Assessing and Quantifying Food Waste on the University of Saskatchewan Campus:

Developing a Comprehensive Food-Waste Reduction Plan

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Assessing and Quantifying Food Waste on the University of Saskatchewan Campus: Developing a Comprehensive Food-Waste Reduction Plan

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<tr>
<td>UN</td>
<td>United Nations</td>
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<tr>
<td>WRAP</td>
<td>Wellness Recovery Action Plan</td>
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<td>FAO</td>
<td>Food and Agriculture Organization (United Nations)</td>
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<td>FSC</td>
<td>Food Supply Chain</td>
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<td>FUSIONS</td>
<td>Food Use for Social Innovation by Optimising Waste Prevention Strategies</td>
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<td>MCC</td>
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<td>CBSM</td>
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Executive Summary

1. Food waste is a growing concern. Globally, one third of food for human consumption is wasted. In Canada, the figure is about 40% per year. Food waste impacts the environment, the economy, and society. Although food waste is increasing, it is an under-researched area.

2. At the University of Saskatchewan, the Office of Sustainability and Marquis Culinary Centre (MCC) are aiming to increase the sustainability of their operations by decreasing food waste.

3. The primary goal of this project was to assess the quantity of food waste at MCC while gaining greater understanding of food waste on campus. Further goals were to prevent and reduce food waste in order to decrease both food waste costs and detrimental impacts on the environment, such as the carbon dioxide caused by the release of harmful greenhouse gases (especially methane) produced from decomposing food. This goal involved investigating the benefits of both preventing waste from occurring and diverting it from the landfill. A final goal was to develop a comprehensive waste reduction plan, incorporating a community-based social marketing campaign to support waste reduction.

4. Two methods were applied: First, a food waste audit was conducted at MCC of both pre-consumer and post-consumer waste; second, behavioural observations were conducted of MCC patrons.

5. This research project had the following results:
   - Pre-consumer (kitchen) waste accounted for the highest food waste output over the course of the audit week. Post-consumer (edible plate) waste was the second highest, whereas post-consumer (non-edible) waste accounted for the least amount of food waste.
   - During the course of the week, supper accounted for the highest volume of food waste. Lunch had the second highest and breakfast had the least amount of food waste. Also, there was a sudden increase in food waste during supper on Wednesday. This increase was as a result of a supper catering event hosted by MCC for 140 guests. During the course of the audit week, several lunch and supper buffets were held at MCC, which could have contributed to the high volume of food wasted during the audit week. One major observation of food waste as a behavioral issue both at the pre-consumer and the post-consumer level was as follows: there appeared to be a lack of awareness of the volume of food being wasted. Most kitchen staff and patrons did not identify themselves as being a part of the food waste problem. These individuals were looking at food waste as an institutional problem.

6. Based on the findings stated above, I recommend the following:
   - Implement the Lean Path 360 program as a pilot project to reduce food waste at the pre-consumer level. The Lean Path program offers a wide variety of benefits such as
reducing food waste, saving on food waste costs, allowing staff to be more accountable for their food waste habits, identifying trends and the most frequently wasted food, decreasing waste disposal charges and reducing the carbon footprint.

• Increase awareness of food waste campus wide, by providing more educational materials on the issue of food waste. One method for increasing awareness would be to report food waste statistics in the SHEAF, the campus news magazine.
• Encourage more collaboration with MCC, the Office of Sustainability and the student body to tackle the issue of food waste.
• Increase more regular food waste audits at MCC.

The issue of food waste is a complex one. However, with greater awareness, increased education and regular food waste audits, the University of Saskatchewan can reduce its food waste over time.
1.1 Introduction

1.2 Background

In recent years, food waste has become a global concern for governments and their citizens. The Food and Agriculture Organization of the United Nations (FAO) estimates that, in 2011, one third of food produced for human consumption was wasted (FAO, 2011). In fact, according to the Green Optimistic, the planet’s annual food waste is equivalent to 50% of its yearly cereal crops (Pullen, 2016). In Canada, the amount of food waste is similar; approximately 40% of food produced for human consumption is being wasted yearly (Gooch, Felfel, & Marenick, 2010). Canadians waste more than seven billion kilograms of edible food annually (Tamburri, 2014). At the household level, Canadians waste almost 50% of the total food produced (Coulter-Low, 2016).

The waste of food in Canada has economic, environmental and social impacts. Economic losses due to food waste and losses were valued in 2010 at $27 billion, increasing to $31 billion in 2014 (Richardson, 2017). Food retail stores account for 11% of the total identified waste stream (Gooch et al., 2010).

Environmental losses are a waste of resources used in food production, including land, water, and energy (FAO, 2011). These wasted resources would be better used for the production of food for people who are hungry in the world (D. Evans 2014). In Canada, 850,000 people use food banks on a monthly basis, yet food waste is increasing (P. Evans, 2014).

Food waste contributes to air pollution such as the release of dangerous methane gasses from decomposing food coming from landfills. Also, water pollution due to the runoff from landfills. (Lam, 2010). Methane, a greenhouse gas that is a by-product of food decomposition in landfills, is 20% more harmful to the atmosphere than carbon dioxide, and food waste accounts for approximately 40% of landfill waste (Allan, 2014).

Universities in Canada have embarked on a journey to tackle the growing problem of food waste. Researchers from the University of Guelph food waste research project have collaborated with the City of Guelph and York Region to study household food waste (Coulter-Low, 2016). The University of Toronto has in the past hosted food waste symposium with a diverse group of stakeholders to tackle food waste using a holistic approach (Dominic, 2014). Interestingly, a PhD Candidate at the University of Toronto has started a project dedicated to addressing food waste. She has launched an initiative called “Food System Lab,” the main objective of which is to look at policy alternatives to address food waste prevention (Elsharkawy, 2016).

Food waste at the University of Saskatchewan is an increasing concern for the Office of Sustainability and the MCC. These offices are working together to reduce food waste, but to be effective their strategies need to be informed by data that quantifies food waste on campus.
The MCC is now a key sustainability player in employing sustainable practices to tackle food waste in its daily operations. The MCC partnered with Facilities Management Division (FMD) and the Office of Sustainability to acquire and launch a food waste dehydrator in February 2017. This food waste dehydrator was installed at MCC as a pilot project. The food waste dehydrator pilot project is expected to last for six months to help eliminate food waste from the campus waste stream (Glazebrook, 2017).

Although food insecurity and food waste are continuing to increase across the globe, food waste is still an under-researched area for social scientists (Evans et al., 2013). A report in 2013 from the Guelph-based Provision Coalition reported that there is inadequate data on food waste and its causes in Canada (Uzea et al. 2013).

1.3 Goal and Objectives

The current research project aimed to assess and quantifying food waste on the University of Saskatchewan Campus, evaluate best practices used by other universities to reduce food waste, and develop a robust, comprehensive food waste reduction plan.

The main partner organization was the Office of Sustainability. Through this office, I engaged with a wide variety of stakeholders: MCC; Consumer Services; Facilities Management Division; staff; and students. The target audience will be all the patrons that dine at MCC, including staff and students.
2.1 Literature Review

In recent years, the issue of food waste has been faced by many countries and has become a growing concern for governments, policy makers, researchers and academic institutions. The University of Saskatchewan is concerned about its food waste on campus. Those involved with the issue know that to tackle food waste they need data on the volumes of food being wasted. The goal and objectives of this research are, first, to quantify the food being wasted on campus, second, to evaluate best practices used by other universities to reduce food waste, and third, to develop a robust comprehensive food-waste reduction plan for the University of Saskatchewan. This literature review is organized into the following themes: an overview of food waste, the causes of food waste, food waste in different jurisdictions, the effects of food waste, methods of measuring food waste, and, best practices used by other universities to reduce food waste.

2.2 Overview of Food Waste

What is Food Waste? There is no universal definition of food waste. The term is defined differently in different jurisdictions, largely because of varying perspectives on food supply chains (FSCs) (Parfitt et al., 2010). A complicating factor is the term “food loss,” which is often defined a little differently from “food waste” (ReFED, 2016), although the two definitions are very close. According to Lipinski (2013, para. 6), “Food loss refers to food that spills, spoils, incurs an abnormal reduction in quality such as bruising or wilting, or otherwise gets lost before it reaches the consumer. Food loss typically takes place at the production, storage, processing and distribution stages in the food supply chain,” whereas “food waste refers to food that is of good quality and fit for consumption, but does not get consumed because it is discarded—either before or after it is left to spoil. Food waste typically, but not exclusively, takes place at the retail and consumption stages in the food supply chain” (Lipinski, 2013 para. 6). Thus, the main distinction between food loss and food waste concerns the stage at which the food is discarded in the food supply chain. While food loss tends to occur at the earlier stages (for example, in production, storage and distribution), food waste occurs at the retail and consumer end of the chain. The Food and Agriculture Organization of the United Nations supports this difference between food waste and food loss, indicating that food loss occurs at the production, postharvest, processing and distribution stage, whereas food waste takes places at the retail and consumption stage (FAO, 2017). In this paper, I have adhered to Lipinski’s definitions of food loss and food waste. See the glossary of terms on page 53 for further details.

2.3 Causes of Food Waste

According to a report by Gooch et al. (2010), there are seven primary creators of food waste along the food supply chain: overproduction, defects in products or equipment, unnecessary inventory, inappropriate processing, excessive transportation, waiting, and unnecessary motion (Gooch et al., 2010). The report further argues that all these factors arise from consumer behaviour, thus emphasizing that the biggest contributors to food waste are consumers (Gooch et al., 2010). Another article reports that consumer behaviour, along with poor coordination between actors in the food supply chain, is a strong contributor to food losses and waste but mainly in higher income countries (FAO, 2011). The same study reports
that in low-income countries, food waste is mainly confined to those with medium to high incomes (FAO, 2011). A report by Chandler (2016) on food waste in the U.S. details the reasons that consumer behaviour leads to food waste: consumers find food is readily expendable because it is cheap (largely due to subsidies); and consumers are selective, preferring aesthetically pleasing fruits and vegetables to those with small blemishes, leading grocers to discard less than perfect-looking produce and even those further up the supply chain to choose not to bring imperfect produce to market (Chandler, 2016). Similarly, D. Evans (2014) found that the wealthiest countries are where the largest volume of food is being wasted at the consumer level. D. Evans (2014) contends that over-purchasing, aesthetic perfection, inadequate understanding of the “use by” date, and underestimating values of food in the household are reasons for the large volume of food being wasted.

2.4 Global Food Waste: The Issue in Different Jurisdictions

Food waste has become an important issue on the global agenda. Lipinski et al. (2013) estimated that 32 percent of food produced in the world was lost or wasted in 2009. Food accounts for 1.6 billion tons of waste annually, which is estimated to be a monetary value of $1 trillion (Goldenberg, 2016). The UN has announced the first-ever global standard to measure food loss and waste while estimating that one-third of all food produced for human consumption worldwide is lost or wasted and valuing this loss at $940 billion per year (UN, 2016). Although it is a global phenomenon, food waste on a per-capita basis varies in different locations, with more food wasted in developed countries than in developing countries (FAO, 2011). It is estimated that food waste per capita in Europe and North-America is 95-115 kg/year. On the other hand, food waste in sub-Saharan Africa and South/Southeast Africa is only 6-11 kg/year (FAO, 2011).

2.4.1 Food Waste in North America.

Food in North America and Europe per capita wasted by consumers accounts for 95-115 kg annually compared to sub-Saharan Africa and south and south-eastern Asia, each accounting for 6-11 kg annually (FAO, 2011). A 2016 ReFED report argues that North American consumers lead the world in per-capita food waste. According to an article by Second Harvest Food Rescue, in North America, over 30% of fruits and vegetables are not accepted by supermarkets for resale, as these supermarkets find these fruits and vegetables unattractive (Second Harvest, 2016).

Chandler (2016) contends that the U.S. wastes more food than any other country. The same article reports that approximately 50% of food produced for human consumption is wasted in the U.S., which accounts for 60 million tons of produce, annually (Chandler, 2016). According to another article, food waste in the United States is approximated at 30-40% of the food supply chain; also, 31% of food is lost at the retailer and consumers levels (USDA, n.d.). Goldenberg (2016) suggests that food waste accounts for the biggest component of both landfills and incinerators.

According to a report by Vuchnich (2015), Canadians waste 50% of food fit for human consumption at the household level. The Toronto Food Policy Council indicates that Canadians waste $31 billion worth of food annually, which is approximately 40% of the food
produced annually for human consumption (Toronto Food Policy Council, 2014). In Canada over 40% of food waste occurs at the consumer and retailer level (Second Harvest, 2016). One article reports that food waste has increased in Canada, indicating that in 2010 Canadians wasted $27 billion of food compared to $31 billion in 2014 (Richardson, 2017). This latter figure is reported to be higher than the total economic output of the world’s poorest countries (Richardson, 2017).

2.4.2 Food Waste in Universities in Canada

Food waste has become a growing concern for universities in Canada. Researchers from the University of Guelph food waste research project have joined with the City of Guelph and York Region to do a detailed study on food waste at the household level (Coulter-Low, 2016). Additionally, a Masters student from the University of Guelph did a project on edible food that people discard. In this research, households were asked to take photographs of waste they discard; this was done to engage these patrons and, to increase food waste awareness (“What a waste! The University of Guelph,” 2017). In 2013, a report was done by University of Regina students, which examined several composting best practices across Canadian universities, to ascertained the best composting options to tackle the issue of food waste on their campus (Ahmed, 2013). In February 2016, the University of Saskatchewan bought a food waste dehydrator to help reduce food waste on campus (Glazebrook, 2017).

2.5 Effects of Food Waste

Food waste involves not only the waste of food itself but also all the natural resources that are wasted in producing the food including energy, water, land, packaging, and physical labour. The effects of food waste can be examined from three main perspectives: economic perspectives; natural resource and environmental perspectives; and ethical and social perspectives (Tielens & Candel, 2014).

2.5.1 The Economic Perspective on Food Waste

Food loss and waste account for approximately US$680 million in industrialized countries, compared to US$310 in developing countries (Food Tank, 2016). A 2014 report by CBC News claims that Canada wastes more than $31 billion dollars of food annually, which is $31 billion lost from the nation’s economy. Additionally, a CBC report highlights that the total food waste cost does not include food waste at federal institutions like prisons, jails, hospitals, and schools; the article contends that if these institutions were to factor in the true cost of food waste, it would total approximately $100 billion a year (P. Evans, 2014). The report also suggests that avoidable food waste can increase the cost of food by 10 percent or more (P. Evans, 2014). Moreover, food waste results in a loss of investment that reduces the incomes of farmers and businesses and increases consumers’ expenses (Tielens & Candel, 2014). University of Guelph Professor Kate Parizeau claims that the cost of food waste per person in Canada is estimated to be $760 annually (Jheon, 2016).
2.5.2 Natural Resource and Environmental Perspectives

According to the UN, food waste accounts for a major loss in limited natural resources such as land, water, chemicals, and energy (UN, 2017). Moreover, food sent to the landfills damages the environment because it releases dangerous greenhouse gases into the atmosphere. 3.3 billion tons of greenhouse gases are produced from landfills worldwide as a result of food waste (Kirby, 2013). A report by Lam (2010) states that food waste also contributes to water pollution as a result of runoff or leaching from landfills (Lam 2010).

Additionally, these landfills use up a quarter of the world’s agricultural lands (Richard, 2016). Similarly, Coulter-Low (2016) reports that 3.3 gigatonnes of carbon dioxide are generated from global food waste annually, putting food waste as the world’s third producer of carbon dioxide, behind USA and China. Another study reports that food waste accounts for 8% of global climate pollution (Goldenberg, 2016). In a 2015 Global News article, it was reported that methane emissions from landfills in Canada account for 20 percent of national methane emissions (Vuchnich, 2015).

2.5.3 Ethical/Social Perspective

According to “Culture Decanted,” a social and cultural website focused on exploring social and cultural trends, food is an integral part of a country’s culture; food brings people together and is a precious commodity that forms a bond and maintains a common identity among a group of people in society (Culture Decanted, 2014).

An article by Culture Decanted titled “Eating Yourself: We Consume Identity Through Food” reports that food has an ethnic and cultural symbolism and that the history of a nation’s diet reflects the nation itself through food fashions. The article argues that food should move from a consumption model to one that reflects individual consumption because consumption at the individual level changes frequently (Culture Decanted, 2014). Global food waste is increasing, and 30% of agricultural land used to produced food is being wasted globally, while 800 million people suffer from chronic hunger (Grijalva & Shank, 2015). Similarly, an article by Shreeves (2015) reports that if one quarter of the food currently being wasted were used, it could feed 870 million hungry people globally (Shreeves, 2015).

2.5 Linkage Between Food Waste and Food Security

The UN defines food security as “A situation that exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (UN, 2015 para. 1). In a recent article on food waste, the author interviewed Tamara Soma, a PhD candidate at the University of Toronto; Soma claims that food waste and food security are connected as global famines happened in the past during periods of food surplus (Dominic, 2014).

A report for the Food & Business Knowledge Platform by Tielen and Candel (2014) argues that many actors in food loss and waste claim that reducing food waste will have a long-term positive impact on food security; however, the report does not clearly state the relationship between food waste and food security. The report further reports that linkage of food waste interventions and food security continues to be under-researched (Tielen & Candel, 2014).
On the other hand, most global actors involved in reducing food waste think doing so would improve food security and reduce global malnutrition. According to D. Evans (2014), approximately 870 million people in the world are undernourished and an unquestionable amount of food is being wasted, while many are suffering from hunger. D. Evans (2014) goes on to argue that the linkage between food waste, food abundance, and poverty are real. He contends that to prevent such waste as well as hunger, food producers should be targeted. He argues that food waste is connected to the issue of food security as there has been pressure for global food production to increase to meet the demands of the increasingly wealthy global population (D. Evans, 2014). Similarly, Lam (2010) argues that reducing food waste could improve the availability of nutrients that will in time enhance health and food security.

Food insecurity is not only a problem for developing countries. Mansfield et al. (2015) argue that food insecurity has reached many parts of Canada, with approximately over 400 million Canadian struggling to access the food they need. Mansfield et al. (2015) also claim that food insecurity is increasing and placing stress on the health and well-being of Canadians (Mansfield et al., 2015). Similarly, in the article mentioned above (Dominic, 2014), Tammara Soma of the University of Toronto was interviewed, Soma claims that the number of Canadians accessing food at the food bank has increased, with $841,000 Canadians who are food insecure and accessing the food bank, while tons of edible food waste is being sent to the landfill. Another article reported one in eight Canadian families struggle to put food on the table whereas, one in six children is unaware where the next meal is coming from (CBC, 2013).

In addition to a link between food security, food waste, and poverty, there is also a link between food security and the environment. D. Evans (2014) argues that food security has an environmental influence on global food production and waste. He claims that the stress placed on the limited resources for food production is damaging. For example, land cleared for agricultural purposes is destroying natural ecosystems and biodiversity. Also, the clearing of land through deforestation releases dangerous greenhouse gasses into the atmosphere (D. Evans, 2014). This emission of greenhouses gasses can be linked to future climate change, the disruption of the hydrological cycle and soil quality that may prove in the long-term that these lands given up for the production of food may not be fertile and productive (D. Evans, 2014).

2.6 Methods for Measuring Food Waste

Various methodologies are used to measure food waste globally. A report published by Wellness Recovery Action Plan (WRAP) reports two approaches used to measure food waste: the manual approach and the Smart Meter approach (WRAP, 2017). The manual approach is the use of separate containers to measure plate waste, which is waste produced during food production and preparation and expired or spoiled goods. Each container is weighed separately, and the results are entered on data collection sheets that are then input into an Excel spreadsheet for analysis (WRAP, 2017). The smart meter approach uses a smart meter called Lean Path 360, an Android tablet connected to Wi-Fi. The smart meter weighs the food waste and the staff records the weights, separating the food into different food groups. With the help of adding procurement data to this device, the actual cost of each type of food waste.
wasted can be calculated. The smart meter also gives information on the areas of high food waste (WRAP, 2017).

Another report published by Moller et al. (2014) claims that there are seven main methods used to calculate food waste: the direct measure and scanning, waste composition analysis, the measurement of mass and energy balance, statistics from authorities or waste management companies, questionnaires, food waste diaries, and, interviews (Moller et al., 2014). The report further argues that these methods have two main aims: to measure and to gather data (Moller et al., 2014). The seven methods can be categorized according to these two aims. The methods for measuring food waste are direct measurement (weight or volume), scanning, composition waste analysis and dairy (Moller et al., 2014). The methods for data gathering include a calculation from statistical data, interviews and surveys, mass and energy balances and questionnaires (Moller et al., 2014).

2.7 Best Practices used by Universities to Reduce Food Waste - Food Waste in North American Universities

As noted earlier, food waste is an increasing concern for Canadian universities. Several universities have engaged in research to examine best practices. For example, University of Regina students examined composting best practices options at Canadian universities, to come up with the best composting option for the University (Ahmed, 2013).

2.7.1 The Holistic Approach to Food Waste

There are numerous best practices used by universities around the world to tackle food waste. According to Merrow et al. (2012), the most effective waste reduction strategies in university dining areas use a holistic approach that involves students and faculty and reflects on sustainable practices outside of the dining area (Merrow et al., 2012). The University of Michigan uses a holistic innovative approach to the dining hall to reduce food waste (“Michigan Dining’s holistic approach to food waste,” 2017). The University uses the farm-to-table notion, which engages all patrons to reflect on each of the food processes from preparation in the kitchen to the plate (“Michigan Dining’s holistic approach to food waste,” 2017). Other universities, such as Western Michigan University, have also used a holistic approach to deal with the issue of food waste in dining halls. Universities of a similar size to Western Michigan University have been successful too in reducing their waste, including Georgia Institute of Technology and the University of California-Davis (Merrow et al., 2012). Work is also being done at Carleton University in Canada, where over the last three years, dining services have implemented a food waste management program on their campus (Richardson, 2017). Under this program, there are several sustainability practices, which include the use of campus green bins and clear bins to show the food waste they contain, the recycling of all fryer oil from on-campus restaurants, educational awareness programs, the training of kitchen staff on waste reduction, the use of on-campus waste compost projects, and a campaign to provide healthy meals to those who are less fortunate (Richardson, 2017).
2.7.2 Education Campaign

Universities acknowledge that food waste is adding to their expenses and are exploring various strategies to reduce food waste. As Stokes (2013) argues, “Simple awareness reduces college food waste.” He adds that a study on food waste at Kansas State University found that 15 percent fewer students wasted their food after a researcher placed short anti-waste slogans in the dining hall (Stokes, 2013). Oberlin College in Oberlin, Ohio also implemented successful educational campaign strategies to reduce plate waste at the University (Merrow et al., 2012). This university’s strategy was to weigh the amount of waste generated by the dining room weekly and publish the results in the school newspaper, as well as implementing campus-wide reporting on food waste statistics (Merrow et al., 2012). York University hosts its annual Zero Waste reduction week in October in sync with Waste Reduction Week in Canada to heighten awareness among community members and students and give them tips on reducing, reusing, recycling and rethinking waste (YFile, 2016). In a similar awareness campaign, in 2015 officials at the University of Saskatchewan hosted a Student’s Dumpster Dive, where they filled a table with all the food that was recovered from dumpsters on campus (Chong, 2015). In 2016, the Office of Sustainability at the University of Saskatchewan collaborated with Consumer Services to host a food waste reduction week, where post-consumer food waste was weighed from the conveyor belt, which is an equipment used to transport diners’ dirty plates to the dishwashing room. This was done to engage the patrons and also to increase their awareness of food waste on campus (Office of Sustainability, 2016). The University of Guelph has taken food waste a step further: an article by McCormick (2016) points out that the university has implemented food waste lesson plans, which connect research to classrooms. These lesson plans have provided benefits to students by enabling them to examine the issue of food waste and food security (McCormick, 2016). The unit plan called “Food Crisis and Food Waste” has been accessible to over 200 teachers from Ontario, China, and Australia. Students in these schools have implemented food waste and food security awareness campaigns based on research that encourages their classmates to change their behaviour by wasting less food (McCormick, 2016).

Other universities in Canada are working assiduously to reduce food waste. For example, the University of Toronto has implemented a Food System Lab to tackle the issue of Canada’s food waste problem (Levine, 2016). This lab is led by a Ph.D. student, whose main aim is to work with private, public and community organizations to develop innovative solutions to food waste (Levine, 2016). Another Canadian venture is occurring at the University of Guelph, where researchers have collaborated with the City of Guelph and York Region to investigate household food waste (Coulter-Low, 2016).

2.7.3 Trayless Dining Rooms

Universities around the world have removed trays from their dining room to prevent food waste. At the University of Michigan, no trays are visible in the dining area to prevent people from loading their trays with food that eventually goes to waste (“Michigan Dining’s holistic approach to food waste,” 2017). The University of Massachusetts’ dining hall eliminated trays from all dining areas in 2009, and post-consumer waste was reduced by 30% (ReFED, 2016). A study at the University of California-Berkeley reveals that 10% of food waste was reduced when the university eliminated trays from one of its dining rooms (Lam, 2010). Similarly,
about ten years ago Dalhousie University in Halifax established a policy that removed trays from all four of their dining areas on campus (Sofer & Pottern, 2008). This move reduced food waste as students take less food when they do not use a tray (Sofer & Pottern, 2008). The removal of trays has other benefits, reducing not only food waste but also energy, water, and chemicals used for washing trays. According to the University of Ottawa, going trayless reduced Dalhousie University’s water consumption by close to 4,000 liters a day and saved over $13,000 in electricity costs annually (“The University of Ottawa,” n.d.). Since Georgia Tech eliminated trays from their dining halls, it achieved savings of 3,000 gallons of water per day, which generated cost savings of $4,500 per year in water along with a reduction in food consumption, energy, and chemicals (Merrow et al., 2012). The University of Ottawa has also removed trays from its dining rooms, arguing that not only will this reduce food waste, water, and electricity but also motivate students to take the time out to practice and develop healthier eating habits (“The University of Ottawa,” n.d.).

2.7.4 Portion Control/Plate Size/Sustainable Menu Planning

Several other strategies are used by universities to reduce food waste. One strategy is to reduce the size of the plates foods are served on, the theory being that smaller plates hold less food and generate less waste. Western Michigan University dining, for example, has reduced the size of its plates to a nine-inch plate. The University of Michigan has also used smaller plates to encourage diners to take only what they can eat. According to a 2016 report by ReFED, a study at Cornell University by Brian Wainsink reveals that consumers given larger bowls took 16% more cereal than those with smaller bowls. He argues that consumers find a 70% plate fill-rate visually pleasing and that smaller plates in self-serve dining reduce consumer waste (ReFED, 2016). Another strategy is to have employees note choices that consumers make and to use this information to prepare future meals, so the students will eat what they take and generate less waste. A report on a food waste audit by Roy (2015) suggests that engaging patrons more with food preferences and encouraging them to provide feedback on menu items can also address plate waste (Roy, 2015). A final strategy is to customize meals according to diner preferences. The University of Michigan recently implemented the “Just Ask” campaign, which encourages diners to ask chefs at each station what they want in order to have a customized plate prepared for them (“Michigan Dining’s holistic approach to food waste,” 2017).

2.7.5 Food Waste Tracking

There has been a recent interest in tracking food waste in businesses. According to a ReFED report (2016), businesses want to know about their food waste for two main reasons: this knowledge can help them increase their profit margin, and, data sharing with stakeholders involved in the journey can reduce overall waste cost. There are various approaches a business can take to manage food waste; however, the two most common approaches are manual and smart-meter approaches. Universities in the USA and Canada use both approaches to quantify the amount of food wasted and, as a result have realized two positive results: quantifying the volume of food wasted, stakeholders can better manage their food waste, and, by engaging workers and making them accountable for the volume of food being wasted, these workers work harder to reduce food waste. Another approach used by some businesses including universities is single-day food weigh-ins to show consumers (including
students) how much is being wasted. Carleton University has also implemented a food management program that manually measures the waste staff is discarding (Richardson, 2017).

2.7.5.1 Lean Path 360

The Lean Path 360 smart food meter tracking has been successful in many business and universities in reducing food waste and saving money (Lean Path, 2017). Lean Path is a sophisticated food-waste monitoring terminal, which includes a built-in scale, camera, and a touchscreen user interface. Food waste is placed on the scale prior to disposal, a picture is taken and the worker answers a few questions. This information is then transmitted in real-time to the Lean Path online reporting dashboard, which provides some analysis of the data (Lean Path, 2017).

The Lean Path 360 smart meter is being used at several colleges and universities to reduce food waste. One such institution is Boston College, which has had great success, with the smart meter. The two biggest successes were a waste reduction in its salad and bakery stations, which prompted a reduction in pre-consumer food waste of nearly 60% after using the Lean Path 360 program for 12 months (Lean Path, 2017). Another college using Lean Path is the University of Massachusetts, which serves over 40,000 meals a day (or five million a year). To reduce food waste, the University adopted Lean Path in January 2012, installing this smart waste meter tracking in two of their largest dining areas. The results were impressive: food waste was reduced by nearly 25%, saving $70,000 in four months and food cost reductions of 1% annually (Lean Path, 2013).

2.7.6 Campus Composting Programs

Although the aim is to eliminate food waste, one must be realistic and realize that it is impossible to eliminate food waste totally. Composting, the natural breakdown of food waste into nutrient-rich components which diverts food waste from the landfills, has been an option that several universities have been practicing. At the University of Michigan in the kitchen, the chefs recover the trimmings from food preparation and transfer them to a bin for composting. Also, the kitchen uses pulpers for plate waste that is treated and then can be used for compost (“Michigan Dining’s holistic approach to food waste,” 2017). The University of British Columbia and the University of Ottawa have public compost bins to divert increasing amounts of food from landfill (Richardson, 2017). The University of Regina students recently launched a coffee grounds pilot project from January to April, where coffee grounds are collected each day at various locations. The coffee grounds are collected by PV Waste Solutions, which uses these grounds to produce compost that will be made available to farmers in Regina for fertilizers to use in their yard or for farming (Johnson, 2017). In addition to composting, several universities have implemented recycling programs. York University has implemented a Zero Waste comprehensive waste management and diversion program, which designates bins for recycling. This program achieved a 68% waste diversion rate in 2016 (YFile, 2016). Another option is using a food waste dehydrator. In February 2017, to reduce food waste on campus, the University of Saskatchewan implemented a food waste dehydrator pilot
program, the first of its kind in a Canadian university. This dehydrator is located at MCC, which has the highest food waste output on campus. It is estimated that the use of this dehydrator will save $11,440 in annual costs for using fewer disposal services along with diverting over approximately 2,487 pounds of weekly food waste output at MCC (Glazebrook, 2017). The Saskatchewan Waste Reduction Council has suggested that this food waste dehydrator will set the standard for larger institutions and businesses for food waste reduction in the province (Glazebrook, 2017). All these initiatives show that universities and colleges campuses are taking steps to reduce their food waste.

2.7.7 Donations to Food Banks

Some Canadian universities have made the decision to donate leftover food to food banks. A student organization called the Food Recovery Network from the University of Michigan recovers excess food and donates it to food banks (“Michigan Dining’s holistic approach to food waste,” 2017). Another example of a food waste initiative is taking place at George Brown College, whose culinary students in 2016 partnered with the school’s student association to reduce food waste by donating healthy food they had prepared to the school’s student food bank (Nanowski, 2017). This initiative was used to feed less fortunate students at the college who are unable to afford to eat a proper meal (Nanowski, 2017). At Carleton University, the dining service partnered with a campus-led student organization, known as Feed the Homeless by U, which provides meals for people who are less fortunate. This program provides 150-200 meals per day to the homeless (Richardson, 2017).

2.7.8 Community-Based Social Marketing (CBSM)

Vigen (2011) defines community-based social marketing (CBSM) as, “an approach to achieving broadly sustainable behaviour in our communities.” Vigen suggests that CBSM is, “more than education”; it uses, “knowledge from psychology and social marketing,” to, “[spur] action by a community and for a community” (Vigen, 2011, p.1). CBSM has been used as an approach to tackle food waste in universities. A study on CBSM was conducted by Pacific Lutheran University to evaluate food waste and improper recycling (Smith, 2015). This research involved weighing garbage that would be otherwise sent to the landfill and implementing a CBSM plan to encourage the students to change their behaviour towards recycling and composting. The results of the research reveal that CBSM is an effective strategy to change student behaviour and to increase awareness of sustainable practices on campus (Smith, 2015).

The University of Saskatchewan in 2016 used a CBSM framework to implement a single-stream recycling communications program. The CBSM started off with a literature review, observational analysis, a focus group and a campus recycling survey. These data collection methods help to provide useful information on the campus community behaviour and attitudes toward recycling. From this CBSM intervention, new signage was posted for better communication (Office of Sustainability, 2016).

Food waste is an increasing problem of epidemic proportions, which requires the commitment of leaders and different sectors across jurisdictions to tackle the issue. However, in order for leaders to effectively manage food waste, one must first look at food waste
holistically rather than as a single entity. Since food waste occurs at various stages of the food supply chain, a holistic and systematic approach would provide better opportunities to engage all stakeholders involved -- businesses, community organizations, citizens, and government -- so that all could be part of the solution to the issue.
3.1 Methodology

3.2 Data Gathering Instruments

The methods used to collect the data needed were as follows: a comprehensive literature review, an audit, and observations at MCC to obtain data on the volume of food being wasted, both at the pre-consumer stage (kitchen) waste, post-consumer stage (edible plate) waste and at the post-consumer (non-edible) waste. I have chosen these methods to understand the behaviour of patrons and staff when it comes to food waste on campus and to ascertain the quantity of food being wasted on campus.

3.2.1 Literature Review (Document Review)

A detailed literature review was done to determine current knowledge, successes, challenges, social marketing strategies and best practices for food waste reduction strategies in similar institutions in Canada and other jurisdictions. Various documents were examined to develop a better knowledge of food waste. These include academic articles, government documents, policy papers, standard operating procedures, and other documents that were relevant to the topic.

3.2.2 Food Waste Audit

A food waste audit was conducted in University of Saskatchewan campus kitchens and restaurants. This food waste audit consisted of the weighing of both pre-consumer (kitchen) waste, post-consumer (edible plate) waste and post-consumer (non-edible) waste. This weighing took place three times daily: after breakfast, after lunch, and after supper. This food waste audit was done at the back of the kitchen without the knowledge of the patrons so as to capture unbiased data. Prior to the audit, extensive research was done on food waste audit templates used globally and locally to conduct food waste audits. After careful examination of all the audit templates, I chose the EPA’s Food and Packaging Waste Prevention Tool as a reference tool; however, I had to substantially adapt it to fit the unique realities present at MCC and to capture the data sought. I developed a food waste audit template that included pre-consumer (kitchen) waste, post-consumer (edible plate) waste and post-consumer (non-edible) waste (napkins, bones, cores, and fruits peel). It was important for me to separate the waste into these various categories to determine the difference in volume of edible and non-edible waste and the total waste, in general, going to the landfill. This food waste audit template was used as a guideline in this audit and can be used for future food waste audits.

3.2.3 Observation

Both announced and unannounced site assessments and observations were made at locations on campus, particularly at the MCC. Also, participant observation was conducted several times at different service hours. Doing the participant observation allowed me to obtain useful information on patron’s attitudes and behaviours towards the issue of food waste. These observations were analyzed to determine staff and patrons’ behaviours and attitudes towards food waste over time.
3.3 Study site description

The study area for this research was MCC at the University of Saskatchewan. MCC is the main dining room offering all-you-can-eat facilities for the university campus and serving over 2,000 meals per day to students, faculty, staff, and visitors. MCC also has eleven retail locations on campus that they run, such as the Agriculture Café, Arts Cafeteria, A & W Arts, Starbucks, Subway at Kinesiology, Tim Hortons in Geology, Tim Hortons in the Arts Tunnel, Health Sciences, and Education, and MCC. MCC currently has two meal plan options: students and employees’ meal plan; however, the all-you-can-eat option is based on a flat rate, whereas the Arts Cafeteria uses a pay by weight system.

The dining facility at MCC has a total of eight different serving stations, all with diverse options. Patrons dine in the cafeteria area. When they are finished they are expected to return their plates to a rotating conveyor belt, which transfers the dirty plate to the dish washing area, where plates are cleared and food waste is collected.

MCC was chosen for this research for three reasons: this is the area that generates most of the food waste on campus; it is also where the food is prepared, third, it is where food sent to the major retail outlets on campus originates.

In recent years MCC has committed to and employed various sustainability practices in their operations which includes: going trayless in their dining room, offering a variety of vegetarian and vegan dishes, using reusable ware in its dining area, employing sustainable cooking techniques such as batch cooking, purchasing food from local vendors and student operations, such as the Horticulture Club and the College of Agriculture and Bioresources Rooftop Garden, using biodegradable cutlery, plates and platter for catering offerings, advertising sustainable events such as Local Food Month, the annual Sustainable Gourmet meal, and International Street Food Week, offering reusable mug discount at all Consumer Services outlets and partnering with Facilities Management and the Office of Sustainability to purchase and implement a food waste dehydrator as a pilot project to reduce food waste going to landfill (Office of Sustainability, 2016). Despite, these various sustainable practices implemented by MCC, there is still room for improvements to reducing food waste on campus. This report will offer some robust recommendations for reducing food waste on campus.

3.4 Data Collection

A food waste audit was conducted from Monday, March 27th to Friday, March 31st, 2017, during the food service hours at the MCC Dining room: breakfast, 7 am to 9 am; lunch, 11 am to 2 pm; and supper, 5 pm to 7 pm. To ensure a smooth audit, a prior meeting was held with the Executive Chef at MCC to discuss the food waste audit template and the auditing process. There were a total of three bins; two in the dish room area (one labeled as post-consumer (edible plate) waste the other one as post-consumer (non-edible) waste, and a third bin set up in the food preparation area (labelled as pre-consumer (kitchen) waste. At the end of each service hour, the bins were collected by the custodial staff and transferred to the garbage area, where a scale was located. Each category of waste was weighed and recorded on the food waste template before it was discarded. The head count for each respective service
hours was also recorded on this food waste audit template. This information was ascertained from the cash register’s daily transactions records.

3.5 Data Analysis

All data from the audit template sheets for one week were entered into Microsoft Excel. After the data was logged in Excel, calculations were done to ascertain the following: cumulative volume of waste for the week in kg, the quantity of food waste per day, the percentage of total food served wasted per meal, the percentage of food waste by source for the week.

3.6 Limitations of the Study

Although there were many strengths about the food waste audit, there were several limitations as well. The main limitation was that the audit was done in a low peak time near the end of the semester when fewer people eat at MCC. This time was chosen due to time constraints and conflicting schedules. Therefore, the scope of the quantity of waste recorded was likely very small and does not represent the actual waste produced at MCC. Second, it was only after the second day of the audit in the late evening that I noticed that the production waste was being placed in the pre-consumer bin. Third, the drink receptacle waste was not included in the food waste audit. Fourth, there were not many volunteers (manpower) to help with the execution of the audit. Fifth, the kitchen staff at the start of the audit were placing things in the wrong bins. I had to be in the area constantly watching to ensure waste was placed in the right bins.

3.7 Recommendations for Future Audits

There are some procedures that I suggest being done differently in the next audit. An audit briefing with the entire staff would be a good idea so that a better understanding is reached for smoother operations. As well, more volunteers present for the food waste audit would be helpful. The audit lasted a whole day and to have only two people transferring the bins and weighing waste was strenuous. It would also be a good idea to separate food into various food categories such as protein, starches, fruits and vegetables, and desserts to ascertain the category of the food waste. This information would help in the management of food and food waste. I would also recommend conducting a waste sorting refresher training for the staff before the start of any food waste audit.
4.0 Results

The figures and tables in this section are figurative illustrations of the data collected on food waste from the University of Saskatchewan at MCC. These include one bar chart, two pie charts, and a table. They are all presented below in that order, respectively:

**Figure 1: Bar Chart Showing Quantity of Food Wasted per Day at MCC**
Figure 2: Pie Chart Showing the Percentage of Total Food Served Wasted per Meal

Figure 3: Pie Chart Showing the Percentage of Food Wasted by Source per Week
Table 1: *Showing the Cumulative Volume of Food Waste for the Week at MCC in Kilograms*

Weekdays March 27th-31st, 2017

Cumulative Volume of Food Waste for the Week in kg

<table>
<thead>
<tr>
<th>Meal</th>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thurs</th>
<th>Fri</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>77.79</td>
<td>44.66</td>
<td>106.82</td>
<td>44.57</td>
<td>125.87</td>
<td>399.71</td>
</tr>
<tr>
<td>Lunch</td>
<td>173.36</td>
<td>183.02</td>
<td>165.79</td>
<td>185.29</td>
<td>170.10</td>
<td>877.57</td>
</tr>
<tr>
<td>Supper</td>
<td>211.15</td>
<td>136.19</td>
<td>270.68</td>
<td>226.46</td>
<td>209.22</td>
<td>1053.70</td>
</tr>
<tr>
<td>Total</td>
<td>462.30</td>
<td>363.87</td>
<td>543.29</td>
<td>456.31</td>
<td>505.19</td>
<td>2330.97</td>
</tr>
</tbody>
</table>
5.1 Discussion

5.2 Food Waste Audit

This section discusses the results of the one-week food waste audit conducted at MCC between March 27th and 31st, 2017. The data were collected using both quantitative methods (via a food waste audit) and qualitative methods (such as site visits and observations).

The main aim of this research project was to quantify the volume of food being wasted (both pre-consumer (kitchen) waste and post-consumer (plate) waste on campus. I am satisfied that the methodology used to collect this data was effective in answering my main objective.

Figure 1 is a bar chart showing the quantity of food wasted per day at MCC, Monday through Friday. As indicated in the figure, breakfast was the least wasted meal per day, and the quantity also fluctuated over the course of the week. This could be due to the fact that breakfast is usually a light meal, or that students are usually busy in the morning sessions attending class. Lunch, however, had a steady increase of food waste over the week. This could be due to the fact that lunch is normally the preferred meal at MCC. After having some long morning sessions in class, patrons take the time to relax and have a good meal. Supper fluctuated over the week. It is important to note that supper produced the highest output of food waste for the week. Also, on Wednesday we saw a sudden increased in food waste. This increase was due to the following reasons: Marquis hosted some lunch and supper buffet from Monday through Friday of the audit week. On Monday, March 27, they had a lunch buffet for 40 guests; Tuesday March 28, lunch buffet for 50 guests and, a cold and hot appetizer for 50 guests; Wednesday March 29, the day of the sudden food waste increase, a supper buffet catering for 140 guests; Thursday March 30, a supper buffet for 60 guests, and on Friday March 31, a supper buffet for 140 guests. These additional catering events indeed contributed to the food waste output for the week. The Executive Chef revealed that Wednesday is the only day that MCC serves hot buffet breakfast and that this waste might also be a part of the supper food waste. Patrons are usually tired after a long day and do not take the time to really sit and enjoy a meal, but, rather hurry to eat to get home.

Figure 2 is a pie chart showing the percentage of total food served wasted per meal. The data indicate that breakfast generated the least amount of waste, whereas supper generated the most food waste per meal, despite lunch service hours’ head count being higher than the supper head count.

Figure 3 is a pie chart showing the percentage of food waste by source: pre-consumer (kitchen) waste, post-consumer (edible plate) waste and post-consumer (non-edible) waste. The data indicate that pre-consumer waste is the highest contributor to food waste at MCC. This result is due to a number of reasons: the pre-consumer waste was combined with the production waste coming from the buffet; a significant amount of overproduction waste came from the hot kitchen, some of which was due to dietary restrictions, such as vegetarian options, spoilage due to overproduction, and the fear of running out of food; securing a head count in advance to adjust
cooking accordingly was a challenge; and patrons were not encouraged to taste a small portion of the food before taking it.

Table 1 shows the cumulative volume of food wasted for the week at MCC in kilograms. For the audit week, a total of **2,330.97 kg** of food waste was generated at MCC. A small portion of this food waste weight accounts for post-consumer (non-edible) waste: bones, napkins, cores and fruit peels. This was calculated based on food waste for the day for different service hours - breakfast, lunch, and, supper. Food waste for each day was recorded in the following categories: pre-consumer (kitchen) waste, post-consumer (edible plate) waste and post-consumer (non-edible) waste. The total of each category was tabulated in an Excel sheet to produce the food waste quantity for the week.

From the data in Table 1, it can be seen that breakfast food waste varied over the course of the week. On Monday, breakfast waste was 77.79 kg. On Tuesday, it decreased to 44.66 kg. On Wednesday, it significantly increased to 106.82 kg. On Thursday, it decreased to 44.57 kg, and on Friday it increased again to 125.87 kg. Breakfast also generated the least amount of food waste.

Similar to breakfast, lunch food waste fluctuated over the course of the week. On Monday, lunch food waste was 173.36 kg. On Tuesday, it increased to 183.02 kg. On Wednesday, it decreased to 165.79 kg. On Thursday, it increased to 185.29 kg, and, on Friday, it decreased again to 170.10 kg.

Supper waste also fluctuated, and supper also had the majority of food waste for the week. On Monday, supper food waste was 211.15 kg. On Tuesday, it decreased to 136.19 kg. On Wednesday, there was a significant increase to 270.68 kg. Thursday saw a decrease again to 226.46 kg and Friday a further decrease to 209.22 kg.

Based on the results presented in the table, supper is a major area of concern, as this high volume of waste can be assumed to be traced to the menu option for the day and several catering events hosted by MCC during the week of the audit. For example, the menu or quality of food on a particular day may not appeal to the patrons, or, possibly, on some days there are fewer patrons than Marquis was expecting.

Prior to starting this research, my assumption was that post-consumer (edible plate) waste was going to be the highest volume of food waste; however, that assumption was wrong. It was surprising to find that the kitchen wasted a high volume of food. I noticed that the kitchen was discarding a great deal of prepared food from the refrigerator due to overproduction. Supper service hours generating the highest volume of food waste was also a surprising outcome.

**5.2 Observation Analysis**

Observations were used to obtain information on patrons’ attitudes and behaviours towards the issue of food waste. Both announced site visits and one unannounced site visit were done at MCC. I also did more than one participant observation. My observations of the patrons’ behaviour produced the following findings:
• Most of the patrons with whom I conversed were unaware of the actual amount of food being wasted.
• Most view food waste as an institutional problem and not as an individual problem. These patrons were more inclined to separate themselves from the problem. They had not internalized food waste as a problem.
• Most did not realize the true cost of food waste, specifically, that it includes more than disposal fees but also includes all the energy, physical labour, water, chemical and fuels wasted in producing food.
• On the first day of my audit, I observed that the kitchen staff had a challenge with proper waste sorting procedures. Some of the staff were not aware of the implications of food waste.
• There was also a lack of communication between the kitchen staff and the front desk cashier to give a proper estimate of total meals needed based on expected head count.

The main result from these observations was the simple lack of awareness of food waste on-campus. The other interesting result was that patrons do not view food waste as their concern, but, rather, they see it as an institutional problem.
5.1 Recommendations

Robust Comprehensive Waste Reduction Plan

The issue of food waste is a complex one that can be viewed from many different angles; however, based on this food waste audit, I am recommending both long-term and short-term solutions to tackle the issue of food waste at the University of Saskatchewan.

5.2 Pre-Consumer (Kitchen) Waste Short-Term

1. Implement the Lean Path 360 program

I recommend the implementation of the Lean Path 360 program as a 12-month pilot project to track, monitor and report on pre-consumer food waste. The benefits of this smart meter far outweigh its costs. These benefits include the following: financial benefits because the business reduces food costs, labour and, disposal costs; environmental benefits because waste is diverted from landfill and greenhouse gas emissions are reduced; and social benefits because a more positive food waste culture is created, demonstrating accountability and transparent communication. I spoke to Todd Pendexter, the Business Development Manager at Lean Path Inc., and he ran some estimates showing the capital investment of their product and the cost-saving benefits the product could potentially save MCC. With an estimated food purchasing of $2,000,000 annually for MCC, and a 3% reduction in food purchasing with Lean Path’s system could save $155,366 over a three years’ period. Refer to Figure 6 below.
Figure 4: A Figure Showing the Estimated Gross and Net Saving to Implement the Lean Path 360

For the week of the food waste audit at MCC, a total of $2,330.97$ kg of compostable food waste was produced. Based on data received from the Office of Sustainability, MCC generated $9,699$ kg of compostable food waste for the month of March. In March, MCC did 23 waste disposals transporting to the landfill at $22.69$ per disposal fee by Lorras.

Based on the audit, if the university were to compost all the organics from MCC, it would only require one disposal transportation monthly from that location, saving $6,352$ annually.
Compared to what the university is currently paying for Marquis’s disposal fees, it would be a good cost-saving measure to redirect that money into a pilot project that would only cost **$10,288** annually. Refer to Figure 7 below.

**Figure 5: A Figure Showing Capital Costs for Implementing the Lean Path 360 Program**

This Lean Path system is successful at several universities, such as Boston University, University of Massachusetts and the University of California. Why wouldn’t the University of Saskatchewan want to be a part of a success story by being a sustainable ambassador? This involves reaping the benefits of increased savings on food purchasing, decreasing waste disposal charges, and reducing their carbon footprints.
2. Quarterly Manual Food Waste Tracking

Another strategy involves the implementation of quarterly manual food waste tracking. This strategy would involve the use of a bin system and scale to track food waste. Setting up different bins with different categories of food waste and scales would allow the staff to weigh waste before discarding it. They would also record waste on a food waste template. For the weighing, a mobile lightweight industrial scale is best because it is specially designed for high volumes and weights, and it can be moved to accommodate food waste weigh-ins at any location in MCC.

3. Institutional Sustainable Cooking Strategies

Sustainable cooking strategies include a smart menu and just in time food preparation. A smart menu uses the same ingredients for a variety of dishes so that food does not spoil or go to waste. A “just-in-time” strategy centers around the accurate last-minute estimates of total meals needed. Ingredients are kept separate. Only the food that is needed is prepared. This strategy would help prevent food waste at MCC.

4. Improved Communications between Production Staff and the Front Desk Cashier

Improving communication between the production staff and cashier could help reduce food waste. The head count expected each day should be communicated to the cashier. When the estimated head count is near, the cashier could communicate this information to the production staff. This communication strategy would allow the production staff to adjust their cooking to reduce production waste. I, however, suggest that this strategy would need to be combined with sustainable cooking strategies, this could include the cashier communicating to the kitchen staff to scale back on their cooking after peak time.

5. Establish Campus-Wide Food Waste Reduction Guidelines.

Specific guidelines for food waste reduction strategies should include targeted goals for staff and students. These guidelines should maintain and encourage full compliance in food waste reduction.

6. Add Food Waste Reduction Targeted Goals to Kitchen Staff’s Performance Evaluation

Adding food waste reduction goals to the kitchen staff’s performance evaluations would encourage them to be more accountable for their individual waste production. This could be achieved with the implementation of the Lean Path 360 program, where individuals weigh their own waste and enters their name to sign off on waste input in the system.

7. Do Regular Food Waste Training

The implementation of mini-refresher training on food waste reduction would keep this front and centre in the minds of the staff. Training on food waste reduction strategies could be done quarterly. Food waste reduction progress should be monitored and progress celebrated. This training should also include a refresher training on knife skills to reinforce proper knife use to
prevent unwanted pre-consumer food waste. Gift cards could be awarded to staff who are outstanding food waste advocates.

8. Institute a Production Inventory System

A daily production inventory should be instituted to track the amount of food being wasted and adjust cooking to reduce food waste. MCC currently uses a waste sheet for its retail locations. I suggest they use the same waste sheet to track their production waste. In this way, the Executive Chef would be able to consult with kitchen staff so that they can make the necessary changes to their prepping and cooking techniques to further reduce the amount of production waste in the future. MCC might also, should investigate doing an inventory of their food waste at their catering events, so they can determine trends, prepare what is needed and reduce food waste.

9. Expand In-house Composting

Even though composting is seen as a last resort in food waste prevention, it is seen as an option to divert food waste from landfills. I suggest the university speed up the process by expanding its present compost system to manage all the food waste on campus. MCC currently has a food waste dehydrator that they are piloting to reduce food waste on campus. One of the end products of this dehydrator is compost in the form of fertilizer. This fertilizer is used by grounds for landscaping and the University community gardens campus wide. This offers a cost-savings to the university not having to purchase fertilizer. I suggest a partnership with Grounds Operations and Maintenance, the Office of Sustainability and the Enactus business group from the School of Edward Business to come up with a creative business plan which could generate opportunities for the university in two areas: research opportunity, how nutritious is the fertilizer coming from the dehydrator in plant growth and development and there could be a trade-off providing fertilizer to local farmers that MCC purchase food and the farmers, in turn, give a discounted price for food, this would achieve the benefit of a closed-loop food system.

Pre-Consumer (Kitchen) Waste Long-Term Recommendations

10. Institute a Food Waste Application

Instituting a food waste application could be a new project for an MSEM graduate student. This app should incorporate the tracking and monitoring of food waste campus-wide. This application could feature a food waste calculator, which would involve entering inputs such as itemized inventory purchases and obtaining output in data analysis that could identify trends in food waste. The university could use this data analysis to address the issue of food waste. I suggest this be done in collaboration with the School of Environment and Sustainability and the Department of Computer Science.
5.3 Post-Consumer (Plate) Waste Recommendations

1. Establish a Food Waste Committee

The purpose of this committee would be to advocate for best practices for food waste reduction campus-wide. This committee should be comprised of members from the student body, Office of Sustainability, USSU Sustainability Committee (USSUSC), Consumer Services and School of Environment and Sustainability Students Association (SENSSA). Forming such a committee with sustainably driven students and university employees is a good idea to promote sustainable practices on campus. The student body would be empowered to share opinions and concerns regarding food waste on campus and to develop solutions to reduce this waste.

2. Hiring a Food Waste Coordinator

I recommend the hiring of a new part-time staff member — a casual food waste coordinator — who would be the head driver of this committee and would track the progress of the Lean Path 360 program. I suggest employing a student for this position as a six-month pilot project. See Tables 2 and 3 below for the cost of hiring an undergraduate or graduate student. The committee would foster better communication with stakeholders, a group of people who are dedicated to promoting food waste awareness and prevention. I suggest doing this as a pilot project for six months and then evaluating the progress made.

Table 2: Showing the Total Cost of Employing an Undergraduate Student for a Six-Month Pilot Project

<table>
<thead>
<tr>
<th>Student</th>
<th>May 1, 2017 Hourly Rate</th>
<th>Monthly Rate (Based on part-time 20 hours/week)</th>
<th>Total Cost for 6 Months</th>
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<td>Undergraduate in 2nd Year</td>
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<td>Undergraduate in 3rd Year</td>
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<td>Undergraduate in 4th Year</td>
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* Monthly rates are calculated as follows: Hourly Rate x 20 hrs per week x 26 weeks / 6 months

Table 3: Showing the Total Cost of Employing a Graduate Student for a Six-Month Pilot Project

<table>
<thead>
<tr>
<th>Student</th>
<th>May 1, 2017 Hourly Rate</th>
<th>Monthly Rate (Based on part-time 20 hours/week)</th>
<th>Total Cost for 6 Month</th>
</tr>
</thead>
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<tr>
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<td>$1604.2</td>
<td>$9625.2</td>
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</table>

* Monthly rates are calculated as follows: Hourly Rate x 40 hrs per week x 26 weeks / 6 months
3. Engage the Student Population in Food Waste Reduction

Engagement with students could involve the collaboration of MSEM graduate students and the Sustainability Living Lab group. This could include facilitating student projects to look deeper into the issue of food waste and to collect future data on food waste on campus.

4. Establish Consumer Educational Campaigns

I recommend having frequent food waste educational campaigns (at least once per month), with the following suggested educational campaigns:

- Placing food waste educational signage on the conveyor belt in the dining hall and cash register. See Figure 6 below for sample educational signs used by the University of California-Davis that could be adopted by the University of Saskatchewan.

![How hungry are you?](image)

Source: Exploring Food Waste Reduction in Campus Dining Halls (2012)

Figure 6: A Sample Poster used to give Facts about Eating Habits and Portion Size

- Placing prompts in areas visible to patrons like the buffet areas, conveyor belt, and dining hall tables. I suggest having a food waste dashboard to track food waste and to make the patrons aware of the amount that is being wasted. Please see below for a signage that could be implemented.
Figure 7: A Sample Post-Consumer Signage used as a Food Waste Reporting Dashboard

- Establishing student food waste ambassadors from all academic departments to help drive awareness for these campaigns.
- Establishing a food waste pledge system where patrons at MCC sign a no food waste pledge book before dining.
- Instituting a zero-waste campaign during orientation week so new students can be aware of the university mandate to reduce food waste. In addition, issue fact sheets to students to promote food waste awareness campus-wide. Refer to the example of fact sheet below.
5. Implement Community-Based Social Marketing (CBSM) Strategies Review

I suggest conducting a CBSM review of food waste on campus to identify behaviour issues that need to be addressed. This could involve establishing a quarterly marketing campaign called Zero Food Waste Challenge for regular patrons at MCC. The school year could end with the announcement of the food waste champion for the academic year. This champion could be rewarded with an economic incentive. See Table 4 for a sample of a quarterly marketing campaign program overview to implement.
<table>
<thead>
<tr>
<th>Title</th>
<th>Description</th>
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<tr>
<td>Zero Waste Food Challenge</td>
<td>A marketing campaign aimed at reducing food waste at the individual level.</td>
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</table>
| Goals                                | Collaboration with the Office of Sustainability and Customer Services to establish zero waste campaigns event to reduce food waste. Behaviour Change Strategies and Tools:  
  - Zero Food Waste Challenge  
  - Clean your Plate Challenge  
  - Smart Portion: Eat More Waste Less  
  - Smart Food Choice: Eat What You Take |
| Outputs: Tools and Resources         | • Food waste summit  
                                         • Food waste symposium  
                                         • Educational posters |
| Inputs: Staff, Financial             | **Staff Inputs** (approximately one part-time student for the duration of the program)  
                                         • Design and implementation of pilot project  
                                         • Market zero food waste challenge  
                                         • Recruit participants  
                                         • Collect, track and monitor data  
                                         • Collaborate with stakeholders  
                                        **Financial Inputs**  
                                         • Print material and economic incentives for zero food waste challenge |
| Timeline                             | 6 to 8 months                                                               |
| Monitoring and Evaluation            | • Good food waste baseline data before the campaign (food waste audit, surveys) then monitor and report on progress  
                                         • Quantity of food waste saved (disposal cost, social and environmental benefits) |
| Success Factors                     | • Spotlight on food waste reduction  
                                         • Engagement of a diverse group of campus community |
| Anticipated Challenge                | • Recruitment process                                                      |
| Partners                            | The Office of Sustainability Consumer Services                              |
4. Reduce Portion and Plate Size

Several universities are controlling their portion size to reduce food waste. This includes switching to smaller plates and allowing students to customize their own meal. The University of Michigan has switched to smaller plate or tapas-style sizes. In addition, to the smaller plate, the University has also implemented the “Just Ask” campaign where diners are encouraged to ask the chef to make a custom plate of food of their choice. In a report by Wansink & Ittersum (2006), they contend that larger plates or bowls make individuals consume more food because they believe the portions are smaller (Wansink & Ittersum, 2006). They further give an example, citing a study conducted at a health and fitness camp, where campers who were given a larger bowl consumed more cereal than campers who were given a smaller bowl. In addition, the report claims that smaller plates can help reduce the waistline, reduce food waste and cost and also cut down the amount of food consumers consume and waste (Wansink & Ittersum, 2006). Similarly, in another report, Poulter (2017) contends that providing people with larger plates allows them to waste more food. He further states that adopting smaller plates can tackle the issue of food waste. Wansink and Ittersum point out the benefits of reducing plate size, arguing that substantial evidence exists to show that organization can tailor the amount of food people take based on the size of the plate and cutlery, and that there is a physical limit to the amount one can take on a small plate. These two strategies have proven to be effective in reducing food waste. I suggest that the university make small gradual changes to smaller plates to reduce food waste. I recommend that MCC start replacing damaged plates with smaller plates. In addition, MCC could look at encouraging its employees to serve dishes that are mostly wasted and giving a small sample to patrons to reduce the high food waste dish.

5. Food Waste Tracking

I recommend that MCC conduct a monthly waste weigh-in, where a scale is placed on the conveyor and the students weigh their individual food waste. This would allow food waste data to be collected and, at the same time, drive awareness and accountability for individual food waste.

6. Institute Menu Tasting to Meal Plan Holder

MCC could develop a guideline to control food tastiness. During the orientation week, they could provide a sample from the menu to their meal plan holders and, do an evaluation on their feedback before settling on the menu. By doing this MCC would obtain useful information on the most and least preferred menu items in order to adjust cooking. Also, regular online menu surveys of patrons to get feedback on menu items should be conducted.
7. Display Food Waste

An alternative idea is to collect the food waste after every meal and place it in a clear bin on top of a scale so people can see a visual picture of the amount of food being wasted. Another suggestion is to have weekly food waste buffet display, where all uneaten food is placed on a table for patrons to see the amount of food being wasted.


I suggest reporting on the quantity of food wasted weekly campus-wide in the university’s magazine (SHEAF), the PAWS website bulletin message and University plasma TV screens. This would heighten awareness of food waste campus-wide.

9. Share and Donate Food

At present, the university does not donate excess food. A food sharing Twitter account could inform the entire campus when there is excess food to be donated to students. For example, the University of Northern British Columbia in January 2015, launched a new Twitter account called UNBCScraps (CBC, 2015). Students are informed through this media where to find free food on campus (CBC, 2015). The campus food strategy coordinator for the University of Northern British Columbia teamed up with the cafeteria staff and reuse food that would otherwise go to the landfill (CBC, 2015). The campus food strategy coordinator reported that over 1200 pounds of food have been donated so far. This new Twitter account was designed with the focus to reduce food waste (CBC, 2015). Also, MCC could use this Twitter account to advertise uneaten food to students who would like to have it. The university could also establish a student association food recovery program, where food could be donated to a food centre on campus for students who cannot afford to eat a proper meal. However, before this is done I suggest this association seek sponsorships from businesses such as the PotashCorp for equipment to help with food distribution under suitable temperature control. Additionally, a donation could be made to the Saskatoon Food Bank and Friendship Inn. The Donation of Food Act of 1995 protects the university from any liability after donating the food with good intentions. The only issue faced with the food donations is holding it at the right temperature before donating. I had a personal conversation with Bonnie-Ann Iverson, Receptionist/Fine Manager at Friendship Inn. She reported that the company does accept left over food coming from the buffet. She further stated that they currently receive leftovers from the University hospital. She said that arrangements could be made with MCC to pick up the food, as the Friendship Inn has a truck that they can send for pick-up. MCC would have to change certain operational procedure to ensure that the food is kept at the proper temperature before donating this food. Saskatoon Food Bank, however, only receives uncooked and packaged food.

9. Collaborate with Department of Education and the College of Pharmacy and Nutrition

Establish a joint effort between these two departments to encourage people to eat healthier and also to drive the issue of food waste prevention in the classroom. This could involve the use of
combined workshops hosted at MCC to engage patrons in activities such as how to choose healthy portion sizes, encouraging consumption of more plant protein and less animal protein, wellness tips and the issuing of educational material on portion size and healthy eating habits.
7.1 Conclusion

The food waste volume at MCC dining area needs to be addressed promptly by the University of Saskatchewan at all levels of the institution. After completing this research project, I am convinced that reducing food waste is not only a significant issue at the University of Saskatchewan but also nationally. Food waste is expected to increase as the global population increases.

The University of Saskatchewan has recognized the significance of addressing food waste on campus and has embarked on a journey to tackle this food waste issue; however, there is still much room for improvement. Tackling food waste is more successful when a holistic approach is used. Practices such as regular food waste audit with the use of Lean Path 360 could be implemented to reduce pre-consumer waste. Lean Path 360 has been proven in several universities to successfully tackle the issue of pre-consumer food waste. Because pre-consumer waste accounts for the highest volume of food waste output, it would make complete sense to implement the Lean Path 360 program as a pilot project to reduce food waste and increase cost-savings. Other practices that could address food waste are operational changes such as increased communication between staff. This would include better communication with the front desk cashier and the kitchen staff in advance of meals. A second practice could be timely head counts, so as to adjust cooking needs accordingly to reduce food waste. Another practice could be frequent research and surveys to obtain feedback on patrons’ behaviour towards food waste. A final practice would foster more collaboration between dining services and sustainability organizations.

Future research should continue to compare numerical data on food waste at MCC, to track progress and improvements, and to track behavioral trends surrounding food waste. Also, doing more research in the area would allow the university to identify significant trends in food waste and gear actions to address these issues over time.

Food waste is just not about the cost associated with it but also the limited resources such as water and energy that are being wasted as well. Therefore, I recommend the following potential research projects for future MSEM students: Conducting a comprehensive energy and water audit, as these two resources play a major role in the cost of food waste. If the University of Saskatchewan focused on food waste prevention and reduction, it could become a leading sustainable ambassador for other Canadian Universities to follow.
References


from http://www.torontosun.com/2016/10/14/get-a-grip-on-food-waste-this-world-food-day


Appendices

Appendix 1: Table showing sample of food waste audit template

<table>
<thead>
<tr>
<th>Marquis Culinary Centre Food Waste Audit Template</th>
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<tbody>
<tr>
<td>Date:</td>
</tr>
<tr>
<td>Venue:</td>
</tr>
<tr>
<td>Food Service Hours</td>
</tr>
<tr>
<td>Meal</td>
</tr>
<tr>
<td>Breakfast</td>
</tr>
<tr>
<td></td>
</tr>
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<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td>Lunch</td>
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<tr>
<td></td>
</tr>
<tr>
<td>Supper</td>
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<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Daily Totals</strong></td>
</tr>
</tbody>
</table>

Notes:
1. All pre-consumer (kitchen) waste in one bin
2. All edible food waste in one bin (including liquid and solid)
3. All non-edible food waste (bones, napkins, cores & fruit peels) in one bin
### Appendix 2: Raw Data Collected

<table>
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<th>Marquis Culinary Centre Food Waste Audit Template</th>
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<tbody>
<tr>
<td>Date: March 27, 2017</td>
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<td>Venue: Marquis Culinary Centre</td>
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<table>
<thead>
<tr>
<th>Food Service Hours</th>
<th>Pre-Consumer (Kitchen) Waste</th>
<th>Post-Consumer (Edible Plate) Waste</th>
<th>Post-Consumer (Non-Edible) Waste</th>
<th>Total Waste</th>
<th>Head Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meal</td>
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<td>Weight (kg)</td>
<td>Weight (kg)</td>
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**Notes:**
1. All pre-consumer (kitchen) waste in one bin
2. All edible food waste in one bin (including liquid and solid)
3. All non-edible food waste (bones, napkins, cores & fruit peels) in one bin

43
<table>
<thead>
<tr>
<th></th>
<th>Food Service Hours</th>
<th>Pre-Consumer (Kitchen) Waste</th>
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<th>Post-Consumer (Non-Edible) Waste</th>
<th>Total Waste</th>
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<td>Weight (kg)</td>
<td>Weight (kg)</td>
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Notes:
1. All pre-consumer (kitchen) waste in one bin
2. All edible food waste in one bin (including liquid and solid)
3. All non-edible food waste (bones, napkins, cores & fruit peels) in one bin
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<th>Food Service Hours</th>
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</tr>
<tr>
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<td>Supper</td>
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</tbody>
</table>

Notes:
1. All pre-consumer (kitchen) waste in one bin
2. All edible food waste in one bin (including liquid and solid)
3. All non-edible food waste (bones, napkins, cores & fruit peels) in one bin
<table>
<thead>
<tr>
<th>Meal</th>
<th>Pre-Consumer (Kitchen) Waste</th>
<th>Post -Consumer (Edible Plate) Waste</th>
<th>Post -Consumer (Non-Edible) Waste</th>
<th>Total Waste</th>
<th>Head Count</th>
<th>Waste per person</th>
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<tbody>
<tr>
<td></td>
<td>Destination (Disposal Method)</td>
<td>Weight (kg)</td>
<td>Weight (kg)</td>
<td>Weight (kg)</td>
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</tr>
<tr>
<td>Breakfast</td>
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<td><strong>456.31</strong></td>
<td><strong>1328</strong></td>
<td><strong>0.35</strong></td>
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</tbody>
</table>

**Notes:**
1. All pre-consumer (kitchen) waste in one bin
2. All edible food waste in one bin (including liquid and solid)
3. All non-edible food waste (bones, napkins, cores & fruit peels) in one bin
<table>
<thead>
<tr>
<th>Food Service Hours</th>
<th>Pre-Consumer (Kitchen) Waste</th>
<th>Post-Consumer (Edible Plate) Waste</th>
<th>Post-Consumer (Non-Edible) Waste</th>
<th>Total Waste</th>
<th>Head Count</th>
<th>Waste per person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meal</td>
<td>Weight (kg)</td>
<td>Weight (kg)</td>
<td>Weight (kg)</td>
<td>Weight (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Destination (Disposal Method)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakfast</td>
<td>97.98</td>
<td>5.67</td>
<td>22.23</td>
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<td>Dehydrator</td>
<td>Composting</td>
<td>Food Bank</td>
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</tr>
<tr>
<td>Lunch</td>
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<tr>
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<td>Landfill</td>
<td>Dehydrator</td>
<td>Composting</td>
<td>Food Bank</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supper</td>
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<td>107.95</td>
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<td>Dehydrator</td>
<td>Composting</td>
<td>Food Bank</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily Totals</td>
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<td>117.93</td>
<td>54.54</td>
<td>505.19</td>
<td>1245</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Notes:
1. All pre-consumer (kitchen) waste in one bin
2. All edible food waste in one bin (including liquid and solid)
3. All non-edible food waste (bones, napkins, cores & fruit peels) in one bin
Appendix 3: Data Analysis

Figure 1: Bar Chart Showing Quantity of Food Wasted per Day at MCC
Figure 2: Pie Chart Showing the Percentage of Total Food Served Wasted per Meal
Figure 3: Pie Chart Showing the Percentage of Food Wasted by Source per Week
Table 1: Showing the Cumulative Volume of Food Waste for the Week at MCC in Kilograms

Weekdays March 27th-31st, 2017

<table>
<thead>
<tr>
<th>Meal</th>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thurs</th>
<th>Fri</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>77.79</td>
<td>44.66</td>
<td>106.82</td>
<td>44.57</td>
<td>125.87</td>
<td>399.71</td>
</tr>
<tr>
<td>Lunch</td>
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<td>183.02</td>
<td>165.79</td>
<td>185.29</td>
<td>170.10</td>
<td>877.57</td>
</tr>
<tr>
<td>Supper</td>
<td>211.15</td>
<td>136.19</td>
<td>270.68</td>
<td>226.46</td>
<td>209.22</td>
<td>1053.70</td>
</tr>
<tr>
<td>Total</td>
<td>462.30</td>
<td>363.87</td>
<td>543.29</td>
<td>456.31</td>
<td>505.19</td>
<td>2330.97</td>
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</tbody>
</table>

51
## Appendix: 4 Current Contact List for Participants (Data Collection Engagement)

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>E-mail</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Margret Asmuss</td>
<td>Sustainability Co-ordinator</td>
<td><a href="mailto:margret.asmuss@usask.ca">margret.asmuss@usask.ca</a></td>
<td>306-966-1236</td>
</tr>
<tr>
<td>Matt Wolsfeld</td>
<td>Community Engagement Co-ordinator</td>
<td><a href="mailto:matt.wolsfeld@usask.ca">matt.wolsfeld@usask.ca</a></td>
<td>306.966.2200</td>
</tr>
<tr>
<td>Odili Obi</td>
<td>Waste Prevention Co-ordinator</td>
<td><a href="mailto:odili.obi@usask.ca">odili.obi@usask.ca</a></td>
<td>306-966-5441</td>
</tr>
<tr>
<td>Erin Akins</td>
<td>Sustainability Initiatives Coordinator</td>
<td><a href="mailto:Erin.akins@usask.ca">Erin.akins@usask.ca</a></td>
<td>306-9662282</td>
</tr>
<tr>
<td>James McFarland</td>
<td>Assistant Director/Executive Chef</td>
<td><a href="mailto:james.mcfarland@usask.ca">james.mcfarland@usask.ca</a></td>
<td>306-966-1905</td>
</tr>
<tr>
<td>Mesfin Gossa</td>
<td>Manager-Facilities</td>
<td><a href="mailto:mesfin.gossa@usask.ca">mesfin.gossa@usask.ca</a></td>
<td>306-966-2668</td>
</tr>
<tr>
<td>Gift Marufu</td>
<td>Manager-Grounds Operations &amp; Maintenance</td>
<td><a href="mailto:gift.marufu@usask.ca">gift.marufu@usask.ca</a></td>
<td>306-966-2359</td>
</tr>
<tr>
<td>Kylie Slade</td>
<td>Marketing Coordinator-Consumer Services</td>
<td><a href="mailto:kylie.slade@usask.ca">kylie.slade@usask.ca</a></td>
<td>306-966-7650</td>
</tr>
</tbody>
</table>
Glossary

**Pre-Consumer Waste**- Food scraps, such as edible parts of raw vegetables or trimmings from meat, left over from the pre-cooking food preparation process.

**Post-Consumer Waste**- Food that consumers take on their plates or trays or is served to them but that they do not consume and discard.

**Production Waste**- Food produced by the kitchen that is not taken by the consumer and is unable to be stored for food safety or other reasons. For example, food set out on a buffet.

**Post-Consumer (Non-Edible) Waste** – Parts of fruits and vegetables, such as rinds, and parts of meat, such as bones, that are not commonly consumed.

**Food Loss**- refers to food that is discarded, often for reasons of quality or problems with agricultural or storage processes, at the earlier stages of the food supply chain, for example during production, processing, and distribution. Food loss occurs before the food reaches the store or the consumer.

**Food Waste**- refers to food that is discarded, often because of perceived visual imperfections, at the latter stages of the food supply chain, typically at the retail level, by restaurants and by the consumer.