommendations made in this report will be thoroughly considered, as Ground Zero will be undergoing major renovations in the near future

(Di Lullo, 2002). Between \$100,000 and \$150,000 will be spent by the FEDs to change Ground Zero into a coffee shop style establishment. The goals of the Environment Commission and WATgreen are to improve sustainability efforts on campus; therefore, part of the cost of renovations can easily be reserved for implementing some of the recommendations noted in this report.

Research for the environmental audit was conducted from October 28th to November 25th 2002. The audit includes information and recommendations of the waste, water, energy and air quality systems in Ground Zero.

The results and recommendations of the audit affect the University of Waterloo community as a whole but concentrate on the employees and customers of Ground Zero.

Ground Zero staff may change certain work procedures, such as composting and customers may have certain amenities, such as single packets of jam, changed to more ecologically sustainable containers should recommendations be implemented. Any changes as a result of the recommendations of this audit will also be felt by the entire University of Waterloo community, as there will be less waste produced on campus in general.

3.0 Ground Zero Café

Ground Zero Café is situated in the Student Life Centre of the University of Waterloo and its hours of operation are 10am to 2pm, Monday to Friday. It is a student run business financed by FEDs. The café consists of a dining room, a bar area and a kitchen. The kitchen area is shared with the kitchen for the Bombshelter, which is an adjacent student-run business in the Student Life Centre. The café employs students as wait staff, kitchen staff and managers as well as having higher level management and a head chef.

3.1 Services

Ground Zero is mainly known for its breakfasts but also offers sandwiches, soups, pastas and other specialties. Meals are quite inexpensive and take-out is offered in order to accommodate university students and staff.

3.2 Previous Research

There has never been an environmental audit conducted on Ground Zero previous to this study. However, an audit was done on the Bombshelter which is located adjacent to Ground Zero. This is relevant as the Bombshelter and Ground Zero share kitchen facilities, food items, and staff members.

4.0 Problem Statement

What practices can Ground Zero Café change to improve the sustainability of the University of Waterloo campus from within its business.

4.1 Definition of Sustainability

For the purposes of this audit, sustainability is defined as maintaining ecological, economical and social aspects of today while not compromising those same factors for future generations. Holmberg's (1992) three-circled approach was used as the basis of our definition.

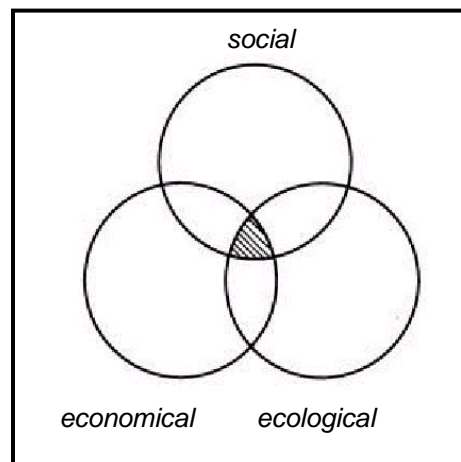


Figure 2: Holmberg's Three-Circled Approach to Sustainability

4.2 Objectives

The main objective of the study was to provide viable recommendations to:

- decrease the energy use
- decrease the water use
- decrease the amount of waste produced
- maintain high air quality of the area

Fulfilling these objectives would require exploration into social, economic and environmental factors for any changes that are recommended.

4.3 Methodology

For the environmental audit of Ground Zero, information was gathered specifically from the Ground Zero establishment. Relevant information was gathered through key informant interviews, case studies and observation.

In our research we found interviews were helpful in gaining further insight into the day-to-day operations of Ground Zero. According to Palys (1997A), the biggest advantage of interviews are “their versatility and the opportunity they provide to hear from a respondent directly. The range of topics you can ask about is limited only by your imagination”. One formal interview was conducted concerning waste and purchasing habits at Ground Zero. In addition to this, informal interviews were performed periodically during the energy and water audits. The interviews were carried out in person to attain results quickly and thoroughly. Persons we interviewed included cooks, support staff and management. Cooks were helpful in attaining first hand knowledge of activities in the kitchen, while support staff input was useful in accessing the feasibility of our recommendations. We questioned management regarding purchasing amounts, costs, usage and preparation of food.

Secondary research that we performed included the use of case studies. We looked at a previous *Watgreen* project completed on the Bombshelter, as there have been no previous audits performed on Ground Zero (Cook, 2002A). The Bombshelter shares its kitchen with Ground Zero, and thus that project served as a starting point to our audit. Analyzing this case study gave us a history of the initiatives undertaken and implemented. Other secondary sources included *A Guide to Waste Auditing on*

Campus: From Audit Planning to Report Writing (Cook and Carrell, 1996), and a thesis titled *Turning Data Into Information: Improving the Accuracy and Efficiency of Waste Audit Data* (Carrell, S, 1995). The latter was a thesis written by an Environment and Resource Studies graduate student at the University of Waterloo. Both the waste audit guide and the thesis were used throughout the data collection, data analysis and report writing stages of the waste audit to provide guidance while completing the project.

Another method of research we used was observation. Each member of our group periodically monitored one of the four systems being audited (air, water, energy, waste). Over the completion of each audit, we individually observed the different processes conducted at Ground Zero, such as observing water usage, how much energy is needed in various appliances, and the waste generated by customers.

Information that we obtained was both qualitative and quantitative. The qualitative approach, “the belief that theory should be grounded in the day-to-day realities of the people being studied” (Palys, 1997C), was employed mainly through the air quality survey. This allowed us to gain insight into the support staff’s personal opinions and concerns. We gathered qualitative data by observing and questioning those who work at Ground Zero. Quantitative data, which places emphasis on numerical precision (Palys, 1997C), was collected from the energy audit as appliance power consumption. Also, in the waste audit quantitative data was compiled through calculations of the mass and percent composition of all waste output at Ground Zero.

Our method of analysis was exploratory, “research that aims to gain familiarity...in order to formulate a more precise research question” (Palys, 1997A). We then considered how any environmental recommendations we might make would also affect the economical and social factors of the business. We assessed how these changes would affect the University of Waterloo community. Through employing the inductive approach, which makes use of empirical generalizations that were based on our observations (Palys, 1997C), we attempted to develop full recommendations that adequately reflected what we had observed at Ground Zero.

4.4 Limitations

Since this audit has many limitations, such as time and lack of specialization, we are unable to perform detailed air, energy and water audits, although observations and recommendations will still be made in regards to these systems.

The general limitations to the environmental audit of Ground Zero involved lack of time and experience. The Fall, 2002 ERS 250, Greening the Campus class was set up to begin specific sections at designated times. Once the ethics application was submitted, there was approximately 10 days until ethics clearance was approved. At that time we began auditing procedures as explained in the Methodology section. During the period of data collection, interviews, surveys and data analysis were completed. For each of the four areas being audited, one to two weeks of daily practices were observed. This amount of data cannot be representative of the yearly practices that take place within an establishment such as Ground Zero. In order to

gather representative data of a typical year, we would need to conduct the audit for several weeks over the course of a year. Due to time limitations, this type of in depth data collection was not possible.

As this was the first environmental audit performed by each of the auditors, inexperience was also a limitation. Our schedule dictated that each person specialize in one of the four areas of the audit that was best suited to each individual. We also were unaware of the procedures of an environmental audit and; therefore, after attempting to follow past audit models, learned by trial and error. This means that our data may not be completely representative and therefore was taken into account during data analysis. An example of this can be seen in the waste audit where weighted averages were used in order to smooth out the data.

Inexperience and time were the main limitations that were encountered throughout the audit. Other limitations include possible reluctance of participants, weather restrictions, availability of participants and the restaurant and its facilities in general.

4.5 Boundaries

The focus of our study was to observe environmental practices of Ground Zero specifically food and packaging waste, water and energy consumption, and air quality. The geographical boundary of our research was the University of Waterloo campus as a whole, although research was conducted primarily on Ground Zero inside the Student

Life Centre (see Figure 3). The target groups used during the various components of the audit included Ground Zero management, staff and customers.

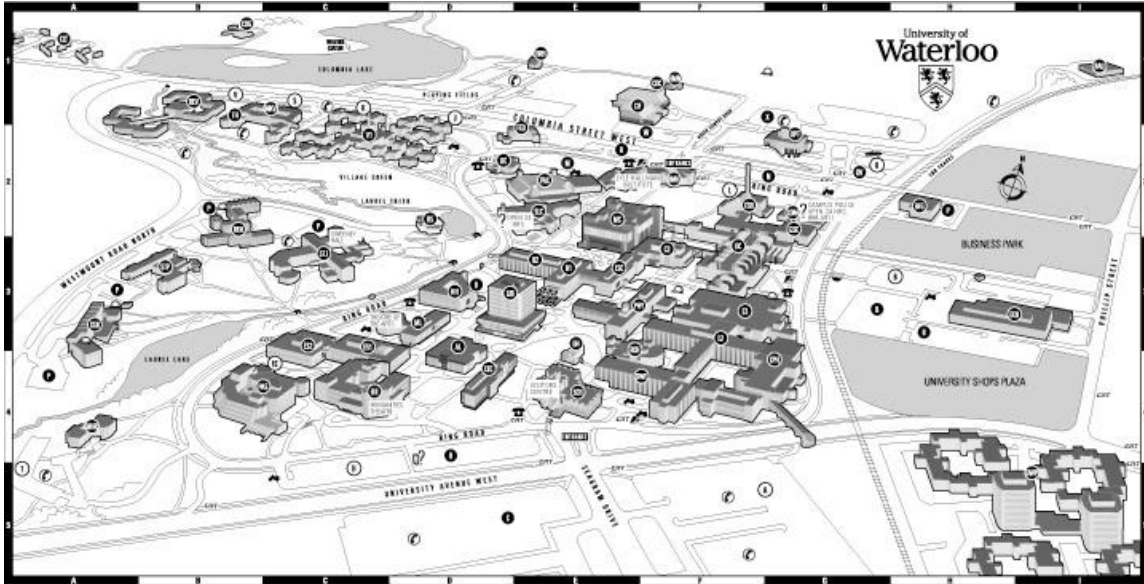


Figure 3: University of Waterloo Campus

5.0 Systems

5.1 Energy System

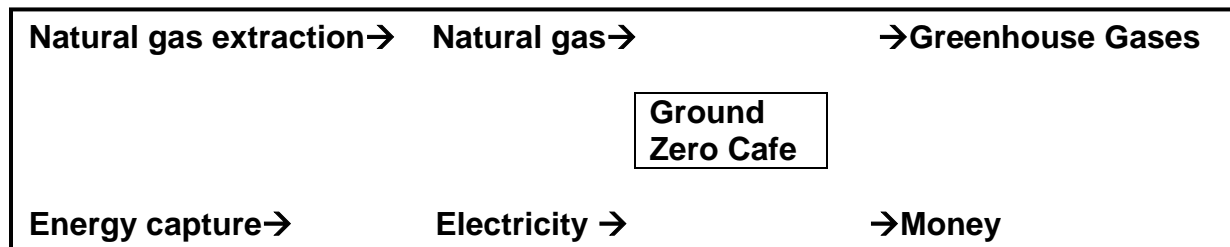


Figure 4: Energy System

The energy system of Ground Zero is run on natural gas and electricity, which are seen above as the inputs. The outputs are greenhouse gases (GHG) and money.

GHGs emissions come from burning fossil fuels, and the money refers to the amount spent on energy bills.

5.1.1 Actors

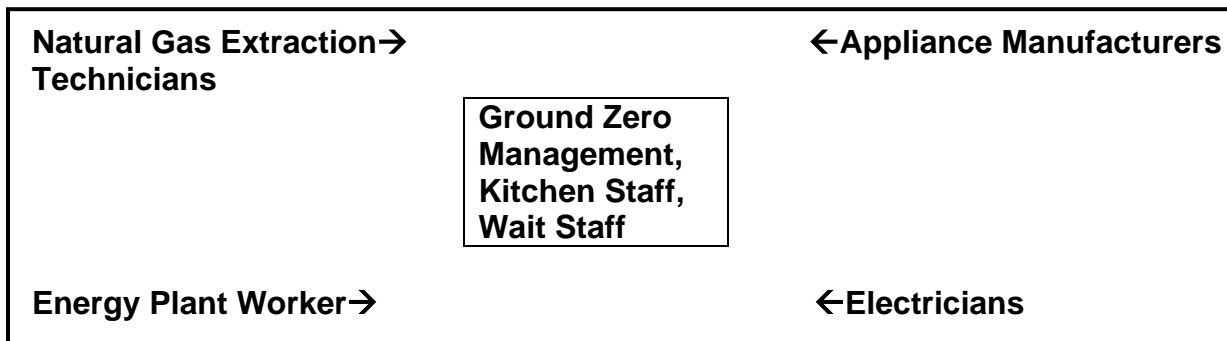


Figure 5: Energy Actors

The actors involved in the energy system of Ground Zero are the natural gas technicians and other workers involved in the process of natural gas extraction, all the workers involved in the energy plant creating electricity, the appliance manufacturers, electricians, and all the employees of Ground Zero.

5.2 Water System

The water system that is used at Ground Zero (refer to Figure 6) comes from two primary water sources, these being the central portion of the Grand River watershed, and 126 groundwater wells. (Schmidt, 2002) Within this, 80% comes from the groundwater, and 20% from the Grand River. (Schmidt, 2002) All water is treated with chlorine, to ensure that it is safe for drinking. Treatment takes place at 11 different treatment plants, throughout the region. (Schmidt, 2002) A system of 41 reservoirs and

37 pumping stations are responsible for transporting the water to all needed areas. (Schmidt, 2002) Ground Zero receives all of its water from this system. Through the completion of various water using processes conducted at Ground Zero, such as dish washing and maintenance, the water is sent to the sewer system. This wastewater is treated, and discharged into the Grand River and its tributaries (Schmidt, 2002).

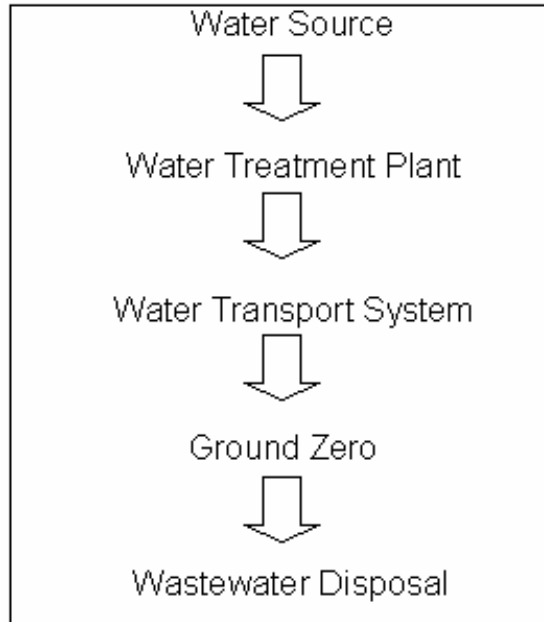


Figure 6: Water System

5.2.1 Actors

The actors involved with the water system primarily consist of treatment plant workers, Ground Zero staff and disposal facility operators. Firstly, the workers in the treatment plant are responsible for monitoring that the water system is operating correctly and safely. They check for presence of bacteria in the water and levels of chemicals, as well as measuring properties such as pH, alkalinity, and turbidity. Water is chlorinated to ensure that it is acceptable for public consumption. Next, Ground Zero

staff use the water for their various needs, such as preparing foods. Once that water is disposed of, it enters the sewers, where disposal facility operators treat the wastewater to ensure it is safe to go back into the environment. These various actors are important in the system because they ensure safe drinking water (See Figure 7).

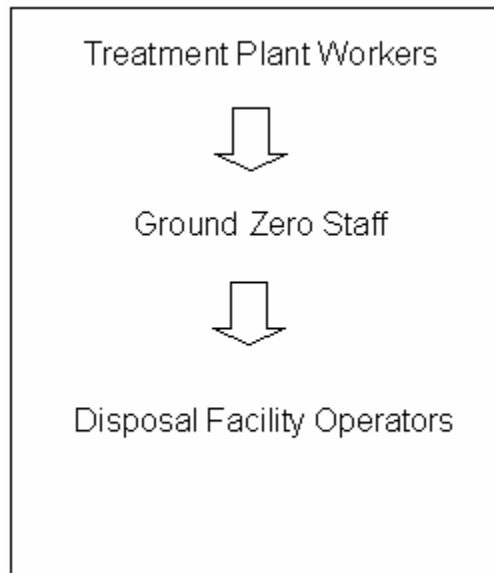


Figure 7: Water Actors

5.3 Air Quality System

The production of the meat and vegetables used as food for Ground Zero are inconsequential in the system of air quality. For purposed of this project we will assume that the farming practices for these products did not cause significant air quality impacts. The production of the utensils, and other materials used in the consumption of Ground Zero products are of some concern, however. The plants that are used to make metal utensils, plastic tables and the plastic and Styrofoam take-out materials cause

significant amounts of air pollution such as Chlorofluorocarbons (CFCs), nitrous oxide (N₂O), nitric oxide (NO_x), nitrogen dioxide (NO₂), and Carbon Dioxide (CO₂) (Socha, 2002).

The transportation of Ground Zero's products also produces CO₂ emissions. CO₂ is a greenhouse gas (GHG) that contributes to global climate change.

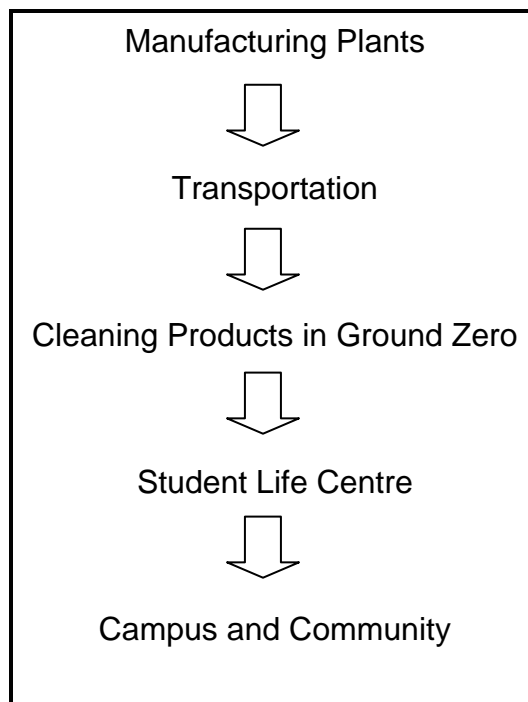


Figure 8: Air Quality System

The air quality system affected by Ground Zero practices begins with the cooking of the food and cleaning of the facility. It is not likely that food contributes significantly to the air quality of the University of Waterloo Campus. The cleaning products used at Ground Zero are a possible contribution to poor air quality. The chemicals used in many cleaning products have been linked to nervous system and immune system diseases,

among others. These chemicals can become air borne after being used to clean a table, stove or floor. They can then lead to the general areas in the SLC and eventually to the rest of the campus and community, affecting the health of all people working, studying or visiting the area (See Figure 8).

5.3.1 Actors

The actors involved with the air quality system begin with those working at the factories and plants that produce the products that are used by Ground Zero. These products then change hands from the industry workers to drivers who transport to the manufacturer. The products are finally transported to the retailer and on to Ground Zero. Products involved in this process range from the stove to the utensils to the cleaning products. The food only begins to contribute to poor air quality once transportation has begun as there is much less concern for air quality in the production of the food.

Once at the restaurant, the air quality system only involves the products used for cleaning and cooking purposes. The gas grill used at Ground Zero causes GHG emissions and cleaning products contribute a myriad of chemicals to the air. These are transported through the air in Ground Zero to the larger SLC area to be dispersed throughout the campus and community (See Figure 9).

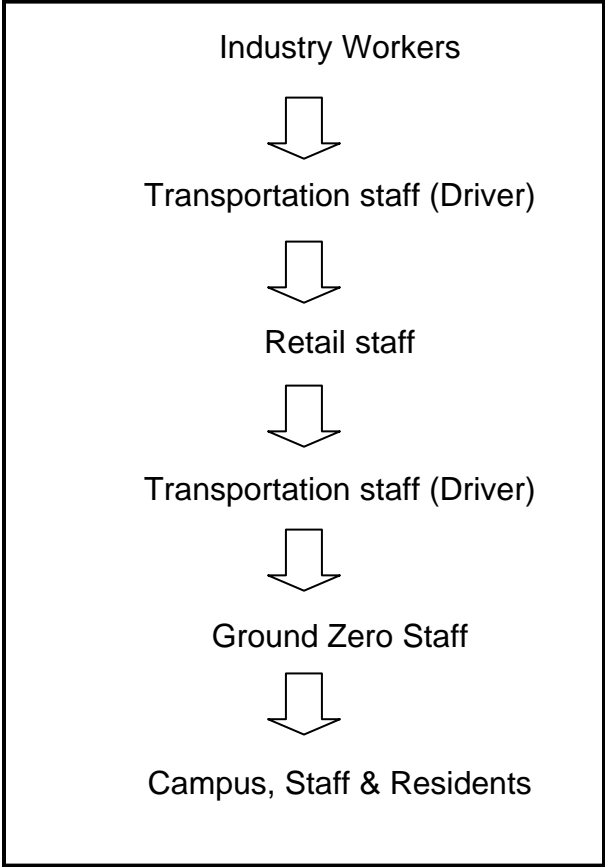


Figure 9: Air Quality Actors

5.2 Waste System

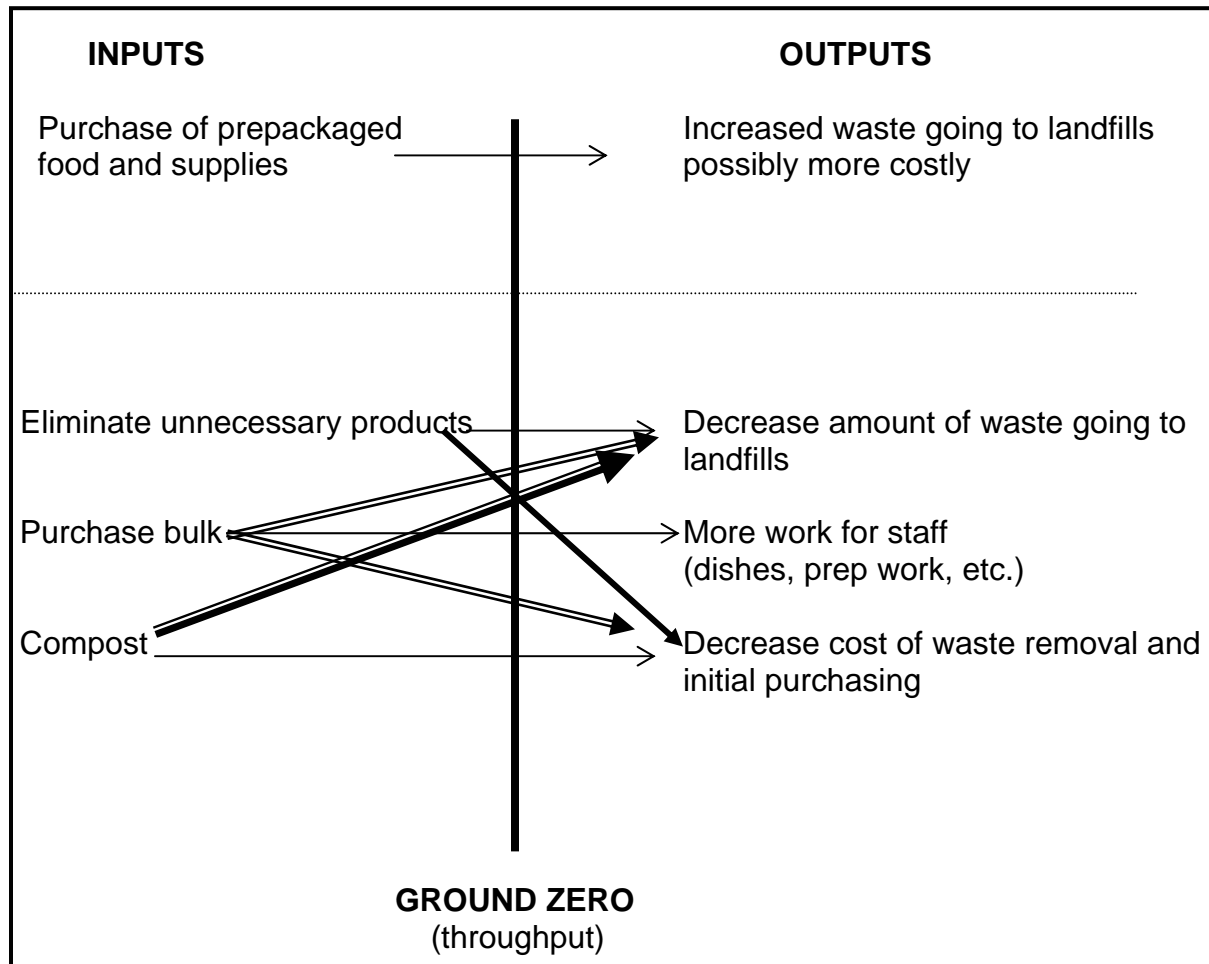


Figure 10: Waste System

The top half of Figure 10 illustrates the waste input-output currently at Ground Zero. Food and Supplies are purchased from outside the University of Waterloo campus and are used at Ground Zero. The waste produced is then brought to a local landfill.

The bottom half of Figure 10 shows our vision of what is possible. The three inputs are eliminating unnecessary products, purchasing bulk and composting. Each of

these inputs when used by Ground Zero include an output of reduced waste going to the landfill site, decreased costs for waste removal from campus and elimination of initial purchasing costs.

5.2.1 Actors

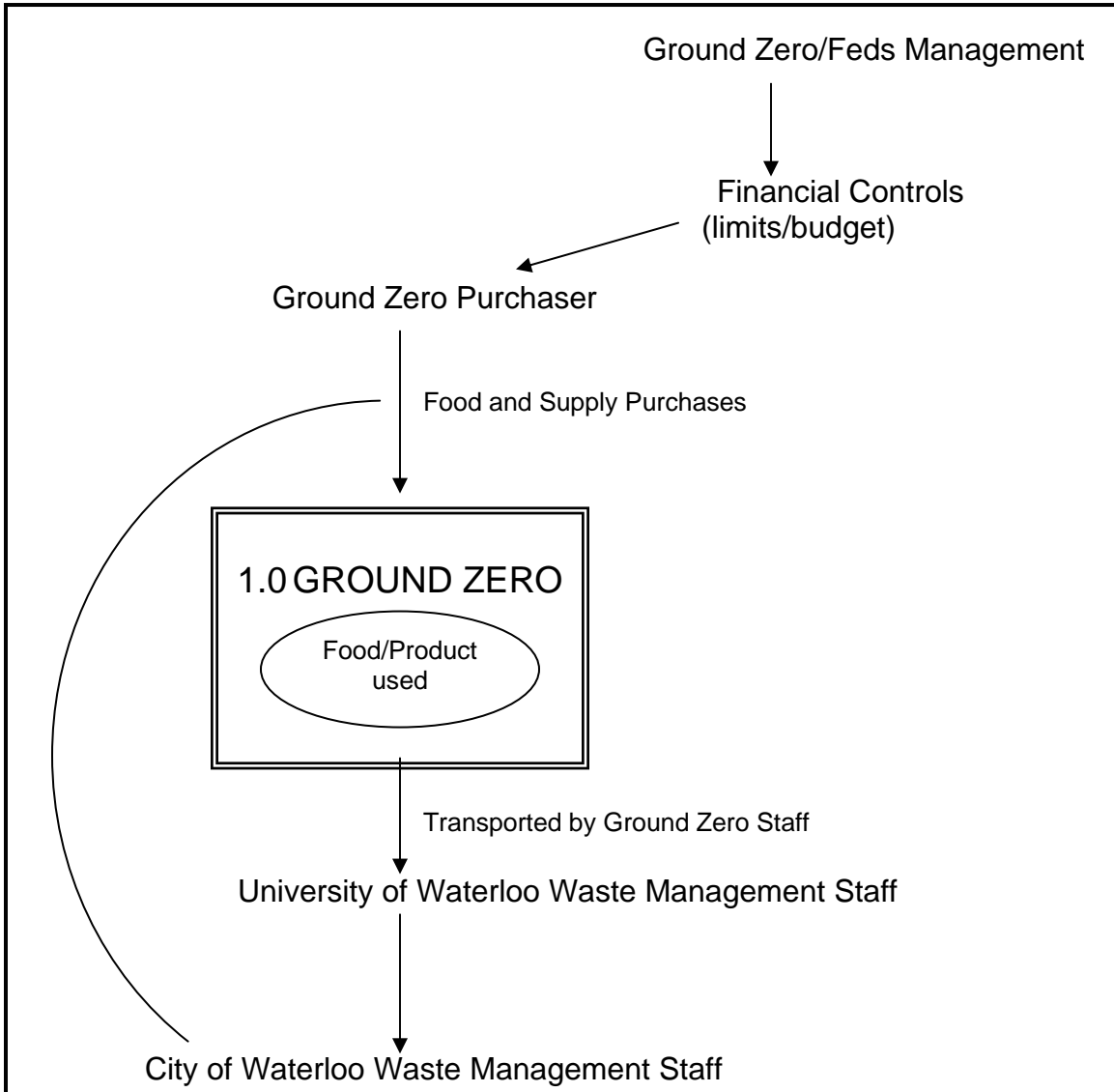


Figure 11: Waste Actors

Figure 11 illustrates the actors involved in the waste system at Ground Zero. The actor system begins with the management of FEDs/Ground Zero Management. It is here that financial limitations, such as a budget, are made and enforced. The financial budget determines what and how much the Ground Zero purchaser can buy and how much can be spent outside the realm of products necessary for the day-to-day operations of the establishment. The purchaser is in charge of buying all food and supplies necessary to in the operation of Ground Zero. It is in the restaurant that most of the food and supplies are consumed and their waste is discarded. The Ground Zero staff brings waste to a central dumping area on campus. The garbage is picked up by the City of Waterloo's Waste Management and is transported to a landfill.

The actors involved include: Ground Zero Management, FEDs Management, Ground Zero Purchaser, Ground Zero Staff, University of Waterloo Waste Management Staff and the City of Waterloo Waste Management employees.

6.0 Energy Audit

6.1 Methodology

Firstly, the research group took a field trip to Ground zero to observe the operations of the café. Arrangements were then made to visit the café and observe the kitchen operations. Notes were taken detailing all of the energy-using appliances in the kitchen and café. Wattage values were recorded on appliances listed. Informal interviews were done while taking observations. The questions involved whether specific appliances run on electricity or natural gas, and frequency of their use.

Information was later obtained regarding energy efficiency and compared to the energy use at Ground Zero in order to make recommendations.

6.2 Data Findings

Appliances running on natural gas

Table 1: Natural Gas Appliances

Appliance	Hours in use each day	Total Hours in use/ week
Salamander	8am - 2pm	30
Grill	8am - 2pm	30
Stove	8am - 2pm	30
Oven a	8am - 2pm	30
Oven b	8am - 2pm	30
Flat grill	8am - 2pm	30
Deep fryer a	8am - 2pm	30
Deep fryer b	8am - 2pm	30

The appliances listed in Table 1 run on natural gas and are usually turned on around 8am, although they may be turned on any time up until 9:30am. They contribute to the energy use for 30 hours total per week; 8am until 2pm, Monday to Friday.

Large Electric Appliances (in use for extended periods of time)

Table 2: Electric Appliances

	Hours in use each day	Total Hours in use / week
sandwich table fridge compressor	All	168
grill table fridge	All	168
French fry freezer	All	168
Walk in fridge compressor	All	168
Walk in freezer compressor	All	168
Lights	8-4	40
2 Heat lamps	8-4	40
2 cooling fans	8-4	40
2 compressor exhaust fans	All	168
2 computers	8-4	40
Coffee maker	10-2	20
Coffee warmer	10-2	20
Radio	10-2	20
Cooling fans	8-4	40
Bar fridge	All	168

The appliances shown in Table 2 represent those that use energy to function, and are either running all the time (ie. fridges and freezers), or run continuously throughout the working day (ie. computers and cooling fans). Computers need to run all day because they are used for waitresses to place orders and for staff to sign in and out of shifts. The coffee maker runs during all operating hours as coffee orders are frequent. The radio runs during all hours of operation on most days. The cooling fans need to run during all hours of operation for the kitchen staff because the kitchen is a very hot work environment and may otherwise cause discomfort and health concerns for staff.

Small Electric Appliances (in use for short periods of time)

Table 3: Small Electric Appliances

Dishwasher
Dishwasher water heater
Cheese grater
Slicer
Toaster a
Toaster b
Microwave a
Microwave b
Order printer
Debit machine
Bar glass dishwasher
Cappuccino/ hot choc. Machine

Hours of use were not recorded for small appliances because they are used only when needed. It was observed that the dishwasher is used periodically throughout the day. It is used most frequently after the café is closed to customers (2pm to 4pm) during clean up. It was observed that employees use the dishwasher only when they have a full load to wash; this is both energy and time efficient. The two toasters are also used almost continually depending on how busy the café is. Toaster 'a' has 210 wattage level, and is older than the 110watt toaster 'b'. Although the older toaster uses more energy, its cycle is much shorter than the new toaster at 1minute and 53seconds as opposed to 2minutes and 21 seconds. The cheese grater is used approximately 3 times a week for short periods of time. The resulting shredded cheese is shared with the Bombshelter deli next door. The slicer is used for short periods of time each morning during vegetable preparation to slice such things as tomatoes, onions, lettuce and green peppers. The two microwaves are used occasionally through out the day for

various tasks. The order printer sends the orders from the computer where the waitresses enter them, to the kitchen to be made. The debit machine is used when customers pay with bankcards. The bar glass dishwasher is used for cups used during the hours of operation. The cappuccino/hot chocolate machine is used when customers order these beverages.

Other

A steam table keeps food hot using steam from the university boiler room.

6.3 Limitations

Usually when energy audits are conducted, the HVAC (heating, ventilation, air conditioning) system are an integral part of the observations (Burrett, 1999). However, since Ground Zero is just one part of the HVAC system for the entire SLC, it was very difficult to obtain information in this area. To further the complexity, the HVAC system is controlled from Plant Operations, which is completely separate from Ground Zero and the Student Life Centre. Therefore we were not able to explore this area.

6.4 Recommendations

Lighting

“Replacing energy-hogging incandescents with energy-saving fluorescents is a simple, effective way to slow the rate of global climate change while saving...money”
(Tufts, 2000)

Currently there are fluorescent bulbs in the café kitchen, but the dining room is lit with 150-watt bulbs. We recommend changing the light bulbs in the café from 150watt regular bulbs to 18watt (or less) compact fluorescent bulbs.

Most electricity is generated at coal and oil power plants that emit air pollutants, which contribute to global climate change. Each compact fluorescent light bulb (CFL) that replaces an incandescent bulb can lower CO₂ emissions by 1300lbs over its lifetime saving the energy equivalent of 50 to 60 gallons of oil. (Tufts, 2000). Also, the CFL lifespan is 13 times longer than an incandescent bulb lifespan, meaning that maintenance workers will have to change the bulbs much less frequently, and many less bulbs will end up in landfill.

Fluorescent bulbs are so much more energy efficient choice because a larger proportion of their energy is put towards light, rather than incandescent bulbs that use 90% of their energy for generating heat (tufts, 2000)

For one 150-watt bulb 0.15kWh are used per hour (150 divided by 1000), and an average 150 watt bulb lasts for 750 hours and thereby uses 113 kWh throughout its entire functioning life (0.15 multiplied by 750). An 18-watt compact fluorescent bulb uses 180 kWh over it's longer lifespan of approx 10 000 hrs. To calculate the operating costs of each type of bulb, they have to be comparable, therefore as the fluorescent bulb lasts 10 000 hours, you would need 13, 150watt bulbs for 10 000 hours of light.

150watt bulb

113kWh(bulb lifetime energy consumption for one bulb)*13 = 1469kWh

1469kWh* 0.074\$/kWh (electricity rate) = \$108.71

Therefore the cost to light a room with one bulb in it for 10 000 hours with 150watt incandescent bulbs is \$108.71

18watt fluorescent bulb

180kWh* 0.074\$/kWh = \$13.32

Therefore the cost to light a room with one bulb in it for 10 000 hours with 18watt fluorescent bulbs is \$13.32.

The energy bill savings from replacing one 150watt bulb with one 18watt compact fluorescent bulb is (\$108.71 - \$13.32 =) \$95.39

Television Sets

There are three television sets in the café. One is in the bar area and the other two are mounted much higher than eye level in the dining room. We observed that the television sets are very rarely watched. All three are turned on during all open hours, which amounts to 20 hours per week. We recommend that the two television sets in the dining room be eliminated since they are particularly ignored. Each television set has a wattage level of 111w.

111Watts / 1000 = 0.11kWh (energy consumption per hour)

0.11kWh * 20 = 2.2kWh (energy consumption per week)

2.2kWh * 0.074\$/kWh = \$0.16 (cost per week to run one television)

2* 2.2kWh = 4.4kWh(energy saved per week by eliminating the two television sets)

4.4kWh * 0.074\$/kWh = \$0.32 (savings per week by eliminating the two television sets)

Therefore, each year energy use would be lowered by 228.8kWh and savings on energy costs would amount to \$16.64 if the two television sets were eliminated.

Slicer

We recommend that staff member of ground zero be discouraged from using the slicer unless absolutely necessary. It is noted that such produce as tomatoes, onions and green peppers can be sliced much thinner using the slicer than by hand and therefore slicing them is a more efficient use of produce. Simply breaking up lettuce instead of slicing it is one easy way to lower energy use.

Oven/ Toaster Oven

In the kitchen of Ground Zero there are two large industrial ovens that are in use most of each operating day. It is used for both large items such as trays of bacon, as well as for single order tasks such as french onion soup and california clubs. We recommend purchasing a toaster oven for small jobs. Toaster ovens are small, relatively inexpensive and use about 50% less energy than a regular oven (Consumer Aid Services, 2000). One reason toaster ovens save energy is because they require little if any preheating time and can therefore be turned off between uses, which is currently not possible of the ovens during the day in ground zero. With the purchase of the toaster oven we find that only one oven would need to be operated on a daily basis. This will help reduce amount of energy used to heat the two large ovens when they are not being fully used.

Fridge and Freezer Tips

Keeping freezers 5-7 cm away from the wall helps to save energy by ensuring that the ventilation grills in the back are not obstructed (Consumer Aid Services, 2000)

Do not put hot food in the fridge or freezer as the unit expends a lot of energy bringing the food down to room temperature, before it can be cooled to fridge or freezer temperature (Consumer Aid Services, 2000)

General tip

Many new models of appliances are much more energy efficient than their older counterparts. Replacing old appliances often results in a reduction of energy use. When buying new appliances look particularly for energy efficient models which often have an energuide label on them detailing their energy consumption. Note that more energy efficient appliances may be more expensive to purchase but will have significant financial savings on energy bills (Ontario Ministry of Energy, 1989).

7.0 Water Audit

7.1 Methodology

Water is used for a multitude of purposes at Ground Zero, such as food preparation, washing dishes and maintenance purposes. A water audit was completed at Ground Zero during the course of two weeks, November 4th to November 18th. During the first week, we completed two visits and in the second we completed three visits. The

water audit was conducted in order to evaluate and give the management a better understanding of their water use practices. In addition to this, we hope it will provide the administration with a few alternative ways of reducing water use that are feasible for implementation.

The methods we used to conduct the water audit were completed in several steps. These steps consisted of: identifying all water use operations at Ground Zero, quantifying the amount of water use of each water operation and identifying strategies for conserving water in the future.

In order to identify all water use operations at Ground Zero we compiled a list by walking through the Ground Zero kitchen and noting the locations of the water use processes. To measure the amount of water used, each water process was carefully examined. By observation, it was determined that most water was only used once and then discharged. We found that various processes at Ground Zero use different amounts of water. We quantified the amount of water use by basing it on the cycle amount in each particular process (ie. dishwasher). Also, the frequency of water use in each process was found through observation and by asking the kitchen staff at Ground Zero how often they use a particular piece of equipment. Lastly, we formed recommendations from our results for water conservation at Ground Zero. These recommendations included various strategies, which could be implemented to not only benefit the environment, but also the Ground Zero establishment.

7.2 Data Findings

Through conducting our water audit we observed the many uses of water at Ground Zero. Water is consumed through the operation of kitchen appliances, cooking and preparing foods as well as sanitary purposes.

The dishwasher is a major source of water use in the kitchen. Water is consumed in this commercial dishwasher during the rinse and wash cycle. Kitchen staff estimated that approximately eight gallons of water was used during each wash. The dishwasher was only used when it was filled to maximum capacity, which was approximately two times a day.

While cooking and preparing foods, the sinks were filled approximately two to three times a day (see Table 4). We found that pots and pans were soaked in a sink full of water. However, when foods were cooled or thawed in the sink, water was often left running. While washing dishes, it was found that a liquid detergent is added. We questioned the manager about the type of detergent and found that a company called Alpine delivers twenty litre jugs to the restaurant.

We also looked at general water use in the kitchen. After observing the kitchen staff, it was found that they wash their hands approximately four times per hour per cook (refer to Table 4). Also, the floor in the kitchen is washed once per day after closing time.

Table 4: Water Audit Data

	Week 1		Week 2			Average
	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	
Hand Wash Frequency (per hour, per cook)	3	4	5	3	5	4
Sink Filling Frequency (per day)	3	2	3	3	2	2.6

7.3 Limitations

The limitations found in conducting the water audit included inexperience in environmental auditing, time restrictions and lack of technical equipment. Due to lack of knowledge of water auditing, we were unsure of the proper methods of water analysis. Time restrictions limited the amount of data that we could collect because limitations were set on preparing and conducting the audit. For example, we were unable to contact the company that supplies Ground Zero’s washing detergents, in order to determine whether their products were environmentally friendly. Lastly, lack of technical equipment limited the water audit, we were unable to precisely measure rate of water flow because we did not have the proper devices.

7.4 Recommendations

In conducting the water audit we have devised several recommendations that we think will improve the sustainability of the business within Ground Zero.

Our first recommendation is to limit sink water use. This would involve being conscious of the amount of water used in sinks while washing dishes, thus limiting excessive water use. Also, when cooling or thawing foods in the sink, instead of leaving

the water continually running, it is more viable to fill the sink with some water and let the food items defrost while soaking in the cool water.

Another recommendation would be to replace taps in the kitchen with motion sensor faucets. Sensor taps would limit water leakage, as well as being easier to operate and more sanitary. However, it would be most effective to designate one sink for washing hands and replace only those taps with motion sensor faucets.

8.0 Air Quality Audit

8.1 Methodology

To measure air quality we surveyed the dining room and kitchen staff. Questions regarding sinus problems, nausea, and their general thoughts on air quality were asked to determine if there is any cause for concern. (See Appendix D)

8.2 Data Findings

There were no indications that there should be cause for concern regarding air quality in Ground Zero. Survey responses to questions asked regarding causation of illness due to air quality were inconclusive.

8.3 Limitations

The limitations encountered in the air quality audit included inexperience by the auditors, lack of technical equipment to properly test air, and time constraints. Limitations also included time restraints of the participants who filled out the survey. As

many of Ground Zero's staff are students, they were only able to complete surveys during their breaks. This may mean that answers were rushed and incomplete.

There were no major problems involved in the air quality audit. A minor problem that was encountered was that some participants were unable to complete the surveys in a timely manner, which caused delays in the audit process. These were not severe delays, nonetheless answers may not have been assessed as well as they could have had the responses been given earlier.

8.4 Recommendations

Since the air quality surveys did not present any cause for concern, recommendations regarding this area of the environmental audit involve further testing. Any future concern for poor air quality in Ground Zero should be met with more technical, in-depth analysis.

9.0 Waste Audit

9.1 Methodology

The methodology used in the waste audit was based on advice from Patti Cook. Other sources for methodology concepts came from a report on a waste audit performed on the Bombshelter called *Greening the Bomber* as well as *A Guide to Waste Auditing on Campus: From Audit Planning and Report Writing* (Cook and Carrell, 1996), and a thesis titled *Turning Data Into Information: Improving the Accuracy and Efficiency of Waste Audit Data* (Carrell, S, 1995).

Observations took place on October 8th, 2002 to make some preliminary conclusions regarding methods to decrease waste within Ground Zero. All of Ground Zero staff was informed of the audit as we posted a paper in the general staff area of Ground Zero explaining the details. Both staff and management signed consent forms if participation was asked of them.

The data analysis of the audit was conducted from November 4th to November 10th 2002. Ground Zero is closed on weekends and therefore the audit was not performed Saturday or Sunday. By conducting the audit every day for one week, we attempted to collect a representative sample of the types and corresponding amounts of waste produced by Ground Zero in one week. To our knowledge there were not any special events conducted during the week of our audit.

Waste collection was scheduled for 2pm on Monday, Thursday, and Friday; and 3pm on Tuesday and Wednesday, of that week. We chose to conduct the waste audits after Ground Zero closed each day.

The waste collected on Tuesday was sorted at our home due to unforeseen circumstances; however, waste from Wednesday to Friday was brought to the loading docks at the Student Life Centre and sorted there. This was where we found the area most conducive to sorting the bags of waste and consequently decided to perform the audit at that location for the duration.

We used several small green compost bins (.45kg) that were used to hold the sorted waste and therefore added to the weight of the waste. The green compost bin was later weighed and subtracted from the total weight of each category for the day.

In order to conduct the audit we separated the waste into 14 categories:

- | | |
|-----------------------------|--|
| 1) Compost | 8) Plastic Bags and Plastic Wrap |
| 2) Paper Towels and Napkins | 9) Non-compostable Food Waste |
| 3) Basket Liners | 10) Unopened Jam Packages |
| 4) Empty Containers | 11) Recyclables |
| 5) Paper Receipts | 12) Cloths (used for cleaning) |
| 6) Straws | 13) Coffee Products including grinds, filters, and packaging |
| 7) Bread | 14) Miscellaneous items |

Day two contained ten categories as the waste from the dining and bar area were not included in the data analysis. As a result we did not sort or record data concerning straws, coffee products, cloths and paper receipts on that day.

The garbage was weighed using a spring scale. Results were recorded per category on a sheet of paper that was later transferred into an excel spreadsheet. We created worksheets that included raw data as well as percentages (see Appendix F). Percentages were calculated to allow for consistency as the garbage from each day weighed differently. In order to work around the missing data from the second day of our audit we decided to use weighted averages of each category. Using weighted averages allowed us to compare our results from each day while maintaining a representative sample.

The following is a list of equipment used throughout data collection:

- a) Industrialized Rubber Gloves,
- b) Spring Scale with a 30kg gauge,
- c) Compost bins (for sorting),
- d) Ground sheets, and
- e) Recording materials.

9.2 Data Findings

Figure 12 summarizes the results of our five-day waste audit. As stated earlier, we were unable to gather complete data for all five days; therefore, we used weighted averages in order to have comparable data. During the course of the audit, non-compostable food waste was the largest component of Ground Zero's waste. For the purpose of our research we defined non-compostable food waste as meat, cheese, pasta and french fries. Compostable items include all fruit, vegetables and eggshells. Empty containers included jam packages, creamers and disposable portion cups. Ground Zero uses portion cups to serve sauces to guests. Miscellaneous items included discarded cooking utensils, cutlery and milk cartons. Basket liners are used at Ground Zero to serve many of their dishes. The liners are made of a waxed, non-recyclable material. Recyclables included all paper, glass and plastic products. The remaining categories are as outlined below.

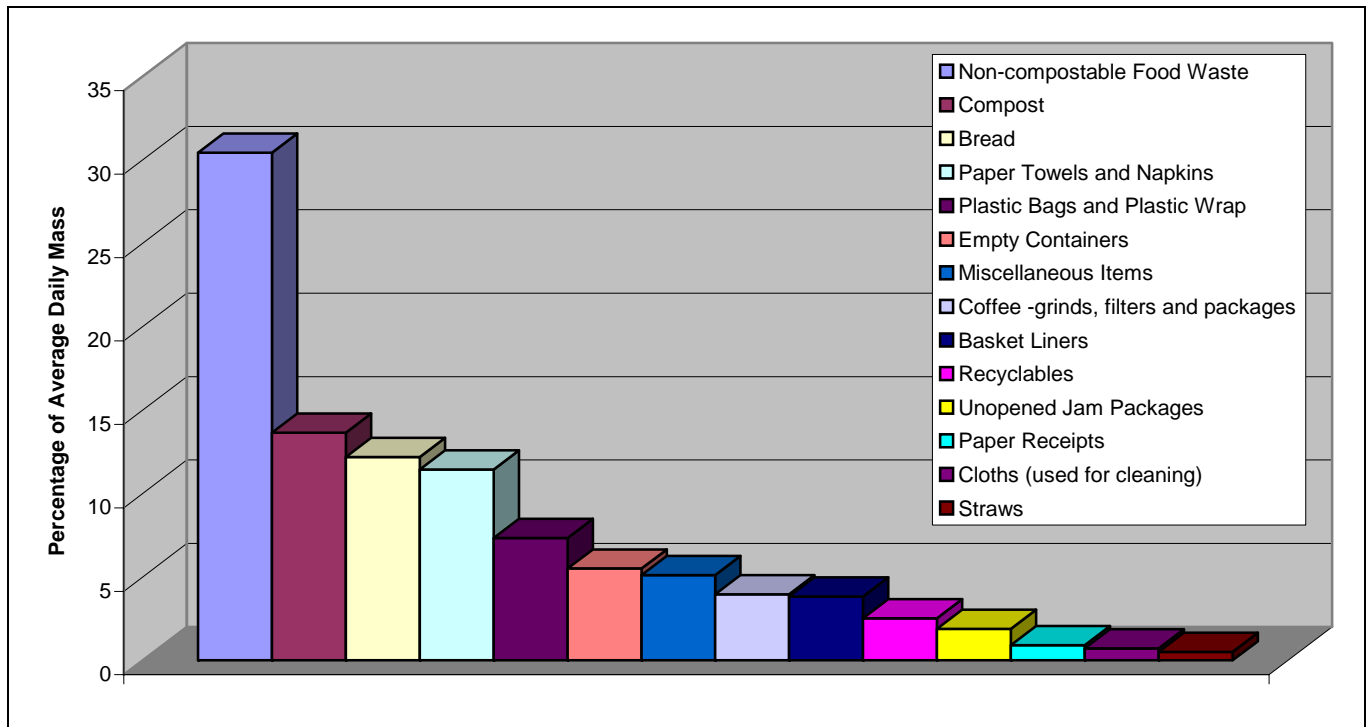


Figure 12: Percentage of Average Daily Mass

9.3 Limitations

One of the limitations in conducting the waste audit was our inexperience in environmental auditing. This meant that several adjustments were made during the first two days regarding waste pick up schedules, locations, and storage facilities. A second limitation was that during data collection, it was very difficult to separate each piece of waste produced, as it was not separated while being disposed. A third limitation was the available amount of time given to prepare and conduct the audits. Due to unforeseen circumstances, representative data was only collected for three days instead of the anticipated five days; therefore, adaptations were necessary in evaluating our data.

9.3.1 Problems Encountered

The first scheduled day of data collection Ground Zero unintentionally removed the daily waste. A timely reminder should have been given to Ground Zero to have avoided this problem. On our third day of auditing, we discovered three garbage bags that had not been noticed by our team nor mentioned by Ground Zero. It is assumed, then, that Ground Zero did not fully understand the process of the waste audit and that more clearly defining the scope of the audit would have prevented this.

Due to the oversight of the first day, waste was picked-up and brought to another location on the second day as neither auditors were able to conduct the audit at the time the restaurant closed. This resulted in the waste audit being conducted in an unsheltered area during a snowfall that may have added to the weight of the waste and therefore preventing the findings from being accurate. As a result of these two factors only three days of representative data were collected. Future waste audits should include more detailed information for the establishment, regarding their role throughout the audit.

After data collection was complete on the third day, arrangements were made with the custodian staff to leave the audit equipment at the loading dock where the audit was being performed. On the fourth day of data collection, it was discovered that the audit equipment had been moved to another location without notification to the audit

team. This resulted in a delay of the audit process. The last evening a more secure location was found to store the audit equipment.

9.4 Recommendations

In the four days that the waste audit was conducted we found that compostable items accounted for approximately 14% of the waste produced by Ground Zero. This was the second largest amount of waste produced after non-compostable food waste, which accounted for 31% of their waste. Based on this data, we recommend that a composting program be implemented. Composting at Ground Zero should begin as a pilot project, to be used by the kitchen staff for fruits, vegetables and eggshells during food preparation. We further recommend that a compost bucket be placed in the dining room at the coffee station for the composting of coffee grinds and filters.

As Patti Cook (2002) has informed us, there have been many attempts to establish composting programs at the University of Waterloo. We have two proposals for composting. The first proposal is that Ground Zero's compost go to a community garden located at the North Campus. The Waterloo Public Interest Research Group (WPIRG), called Food Not Bombs, uses this garden to grow food that is later distributed through a local church to homeless people. Using the Food Not Bombs garden as a composting location would allow Ground Zero to dispose of their waste while improving the quality of produce grown in the garden. This would also reduce the amount of waste that goes to the landfill. As landfill gases are an air pollution concern (due to

gases released by trapped waste material), this diversion of waste would be valuable in reducing waste and air pollution, while helping a garden that feeds homeless people.

The second composting option is that Ground Zero utilize a system similar to that used by St. Jerome's Residence. St. Jerome's pays a fee to have their compost removed by the Planet Earth Composting Company located in the Greater Toronto Area (Cook, 2002). It may be in the best interest, both economically and ecologically, of St. Jerome's and Ground Zero to pool their resources and combine the composting programs. Further investigation will be required to determine the best system and best place for Ground Zero compost to go. It will be necessary for Ground Zero and the university Waste Management staff to derive a plan for compost removal at the end of each business day. Any composting program at Ground Zero would be beneficial as it would divert the amount of waste that would otherwise go to the local landfill.

Our second recommendation is that Ground Zero broaden its recycling program to include all recyclable products at the University of Waterloo. This should include all paper, glass, plastics and aluminum cans. In conducting our audit we found that Ground Zero only recycles cardboard. Furthering the recycling program should be relatively easy to implement, as recycling bins are located at the loading docks where Ground Zero currently brings its waste.

The third recommendation is that Ground Zero replace all prepackaged condiments such as jams and creamers as well as disposable portion cups with

reusable dishwasher safe products. This would require that the individually portioned cream, milk, and jam be purchased in bulk. Although these items are not expensive in the individually packaged state (Ulmer, 2002), bulk purchasing would be even more economically viable. Not only could this reduce purchasing costs for Ground Zero, but it would also decrease the amount of waste being produced each day. Another cost reduction would be to only serve those condiments on request of the customer. In our data collection we found that several unused packages of creamers and jams were disposed. If Ground Zero chooses to adopt the recommended system, much of the unnecessary waste from these condiments would be eliminated.

We also propose that Ground Zero eliminate the use of baskets and waxed basket liners as serving plates. The liners cannot be recycled, and should a recyclable alternative be found it would be difficult to ensure that all food remnants be removed as food and grease stained paper cannot be recycled. Since Ground Zero already uses reusable plates, replacing the current system with reusable dishwasher safe dishes should be more economically and ecologically viable.

Our fifth recommendation is that Ground Zero discontinue or limit the amount of garnishes being served. In conducting the waste audit we observed that most lemons, limes, and oranges were not consumed. The elimination of such garnishes would reduce the amount of needless waste.

We also recommend that Ground Zero reduce the amount of straws that are being given to customers. A suggestion is that they are only served to customers upon individual request.

Our final recommendation is that Ground Zero discontinue offering take-out to customers. According to the Federation of Students (2002), take-out containers are very expensive. The most economical take-out containers are Styrofoam, which take a long time to decompose. If the elimination of take-out at Ground Zero is not viable, more environmentally friendly options should be considered such as plastic, reusable take out containers. Reusable containers, however, are considerably more expensive (Ulmer, 2002).

Although some of the areas to which recommendations have been made individually account for small amounts of waste, it is important to consider that every effort that can be made to reduce, reuse and recycle products will contribute to the larger scope of social, economical, and ecological well-being of staff and students at the University of Waterloo.

10.0 Conclusions

The environmental audit of Ground Zero was necessary to improve sustainability of the University of Waterloo campus. The audit focused on waste, specifically composting and waste reduction. We also conducted less-detailed audits of air, water and energy systems.

While conducting our research we were able to find a number of ways in which Ground Zero could improve the sustainability of their business and the overall sustainability of the University of Waterloo campus. It is anticipated that the preceding recommendations will be implemented and will serve as a model for food service providers at this and other university campuses.

11.0 Acknowledgements

We would like to give thanks to Patti Cook (Waste Management Co-ordinator, University of Waterloo), Mike Ulmer (Ground Zero Manager), Marion Gadd (Ground Zero Head Chef), Chris Di Lullo (VP Administration and Finance, FEDs), all Ground Zero staff and all others who advised us and answered our questions. We greatly appreciate all of your help.

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Appendix A: Information Letter

<<insert name>>

Ground Zero Café
Student Life Centre, University of Waterloo

<<insert date>>

Dear Sir or Madam;

A study is being conducted by Wendy Frise, Rebecca Betik, Lesley Bayne and Justine Ulman under the supervision of Professor Susan Wismer of the Department of Environmental Studies at the University of Waterloo. You are being invited to participate in a research study. We plan to collect data from Ground Zero Café in terms of water and energy inputs, and waste and air outputs in order to learn more about the sustainability of the business. If you decide to volunteer, you will be asked to participate in an interview at a mutually agreed upon time, and information from other sources such as users manuals of kitchen equipment. You may not benefit personally from your participation in this study. However, the information obtained from this research may aid in making Ground Zero Café a more sustainable business within the University of Waterloo campus. Participation in this study with an interview is expected to take approximately 1 hour or less of your time. You may refuse to participate and still receive the care you would receive if you were not in the study. Also, you may quit after the study has started without any loss. With your agreement, we would like to contact you again in 1 to 2 weeks to ask you another set of similar questions. You may decide at that time whether or not you wish to participate in that part of the study. All information collected from participants in this study will be aggregated. Thus, your name will not appear in any report, publication or presentation resulting from this study. For the time you have given to this study, you will gain better awareness of energy, water, air and waste in relation to your business. The data, with identifying information removed, will be securely stored in a locked office in the research laboratory.

You may withdraw from the study at any time by advising the researcher of this decision by way of email (addresses provided in contact information). Be assured that you may leave unanswered any question you prefer not to answer, and the type of questions you will be asked will be provided in a general outline of interview questions attached to this letter. If you have any questions about participation in this study, please feel free to contact the researchers.

Wendy Frise - w_frise@hotmail.com (519) 725-8933

Lesley Bayne - lesleybayne76@hotmail.com (519) 883-8292

Rebecca Betik - rebeccabetik@hotmail.com (519) 883-8292

Justine Uman - saffronjade@thegreenpages.ca (519) 725-4526

If you have additional questions, please contact either

Professor Susan Wismer
ERS 250 Professor
Office: ES1 21
(519) 888-4567 ext. 5795
skwismer@fes.uwaterloo.ca

Or

Patti Cook, Waste Management
Coordinator
Office: DC 3611
(519) 888-4567 ext. 3245
plcook@uwaterloo.ca

This project is being reviewed by, and pending ethics clearance through the Office of Research Ethics. Research will begin only when ethics clearance has been received. In the event you have any comments or concerns resulting from your participation in this study, please contact Dr. Susan Sykes at the Office of Research Ethics, 519-888-4567, Ext. 6005

Thank you for your time,

Rebecca Betik

Lesley Bayne

Wendy Frise

Justine Ulman

Attention all Ground Zero Staff:

Environmental Audit of Ground Zero taking place between Nov. 1st and Dec. 1st, 2002

as part of an ERS 250, Greening the Campus course with the support of the
Federation of Students and University of Waterloo Ethics Clearance.

How this affects you during this time:

Auditors will be monitoring the kitchen and dining room of Ground Zero:

- Walking around Ground Zero to record observations-
- Sifting through garbage and other materials/machines used in Ground Zero-

Auditors may ask you to participate in a voluntary interview:

Any interviews conducted are for purposes of this environmental audit only and you
may choose not to answer any or all questions asked

Your patience and participation in this audit are greatly appreciated

Sincerely,
Lesley Bayne, Becca Betik, Wendy Frise, Justine Ulman

If there are any questions concerning this environmental audit please contact us at
lesleybayne76@hotmail.com

Thank you!

Appendix C: Consent Letter

Consent of Participant

I have read the information presented in the information letter about a study being conducted by Justine Ulman, Wendy Frise, Rebecca Betik and Lesley Bayne of the Department of Environmental Studies as part of a project for ERS 250, Greening the Campus at the University of Waterloo. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted. I am aware that I may withdraw from the study without penalty at any time by advising the researchers of this decision.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I understand that if I have any comments or concerns resulting from my participation in this study, I may contact the Director, Office of Research Ethics at (519) 888-4567 ext. 6005.

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

Name of Participant (please print)

Signature of Participant

Dated at Waterloo, Ontario

Witnessed

Appendix D: Air Survey

Air Quality Questions

1. Do you experience headaches at work? If yes, how often?
2. Do you experience nausea at work? If yes, how often?
3. Do you have sinus problems? If no, please skip to question 4.
If yes, do they get worse at work?
4. Do you experience sinus problems at work? If yes, how often?
5. Do you ever get light-headed at work? If yes, how often?
6. Do you find your work area stuffy?
7. Do you find it too warm, too cold, or just perfect?
8. What do you smell other than food during an average shift?
9. When food is burnt in the kitchen, does the kitchen get smoky? If it smells, how long does it last?

Appendix E: Waste Interview

Waste Questions

Approximately how long does it take to use a package of straws? How many are in a package?

How much does a package (or case) of straws cost?

Would you consider eliminating straws from your business? Why or why not

Approximately how long does it take you to go through a package of napkins? How many are in a package?

How much does a package (or case) of napkins cost?

Would you consider using cloth napkins and laundering them with the aprons in the kitchen? Why or why not

Approximately how long does it take you to go through a package of green and white checked paper sheets? How many are in a package?

How much does a package (or case) of green and white checked paper sheets cost?

Would you consider eliminating the use of the disposable sheets by putting all orders on the plates? Why or why not

Approximately how long does it take you to go through a package of coffee filters? How many are in a package?

How much does a package (or case) of coffee filters cost?

Would you consider a re-usable coffee filter instead of disposables? Why or why not

Assuming the garbage is full when taken out, how many times a day is the garbage taken out?

If composting facilities were available in or around the SLC would you consider a compost program? Why or why not

We have observed that you recycle cardboard but not other materials such as hard plastic in the kitchen. Would you consider expanding your recycling program in the kitchen? Why or why not

Appendix F: Waste Data

Table 5: Daily Mass (in kilograms)

WASTE	Day 2	Day 3	Day 4	Day 5	Total Waste
Non-compostable Food Waste	8.75	9.00	6.70	3.75	28.20
Compost	3.5	4.45	2.25	2.45	12.65
Bread	2.3	2.70	3.10	3.20	11.30
Paper Towels and Napkins	2.5	3.85	2.60	1.65	10.60
Plastic Bags and Plastic Wrap	1.2	1.50	2.50	1.60	6.80
Empty Containers	1	1.65	1.45	1.00	5.10
Miscellaneous Items	n/a	2.05	1.15	0.35	3.55
Coffee -grinds, filters and packages	n/a	0.95	1.10	0.70	2.75
Basket Liners	0.8	1.50	0.60	0.65	3.55
Recyclables	n/a	0.95	0.40	0.40	1.75
Unopened Jam Packages	0.35	0.70	0.50	0.20	1.75
Paper Receipts	0.1	0.25	0.35	0.15	0.85
Cloths (used for cleaning)	n/a	0.30	0.10	0.10	0.50
Straws	n/a	0.15	0.10	0.10	0.35
TOTAL MASS OF WASTE	20.5	30.00	22.90	16.30	89.70

Table 6: Percentage of Daily Mass

WASTE	Day 2	Day 3	Day 4	Day 5	Total
Non-compostable Food Waste	42.68	30.00	29.26	23.01	31.44
Compost	17.07	14.83	9.83	15.03	14.10
Bread	11.22	9.00	13.54	19.63	12.60
Paper Towels and Napkins	12.20	12.83	11.35	10.12	11.82
Plastic Bags and Plastic Wrap	5.85	5.00	10.92	9.82	7.58
Empty Containers	4.88	5.50	6.33	6.13	5.69
Miscellaneous Items	n/a	6.83	5.02	2.15	3.96
Coffee -grinds, filters and packages	n/a	3.17	4.80	4.29	3.07
Basket Liners	3.90	5.00	2.62	3.99	3.96
Recyclables	n/a	3.17	1.75	2.45	1.95
Unopened Jam Packages	1.71	2.33	2.18	1.23	1.95
Paper Receipts	0.49	0.83	1.53	0.92	0.95
Cloths (used for cleaning)	n/a	1.00	0.44	0.61	0.56
Straws	n/a	0.50	0.44	0.61	0.39
TOTAL MASS OF WASTE	100.00	100.00	100.00	100.00	100.00